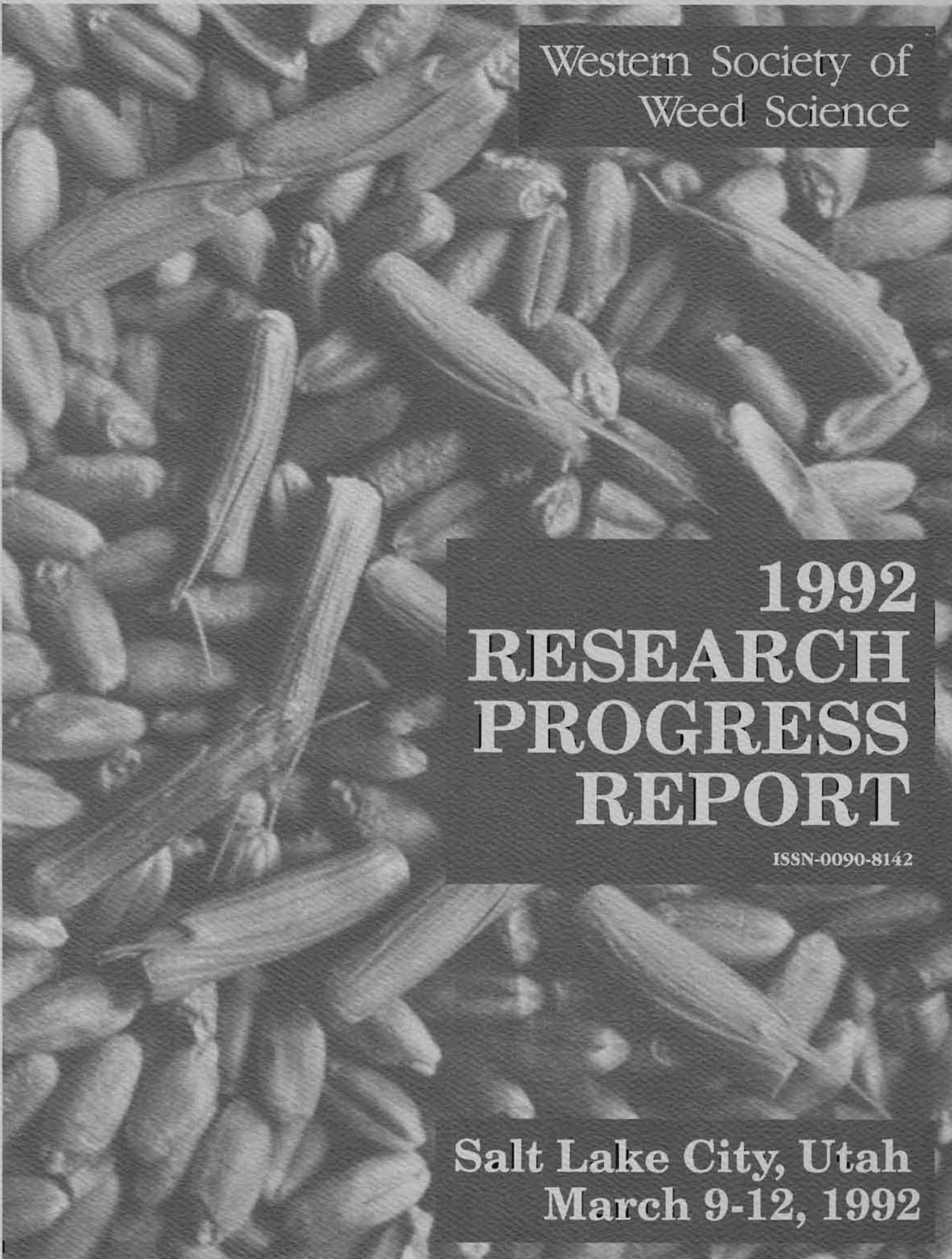

Western Society of Weed Science

1992 RESEARCH PROGRESS REPORT

ISSN-0090-8142

Salt Lake City, Utah
March 9-12, 1992

Western Society
of Weed Science

1992
Research Progress Report

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FOREWORD

The 1992 Research Progress Report of the Western Society of Weed Science (WSWS) is a compilation of contributed results of research investigations by weed scientists in the Western United States. This report contains preliminary information and is not for publication, endorsements, or recommendations to the general public. The overall objective of the Research Progress Report is to provide an avenue for the presentation and exchange of on-going research to the weed science community.

