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FOREWORD

The 2011 Research Progress Report of the Western Society of Weed Science (WSWS) is a compilation of research investigations contributed by weed scientists in the western United States of America. The objective of the Research Progress Report is to provide an avenue for presentation and exchange of on-going research to the weed science community. The information in this report is preliminary; therefore, it is not for the development of endorsements or recommendations.

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

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Meadow hawkweed control at various timings using aminopyralid. John Wallace and Tim Prather. (Plant Science Divison, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Santa, Idaho in 2009 to evaluate meadow hawkweed (HIECA) control with aminopyralid at multiple growth stages; early fall senescence, fall rosette, spring rosette and bolting stage. The experiment was designed as a randomized complete block with four replications at two different sites. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer (Table 1).

Table 1. Application data for meadow hawkweed control.

Weed growth stage	senescence	fall rosette	spring rosette	bolt
Application date	16-Sept-2009	4-Nov-2009	13-May-2010	2-June-2010
Air temp (F)	86	63	61	53
Relative humidity (%)	24	35	34	41
Wind (mph, direction)	W, 0 to 5	W, 0 to2	SE, 1 to 4	W, 2 to 6
Cloud cover (%)	0	20	0	40
Soil temp at 2 inches (F)	67	38	60	58
Gallons per acre (gpa)	15.1	14.8	16.9	14.8

Evaluations were conducted on May 13, June 10, and September 7 in the 2010 growing season. Meadow hawkweed control is expressed as a percentage in comparison to the untreated check. Treatments timed to the spring rosette and bolting stages resulted in complete control (100%) at 1.25 and 1.75 oz ae/A (Table 2). Treatments timed to fall stages, both senescence and rosette, resulted in moderate levels of control. No differences were detected between rates in fall treatments. General trends suggest that fall timed treatments do decrease meadow hawkweed cover and prevent flowering of plants in the following growing season (Table 3). Treatments did not result in differences of meadow hawkweed or perennial grass yields (Table 4).

Table 2. Meadow hawkweed control at three evaluation dates. Control (%) expressed relative to untreated check.

			Meadow hawkweed		
Treatment[1]	Rate	Stage	13May10	24Jun10	7Sept10
	oz ae/A	---	---------------% control --------------		
Aminopyralid	1.25	senescence	47	45	51
Aminopyralid	1.75	senescence	72	54	72
Aminopyralid	1.25	fall rosette	14	33	36
Aminopyralid	1.75	fall rosette	24	36	35
Aminopyralid	1.25	spring rosette	--	100	100
Aminopyralid	1.75	spring rosette	--	100	100
Aminopyralid	1.25	bolting	--	100	100
Aminopyralid	1.75	bolting	--	100	100
Untreated check			0	0	0
Tukey's Studentized Range HSD (0.05)			27	24	16

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

Table 3. Cover estimates of meadow hawkweed and perennial grass at conclusion of 2010 growing season.

Treatment[1]	Rate	Stage	Meadow hawkweed Cover	Meadow hawkweed Flowering	Cover Idaho fescue	Cover Other grass
	oz ae/A	---	-----------%-----------		--------------%-------------	
Aminopyralid	1.25	senescence	19.8	3.3	45.3	5.2
Aminopyralid	1.75	senescence	7.6	0.0	30.6	25.8
Aminopyralid	1.25	fall rosette	46.5	0.8	19.4	6.8
Aminopyralid	1.75	fall rosette	38.1	0.3	30.1	7.4
Aminopyralid	1.25	spring rosette	0.1	0.0	48.9	7.7
Aminopyralid	1.75	spring rosette	0.0	0.0	40.6	10.0
Aminopyralid	1.25	bolting	0.1	0.0	48.1	7.4
Aminopyralid	1.75	bolting	0.0	0.0	35.1	8.7
Untreated check			45.1	36.8	21.4	25.8
Tukey's Studentized Range HSD (0.05)			16.1	9.8	27.9	16.9

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

Table 4. Biomass of meadow hawkweed and perennial grass following treatments.

Treatment[1]	Rate	Stage	Aboveground biomass Meadow hawkweed	Aboveground biomass Perennial grass
	oz ae/A	---	----------g/0.125 yd^2----------	
Aminopyralid	1.25	senescence	1.2	7
Aminopyralid	1.75	senescence	0.1	7.1
Aminopyralid	1.25	fall rosette	3.2	3.6
Aminopyralid	1.75	fall rosette	4.3	7
Aminopyralid	1.25	spring rosette	0.0	6.4
Aminopyralid	1.75	spring rosette	0.0	6.6
Aminopyralid	1.25	bolting	0.1	6.9
Aminopyralid	1.75	bolting	0.1	6.3
Untreated check			3.1	4.8
Tukey's Studentized Range HSD (0.05)			NS	NS

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

St. Johnswort and meadow hawkweed control with various rates and combinations of aminocyclopyrachlor. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Harrison, ID in an abandoned pasture to evaluate St. Johnswort (HYPPE) control with aminocyclopyrachlor, metsulfuron, chlorsulfuron, and 2,4-D timed to the pre-flower stage. Meadow hawkweed (HIECA) was present throughout the study sight and was also evaluated for control. Treatments were randomly assigned and replicated four times. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer (Table 1). Treatments were timed to new stem growth, which ranged from 2 to 6 inches at application.

Visual evaluations were conducted on June 22, 2010, approximately one and two months after treatment (MAT) to determine St. Johnswort and meadow hawkweed control following treatments timed to the pre-flower stage of St. Johnswort. Two 1-m^2 quadrats were evaluated in each plot for density or cover of target species, and injury symptoms. Injury symptoms included stem and leaf curling, leaf chlorosis, injury to growing points, and flower abortion. Symptoms were evaluated as a percentage of the control treatment.

Table 1. Application and soil data.

Application date	May 13, 2010
Weed growth stage	2 to 6 in. stems
Air temp (F)	68
Relative humidity (%)	34
Wind (mph, direction)	3 to 6, W
Cloud cover (%)	10
Soil temp at 2 inches (F)	70
Soil type	sandy loam
Delivery rate (gpa)	15.5

Results indicate that aminocyclopyrachlor rate had a significant effect on St. Johnswort control. Aminocyclopyrachlor applied at 3 oz ai/A resulted in a high level of control at the end of the growing season (91%; Table 2). Lower rates of amincyclopyrachlor, applied alone, ranged from 50 to 81% control. Aminocyclopyrachlor applied in combination with chlorsulfuron or metsulfuron resulted in complete control (100%) of St. Johnswort. Aminocyclopyrachlor applied with metsulfuron did not differ from metsulfuron applied alone for St. Johnswort control. Applications of 2,4-D alone and in combination with aminocyclopyrachlor did not result in high levels of control, 46 and 78% respectively.

Aminocyclopyrachlor rate did not affect meadow hawkweed control. Each treatment rate resulted in high levels (>95%) of control at the end of the growing season (Table 3). Aminocyclopyrachlor applied in combination with metsulfuron or 2,4-D improved meadow hawkweed control in comparison to either product applied alone.

Perennial grasses at the site included Canada bluegrass, quackgrass and smooth brome. Densities of these species were variable across sites. Visual observations suggested that herbicide treatments stunted growth of quackgrass. Injury symptoms across perennial grass species were evaluated, but no trends were detected. Injury, rated as a percentage of the untreated check, ranged from 13 to 27% (Table 4).

Table 2. Evaluation of St. Johnswort (HYPPE) control at 1 and 2 months after treatment (1MAT, 2MAT).

Treatment [1]	Rate	HYPPE density			HYPPE control	
		PRE	1 MAT	2 MAT	1 MAT	2 MAT
	oz ai /A[2]	--------- #stems/m^2		----------	--------%--------	
Aminocyclopyrachlor	1.0	12	11	11	67	50
Aminocyclopyrachlor	1.5	15	8	4	77	59
Aminocyclopyrachlor	2.0	8	1	2	92	81
Aminocyclopyrachlor	3.0	12	1	1	93	91
Aminocyclopyrachlor + metsulfuron	1.33 + 0.20	7	0	0	100	100
Aminocyclopyrachlor + chlorsulfuron	1.58 + 0.63	14	1	0	98	100
Aminocyclopyrachlor + 2,4-D DMA	1.39 + 10.6	20	1	7	96	78
2,4-D DMA	14.14	8	3	7	53	46
Metsulfuron	0.6	17	2	1	92	98
Untreated check	--	24	22	29	0	0
Tukey's HSD		21	7	10	20	37

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

[2]2,4-D DMA expressed as oz ae /A

Table 3. Evaluation of meadow hawkweed (HIECA) control at 1 and 2 months after treatment (1MAT, 2MAT).

Treatment [1]	Rate	HIECA cover			HIECA control	
		PRE	1 MAT	2 MAT	1 MAT	2 MAT
	oz ai /A[2]	------------ % ------------			-------- % --------	
Aminocyclopyrachlor	1.0	17	9	1	78	95
Aminocyclopyrachlor	1.5	17	9	0	82	100
Aminocyclopyrachlor	2.0	9	3	0	93	100
Aminocyclopyrachlor	3.0	19	1	0	97	100
Aminocyclopyrachlor + metsulfuron	1.33 + 0.20	9	2	0	91	100
Aminocyclopyrachlor + chlorsulfuron	1.58 + 0.63	7	2	0	91	100
Aminocyclopyrachlor + 2,4-D DMA	1.39 + 10.6	21	10	0	90	100
2,4-D DMA	14.14	20	16	8	70	66
Metsulfuron	0.6	9	9	4	78	82
Untreated check	--	18	23	28	0	0
Tukey's HSD		23	14	11	17	17

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

[2]2,4-D DMA expressed as oz ae /A

Table 4. Perennial grass injury at 1 and 2 months after treatment (1, 2 MAT).

Treatment [1]	Rate	Perennial grass injury 2 MAT
	oz ai/A[2]	--------%--------
Aminocyclopyrachlor	1.0	17
Aminocyclopyrachlor	1.5	24
Aminocyclopyrachlor	2.0	16
Aminocyclopyrachlor	3.0	26
Aminocyclopyrachlor + metsulfuron	1.33 + 0.20	12
Aminocyclopyrachlor + chlorsulfuron	1.58 + 0.63	16
Aminocyclopyrachlor + 2,4-D DMA	1.39 + 10.6	27
2,4-D DMA	14.14	23
Metsulfuron	0.6	13
Untreated check	--	0
Tukey's HSD		22

[1] 90% non-ionic surfactant (R-11) at 0.25% v/v was applied with all treatments
[2]2,4-D DMA expressed as oz ae /A

Russian knapweed control with goat grazing and aminopyralid. Clarke G. Alder and Corey V. Ransom. (Plants, Soils, and Climate Department, Utah State University, Logan, UT 84322-4820) Field studies were established at two sites in Dinosaur National Monument, UT in 2009 to determine the effects of a spring grazing paired with late fall herbicide applications to Russian knapweed in an abandoned pasture setting. Plots were arranged in a randomized split-plot design with 4 replications and grazing as blocks on the whole plot level and herbicide treatment as subplots. Preliminary plant cover, density and biomass data were obtained during May 2009. Russian knapweed density was measured using a centered transect and placing 0.25 m^2 wire frames every 1.8 m (6 feet) along the transect. Plant shoots were counted inside each frame. Cover measurements were obtained along the same transect line as the density measurements using a point-intersect method. Samples were dried for 1 week and dry mass was weighed and recorded. Grazing was implemented during the first two weeks of June 2009 using goats from a local rancher. Grazing was performed until maximum utilization was achieved in each block. Biomass was then measured a second time to record utilization by the goats. Knapweed biomass and cover were measured again in August 2009 using the same methods as previously described. Aminopyralid (Milestone) was applied in October 2009 at 0, 0.75, 1, 1.25 and 1.5 oz ae/A using a CO_2-pressurized backpack sprayer calibrated to deliver 20 gal/ac at 30psi. Preliminary analyses of the data show no interaction between grazing and herbicide treatment. Means for herbicide treatments averaged over grazing treatments are provided in the table below. Aminopyralid effectively reduced Russian knapweed density and cover regardless of herbicide rate. Grass density was not affected by aminopyralid, however grass cover was increased by all aminopyralid rates. At 10 months after treatment (MAT) grazing appeared to provide some suppression of Russian knapweed compared to untreated plots.

Table. Means for cover, density and percent control of Russian knapweed and desirable grasses.

		7 MAT				Control 10 MAT	
		Russian knapweed		Desirable grasses		Russian knapweed	
Treatment	Rate	Density	Cover	Density	Cover	Ungrazed	Grazed
	oz ae/A	Plt/0.25m^2	%	Plt/0.25m^2	%	----------%----------	
Untreated	---	29	25	101	35	0	20
Aminopyralid	0.75	0	0	113	59	99	99
Aminopyralid	1	0	0	117	61	99	100
Aminopyralid	1.25	0	0	116	61	100	99
Aminopyralid	1.50	0	0	98	55	100	100
LSD (0.05)	---	8	4	NS	18	9	

Spotted knapweed control with aminocyclopyrachlor and sulfonylurea combinations. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Hayden, ID in unimproved pasture to evaluate spotted knapweed (CENMA) control with combinations of aminocyclopyrachlor and sulfonylureas timed to the fall or spring rosette stages, and compared to aminopyralid standards. Treatments were blocked by timing and replicated four times. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer (Table 1).

Table 1. Application and soil data.

Application date	November 10, 2009	April 23, 2010
Weed growth stage	fall rosette	spring rosette
Air temp (F)	49	55
Relative humidity (%)	56	15
Wind (mph, direction)	3 to 8	3 to 10
Cloud cover (%)	35	10
Soil temp at 2 inches (F)	44	48
Soil type	sandy loam	sandy loam
Delivery rate (gpa)	15.5	16.3

Spotted knapweed density and control was measured in two 1 m^2 quadrats per plot at each evaluation. On April 23, spotted knapweed rosette density averaged 65 plants/m^2 in the untreated plots of the fall timing stage (5 MAT; Table 2). All treatments resulted in high levels of control (>99%) 5 MAT and continued through the growing season. Similar results were observed for the spring rosette application timing (Table 3). Treatments resulted in near complete mortality of rosettes 2 MAT (>94% control). No differences were detected between aminocyclopyrachlor and aminopyralid when applied in combination with metsulfuron. No differences between chlorsulfuron and metsulfuron applied in combination with aminocyclopyrachlor were detected at both treatment timings.

Table 2. Spotted knapweed (CENMA) density and control following treatments timed to fall rosette stage.

		CENMA density		CENMA control	
Treatment [1]	Rate	5 MAT	7 MAT	5 MAT	7 MAT
	oz ai /A[2]	-------- #plts/m^2 --------		--------- % ---------	
Aminocyclopyrachlor + chlorsulfuron	1.88 + 0.75	1	0	99	100
Aminocyclopyrachlor + metsulfuron	1.88 + 0.60	0	0	100	100
Aminopyralid	1.75	0	0	100	100
Aminopyralid + metsulfuron	1.75 + 0.30	0	0	100	100
Untreated check	--	65	53	0	0
Tukey's HSD		31	15	0.3	0

[1] 90% non-ionic surfactant (R-11) at 0.25% v/v was applied with all treatments
[2] aminopyralid expressed as oz ae/A

Table 3. Spotted knapweed (CENMA) density and control following treatments timed to spring rosette stage.

		CENMA density		CENMA control
Treatment [1]	Rate	PRE	2 MAT	2 MAT
	oz ai /A[2]	--------- #plts/m^2 --------		---- % ----
aminocyclopyrachlor + chlorsulfuron	1.88 + 0.75	74	6	94
aminocyclopyrachlor + metsulfuron	1.88 + 0.60	69	0	100
aminopyralid	1.75	104	0	100
aminopyralid + metsulfuron	1.75 + 0.30	95	0	100
untreated check	--	62	43	0
Tukey's HSD		71	14	12

[1] 90% non-ionic surfactant (R-11) at 0.25% v/v was applied with all treatments
[2] aminopyralid expressed as oz ae/A

Yellow toadflax control with combinations of aminocyclopyrachlor and sulfonylureas. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established within Farragut State Park in northern Idaho to evaluate yellow toadflax (LINVU) control using aminocyclopyrachlor in combination with chlorsulfuron or metsulfuron. Treatments were randomly assigned and replicated four times. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized (38 psi) backpack sprayer (Table 1). Treatments were timed as an early post-emergent application. Toadflax plants were approximately 1 to 2 inches tall.

Yellow toadflax density and control was measured in two 1-m quadrats per plots at each evaluation. Toadflax density was variable within the study plots. Plots with low density toadflax were identified as control treatments and toadflax patches outside the study plots were visually inspected for treatment comparisons. Spotted knapweed (CENMA) was the dominant broadleaf weed at the study site and was included in evaluations of treatment effects.

Table 1. Application and soil data.

Application date	June 15, 2010
Weed growth stage	1 to 2 inches
Air temp (F)	68
Relative humidity (%)	36
Wind (mph, direction)	3 to 9, W
Cloud cover (%)	15
Soil temp at 2 inches (F)	69
Soil type	sandy loam
Delivery rate (gpa)	16.1

Treatments were evaluated for yellow toadflax and spotted knapweed control 1 and 2.5 months after treatment (MAT). The number of living yellow toadflax plants and the percent foliar cover of living spotted knapweed were recorded. Control ratings were based on herbicide symptoms (injury to growing points, chlorosis/necrosis, and mortality) in comparison to the untreated check.

Each treatment resulted in high levels (>95%) of yellow toadflax control by the end of the growing season (2.5MAT; Table 2). No differences between the low and high rates of the aminocyclopyrachlor and chlorsulfuron combination, or between chlorsulfuron and metsulfuron treatments in combination with aminocyclopyrachlor, were detected at 1 and 2.5 MAT. Trends suggest that the combination of aminocyclopyrachlor and chlorsulfuron results in greater control in comparison to chlorsulfuron alone at 1 MAT. Similar results were observed in evaluations of spotted knapweed control (Table 3). Aminocyclopyrachlor combinations resulted in high levels (>95%) of yellow toadflax and spotted knapweed control, which was significantly greater than observed control levels of chlorsulfuron alone.

Perennial grasses present at the study site included smooth brome (*Bromus inermis* Leyss; BROIN), Canada bluegrass (*Poa compressa* L.; POACO) and tall oatgrass (*Arrhenatherum elatius* L; ARREL). Visual observations suggest that smooth brome was injured across treatments and resulted in reduced yields (visual), prevention of flowering, and chlorosis (data not shown). Injury ranged from 20 to 43% in comparison to the untreated check. No differences were detected between treatments.

Table 2. Yellow toadflax (LINVU) control 1 and 2.5 months after treatment (MAT) at Farragut State Park, ID.

		LINVU density			LINVU control	
Treatment [1]	Rate	PRE	1 MAT	2.5 MAT	1 MAT	2.5 MAT
	oz ai /A	---------- # plts/m^2 ----------			-------- % --------	
Aminocyclopyrachlor + chlorsulfuron	0.94 + 0.38	26	19	0	92	100
Aminocyclopyrachlor + chlorsulfuron	2.5 + 1.0	14	11	0	95	100
Aminocyclopyrachlor + metsulfuron	2.5 + 0.8	26	11	0	94	100
Chlorsulfuron	1.0	17	8	3	75	98
Untreated check	--	1	1	1	0	0
Tukey's HSD		20	24	6	18	22

[1] 90% non-ionic surfactant (R-11) at 0.50% v/v was applied with all treatments

Table 3. Spotted knapweed (CENMA) control 1 and 2.5 months after treatment (MAT) at Farragut State Park, ID.

		CENMA cover			CENMA control	
Treatment [1]	Rate	PRE	1 MAT	2.5 MAT	1 MAT	2.5 MAT
	oz ai /A	--------------- % ---------------			-------- % --------	
Aminocyclopyrachlor + chlorsulfuron	0.94 + 0.38	10	14	0	100	100
Aminocyclopyrachlor + chlorsulfuron	2.5 + 1.0	15	11	0	85	100
Aminocyclopyrachlor + metsulfuron	2.5 + 0.8	12	9	0	100	100
Chlorsulfuron	1.0	13	22	20	39	62
Untreated check	--	15	22	34	0	0
Tukey's HSD		9	19	16	31	31

[1] 90% non-ionic surfactant (R-11) at 0.50% v/v was applied with all treatments

Kochia control using aminocyclopyrachlor with combinations of roadside vegetative herbicides. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Anatone, WA in rangeland to evaluate kochia (KOSC) control with aminocyclopyrachlor, chlorsulfuron, sulfometuron methyl and diuron at various rates. Treatments were randomly assigned and replicated four times. Plot size was 10 by 20 feet. All treatments were applied with a CO_2-pressurized backpack sprayer (Table 1). At application, kochia had emerged (4 to 10 leaves). Glyphosate was applied in each plot, including the untreated check, in order to evaluate the pre-emergent activity of the treatments.

Table 1. Application and soil data.

Application date	May 6, 2010
Weed growth stage	PRE-emergent
Air temp (F)	50
Relative humidity (%)	50
Wind (mph, direction)	2 to 5, W
Cloud cover (%)	85
Soil temp at 2 inches (F)	58
Soil type	sandy loam
Delivery rate (gpa)	16.2

Visual evaluations were conducted approximately 1 and 4 months after treatment (MAT) within two 0.5 m^2 quadrats per plot. Kochia density was measured and levels of control were expressed as a percentage of the untreated check. Each herbicide treatment resulted in complete control (100%) 1 and 4 MAT (Table 2). In the untreated check, kochia density averaged 23 plants per 0.5 m^2 1MAT, but declined to 6 plants per 0.5 m^2 4 MAT, most likely due to intraspecific competition. Kochia canopy cover averaged 81% in the untreated check 4 MAT.

Table 2. Kochia (KOSC) density and control 1 and 4 months after treatment (MAT) near Anatone WA.

Treatment [1]	Rate	KOSC density		KOSC control	
	oz ai / A	1 MAT	4 MAT	1 MAT	4 MAT
		------- #plts/0.5m^2 -------		------------ % ------------	
Aminocyclopyrachlor +	2.75	0	0	100	100
Sulfometuron methyl +	1.65				
Chlorsulfuron +	0.83				
Diuron	76.8				
Aminocyclopyrachlor +	3.75	0	0	100	100
Sulfometuron methyl +	2.25				
Chlorsulfuron +	1.13				
Diuron	76.8				
Aminocyclopyrachlor +	4.50	0	0	100	100
Sulfometuron methyl +	2.75				
Chlorsulfuron +	1.38				
Diuron	76.8				
Aminopyralid +	1.75	0	0	100	100
Sulfometuron methyl +	2.25				
Metsulfuron +	0.60				
Diuron	76.8				
Untreated check	-	23	6	0	0
Tukey's HSD		12	2	0	0

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

Medusahead response to herbicide treatments. Katie M. Stoker and Corey V. Ransom. (Plants, Soils, and Climate Department, Utah State University, Logan, UT 84322-4820) Ongoing efforts are being made to control medusahead (*Taeniatherum caput-medusae (L.) Nevski*) in areas of Northern Utah. Herbicide treatments have produced variable results. Trials were conducted to evaluate efficacy of different herbicides and to compare medusahead response to different application timings. Twelve different treatments of five herbicides were tested in Avon and Paradise, Utah. Individual plots measured 10 x 30 feet and were arranged in a randomized block design with four replications. Treatments were applied with a backpack sprayer calibrated to deliver 20 gallons per acre. Fall treatments were applied September 1, 2009 and spring treatments on June 2, 2010 at both sites. Plots were evaluated on July 9, 2010. Medusahead control with imazapic and rimsulfuron increased with increasing rates. The reduced level of control with rimsulfuron may be due to the early fall application. It is recommended to be applied closer to soil freezing. There were no significant differences between spring and fall applied imazapic. Spring applications of imazapic at 1.5 oz plus 5.5 oz of glyphosate provided similar control to the imazapic at 2.5 oz alone. Fall applied sulfometuron plus chlorsulfuron provided 99% control at both rates evaluated. It may be possible that lower rates of this treatment could still be efficacious.

Table. Medusahead control with herbicides in Avon and Paradise, Utah

Treatment[1]	Rate	Application time	Medusahead control[2] Avon	Paradise
	oz ai/ A		%	
Untreated	-	-	-	-
Imazapic	1.5	Fall	71 ef	65 d
Imazapic	2.0	Fall	86 cd	79 cd
Imazapic	2.5	Fall	92 bc	84 bc
Imazapic	2.5	Spring	95 ab	94 ab
Imazapic + glyphosate	1.5 + 5.5	Spring	99 a	98 a
Rimsulfuron	0.75	Fall	60 f	75 cd
Rimsulfuron	1.0	Fall	70 ef	82 bc
Rimsulfuron	1.5	Fall	81 de	93 ab
Sulfometuron + chlorsulfuron	0.75 + 0.38	Fall	99 a	99 a
Sulfometuron + chlorsulfuron	1.5 + 0.75	Fall	99 a	99 a

[1]All treatments had NIS (non-ionic surfactant) added at 0.25 % v/v. Treatment with imazapic and glyphosate also included AMS at 8.5 lb/100 gal.

[2]Mean separations were performed on transformed data. Non-transformed data are shown. Values within a column followed by the same letter are not significantly different at P=0.05.

Wand mullein control two years after herbicide application. Heather Elwood and Corey Ransom. (Plants, Soils, and Climate Department, Utah State University, Logan, UT 84322-4820) Wand mullein (*Verbascum virgatum* S.) is a non-native biennial introduced from Europe that has been found spreading on western rangelands. Fall herbicide applications were made in October 2008 and spring herbicide applications were made in May 2009 on Antelope Island State Park. Individual plots measuring 10 by 30 feet were arranged in a randomized complete block design with four replications. All herbicides were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 19 gallons per acre. Non-ionic surfactant was added to all treatments at the rate of 0.25% v/v. Two years after application, data was collected on June 1, 2010. Plots were visually evaluated and density counts of bolted plants and rosettes were made. No significant application timing by herbicide interactions were observed so data are presented averaged over application timing. Chlorsulfuron provided the least control at 28%. Aminopyralid had less control than some of the best treatments, providing 80% control, while all other treatments continued to provide excellent control after two years. The number of bolted plants and rosettes per plot was not different among treatments except for chlorosulfuron. The number of plants found in plots treated with chlorsulfuron was similar to the untreated.

Table. Wand mullein control two years after herbicide application on Antelope Island State Park, UT

		Wand mullein[3]		
Treatment[1]	Rate[2]	Control	Stalks	Rosettes
	oz ae or ai/A	%	-------- #/plot -------	
Untreated	--	--	73 a	7.3 a
2,4-D amine	16.3	92 bc	5 b	0.4 b
2,4-D ester	16.3	95 ab	3 b	0.1 b
2,4-D amine + dicamba	12.0 + 4.0	94 bc	3 b	0.8 b
Chlorsulfuron	0.368	28 d	67 a	6.3 a
Metsulfuron	0.304	96 ab	2 b	0.1 b
Aminopyralid	1.25	80 c	11 b	0.5 b
Aminopyralid + 2,4-D	1.34 + 10.7	97 ab	1 b	0.6 b
Picloram	6.0	97 ab	1 b	0.1 b
Picloram + 2, 4-D	4.32 + 17.3	97 ab	2 b	0.1 b

[1]All treatments included non-ionic surfactant (NIS) applied at 0.25% v/v.
[2]Chlorsulfuron and metsulfuron rates applied at oz ai/A while all other rates were oz ae/A.
[3]Within a column, numbers followed by the same letter are not significantly different at $P<0.05$ according to Fisher's protected LSD.

Evaluation of aminocyclopyrachlor for Russian olive control. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminocyclopyrachlor (KJM44-062 or MAT28) has been evaluated for control of wide spread invasive weeds such as leafy spurge and Canada thistle. However, the effect of aminocyclopyrachlor on other invasive or troublesome weeds is largely unknown. The purpose of this research was to evaluate aminocyclopyrachlor efficacy on Russian olive (*Elaeagnus angustifolia* L.) applied as a cut-stump or basal bark treatment.

The first study evaluated aminocyclopyrachlor as a cut-stump treatment for control of Russian olive regrowth and was established on the Sheyenne National Grassland in cooperation with the U.S. Forest Service near McLeod, ND. Russian olive originally had been planted as part of a shelter belt but had spread into an adjacent pasture. The trees were 15 to 25 feet tall and ranged from approximately 10 to over 50 years old. The trees were cut by Forest Service personnel on April 21, 2008 and herbicides were applied to the stumps on May 8, 2009. Each treatment was applied to 3 trees (reps) and each replicate consisted of similar size tree stumps. The first replicate contained the smallest tree stumps which averaged 11 inches in diameter while replicate three contained the largest diameter stumps which averaged 20 inches.

Herbicides were applied on a percent solution basis in a petroleum based oil (herbicide:oil v:v) with a single nozzle hand-held pump sprayer. The aminocyclopyrachlor formulation was DPX MAT28-067 2 SL. Stumps were thoroughly covered to the point of run-off. Control was evaluated by counting the number of shoots arising from the stump and root collar of treated compared to non-treated stumps.

All cut-stump treatments provided excellent control of Russian olive regrowth (Table 1). An average of 127 stems/stump regrew from untreated trees in 2009 compared to no regrowth from any of the treated stumps. No regrowth was observed on any treated stump in 2010, 13 MAT, compared to an average of 24 stems/stump in the untreated control. Previous studies had found that the aminocyclopyrachlor spray solution became increasingly viscous and difficult to apply as the application rate increased. However, with the MAT28-067 2 SL formulation, the solution remained much less viscous and was not difficult to apply. Grass and brush species surrounding the cut-stumps also died even though the herbicide was not directly applied to these plants. The area of total vegetation control around each stump increased as the aminocyclopyrachlor application rate increased.

The second study evaluated aminocyclopyrachlor as a basal bark treatment and was established on private land near the first experiment. Herbicides were applied in bark oil on July 8, 2009 as previously described, except the application was made to the bark of uncut Russian olive trees. The herbicide was applied in an 8-inch band around the tree about 12 inches above the soil. If the tree had more than one stem, the largest was chosen for treatment. Each treatment was applied to four trees (reps). Each replicate had similar size trees which ranged from an average 5 inch circumference in Rep one to 13 inches in Rep four.

Aminocyclopyrachlor slowly controlled Russian olive when applied as a basal bark treatment (Table 2). Injury increased from 54 to 75% 6 weeks after treatment (18 Aug) as the aminocyclopyrachlor rate increased from a 5 to 15% solution. Aminocyclopyrachlor at 5% solution killed all but the largest trees and averaged 90% control by June 2010 (13 months after treatment). All Russian olive trees died when aminocyclopyrachlor was applied as a 10 or 15% solution. Control was similar with triclopyr applied alone at 25% or with imazapyr at 20 + 1%, respectively. As with the cut-stump study, all vegetation surrounding the treated tree was killed and the size of the area increased to over 6 ft in diameter, as the aminocyclopyrachlor rate increased. The largest area of injury was observed when the treatment included imazapyr.

In summary, aminocyclopyrachlor provided excellent Russian olive control when applied as a cut-stump or basal bark treatment. Aminocyclopyrachlor provided 100% control of regrowth when applied as a 2.5% solution in bark oil blue to cut-stumps, but had to be applied at a 10% or more solution to kill well established trees. Aminocyclopyrachlor should be applied as a 10% or less solution to reduce the application costs and non-target plant injury.

Table 1. Evaluation of aminocyclopyrachlor in combination with a bark oil as a cut stump treatment for Russian olive control applied on June 19, 2009 on the Sheyenne National Grassland, near McLeod, ND.

		Evaluation		
		2009		2010
Treatment[1]	Rate	8 July	18 Aug	16 June
	%	----------------Stems/stump----------------		
Aminocyclopyrachlor	2.5	0	0	0
Aminocyclopyrachlor	5	0	0	0
Aminocyclopyrachlor	10	0	0	0
Aminocyclopyrachlor	15	0	0	0
Triclopyr ester[2]	30	0	0	0
Triclopyr ester + imazapyr[3]	20 + 1	0	0	0
Aminocyclopyrachlor + imazapyr	10 + 1	0	0	0
Untreated	...	124	129	24
LSD (0.05)		72	47	3

[1] Herbicide treatments applied in Bark Oil Blue LT from UAP Distribution Inc., 7251 West 4th St., Greeley, CO.
[2] Commercial formulation - Garlon 4 from Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN.
[3] Commercial formulation - Stalker from BASF Corporation, 100 Campus Drive, Florham Park, ND.

Table 2. Evaluation of aminocyclopyrachlor as a basal bark treatment applied on July 8, 2009 for Russian olive control near McLeod, ND.

		Evaluation			
		2009		2010	
Treatment[1]	Rate	22 July	18 Aug	16 June	26 Aug
	%	--------% injury--------		--------%control--------	
Aminocyclopyrachlor	5	30	54	83	90
Aminocyclopyrachlor	10	41	79	100	100
Aminocyclopyrachlor	15	35	75	100	100
Triclopyr ester[2]	25	63	96	99	100
Triclopyr ester + imazapyr[3]	20 + 1	46	88	93	99
Aminocyclopyrachlor + imazapyr	10 + 1	45	68	99	100
Untreated	...	0	0	0	0
LSD (0.05)		21	25	12	8.5

[1] Herbicide treatments applied in Bark Oil Blue LT from UAP Distribution Inc., 7251 West 4th St., Greeley, CO.
[2] Commercial formulation - Garlon 4 from Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN.
[3] Commercial formulation - Stalker from BASF Corporation, 100 Campus Drive, Florham Park, ND.