At the 1990 summer meeting the Executive Committee rearranged, realigned, deleted, added, and restructured the seven research projects. The project sections had not been changed since their creation in the 1950's and it was felt they did not reflect accurately present day weed science activities. Major restructuring included: a) Combining the old perennial weeds, herbaceous weeds of range and forest, and undesirable woody plants into one project entitled Weeds of Range and Forest; b) Expanding the chemical and physiological section into a Basic Sciences: Ecology, Biology, Physiology, Genetics, and Chemistry project; and c) Adding two new projects: Extension, Education, and Regulatory and Alternative Methods of Weed Management.

The only change made in the 1992 Research Progress Report is page numbering. Each project section has its own page numbers. The new page numbers are reflected in all of the indices.

The reports contained herein and their respective content, format, and style are the responsibility of the author(s) who submitted them. Reports are not retyped or edited significantly and are photoreproduced for publication. The seven project chairpersons and chairpersons-elect were responsible for organizing and indexing reports within their projects. WSWS appreciates the time and effort of each chairperson and chairperson-elect of each project as well as to the authors who took the time to share their research results with other members of WSWS. Final compilation of this report is the responsibility of the Research Section Chairperson.

Edward E. Schweizer
Chairperson, Research Section
Western Society of Weed Science
1992

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PROJECT I

WEEDS OF RANGE AND FOREST

Mike Ralphs - Project Chairperson
Paul Figueroa - Project Chairperson-Elect

Seaside arrowgrass (Triglochin maritimum L.) control with various herbicides applied at two growth stages. Whitson, T.D. and W.R. Tatman. Seaside arrowgrass is a highly poisonous perennial common to mountain meadows of the West. These studies were established near Laramie, Wyoming to determine the effectiveness of applications of chlorsulfuron, metsulfuron and 2,4-D applied at different growth stages. Herbicides were applied with a six-nozzle knapsack unit delivering 30 gpa at 41 psi. Plots were 10 by 27 ft arranged in a randomized complete block design with four replications. The soil was a sandy loam (61% sand, 13% silt and 26% clay) with 6.6% organic matter and a pH of 7.9. Application information on August 23, 1988 when seaside arrowgrass was in late bloom, temperature: air 73F, surface 74F, 1 inch 74F, 2 inches 70F and 4 inches 65F with 36% relative humidity and 1 to 2 mph west winds. Application information on June 21, 1989 when seaside arrowgrass was in the 6 to 10 leaf stage, temperature: air 82F, surface 63F, 1 inch 61F, 2 inches 62F and 4 inches 63F with 28% relative humidity and east winds 3 to 6 mph.

Herbicides applied in August 1988 that controlled greater than 90% of the arrowgrass three years after treatment were: chlorsulfuron at .050, .0567 and .126 lb ai/A. Herbicides applied in June 1989 that controlled greater than 90% of the arrowgrass were chlorsulfuron at .038, .057, .063, .095, .126 and metsulfuron at .063 lb ai/A. Arrowgrass control was 94% in 1990 compared to 77% in 1991 in areas treated with chlorsulfuron. Metsulfuron treatments applied in August 1988 averaged 99% control in 1990 and 68% in 1991. Those areas treated with chlorsulfuron in June 1989 averaged 92% control in 1990 and those same treatments decreased to 86% in 1991. The combined treatments of chlorsulfuron and metsulfuron had an average control of 94% in 1990 and decreased to 78% in 1991. Therefore, initial treatments wil control s. arrowgrass for three years, then a repeated application wil likely be needed. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1647)

Arrowgrass Control With June and August Applications
of Chlorsulfuron, Metsulfuron and 2,4-D