<u>Feral rye application timing study on Colorado Rangeland</u>. James R. Sebastian and K.G. Beck, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Ft. Collins, Colorado 80523; Bobby Goeman and Tim D'Amato Larimer County Weed District, Ft. Collins, CO 80525. Feral rye (*Secale cereale*; SECCE) is a winter annual grass weed that reproduces by seed. SECCA was once an important crop and is a common problem in winter cereals. It also readily invades roadsides, abandoned areas, and rangeland in Colorado. SECCA competes with desirable rangeland perennial grasses for moisture because of its winter and early spring growth habit. The objective of this study was to determine if herbicides could effectively control SECCE without causing excessive and permanent perennial grass injury. An experiment was established near Loveland, CO in August 2009 to evaluate chemical control of SECCE on Colorado rangeland. SECCE emerged in November 2009 following fall precipitation. Application data are in Table 1.

Early fall (pre-emergence, August), early winter (1 to 2 leaf, November), early spring (1 tiller, March), and late spring (multi-tiller, April) application timings were compared in this experiment. Different timings were selected to evaluate feral rye control and perennial grass injury when sprayed at different growth stages (dormant, 1 to 2 leaf, and tillered). All perennial grass species were 35% green when PRE treatments were sprayed in August 2009 and dormant at the early winter timing. Western wheatgrass (*Pascopyrum smithii;* PASSM)was just emerging from dormancy or 2 to 4" tall at the early or late spring application timings, respectively. Blue grama (*Bouteloua gracilis*; a warm season grass) was dormant at all but the PRE timing in this experiment. The experiment was analyzed as a randomized complete block and treatments were replicated four times. Visual evaluations for SECCE control and western wheatgrass injury were conducted on April 27 and July 23, 2010. The July 2010 evaluation will be used for the SECCE control discussion in this report.

RESULTS

Imazapic was applied at the 1 to 2 leaf stage controlled 60% of SECCE (Table 2) while imazapic applied PRE or after tillering controlled 8 to 28% of SECCE. Rimsulfuron PRE treatments controlled 37% of SECCE. Rimsulfuron controlled 78 or 67% of SECCE when sprayed in early fall or early spring, respectively. Imazapic plus rimsulfuron tank mixes controlled SECCE similarly as the same rate of rimsulfuron sprayed alone. Nicosulfuron controlled 38 to 55% of SECCE at all timings.

Glyphosate controlled 55% of SECCE when sprayed in early fall and 89% was controlled when sprayed in early or late spring. Glyphosate has no residual activity and all SECCE that emerged after the early fall glyphosate treatments were not controlled. Glyphosate sprayed in late spring after all flushes of SECCE had emerged provided better SECCE control than fallapplied glyphosate. Glyphosate applied alone verses imazapic plus glyphosate controlled 55 vs. 82% SECCE at the early fall timing. SECCE control from glyphosate applied alone at all other timings was similar to imazapic plus glyphosate tank mixes (77 to 99% control) so there was little benefit to adding imazapic to glyphosate when sprayed in the spring. Past CSU research, however, has shown that there is poor residual SECCE control with imazapic the year following initial applications.

There was 0 to 70% western wheatgrass injury from all treatments at the April evaluation. The greatest initial western wheatgrass injury occurred from the early spring timing of rimsulfuron, rimsulfuron plus imazapic, or imazapic plus glyphosate (67 to 75% stand reduction) when PASSM was just emerging from dormancy. These same treatments when applied in early fall or late spring had 32 to 38% or 15 to 23% PASSM injury at the April 2010 evaluation, respectively. Western wheatgrass recovered from all injury caused by treatments in this experiment (0% stand reduction) by the July 2010 evaluation.

SECCE and perennial grass biomass were collected in November, 2010. Western wheatgrass, blue grama, and prairie sandreed (*Calamovilfa longifolia*) were the dominate perennial grass species present at this site and their biomass was pooled for analysis. Feral rye biomass tended to mirror feral rye control ratings and perennial grass biomass tended to increase with the increase in SECCE control (Table 3). The exception was the two spring imazapic plus rimsulfuron treatments that had fewer SECCE plants but were much larger in size. Untreated control plots produced 921 lb/A of feral rye and 71 lb/A of perennial grass compared to spring glyphosate or tank mix treatments that produced 0 to 54 lb/A of SECCE and 661 to 839 lb/A of perennial grass. Even though there was up to 75% injury of perennial grass in April 2010 the grass fully recovered and biomass increased 2- to 13-fold by the end of the growing season with all but the 2 spring-applied imazapic timings. Spring-applied imazapic controlled only 8 to 12% SECCA and grass biomass was similar to untreated checks.

CONCLUSIONS

Although there was initial perennial grass injury from most of the herbicides and timings in this study, all grass injury and stand reductions recovered by the end of the 2010 growing season. The treatments that provided the greatest SECCE control with the greatest increase in perennial grass stand were spring-applied glyphosate or glyphosate plus imazapic. This and previous research conducted by CSU has shown that SECCE can be effectively controlled and existing native perennial grass re-establish with appropriately timed applications of herbicides for one growing season. Past CSU research has also demonstrated poor SECCE control the year following initial applications. It may take several consecutive years of applications to rid the soil of viable SECCE seed. All treatments in this experiment will be re-applied over the original treated plots starting in fall 2010 to determine if several consecutive years of application will eliminate viable SECCE seed from the soil and continue to increase the production of the existing perennial grass species.

Table 1. Application data for feral rye control on Colorado rangeland.

Herbicide timing	Early fall	Late fall	Early spring	Late spring
Application date	August 25, 2009	November 6, 2009	March 5, 2010	April 13, 2010
Air temperature, F	67	58	48	55
Relative humidity, %	68	42	36	32

Application date	Species	Common name	Growth stage	Height
				--(in.)--
August 25, 2009	SECCE	Feral rye	Pre-emerge	0
	PASSM	Western wheatgrass	65% dried out	14 to 18
	BOUGR	Blue grama	Dormant	0
November 6, 2009	SECCE	Feral rye	1 to 2 leaf	½ to 1
	PASSM	Western wheatgrass	Dormant	0
	BOUGR	Blue grama	Dormant	0
March 5, 2010	SECCE	Feral rye	1 tiller	1½ to 2
	PASSM	Western wheatgrass	Emerging	0
	BOUGR	Blue grama	Dormant	0
April 13, 2010	SECCE	Feral rye	1-4 tiller	1½ to 2½
	PASSM	Western wheatgrass	2 to 3 leaf	2 to 4
	BOUGR	Blue grama	Dormant	0

Table 2. Visual estimates taken April 2010 of SECCE control and perennial grass injury on Colorado rangeland.

			Feral rye		Perennial grass	
Herbicide[1]	Rate	Timing	April 2010	July 2010	April 2010	July 2010
	oz ai/A		----------(% Control)--------		-----------(% Injury)---------	
Imazapic	1.8	PRE	40	28	0	0
Rimsulfuron	0.01	PRE	53	37	0	0
Imazapic	1.8	Early fall	83	60	28	0
Rimsulfuron	0.01	Early fall	92	78	32	0
Imazapic + rimsulfuron	1.0 + 0.01	Early fall	89	78	33	0
Glyphosate	8.0	Early fall	89	55	7	0
Imazapic + glyphosate[2]	2.0 + 8.0	Early fall	99	82	38	0
Nicosulfuron	0.8	Early fall	80	38	12	0
Imazapic	1.8	Early spring	55	12	47	0
Rimsulfuron	0.01	Early spring	94	67	67	0
Imazapic + rimsulfuron	1.0 + 0.01	Early spring	96	72	75	0
Glyphosate	8.0	Early spring	98	89	38	0
Imazapic + glyphosate[2]	2.0 + 8.0	Early spring	100	99	70	0
Nicosulfuron	0.8	Early spring	98	55	43	0
Imazapic	1.8	Late spring	23	8	10	0
Rimsulfuron	0.01	Late spring	23	25	15	0
Imazapic + rimsulfuron	1.0 + 0.01	Late spring	23	50	23	0
Glyphosate	8.0	Late spring	48	89	12	0
Imazapic + glyphosate[2]	2.0 + 8.0	Late spring	47	77	20	0
Nicosulfuron	0.8	Late spring	25	40	18	0
LSD (0.05)			18	25	18	0

[1] Nonionic surfactant and nitrogen was added to all treatments at 1% v/v (each).
[2] Pre-mix formulation of imazapic plus glyphosate (Journey).

Table 3. SECCE percent control and biomass of SECCE and perennial grass, November 2010.

Herbicide[1,2]	Rate	Timing	Feral rye	Feral rye	Perennial grass
---	oz ai/A		---(Control %)---	-------------(Biomass lb/A)-------------	
Imazapic	1.8	PRE	28	383	234
Rimsulfuron	0.01	PRE	37	448	205
Imazapic	1.8	Early fall	60	165	654
Rimsulfuron	0.01	Early fall	78	173	935
Imazapic + rimsulfuron	1.0 + 0.01	Early fall	78	46	503
Glyphosate	8.0	Early fall	55	213	592
Imazapic + glyphosate[2]	2.0 + 8.0	Early fall	82	207	527
Nicosulfuron	0.8	Early fall	38	390	264
Imazapic	1.8	Early spring	12	667	103
Rimsulfuron	0.01	Early spring	67	222	395
Imazapic + rimsulfuron	1.0 + 0.01	Early spring	72	389	508
Glyphosate	8.0	Early spring	89	13	773
Imazapic + glyphosate[2]	2.0 + 8.0	Early spring	99	0	839
Nicosulfuron	0.8	Early spring	55	270	742
Imazapic	1.8	Late spring	8	677	33
Rimsulfuron	0.01	Late spring	25	510	337
Imazapic + rimsulfuron	1.0 + 0.01	Late spring	50	502	399
Glyphosate	8.0	Late spring	89	1	661
Imazapic + glyphosate[2]	2.0 + 8.0	Late spring	77	54	709
Nicosulfuron	0.8	Late spring	40	273	323
Untreated check			0	921	71
LSD (0.05)			25	283	300

[1] Nonionic surfactant and nitrogen was added to all treatments at 1% v/v (each).
[2] Pre-mix formulation of imazapic plus glyphosate (Journey).

<u>St. Johnswort control using aminocyclopyrachlor at various rates</u>. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Harrison, ID in an abandoned pasture to evaluate St. Johnswort (HYPPE) control with aminocyclopyrachlor, metsulfuron, chlorsulfuron, and 2,4-D timed to the pre-flower stage. Treatments were randomly assigned and replicated three times. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer (Table 1). Treatments were timed to new stem growth, which ranged from 2 to 8 inches at application.

Visual evaluations were conducted one and two months after treatment (MAT) to determine St. Johnswort control following treatments timed to the pre-flower stage. Treatments were evaluated within 1-m^2 quadrats in each plot for density and injury symptoms of St. Johnswort. Injury symptoms included stem and leaf curling, leaf chlorosis, injury to growing points, and flower abortion; symptoms were evaluated as a percentage of the control treatment.

Table 1. Application and soil data.

Application date	May 20, 2010
Weed growth stage	2 to 8 inch stem
Air temp (F)	54
Relative humidity (%)	27
Wind (mph, direction)	3 to 10, W
Cloud cover (%)	85
Soil temp at 2 inches (F)	58
Soil type	sandy loam
Delivery rate (gpa)	16.6

Results indicate that aminocyclopyrachlor rate significantly affected the level of St. Johnswort control (Table 2). Aminocyclopyrachlor applied at 2 and 3 oz ai/A resulted in complete (100%) control, and the 1.5 oz ai/A rate resulted in a high-level (93%) of control at the end of the growing season (2 MAT). Lower rates, 0.5 and 1 oz ai/A, resulted in only partial control of St. Johnswort. The addition of chlorsulfuron improved control compared to aminocyclopyrachlor at 1 oz ai/A rate applied alone. The addition of aminocyclopyrachlor to a 2,4-D application also improved control in comparison to 2,4-D applied alone.

Table 2. St. Johnswort (HYYPE) control 1 and 2 months after treatment (MAT) near Harrison, ID in 2010.

		HYYPE density			HYYPE control	
Treatment [1]	Rate	PRE	1 MAT	2 MAT	1 MAT	2 MAT
	oz ai /A[2]	--------	#stems/m^2	--------	-------- %	--------
Aminocyclopyrachlor	0.5	49	37	39	13	28
Aminocyclopyrachlor	1.0	29	27	19	30	68
Aminocyclopyrachlor	1.5	39	18	1	73	93
Aminocyclopyrachlor	2.0	26	12	0	98	100
Aminocyclopyrachlor	3.0	45	15	0	100	100
2,4-D DMA	14.14	52	30	17	47	40
Metsulfuron	0.6	34	13	1	100	93
Aminocyclopyrachlor + chlorsulfuron	1.0 + 0.125	33	15	1	95	90
Aminocyclopyrachlor + 2,4-D DMA	1.0 + 3.5	62	35	16	48	87
Untreated check	--	44	53	53	0	0
Tukey's HSD		66	53	48	30	31

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

[2] 2,4-D DMA expressed as oz ae/A

Rush skeletonweed control with aminopyralid on Idaho rangeland. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Cambridge, ID in sagebrush-steppe to evaluate rush skeletonweed (CHOJU) control with various aminopyralid mixes at the rosette stage in the spring and late fall. The experiment was blocked by timing with four replications. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer at 15 gpa (Table 1).

Table 1. Application and soil data.

Application date	November 17, 2008	April 20, 2009
Weed growth stage	fall – rosette	spring - rosette
Air temp (F)	54	82
Relative humidity (%)	50	30
Wind (mph, direction)	0-1, W	1-3, NW
Cloud cover (%)	70	10
Soil temp at 2 inches (F)	50	80
Soil type	sandy loam	sandy loam

A visual evaluation was conducted on July 29, 2010, approximately 20 months after treatment (MAT) for the fall timing and 15 MAT for the spring timing. Rush skeletonweed density and cover was recorded in 1-m^2 quadrats at two transect points. Intermediate wheatgrass (AGIN) canopy cover was also recorded to estimate treatment effects on forage response.

Aminopyralid applied alone at 1.75 oz ai/A for both timings and picloram at 8 oz ai/A applied alone at the fall timing did not differ from rush skeletonweed densities in the untreated control. General trends indicate that long-term rush skeletonweed control improves when aminopyralid is applied in combination with picloram and at higher rates of both products. No differences between the premix of aminopyralid potassium and metsulfuron methyl and the aminopyralid-picloram tank mix were detected. Each treatment resulted in increased canopy cover of intermediate wheatgrass in comparison to the untreated check.

Table 2. Rush skeletonweed (CHOJU) control following herbicide treatments near Cambridge, ID.

Treatment [1]	Rate	Timing	CHOJO density	CHOJO cover	AGIN cover
	oz ae /A		--plts/ft^2--	--%--	--%--
Aminopyralid	1.75	Fall	14	25	16
Picloram	8	Fall	19	16	18
Aminopyralid + picloram	1.25 + 3	Fall	5	4	23
Aminopyralid + picloram	1.25 + 4.5	Fall	13	16	16
Aminopyralid + picloram	1.75 + 4	Fall	2	1	29
Aminopyralid + picloram	1.75 + 6	Fall	1	1	21
Aminopyralid potassium/metsulfuron methyl	2	Fall	8	8	17
Aminopyralid	1.75	Spring	17	22	17
Picloram	8	Spring	7	8	21
Aminopyralid + picloram	1.25 + 3	Spring	5	5	37
Aminopyralid + picloram	1.25 + 4.5	Spring	3	4	24
Aminopyralid + picloram	1.75 + 4	Spring	7	7	28
Aminopyralid + picloram	1.75 + 6	Spring	3	5	31
Aminopyralid potassium/metsulfuron methyl	2	Spring	14	14	17
Untreated check	--	--	29	46	4
Tukey's HSD			16	23	5

[1] 90% non-ionic surfactant (R-11) at 0.5% v/v was applied with all treatments

Aminopyralid applied alone or in combination with metsulfuron for western snowberry and Canada thistle control. Rodney G. Lym. (Plant Sciences Department, North Dakota State University, Fargo, ND 58108-6050). Western snowberry (*Symphoricarpos occidentalis* Hook.) also known as buckbrush, is perennial native forb species that often grows 4 to 5 feet tall in dense patches. Western snowberry can become weedy when grasses are over-grazed or removed by herbicides. Western snowberry is often found in areas previously treated with high rates of picloram for leafy spurge control as this species tolerates repeated picloram applications. The purpose of this research was to evaluate aminopyralid applied with metsulfuron for western snowberry and Canada thistle control.

The study was established on unused land near the campus of North Dakota State University in Fargo. The area had been heavily infested with leafy spurge, but repeated picloram applications combined with *Aphthona* spp. biocontrol agents had eliminated the weed. Western snowberry and Canada thistle had replace leafy spurge in the area. The treatments were applied June 19 or July 13, 2009. Western snowberry was in the vegetative to early flowering growth stage and 36 to 48 inches tall when treated in June while plants were post-flower to seed-set when herbicides were applied in July. Canada thistle was commonly found in the under story prior to treatment.

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 times in a randomized complete block design. Weed control was evaluated visually using percent stand reduction compared to the untreated control.

Herbicide treatments applied in June generally gave better initial western snowberry control (96%) than the same treatments applied in July (85%) (Table). However, control declined rapidly for all treatments. For instance, aminopyralid plus metsulfuron provided an average of 80 and 75% western snowberry control in June and September 2010 regardless of application date. Western snowberry control averaged 84 and 80% in June and August 2010 with 2,4-D at 32 oz/A which would be the most cost-effective treatment evaluated.

None of the treatments in this study provided satisfactory long-term Canada thistle control (Table). Generally aminopyralid at 1.25 to 1.75 oz/A provides better than 90% Canada thistle control for 1 to 2 yr in North Dakota, but in this study Canada thistle control from aminopyralid applied at similar rates averaged less than 50% control. The reason for the reduced control is likely from poor coverage during application. The western snowberry canopy was very dense and little herbicide likely reached Canada thistle or the soil. Once the brush species was injured Canada thistle tended to increase in the treated areas rather than decline.

In summary, aminopyralid applied with metsulfuron or metsulfuron plus 2,4-D provided similar western snowberry control to 2,4-D alone and would not be a cost-effective treatment for this species. A better approach for controlling Canada thistle growing in western snowberry would be to first reduce the brush species with 2,4-D and then apply aminopyralid to control the thistle.

Table. Aminopyralid plus metsulfuron applied at various rates alone and with 2,4-D in June or July 2009 for western snowberry and Canada thistle control at Fargo, ND.

		Evaluation date/species					
		17 Sept 09		9 June 10		20 Aug 10	
Treatment[1]		WESN[2]	CT	WESN	CT	WESN	CT
	— oz/A	——— % control					
June application							
Aminopyralid + metsulfuron[3]	1.05 + 0.19	100	70	74	60	62	22
Aminopyralid + metsulfuron	1.32 + 0.23	93	70	74	56	66	27
Aminopyralid + metsulfuron	1.58 + 0.28	96	97	80	69	73	47
Aminopyralid + metsulfuron + 2,4-D amine	1.05 + 0.19 + 16	98	78	86	62	75	48
Aminopyralid + metsulfuron + 2,4-D amine	1.05 + 0.19 + 8	93	88	84	73	79	43
Aminopyralid + metsulfuron + 2,4-D ester	1.05 + 0.19 + 8	100	88	87	90	80	52
2,4-D amine	32	90	77	86	75	78	17
Chlorsulfuron + metsulfuron[4]	0.076 + 0.24	100	65	93	63	82	30
July application							
Aminopyralid + metsulfuron	1.05 + 0.19	95	100	91	92	85	35
Aminopyralid + metsulfuron	1.32 + 0.23	77	100	77	87	67	52
Aminopyralid + metsulfuron	1.58 + 0.28	87	99	73	84	69	30
Aminopyralid + metsulfuron + 2,4-D amine	1.05 + 0.19 + 16	86	85	78	61	75	30
Aminopyralid + metsulfuron + 2,4-D ester	1.05 + 0.19 + 8	93	100	79	62	80	35
Aminopyralid + metsulfuron + 2,4-D amine	1.05 + 0.19 + 8	88	90	78	78	83	37
2,4-D amine	32	59	80	82	69	88	27
Chlorsulfuron + metsulfuron	0.076 + 0.24	96	100	82	83	86	13
LSD (0.05)		13	32	24	38	28	NS

[1] All treatments applied with NIS Activator 90 at 0.25%. Activator 90 from United Agri Products 7251 W. 4th St., Greeley, CO 80634.
[2] Abbreviations: WESN = western snowberry; CT=Canada thistle.
[3] Commercial formulation - Chaparral from Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.
[4] Commercial formulation - Cimarron Plus from DuPont Crop Protection P.O. Box 80705 CRP 705/L1S11, Wilmington, DE 19880-0705.

Long-term control of leafy spurge with aminocyclopyrachlor. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminocyclopyrachlor (KJM44-062 or MAT28) is a new and currently non-classified herbicide from E. I. DuPont company. Initial evaluations of this compound for general pasture and invasive weed control was promising on a variety of species. The purpose of this research was to evaluate aminocyclopyrachlor applied twice for both leafy spurge control and possible grass injury.

Aminocyclopyrachlor methyl ester (DPX KJM44-062) was initially applied alone from 1 to 3 oz ai/A in the spring or fall of 2007. The first experiment was established near Walcott, ND in an ungrazed area of pasture with a dense stand of leafy spurge (92 stems/m^2). Treatments were applied June 5, 2007 when leafy spurge was in the true-flower growth stage. All herbicides were reapplied on June 30, 2009 to evaluate long-term control and potential grass injury. The second experiment was established on abandoned cropland near Fargo, ND on September 19, 2007 when leafy spurge was in the fall regrowth stage with a stand density of 30 stems/m^2.

Treatments 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 for the fall and spring study, respectively, in a randomized complete block design. Leafy spurge control was evaluated visually using percent stand reduction compared to the untreated control.

Aminocyclopyrachlor applied at 2 oz/A or higher provided better long-term leafy spurge control than the standard treatments of picloram at 8 oz/A or picloram plus imazapic plus 2,4-D at 4 + 1 + 16 oz/A (Table 1). For instance, aminocyclopyrachlor applied at 2 oz/A provided 90 and 88% leafy spurge control in June and August 2008, respectively, compared to 58 and 45% control respectively, with picloram at 8 oz/A. Control averaged >80% with aminocyclopyrachlor at 2 to 3 oz/A in June 2009, 24 MAT (months after treatment) but had declined to 48 to 65% with aminocyclopyrachlor applied at 1 to 1.5 oz/A.

Long-term leafy spurge control tended to be higher 15 MAT following a second application compared to a single treatment. For instance, leafy spurge control averaged 89% compared to 55% in August 2010 or August 2008 (15 MAT), respectively, when aminocyclopyrachlor at 1 oz/A was applied twice. Also, the commonly used treatment of picloram + imazapic + 2,4-D provided 83% leafy spurge control in August 2010 (15 months after second application) compared to only 56% in August 2008 (15 months after single application). The major grass species present were Kentucky bluegrass and smooth brome and less than 5% grass injury was observed following either the 2007 or 2009 treatment applications (data not shown).

Leafy spurge control 11 MAT with aminocyclopyrachlor applied in the fall increased from 89 to 99% as the application rate increased from 1 to 3 oz/A (Table 2). Control was similar to picloram at 16 oz/A . Grass injury was not observed with either herbicide (data not shown). Leafy spurge control averaged over treatments was 93% in June 2010 but declined to 86% by September (36 MAT). This was much better control than normally observed with the standard treatment of picloram at 16 oz/A. In summary, aminocyclopyrachlor provided better long-term leafy spurge control than commonly used treatments with little grass injury.

Table 1. Evaluation of aminocyclopyrachlor for leafy spurge control applied in June 2007 and again in June 2009 near Walcott, ND.

		Leafy spurge control/evaluation date						
		2007	2008		2009		2010	
Treatment	Rate	6 Aug	9 June	19 Aug	10 June	18 Aug	15 June	20 Aug
	oz/A	----------------------------------			%		----------------------------------	
Aminocyclopyrachlor[1]	1	92	79	55	48	92	93	89
Aminocyclopyrachlor	1.5	98	87	71	65	95	92	86
Aminocyclopyrachlor	2	99	90	88	81	95	98	96
Aminocyclopyrachlor	2.5	99	97	92	86	98	99	97
Aminocyclopyrachlor	3	99	96	92	87	100	99	95
Picloram	8	86	58	45	41	98	76	79
Picloram + imazapic + 2,4-D	4 + 1 + 16	97	45	56	38	95	89	83
LSD (0.05)		7	31	23	36	NS	15	17

[1] MSO was added to all treatments at 1% v/v except at 1 qt/A with picloram + imazapic + 2,4-D. Scoil by AGSCO, 1168 12th St NE, Grand Forks, ND 58201.

Table 2. Evaluation of aminocyclopyrachlor for leafy spurge control applied in September 2007 at Fargo, ND.

		Leafy spurge control/evaluation date					
		2008		2009		2010	
Treatment	Rate	20 June	20 Aug	12 June	3 Sept	10 July	8 Sept
	oz/A	--------------------------------		%		--------------------------------	
Aminocyclopyrachlor[1]	1	93	89	92	74	90	78
Aminocyclopyrachlor	2	99	97	98	85	93	82
Aminocyclopyrachlor	3	100	99	98	89	97	95
Picloram	16	99	97	98	82	90	88
LSD (0.05)		NS	7	4	NS	NS	NS

[1] MSO was added to all treatments at 1% v/v except at 1 qt/A with picloram. Scoil by AGSCO, 1168 12th St NE, Grand Forks, ND 58201.

Evaluation of aminocyclopyrachlor for plumeless thistle control. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminocyclopyrachlor (KJM44-062 or MAT28) has been evaluated for control of several perennial weed species but the effect on non-perennial invasive weeds is generally unknown. The purpose of this research was to evaluate aminocyclopyrachlor for long-term control of the biennial invasive species plumeless thistle (*Carduus acanthoides* L.).

The experiment was established on former pastureland on the campus of North Dakota State University on June 19, 2009. Plumeless thistle was in the rosette growth stage and beginning to bolt. 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 times in a randomized complete block design. Control of plumeless thistle was evaluated visually using percent stand reduction compared to the untreated control. Results were compared to other commonly used herbicides applied at the general use rate for this weed.

Aminocyclopyrachlor provided excellent long-term plumeless thistle control, but initial injury was slower than with aminopyralid (Table). For instance, plumeless thistle injury a month after treatment averaged 90% with aminopyralid at 1.25 oz/A compared to 75% with aminocyclopyrachlor at 1.5 oz/A. Control gradually increased over the summer and averaged 95 to 100% when aminocyclopyrachlor was applied at 1 to 2 oz/A. Control was similar whether aminocyclopyrachlor was applied alone or with metsulfuron or chlorsulfuron. The following growing season plumeless thistle control was 99 to 100% regardless of treatment (May 2010). Thus, 2,4-D at 16 oz/A would be the most cost-effective treatment in this study. Grass injury was not observed with any treatment. In conclusion, aminocyclopyrachlor applied at 0.25 oz/A or more provided near complete control of plumeless thistle by the following growing season, but plants died at a much slower rate than those treated with aminopyralid.

Table. Plumeless thistle control with aminocyclopyrachlor applied on June 19, 2009 at Fargo, ND.

		2009			2010
Treatment	Rate	15 July	14 Aug	17 Sept	27 May
	oz/A	% injury	--------------% control--------------		
Aminocyclopyrachlor + NIS[1]	0.25 + 0.25 %	42	53	71	100
Aminocyclopyrachlor + NIS	0.5 + 0.25 %	50	70	80	99
Aminocyclopyrachlor + NIS	1 + 0.25 %	73	95	95	100
Aminocyclopyrachlor + MSO[2]	1 + 0.25 %	77	93	100	99
Aminocyclopyrachlor + NIS	1.5 + 0.25 %	75	98	96	99
Aminocyclopyrachlor + NIS	2 + 0.25 %	90	100	100	100
Aminocyclo[3] + metsulfuron + NIS	1 + 0.2 + 0.25 %	70	98	98	100
Aminocyclo + chlorsulfuron + NIS	1 + 0.125 + 0.25 %	65	90	100	99
Aminocyclo + 2,4-D + NIS	1 + 8 + 0.25 %	80	95	100	99
Aminopyralid + NIS	1.25 + 0.25 %	90	100	100	99
2,4-D + NIS	16 + 0.25 %	60	57	77	100
Untreated	...	0	0	10	0
LSD (0.05)		7	9	15	1.5

[1] NIS was Induce from Helena Chemical Co., Collierville, TN 38017.
[2] MSO was Scoil, by UAP, Grand Forks, ND 58203.
[3] Amincocyclo = aminocyclopyrachlor.

<u>Tolerance of rangeland forbs to various rates of aminocyclopyrachlor</u>. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Moscow, ID in Palouse Prairie remnant to evaluate the level of impact of various rates of aminocyclopyrachlor on desirable rangeland forbs. The experiment was designed as a randomized complete block with three replications and conducted at two sites located within the same remnant. Plot size was 10 by 40 feet. All treatments were applied with a CO_2-pressurized backpack sprayer at 15 gpa (Table 1).

Table 1. Application and soil data.

Application date	May 21, 2009
Target growth stage	actively growing plants
Air temp (F)	68
Relative humidity (%)	32
Wind (mph, direction)	0 to 2, W
Cloud cover (%)	0
Soil temp at 2 inches (F)	60
Soil type	loam

Injury symptoms on desirable forb species were evaluated in comparison to the untreated control during the first growing season (2009) in multiple quadrats along a permanent transect in each plot. In 2010, approximately 13 MAT, quadrats were re-evaluated to assess changes in canopy cover of desirable forbs that were impacted by herbicide treatments. The primary forb species evaluated were: arrowleaf balsamroot (BALSA), fernleaf biscuitroot (LOMDI), snowberry (SYMAL), wood's rose (ROSWO), Lupine species (LU SPP.), and yellow salsify (TRODU). Analysis of injury symptoms is pooled across sites.

Results indicate that cover of arrowleaf balsamroot (BALSA) and fernleaf biscuitroot (LOMDI) had significantly declined in the second growing season (13 MAT; Table 2). Trends indicate that cover declined with increasing rates of aminocyclopyrachlor when applied alone or in combination with chlorsulfuron or 2,4-D DMA. No trends were discernible in analysis of snowberry (SYMAL), rose (ROSWO) or lupine species (LU SPP). Analysis of annual grasses and forbs, as well as soil and litter, did not result in detection of herbicide effects (Table 3).

Table 2. Cover (%) of six forb species approximately 1 and 13 MAT.

		BALSA[3]		LOMDI		SYMAL		ROSWO		LU SPP.	
		MAT		MAT		MAT		MAT		MAT	
Treatment [1]	Rate[2]	1	13	1	13	1	13	1	13	1	13
	oz ai /A	------------------------------- % Cover -------------------------------									
DPX-MAT28	0.5	8	8	13	3	23	24	0	2	0	1
DPX-MAT28	1	15	8	23	1	20	13	0	4	0	1
DPX-MAT28	2	13	3	9	0	21	13	3	1	1	1
DPX-MAT28 + 2,4-D DMA	1 + 6.2	4	1	26	0	20	15	0	1	1	1
DPX-MAT28 + chlorsulfuron	1 + 0.15	23	4	20	5	18	20	2	1	0	1
Untreated check	--	7	23	24	16	22	14	3	1	0	1
Tukeys HSD		4	16	13	10	21	8	2	5	1	3

[1] 90% non-ionic surfactant (R-11) at 0.5% v/v was applied with all treatments
[2] 2,4-D DMA expressed as oz ae/A
[3] BALSA = arrowleaf balsamroot., LOMDI = fernleaf biscuitroot, SYMAL = common snowberry, ROSWO = wood's rose., LU SP. = Lupine species, TRODU = yellow salsify.

Table 3. Cover (%) estimates of annual plants and soil approximately 13 MAT.