		Average % Control[2]			
		Eval. 1990		Eval. 1991	
Herbicide	Rate lb ai/A	8/23/88[1]	6/21/89	8/23/88	6/21/89
chlorsulfuron+X-77	.0063+.25%	79	64	72	31
chlorsulfuron+X-77	.0125+.25%	86	76	85	56
chlorsulfuron+X-77	.0183+.25%	98	81	62	75
chlorsulfuron+X-77	.025+.25%	86	96	47	65
chlorsulfuron+X-77	.0315+.25%	89	91	63	81
chlorsulfuron+X-77	.0378+.25%	100	95	68	91
chlorsulfuron+X-77	.0441+.25%	90	98	84	83
chlorsulfuron+X-77	.0504+.25%	98	100	94	77
chlorsulfuron+X-77	.0567+.25%	100	100	100	91
chlorsulfuron+X-77	.063+.25%	100	98	81	97
chlorsulfuron+X-77	.0945+.25%	100	100	78	98
chlorsulfuron+X-77	.126+.25%	100	100	91	98
metsulfuron+X-77	.0157+.25%	*	95	*	79
metsulfuron+X-77	.0315+.25%	98	99	71	87
metsulfuron+X-77	.063+.25%	98	100	56	92
metsulfuron+X-77	.125+.25%	100	*	76	*
2,4-D	4.0	43	65	75	61
2,4-D	6.0	60	63	80	65
check	- - -	0	0	0	0

[1] Date of herbicide application
* Treatments not applied at this date.
[2] Evaluations were made August 27, 1991

Control of seaside arrowgrass (Triglochin maritimum) with various rates of metsulfuron. Whitson, T.D., W.R. Tatman and R.J. Swearingen. Seaside arrowgrass is a native perennial, highly toxic to livestock. It commonly grows in mountain meadows in the west. Control in the past was usually only fair with application of 2,4-D at 5 lbs ai/A. This experiment was conducted near Rock River, WY to determine metsulfuron rates required to control s. arrowgrass. Herbicides were applied with a six-nozzle knapsack unit delivering 30 gpa at 41 psi. Plots were 10 by 27 ft. arranged in a randomized complete block design with four replications. The soil was a sandy clay loam (57.4% sand, 21.5% silt and 21.1% clay) with 6.7% organic matter and a pH of 6.7. Application information on August 20, 1990 when s. arrowgrass was in mid-seed production with green stems and leaves, temperature: air 77F, soil surface 74F, 1 inch 67F, 2 inches 68F, 4 inches 61F with 55% relative humidity and calm winds. Evaluations were made August 28, 1991.

All treatments were 100% effective in the control of seaside arrowgrass when applied at the mid-seed production stage. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1657)

Seaside arrowgrass control with metsulfuron.

Herbicide	Rate G/product/A	% Control
metsulfuron	2.9	100
metsulfuron	5.7	100
metsulfuron	8.3	100
metsulfuron	11.4	100
metsulfuron	14.2	100
metsulfuron	17.0	100
metsulfuron	22.7	100

The effects of successive herbicide applications on the seed bank of downy brome (Bromus tectorum L.) growing on rangeland. Whitson, T.D., G.E. Fink and S.E. Barnard. Downy brome has become a very competitive annual grass in rangeland. Because of its very early growth habit it takes most of the moisture and nutrients away from the desirable perennial grasses in a rangeland community. Four studies were established to determine the effects of three yearly applications of various herbicides on the seed bank of downy brome. Treatments were applied to 35 by 60 ft. plots as single blocks with four randomized permanent transects established within each block. Herbicides were applied with a tractor mounted sprayer delivering 17 gpa at 35 psi. Application information: Niobrara County, WY April 25, 1991, temperature: air 70F, soil surface 60F, 1 inch 60F, 2 inches 60F, 4 inches 56F with 70% relative humidity and 3 to 4 mph south winds. Downy brome was in the 3 to 4 leaf stage, 1 inch tall. May 29, 1991, temperature: air 75F, soil surface 84F, 1 inch 76F, 2 inches 74F, 4 inches 73F with 65% relative humidity and 2 to 5 mph SE winds. Downy brome was in the early bloom stage. Johnson County, WY April 9, 1991, temperature: air 48F, soil surface 45F, 1 inch 45F, 2 inches 45F, 4 inches 42F with 48% relative humidity and 2 to 5 mph north winds. Downy brome was in the 2 to 4 leaf stage, 1 inch tall. May 17, 1991, temperature: air 55F, soil surface 53F, 1 inch 49F, 2 inches 49F, 4 inches 55F with 55% relative humidity and calm winds. Downy brome was in the 5 to 6 leaf stage, 2 inches tall.