Treatment [1]	Rate[2]	Annual grass	Annual forbs	Soil
	oz ai /A	----------------------	% Cover	-------------------------
DPX-MAT28	0.5	15	17	30
DPX-MAT28	1	22	13	34
DPX-MAT28	2	10	17	38
DPX-MAT28 + 2,4-D DMA	1 + 6.2	17	16	41
DPX-MAT28 + chlorsulfuron	1 + 0.15	15	12	32
Untreated check	--	18	15	25
Tukeys HSD		17	13	19

[1] 90% non-ionic surfactant (R-11) at 0.5% v/v was applied with all treatments
[2] 2,4-D DMA expressed as oz ae/A

Effect of postemergent applied herbicides on small burnet forage and seed production. Ryan L. Nelson, Corey V. Ransom, and Michael Peel*. (Plants, Soils, and Climate Department, Utah State University, Logan, UT 84322-4820, *USDA-ARS Forage and Range Research Lab, Logan, UT 84322-6300) Small burnet (*Sanguisorba minor* scop) is a perennial, evergreen forb in the rosacaceae family. It is a hardy, relatively long lived forb native to Eurasia that does well in most of North America. Because of its evergreen nature there is interest in its use to extend grazing of pastures and rangelands into late fall and winter. A study was designed to evaluate small burnet tolerance to herbicides that have potential for use in seed and forage production. The study was conducted at Utah State University's Evans research farm in Millville, UT. The study was a randomized complete block design with a split-plot arrangement where herbicide treatment was the whole-plot and small burnet genotype was the sub-plot. Plots were 6.3 x 10 ft consisting of one row of each genotype spaced 3 ft apart and a plant every 1.5 ft. The varieties were Delar, a commercially available variety, and C-05 a morphologically distinct experimental variety. Six plants of both varieties were included in each plot. Plots were given a visual rating of 1 to 10, where 1= complete mortality and 10= no injury. Herbicide treatments were applied using a CO_2 -pressurized backpack sprayer calibrated to deliver 20 gpa at 30 psi. Twelve treatments were applied, 11 herbicides and 1 untreated. Treatments were applied June 4, 2009 (spring), and November 11, 2009 (fall). Seed from Delar was hand harvested July 21, 2010 and seed from C-05 August 5, 2010 to determine seed yield. The remaining biomass was harvested August 6, 2010 with a mechanical harvestor and samples were taken to determine the Dry Matter Yield (DMY). The dry weight seed yield from each plot was added to the DMY. Fall treatments of aminopyralid and imazamox showed the most injury reducing seed yield and DMY by 95% and 84% (aminopyralid) and 48% and 42% (imazamox). Aminopyralid caused the greatest visual injury of all the spring treatments with a rating of 5.5 compared to 9.0 for the untreated. Fall applications of dicamba also caused significant injury with a rating of 5.1 compared to 9.5 for the untreated, and DMY was 7% less than the untreated plots with seed yield showing a 14% increase. Pendimethalin and dimethenamid-P showed little or no injury. This data suggests that clethodim, metribuzin, and quinclorac have potential for use in small burnet seed or forage production.

Table. Herbicide injury, biomass, and seed yield of small burnet (*Sanguisorba minor*) in response to spring and fall postemergence herbicide applications.

Herbicide[1]	Rate[2]	Injury		Total dry matter		Seed yield	
		Spring	Fall	Spring	Fall	Spring	Fall
	oz ai or ae/A	—1 to 10—		———% of untreated———			
Untreated	--	9.0	9.5	-	-	-	-
Clethodim	1.94	8.5	8.6	92	110	107	118
Clopyralid	3.96	7.1	7.9	87	115	92	118
Imazamox	0.63	8.3	1.8	92	58	102	52
2,4-DB	16.0	7.5	7.6	86	109	98	122
Metribuzin	8.0	7.4	8.3	91	102	111	114
Aminopyralid	1.25	5.5	1.0	74	16	97	5
Pendimethalin	30.4	7.6	8.6	96	103	118	111
Dimethenamid-P	13.5	9.0	8.6	101	117	104	113
Bromoxynil	4.0	8.5	8.8	90	106	96	114
Dicamba	8.0	8.6	5.1	101	93	119	114
Quinclorac	3.98	8.0	8.4	94	123	99	138
LSD (0.05)		1.68		25		20	

[1]Imazamox treatment included MSO at 1.0%v/v and AMS at 10 lb/100 gal. Clethodim treatment included NIS at 0.25% v/v.

[2]All herbicide rates are oz ai/A except clopyralid, 2,4D-B, aminopyralid, dicamba, and quinclorac which are listed as oz ae/A.

[3]Injury rating were on a scale of 1 to 10, with 1= complete mortality and 10= no injury.

Tolerance of rangeland pasture grasses to aminocyclopyrachlor. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho). An experiment was established at two sites near Moscow, ID to evaluate the tolerance of established stands of Idaho fescue (FEID) and bluebunch wheatgrass (PSSP) to various rates of aminocyclopyrachlor. Plot size was 10 by 10 feet and replicated four times. All treatments were applied with a CO_2-pressurized backpack sprayer. Herbicide applications were timed to a typical spring application for broadleaved weeds in northern Idaho (Table 1.)

Table 1. Application and soil data.

Site	Lenville	Gormsen
Target plant	Bluebunch wheatgrass	Idaho fescue
Application date	May 12, 2010	June 1, 2010
Application timing	spring broadleaf timing	spring broadleaf timing
Air temp (F)	62	58
Relative humidity	5	65
Wind (mph, direction)	3 to 7	1 to 3
Soil temp at 2 inches (F)	57	50
Soil type	loam	loam

Visual evaluations were conducted 24 and 32 days after treatment (DAT) for the Idaho fescue and bluebunch wheatgrass studies, respectively. Herbicide symptoms, including chlorosis, epinasty, and stunting were assessed as a percentage of the untreated check. In addition, the percentage of flowering plants within the plot was estimated and five random height (natural canopy) measurements of target plants were recorded. No differences were detected in the height or percentage of flowering plants between treatments for both studies (Table 2-3). Visual symptoms such as chlorosis or epinasty in comparison to the untreated check were negligible (<6%) for either target species.

At the peak of the growing season, biomass was estimated by clipping two samples (0.015 m^2) of the target species in each plot. Samples were dried at 60° C for 72 hrs and weighed to the nearest gram. No differences between treatments in biomass yields were detected (Table 4). These results suggest that herbicide treatments had minimal effect on the native bunchgrasses, Idaho fescue or bluebunch wheatgrass.

Table 2. Treatment effects on Idaho fescue (FEID) 24 days after treatment (DAT).

		FEID		
Treatment[1]	Rate	Height	Flowering	Chlorosis
	oz ai/A	---- cm ----	---- % ----	----- % -----
Aminocyclopyrachlor	1.0	60	80	0
Aminocyclopyrachlor	2.0	63	76	6
Aminocyclopyrachlor	4.0	61	70	6
Aminocyclopyrachlor + chlorsulfuron	1.58 + 0.63	65	76	0
Aminocyclopyrachlor + chlorsulfuron	2.37 + 0.94	65	90	0
Aminocyclopyrachlor + chlorsulfuron	4.74 + 1.89	57	76	0
Aminopyralid	1.25	64	83	0
Aminopyralid	1.75	63	83	0
Aminopyralid	3.50	65	90	0
Aminocyclopyrachlor + metsulfuron	1.33 + 0.20	62	86	0
Aminocyclopyrachlor + 2,4-D DMA	1.39 + 10.6	61	72	6
Untreated check	--	64	80	0
Tukeys HSD		12	38	--

[1] All treatments applied with a non-ionic surfactant (NIS) at 0.25% v/v

Table 3. Treatment effects on bluebunch wheatgrass (PSSP) 32 days after treatment (DAT).

Treatment[1]	Rate	PSSP Height	PSSP Flowering	PSSP Chlorosis
	oz ai/A	--- cm ---	---- % ----	----- % -----
Aminocyclopyrachlor	1.0	57	63	0
Aminocyclopyrachlor	2.0	48	6	0
Aminocyclopyrachlor	4.0	48	25	0
Aminocyclopyrachlor + chlorsulfuron	1.58 + 0.63	48	19	0
Aminocyclopyrachlor + chlorsulfuron	2.37 + 0.94	47	19	0
Aminocyclopyrachlor + chlorsulfuron	4.74 + 1.89	45	19	0
Aminopyralid	1.25	50	31	0
Aminopyralid	1.75	51	38	0
Aminopyralid	3.50	51	25	0
Aminocyclopyrachlor + metsulfuron	1.33 + 0.20	48	6	0
Aminocyclopyrachlor + 2,4-D DMA	1.39 + 10.6	53	32	0
Untreated check	--	51	13	0
Tukeys HSD		11	68	NS

[1] All treatments applied with a non-ionic surfactant (NIS) at 0.25% v/v

Table 4. Effect of herbicide treatments on Idaho fescue (FEID) and bluebunch wheatgrass yields (PSSP).

Treatment[1]	Rate	Biomass FEID	Biomass PSSP
	oz ai/A	-------------------- g/0.125m^2	--------------------
Aminocyclopyrachlor	1.0	25	67
Aminocyclopyrachlor	2.0	28	63
Aminocyclopyrachlor	4.0	20	37
Aminocyclopyrachlor + chlorsulfuron	1.58 + 0.63	29	59
Aminocyclopyrachlor + chlorsulfuron	2.37 + 0.94	23	44
Aminocyclopyrachlor + chlorsulfuron	4.74 + 1.89	23	70
Aminopyralid	1.25	28	53
Aminopyralid	1.75	25	54
Aminopyralid	3.50	26	78
Aminocyclopyrachlor + metsulfuron	1.33 + 0.20	30	71
Aminocyclopyrachlor + 2,4-D DMA	1.39 + 10.6	23	55
Untreated check	--	32	62
Tukeys HSD		20	70

[1] All treatments applied with a non-ionic surfactant (NIS) at 0.25% v/v

Tolerance of perennial pasture grass seedlings to aminocyclopyrachlor. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho). An experiment was established at Parker and Kambitsch Farms near Moscow, ID in October 2009 to evaluate the tolerance of Idaho fescue (FEID), bluebunch wheatgrass (PSSP), Sandberg bluegrass (POSE), basin wildrye (LECI) and mountain brome (BRMA) seedlings to various rates of aminocyclopyrachlor and surfactants. Grasses were planted on October 13, 2009. Treatments were applied on May 12, 2010 targeting the emerged grasses that ranged from 1 to 3 tillers (Table 1). Treatments will be replicated on two-year stands of planted grasses at both sites.

Table 1. Application and soil data.

Site	Parker	Kambitsch
Application date	May 12, 2010	May 12, 2010
Application timing	1 to 3 tiller	1 to 3 tiller
Air temp (F)	62	64
Relative humidity	5	5
Wind (mph, direction)	3 to 7	3 to 9
Soil temp at 2 inches (F)	57	58
Soil type	loam	loam

Crop recruitment was highly variable across plots and sites. Plant density was recorded within transects at the initiation of the study in order to evaluate mortality. Transects were re-evaluated 28 days after treatment (DAT). Results indicate that herbicide treatments did not result in mortality (Table 2-6). Differences in density between the two sampling dates was likely due to increased emergence, intra-specific competition or observation error. Injury symptoms were evaluated 28 and 50 DAT for each species (Table 2-6). Biomass was sampled 2 months after treatment (MAT). Five plants per plot were randomly selected, clipped and dried for 64 hrs at 60 C (Table 7). Biomass estimates are expressed as grams per plant. Treatment effects differed across perennial grass species.

Idaho fescue (Table 2): Evidence of chlorosis was greater (28%) at the highest rate of aminocyclopyrachlor with either surfactant 28 DAT. Injury symptoms were minimal at other aminocyclopyrachlor rates. By 50 and 80 DAT, herbicide effects were negligible at all rates. Biomass yields did not differ from the untreated control across all treatments (Table 7).

Bluebunch wheatgrass (Table 3): Chlorosis and twisting were observed at all rates and surfactant combinations. Trends suggest that herbicide injury increases at higher rates and when herbicide is used in combination with methylated seed oil (MSO) in comparison to a non-ionic surfactant (NIS). The effect of MSO seems to be amplified at higher rates of aminocyclopyrachlor. No trends were detected in analysis of biomass yields (Table 7).

Sandberg's bluegrass (Table 4): Chorosis was observed at 28 DAT across all treatments, but twisting symptoms were negligible. Chlorosis was greatest at the 4 oz ai/A rate, and in general, treatment rates with MSO resulted in greater injury than a NIS. At 50 DAT, chlorosis and twisting were observed at the 4 oz ai/A rate, but injury symptoms were negligible across other treatments. No trends were detected in comparison of biomass (Table 7).

Mountain brome (Table 5): Chlorosis and twisting symptoms were observed at each evaluation. Increased rates of aminocyclopyrachlor resulted in greater injury, and the use of MSOs resulted in greater injury in comparison to NIS. At high rates, 2 and 4 oz ai/A, injury was significant to the plants. Secondary and tertiary leaves were significantly twisted, affecting growth and architecture of the plant. These symptoms are reflected in analysis of biomass. Plant biomass in the untreated check were approximately two times the biomass of plants treated at the high rate of aminocyclopyrachlor (Table 7).

Basin wildrye (Table 6): Chlorosis and twisting symptoms were observed at each evaluation. Increased rates of aminocyclopyrachlor resulted in greater injury. Injury symptoms persisted at later evaluation dates (50 and 80 DAT) in plants treated at the high rate of aminocyclopyrachlor. No trends were detected in analysis of biomass yields, but visual observations suggest that the 2 and 4 oz ai/A rates of aminocyclopyrachlor resulted in herbicide injury that significantly affected plant growth (Table 7).

Table 2. Treatment effects on Idaho fescue (FEID) 28, 50 and 80 days after treatment (DAT).

		Density DAT		Chlorosis DAT		Twisting DAT		Injury DAT		
Treatment[1]	Rate	6	28	28	50	28	50	28	50	80
	oz ai/A	plant/transect		----%----		----%----		------%------		
Aminocyclopyrachlor + NIS	0.5	18	15	3	0	0	0	1	0	0
Aminocyclopyrachlor + MSO	0.5	11	10	18	0	0	0	7	0	0
Aminocyclopyrachlor + NIS	1.0	15	15	3	0	1	0	6	0	0
Aminocyclopyrachlor + MSO	1.0	11	11	7	0	4	0	2	0	0
Aminocyclopyrachlor + NIS	2.0	14	13	9	0	1	4	4	2	0
Aminocyclopyrachlor + MSO	2.0	14	14	9	1	0	0	4	1	0
Aminocyclopyrachlor + NIS	4.0	18	20	28	0	6	0	15	0	0
Aminocyclopyrachlor + MSO	4.0	16	14	28	3	0	0	11	0	0
Untreated check		14	14	0	0	0	0	0	2	0
Tukey's HSD		12	11	8	5	12	5	18	4	0

[1] Non-ionic surfactant (NIS) applied at 0.25% v/v; methylated seed oil (MSO) applied at 1.0% v/v

Table 3. Treatment effects on bluebunch wheatgrass (PSSP) 28, 50 and 80 days after treatment (DAT).

		Density DAT		Chlorosis DAT		Twisting DAT		Injury DAT		
Treatment[1]	Rate	6	28	28	50	28	50	28	50	80
	oz ai/A	plant/transect		----%----		----%----		------%------		
Aminocyclopyrachlor + NIS	0.5	8	8	6	0	3	0	4	0	8
Aminocyclopyrachlor + MSO	0.5	9	8	16	13	3	3	8	7	5
Aminocyclopyrachlor + NIS	1.0	8	8	11	3	0	0	4	1	8
Aminocyclopyrachlor + MSO	1.0	8	11	7	0	0	3	3	2	33
Aminocyclopyrachlor + NIS	2.0	7	7	23	6	3	16	11	18	7
Aminocyclopyrachlor + MSO	2.0	8	10	38	13	16	22	24	12	18
Aminocyclopyrachlor + NIS	4.0	6	7	44	31	6	22	21	26	42
Aminocyclopyrachlor + MSO	4.0	7	6	56	34	16	44	32	40	33
Untreated check		10	7	0	0	0	0	0	0	0
Tukey's HSD		6	7	39	27	19	28	23	21	63

[1] Non-ionic surfactant (NIS) applied at 0.25% v/v; methylated seed oil (MSO) applied at 1.0% v/v

Table 4. Treatment effects on Sandberg's bluegrass (POSE) 28, 50 and 80 days after treatment (DAT).

		Density DAT		Chlorosis DAT		Twisting DAT		Injury DAT		
Treatment[1]	Rate	6	28	28	50	28	50	28	50	80
	oz ai/A	plant/transect		-----%-----		-----%-----		------%------		
Aminocyclopyrachlor + NIS	0.5	3	4	9	0	0	6	4	4	3
Aminocyclopyrachlor + MSO	0.5	30	5	16	0	0	1	16	1	0
Aminocyclopyrachlor + NIS	1.0	5	6	4	0	1	0	10	0	0
Aminocyclopyrachlor + MSO	1.0	9	12	3	0	4	1	1	1	3
Aminocyclopyrachlor + NIS	2.0	8	8	9	0	1	7	7	7	12
Aminocyclopyrachlor + MSO	2.0	6	6	17	0	0	7	9	4	14
Aminocyclopyrachlor + NIS	4.0	9	5	33	4	6	21	18	14	32
Aminocyclopyrachlor + MSO	4.0	4	7	47	21	0	54	20	41	29
Untreated check		5	5	0	0	0	0	0	0	0
Tukey's HSD		41	10	40	21	12	30	29	23	50

[1] Non-ionic surfactant (NIS) applied at 0.25% v/v; methylated seed oil (MSO) applied at 1.0% v/v

Table 5. Treatment effects on mountain brome (BRMA) 28, 50 and 80 days after treatment (DAT).

		Density DAT		Chlorosis DAT		Twisting DAT		Injury DAT		
Treatment[1]	Rate	6	28	28	50	28	50	28	50	80
	oz ai/A	plant/transect		----%-----		-----%-----		------%------		
Aminocyclopyrachlor + NIS	0.5	14	14	16	3	3	9	8	7	5
Aminocyclopyrachlor + MSO	0.5	13	14	8	4	0	3	3	3	5
Aminocyclopyrachlor + NIS	1.0	12	13	19	6	0	6	8	6	5
Aminocyclopyrachlor + MSO	1.0	12	13	25	6	16	6	19	6	15
Aminocyclopyrachlor + NIS	2.0	13	12	31	8	19	13	24	11	24
Aminocyclopyrachlor + MSO	2.0	12	13	63	3	34	28	46	18	23
Aminocyclopyrachlor + NIS	4.0	13	14	59	13	37	44	46	31	27
Aminocyclopyrachlor + MSO	4.0	13	14	78	28	41	59	56	47	40
Untreated check		10	12	9	0	6	0	0	0	0
Tukey's HSD		6	5	45	25	37	26	36	20	34

[1] Non-ionic surfactant (NIS) applied at 0.25% v/v; methylated seed oil (MSO) applied at 1.0% v/v

Table 6. Treatment effects on basin wildrye (LECI) 28, 50 and 80 days after treatment (DAT).

		Density DAT		Chlorosis DAT		Twisting DAT		Injury DAT		
Treatment[1]	Rate	6	28	28	50	28	50	28	50	80
	oz ai/A	plant/transect		-----%-----		-----%-----		------%------		
Aminocyclopyrachlor + NIS	0.5	13	17	22	6	19	19	20	14	5
Aminocyclopyrachlor + MSO	0.5	14	18	31	6	13	20	20	15	5
Aminocyclopyrachlor + NIS	1.0	12	12	22	3	5	11	12	8	8
Aminocyclopyrachlor + MSO	1.0	13	13	18	6	14	11	16	9	24
Aminocyclopyrachlor + NIS	2.0	14	14	47	6	28	33	36	22	33
Aminocyclopyrachlor + MSO	2.0	13	14	56	19	40	50	47	38	53
Aminocyclopyrachlor + NIS	4.0	18	20	66	44	35	63	47	55	56
Aminocyclopyrachlor + MSO	4.0	15	14	63	22	48	63	54	47	57
Untreated check		9	12	0	0	1	6	0	0	0
Tukey's HSD		8	10	52	31	41	36	40	30	34

[1] Non-ionic surfactant (NIS) applied at 0.25% v/v; methylated seed oil (MSO) applied at 1.0% v/v

Table 7. Biomass estimates collected 2 MAT.

Treatment[1]	Rate	FEID	PSSP	POSE	BRMA	LECI
	oz ai/A	------------------------------ g/plt ------------------------------				
Aminocyclopyrachlor + NIS	0.5	5	14	15	54	12
Aminocyclopyrachlor + MSO	0.5	5	11	8	55	15
Aminocyclopyrachlor + NIS	1.0	5	8	6	47	11
Aminocyclopyrachlor + MSO	1.0	5	12	19	43	11
Aminocyclopyrachlor + NIS	2.0	6	9	13	53	13
Aminocyclopyrachlor + MSO	2.0	5	9	12	40	10
Aminocyclopyrachlor + NIS	4.0	6	13	11	37	13
Aminocyclopyrachlor + MSO	4.0	5	6	11	35	11
Untreated check		4	17	10	67	11
Tukey's HSD		4	16	20	51	15

[1] Non-ionic surfactant (NIS) applied at 0.25% v/v; methylated seed oil (MSO) applied at 1.0% v/v

Almond weed control 2010. Steve Wright and Gerardo Banuelos. (Agriculture and Natural Resources, University California Cooperate Extension, Tulare, CA 93274-9537) This study was in Richgrove California. The objective was to evaluate the effectiveness of various herbicide combinations at controlling hairy fleabane (*Conyza bonariensis* L.), common mallow (*Molva neglecta* W.), puncturevine (*Tribulus terrestris* L.), redstem filaree (*Erodium cicutarium* L.), and rescuegrass (*Bromus catharticus* V.). The treatments were applied June 16, 2010 using a CO2 backpack sprayer. The plot sizes were 10 feet wide by 30 feet long, with three replications. The application speed was 4 miles per hour (mph), with 0 to 2 mph winds and a temperature of 76ºF. Hairy fleabane was sprayed at 4 to 12 inches tall, common mallow was sprayed at 2 to 10 inches tall, puncturevine was sprayed at a 2 to 16 inch diameter, redstem filaree was sprayed at 2 to 8 inches, and rescuegrass was sprayed at 4 to 12 inches tall. In general, glufosinate tank mixes provided the greatest control over hairy fleabane, rescuegrass, puncturevine, common mallow, and redstem filaree.

Table. Weed control in almond orchard 2010.

		Hairy fleabane			Rescuegrass			Puncturevine			Common mallow			Redstem filaree	
		DAT			DAT			DAT			DAT			DAT	
Treatment[1]	Rate	7	15	21	7	15	21	7	15	21	7	15	21	15	21
	lb ai/A	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Glufosinate + AMS	3.44 + 1.88	83	98	93	75	99	100	87	100	98	90	100	100	100	100
Saflufenacil+ COC	0.005 + 0.25	40	50	20	0	3	37	68	33	33	67	72	57	70	92
Paraquat + COC	0.875 + 0.25	23	40	33	78	100	98	93	95	93	93	95	100	100	100
Glyphosate + AMS	0.81 + 1.88	10	40	33	80	95	98	62	77	95	65	90	92	100	100
Glufoisnate + glyphosate + AMS	3.44 + 0.81 + 1.88	78	96	95	43	93	88	87	98	95	83	100	97	100	100
Saflufenacil + glyphosate + COC	0.005 + 0.81 + 0.25	75	90	53	65	98	97	95	95	88	92	100	77	100	100
Glufosinate + oxyfluorfen + COC	2.41 + 0.063 + 0.25	73	98	88	78	100	95	82	97	95	88	100	100	100	100
Saflufenacil + oxyfluorfen + COC	0.005 + 0.063 + 0.25	65	82	60	0	53	50	87	83	68	92	100	100	100	100
Glufosinate + carfentrazone + COC	2.41 + 0.015 + 0.25	80	95	88	80	93	95	96	98	97	92	100	100	100	100
Saflufenacil + carfentrazone + COC	0.005 + 0.015 + 0.25	62	58	33	13	37	40	67	53	63	77	92	93	100	100
Glufosinate + glyphosate + oxyfluorfen + COC	2.41 + 0.80 + 0.063 + 0.25	80	99	75	68	100	93	93	100	100	95	100	100	100	100
Glyphosate + oxyfluorfen + COC	0.80 + 0.063 + 0.25	53	77	62	70	100	98	80	95	78	92	100	98	100	100
Glyphosate + AMS	1.61 + 0.25	30	62	47	42	83	98	93	100	100	90	100	100	100	100
Untreated check	---	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[1]COC (crop oil concentrate) and AMS (ammonium sulfate) rates are in %v/v.

Evaluation of indaziflam for *Poa annua* control in non-overseeded bermudagrass turf. Kai Umeda. (University of Arizona Cooperative Extension, Maricopa County, Phoenix, AZ 85040) A small plot field experiment was conducted at the Karsten Golf Course in Tempe, AZ on non-overseeded common bermudagrass. Treatment plots measured 5 ft by 10 ft and were replicated three times in a randomized complete block design. Herbicide treatments were applied with a CO_2 backpack sprayer equipped with a hand-held boom with three 8003LP flat fan nozzles spaced 20-inches apart. Herbicides were applied with 0.5% v/v methylated seed oil added in 38 gpa water and pressurized to 30 psi. On 03 November 2009, at the time of applications, the air temperature was 87ºF, clear sky, slight breeze at less than 2 mph and turf was dry. *Poa annua* was emerging and established at the 1 to 2-leaf stage of growth. Indaziflam was highly effective in controlling *P. annua* at all rates and exhibited a rate response with 0.0.067 lb a.i./A providing nearly complete control versus acceptable control observed with 0.031 lb a.i./A.

Table. Indaziflam *Poa annua* control in non-overseeded bermudagrass turf, Tempe, AZ

		POANN control[1]							CYNDA injury[1]	CYNDA greenup[2]		CYNDA quality[2]	
Treatment	Rate	18 Nov	15 Dec	29 Dec	03 Mar	24 Mar	16 Apr	11 May	18 Nov	24 Mar	16 Apr	11 May	08 Jun
	lb a.i./A	---------------------------- % ---							%				
Untreated check		0	0	0	0	0	0	0	0	1.0	4.0	4.3	4.7
Indaziflam	0.031	92	99	96	87	87	85	90	3	4.7	5.0	6.7	7.0
Indaziflam	0.047	90	99	96	90	92	90	95	3	4.7	4.7	7.0	7.0
Indaziflam	0.067	95	99	98	98	98	96	98	7	3.7	4.3	6.3	7.3
Prodiamine	0.5	0	0	0	0	0	0	0	0	-	4.0	4.7	4.0
Prodiamine	0.75	0	0	0	0	0	0	0	0	-	4.0	4.3	5.0
LSD (p=0.05)		2.1	0	2.5	6.3	5.8	7.2	3.8	6.4	1.6	1.0	0.92	1.05

[1]Annual bluegrass = POANN, common bermudagrass = CYNDA. Treatments applied on 03 November 2009.
[2]Bermudagrass turf greenup and quality rated on 1 to 9 scale, 9 is best

Flazasulfuron for clumpy ryegrass removal in non-overseeded bermudagrass. Kai Umeda. (University of Arizona Cooperative Extension, Maricopa County, Phoenix, AZ 85040) A small plot field experiment was conducted on the driving range at the Arizona State Polytechnic, Mesa, AZ. Treated plots measured 5 ft by 5 ft and each treatment was replicated three times in a randomized complete block design. Herbicides were sprayed with a backpack CO_2 sprayer equipped with a hand-held boom with three 8003LP flat fan nozzles spaced 20-inches apart. Sprays were mixed in 70 gpa water and included a non-ionic surfactant Latron CS-7 at 0.25% v/v. At the time of application on 24 February 2010, the air temperature was 71ºF, high overcast sky to clear, and wind was less than 2 mph. The turf was dry and mowed the day before with *Poa annua* flowering and clumps of ryegrass scattered throughout plots. At 7 weeks after treatment, all treatments removed nearly all ryegrass. Foramsulfuron at both rates tested was more effective in reducing *P. annua* compared to the two higher rates of flazasulfuron.

Table. Flazasulfuron for clumpy ryegrass and *Poa annua* control, Mesa, AZ

		LOLPE control[2]			POANN control[2]		
Treatment[1]	Rate	19 Mar	30 Mar	14 Apr	19 Mar	30 Mar	14 Apr
	lb ai/A	----------------------------------			% ----------------------------------		
Untreated check		0	0	0	0	0	0
Flazasulfuron	0.0078	80	88	99	73	82	77
Flazasulfuron	0.0156	80	80	98	73	88	75
Flazasulfuron	0.0234	80	80	99	73	92	88
Flazasulfuron	0.0352	80	95	99	72	92	88
Foramsulfuron	0.025	70	95	99	70	93	99
Foramsulfuron	0.051	80	95	96	77	95	98
LSD (p=0.05)		0	1.9	3.9	3.5	4.6	10.0

[1]Treatments applied on 24 February 2010.
[2]LOLPE = perennial ryegrass, POANN= annual bluegrass.

Evaluation of thiencarbazone/iodosulfuron/dicamba herbicide for burclover control in turf. Kai Umeda. (University of Arizona Cooperative Extension, Maricopa County, Phoenix, AZ 85040) A small plot field experiment was conducted at the Arizona State University Polytechnic, Mesa, AZ on a driving range that had non-overseeded bermudagrass cv. Princess. The treated plots measured 5 ft by 10 ft and treatments were replicated four times in a randomized complete block design. Herbicides were applied with a backpack CO_2 sprayer equipped with a hand-held boom with three 8003LP flat fan nozzles spaced 20-inches apart. Sprays were applied in 57 gpa water with a non-ionic surfactant, Latron CS-7, at 0.25% v/v added. The test was initiated on 03 March 2010 when the air temperature was 59ºF, clear sky, and wind at less than 3 mph. The maturing burclover was approximately 20% in bloom. Thiencarbazone/iodosulfuron/dicamba at all rates was very effective in giving highly acceptable burclover control after one month of a single application. Carfentrazone/2,4-D/MCPP/dicamba control of burclover was more rapid than thiencarbazone/iodosulfuron/dicamba at 2 weeks after application.

Table. Efficacy and safety of thiencarbazone/iodosulfuron/dicamba herbicide for burclover control in turf, ASU Poly, Mesa, AZ

		Weed control[2]									Bermudagrass quality[3]	
		MEDPO				POANN			LOLPE			
Treatment	Rate	19 Mar	30 Mar	14 Apr	06 May	30 Mar	14 Apr	06 May	14 Apr	06 May	14 Apr	06 May
	oz ai/A	%										
Untreated check		0	0	0	0	0	0	0	0	0	4.0	3.6
Thien/iodo/dic	1.7	78	86	96	89	88	83	84	98	89	5.0	4.0
Thien/iodo/dic	2.5	78	89	97	91	85	88	89	99	91	5.0	4.0
Thien/iodo/dic	3.33	78	90	99	93	89	96	89	97	91	5.0	4.0
Car/2,4-D/MCP/dic	22	95	99	99	99	64	0	0	0	0	5.0	3.8
LSD (p=0.05)		3.2	3.7	3.5	5.6	13.9	5.4	3.5	1.9	5.0	0	0.49

[1]Thien/iodo/dic is thiencarbazone (8.7%) + iodosulfuron (1.9%) + dicamba (57.4%) which is Celsius 68% WG. Car/2,4-D/MCP/dic is carfentrazone (0.05 lb per gallon or 0.62%) + 2,4-D (1.53 lbs acid equivalent per gallon or 18.95%) + MCPP (0.48 lb acid equivalent per gallon or 5.88%) + dicamba (0.14 lb acid equivalent per gallon or 1.71%) which is Speed Zone (2.2 lb ai/gal). Application date – 03 March 2010

[2]MEDPO = burclover, POANN = annual bluegrass, LOLPE = perennial ryegrass

[3]Bermudagrass quality – 9 is best, 1 is worst.

Potato crop safety and weed control with dimethenamid-p alone or in tank mixtures ground-applied or chemigated preemergence or chemigated early postemergence or flumioxazin ground-applied or chemigated early postemergence. Pamela J.S. Hutchinson, Brent Beutler, and JaNan Farr (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210). The objectives of this trial were to 1) compare weed control and potato crop safety with dimethenamid-p (alone and in tank mixtures) ground-applied or chemigated preemergence (PRE) or early postemergence (EPOST) and 2) determine weed control and potato crop safety with flumioxazin + metribuzin ground-applied or chemigated PRE or EPOST.

The trial area was fertilized on April 22, 2009 with 180 lb N, 200 lb P, 4 lb Zn, and 2 lb Mn/A based on soil tests before planting and received additional N injected through the sprinkler system on July 17 and 30 and August 6, 2009. 'Russet Burbank' potatoes were planted May 13, 2009. Potatoes were planted 5 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo loam soil with 1.4 % organic matter and pH 8.2.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 28, 2009, prior to potato and weed emergence. Dimethenamid-p was ground-applied or chemigated PRE or chemigated EPOST at 0.84 lb ai/A alone or in two-way tank mixtures with metribuzin at 0.5, pendimethalin at 1.0, or EPTC at 5.3 lb ai/A. Flumioxazin at 0.47 + metribuzin at 0.5 lb ai/A was ground-applied or chemigated PRE or EPOST. Ground-applied PRE or EPOST treatments were made May 29 or June 29, 2009, respectively, with a CO_2-pressurized backpack sprayer delivering 17.5 GPA at 30 psi and immediately sprinkler incorporated with 0.5 inches irrigation water. Chemigated PRE and EPOST treatments were applied May 29 and June 29, 2009, respectively, in 0.25 inches irrigation water followed immediately by another 0.25 inches water. No potato or weed plants were exposed at PRE application times. The same treatments were applied in a 2008 trial. In 2008, redroot pigweed, common lambsquarters, hairy nightshade, and green foxtail densities EPOST were 3, 3, 2, and 5 per sq ft, respectively. In 2009, redroot pigweed, common lambsquarters, hairy nightshade, and green foxtail densities EPOST were 2, 4, 2, and 6 per sq ft, respectively. The broadleaves were 0.25 to 1.5 inches and green foxtail was 0.5 to 1 inch tall; and potatoes were 5 to 8 inches tall both years. Nontreated weed-free and weedy controls were included for yield comparisons. The experimental design was a randomized complete block with three replications and plot size was 18 by 40 ft.

Potatoes were sprinkler irrigated and nutrients and fungicides were applied via the irrigation system as needed throughout the growing season. Crop injury was rated visually at 2 wk after treatment (WAT) and at potato row closure approximately 6 WAT. Weed control was rated 2 WAT, at potato row closure, and just prior to potato harvest. The last rating is representative of season-long control and is shown and discussed. Potato vines were desiccated with 0.5 lb ai/A diquat Sep 16, 2009. Tubers were harvested from 20 feet of each of the two center rows in each plot using a single-row mechanical harvester on Sept. 28, 2009 and graded according to USDA standards.

Although some slight differences between treatments occurred in 2008, season-long redroot pigweed and green foxtail control ranged from 93 to 100% with the exception of 88% green foxtail control by EPOST chemigated flumioxazin plus metribuzin (Table). In contrast, redroot pigweed control in 2009 by EPOST chemigated dimethenamid-p alone or with pendimethalin or EPTC only was 60 to 83% while all other treatments provided 93 to 100% control (Table). Hairy nightshade control in 2008 and 2009 was 92 to 100% regardless of herbicide, application method, or application time (Table). Common lambsquarters control in 2008 with dimethenamid-p alone PRE ground or chemigated was 67 to 68% while the tank mixtures improved control to 93 to 100%. Results were similar in 2009 although the differences were numerical rather than statistical. Chemigated EPOST dimethenamid-p alone provided only 27 to 30% common lambsquarters control both years and similar to the PRE treatments, control also was improved with the tank mixtures (Table). The only EPOST chemigated dimethenamid-p combination providing greater than 90% control, however, was with metribuzin, and except for this treatment, the PRE treatments controlled common lambsquarters better than the same treatment applied EPOST. Flumioxazin plus metribuzin with any application method or timing provided 93 to 100% common lambsquarters control both years (Table).

Regardless of application method or timing, crop injury consisting mainly of stunting was 5% or less with dimethenamid-p alone or in tank mixtures in 2008 and 2009 (data not shown). Flumioxazin plus metribuzin applied PRE with either method also caused 5% or less injury. In contrast, this combination applied EPOST by ground resulted in 35 to 45% injury while the chemigation method safened the herbicide somewhat resulting in only 1o to15% injury both years. The potatoes recovered and tuber yield and quality were more affected by weed control than injury (data not shown).

Table. Season-long weed control and potato crop response with dimethenamid-p alone or in tank mixtures ground-applied or chemigated preemergence or chemigated early postemergence or flumioxazin + metribuzin ground-applied or chemigated early postemergence at the Aberdeen R&E Center in 2008 and 2009.

			Control[a]							
			redroot pigweed		common lambsquarters		hairy nightshade		green foxtail	
Treatment	Rate	Method/Timing[b]	2008	2009	2008	2009	2008	2009	2008	2009
	lb ai/A		%							
dimethenamid-p	**0.84**	Ground/PRE	95 bc	100 a	68 c	82 a	100 a	100 a	98 a	100 a
+ pendimethalin	1.0	Ground/PRE	98 ab	100 a	98 a	97 a	100 a	100 a	100 a	100 a
+ metribuzin	0.5	Ground/PRE	100 a	100 a	100 a	97 a	100 a	97 a	100 a	98 ab
+ EPTC	5.3	Ground/PRE	100 a	98 a	95 ab	90 a	100 a	100 a	100 a	100 a
dimethenamid-p	**0.84**	Chem/PRE	100 a	97 a	67 cd	83 a	100 a	100 a	100 a	100 a
+ pendimethalin	1.0	Chem/PRE	100 a	98 a	100 a	97 a	100 a	98 a	100 a	98 ab
+ metribuzin	0.5	Chem/PRE	100 a	100 a	100 a	97 a	100 a	98 a	100 a	98 ab
+ EPTC	5.3	Chem/PRE	100 a	100 a	93 ab	87 a	100 a	100 a	100 a	98 ab
dimethenamid-p	**0.84**	Chem/EPOST	93 c	73 b	30 e	27 c	97 a	92 a	97 a	97 ab
+ pendimethalin	1.0	Chem/EPOST	98 ab	60 c	85 b	65 ab	100 a	95 a	98 a	87 abc
+ metribuzin	0.5	Chem/EPOST	100 a	95 a	100 a	97 a	98 a	97 a	100 a	95 ab
+ EPTC	5.3	Chem/EPOST	100 a	83 ab	57 d	40 bc	100 a	93 a	100 a	97 ab
flumioxazin + metribuzin	0.047 + 0.5	Ground/PRE	100 a	100 a	100 a	100 a	100 a	100 a	100 a	95 abc
flumioxazin + metribuzin	0.047 + 0.5	Chem/PRE	100 a	100 a	100 a	98 a	100 a	100 a	100 a	93 abc
flumioxazin + metribuzin	0.047 + 0.5	Ground/EPOST	100 a	97 a	100 a	100 a	100 a	100 a	97 a	83 c
flumioxazin + metribuzin	0.047 + 0.5	Chem/EPOST	100 a	93 a	98 a	95 a	100 a	93 a	88 b	73 d

[a]Means in the same column followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test (p = 0.05). Nontreated control means were not included in this weed control mean separation analyses.

[b]Ground, ground-applied with a backpack sprayer and sprinkler-incorporated with 0.5 inches irrigation water within 24 h of application; Chem, chemigated in 0.25 inches irrigation followed immediately by another 0.25 inches water; PRE, preemergence to potatoes 'Russet Burbank' and weeds; EPOST, potatoes were 5 to 8 inches tall, the broadleaves were 0.25 to 1.5 inch tall and green foxtail was 0.5 to 1 inch tall both years.

[c]Means in the same column followed by the same letter(s) are not significantly different according to a Fisher's Protected LSD Test (p = 0.05). Nontreated control means were not included in the crop injury mean separation analyses.

Weed control with V-10206 and flumioxazin in potato. Pamela J.S. Hutchinson, Brent Beutler, and JaNan Farr (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210). The objective of this study was to determine weed control and potato crop safety with the experimental compound, V-10206, alone or in tank mixtures with flumioxazin, s-metolachlor, or dimethenamid-p.

The trial area was fertilized on April 22, 2009 before planting with 180 lb N, 200 lb P, 4 lb Zn, and 2 lb Mn/A based on soil tests and received additional N injected through the sprinkler system on July 17 and 30 and August 6, 2009. ‘Russet Burbank’ potatoes were planted on May 13, 2009 5 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo loam soil with 1.4% organic matter and pH 8.2. Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 28, 2009, prior to potato emergence.

Herbicide treatments consisted of a factorial arrangement of V-10206 at three rates, 0, 0.106, or 0.213 lb ai/A, and four tank-mix partners (TMP), none, flumioxazin at 0.047, s-metolachlor at 1.2, or dimethenamid-p at 0.84 lb ai/A. A nontreated, weedy control was included for yield comparisons. Treatments were replicated three times and plot size was 12 by 30 ft. Herbicides were applied PRE June 1, 2009 with a CO_2-pressurized backpack sprayer that delivered 17.5 GPA at 30 psi and incorporated with a combination of rain and sprinkler irrigation totaling 0.5 inches of water within 24 h of application. No potato plants were exposed at the time of application.

Potatoes were sprinkler irrigated as needed throughout the growing season. Crop injury was rated visually at 2 wk after treatment (WAT) and at potato row closure approximately 6 WAT. Weed control was rated 2 WAT, at potato row closure, and just prior to potato harvest. The last rating is representative of season-long control and is shown and discussed. Potato vines were desiccated with 0.5 lb ai/A diquat September 16, 2009. Tubers were harvested from 20 feet of each of the two center rows in each plot using a single-row mechanical harvester on Sept. 28, 2009 and graded according to USDA standards. The same treatments were applied and the trial area was managed the same in 2008.

No crop injury occurred in 2008, however, early-season stunting in 2009 increased from 0 to 10% as the rate of V-10206 applied alone increased from 0 to 0.213 lb ai/A (data not shown). Spring 2009 conditions were unusually wet and cold compared with 2008 conditions. Rate by TMP interactions were significant each yr for season-long common lambsquarters and hairy nightshade control so these data were sorted by TMP and analyzed separately. Combined across yrs, common lambsquarters control with the low and high V-10206 rates was 89 and 97%, respectively, while control with the flumioxazin, s-metolachlor, or dimethenamid-p mixtures increased from 64 to 96, 85 to 99, or 87 to 99%, respectively, as the V-10206 rate increased from 0 to 0.213 lb/A (Table). Hairy nightshade control was 96 to 100% with all combinations except s-metolachlor mixtures which provided 67 to 100% as V-10206 rates increased from 0 to 0.213 lb ai/A (Table). In 2008, rate by TMP interactions also were significant for season-long redroot pigweed control so data were sorted by TMP and analyzed separately. Control with the low and high V-10206 rate alone was 95 and 98%, respectively (Table). Control with the flumioxazin , s-metolachlor, or dimethenamid-p mixtures increased from 57 to 97 or 85 to 99, or 87 to 99%, respectively, as the V-10206 rate increased from 0 to 0.213 lb/A (Table). Season-long redroot pigweed control in 2009 was 100% regardless of treatment. In 2008, slight U.S. No. 1 tuber yields reductions occurred with some treatments most likely due to lower common lambsquarters control by those treatments (data not shown). Total tuber yield reductions occurred in 2009 with some treatments possibly related to early-season crop injury (data not shown).

Table. The effect of V-10206 rate and tank-mix partner on season-long redroot pigweed, common lambsquarters, and hairy nightshade control at Aberdeen, ID in 2008 and 2009[a].

	Tank-mix partner											
	none			flumioxazin			s-metolachlor			dimethenamid-p		
V-10206 rate	AMARE	CHEAL	SOLSA	AMARE	CHEAL	SOLSA	AMARE	CHEAL	SOLSA	AMARE	CHEAL	SOLSA
lb ai/A	--% control--											
0	-	-	-	57	64	99	88	85	67	90	87	100
0.106	95	89	96	97	95	100	93	98	100	98	99	99
0.213	98	93	100	97	96	100	97	99	100	97	99	99
	--Pr > F--											
Rate effect[b]		NS		*	*	NS	*	*	NS	NS	*	NS
Linear effect		NS		*	*	NS	*	*	*	NS	*	NS
Quadratic effect		NS		*	*	NS	NS	NS	*	NS	*	NS

[a]The V-10206 rate by tank-mix partner (TMP) interaction was significant for redroot pigweed (AMARE), common lambsquarters (CHEAL), and hairy nightshade (SOLSA), so the data were sorted by TMP and the rate effect within each TMP was analyzed. AMARE data is 2008 only while CHEAL and SOLSA data are combined over 2008 and 2009.
[b]Orthogonal contrasts were used to determine if the dimethenamid-p rate effect was significant ($p \geq 0.05$), and if it was, trend contrasts were performed to determine if the response was linear or quadratic. Significance denoted by a *.

Efficacy and potato crop safety with two metribuzin 75 DF brands applied preemergence or early postemergence. Pamela J.S. Hutchinson, Brent R. Beutler, and JaNan Farr. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210). The objective of this trial was to compare weed control and potato crop safety with various rates of a generic formulation of metribuzin 75 DF marketed by Cheminova Inc. vs Sencor 75 DF® applied preemergence (PRE) or early postemergence (EPOST).

The trial area was fertilized on April 22, 2009 before planting with 180 lb N, 200 lb P, 4 lb Zn, and 2 lb Mn/A based on soil tests and received additional N injected through the sprinkler system on July 17 and 30 and August 6, 2009. 'Russet Burbank' potatoes were planted on May 13, 2009 5 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo loam soil with 1.4% organic matter and pH 8.2. Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 28, 2009, prior to potato emergence. Treatments were arranged in a randomized complete block design with three replications and plot size of 12 by 30 ft.

Herbicide treatments consisted of metribuzin 75 DF applied PRE at 0.5 and 1 lb ai/A or at 0.25 and 0.5 EPOST. Sencor 75 DF® was applied at 0.5 lb ai/A PRE or 0.25 lb ai/A EPOST. Nontreated weedy and weed-free controls were included for yield comparisons. PRE and EPOST applications were made June 1 and 29, 2009, respectively, with a CO_2-pressurized backpack sprayer that delivered 17.5 GPA at 30 psi. PRE treatments were incorporated with a combination of rain and sprinkler irrigation totaling 0.5 inches of water within 24 h of application. No potato plants were exposed at the time of application. With the exception of metribuzin 75 DF applied EPOST at 1 lb ai/A, the same treatments were included in a 2008 trial. Weed densities/hts in the weedy control plots at the EPOST application timing in 2008 were 45/1.0 inch redroot pigweed, 45/0.5 inch common lambsquarters, 15/0.5 inch hairy nightshade, and 5/1.0 inch green foxtail per sq m; and potato were 5 inches tall. At the EPOST timing in 2009, weed densities/hts in the weedy control plots were 20/0.75 inch redroot pigweed, 35/1.0 inch common lambsquarters, and 50/1.0 inch green foxtail per sq m; potato were 8 inches tall. Hairy nightshade was not present in the trial in 2009.

Potatoes were sprinkler irrigated as needed throughout the growing season. Crop injury was rated visually at 2 wk after treatment (WAT) and at potato row closure approximately 6 WAT. Weed control was rated 2 WAT, at potato row closure, and just prior to potato harvest. The last rating is representative of season-long control and is shown and discussed. Potato vines were desiccated with 0.5 lb ai/A diquat September 16, 2009. Tubers were harvested from 20 feet of each of the two center rows in each plot using a single-row mechanical harvester on Sept. 28, 2009 and graded according to USDA standards. The trial area was managed similarly in 2008.

In 2008, redroot pigweed, hairy nightshade, or green foxtail control by metribuzin 75 DF compared with the same rates of Sencor 75 DF® rates was not different (Table). Redroot pigweed control by either brand applied EPOST at 0.25 lb/A ranged from 88 to 92% and was less than control by 0.5 or 1.0 lb/A applied PRE or EPOST which ranged from 98 to 100%. Regardless of brand, rate, or application timing, hairy nightshade control was similar and ranged from 40 to 63% while green foxtail control by all herbicide treatments also was similar and ranged from 97 to 100% (Table). Common lambsquarters control by metribuzin 75 DF applied EPOST at 0.25 lb/A was statistically less than control by the same EPOST rate of Sencor 75 DF®, however, control by the generic was 93% compared with 100% control by all other treatments (Table). In 2009, regardless of brand, rate, or application timing, redroot pigweed, common lambsquarters, or green foxtail control was similar and ranged from 95 to 100% (Table).

No treatment caused visible crop injury either year (data not shown). Herbicide treatment U.S. No. 1 and total tuber yields were similar and all were greater than weedy control yields, and not different than weed-free control yields both years according to a Fisher's Protected LSD Test performed at the 0.05 probability level (data not shown).

Table. Season-long weed control with metribuzin 75 DF or Sencor 75 DF® applied preemergence or early postemergence at the Aberdeen R&E Center in 2008 and 2009.

			Control[a]						
			redroot pigweed		common lambsquarters		hairy nightshade	green foxtail	
Treatment[b]	Rate	Timing[c]	2008	2009	2008	2009	2008	2008	2009
	lb ai/A		----------	----------	----------	----------	%	----------	----------
metribuzin 75 DF	0.5	PRE	100 a	98 a	100 a	100 a	53 a	100 a	100 a
metribuzin 75 DF	1.0	PRE	100 a	100 a	100 a	100 a	63 a	100 a	100 a
Sencor 75 DF®	0.5	PRE	98 a	100 a	100 a	100 a	53 a	97 a	100 a
metribuzin 75 DF	0.25	EPOST	88 b	98 a	93 b	100 a	40 a	97 a	100 a
metribuzin 75 DF	0.5	EPOST	98 a	98 a	100 a	100 a	53 a	97 a	100 a
metribuzin 75 DF	1.0	EPOST	100 a	-	100 a	-	63 a	100 a	-
Sencor 75 DF®	0.25	EPOST	92 b	95 a	100 a	98 a	43 a	97 a	98 a

[a]Means in the same column followed by the same letter are not significantly different according to a Duncan's New Multiple Range Test (p = 0.05). Nontreated control means were not included in the mean separation analyses.
[b]metribuzin 75 DF is marketed by Cheminova Inc.; Sencor 75 DF® is a registered trademark of Bayer CropScience and the active ingredient is metribuzin.

Weed control and potato crop safety with fomesafen tank mixtures. Pamela J.S. Hutchinson, Brent R. Beutler, and JaNan Farr. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210). Fomesafen herbicide is labeled for use in several crops, but not currently labeled for use in potatoes. The objective of this study was to determine weed control and potato crop safety with fomesafen alone or in tank mixtures with several standard potato herbicides.

The trial area was fertilized on April 22, 2009 before planting with 180 lb N, 200 lb P, 4 lb Zn, and 2 lb Mn/A based on soil tests. On April 27, 2009, 'Russet Burbank' potatoes were planted 5 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo loam soil with 1.5% organic matter and pH 8.0. Treatments were arranged in a randomized complete block design with three replications and plot size of 12 by 30 ft.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 18, 2009, prior to potato emergence. Treatments consisted of preemergence (PRE) fomesafen alone or with s-metolachlor, dimethenamid-p, or a pre-mix of s-metolachlor and metribuzin, or with the pre-mix + rimsulfuron, pendimethalin or additional metribuzin; the pre-mix alone or with rimsulfuron or additional metribuzin; or s-metolachlor alone (see the Table for combinations and rates). Applications were made May 20, 2009 with a CO_2-pressurized backpack sprayer that delivered 17.5 GPA at 30 psi. PRE treatments were incorporated within 48 h of application with 0.5 inches sprinkler irrigation. No potato plants were exposed at the PRE application. The same treatments also were applied and trial area treated similarly in 2008.

Potatoes were sprinkler irrigated as needed throughout the growing season. Additional N was injected through the sprinkler system on July 16 and 29 and August 5, 2009. Crop injury was rated visually at 2 wk after treatment (WAT) and at potato row closure approximately 6 WAT. Weed control was rated 2 WAT, at potato row closure, and just prior to potato harvest. The last rating is representative of season-long control and is shown and discussed. Potato vines were desiccated with 0.5 lb ai/A diquat September 1, 2009. Tubers were harvested from 20 feet of each of the two center rows in each plot using a single-row mechanical harvester on Sept. 14, 2009 and graded according to USDA standards. The same treatments also were applied and trial area treated similarly in 2008.

Crop injury 2 wks after treatment or at row closure in either year was never greater than 5% (data not shown). Similar to 2008, season-long redroot pigweed control was similar and ranged from 87 to 100% for all treatments except s-metolachlor alone which provided only 80% control (Table). As in 2008, common lambsquarters control in 2009 was 92% or greater with fomesafen in a two-way mixture with the pre-mix or in any of the three-way tank mixtures. Application of the pre-mix + rimsulfuron PRE or POST or with metribuzin also provided greater than 92% common lambsquarters control (Table). Hairy nightshade control in 2008 ranged from 92 to 100% with the exception of s-metolachlor alone or the pre-mix alone or with metribuzin which resulted in 70, 73, or 85% control, respectively (Table). In contrast, fomesafen alone at either rate only provided 70 to 75% hairy nightshade control in 2009 (Table). Control improved to at least 83% when either rate was applied in combination with other herbicides, however, 90% or greater control only was achieved with the highest fomesafen rate plus the pre-mix or any of the fomesafen three-way tank mixtures which also included rimsulfuron at 0.023 lb ai/A or pendimethalin. The PRE rimsulfuron plus pre-mix treatment and dimethenamid-p at the highest rate plus fomesafen provided 92 and 93% hairy nightshade control, respectively. Hairy nightshade population density was 2/sq ft in 2008 compared with 6/sq ft in 2009.

In summary, fomesafen at 0.25 lb ai/A in two-way tank mixture with s-metolachlor, dimethenamid-p at 1 lb ai/A, or a pre-mix of s-metolachlor and metribuzin; or in three-way combinations with the pre-mix plus rimsulfuron, pendimethalin, or additional metribuzin usually provided greater than 90% redroot pigweed and common lambsquarters control. Similarly, hairy nightshade control in 2008 was greater than 90% with any of these fomesafen combinations. However, in 2009 when the hairy nightshade population density was relatively slightly greater than it was in 2008, fomesafen plus dimethenamid-p at 1 lb ai/A or in three-way tank mixtures which also included rimsulfuron at 0.023 lb ai/A or pendimethalin were required for 90% or greater hairy nightshade control. In addition, hairy nightshade control in 2009 with fomesafen at 0.25 or 0.5 lb ai/A plus the pre-mix controlled hairy nightshade 90 or 83%, respectively, which was greater than the 70% control by fomesafen at 0.125 combined with the pre-mix.

Table. Season-long control of redroot pigweed, common lambsquarters, and hairy nightshade with preemergence applications of fomesafen or a pre-mix of s-metolachlor + metribuzin alone or in tank mixtures with other potato herbicides at the Aberdeen R&E Center in 2008 and 2009.

			Control[a]					
			redroot pigweed		common lambsquarters		hairy nightshade	
Treatment[b]	Rate	Timing[c]	2008	2009	2008	2009	2008	2009
	lb ai/A		---------- % ----------					
fomesafen	**0.25**	PRE	95 a-d	87 a	85 d	78 b	92 ab	70 cd
+ s-metolachlor	1.31	PRE	88 d	97 a	87 d	88 ab	95 a	85 ab
+ s-metolachlor + metribuzin (pre-mix)	1.31 + 0.31	PRE	98 ab	90 a	97 ab	95 ab	97 a	83 ab
+ s-metolachlor + metribuzin (pre-mix) + rimsulfuron	1.31 + 0.31 + 0.023	PRE	100 a	95 a	97 ab	92 ab	100 a	95 a
+ s-metolachlor + metribuzin (pre-mix) + rimsulfuron	1.31 + 0.31 + 0.016	PRE	97 abc	97 a	92 bcd	98 a	93 a	87 ab
+ s-metolachlor + metribuzin (pre-mix) + rimsulfuron	0.98 + 0.23 + 0.023	PRE	100 a	95 a	100 a	92 ab	100 a	92 a
+ s-metolachlor + metribuzin (pre-mix) + metribuzin	0.98 + 0.23 + 0.25	PRE	95 a-d	95 a	98 ab	98 a	97 a	85 ab
+ s-metolachlor + metribuzin (pre-mix) + pendimethalin	0.98 + 0.23 + 1.0	PRE	92 bcd	92 a	95 abc	100 a	92 ab	90 ab
+ dimethenamid-p	0.84	PRE	90 cd	88 a	88 cd	87 ab	100 a	88 ab
+ dimethenamid-p	1.0	PRE	95 a-d	93 a	88 cd	92 ab	93 a	93 a
fomesafen	**0.5**	PRE	98 ab	90 a	88 cd	85 ab	97 a	75 bc
+ s-metolachlor + metribuzin (pre-mix)	1.31 + 0.31	PRE	98 ab	95 a	95 abc	93 ab	98 a	90 ab
s-metolachlor + metribuzin (pre-mix)	**1.31 + 0.31**	PRE	95 a-d	93 a	95 abc	95 ab	73 c	53 ef
+ metribuzin	0.19	PRE	98 ab	97 a	98 ab	98 a	85 b	60 de
+ rimsulfuron	0.023	PRE	98 ab	97 a	98 ab	95 ab	97 a	92 a
+ rimsulfuron	0.023	EPOST	100 a	93 a	100 a	93 ab	100 a	87 ab
fomesafen + s-metolachlor + metribuzin (pre-mix)	**0.125 + 1.31 + 0.31**	PRE	100 a	90 a	98 ab	88 ab	98 a	70 cd
s-metolachlor	**1.31**	PRE	80 e	80 a	68 e	67 c	70 c	47 f

[a] Means in the same column followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test (p = 0.05). Nontreated control means were not included in the mean separation analyses.
[b]The pre-mix is a 6.5 lb ai/gal formulated product of s-metolachlor + metribuzin at 5.25 + 1.25 lb ai/gal.
[c]PRE, preemergence; EPOST, early postemergence.

Wild oat control with broadleaf and wild oat herbicide combinations. Don W. Morishita, J. Daniel Henningsen and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to compare several broadleaf and wild oat herbicide tank mixtures for weed control in spring barley. 'Moravian 69' was planted April 2, 2010 at 95 lb/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Portneuf silt loam (20.4% sand, 71% silt, and 8.6% clay) with a pH of 8.1, 1.5% organic matter, and CEC of 17-meq/100 g soil. Herbicides were applied with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 23 psi. Additional application information is given in Table 1. Common lambsquarters, wild oat, redroot pigweed and kochia densities averaged 18, 11, 0.5 and 0.5 plants/ft^2, respectively. Crop injury and weed control were evaluated visually 15 and 42 days after the last application (DALA) on June 29 and July 26. Grain was harvested August 20 with a small-plot combine.

Table 1. Environmental conditions at each application date.

Application date	May 21	June 9	June 14
Application timing	1 to 5 leaf wild oat	1 to 2 tiller wild oat	flag leaf ligule visible
Air temperature (F)	45	62	67
Soil temperature (F)	50	63	80
Relative humidity (%)	66	56	48
Wind velocity (mph)	5	3	2
Cloud cover (%)	100	100	100
Time of day	0830	0730	2115

A crop injury evaluation was taken May 27, six days after the 1 to 5 leaf applications because minimum air temperatures were below freezing for three out of four days following application (Table 1). Crop injury with those treatments ranged from 8 to 44%, with pinoxaden/florasulam plus pyrasulfotole/bromoxynil or bromoxynil/MCPA causing the most injury. Crop injury evaluations taken June 29 (15 DALA) showed little or no injury from those same treatments with injury at the first evaluation. However, all of the treatments containing pyrasulfotole/bromoxynil + fenoxaprop injured the barley 38 to 45%. By 41 DALA, injury from these same treatments was reduced to 16 to 20%. Kochia control 15 DALA ranged from 94 to 100% for all treatments except dicamba/fluroxypyr + pinoxaden. However, at 41 DALA, kochia control was 92% or better for all treatments. Common lambsquarters control ranged from 92 to 99% for all treatments and both evaluations, with the exception of pinoxaden/florasulam + fluroxypyr + Adigor. Common lambsquarters control with this treatment averaged 44 and 79% at the 15 and 41 DALA evaluations. Redroot pigweed and annual sowthistle control ranged from 91 to 100% for all herbicide treatments over both evaluation dates. At 15 DALA, wild oat control ranged from 83 to 100% with no significant differences among herbicide treatments. At 41 DALA, some differences in wild oat control were evident, although none of the treatments had failed. Wild oat control with pyrasulfotole/bromoxynil + fenoxaprop ranged from 81 to 89%. Addition of propiconazole and trifloxystrobin to pyrasulfotole/bromoxynil + fenoxaprop appeared to reduce wild oat control slightly, although grain yield was not reduced. Barley yield ranged from 116 to 159 bu/A for all treatments. Pinoxaden/florasulam + dicamba/fluroxypyr, pyrasulfotole/bromoxynil, or MCPA LVE were among the highest yielding treatments.

Table 2. Crop injury, weed control and grain yield in irrigated spring barley, near Kimberly, Idaho[1].

Treatment[3]	Rate	Appl. date	Crop injury 5/27	Crop injury 6/29	Crop injury 7/26	Weed control[2] KCHSC 6/29	KCHSC 7/26	CHEAL 6/29	CHEAL 7/26	AMARE 6/29	AMARE 7/26	SONOL 6/29	SONOL 7/26	AVEFA 6/29	AVEFA 7/26	SETVI 7/26	ECHCG 7/26	Grain yield
	lb ai/A		%															bu/A
Check																		120 de
Pyrslftl/brmxl + fenoxaprop	0.217 + 0.083	6/9	-	45 a	16 a	98 abc	98 abc	92 d	95 b	100 a	100 a	100 a	100 a	98 a	89 b	99 a	99 a	116 e
Pyrslftl/brmxl + pinoxaden	0.217 + 0.05	6/9	-	0 c	4 b	96 bc	100 ab	95 bcd	99 a	100 a	100 a	100 a	100 a	99 a	100 a	97 ab	98 ab	135 bcd
Pyrslftl/brmxl + pinoxaden + prcnz/trfbn	0.217 + 0.054 + 0.081	6/9	-	0 c	4 b	94 c	95 cd	94 bcd	98 ab	100 a	100 a	100 a	100 a	98 a	99 a	99 a	99 a	125 cde
Ptcnzl/tcnzl + NIS	0.179 + 0.13% v/v	6/14																
Pyrslftl/brmxl + fenoxaprop + prcnz/trfbn	0.21 + 0.083 + 0.081	6/9	-	45 a	20 a	97 abc	98 abc	93 cd	98 ab	100 a	100 a	100 a	100 a	83 a	81 c	99 a	99 a	120 de
Pyrslftl/brmxl + fenoxaprop + prcnz/trfbn	0.217 + 0.083 + 0.081	6/9	-	38 b	18 a	97 abc	97 a-d	96 a-d	96 ab	100 a	100 a	100 a	100 a	90 a	84 c	98 ab	98 ab	117 de
Pnxdn/flslm + MCPA LVE + Adigor	0.058 + 0.32 + 9.6 fl oz	5/21	20 bc	0 c	4 b	96 bc	97 bcd	96 a-d	97 ab	99 a	98 cd	100 a	97 ab	100 a	100 a	96 bc	97 bc	155 a
Pnxdn/flslm + fluroxypyr + Adigor	0.058 + 0.062 + 9.6 fl oz	5/21	11 cd	0 c	0 b	100 a	99 abc	44 e	79 c	100 a	100 a	100 a	100 a	100 a	100 a	97 ab	97 abc	142 abc
Pnxdn/flslm + pyrslftl/brmxnl Adigor	0.058 + 0.177 + 9.6 fl oz	5/21	39 a	0 c	3 b	100 a	98 abc	99 a	96 b	100 a	98 cd	100 a	97 ab	100 a	100 a	94 c	94 c	157 a
Pnxdn/flslm + brmxnl/MCPA Adigor	0.058 + 0.5 + 9.6 fl oz	5/21	44 a	0 c	3 b	100 a	99 abc	98 ab	97 ab	100 a	98 cd	100 a	98 a	100 a	100 a	95 bc	95 bc	151 ab
Pnxdn/flslm + dicmb/flxpr + Adigor	0.058 + 0.108 + 9.6 fl oz	5/21	8 d	0 c	4 b	99 ab	100 a	94 bcd	98 ab	100 a	99 abc	100 a	99 a	93 a	91 c	98 ab	98 ab	159 a

Table 2. continued.

Treatment[3]	Rate	Appl. date	Crop injury 5/27	Crop injury 6/29	Crop injury 7/26	Weed control[2] KCHSC 6/29	KCHSC 7/26	CHEAL 6/29	CHEAL 7/26	AMARE 6/29	AMARE 7/26	SONOL 6/29	SONOL 7/26	AVEFA 6/29	AVEFA 7/26	SETVI 7/26	ECHCG 7/26	Grain yield
	lb ai/A		---%														---%	bu/A
Florasulam + fluroxypyr + pinoxaden	0.31 + 0.062 + 0.054	5/21	21 b	0 c	1 b	99 ab	99 abc	99 a	97 ab	99 a	99 abc	100 a	95 b	100 a	100 a	97 ab	97 abc	155 a
Dicmb/flxpr + pinoxaden	0.157 + 0.054	5/21	21 b	0 c	0 b	74 d	92 d	98 ab	98 ab	99 a	97 d	98 b	91 c	100 a	100 a	96 bc	96 bc	149 ab
Dicmb/flxpr + MCPA LVE + pinoxaden	0.108 + 0.257 + 0.054	5/21	24 b	0 c	3 b	98 abc	100 ab	97 abc	98 ab	100 a	99 abc	100 a	100 a	100 a	100 a	98 ab	98 ab	146 ab

[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), annual sowthistle (SONOL), Avena Fatua (AVEFA), green foxtail (SETVI) and barnyardgrass (ECHCG).
[3]Pyrslftl/brmxnl is a 1:8 formulated mixture of pyrasulfotole and bromoxynil sold as Huskie; Prcnz/trfbn is a 1:1 formulated mixture of propaconazole and trifloxystrobin (fungicide) sold as Stratego; ptcnzl/tcnzl is a 1:1 formulated mixture of prothioconazole and tebuconazole sold as Prosaro; NIS is nonionic low foam wetter/spreader adjuvant sold as Induce; pnxdn/flslm is a 12:1 formulated mixture of pinoxaden and florasulam sold as Axial TBC; and dicmb/flxpr is a 1:1.3 formulated mixture of dicamba and fluroxypyr sold as Pulsar. Dicamba and fluroxypyr, florasulam, fluroxypyr, bromoxynil/MCPA and MCPA rates expressed at lb ae/A. Adigor is methylated rape seed oil.

Crop tolerance and broadleaf weed control with bromoxynil/pyrasulfotole alone and in tank mixtures. Don W. Morishita, J. Daniel Henningsen and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to evaluate crop tolerance and weed control with bromoxynil/pyrasulfotole applied alone and in combination with other herbicides and with fungicides in irrigated spring barley. 'Moravian 69' was planted April 2, 2010 at 95 lb/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Portneuf silt loam (20.4% sand, 71% silt, and 8.6% clay) with a pH of 8.1, 1.5% organic matter, and CEC of 17-meq/100 g soil. Herbicides were applied with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 23 psi. Environmental conditions at application are shown on Table 1. Common lambsquarters and annual sowthistle densities averaged 14 and 1 plants/ft^2, respectively. Crop injury was evaluated visually 6 and 32 days after application (DAA) on May 27 and June 23, respectively. Weed control was evaluated visually 10 and 32 DAA on June 1 and 23, respectively. Grain was harvested August 20 with a small-plot combine.

Table 1. Environmental conditions at each application date.