Unusually wet conditions stimulated a second flush of downy brome seed to germinate following April herbicide applications, therefore, the applications made in early bloom rather than in vegetative stages controlled both germinations and provided effective control. Percent control of all herbicides averaged by location: Niobrara County, WY April 25, and May 29, 1991 51 and 96%, respectively, Johnson County, WY April 14 and May 17, 1991 17 and 66% respectively. When time of application was ideal on May 29, 1991, at Niobrara County WY paraquat and glyphosate applied at rates of 0.7 and 0.28 lb ai/A and above controlled 100% of the downy brome. This study will be continued for a minimum of three more years to determine the effects of repeated applications on the downy brome seed bank. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1650)

Downy brome control with various herbicides.

Herbicide	Rate lb ai/A	Niobrara County[1] Applied 4/25/91	Niobrara County[1] Applied 5/29/91	Johnson County[2] Applied 4/9/91	Johnson County[2] Applied 5/17/91
paraquat	.5	40	94	0	50
paraquat	.7	50	99	50	70
paraquat	.9	80	100	50	70
paraquat	1.1	80	100	50	70
glypohsate[3]	.28	10	100	0	60
glyphosate	.38	10	100	0	60
glyphosate	.48	20	100	0	60
glyphosate	.58	92	100	0	60
dicamba+atrazine	.28+.53	80	70	--*	95

* Not applied at this date.

[1] Evaluated

[2] Evaluated July 12, 1992.

[3] Perennial grass damage of 20% occurred in the .28 and .38 lb ai/A rates and 40% occurred in the .48 and .58 lb ai/A rates of glyphosate.

Broom snakeweed (Gutierrezia sarothrae (Pursh) Britt and Rusby) control in rangeland. Whitson, T.D. Broom snakeweed, a highly competitive species, now infests approximately 118 million aces of rangeland in the western U.S.. Livestock abortions are also common because of b. snakeweed. Three studies were established near McFadden and Wheatland, Wyoming to determine how grazing and application timing affect the long-term control of this species. Plots were 10 by 27 ft. with four replications arranged in a completely randomized design. Herbicides were applied broadcast with a CO_2 pressurized knapsack unit delivering 30 gpa at 45 psi. Application information: McFadden, June 28, 1988, temperature: air 70F, soil surface 65F, 1 inch 70F, 2 inches 70F, 4 inches 80F with 60% relative humidity and 5 mph NW winds. B snakeweed, was 4 to 5 inches and in the vegetative stage. July 28, 1987 at Wheatland, temperature: air 96F, soil surface 100F, 1 inch 90F, 2 inches 93F, 4 inches 91F with 40% relative humidity and 1 to 2 mph N wind. Soils: McFadden, sandy loam (75% sand, 18% silt and 7% clay) with 2.4% organic matter and a 7.8 pH, at Wheatland, sandy loam (54% sand 28% silt and 18% clay) with 1.6 organic matter and a 7.6 pH.

At McFadden when studies were grazed control percentages in areas treated with various herbicides remained almost the same from 1988 to 1991. All picloram treatments applied at .125 lb ai/A and above maintained 100% control, metsulfuron applied at 0.025 lb ai/A and above continued to control 98% or more of the broom snakeweed. The control was similar in the grazed study with percent control increasing significantly from 1988 to 1991 in areas treated with triclopyr and fluroxypyr. Grass competition was much greater in the ungrazed study. In the Wheatland study all treatments became reinfested with broom snakeweed seedlings, therefore, no original herbicide treatment was effective in the control of broom snakeweed for more than three years. Conditions for snakeweed germination, drought followed by rainfall, were met during that period. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1658)