Application date	5/21	6/14
Application timing	< 4 inch weed	Flag leaf ligule
Air temperature (F)	45	67
Soil temperature (F)	50	80
Relative humidity (%)	63	49
Wind velocity (mph)	6	2
Cloud cover (%)	100	100
Time of day	0930	1115

Cold weather preceding and following the herbicide application, caused mild to severe crop injury 6 DAA (Table 2). Injury at the first evaluation ranged from 9 to 60%. By 32 DAA however, no injury was evident from these herbicide treatments. Only common lambsquarters was evaluated for control both times. At the 10 DAA evaluation control ranged from 2 to 83%. By 32 DAA, common lambsquarters control was 99 to 100% with all herbicide treatments except fluroxypyr alone, which did not control common lambsquarters. Annual sowthistle control with all treatments was 100%. Barley yield was not affected by weed competition due to the relatively light weed infestation, although test weight of the untreated control was lower than all of the herbicide treatments. It is interesting to note however, that even bromoxynil/pyrasulfotole + propiconazole/trifloxystrobin + nonionic surfactant + ammonium sulfate, which had the highest crop injury, had grain yield equal to all of the other treatments.

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

Treatment[3]	Application rate	Application date	Crop injury 5/27	Crop injury 6/23	Weed control[2] CHEAL 6/1	Weed control[2] CHEAL 6/23	Weed control[2] SONOL 6/23	Test weight	Grain yield
	lb ai/A		--------------------%---------------------					lb/bu	bu/A
Check			-	-	-	-	-	52 b	148 a
Bromoxynil/pyrasulfotole +	0.217 +	5/21	29 b	0 a	78 a	100 a	100 a	53 a	148 a
NIS-1 +	0.25% v/v +								
ammonium sulfate	0.5								
Fluroxypyr	0.139 lb ae/A	5/21	9 c	0 a	2 c	0 c	100 a	52 b	148 a
Fluroxypyr/bromoxynil	0.318	5/21	16 c	0 a	49 b	99 b	100 a	53 a	150 a
Bromoxynil/pyrasulfotole +	0.217	5/21	36 b	0 a	76 a	99 b	100 a	53 a	156 a
pinoxaden	0.054								
Bromoxynil/pyrasulfotole +	0.241 +	5/21	60 a	0 a	83 a	100 a	100 a	53 a	147 a
propiconazole/ trifloxystrobin +	0.081 +								
NIS-1 +	0.25% v/v +								
ammonium sulfate	0.5 +								
prothioconazole/tebuconazole +	0.179 +	6/14							
NIS-2	0.125% v/v								
LSD (0.05)								1	ns

[1]Means followed by same letter are not significantly different using Fisher's Protected LSD (P=0.05).
[2]Weeds evaluated for control were common lambsquarters (CHEAL) and annual sowthistle (SONOL).
[3]Bromoxynil/pyrasulfotole is a formulated pre-mixture sold as Huskie. Fluroxypyr/bromoxynil is a formulated pre-mixture sold as Starane NXT. Propiconazole/trifloxystrobin is a formulated pre-mixture fungicide sold as Stratego. Prothioconazole/tebuconazole is a formulated pre-mixture fungicide sold as Prosaro. AMS is ammonium sulfate. NIS-1 is R-11nonionic surfactant. NIS-2 is Induce nonionic surfactant and wetter/spreader adjuvant.

Weed control in furrow irrigated strip tilled sugar beet. Don W. Morishita, J. Daniel Henningsen, and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A field experiment was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to compare weed control in furrow irrigated strip till and conventional till sugar beet. Two additional treatments containing WE1225 applied at different rates were included to determine suitability as an anti-transpirant. Experimental design was a split block randomized complete block with four replications. Main plots were tillage treatment and sub-plots were herbicide treatment. Individual sub-plots were four rows by 30 ft. Soil type was a Portneuf silt loam (19.2% sand, 62.2% silt, and 18.6% clay) with a pH of 8.3, 1.3% organic matter, and CEC of 23.4-meq/100 g soil. 'BTS 26RR14' sugar beet was planted May 1, 2010, in 22-inch rows at a rate of 71,280 seed/A. Common lambsquarters, redroot pigweed, annual sowthistle, green foxtail and barnyardgrass were the major weed species present. Herbicides were applied broadcast with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gpa using 8001 flat fan nozzles. Additional environmental and application information is given in Table 1. Crop injury and weed control were evaluated visually 16, 28 and 98 days after the last herbicide application (DALA) on July 7, 19 and September 27. However, only the first and last evaluation dates are reported. The two center rows of each plot were harvested mechanically October 14.

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

Application date	6/2	6/8	6/21	7/9	7/12	8/5
Application timing	3 leaf	4 to 6 leaf	8 leaf	12 leaf	13 leaf	row closure
Air temperature (F)	73	78	61	65	78	79
Soil temperature (F)	60	63	72	69	76	70
Relative humidity (%)	47	42	48	62	37	42
Wind speed (mph)	1.2	0.6	2	2.5	7	2
Cloud cover (%)	80	70	90	80	0	20
Time of day	0926	1040	2120	0910	1010	0915
Weed species/yd^2						
lambsquarters, common	67	40	37	-	-	-
pigweed, redroot	10	10	7	-	-	-
sowthistle, annual	7	7	3	-	-	-
foxtail, green and barnyardgrass	940	592	254	-	-	-

There were no differences in crop injury, weed control, or crop yield between conventional and strip tilled treatments. Thus, the data are presented as pooled averages across tillage treatments (Table 2). Crop injury was minimal at 16 DALA. Crop injury ratings prior to harvest (98 DALA) ranged from 6 to 10%, but no differences were observed between herbicide treatments. The noted injury may have likely been chlorosis from nitrogen deficiency, which is a desirable condition in sugar beet. Common lambsquarters, redroot pigweed and annual sowthistle control ranged from 97 to 100% with no differences among herbicide treatments. Green foxtail and barnyardgrass control was similar and ranged from 94 to 100%. Sugar beet root and sugar yield with all of the herbicide treatments were greater than the untreated check, which yielded 16 ton/A. All of the glyphosate + a soil-active herbicide controlled weeds and yielded as well as three glyphosate applications.

Table 2. Crop injury, weed control and yield pooled across conventional and strip tillage treatments in sugar beets near Kimberly, ID[1].

					Weed control[2]															
	Application		Crop injury		KCHSC		CHEAL		AMARE		SONOL		SASKR		SETVI		ECHCG		Root	ERS[4]
Treatment[3]	rate	date	7/7	9/27	7/7	9/27	7/7	9/27	7/7	9/27	7/7	9/27	7/7	9/27	7/7	9/27	7/7	9/27	yield	yield
	lb ae/A																		ton/A	lb/A
Check			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	4,609
Glyphosate	0.75	6/2,	1	7	100	100	99	100	100	100	100	100	100	100	98	98	98	98	32	9,290
glyphosate	0.75	6/21,																		
glyphosate	0.75	7/9																		
Glyphosate +	1.13 +	6/8,	2	8	100	100	99	100	99	100	100	100	100	100	96	99	96	99	28	8,364
dimethenamid-p	0.75 lb ai/A																			
glyphosate	0.75	7/9																		
Glyphosate +	1.13 +	6/8,	1	9	100	100	99	100	100	100	100	100	100	100	96	99	96	99	30	8,805
dimethenamid-p	0.98 lb ai/A																			
glyphosate	0.75	7/9																		
Glyphosate +	1.13 +	6/8,	1	6	100	100	99	100	99	100	100	100	100	100	95	98	95	98	31	9,092
ethofumesate	1 lb ai/A																			
glyphosate	0.75	7/9																		
Glyphosate +	1.13 +	6/8,	2	10	100	100	99	100	99	100	100	100	100	100	96	97	96	97	28	8,210
EPTC	3 lb ai/A																			
glyphosate	0.75	7/9																		
Glyphosate +	1.13 +	6/8,	3	16	100	100	99	100	100	100	100	100	100	100	96	96	96	96	28	8,330
s-metolachlor	1.22 lb ai/A																			
glyphosate	0.75	7/9																		
Glphst/mtlchlr	2	6/8,	3	10	100	100	97	99	100	100	99	100	99	100	94	97	94	97	28	8,100
glyphosate-2	0.75	7/9																		
Glyphosate	0.75	6/2,	2	8	100	88	99	100	99	100	100	100	100	100	99	99	99	99	31	8,977
glyphosate +	0.75 +	6/21,																		
WE1225-1	0.5 gal/A																			
glyphosate	0.75	7/9,																		
WE1225-1	0.5 gal/A	7/12,																		
WE1225-1	0.5 gal/A	8/5																		
Glyphosate	0.75	6/2,	2	9	100	100	99	100	100	100	100	100	100	100	98	98	98	98	31	9,054
glyphosate	0.75	6/21,																		
glyphosate	0.75	7/9,																		
WE1225-1	1 gal/A	8/5,																		
WE1225-1	1 gal/A	9/3																		
LSD (0.05)			ns	ns	3	11	5	ns	ns	ns	ns	ns	ns	ns	3	2	3	2	5	1,536

[1]Means were separated using Fisher's protected LSD at P=0.05.

[2]Weeds evaluated for control were kochia (KCHSC), common lambsquarters, (CHEAL), redroot pigweed (AMARE), annual sowthistle (SONOL), Russian thistle (SASKR), green foxtail (SETVI), and barnyardgrass (ECHCG).

[A]mmonium sulfate was included with all glyphosate applications at a rate of 17 lb/100 gal water. Glphst/mtlchlr is a formulated mixture of glyphosate and *s*-metolachlor sold as Sequence. Glyphosate-2 is Touchdown Total.

[3]ERS is estimated recoverable sugar.

Comparison of various adjuvants with glyphosate for weed control and crop tolerance in sugar beet. Don W. Morishita, J. Daniel Henningsen, and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to compare various adjuvants applied with glyphosate at different rates 'BTS 26RR14'was planted April 15, 2010 in 22-inch rows at 71,280 seed/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Portneuf silt loam (25.6 % sand, 66.8 % silt, and 7.6% clay) with a pH of 8.0, 1.4 % organic matter, and CEC of 22.1 meq/100 g soil. Herbicides were applied with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gpa at 26 psi using 8001 flat fan nozzles. Environmental conditions and average weed densities at each application are given in Table 1. Crop injury and weed control were evaluated 8, 23, and 86 days after application on July 7, July 22 and September 23, respectively. Only the weed control and crop injury from the first and last evaluation dates are reported. The two center rows of each plot were harvested mechanically October 7.

Table 1. Environmental conditions and weed species density at each application date.

Application date	5/27	6/19	6/29
Application timing	2 lf	6 lf	
Air temperature (F)	65	70	74
Soil temperature (F)	60	65	60
Relative humidity (%)	55	39	36
Wind velocity (mph)	0.6	2	1.4
Cloud cover (%)	80	10	60
Time of day	1115	1030	0945
Weed species per square foot			
kochia	2	1	1
lambsquarters, common	43	48	41
pigweed, redroot	10	11	12
thistle, Russian	<1	1	1
nightshade, hairy	5	7	7
foxtail, green and barnyardgrass	36	46	42

None of the treatments injured the crop (Table 2). Glyphosate applied at 0.75 lb ae/A with or without any of the adjuvants tested had better overall weed control than glyphosate applied at 0.35 lb ae/A with or without any adjuvant. Some weed species such as redroot pigweed, hairy nightshade, and green foxtail were effectively controlled with 0.35 lb ae/A with or without an adjuvant. However, kochia, common lambsquarters and Russian thistle control were variable depending on the adjuvant used. Glyphosate + Alliance at 0.35 lb ae/A + 1.25% v/v had the best overall weed control with the lower glyphosate rate. However, most of the glyphosate treatments applied at 0.75 lb ae/A controlled one or more weed species better than glyphosate + Alliance at 0.35 lb ae/A + 1.25% v/v. Root yields ranged from 1 to 34 ton/A and sucrose yields ranged from 368 to 9,283 lb/A. The lowest yielding treatments were glyphosate applied at 0.35 lb ae/A + Bronc Max + R-11 and Alliance + sucrose. Sugar beet root and sucrose yields were ranked in the same order, which indicates that herbicide treatment did not influence sugar content.

Table 2. Crop injury, weed control and sugar beet yield with glyphosate and various adjuvants, near Kimberly, ID[1].

	Application		Crop injury	Weed control[2]												Root yield	ERS[4] yield
				KCHSC		CHEAL		AMARE		SOLSA		SASKR		SETVI			
Treatment[3]	rate	date	9/23	7/7	9/23	7/7	9/23	7/7	9/23	7/7	9/23	7/7	9/23	7/7	9/23		
			--------------------------------%											--------------------------------		ton/A	lb/A
Check			-	-	-	-	-	-	-	-	-		-			1 d	368 d
Glyphosate	0.35	5/27, 6/19, & 6/29	0 a	91 bc	90 cd	81 c	85 gh	98 bc	100 a	99 a	100 a	68 af	42 de	95 abc	97 a	28 abc	7,791 a
Glyphosate	0.75	5/27, 6/19, & 6/29	0 a	95 ab	99 a	95 a	99 ab	100 ab	100 a	100 a	100 a	90 ab	98 a	97 a	99 a	33 a	9,161 a
Glyphosate Bronc	0.35 3 lb/100 gal	5/27, 6/19, & 6/29	0 a	78 e	53 g	78 c	77 ij	97 c	100 a	100 a	100 a	84 cd	72 cd	96 ab	98 a	28 abc	7,507 a
Glyphosate Bronc	0.75 3 lb/100 gal	5/27, 6/19, & 6/29	0 a	91 bc	100 a	94 ab	100 a	99 abc	100 a	100 a	100 a	90 ab	100 a	97 a	99 a	31 abc	8,499 a
Glyphosate Bronc	0.35 9 lb/100 gal	5/27, 6/19, & 6/29	0 a	75 e	75 f	71 d	84 ghi	98 bc	100 a	100 a	100 a	80 de	89 abc	95 abc	98 a	32 ab	8,852 a
Glyphosate Bronc	0.75 9 lb /100 gal	5/27, 6/19, & 6/29	0 a	89 cd	99 a	91 ab	99 abc	99 abc	99 a	100 a	100 a	94 a	99 a	96 ab	98 a	34 a	9,283 a
Glyphosate Bronc plus Dry EDT	0.35 10 lb/100 gal	5/27, 6/19, & 6/29	1 a	85 d	88 cde	81 c	89 fg	96 c	100 a	100 a	100 a	83 cd	77 bc	95 abc	98 a	28 abc	7,795 a
Glyphosate Bronc plus Dry EDT	0.75 10 lb/100 gal	5/27, 6/19, & 6/29	0 a	91 bc	98 ab	93 ab	95 de	99 abc	100 a	100 a	100 a	88 bc	92 abc	97 a	97 a	29 abc	7,890 a
Glyphosate Bronx Max R-11 Coverage G-20	0.35 0.5% v/v 0.25% v/v 4 fl oz/A	5/27, 6/19, & 6/29	0 a	91 bc	82 def	76 j	64 d	97 c	100 a	100 a	99 a	65 f	14 f	95 bc	97 a	26 bc	7,271 a
Glyphosate Bronx Max R-11 Coverage G-20	0.75 0.5% v/v 0.25% v/v 4 fl oz/A	5/27, 6/19, & 6/29	0 a	96 a	100 a	99 ab	95 a	99 abc	100 a	100 a	100 a	94 a	95 ab	97 a	97 a	31 abc	8,532 a

Table 2. continued.

Treatment[3]	Application rate	Application date	Crop injury 9/23	Weed control[2] KCHSC 7/7	KCHSC 9/23	CHEAL 7/7	CHEAL 9/23	AMARE 7/7	AMARE 9/23	SOLSA 7/7	SOLSA 9/23	SASKR 7/7	SASKR 9/23	SETVI 7/7	SETVI 9/23	Root yield	ERS[4] yield
			--------	--------	--------	--------	--------	--------	%	--------	--------	--------	--------	--------	--------	ton/A	lb/A
Glyphosate Class Act NG	0.35 2.5% v/v	5/27, 6/19, & 6/29	1 a	89 cd	93 bc	93 ef	80 c	99 abc	100 a	99 a	100 a	85 bcd	88 abc	94 c	96 a	28 abc	7,640 a
Glyphosate Class Act NG	0.75 2.5% v/v	5/27, 6/19, & 6/29	1 a	94 ab	99 a	95 a	96 cde	100 a	100 a	100 a	99 a	94 a	94 ab	96 ab	97 a	30 abc	8,340 a
Glyphosate Alliance	0.35 1.25% v/v	5/27, 6/19, & 6/29	0 a	89 cd	95 bc	90 b	94 def	98 bc	100 a	100 a	100 a	86 bc	95 ab	95 abc	97 a	31 ab	8,611 a
Glyphosate Alliance	0.75 1.25% v/v	5/27, 6/19, & 6/29	0 a	93 abc	98 ab	93 ab	97 bcd	100 ab	100 a	100 a	100 a	90 ab	99 a	97 a	96 a	33 a	9,162 a
Glyphosate Alliance Sucrose	0.35 0.43 lb ai/A 0.25 lb/A	5/27, 6/19, & 6/29	0 a	76 e	78 ef	65 d	80 hij	99 abc	100 a	100 a	97 a	76 a	38 ef	95 abc	98 a	25 c	6,955 a

[1]Means followed by the same letter are not significantly different using Fisher's Protected LSD (P = 0.05).

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

[3]Bronc is ammonium sulfate; Bronc Plus Dry EDT is a dry water soluble blend of ammonium sulfate, nonionic surfactant, deposition aid and anti-foam agent; R-11 is a nonionic surfactant, Coverage G-20 is a drift management agent, and Bronc Max is ammonium sulfate with silicone sold by Wilbur Ellis. Class Act-NG is a water conditioning agent and nonionic surfactant blend and Alliance is ammonium sulfate and water conditioning and anti-foam agents sold by Winfield Solutions. Sucrose is White Satin Sugar.

Ventenata control in Kentucky bluegrass. Traci Rauch and Donn Thill (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339). Studies were conducted near Tensed and Plummer, ID to determine the effect of preemergence and postemergence herbicides on crop response and ventenata control in Kentucky bluegrass. Plots were 8 by 25 ft, arranged in a randomized complete block design with four replications and an untreated check. Treatments in both studies were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Crop injury and weed control were evaluated visually during the growing season. At the Tensed site, no ventenata emerged and only crop injury was measured.

Table 1. Application and soil data.

	Tensed, ID			Plummer, ID		
Bluegrass variety	Alene			Argyle		
Application time	fall	early spring	spring	preemergence	early spring	spring
Application date	10/15/09	3/10/10	4/19/10	10/19/09	3/15/10	4/19/10
Growth stage						
Kentucky bluegrass	1 to 2 in	1 to 4 in	4 to 6 in	1 to 3 in	1 to 4 in	4 to 6 in
Ventenata	---	---	---	preemergence	1 to 2 leaf	4 to 5 leaf
Air temp (F)	63	46	70	59	51	68
Humidity (%)	62	65	61	70	70	63
Wind (mph, direction)	2, SW	4, NW	1, W	2, SE	3, NE	5, W
Cloud cover (%)	10	80	10	50	20	10
Soil moisture	dry	wet	good	dry	wet	good
Soil temp at 2 in (F)	48	37	55	42	38	55

Flufenacet/metribuzin treatments, ethofumesate, pendimethalin, metolachlor, terbacil, and pyroxsulam controlled ventenata 74 to 100% (Table 2). At Plummer, flufenacet/metribuzin at the high rate injured Kentucky bluegrass 29%. At both locations, bluegrass injury was greatest (42 to 80%) with treatments containing pyroxsulam.

Table 2. Ventenata control and Kentucky bluegrass response in 2010.

Treatment[1]	Rate	Timing	Ventenata control	Kentucky bluegrass injury	
				Plummer	Tensed
	lb ai/A		%	%	%
Flufenacet/metribuzin	0.3825	fall	100	15	12
Flufenacet/metribuzin	0.51	fall	75	29	0
Ethofumesate	1	fall	100	2	0
Mesotrione	0.187	fall	0	0	0
Pendimethalin	3	fall	96	0	0
Metolachlor	1.27	fall	98	0	0
Flufenacet/metribuzin+	0.3825	fall			
mesotrione	0.094	fall	99	4	6
Flufenacet/metribuzin+	0.3825	fall			
pendimethalin	2	fall	100	16	0
Flucarbazone	0.026	fall	7	0	0
Mesotrione+	0.094	fall			
flucarbazone	0.026	fall	20	0	0
Flufenacet/metribuzin +	0.3825	fall			
terbacil	0.6	early spring	100	6	0
Flufenacet/metribuzin+	0.3825	fall			
primisulfuron	0.018	early spring	100	30	15
Flufenacet/metribuzin+	0.3825	fall			
oxyfluorfen	0.37	early spring	100	30	0
Terbacil	0.6	early spring	87	0	0
Primisulfuron	0.036	early spring	42	18	6
Oxyfluorfen +	0.37	early spring			
diuron	0.75	early spring	2	0	0
Pyroxsulam	0.0164	early spring	100	80	42
Pyroxsulam/fluroxypyr/florasulam	0.105	spring	34	52	44
LSD (0.05)			26	14	17
Density (plants/ft^2)			5		

[1]Diuron and pyroxsulam containing treatments were applied with a 90% non-ionic surfactant (R-11) at 0.25% v/v. Primisulfuron was applied with a crop oil concentrate (Moract) at 2.5% v/v. Pyroxsulam containing treatments were applied with ammonium sulfate (Bronc) at 1.5 lb ai/A.

Kentucky bluegrass tolerance to pyrasulfotole/bromoxynil. Traci Rauch and Donn Thill (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339). A study was established near Tensed, ID to determine tolerance of Argyle' Kentucky bluegrass to pyrasulfotole/bromoxynil, a broadleaf herbicide. Plots were 8 by 30 ft, arranged in a randomized complete block design with four replications and an untreated check. Kentucky bluegrass was seeded in May 2009. Treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Crop injury was evaluated visually. Bluegrass seed was swathed and harvested in July 2010.

Table 1. Application data.

Application date	April 20, 2010
Growth stage	
Kentucky bluegrass	3 to 6 inches
Air temperature (F)	71
Humidity (%)	60
Wind velocity, direction	3, WSW
Cloud cover (%)	95
Soil moisture	wet
Soil temp at 2 in. (F)	60

No treatment injured Kentucky bluegrass at 7, 21, and 51 DAT (data not shown). Kentucky bluegrass seed yield did not differ among treatments including the untreated check but tended to be lowest in the standard treatment (Table 2).

Table 2. Kentucky bluegrass seed yield with pyrasulfotole/bromoxynil near Tensed, ID 2010.

Treatment[1]	Rate	Kentucky bluegrass seed yield
	lb ai/A	lb/A
Untreated check	---	521
Pyrasulfotole/bromoxynil	0.217	638
Pyrasulfotole/bromoxynil	0.435	545
Bromoxynil + tribenuron	0.375 + 0.0155	515
LSD (0.05)		NS

[1]Bromoxynil + tribenuron treatment applied with non-ionic surfactant (R-11) at 0.25% v/v.

Weed control in chickpea with saflufenacil and pendimethalin combinations. Joan Campbell and Donn Thill. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339) Broadleaf weed control was evaluated in 'Sierra' chickpea at the University of Idaho research farm near Genesee, Idaho. Chickpea was seeded into barley stubble with a Flexicoil 8000 direct seed drill with Barton II disk type openers on May 14, 2010. On the same day, herbicides were applied pre-emergence with a CO_2 pressurized, backpack sprayer calibrated to deliver 15 gpa at 30 psi and 3 mph. Air and soil temperatures, soil pH, organic matter, CEC, and texture were 80 F, 65 F, 5.6, 2.9%, 28 cmol(+)/kg, and silt loam, respectively. The soil surface was dry with good moisture at 1.5 inch. The experiment was a randomized complete block design with four replications and plots were 8 by 25 ft. Chickpea injury and weed control were evaluated visually.

No treatment injured chickpea (data not shown). Prickly lettuce control was 90% or greater with all saflufenacil combinations on June 15 and with saflufenacil at 0.111 and 0.134 lb ai/a combinations on July 20, although control was not different among saflufenacil treatments (Table). Mayweed chamomile control was 97% with the combination of saflufenacil at 0.134 lb ai/a, but this treatment was not different from other treatments with saflufenacil. Common lambsquarters control ranged from 64 to 90% control with all pendimethalin combinations, but control did not differ among most treatments.

Table. Prickly lettuce, common lambsquarters, and mayweed chamomile control in chickpea near Genesee, Idaho.[1]

Treatment	Rate	Prickly lettuce June 15	Mayweed chamomile July 20	Prickly lettuce July 20	Common lambsquarters July 20
	lb ai/a	-------------	------------- %	-------------	-------------
Glyphosate + pendimethalin	0.86 0.475	79 ab	56 c	50 b	72 ab
Glyphosate + Pendimethalin + saflufenacil	0.86 0.475 0.0334	90 a	85 ab	79 a	64 b
Glyphosate + Pendimethalin + saflufenacil	0.86 0.475 0.0445	92 a	66 bc	80 a	74 ab
Glyphosate + pendimethalin saflufenacil	0.86 0.475 0.0557	96 a	71 abc	89 a	84 ab
Glyphosate + pendimethalin + saflufenacil	0.86 0.475 0.067	97 a	84 ab	86 a	90 a
Glyphosate + pendimethalin + saflufenacil	0.86 0.475 0.089	92 a	78 abc	76 a	81 ab
Glyphosate + pendimethalin + saflufenacil	0.86 0.475 0.111	94 a	85 ab	91 a	82 ab
Glyphosate + pendimethalin + saflufenacil	0.86 0.475 0.134	97 a	97 a	90 a	80 ab
Glyphosate + pendimethalin + flumioxazin	0.86 0.475 0.048	94 a	74 abc	80 a	80 ab
Glyphosate	0.86	62 b	24 d	24 c	10 c
Weed density (plants /ft^2)		2	1	3	1

[1]Means followed by the same letter are not statistically different.

Weed control in chickpea with flumioxazin and linuron combinations. Joan Campbell and Donn Thill. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339) Broadleaf weed control was evaluated in 'Sierra' chickpea at the University of Idaho research farm near Genesee, Idaho. Chickpea was seeded into barley stubble with a Flexicoil 8000 direct seed drill with Barton II disk type openers on May 14, 2010. On the same day, herbicides were applied pre-emergence with a CO_2 pressurized, backpack sprayer calibrated to deliver 15 gpa at 30 psi and 3 mph. Air and soil temperatures, soil pH, organic matter, CEC, and texture were 80 F, 65 F, 5.6, 2.9%, 28 cmol(+)/kg, and silt loam, respectively. The soil surface was dry with good moisture at 1.5 inch. The experiment was a randomized complete block design with four replications and plots were 8 by 25 ft. Chickpea injury and weed control were evaluated visually.

No treatment injured chickpea (data not shown). Prickly lettuce control on June 15 was 91% or better with flumioxazin at 0.064 lb ai/a alone and in combination and with linuron at 0.625 lb ai/a combined with metribuzin, pendimethalin or imazethapyr. Prickly lettuce control by July 20 did not differ among treatments and was lower than on June 15. Common lambsquarters control was not different among treatments, but control was lower with all treatments on July 20 compared to June 15. Mayweed chamomile control was 78% or higher with all treatments on June 15, but control did not differ among treatments. Mayweed chamomile control on July 20 was 86% with linuron + imazamethapyr, but this treatment was not statistically different from sulfentrazone + flumioxazin (60%) or other linuron treatments (61 to 82%) except linuron + saflufenacil (59%).

Table. Prickly lettuce, common lambsquarters, and mayweed chamomile control in chickpea near Genesee, Idaho.[1]

		Prickly lettuce		Common lambsquarters		Mayweed chamomile	
Treatment	Rate	June 15	July 20	June 15	July 20	June 15	July 20
	lb ai/a	--------------------------- % of untreated control -------------------------------					
Flumioxazin	0.048	85 ab	64 a	87 a	40 a	85 a	18 e
Flumioxazin	0.064	92 a	80 a	91 a	64 a	90 a	55 cd
Flumioxazin + metribuzin	0.064 0.28	94 a	84 a	96 a	55 a	86 a	52 cd
Flumioxazin + metribuzin + pendimethalin	0.064 0.28 0.475	94 a	80 a	94 a	57 a	81 a	51 cd
Sulfentrazone + flumioxazin	0.14 0.048	82 ab	58 a	86 a	42 a	78 a	60 a-d
Sulfentrazone	0.188	74 b	44 a	72 a	52 a	84 a	48 d
Linuron + sulfentrazone	0.625 0.14	72 b	73 a	84 a	74 a	87 a	70 a-d
Linuron + saflufenacil	0.625 0.0223	82 ab	60 a	86 a	40 a	83 a	59 bcd
Linuron + metribuzin + pendimethalin	0.625 0.28 0.475	84 ab	79 a	88 a	70 a	96 a	61 a-d
Linuron + metribuzin	0.625 0.28	91 a	72 a	90 a	65 a	96 a	65 a-d
Linuron + pendimethalin	0.625 0.475	92 a	84 a	94 a	86 a	90 a	75 abc
Linuron + imazamethapyr	0.625 0.047	91 a	82 a	97 a	75 a	92 a	86 a
Linuron	0.625	90 a	78 a	86 a	60 a	92 a	82 ab
Linuron	0.75	86 a	75 a	89 a	76 a	78 a	71 a-d
Weed density (plants/ft^2)		2	4	4	1	0.5	2

[1]Means followed by the same letter are not statistically different.

Harvest aid burn down in chickpea. Joan Campbell and Donn Thill. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339) Chickpea burn down was evaluated in ‘Sierra’ chickpea at the University of Idaho research farm north of Moscow, Idaho. Chickpea was seeded with a Flexicoil 8000 direct seed drill with Barton II disk type openers on May 15, 2010. Herbicides were applied August 27 with a CO_2 pressurized, backpack sprayer calibrated to deliver 20 gpa at 30 psi and 3 mph. Air and soil temperatures, relative humidity, wind velocity, and cloud cover were 65 F, 64 F, 48%, 3 to 5 mph west, and 60%, respectively. The chickpea plants were 70% yellow and 30% green and soil was dry. The experiment was a randomized complete block design with four replications and plots were 8 by 25 ft. Chickpea chorosis was evaluated visually on September 7 and 21, and above ground dry weight was measured by sampling five random chickpea plants per plot on September 21. Seed moisture was determined by harvesting pods by hand at harvest and measuring wet and dry weights.

At 3 days after treatment (DAT), chickpea and weed plants had necrotic spots on leaves with paraquat and a small amount of necrosis with saflufenacil (data not shown). Chickpea plant burn down (necrosis and chlorosis) was 91% with paraquat 7 DAT (Table). Burn down with saflufenacil was lower but not statistically different from paraquat. At 21 DAT, burn down was 90% or greater with paraquat, flumioxazin+glyphosate, and saflufenacil. Chickpea plant dry weight and seed pod dry weight were not different among treatments.

Table. Harvest aid chickpea burndown near Moscow, Idaho.

		Chickpea[1]			
		Plant burn down			
Treatment	Rate	7 DAT[2]	21 DAT[2]	Plant dry weight	Seed pod dry weight
	lb ai/a	--------------------	%	--------------------	
Untreated contol	-	74 c	80 c	42 a	89 a
Paraquat + nonionic surfactant	0.487 0.25[3]	91 a	94 a	52 a	90 a
Flumioxazin + methylated seed oil	0.0625 2[3]	84 b	89 b	47 a	90 a
Flumioxazin + glyphosate	0.0625 0.95	81 b	95 a	52 a	90 a
Saflufenacil methylated seed oil+ ammonium sulfate	0.0223 2[3] 2.5	88 ab	95 a	45 a	92 a
Saflufenacil + methylated seed oil+ ammonium sulfate	0.0445 2[3] 2.5	85 ab	90 ab	45 a	91 a
Carfentrazone + nonionic surfactant	0.0297 0.25[3]	82 b	85 b	42 a	90 a

[1]Means followed by the same letter are not statistically different.
[2] Days after treatment
[3]Nonionic surfactant and methylated seed oil rates are expressed as % v/v.

Broadleaf weed control in field corn with preemergence herbicides. Richard N. Arnold, Michael K. O'Neill and Kevin Lombard. (New Mexico State University Agricultural Science Center, Farmington, NM 87499)

Research plots were established on May 10, 2010 at the Agricultural Science Center, Farmington, New Mexico, to evaluate the response of field corn (var. Pioneer PO751HR) and annual broadleaf weeds to preemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 0.3%. 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 10. Preemergence treatments were applied on May 12 and immediately incorporated with 0.75 in of sprinkler applied water. Russian thistle, prostrate and redroot pigweed infestations were heavy and common lambsquarters and black nightshade infestations were moderate throughout the experimental area. Preemergence treatments and crop injury were evaluated on July 10. No crop injury was noted from any of the treatments.

All treatments gave excellent control of prostrate and redroot pigweed, common lambsquarters, and black nightshade. Russian thistle control was poor with dimethenamid-p plus saflufenacil applied at 0.56 lb ai/A.

Table. Broadleaf weed control in field corn with preemergence herbicides.

Treatments[1]	Rate	Crop Injury[2]	Weed control[2,3] CHEAL	SOLNI	AMARE	AMABL	SASKR
	lb ai/A	—%–	———%				
Dimethenamid-p+saflufenacil (pm)	0.56	0	100	100	100	100	77
Metolachlor+atrazine+mesotrione (pm)	2.0	0	100	100	100	100	100
Isoxaflutole	0.07	0	100	100	100	100	100
Thiencarbazone + isoxaflutole (pm)	0.11	0	100	100	100	100	100
Acetochlor + atrazine (pm)	2.25	0	100	100	100	100	100
Acetochlor + atrazine (pm) + saflufenacil	2.25 + 0.04	0	100	100	100	100	100
Isoxaflutole+ atrazine	0.04+ 1.0						
Weedy check		0	0	0	0	0	0

[1]pm equal packaged mix.
[2]Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.
[3]CHEAL (common lambsquarters), SOLNI (black nightshade), AMARE (redroot pigweed), AMABL (prostrate pigweed), and SASKR (Russian thistle).

Broadleaf weed control in field corn with postemergence herbicides. Richard N. Arnold, Michael K. O'Neill and Kevin Lombard. (New Mexico State University Agricultural Science Center, Farmington, NM 87499) Research plots were established on May 12, 2010 at the Agricultural Science Center, Farmington, New Mexico, to evaluate the response of field corn (var. Pioneer PO751HR) and annual broadleaf weeds to early postemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 0.3%. 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 10. Postemergence treatments were applied on June 1 and June 9 when corn was in the 2nd and 4th leaf stage and weeds were <2 inch in height. Russian thistle, prostrate and redroot pigweed infestations were heavy and common lambsquarters and black nightshade infestations were moderate throughout the experimental area. Postemergence treatments were evaluated on June 28.

All treatments gave excellent control of common lambsquarters, black nightshade, redroot and prostrate pigweed. Rimsulfuron+thifensulfuron in combination with glyphosate applied at 0.017 plus 0.94 lb ai/A gave poor control of Russian thistle.

Table. Broadleaf weed control in field corn with postemergence herbicides.

Treatments[1]	Rate	Crop Injury[4]	Weed control[4,5] CHEAL	SOLNI	AMARE	AMABL	SASKR
	lb ai/A	—%–	%				
Thiencarbazone+isoxaflutole (pm)	0.11	0	100	100	98	100	100
+ atrazine	1.0						
Isoxaflutole+atrazine	0.09+1.0	0	100	100	100	100	100
Thiencarbazone+tembotrione (pm)	0.08	0	100	100	100	100	100
+glyphosate[2]	0.47						
Thiencarbazone+tembotrione (pm)	0.08	0	100	100	100	100	100
+glyphosate[2]	0.47						
Rimsulfuron+thifensulfuron (pm)	0.017	0	100	100	100	100	47
+glyphosate[3]	0.94						
Weedy check		0	0	0	0	0	0

[1]pm equal packaged mix.
[2]A crop oil concentrate (Maximizer) was added at 16 oz/A.
[3]Sprayable ammonium sulfate was added at 2 lb/A.
[4]Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.
[5]CHEAL (common lambsquarters), SOLNI (black nightshade), AMARE (redroot pigweed), AMABL (prostrate pigweed), and SASKR (Russian thistle).

<u>Weed control in liberty link cotton</u>**.** Steve Wright, Gerardo Banuelos, Sarah Avila and Jamie Changala. (Agriculture and Natural Resources, University California Cooperate Extension, Tulare, CA 93274-9537) This study was conducted near Pixley California. The objective was to evaluate the effectiveness of glufosinate at controlling tall moriningglory (*Ipomoea purpurea* L.), applied at different water volumes, using three nozzle types and sizes. The treatment was applied June 29, 2010. The plot sizes consisted of four 30 inch rows by 40 feet, with three replications. Treatments were tested using three nozzles types; Flat Fan, Turbo T-Jet, and Air Induction, at 15 and 20 gallons per acre. The application speed was 4 miles per hour (mph), with 4 mph winds and a temperature of 87ºF. The variety of cotton used was Liberty Link® Fibermax 966. The cotton was sprayed at 10 to 33 inches tall during the 10 to 21 node stage, and the tall morningglory was in the 2-6 leaf stage. There were no differences between nozzle types or water volume for tall morningglory control.

Table. Tall morningglory control in Liberty Link cotton in 2010.

				Tall morningglory control		
Treatments	Rate	Nozzles	GPA	7 DAT	14 DAT	21 DAT
	oz ai/A			%	%	%
Glufosinate	29	FF 8002		90	99	100
Glufosinate	29	TT 8002	15	93	99	100
Glufosinate	29	AI 8002		83	92	100
Glufosinate	29	FF 8003		92	99	100
Glufosinate	29	TT 8003	20	90	99	100
Glufosinate	29	AI 8003		85	98	100

FF=Flat Fan; TT=Turbo T-Jet; AI= Air Induction

Weed control in Roundup Ready cotton 2010**.** Steve Wright, Gerardo Banuelos, Sarah Avila and Jamie Changala. (Agriculture and Natural Resources, University California Cooperate Extension, Tulare, CA 93274-9537) This study was conducted at the College of the Sequoias, COS farm located in Tulare. The objective was to evaluate the effectiveness of glyphosate at controlling tall moriningglory (*Ipomoea purpurea* L.), applied at different water volumes, using three nozzle types and sizes. The treatments were applied July 1, 2010. The plot sizes consisted of four 30 inch rows by 40 feet, with four replications. Treatments were tested using three nozzles types; Flat Fan, Turbo T-Jet, and Air Induction, at 15 and 20 gallons per acre. The application speed was 4 miles per hour (mph), with a wind speed of 1 to 4 mph and a temperature of 79ºF. The variety of cotton used was Roundup Ready® Flex Phytogen 725 RF. The cotton was sprayed at 13 to 14 inches tall during the 8 to 9 node stage, and the tall morningglory was in the 2 leaf stage. There were no differences between nozzle types or water volume for tall morningglory control.

Table. Tall morningglory control in Roundup Ready cotton in 2010.

			Tall morningglory control		
Treatment	Rate	GPA	7 DAT	13DAT	22 DAT
	oz/A		%	%	%
Glyphosate + ammonium sulfate	32 oz + 17 lbs/100 gallons		48	92	100
Glyphosate + ammonium sulfate	32 oz + 17 lbs/100 gallons	15	46	93	100
Glyphosate + ammonium sulfate	32 oz + 17 lbs/100 gallons		55	95	100
Glyphosate + ammonium sulfate	32 oz + 17 lbs/100 gallons		55	93	100
Glyphosate + ammonium sulfate	32 oz + 17 lbs/100 gallons	20	59	91	100
Glyphosate + ammonium sulfate	32 oz + 17 lbs/100 gallons		55	93	100

Dry pea tolerance to saflufenacil and pendimethalin combinations. Joan Campbell and Donn Thill. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339) Dry pea tolerance to saflufenacil and pendimethalin combinations was evaluated in 'Aragorn' spring pea at the University of Idaho research farm east of Moscow, Idaho. Pea was seeded into worked soil and then rolled on May 12, 2010. Herbicides were applied pre-emergence May 13 with a CO_2 pressurized, backpack sprayer calibrated to deliver 10 gpa at 28 psi and 3 mph. Air and soil temperatures, soil pH, organic matter, CEC, and texture were 72 F, 61 F, 4.8, 2.6%, 14 cmol(+)/kg, and loam, respectively. The soil surface was dry with good moisture at 1.5 inch. The experiment was a randomized complete block design with four replications and plots were 8 by 25 ft. Dry pea injury was evaluated visually and seed was harvested with a small plot combine at maturity.

No treatment injured dry pea from cracking stage to harvest (data not shown). Pea seed yield did not differ among treatments (Table).

Table. Pea tolerance to pendimethalin and saflufenacil near Moscow, Idaho.

Treatment	Rate	Dry pea seed yield
	lb ai/a	lb/a
Untreated control	-	941 a[1]
Glyphosate + pendimethalin	0.86 + 0.475	1080 a
Glyphosate + pendimethalin + saflufenacil	0.86 + 0.475 + 0.0334	1074 a
Glyphosate + pendimethalin + saflufenacil	0.86 + 0.475 + 0.0445	1241 a
Glyphosate + pendimethalin + saflufenacil	0.86 + 0.475 + 0.0557	1082 a
Glyphosate + pendimethalin + saflufenacil	0.86 + 0.475 + 0.067	1128 a
Glyphosate + pendimethalin + saflufenacil	0.86 + 0.475 + 0.089	1189 a
Glyphosate + pendimethalin + saflufenacil	0.86 + 0.475 + 0.111	1147 a
Glyphosate + pendimethalin + flumioxazin	0.86 + 0.475 + 0.048	1120 a
Glyphosate	0.86	883 a

[1]Means followed by the same letter are not statistically different.

Broadleaf weed control in grain sorghum with postemergence herbicides. Richard N. Arnold, Michael K. O'Neill and Kevin Lombard. (New Mexico State University Agricultural Science Center, Farmington, NM 87499)
Research plots were established on May 28, 2010 at the Agricultural Science Center, Farmington, New Mexico, to evaluate the response of grain sorghum (var. DKS 53-67) and annual broadleaf weeds to postemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 0.3%. The experimental design was a randomized complete block with three replications. Individual plots were 4, 30 in rows 30 ft long. Grain sorghum was planted with flexi-planters equipped with disk openers on May 28. Postemergence treatments were applied on June 30 when grain sorghum was in the V5 leaf stage and weeds were <6 inch in height. Russian thistle, prostrate and redroot pigweed infestations were heavy and common lambsquarters and black nightshade infestations were moderate throughout the experimental area. Postemergence treatments were evaluated on July 22.

All treatments gave good to excellent control of common lambsquarters, black nightshade, redroot and prostrate pigweed and Russian thistle.

Table. Broadleaf weed control in field corn with postemergence applications of topramezone applied alone or in combination.

Treatments[1]	Rate	Crop Injury[4]	Weed control[4,5] CHEAL	SOLNI	AMARE	AMABL	SASKR
	lb ai/A	—%–	%				
Pyrasulfotole+bromoxynil (pm) + atrazine[2]	0.25 0.5	0	100	100	100	100	100
Pyrasulfotole+bromoxynil (pm) + atrazine[2]	0.3 0.5	0	100	100	100	100	100
Pyrasulfotole+bromoxynil (pm) + atrazine+2,4-D ester[2]	0.25 0.5 + 0.18	0	100	100	100	100	100
Pyrasulfotole+bromoxynil (pm) + atrazine+dicamba[2]	0.25 0.5 + 0.13	0	100	100	100	100	100
Atrazine+bromoxynil	0.5 + 0.5	0	100	100	100	100	100
Carfentrazone +2,4-D amine[3]	0.015 + 0.19	0	90	92	98	98	87
Weedy check		0	0	0	0	0	0

[1]pm equal packaged mix.
[2]Sprayable ammonium sulfate was added at 1 lb/A.
[3]A nonionic surfactant (Biosurf) was added at 6 oz/A.
[4]Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.
[5]CHEAL (common lambsquarters), SOLNI (black nightshade), AMARE (redroot pigweed), AMABL (prostrate pigweed), and SASKR (Russian thistle).

Tolerance and grass weed control in timothy. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Many annual grasses, including ventenata, downy brome, and rattail fescue, contaminate timothy hay which decrease stand life and lower quality for foreign export. No grass herbicides are currently registered in timothy. Studies were established at five 'Climax' timothy sites in Nez Perce, Latah, and Boundary counties in Idaho with one site each to evaluate ventenata, downy brome, and rattail fescue control. Additionally, timothy response was evaluated at two weed-free sites, one for seed yield and one for forage hay. Studies were arranged in a randomized complete block design with four replications and included an untreated check. Treatments were applied before weed emergence (preemergence) in October and after weed emergence (postemergence) in November 3-10, 2009 at all sites, including the weed-free locations (Tables 1 and 2).All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph. Timothy injury and grass weed control were evaluated visually. Due to quackgrass contamination at our forage site, visual injury was confounded and no biomass was harvested. At the seed site, forage biomass was harvested instead of seed yield. Forage biomass was swathed from a 5 by 27 ft area and a wet in-field total weight was measured on July 14, 2010. A subsample was weighed and dried to determine percent moisture to calculate a forage hay weight. The study will be repeated at five locations in 2010-2011.

Table 1. Application data for grass weed sites.

Location	Gifford, ID		Troy, ID		Princeton, ID	
Application date	10/8/09	11/3/09	10/8/09	11/3/09	10/7/09	11/10/09
Growth stage						
Timothy	3-5 in	dormant	6-8 in	dormant	2-4 in	dormant
Ventenata	pre	1 leaf	--	--	--	--
Downy brome	--	--	pre	1 leaf	--	--
Rattail fescue	--	--	--	--	pre	1 leaf
Air temperature (F)	49	47	49	47	59	49
Relative humidity (%)	65	70	61	70	55	68
Wind (mph, direction)	4, NW	4, SE	6, NW	3, SE	4, NW	3, N
Cloud cover (%)	10	5	10	5	25	80
Soil moisture	dry	normal	dry	normal	very dry	normal
Soil temperature at 2 inch (F)	42	38	42	38	45	39

Table 2. Application data for weed-free sites.

Study -location	Forage - Potlatch, ID		Seed - Bonners Ferry, ID	
Application date	10/7/09	11/4/09	10/13/09	11/5/09
Timothy growth stage	3 to 8 inches	dormant	4 to 10 inches	dormant
Air temperature (F)	44	60	43	44
Relative humidity (%)	75	56	60	68
Wind (mph, direction)	0	4, SE	3, NW	3, NE
Cloud cover (%)	0	10	100	50
Soil moisture	dry	normal	dry	normal
Soil temperature at 2 inch (F)	35	39	37	34

Ventenata (VETDU) control was 90% or greater with all treatments, except aminopyralid and sulfosulfuron applied alone and flucarbazone alone or plus primisulfuron (Table 3). Flufenacet/metribuzin combined with terbacil, sulfosulfuron, or primisulfuron controlled downy brome (BROTE) 88 to 96%. All flufenacet/metribuzin combinations, except with diclofop or primisulfuron, controlled rattail fescue (VLPMY) 90 to 99%. Oxyfluorfen plus diuron controlled all three grass species 95% and greater. Timothy tolerance was evaluated only at one site due to quackgrass contamination at the second weed-free location. Visual injury ranged from 15 to 20% with sulfosulfuron and flufenacet/metribuzin treatments. Pronamide killed timothy, ventenata, rattail fescue and downy brome 100% and was not included in the analysis. Dry forage hay weight did not differ among treatments (excluding the Kerb treatment) and from the untreated check**.**

Table 3. Timothy response and ventenata, downy brome and rattail fescue control in 2010.

Treatment[1]	Rate	Timing[2]	Weed control[3,4] VETDU	BROTE	VLPMY	Timothy- Bonners Ferry[4] Injury	Forage dry weight
	lb ai/A		%	%	%	%	ton/A
Flufenacet/metribuzin	0.319	pre	97	20	86	21	2.9
Flufenacet/metribuzin	0.425	pre	99	0	77	20	2.6
Metolachlor	1.27	pre	92	12	76	11	3.2
Ethofumesate	1	pre	96	42	86	0	3.5
Flufenacet/metribuzin +	0.319	pre					
terbacil	0.4	pre	98	94	90	19	3.5
Flucarbazone	0.027	pre	62	12	12	6	3.5
Flufenacet/metribuzin+	0.319	pre					
flucarbazone	0.018	pre	93	35	94	8	3.1
Diclofop	1	pre	99	5	0	12	3.3
Flufenacet/metribuzin+	0.319	pre					
diclofop	1	pre	99	25	22	20	2.9
Aminopyralid	0.078	pre	78	61	26	9	4.0
Flufenacet/metribuzin+	0.319	pre					
aminopyralid	0.078	pre	93	61	96	10	3.1
Flufenacet/metribuzin+	0.319	pre					
sulfosulfuron	0.023	post	98	88	99	18	3.4
Flufenacet/metribuzin+	0.319	pre					
primisulfuron	0.027	post	98	93	77	14	2.7
Flucarbazone+	0.018	pre					
primisulfuron	0.027	post	88	80	56	10	3.5
Primisulfuron	0.036	post	99	35	52	10	2.6
Oxyfluorfen +	0.375	post					
diuron	0.75	post	99	96	99	2	3.9
Pyroxsulam	0.0123	post	98	45	5	6	3.9
Sulfosulfuron	0.023	post	76	8	53	15	2.5
Pronamide	1.5	post	100	100	100	100	0
Untreated check	--	--	--	--	--	--	3.2
LSD (0.05)			12	43	31	13	NS
Density (plants/ft^2)							

[1]Sulfosulfuron and pyroxsulam were applied with a 90% non-ionic surfactant (R-11) at 0.25% v/v. Primisulfuron was applied with a crop oil concentrate (Moract) at 2.5% v/v. Pyroxsulam was applied with ammonium sulfate (Bronc) at 1.5 lb ai/A.
[2]Application timing based on weed growth stage, pre =preemergence, post= postemergence.
[3]VETDU= ventenata, BROTE= downy brome, and VLPMY= rattail fescue.
[4]Pronamide killed all grasses, including timothy, and was not included in the analysis.

Volunteer chicory control in irrigated spring wheat. Don W. Morishita, J. Daniel Henningsen and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). Chicory is a potential alternate crop being considered for production in southern Idaho. However, chicory is a perennial plant with the ability to reproduce from the large tap root it produces. Consequently, volunteer chicory is a potential weed problem in southern Idaho irrigated cropping systems. A study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to evaluate some currently registered cereal herbicides for their effectiveness in controlling volunteer chicory the year after a chicory crop is harvested. 'Alpowa' was planted April 2, 2010 at 95 lb/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Portneuf silt loam (17.9% sand, 61.8% silt, and 20.3% clay) with a pH of 8.0, 1.7% organic matter, and CEC of 21.0-meq/100 g soil. Herbicides were applied with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 22 psi. Environmental conditions and addition application information is shown on Table 1. The June 6 application was delayed due to cool wet conditions and some wheat plants already had more than one joint. Kochia, common lambsquarters, and annual sowthistle densities averaged 21, 167, 15 plants/ft^2, respectively. Volunteer chicory density averaged only 4 plants per plot when the herbicides were applied. Crop injury and weed control were evaluated visually 20 and 34 days after the last application (DALA) on June 28 and July 12. Grain was harvested August 24 with a small-plot combine.

Table 1. Environmental conditions at each application date.

Application date	5/21	6/6	6/8
Application timing	tillering	first joint	jointing
Air temperature (F)	46	62	63
Soil temperature (F)	48	60	60
Relative humidity (%)	65	72	44
Wind velocity (mph)	6.5	4.5	1
Cloud cover (%)	100	95	40
Time of day	0930	1000	0905

Crop injury 20 DALA ranged from 0 to 10% (Table 2). Injury was highest with clopyralid/fluroxypyr + 1:1 thifensulfuron/tribenuron + methylated seed oil and with 1:1 thifensulfuron/tribenuron + fluroxypyr + methylated seed oil. At the 34 DALA evaluation, crop injury did not differ among herbicide treatments and ranged from 0 to 5%. Volunteer chicory control 20 DALA was very poor and averaged less than 5% among all herbicide treatments. By 34 DALA, overall chicory control had improved with all herbicide treatments. Florasulam/fluroxypyr/pyroxsulam had the poorest volunteer chicory control averaging only 25% 34 DALA. Control with all other treatments ranged from 59 to 83% with no statistical differences among treatments. This was because of the variability in control with some of the treatments. Clopyralid/2,4-D + nonionic surfactant and clopyralid/fluroxypyr + 1:1 thifensulfuron/tribenuron had the most consistent control and had the highest numerical average for volunteer chicory control. Bromoxynil/pyrasulfotole + nonionic surfactant + ammonium sulfate averaged 59% overall, but had two replications with 25% control and 85 and 100% control in the other two replications. Thifensulfuron/tribenuron applied one time at 0.0313 lb ai/A and thifensulfuron/tribenuron applied two times at 0.0234 and 0.0078 lb ai/A both averaged 80 to 90% control in three replications, but only 50% in one of the replications. Kochia control ranged from 0 to 94% and 0 to 96% 20 and 34 DALA, respectively. Florasulam/fluroxypyr/pyroxsulam + nonionic surfactant + ammonium sulfate and 1:1 thifensulfuron/tribenuron + fluroxypyr + methylated seed oil controlled kochia the best among all the herbicides compared. Common lambsquarters control 20 DALA ranged from 14 to 94%. The sequential application of 1:1 thifensulfuron/tribenuron + fluroxypyr + methylated seed oil and clopyralid/2,4-D + nonionic surfactant controlled common lambsquarters best at 91 and 94%, respectively. At 34 DALA, all herbicide treatments, except bromoxynil/pyrasulfotole + nonionic surfactant + ammonium sulfate controlled common lambsquarters 83% or better. It is not clear why this treatment performed so poorly because it typically controls this weed species. Redroot pigweed and annual sowthistle were controlled effectively with all herbicide treatments. All herbicide treatments had higher test weights than the untreated check, although bromoxynil/pyrasulfotole + nonionic surfactant + ammonium sulfate was lower than all of the other herbicide treatments. Grain yield apparently was not affected by the low chicory population in this study and was more influenced by the kochia and common lambsquarters populations. Florasulam/fluroxypyr/pyroxsulam + nonionic surfactant + ammonium sulfate, bromoxynil/pyrasulfotole + nonionic surfactant + ammonium sulfate, and the sequential application of 1:1 thifensulfuron/tribenuron + fluroxypyr + methylated seed oil were among the highest yielding treatments, with grain yields ranging from 98 to 112 bu/A. Further studies will be conducted to find the most effective volunteer chicory herbicide used in small grains.

Table. Crop injury, volunteer chicory and broadleaf weed control in irrigated spring wheat[1].

Treatment[3]	Rate	Crop injury 6/28	Crop injury 7/12	Weed control[2] CICIN 6/28	CICIN 7/12	KCHSC 6/28	KCHSC 7/12	CHEAL 6/28	CHEAL 7/12	AMARE 7/12	SONOL 7/12	Test weight	Grain yield
	lb ai/A											lb/bu	bu/A
Check		-	-	-	-	-	-	-	-	-	-	39 c	82 bcd
Clopyralid/2,4-D	0.79 lb ae/a	4 cd	5 a	5 a	83 a	1 de	0 c	91 a	92 a	100 a	99 a	58 a	73 d
nonionic surfactant	0.25 % v/v												
Clopyralid/2,4-D +	0.79 lb ae/a +	0 d	0 a	3 a	70 a	0 e	0 c	73 b	89 a	100 a	96 ab	57 a	76 d
bromoxynil/pyrasulfotole +	0.179 +												
nonionic surfactant	0.25 % v/v												
Clopyralid/fluroxypyr +	0.25 lb ae/a +	10 a	5 a	6 a	81 a	48 bc	69 b	54 c	83 a	100 a	95 ab	60 a	77 d
thifensulfuron/tribenuron 1:1 +	0.0313 +												
methylated seed oil	0.5 % v/v												
Florasulam/fluroxypyr/pyroxsulam +	0.105 lb ae/a +	5 bc	1 a	1 a	25 b	84 ab	94a	88 ab	89 a	100 a	93 b	60 a	112 a
nonionic surfactant +	0.25 % v/v +												
ammonium sulfate	1.5												
Bromoxynil/pyrasulfotole +	0.241 +	0 d	0 a	3 a	59 a	9 cde	55 b	14 d	29 b	100 a	93 b	48 b	98 abc
nonionic surfactant +	0.25 % v/v +												
ammonium sulfate	1.0												
Thifensulfuron/tribenuron 1:1 +	0.0313 +	9 ab	5 a	5 a	76 a	29 cd	53 b	71 b	89 a	100 a	99 a	58 a	79 cd
fluroxypyr +	0.175 lb ae/a +												
methylated seed oil	0.5 % v/v												
Thifensulfuron/tribenuron 1:1 +	0.0234 +	6 abc	1 a	4 a	74 a	94 a	96 a	94 a	97 a	100 a	99 a	60 a	99 ab
fluroxypyr +	0.131 lb ae/a +												
methylated seed oil +	0.5 % v/v +												
thifensulfuron/tribenuron 1:1 +	0.0078 +												
fluroxypyr +	0.131 lb ae/a +												
methylated seed oil	0.5 % v/v												
LSD (P=0.05)		4	ns	ns	24	28	11	17	16	ns	4	8	20

[1]Means followed by same letter are not significantly different using Fisher's Protected LSD (P=0.05)
[2]Weeds evaluated for control were volunteer chicory (CICIN), kochia (KCHSC), common lambsquarters (CHEAL), redroot pigweed (AMARE), and annual sowthistle (SONOL).
[3]Clopyralid/2,4-D is a formulated mixture and sold as Curtail. Bromoxynil/pyrasulfotole is a formulated mixture and sold as Huskie. Clopyralid/fluroxypyr is a formulated mixture and sold as Widematch. Thifensulfuron/tribenuron is a 1:1 formulated mixture and sold as Affinity BroadSpec. Florasulam/fluroxypyr/pyroxsulam is a formulated mixture and sold as GoldSky. Nonionic surfactant used was R-11, methylated seed oil used was Super Spread, and ammonium sulfate used was Bronc.

Broadleaf and crop safety study in wheat. Steve Wright, Gerardo Banuelos, Sara Avila, and Jamie Changala. (Agriculture and Natural Resources, University California Cooperate Extension, Tulare, CA 93274-9537) This study was conducted at the Westside Research Extension Center near Five Points. The objective was to evaluate the effectiveness of various herbicides at different rates at controlling London rocket (*Sisymbrium irio*) and crop safety in wheat, applied at two different timings, 4 to 6 leaf and 5 to 8 leaf stages. The first application was conducted on February 3, 2010 and the second application was conducted on February 17, 2010. The plot sizes were 10 feet by 25 feet plots with four replications. Treatments were applied using a CO_2 backpack sprayer at 3.5 mph. The nozzles were 8002 flat fans with a spray pressure of 40 psi and a volume of 15 gpa. The variety of the wheat was Blanca Fuerte. The height of the wheat during the first application was 3 to 8 inches tall and was applied at the 4 to 6 leaf stage. At the second application, the wheat was 8 to 12 inches tall and was at the 5 to 8 leaf stage. All treatments showed zero percent injury during the last rating on March 23rd, with the exception pinoxaden plus pyraflufen or carfentrazone applied at the 5 to 8 leaf stage, showing an average 6.5% injury. In general, London Rocket control was higher with most treatments applied at the 4 to 6 leaf stage of the wheat.

Table. London rocket control in 'Blanca Fuerte' spring wheat 2010

		Application	London rocket control	
Treatment[1]	Rate	timing	March 17	March 23
	oz/A		%	%
Mesosulfuron	4.76	4-6 lf	85	78
Mesosulfuron/iodosulfuron	7	4-6 lf	88	83
Fenoxaprop	10.6	4-6 lf	0	0
Pinoxaden	16.4	4-6 lf	0	30
Pinoxaden + pyraflufen	16.4 + 1	4-6 lf	38	45
Pinoxaden + carfentrazone	16.4 + 1	4-6 lf	56	79
Pinoxaden + MCPA	16.4 + 16	4-6 lf	86	84
Fenoxaprop +pyraflufen	10.6 + 1	4-6 lf	51	71
Fenoxaprop + carfentrazone	10.6 + 1	4-6 lf	81	84
Pyraflufen	1	4-6 lf	68	49
Carfentrazone	1	4-6 lf	91	78
Pyroxsulam	6.75	4-6 lf	84	79
Pyroxsulam +ammonium sulfate	6.75 + 1.5	4-6 lf	85	71
Pyroxsulam + COC	6.75 + 1.25	4-6 lf	88	78
Mesosulfuron	4.76	5-8 lf	94	86
Mesosulfuron/iodosulfuron	7	5-8 lf	98	93
Fenoxaprop	10.6	5-8 lf	0	0
Pinoxaden	16.4	5-8 lf	0	50
Pinoxaden + pyraflufen	16.4 + 1	5-8 lf	55	60
Pinoxaden + carfentrazone	16.4 + 1	5-8 lf	78	88
Pinoxaden + MCPA	16.4 + 16	5-8 lf	98	94
Fenoxaprop +pyraflufen	10.6 + 1	5-8 lf	64	79
Fenoxaprop + carfentrazone	10.6 + 1	5-8 lf	95	93
Pyraflufen	1	5-8 lf	80	63
Carfentrazone	1	5-8 lf	100	85
Pyroxsulam	6.75	5-8 lf	98	88
Pyroxsulam +ammonium sulfate	6.75 + 1.5	5-8 lf	99	85
Pyroxsulam + COC	6.75 + 1.25	5-8 lf	98	86
Untreated check	---	5-8 lf	0	0

[1]A nonionic surfactant (Induce) at 0.5% v/v was included with all treatments, except pyroxsulam + COC. Ammonium sulfate rate was in lb ai/A. COC is a crop oil concentrate (Agridex) and was applied at a % v/v rate.

<u>Wild oat control in spring wheat</u>. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established to evaluate crop response and wild oat control in 'Alturas' spring wheat near Moscow, ID with flucarbazone formulations at two application timings. Due to a known history of an extremely heavy wild oat population, studies were established without (study 1) and with triallate (study 2). Triallate was applied postplant incorporated on April 16, 2010 at 1 lb ai/A. ARY-0454-113 is a 42% water dispersible granule flucarbazone formulation and it was compared to ARY-0454-105, a suspension concentrate formulation of flucarbazone. Studies were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Wheat response and wild control were evaluated visually. Wheat grain was harvested with a small plot combine on August 19, 2010 from the triallate treated study only. Harvest was not possible in the non-triallate treated study due to lodging caused by the dense wild oat population.

Table 1. Application and soil data.

Study	Study 1 (without triallate)		Study 2 (with triallate)	
Application date	5/12/10	5/24/10	5/17/10	6/1/10
Growth stage				
Spring wheat	2 leaf	2 tiller	2 leaf	2 tiller
Wild oat	2 leaf	2 tiller	2 leaf	2 tiller
Air temperature (F)	60	56	61	54
Relative humidity (%)	68	64	64	85
Wind (mph, direction)	3, NW	3, SW	0	1, W
Dew present?	no	no	no	yes
Cloud cover (%)	100	50	100	100
Soil moisture	adequate	adequate	adequate	excessive
Soil temperature at 2 in (F)	60	65	100	100
pH	5.0			
OM (%)	3.0			
CEC (meq/100g)	23			
Texture	silt loam			

In study 1 (without triallate), no treatment injured spring wheat (data not shown). On June 8, the pinoxaden treatment (2 tiller) and all treatments applied at the two leaf wild oat growth stage controlled wild oat 84 and 95%, respectively (Table 2). By June 23, the pinoxaden treatment and fenox/pyra/bromo controlled wild oat 95%. Wild oat control decreased for all two leaf timing treatments likely due to additional wild oat emergence between evaluation dates.

On June 8 in study 2 (triallate applied PPI), pinoxaden and fenox/pyra/bromo injured spring wheat 16 and 18% (Table 2). By June 23, no visual injury was observed (data not shown). On June 8, wild oat control was best with all treatments applied at the two leaf wild oat growth stage (95%), but did not differ from mesosulfuron (82%). By June 23, fenox/pyra/bromo and pinoxaden controlled wild oat 94 and 95%, respectively. Similar to study 1, wild oat control decreased for all two leaf timing treatments due to additional wild oat emergence between evaluation dates. Wild oat control increased from the first to the second evaluation time for all two tiller timing treatments. Grain yield did not differ among treatments applied at the two leaf timing. ARY-0454-113 and ARY-0454-105 treatments applied at the 2 leaf timing (61 to 66 bu/A) tended to have higher grain yield than when they were applied at the 2 tiller timing (52 to 61 bu/A). Wheat grain yield was greater than the untreated check in all herbicide treated plots. Wheat grain test weight did not differ among herbicide treatments but was greater for all herbicide treatments compared to the untreated check.

Table 2. Wild oat control and spring wheat response with flucarbazone formulations at two application timings with and without triallate preplant near Moscow, ID in 2010.

			Study 1(without triallate)		Study 2 (with triallate)				
		Application	Wild oat control		Wild oat control		Spring wheat		
Treatment[1]	Rate[2]	timing[3]	6/8[3]	6/23	6/8	6/23	Injury[4]	Yield	Test weight
	lb ai/A		%	%	%	%	%	bu/A	lb/bu
ARY-0454-113 +	0.0179								
clopyralid/fluroxypyr	0.188	2 leaf	95	79	95	82	0	66	60.0
ARY-0454-105+	0.0179								
clopyralid/fluroxypyr	0.188	2 leaf	95	70	95	76	0	64	59.1
ARY-0454-113 +	0.0179								
thifen/triben/fluro	0.097	2 leaf	95	79	92	85	0	61	59.3
ARY-0454-113 +	0.0179								
clopyralid/fluroxypyr	0.188	2 tiller	60	60	72	80	0	61	60.1
ARY-0454-105+	0.0179								
clopyralid/fluroxypyr	0.188	2 tiller	68	69	69	80	0	52	59.5
ARY-0454-113 +	0.0179								
thifen/triben/fluro	0.097	2 tiller	52	70	65	80	0	52	59.7
ARY-0548-019 +	0.112								
2,4-D ester	0.375	2 tiller	48	38	64	70	0	50	58.9
Pinoxaden +	0.054								
clopyralid/fluroxypyr +	0.188								
2,-4 D ester	0.25	2 tiller	84	95	68	95	16	56	60.1
Pyrox/fluo/flor	0.105	2 tiller	58	77	69	82	0	52	59.9
Fenox/pyra/bromo	0.293	2 tiller	62	95	66	94	18	61	59.5
Mesosulfuron	0.009	2 tiller	64	82	82	85	2	58	59.9
Untreated check	--	--	--	--	--	--	--	26	54.4
LSD (0.05)			12	12	12	8	3	10	2.0
Density (plants/ft^2)			30		15				

[1]ARY-0454-113 is a water dispersal granule formulation of flucarbazone. ARY-0454-105 is a suspension concentrate formulation of flucarbazone. ARY-0548-019 is a premix suspension concentrate of flucarbazone and fluroxypyr. Thifen/triben/fluro = thifensulfuron/tribenuron/fluroxypyr. Pyrox/fluo/flor = pyroxsulam/fluroxypyr/florasulam. Fenox/pyra/bromo = fenoxaprop/pyroxsulam/bromoxynil. A basic blend (Quad 7) was applied at 1% v/v with all treatments, except pinoxaden, fenoxaprop, mesosulfuron, ARY-0548-019. Urea ammonium nitrate (URAN 32%) and nonionic surfactant (R-11) were applied at 5 and 0.25% v/v, respectively, with mesosulfuron.

[2]Rate for clopyralid/fluroxypyr, ARY-0548,-019, 2,4-D ester, and MCPA ester based on lb ae/A.

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

[4]June 8, 2010 evaluation.

Wild oats and crop safety study in wheat. Steve Wright, Gerardo Banuelos, Sara Avila, and Jamie Changala. (University California Cooperate Extension - Tulare/Kings Co.). This study was conducted near Ducor, CA. Two application timings were evaluated, 3 to 5 leaf stage and the 6 to 8 leaf stage. The first application was conducted on February 1, 2010 with a temperature of 65ºF with a wind of 1 to 3 mph. The second application was conducted on February 19, 2010 with a temperature of 65ºF and a wind speed of 0 to 2 mph. The plot sizes were 10 feet by 25 feet plots with four replications. The sprayer used was a CO_2 backpack going at 3.5 mph. The nozzles used were 8002 flat fans with a spray pressure of 40 psi and a volume of 15 gpa. The variety of the wheat was Joaquin. The height of the wheat at the time of the first application was 4 to 6 inches tall or at the 3 to 6 leaf stage. At the time of the second application the wheat was 6 to 15 inches tall and was at the 6 to 9 leaf stage. All treatments showed no signs of injury during the last rating on March 29th. All treatments gave good wild oat control, except for the two broadleaf herbicides used, pyraflufen and carfentrazone. In general, early application timing, 3 to 6 leaf stage, resulted in better wild oat control.

Table. Wild oat control in Joaquin wheat in 2010

Treatment[1]	Rate[2]	Application timing	Wild oat control 2/12	2/19	2/23	3/2	3/19	3/29
	oz /A	3-6 lf	%	%	%	%	%	%
Mesosulfuron	4.76	3-6 lf	0	45	51	59	81	98
Mesosulfuron/iodosulfuron	7	3-6 lf	50	59	78	91	78	91
Fenoxaprop	10.6	3-6 lf	0	55	78	85	93	100
Pinoxaden	16.4	3-6 lf	0	69	88	95	99	100
Pinoxaden + pyraflufen	16.4	3-6 lf	0	70	79	88	90	89
Pinoxaden + carfentrazone	16.4	3-6 lf	0	74	89	96	100	100
Pinoxaden + MCPA	16.4	3-6 lf	0	54	73	89	96	100
Fenoxaprop + pyraflufen	10.6	3-6 lf	0	69	75	86	93	100
Fenoxaprop + carfentrazone	10.6	3-6 lf	0	71	81	90	96	99
Pyraflufen	1	3-6 lf	0	0	0	0	0	0
Carfentrazone	1	3-6 lf	0	0	0	0	0	0
Pyroxsulam	6.75	3-6 lf	0	0	66	74	88	96
Pyroxsulam + AMS	6.75	3-6 lf	0	0	66	73	86	95
Pyroxsulam + COC	6.75	3-6 lf	0	53	51	58	84	99
Tribenuron	7	3-6 lf	0	0	0	0	0	0
Mesosulfuron	4.76	6-9 lf	--	--	0	1	30	44
Mesosulfuron/iodosulfuron	7	6-9 lf	--	--	78	91	78	91
Fenoxaprop	10.6	6-9 lf	--	--	0	6	48	81
Pinoxaden	16.4	6-9 lf	--	--	0	5	53	78
Pinoxaden + pyraflufen	16.4	6-9 lf	--	--	0	8	59	89
Pinoxaden + carfentrazone	16.4	6-9 lf	--	--	0	10	61	88
Pinoxaden + MCPA	16.4	6-9 lf	--	--	0	8	55	80
Fenoxaprop + pyraflufen	10.6	6-9 lf	--	--	0	9	59	88
Fenoxaprop + carfentrazone	10.6	6-9 lf	--	--	0	9	53	84
Pyraflufen	1	6-9 lf	--	--	0	0	0	0
Carfentrazone	1	6-9 lf	--	--	0	0	0	0
Pyroxsulam	6.75	6-9 lf	--	--	0	1	26	43
Pyroxsulam + AMS	6.75	6-9 lf	--	--	0	4	36	59
Pyroxsulam + COC	6.75	6-9 lf	--	--	0	3	43	65
Tribenuron	7	6-9 lf	--	--	0	0	0	0
Untreated check	---	6-9 lf	--	--	0	0	0	0

[1]A 90% nonionic surfactant (R-11) was applied at 0.5% v/v with all treatment, except pyroxsulam plus AMS or COC. AMS was ammonium sulfate and was applied at 1.5 lb ai/A. COC was crop oil concentrate and was applied at 1.25% v/v.

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

<u>Catchweed bedstraw and mayweed chamomile control in winter wheat</u>. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in 'OR CF 102' winter wheat near Lapwai, ID to evaluate winter wheat response and catchweed bedstraw and mayweed chamomile control with pyrasulfotole/bromoxynil and thifensulfuron/tribenuron/fluroxypyr (thifen/triben/fluro). 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). Both studies were sprayed with pinoxaden at 0.054 lb ai/A on April 23, 2010 to control Italian ryegrass. Wheat response and weed control were evaluated visually.

Table 1. Application and soil data.

Study	Pyrasulfotole/bromoxynil study	Thifensulfuron/tribenuron/fluroxypyr study
Application date	4/15/2010	4/15/2010
Growth stage		
Winter wheat	3 tiller	3 tiller
Catchweed bedstraw (GALAP)	2 inch tall	2 inch tall
Mayweed chamomile (ANTCO)	--	0.5 inch tall
Air temperature (F)	71	71
Relative humidity (%)	52	76
Wind (mph)	0	2, W
Cloud cover (%)	20	10
Soil moisture	excessive	excessive
Soil temperature at 2 inch (F)	62	60
pH	4.9	
OM (%)	4.3	
CEC (meq/100g)	30	
Texture	silt loam	

In the pyrasulfotole/bromoxynil study, no winter wheat injury was visible (data not shown). At 8 DAT, pyrasulfotole/bromoxynil combined with fluroxypyr/bromoxynil, bromoxynil/MCPA or fluroxypyr alone controlled catchweed bedstraw 95 to 96% (Table 2). By 40 DAT, catchweed bedstraw control was best with fluroxypyr/clopyralid (91%) but did not differ from pyrasulfotole/bromoxynil plus fluroxypyr/clopyralid, fluroxypyr/bromoxynil, or bromoxynil/MCPA (79 to 84%).

In the thifen/triben/fluro study at 8 DAT, thifen/triben/fluro plus pyrasulfotole/bromoxynil injured wheat 4% (Table 3). By 16 DAT, no visible winter wheat injury was present (data not shown). Catchweed bedstraw control was best with thifen/triben/fluro at 0.116 lb ai/A plus NIS or MCPA ester (92 and 94%) but did not differ from thifen/triben/fluro at 0.097 lb ai/A plus MCPA ester, thifensulfuron plus tribenuron and fluroxypyr (tankmix not premix), clopyralid/fluroxypyr and flucarbazone/fluroxypyr treatments (84 to 91%). All treatments controlled mayweed chamomile 78 to 95%, except thifen/triben/fluro at 0.0775 and 0.097 lb ai/A, flucarbazone/fluroxypyr treatment, and thifensulfuron plus tribenuron and fluroxypyr tankmix instead of a premix (50 to 70%).

Table 2. Wheat response and catchweed bedstraw control with pyrasulfotole/bromoxynil combinations near Lapwai, ID in 2010.

		Catchweed bedstraw control	
Treatment[1]	Rate[2]	8 DAT	40 DAT
	lb ai/A	%	%
Pyrasulfotole/bromoxynil	0.217	82	74
Pyrasulfotole/bromoxynil +	0.217		
fluroxypyr	0.0525	95	76
Pyrasulfotole/bromoxynil +	0.217		
fluroxypyr/clopyralid	0.094	84	84
Pyrasulfotole/bromoxynil +	0.217		
fluroxypyr/bromoxynil	0.239	96	82
Pyrasulfotole/bromoxynil +	0.217		
bromoxynil/MCPA	0.375	95	79
Pyrasulfotole/bromoxynil +	0.217		
thifensulfuron/tribenuron	0.0188	75	70
Fluroxypyr/clopyralid	0.218	79	91
Bromoxynil/MCPA	0.75	83	35
LSD (0.05)		12	13
Density (plants/ft^2)		20	

[1]A nonionic surfactant (R-11) was applied with thifensulfuron/tribenuron treatment at 0.25% v/v.
[2]Rate is in lb ae/A for all treatments containing fluroxypyr or MCPA.

Table 3. Wheat response and broadleaf weed control with thifen/triben/fluro combinations near Lapwai, ID in 2010.

Treatment[1]	Rate[2]	Wheat injury[3]	Weed control GALAP[4]	Weed control ANTCO[4]
	lb ai/A	%	%	%
Thifen/triben/fluro+	0.0775			
MCPA ester	0.25	1	66	54
Thifen/triben/fluro+	0.097			
MCPA ester	0.25	0	88	74
Thifen/triben/fluro+	0.116			
MCPA ester +	0.25			
NIS	0.25	0	94	79
Thifen/triben/fluro+	0.116			
MCPA ester	0.25	0	94	84
Thifen/triben/fluro+	0.097			
2,4-D ester	0.375	0	78	87
Thifen/triben/fluro+	0.097			
bromoxynil/MCPA	0.5	4	65	84
Thifen/triben/fluro+	0.116			
bromoxynil/MCPA	0.5	1	80	88
Flucarbazone/fluroxypyr +	0.128			
thifensulfuron +	0.0176			
tribenuron	0.0059	0	84	58
Thifen/triben/fluro+	0.116			
NIS	0.5	0	92	78
Thifensulfuron +	0.0169			
tribenuron +	0.0056			
fluroxypyr +	0.094			
NIS	0.5	0	84	70
Clopyralid/fluroxypyr +	0.188			
MCPA ester	0.25	0	91	95
Pyrasulfotole/bromoxynil	0.211	0	58	94
LSD (0.05)		2	12	18
Density (plants/ft^2)			20	10

[1]Thifen/triben/fluro is thifensulfuron/tribenuron/fluroxypyr. NIS is a nonionic surfactant (R-11).
[2]Rate is in %v/v for NIS and lb ae/A for 2,4-D, clopyralid/fluroxypyr, flucarbazone/fluroxypyr and treatments containing MCPA.
[3]Evaluation date 8 DAT.
[4]Evaluation date 40 DAT.

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, ID to evaluate winter wheat response and downy brome control with 1) diclofop and flufenacet combinations; 2) standard grass herbicides at two application times and 3) a new flucarbazone formulation (ARY-0454-113) combined with sulfonylurea herbicides. ARY-0454-113 is a 42% water dispersible granule formulation of flucarbazone. Plots were arranged in a randomized complete block design with four replications and included an untreated check. 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 flufenacet and diclofop study was oversprayed with pyrasulfotole/bromoxynil at 0.241 lb ai/A on April 19, 2010 for broadleaf weed control. The application timing study was oversprayed with thifensulfuron/tribenuron at 0.0313 lb ai/A and pyrasulfotole/bromoxynil at 0.177 lb ai/A on May 10, 2010 for broadleaf weed control. In all experiments, wheat injury and downy brome control were evaluated visually.

Table 1. Application and soil data.

Experiment	Diclofop and flufenacet		Application timing		Flucarbazone
Location	Lewiston, ID		Lewiston, ID		
Winter wheat variety	Paladin		Rod/West Bred 528 mix		
Application date	10/13/09	4/14/10	4/14/10	5/7/10	4/18/10
Growth stage					
Winter wheat	preemergence	3 tiller	4 tiller	pre-joint	4 tiller
Downy brome (BROTE)	preemergence	1 tiller	3 tiller	4 tiller	3 tiller
Air temperature (F)	44	64	58	53	56
Relative humidity (%)	46	51	62	71	82
Wind (mph, direction)	1, E	3, NE	3, SE	5, E	1, NW
Dew present?	no	no	no	yes	no
Cloud cover (%)	80	80	20	30	90
Soil moisture	very dry	wet	adequate	wet	adequate
Soil temperature at 2 in (F)	40	57	60	55	60
pH	4.7		5.1		
OM (%)	4.2		4.4		
CEC (meq/100g)	30		26		
Texture	silt loam		silt loam		

In the diclofop and flufenacet combination study, diclofop plus flufenacet at 0.75 plus 0.0272 or 1 plus 0.338 lb ai/A, respectively, injured wheat 9 and 7%, and propoxycarbazone plus metribuzin injured wheat 20% (Table 2). All treatments controlled downy brome 90 to 99%.

In the timing study, all treatments applied at the three tiller timing injured winter wheat 10 to 14% on April 23 (Table 3). Injury likely was caused by cold and wet weather during the period following herbicide application, which slowed herbicide metabolism in the wheat plants. By May 14, wheat injury ranged from 0 to 6% and did not differ among treatments. Propoxycarbazone/mesosulfuron, applied to three tiller downy brome, provided 97% control, which did not differ from the 3 tiller timing of pyroxsulam (88%). Based on the final evaluation of downy brome control, the early timing (80 to 97%) treatments tended to control downy brome better than the late timing (68 to 80%).

In the flucarbazone study, no treatment injured winter wheat (data not shown). At June 1 and 30, downy brome control was best with pyroxsulam (95 and 96%), while control with flucarbazone combinations ranged from 44 to 56% (Table 4).

Table 2. Downy brome control and winter wheat response with diclofop and flufenacet combinations near Lewiston, Idaho in 2010.

Treatment[1]	Rate	Application timing[2]	Wheat injury[3]	BROTE control[3]
	lb ai/A		%	%
Flufenacet/metribuzin	0.425	preemergence	4	92
Flufenacet/metribuzin +	0.34	preemergence		
pyroxasulfone	0.08	preemergence	6	90
Diclofop	1	preemergence	0	92
Flufenacet	0.338	preemergence	1	92
Diclofop +	0.75	preemergence		
flufenacet	0.204	preemergence	0	94
Diclofop +	0.75	preemergence		
flufenacet	0.272	preemergence	9	90
Diclofop +	0.75	preemergence		
flufenacet	0.338	preemergence	4	97
Diclofop +	1	preemergence		
flufenacet	0.204	preemergence	2	94
Diclofop +	1	preemergence		
flufenacet	0.272	preemergence	1	95
Diclofop +	1	preemergence		
flufenacet	0.338	preemergence	7	99
Propoxycarbazone +	0.04	1 tiller		
metribuzin	0.14	1 tiller	20	99
LSD (0.05)			7	NS
Density (plants/ft^2)				0.5

[1]A 90% nonionic surfactant (R-11) was applied at 0.5% v/v with propoxycarbazone treatment.
[2]Application timing based on downy brome growth stage.
[3]June 16, 2010 evaluation. BROTE =downy brome.

Table 3. Downy brome control and wheat response with standard grass herbicides at two application times near Lewiston, Idaho in 2009.

Treatment[1]	Rate	Application timing[2]	Wheat injury 4/23[3]	Wheat injury 5/14	Downy brome control 6/1	Downy brome control 6/30
	lb ai/A		%	%	%	%
Pyroxsulam	0.0164	3 tiller	12	2	84	88
Propoxycarbazone/mesosulfuron	0.0223	3 tiller	14	6	91	97
Sulfosulfuron	0.0312	3 tiller	10	2	78	80
Pyroxsulam	0.0164	4 tiller	NA	2	75	80
Propoxycarbazone/mesosulfuron	0.0223	4 tiller	NA	1	64	76
Sulfosulfuron	0.0312	4 tiller	NA	0	64	67
LSD (0.05)			--	NS	15	15
Density (plants/ft^2)					10	

[1]A 90% nonionic surfactant (R-11) at 0.5% v/v and dry ammonium sulfate at 1.5 lb ai/A were applied with all treatments.
[2]Application timing based on downy brome growth stage.
[3]NA = not yet applied at this date.

Table 4. Downy brome control and wheat response with a new flucarbazone formulation combined with sulfonylurea herbicides near Lewiston, ID in 2010.

		Downy brome control	
Treatment[1]	Rate	6/1	6/30
	lb ai/A	%	%
ARY-0454-113	0.0268	56	44
ARY-0454-113 +	0.0268		
metsulfuron	0.0013	50	50
ARY-0454-113 +	0.0268		
metsulfuron	0.0027	49	51
ARY-0454-113 +	0.0268		
triasulfuron	0.0055	51	54
ARY-0454-113 +	0.0268		
tribenuron	0.0078	52	55
Pyroxsulam	0.016	95	96
LSD (0.05)		17	20
Density (plants/ft^2)		15	

[1]Basic blend (Quad 7) was applied at 1% v/v with all treatments.

Broadleaf weed control in winter wheat with thifensulfuron/tribenuron. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Due to widespread acetolactate synthase (ALS –Group 2) resistance in broadleaf weeds, a study was established in winter wheat near Genesee, ID to evaluate broadleaf weed control and winter wheat response with thifensulfuron/tribenuron combined with other broadleaf herbicides. The study was arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Wheat response and broadleaf weed control were evaluated visually.

Table 1. Application and soil data.

Application date	May 12, 2010
Growth stage	
Winter wheat 'AP700'	3 tiller
Field pennycress (THLAR)	bud stage
Shepherd's purse (CAPBP)	3 inch tall
Scentless chamomile (MATMA)	4 inch tall
Prickly lettuce (LACSE)	3 inch rosette
Air temperature (F)	59
Relative humidity (%)	62
Wind (mph)	3, NW
Cloud cover (%)	10
Soil moisture	adequate
Soil temperature at 2 inch (F)	55
pH	5.2
OM (%)	4.0
CEC (meq/100g)	27
Texture	silt loam

No treatment visually injured winter wheat (data not shown). On May 21, all treatments containing fluroxypyr or florasulam controlled field pennycress, shepherd's purse, and scentless chamomile 81 to 85% (Table 2). Field pennycress, shepherd's purse and scentless chamomile were not controlled by thifensulfuron/tribenuron alone or combined with bromoxynil/MCPA or pyrasulfotole/bromoxynil (50 to 75%). Prickly lettuce control was not rated due to heavy infestations of shepherd's purse and scentless chamomile. By June 23, all broadleaf weeds, except prickly lettuce, were controlled 100% by all treatments (data not shown). Prickly lettuce control at bolting stage ranged from 81 to 99% with all thifensulfuron/tribenuron tankmixes. Thifensulfuron/tribenuron alone did not control prickly lettuce (50%) due to ALS resistance.

Table 2. Broadleaf weed control with thifensulfuron/tribenuron near Genesee, ID in 2010.

		Broadleaf weed control			
Treatment[1]	Rate[2]	THLAR[3]	CAPBP[3]	MATMT[3]	LACSE[4]
	lb ai/A	%	%	%	%
Thifensulfuron/tribenuron	0.0156	60	55	50	50
Thifensulfuron/tribenuron+	0.0156				
clopyralid/fluroxypyr	0.188	82	85	81	99
Thifensulfuron/tribenuron+	0.0156				
pyrasulfotole/bromoxynil	0.177	72	75	71	99
Thifensulfuron/tribenuron+	0.0156				
florasulam/MCPA	0.315	85	85	84	99
Thifensulfuron/tribenuron +	0.0156				
fluroxypyr/MCPA	0.666	85	85	85	99
Thifensulfuron/tribenuron+	0.0156				
bromoxynil/MCPA	0.547	74	75	66	81
LSD (0.05)		3	4	7	26
Density (plants/ft^2)		10	15	15	5

[1]A nonionic surfactant (R-11) was applied with all treatments at 0.25% v/v.
[2]Rate is in lb ae/A for all treatments containing MCPA or fluroxypyr.
[3]Rating date May 21, 2010. THLAR (field pennycress), CAPBP (shepherd's purse), MATMT (scentless chamomile)
[4]Rating date June 23, 2010. LACSE (prickly lettuce)

Italian ryegrass and mayweed chamomile control in winter wheat with mesosulfuron/iodosulfuron combined with broadleaf herbicides. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established in winter wheat near Moscow, ID to evaluate Italian ryegrass and mayweed chamomile control and winter wheat response with mesosulfuron/iodosulfuron combined with broadleaf herbicides. The study was arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Wheat response and weed control were evaluated visually.

Table 1. Application and soil data.

Application date	May 5, 2010
Growth stage	
Winter wheat 'AP700'	4 tiller
Italian ryegrass (LOLMU)	2 tiller
Mayweed chamomile (ANTCO)	2 inch tall
Air temperature (F)	57
Relative humidity (%)	62
Wind (mph)	2, W
Cloud cover (%)	50
Soil moisture	excessive
Soil temperature at 2 inch (F)	58
pH	5.1
OM (%)	3.2
CEC (meq/100g)	20
Texture	silt loam

Winter wheat injury ranged from 0 to 12% and was not different among treatments (Table 2). All treatments, except pinoxaden (5%), controlled Italian ryegrass (79 to 90%). Pinoxaden did not control Italian ryegrass due to an ACCase resistant population. Mayweed chamomile (ANTCO) control was best with mesosulfuron/iodosulfuron plus pyrasulfotole/bromoxynil and clopyralid/fluroxypyr (91%) but did not differ from mesosulfuron/iodosulfuron plus pyrasulfotole/bromoxynil alone, and pinoxaden, pyroxsulam or mesosulfuron/iodosulfuron plus pyrasulfotole/bromoxynil and bromoxynil/MCPA (81 to 89%). Mesosulfuron/iodosulfuron alone did not control mayweed chamomile (6%).

Table 2. Wheat response and weed control with mesosulfuron/iodosulfuron combinations near Moscow, ID in 2010.

Treatment[1]	Rate[2]	Wheat injury[3]	Weed control LOLMU[4]	ANTCO[4]
	lb ai/A	%	%	%
Mesosulfuron/iodosulfuron	0.0158	5	84	6
Mesosulfuron/iodosulfuron+	0.0158			
bromoxynil/MCPA	0.75	9	90	71
Mesosulfuron/iodosulfuron+	0.0158			
pyrasulfotole/bromoxynil	0.217	0	82	89
Mesosulfuron/iodosulfuron+	0.0158			
pyrasulfotole/bromoxynil +	0.177			
thifensulfuron/tribenuron	0.0188	4	86	68
Mesosulfuron/iodosulfuron+	0.0158			
pyrasulfotole/bromoxynil +	0.177			
clopyralid/fluroxypyr	0.14	0	86	91
Mesosulfuron/iodosulfuron+	0.0158			
pyrasulfotole/bromoxynil +	0.177			
bromoxynil/MCPA	0.375	2	79	81
Mesosulfuron+	0.0134			
pyrasulfotole/bromoxynil +	0.177			
bromoxynil/MCPA	0.375	12	86	79
Pinoxaden +	0.054			
pyrasulfotole/bromoxynil +	0.177			
bromoxynil/MCPA	0.375	0	5	89
Pyroxsulam +	0.0164			
pyrasulfotole/bromoxynil +	0.177			
bromoxynil/MCPA	0.375	5	86	85
LSD (0.05)		NS	7	11
Density (plants/ft^2)			20	5

[1]A nonionic surfactant (R-11) was applied with mesosulfuron/iodosulfuron alone at 0.5% v/v and with all other treatments, except pinoxaden, at 0.25% v/v. Urea ammonium nitrate at 32% (URAN) was applied with all mesosulfuron treatments at 5% v/v.
[2]Rate is in lb ae/A for all treatments containing MCPA or fluroxypyr.
[3]Rating date 36 DAT.
[4]Rating date 66 DAT.. LOLMU (Italian ryegrass), ANTCO (mayweed chamomile).

Rattail fescue 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 to evaluate rattail fescue control with pyroxsulam combinations applied at two application times and flufenacet/metribuzin and flucarbazone combinations applied pre- and post-emergence in 'Westbred 528' winter wheat near Genesee, ID. An identical flufenacet/metribuzin and flucarbazone combination study was located in a weed-free portion of the same field to evaluate winter wheat tolerance. The plots were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Winter wheat was seeded on October 17, 2009. All studies were oversprayed for broadleaf weed control with clopyralid/fluroxypyr at 0.24 lb ae/A and 2,4-D ester at 0.5 lb ae/A on April 25, 2010. Winter wheat injury and rattail fescue control were evaluated visually during the growing season. In the tolerance study, grain was harvested with a small plot combine on August 9, 2010.

Table 1. Application and soil data.

				Flufenacet/metribuzin and flucarbazone study			
	Pyroxsulam timing study			Weed control		Tolerance	
Application date	10/20/09	3/6/10	3/23/10	10/20/09	3/23/10	10/20/09	3/23/10
Growth stage							
Winter wheat	pre	3 leaf	1 tiller	pre	1 tiller	pre	1 tiller
Rattail fescue (VLPMY)	pre	2 leaf	2 tiller	pre	2 tiller	pre	2 tiller
Air temperature (F)	59	57	64	61	62	60	60
Relative humidity (%)	70	57	63	65	56	69	55
Wind (mph, direction)	0	1, S	3, NW	2, S	0	1, S	1, NW
Cloud cover (%)	60	75	20	70	20	80	20
Soil moisture	dry	adequate	adequate	dry	adequate	dry	adequate
Soil temperature at 2 inch (F)	48	58	50	49	45	49	48
pH	5.0						
OM (%)	4.0						
CEC (meq/100g)	27						
Texture	silt loam						

In the pyroxsulam timing study, no treatment injured winter wheat (data not shown). At both evaluation dates, flufenacet/metribuzin treatments controlled rattail fescue 90 to 95% (Table 2). Application timing for treatments without flufenacet/metribuzin did not affect rattail fescue control. Without flufenacet/metribuzin, rattail fescue control decreased 13 to 36% between visual evaluations for pyroxsulam without AMS at the 2 leaf timing, pyro/flur/flor without AMS at both timings, and mesosulfuron.

In the flufenacet/metribuzin and flucarbazone combination weed control study, all treatments, except flucarbazone alone preemergence and pyroxsulam postemergence alone, controlled rattail fescue 84 to 95% (Table 3).

In the flufenacet/metribuzin and flucarbazone combinations weed-free tolerance study, flufenacet/metribuzin plus pyroxasulfone, high rate of flufenacet/metribuzin plus flucarbazone preemergence, and the low rate of flufenacet/metribuzin plus flucarbazone postemergence injured winter wheat 5 and 6% (Table 3). Wheat grain yield and test weight ranged from 88 to 103 bu/A and 63.6 to 64.3 lb/bu, respectively, and did not differ among herbicide treatments and the untreated check.

Table 2. Rattail fescue control in winter wheat with pyroxsulam combinations at two application times near Genesee, ID in 2010.

Treatment[1]	Rate	Application timing[2]	Rattail fescue control 4/20	Rattail fescue control 6/1
	lb ai/A		%	%
Flufenacet/metribuzin	0.34	pre	93	90
Flufenacet/metribuzin +	0.34	pre		
pyroxsulam +	0.0164	2 leaf		
AMS	1.5	2 leaf	95	91
Pyroxsulam	0.0164	2 leaf	72	59
Pyroxsulam +	0.0164	2 leaf		
AMS	1.5	2 leaf	71	70
Pyroxsulam	0.0164	2 tiller	72	64
Pyroxsulam +	0.0164	2 tiller		
AMS	1.5	2 tiller	76	68
Flufenacet/metribuzin +	0.34	pre		
pyro/flur/flor	0.105	2 leaf	94	91
Pyro/flur/flor	0.105	2 leaf	72	59
Pyro/flur/flor +	0.105	2 leaf		
AMS	1.5	2 leaf	74	68
Pyro/flur/flor	0.105	2 tiller	71	35
Pyro/flur/flor +	0.105	2 tiller		
AMS	1.5	2 tiller	78	68
Flufenacet/metribuzin +	0.34	pre		
mesosulfuron	0.0134	2 leaf	95	90
Mesosulfuron	0.0134	2 leaf	64	50
Mesosulfuron	0.0134	2 tiller	71	52
LSD (0.05)			13	19
Density (plants/ft^2)			15	

[1]A 90% nonionic surfactant (R-11) applied at 0.5% v/v with all treatments, except flufenacet/metribuzin. AMS= ammonium sulfate. Pyro/flur/flor = pyroxsulam/fluroxypyr/florasulam.

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

Table 3. Winter wheat injury and rattail fescue control with flufenacet/metribuzin and flucarbazone combinations near Genesee, ID in 2010.

			Weed control study	Tolerance study		
		Application	Rattail fescue	Wheat		
Treatment[1]	Rate	timing[2]	control[3]	Injury	Yield	Test weight
	lb ai/A		%	%	bu/A	lb/bu
Flufenacet/metribuzin	0.425	pre	90	0	99	63.8
Flufenacet/metribuzin	0.34	pre	94	1	100	63.7
Pyroxasulfone	0.08	pre	95	0	102	64.0
Flufenacet/metribuzin +	0.34	pre				
pyroxasulfone	0.08	pre	95	6	96	63.6
Flucarbazone	0.027	pre	49	0	90	64.0
Flufenacet/metribuzin +	0.425	pre				
flucarbazone	0.027	pre	93	5	93	63.8
Flufenacet/metribuzin +	0.34	pre				
flucarbazone	0.027	pre	89	0	91	64.0
Pyroxasulfone +	0.08	pre				
flucarbazone	0.014	pre	95	1	97	64.1
Flufenacet/metribuzin +	0.425	pre				
sulfosulfuron	0.031	2 tiller	95	0	95	63.9
Flufenacet/metribuzin +	0.34	pre				
sulfosulfuron	0.031	2 tiller	95	0	88	64.2
Flufenacet/metribuzin +	0.425	pre				
flucarbazone	0.027	2 tiller	95	1	98	63.9
Flufenacet/metribuzin +	0.34	pre				
flucarbazone	0.027	2 tiller	94	5	92	64.1
Flucarbazone +	0.014	pre				
flucarbazone	0.014	2 tiller	84	0	101	63.9
Flufenacet/metribuzin +	0.425	pre				
pyroxsulam	0.0164	2 tiller	95	0	97	64.0
Flufenacet/metribuzin +	0.34	pre				
pyroxsulam	0.0164	2 tiller	94	0	100	63.9
Sulfosulfuron	0.031	2 tiller	86	0	95	64.2
Flucarbazone	0.027	2 tiller	86	4	103	64.0
Pyroxsulam	0.0164	2 tiller	72	2	95	63.9
Untreated check	--	--	--	--	98	64.3
LSD (0.05)			6	4	NS	NS
Density (plants/ft^2)			10			

[1]A non-ionic surfactant (R-11) was applied at 0.25% v/v with postemergence flucarbazone and sulfosulfuron and at 0.5% v/v with pyroxsulam treatments. Ammonium sulfate (Bronc) was applied at 2.5% with postemergence flucarbazone, 5% v/v with sulfosulfuron and 1.5 lb ai/A with pyroxsulam.
[2]Application timing based on rattail fescue growth stage.
[3]June 1, 2010 evaluation.

Tumble mustard control in winter wheat. Richard N. Arnold, Michael K. O'Neill and Kevin A. Lombard. (New Mexico State University Agricultural Science Center, Farmington, NM 87499) Research plots were established on September 14, 2009 at the Agricultural Science Center, Farmington, New Mexico, to evaluate the response of winter wheat (var. Jagaline) and tumble mustard to postemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 0.3%. The experimental design was a randomized complete block with three replications. Individual plots were 8, 16 in rows 30 ft long. Winter wheat was planted at 100 lb/A on September 14. Postemergence treatments were applied on March 23, 2010 when winter wheat was six inch or less in height and tumble mustard was in the two inch rosette stage. Treatments were applied with a compressed air backpack sprayer equipped with 11004 nozzles calibrated to deliver 30 gal/A at 35 psi. Tumble mustard infestations were heavy throughout the experimental area. Treatments were evaluated on April 26. Winter wheat was harvested for yield on August 10, 2010.

No crop injury was noted from any of the treatments. All treatments except the weedy check gave over 83% or better control of tumble mustard. Yields were 1224 to 2523 lb/A higher in the herbicide treated plots as compared to the weedy check.

Table. Tumble mustard control and yield of Jagaline winter wheat treated with postemergence herbicides.

Treatments	Rate	Crop Injury[7]	Weed control[7,8] SSYAL	Yield
	lb ai/A	––%––	––%––	lb/A
Dicamba+thifensulfuron+tribenuron[1] (pm)	0.13+0.23	0	99	3715
Pyroxsulam[2]	0.013	0	99	3992
Mesosulfuron[3]	0.21	0	100	3745
Pinoxaden+florasulam (pm)	0.11	0	83	3107
Thifensulfuron+tribenuron[1] (pm)+ 2,4D	0.45+0.28	0	100	4169
Thifensulfuron+tribenuron[4] (pm)+ 2,4D	0.45+0.28	0	100	4245
Thifensulfuron+tribenuron[5] (pm)+2,4D	0.45+0.19	0	100	4406
Thifensulfuron+tribenuron[6] (pm)+2,4D	0.45+0.19	0	100	3987
Weedy check		0	0	1883

[1]Treatments were applied with a nonionic surfactant (Biosurf) at 5 oz/A.
[2]Treatment applied with a crop oil concentrate (Maximizer) at 16 oz/A.
[3]Treatment applied with a nonionic surfactant (Biosurf) and sprayable ammonium sulfate at 5 oz/A and 1.5 lb/A.
[4]Treatment applied with URAN (urea ammonium nitrate) at 384 oz/A.
[5]Treatment applied with URAN (urea ammonium nitrate) at 768 oz/A.
[6]Treatment applied with URAN (urea ammonium nitrate) at 1152 oz/A.
[7]Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.
[8]SSYAL is tumble mustard.

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 control with 1) pyroxasulfone plus glyphosate combinations and 2) pyroxasulfone and triasulfuron combinations near Moscow, ID; and 3) flufenacet/metribuzin combinations near Viola, ID. The plots were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). All studies were oversprayed for broadleaf weed control with thifensulfuron/tribenuron at 0.0313 lb ai/A, pyrasulfotole/bromoxynil at 0.177 lb ai/A, and bromoxynil/MCPA at 0.75 lb ae/A on April 19 at Viola and April 21, 2010 at Moscow. Winter wheat injury and Italian ryegrass control were evaluated visually during the growing season. In the pyroxasulfone plus glyphosate study, grain was harvested with a small plot combine on August 23, 2010.

Table 1. Application and soil data.

Experiment	Pyroxasulfone plus glyphosate			Pyroxasulfone and triasulfuron		Flufenacet/metribuzin	
Location	ORCF 102 – 9/29/09					Brundage96 - 10/2/09	
Wheat variety/planting date	Moscow			Moscow		Viola	
Application date	9/22/09	10/5/09	5/9/10	10/5/09	5/9/10	10/8/09	5/13/10
Growth stage							
Winter wheat	preplant	postpre	4 tiller	pre	1 tiller	pre	3 tiller
Italian ryegrass	pre	pre	1 tiller	pre	2 tiller	pre	1 tiller
Air temperature (F)	84	59	56	61	62	52	66
Relative humidity (%)	29	35	62	65	56	51	52
Wind (mph, direction)	2, S	3, NW	0	2, S	0	0	1, SW
Dew present?	no	no	yes			no	no
Cloud cover (%)	0	20	10	70	20	10	10
Soil moisture	very dry	very dry	wet	dry	adequate	very dry	normal
Soil temperature at 2 inch (F)	75	60	58	49	45	54	60
pH	5.1					5.8	
OM (%)	3.2					3.2	
CEC (meq/100g)	20					21	
Texture	silt loam					silt loam	

In the pyroxasulfone plus glyphosate study, glyphosate plus flufenacet/metribuzin plus mesosulfuron injured wheat 18% but did not differ from other mesosulfuron treatments or pyroxasulfone at 0.106 lb ai/A (10 and 15%) (Table 2). All treatments controlled Italian ryegrass 81 to 94%, except glyphosate plus pinoxaden or pyroxasulfone at 0.053 lb ai/A (38 and 72%). Pinoxaden alone did not control Italian ryegrass due to an ACCase resistant population. Winter wheat yield for all herbicide treatments ranged from 79 to 87 bu/A, except the pinoxaden treatment yielded 75 bu/A. Grain yield was greater in all herbicide plots compared to glyphosate alone. Wheat test weight was lowest for flufenacet/metribuzin plus mesosulfuron combination and did not differ from glyphosate plus pinoxaden.

In the pyroxasulfone and triasulfuron study, pyroxasulfone at the high rate, 0.106 lb ai/A, injured wheat 12% but did not differ from other treatments (0 to 6%) (Table 3). All treatments controlled Italian ryegrass 86 to 94%, except triasulfuron and pinoxaden alone or in combination (56 to 68%). Pinoxaden resistance has been confirmed in this Italian ryegrass population and will be tested for triasulfuron resistance via greenhouse screening.

In the flufenacet/metribuzin combination study, wheat injury ranged from 1 to 20% but tended to be highest with flufenacet/metribuzin at 0.425 lb ai/A, except when combined with triasulfuron (9 to 20%) (Table 4). Italian ryegrass control tended to be better with postemergence treatments alone or in combination (85 to 95%).

Table 2. Wheat response and Italian ryegrass control in with pyroxasulfone plus glyphosate combinations near Moscow, ID in 2010.

Treatment[1]	Rate	Application timing[2]	Wheat injury[3]	Italian ryegrass control[3]	Wheat Yield	Wheat Test weight
	lb ai/A		%	%	bu/A	lb/bu
Glyphosate +	0.77	preplant				
pyroxasulfone	0.053	preplant	4	72	87	60.8
Glyphosate +	0.77	preplant				
pyroxasulfone	0.08	preplant	9	81	85	60.7
Glyphosate +	0.77	preplant				
pyroxasulfone	0.106	preplant	10	89	86	60.4
Glyphosate +	0.77	preplant				
pyroxasulfone +	0.08	preplant				
mesosulfuron	0.0134	4 tiller	15	93	86	60.5
Glyphosate +	0.77	preplant				
pyroxasulfone +	0.08	preplant				
pinoxaden	0.054	4 tiller	9	82	82	60.5
Glyphosate +	0.77	preplant				
flufenacet/metribuzin	0.425	postpre	9	81	87	60.3
Glyphosate +	0.77	preplant				
flufenacet/metribuzin +	0.425	postpre				
mesosulfuron	0.0134	4 tiller	18	94	84	59.3
Glyphosate +	0.77	preplant				
flufenacet/metribuzin +	0.425	postpre				
pinoxaden	0.054	4 tiller	4	85	84	60.1
Glyphosate +	0.77	preplant				
mesosulfuron	0.0134	4 tiller	10	84	79	60.3
Glyphosate +	0.77	preplant				
pinoxaden	0.054	4 tiller	0	38	75	59.9
Glyphosate	0.77	preplant	--	--	65	60.2
LSD (0.05)			8	18	9	0.8
Density (plants/ft^2)				20		

[1]Ammonium sulfate (Bronc) was applied with glyphosate at 7.5 lb ai/100 gal mix and with mesosulfuron at 5% v/v. A 90% nonionic surfactant (R-11) applied at 0.5% v/v with mesosulfuron. Glyphosate rate in lb ae/A.

[2]Application timing based on winter wheat growth stage. Preplant= 7 days before planting. Postpre= post plant preemergence to the wheat.

[3]June 14 evaluation date.

Table 3. Winter wheat injury and Italian control with pyroxasulfone and triasulfuron combinations near Moscow, ID in 2010.

Treatment[1]	Rate	Application timing[2]	Wheat injury[3]	Italian ryegrass control[3]
	lb ai/A		%	%
Pyroxasulfone	0.053	preemergence	5	88
Pyroxasulfone	0.08	preemergence	2	88
Pyroxasulfone	0.106	preemergence	12	92
Triasulfuron	0.026	preemergence	0	61
Flufenacet/metribuzin	0.34	preemergence	1	87
Pyroxasulfone +	0.053	preemergence	6	91
triasulfuron	0.026	preemergence		
Pyroxasulfone +	0.053	preemergence	5	94
flufenacet/metribuzin	0.34	preemergence		
Flufenacet/metribuzin +	0.34	preemergence	2	90
triasulfuron	0.026	preemergence		
Triasulfuron+	0.026	preemergence	2	86
pyroxsulam	0.0164	1 tiller		
Triasulfuron+	0.026	preemergence	5	89
mesosulfuron	0.0134	1 tiller		
Triasulfuron +	0.026	preemergence	4	87
mesosulfuron/iodosulfuron	0.0158	1 tiller		
Triasulfuron +	0.026	preemergence	0	68
pinoxaden	0.054	1 tiller		
Pyroxsulam	0.0164	1 tiller	0	82
Mesosulfuron	0.0134	1 tiller	4	90
Mesosulfuron/iodosulfuron	0.0158	1 tiller	4	90
Pinoxaden	0.054	1 tiller	0	56
LSD (0.05)			NS	13
Density (plants/ft^2)				15

[1]A non-ionic surfactant (R-11) was applied at 0.5% v/v with postemergence treatments, except pinoxaden. Ammonium sulfate (Bronc) was applied at 1.5 lb ai/A with pyroxsulam and 5% v/v with mesosulfuron treatments.
[2]Application timing based on Italian ryegrass growth stage.
[3]June 14, 2010 evaluation.

Table 4. Winter wheat injury and Italian control with flufenacet/metribuzin combinations near Viola, ID in 2010.

Treatment[1]	Rate	Application timing[2]	Wheat injury[3]	Italian ryegrass control[3]
	lb ai/A		%	%
Flufenacet/metribuzin	0.425	preemergence	9	78
Flufenacet/metribuzin	0.34	preemergence	6	60
Pyroxasulfone	0.08	preemergence	5	72
Flufenacet/metribuzin +	0.34	preemergence	8	78
pyroxasulfone	0.08	preemergence		
Triasulfuron	0.026	preemergence	1	65
Flufenacet/metribuzin +	0.425	preemergence	4	80
triasulfuron	0.026	preemergence		
Flufenacet/metribuzin +	0.34	preemergence	9	80
triasulfuron	0.026	preemergence		
Flufenacet/metribuzin +	0.425	preemergence	10	93
pyroxsulam	0.0164	1 tiller		
Flufenacet/metribuzin +	0.34	preemergence	8	85
pyroxsulam	0.0164	1 tiller		
Pyroxsulam	0.0164	1 tiller	2	90
Flufenacet/metribuzin +	0.425	preemergence	20	93
mesosulfuron	0.0134	1 tiller		
Flufenacet/metribuzin +	0.34	preemergence	5	95
mesosulfuron	0.0134	1 tiller		
Mesosulfuron	0.0134	1 tiller	2	95
Flufenacet/metribuzin +	0.425	preemergence	11	95
mesosulfuron/iodosulfuron	0.0158	1 tiller		
Flufenacet/metribuzin +	0.34	preemergence	2	95
mesosulfuron/iodosulfuron	0.0158	1 tiller		
Mesosulfuron/iodosulfuron	0.0158	1 tiller	1	95
LSD (0.05)			NS	21
Density (plants/ft^2)				6

[1]A non-ionic surfactant (R-11) was applied at 0.5% v/v with postemergence treatments. Ammonium sulfate (Bronc) was applied at 1.5 lb ai/A with pyroxsulam and 5% v/v with mesosulfuron treatments.
[2]Application timing based on Italian ryegrass growth stage.
[3]July 13, 2010 evaluation.

Xerpha winter wheat tolerance to various herbicides. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Xerpha, a soft white winter wheat, was released from Washington State University in 2008. By fall 2009, Xerpha had been planted extensively throughout the Pacific Northwest. Xerpha crop injury symptoms were reported by growers following herbicide application in spring 2010. In response to these reports, a study was established in Xerpha winter wheat near Potlatch, ID to evaluate winter wheat response with commonly used broadleaf and grass herbicides. The study was arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Wheat response was evaluated visually.

Table 1. Application and soil data.

Application date	May 7, 2010
Growth stage	
Winter wheat 'Xerpha'	3 tiller
Air temperature (F)	56
Relative humidity (%)	47
Wind (mph)	3, SW
Cloud cover (%)	100
Soil moisture	excessive
Soil temperature at 2 inch (F)	56
pH	4.8
OM (%)	4.3
CEC (meq/100g)	27
Texture	silt loam

At 4 days after treatment (DAT), mesosulfuron and propoxycarbazone treatments, thifensulfuron/tribenuron alone, pinoxaden, and pyroxsulam plus bromoxynil/MCPA caused 5 to 9 % leaf margin chlorosis (leaf burn), but these treatments did not differ from other treatments or from zero. By 12 and 25 DAT, no winter wheat injury was visible.

Table 2. Xerpha winter wheat visual injury with various herbicides near Potlatch, ID in 2010.

		Winter wheat visual injury		
Treatment[1]	Rate[2]	4 DAT	12 DAT	25 DAT
	lb ai/A	%	%	%
Propoxycarbazone	0.04	5	0	0
Propoxycarbazone/mesosulfuron	0.0223	5	0	0
Mesosulfuron	0.0134	8	0	0
Pinoxaden	0.054	9	0	0
Thifensulfuron/tribenuron	0.0313	8	0	0
Pyrasulfotole/bromoxynil	0.241	0	0	0
Bromoxynil/MCPA	1	0	0	0
Pyroxsulam	0.0164	0	0	0
Pyroxsulam +	0.0164			
Thifensulfuron/tribenuron	0.0313	0	0	0
Pyroxsulam +	0.0164			
pyrasulfotole/bromoxynil	0.241	0	0	0
Pyroxsulam +	0.0164			
bromoxynil/MCPA	1	9	0	0
LSD (0.05)		NS	NS	NS

[1]A nonionic surfactant (R-11) was applied at 0.5% v/v with all treatments, except pinoxaden and bromoxynil with MCPA or pyrasulfotole alone. Ammonium sulfate (Bronc) was applied at 1.52 lb ai/A with pyroxsulam and 5% v/v with mesosulfuron treatments.
[2]Rate is in lb ae/A for all treatments containing MCPA.

Glyphosate timing affect on CRP burndown. Traci A. Rauch, Donald C. Thill, and Joe P. Yenish. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Farmland in the Conservation Reserve Program (CRP) is being placed back into agronomic production due to expiring contracts and a strong agriculture market. Herbicide application timing of glyphosate is an important step in removing perennial grasses and forbs and resuming production. A study was established to evaluate burndown control of perennial grasses and forbs with glyphosate applied at three application times near Gifford, ID. The experimental design was a randomized complete block with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). CRP was established in 1986. Grasses and forbs were evaluated visually as total vegetation control. The primary plant was smooth brome (95%). Secondary plants included timothy, panicle willowherb, meadow salsify, and common vetch (total 5%).

Table 1. Application and soil data.

Application date	5/14/10	5/25/10	7/16/10
Growth stage			
Smooth brome	1 to 2 tiller	jointing	heading
Air temperature (F)	73	65	67
Relative humidity (%)	41	47	72
Wind (mph, direction)	2, E	5, ESE	0
Cloud cover (%)	10	40	0
Soil moisture	good	good	good
Soil temperature at 2 inch (F)	50	50	62

On July 1, burndown vegetation control was 90% or greater with the high rate of glyphosate (2.25 lb ae/A) applied at jointing, the split application of glyphosate with 2.25 lb ae/A applied at 1-2 tiller (later timing not yet applied), and glyphosate at 3.38 lb ae/A (Table 2). On July 16, only glyphosate at 2.25 lb ae/gal applied at jointing controlled vegetation 90%. By November, only the split applications of glyphosate (tillering and heading) controlled vegetation 45 to 58%.

Table 2. Vegetation control in CRP burndown with glyphosate at three application times near Gifford, ID in 2010.

Treatment[1]	Rate	Application timing[2]	Total weed burndown control 7/1[3]	7/16[3]	11/5
	lb ae/A		%	%	%
Glyphosate	1.13	1-2 tiller	85	76	10
Glyphosate	2.25	1-2 tiller	88	80	10
Glyphosate	1.13	jointing	75	69	0
Glyphosate	2.25	jointing	92	90	12
Glyphosate +	1.13	1-2 tiller			
glyphosate	1.13	heading	75	65	48
Glyphosate +	1.13	1-2 tiller			
glyphosate	2.25	heading	70	58	45
Glyphosate +	2.25	1-2 tiller			
glyphosate	2.25	heading	88	81	55
Glyphosate +	2.25	1-2 tiller			
glyphosate	1.13	heading	90	82	58
Glyphosate +	1.13	1-2 tiller			
clopyralid/fluroxypyr	0.25	1-2 tiller	88	86	0
Glyphosate +	1.13	1-2 tiller			
2,4-D ester	1	1-2 tiller	80	81	0
Glyphosate +	1.13	1-2 tiller			
2,4-D amine	1	1-2 tiller	89	86	0
Glyphosate	3.38	1-2 tiller	92	85	12
LSD (0.05)			12	16	17

[1]A 90% nonionic surfactant (R-11) and ammonium sulfate (Bronc) applied at 0.5% v/v and 17 lb ai/100gal mix, respectively, with all treatments at all timings. 2,4-D ester and amine rates are in lb ai/A

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

[3]Heading application time not yet applied.

Newly reported exotic species in Idaho for 2010. Timothy S. Prather and Larry Lass. (Idaho Agricultural Experiment Station, University of Idaho, Moscow, Idaho, 83844-2339). The Lambert C. Erickson Weed Diagnostic Laboratory received 186 specimens for identification in 2010 (Figure 1). Eighty two exotic species were identified. The lab received two weedy species not previously reported in the state and identified six exotic species that were new county records (see Tables 1 and Figure 2). A total of 22 counties in Idaho submitted samples (Figure 3) and we had on-line photo submissions from four states. Species in Table 1 have not previously been reported from the county and state to the Erickson Weed Diagnostic Laboratory or the USDA Plants Database.

Table 1. Identified introduced species new county and state based on USDA Plants Database.

County	Family	Genus	Species	Common Name
Bannock*	Asteraceae	Tripleurospermum	maritimum	false mayweed
Bonneville	Boraginaceae	Anchusa	arvensis	small bugloss
Elmore	Brassicaceae	Berteroa	incana	hoary alyssum
Idaho*	Asteraceae	Centaurea	virgata	squarrose knapweed
Nez Perce	Asteraceae	Sonchus	asper	spiny sowthistle
Shoshone	Poaceae	Arrhenatherum	elatius	tall oatgrass

*= new to State of Idaho.

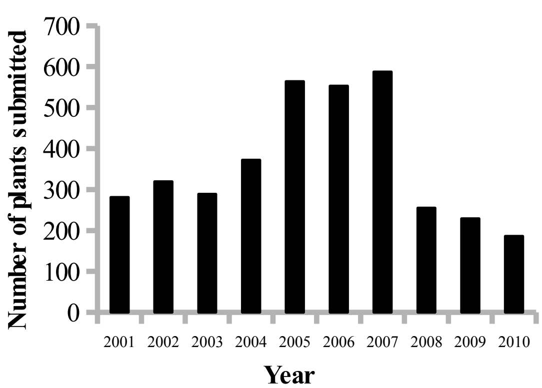

Figure 1. Erickson Weed Diagnostic Laboratory received 186 plant specimens for identification in 2010.

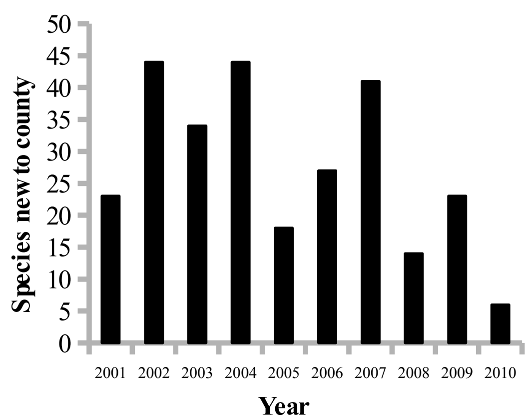

Figure 2. The lab identified 6 exotic species that were new Idaho records in 2010.

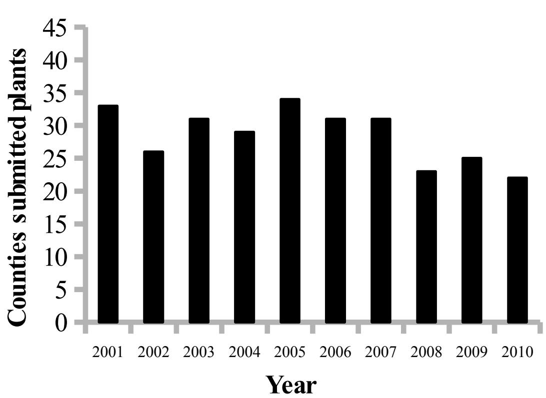

Figure 3. Twenty-two Idaho counties submitted plants in 2010.

Seedling emergence of horseweed in no-till. Randy L. Anderson. (USDA-ARS, Brookings SD 57006). No-till practices are gradually being adopted in the western Corn Belt region. One weed increasing in no-till systems is horseweed (*Conyza canadensis* (L.) Cronq.). Horseweed seed is transported by wind and seedlings can establish from seeds lying on the soil surface. Furthermore, horseweed has developed resistance to commonly-used herbicides, thus control tactics are often ineffective.

Because horseweed infestations are increasing, producers are looking for tactics to manage this species. We are examining seedling emergence of the weed community in this region for insight in developing population-based weed management. This report summarizes data collected on horseweed seedling emergence.

Methodology: Sixteen permanent quadrats (0.5 yd^2) were established in a production field where a corn-soybean rotation was established with no-till practices. Horseweed emergence was recorded weekly, starting on April 1 and continued until November 1. The weed community is not biologically active during the winter months due to cold temperatures. Emergence was recorded for four years in the same quadrats; after counting, seedlings were removed by hand. The area around the quadrats was kept weed-free also, to prevent addition of new seeds after starting the study. The study was repeated at a second location, initiated one year after the first location; both studies were located near Brookings, SD.

We developed an emergence curve for horseweed by converting weekly seedling emergence to a percentage of total emergence during the growing season for each quadrat. We then averaged emergence values across quadrats, years, and locations. Cubic spine interpolation was used to develop the emergence curve.

We also compared seedling emergence across years by summing number of seedlings within a year for each quadrat, and then averaging values across quadrats and locations for each year.

Results: Horseweed began emerging in early April and continued through October (Figure 1). Seedlings did not emerge in June or July. Approximately 40% of seasonal emergence occurred in between April 18 and May 31, with the remainder of seedlings emerging between August 8 and October 31. Apparently, horseweed has a wide tolerance to environmental conditions related to emergence, as seedlings were observed in 5 of the 7 months of the growing season.

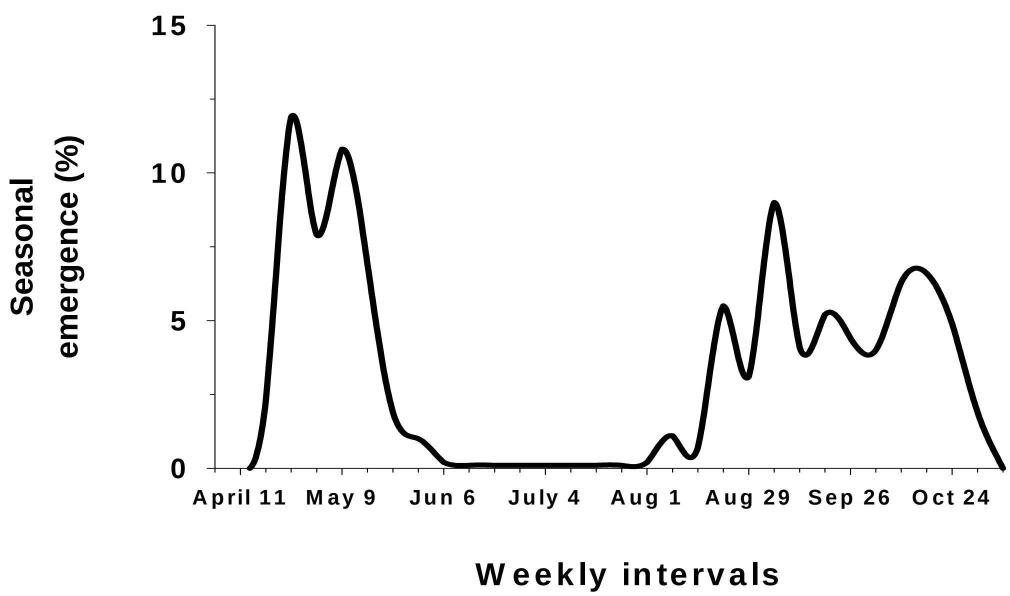

Figure1. Seedling emergence pattern of horseweed. Data averaged across 16 quadrats, two locations, and four years.

Seedling emergence within a quadrat declined across time; 45 horseweed seedlings emerged in year 1 whereas only 4.3 seedlings emerged in year 3, a reduction of more than 90% (Figure 2). Weed-dispersed seed may have moderated our results, but it is noteworthy that seedling density still declined dramatically within 3 years.

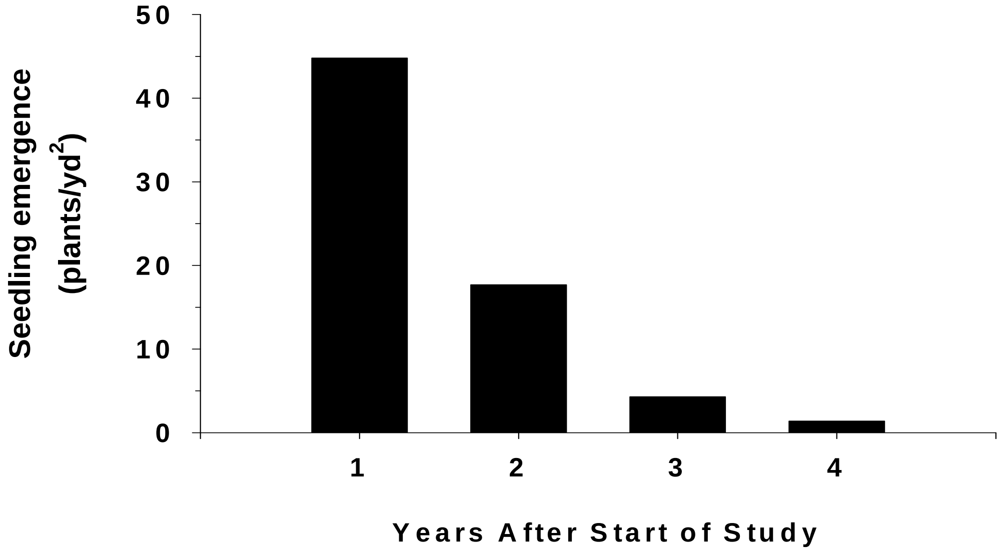

Figure 2. Seedling emergence of horseweed across four years. Data averaged within years but across locations.

Implications for Weed Management: With its wide interval of emergence, horseweed likely can establish in most crops grown in this region, especially cool-season crops such as winter wheat or oat. Horseweed invasion of the no-till corn-soybean rotation may be related to the wide window of horseweed seedling recruitment in the fall.

Including an interval of alfalfa (3 or more years) may help producers reduce horseweed density in their croplands. Horseweed is not able to complete its life cycle in alfalfa due to frequent mowing and crop competition. Seedling density was reduced more than 95% if seed addition to the quadrats were prevented for 4 years.

Synergism among crops can help weed management. Randy L. Anderson. (USDA-ARS, Brookings SD 57006). The adoption of no-till practices in the Great Plains has stimulated a renewed interest in the design of rotations. To help producers plan new rotations, scientists started a series of cropping systems studies in the region during the 1980s and 1990s. In these studies, we observed that some crops improve water-use-efficiency (WUE) of following crops. For example, dry pea increased WUE of winter wheat 10 to 20% compared with canola, proso millet, or fallow preceding winter wheat.

Because weeds compete with crops for water, we wondered if crops that improve WUE of following crops would also increase crop tolerance to weeds. Our initial study exploring this hypothesis found that winter wheat was almost three times more tolerant of a uniform infestation of wild rye following dry pea compared with soybean or spring wheat as preceding crops (2010 WSWS research reports: pages 100-101). We also found that corn yielded 2-fold more following dry pea compared with soybean when a uniform infestation of foxtail millet was present [2008 WSWS research reports, pages 79-80]. Winter wheat and corn also yielded more following dry pea than soybean in weed-free conditions. In some way, dry pea synergistically improves winter wheat and corn growth to increase yield and tolerance to weeds.

Corn has been shown to increase WUE of soybean, thus we wondered if corn would also improve soybean tolerance to weeds. This report summarizes research that examined soybean tolerance to weeds as affected by preceding crops in studies located at Brookings, SD.

Methodology: Four crops, spring wheat, corn, soybean, and dry pea, were grown with conventional practices in the first year, and soybean was grown in all plots in the second year. For the second year, soybean (Pioneer 91M70 RR) was planted in mid-May at 150,000 seeds/acre; each plot was split into weed-free and weed-infested subplots. To achieve uniform weed interference, foxtail millet was broadcast on the soil surface on the day of soybean planting. Approximately 100 seedlings per square yard established in soybean. Fresh weight of foxtail millet measured 7 weeks after emergence was 500 $\pm$ 35 gm/yard^2; biomass was not affected by preceding crop treatments. S-metoachlor applied PRE and glyphosate applied POST controlled weeds in the weed-free subplots of soybean.

Soybean was harvested from 50% of each subplot; plot size was 20 ft long by 25 ft wide. Four replications for each treatment were established, and the study was conducted twice.

Results: Corn was most favorable for improving soybean tolerance to weeds. Foxtail millet interference reduced yield 18% when soybean followed corn, but more than 30% when soybean followed spring wheat (see Figure below). However, yield in weed-free conditions did not differ when soybean followed corn or spring wheat. Soybean in weed-free conditions yielded 16% less following soybean or dry pea compared to the grass crops. Dry pea improved soybean tolerance to foxtail millet compared with monoculture soybean, but not as beneficial as corn. We speculate that soybean tolerance to foxtail millet increases because corn improves resource-use-efficiency of soybean, thus minimizing impact of foxtail millet competition for resources.

Synergism and Weed Management: Crop diversity and rotation design helps weed management by disrupting population growth of weeds. Producers in the Great Plains have reduced herbicide inputs 50% in no-till rotations with crop diversity because weed community density has declined across time. Designing rotations to include crop sequences that improve tolerance to weeds will further reduce impact of weeds on crop yield. These sequences will be especially helpful in production systems that seek to reduce herbicide use and accept a low density of weeds present in the crop.

Our research has identified three sequences that improve crop tolerance to weeds: dry pea preceding winter wheat, dry pea preceding corn, and corn preceding soybean. However, this change in tolerance to weeds appears to be crop-to-crop specific; not all sequences improve tolerance to weeds. It is also possible that dry pea or corn may improve growth of some weeds. Yet, conventional tactics that control these weeds will preserve the advantage crops gain with synergism in weed-free conditions.

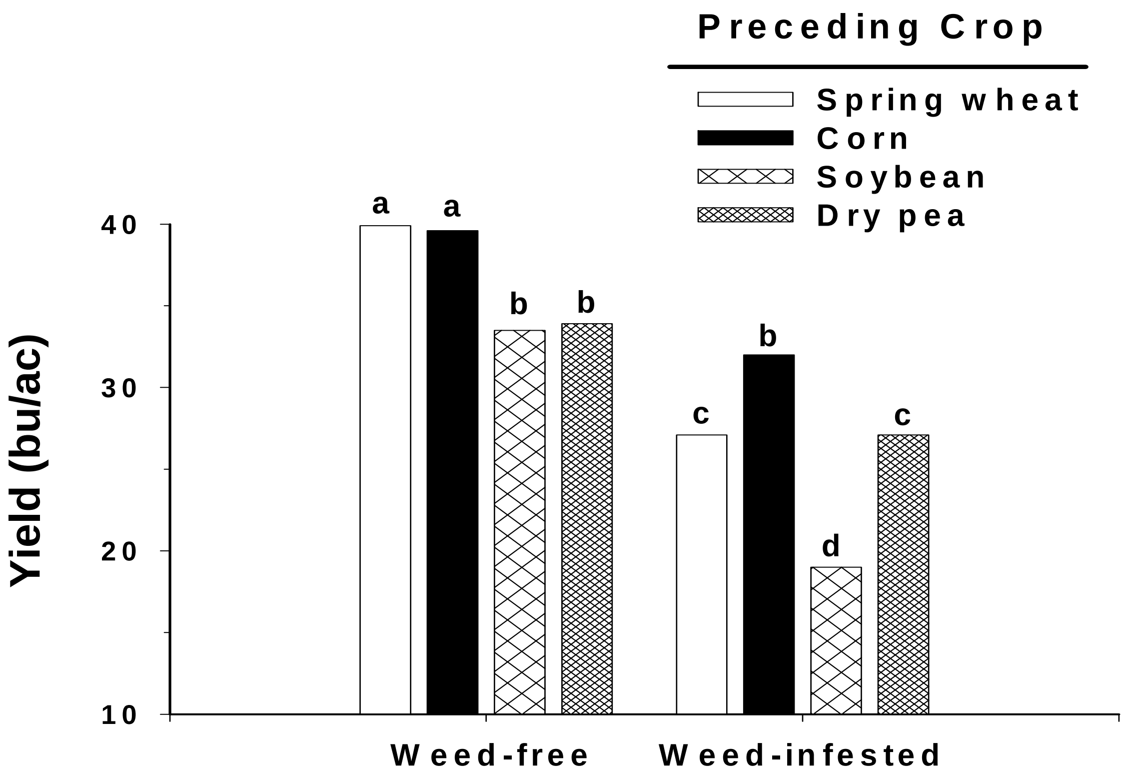

Figure. Soybean yield in weed-free and weed-infested conditions as affected by preceding crop. A uniform weed infestation was established with foxtail millet; millet biomass in soybean seven weeks after emergence was approximately 500 g/yd^2 and did not vary among preceding crop treatments. Data averaged across two studies. Bars with the same letter are not significantly difference based on Fischer's Protected LSD (0.05).

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