Broom Snakeweed Control Using Various Herbicides
Summary Data

		% Control					
		Sim's Ranch				Wheatland[1]	
Herbicide	Rate lb ai/A	Grazed		Ungrazed		Grazed	
		8/5/88	8/9/91	8/5/88	8/9/91	8/5/88	8/9/91
Picloram	.125	95	100	98	100	91	0
Picloram+X-77	.125+.25%	98	100	94	97	80	0
Picloram	.25	100	100	100	100	98	0
Picloram+X-77	.25+.25%	100	100	100	100	89	0
Picloram	.5	100	100	100	100	100	0
2,4-D LVE	2.0	83	96	88	100	11	0
Triclopyr	.125	38	60	0	90	0	0
Triclopyr	.5	30	56	14	90	0	0
Fluroxypyr	.25	37	9	25	75	12	0
Fluroxypyr	.5	67	87	48	90	0	0
Fluroxypyr	.75	78	78	76	92	0	0
Dicamba+2,4-D	1 qt	75	78	80	90	12	24
Triclopyr+2,4-D	1 qt	65	84	72	82	8	6
2,4-D	2.0	90	96	88	100	0	0
Metsulfuron	.0125	93	96	98	95	19	0
Metsulfuron	.025	100	98	100	100	75	12
Metsulfuron	.0375	100	100	100	100	92	0
Metsulfuron	.050	100	100	100	97	97	0
Metsulfuron	.0625	100	98	100	100	98	18
Check[2]		0	0	0	0	0	0

[1] Snakeweed re-invading the plot.
[2] Naturally, over time, the stand density of the checks decreased by an average of 65%.

Comparison of several herbicides applied at different growth stages for control of Canada thistle(Cirsium arvense) and musk thistle(Carduus nutans). Bultsma, P. M., T. D. Whitson and F. Lamming. Canada and musk thistle are problem weeds on many land use sites throughout Wyoming. Two experiments were established near Jackson, Wyoming on land having dense stands of the respective weed species. Plots 3 by 9 meters were arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized hand sprayer delivering 40 gpa at 30 psi. Soils were loamy sands at the Canada thistle site and sandy loam at the musk thistle site. Applications were made with air temperatures between 60 and 75F and winds between 0 and 2 mph. Canada thistle was in the rosette and stalk elongation stage for the respective dates and musk thistle was in the rosette, bud and seed formation stages on the respective dates.

Metsulfuron provided good control of Canada thistle when applied in late June (Table 1) and clopyralid plus 2-4,D provided excellent control of musk thistle for the three dates of application (Table 2). (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, Wy 82071.)

Table 1. Comparison of timing and rates of herbicides for Canada thistle control.

		Average % Control[1]	
	Rate	Application Date	
Herbicide	kg ai/ha	June 6, 1990	June 29, 1990
2,4-D+Dicamba+X-77	2.2+2.2+0.25%V/V	78	86
Clopyralid+2,4-D	0.10+0.55	64	60
Clopyralid+2,4-D	0.21+1.1	65	63
Metsulfuron+X-77	0.03+0.25%V/V	30	73
Metsulfuron+X-77	0.05+0.25%V/V	48	69
Control	———	0	0

Table 2. Comparison of timing and rates of herbicides for musk thistle control.

		Average % Control[1]		
	Rate	Application Date		
Herbicide	kg ai/ha	June 6, 1990	June 28, 1990	Aug. 29, 1990
2,4-D	2.2	100	61	30
Clopyralid+2,4-D	0.10+0.55	100	100	99
Clopyralid+2,4-D	0.21+1.1	100	100	100
Metsulfuron+X-77	0.01+0.25%V/V	0	0	0
Metsulfuron+X-77	0.02+0.25%V/V	0	0	0
Control	———	0	0	0

[1]Evaluation made July 17, 1991.

Canada thistle control with metsulfuron, picloram, 2,4-D, and split applications of 2,4-D and the sulfonylureas. Sebastian, J.R., Owsley, C.J., and K.G. Beck. A rangeland experiment was conducted near Laporte, CO to evaluate Canada thistle (CIRAR) control with metsulfuron, picloram, dicamba, 2,4-D and spring/fall split applications of 2,4-D with the sulfonylurea herbicides. The design was a randomized complete block with four replications. CIRAR was sprayed at flowering and in fall to regrowth. All treatments were sprayed with X-77 surfactant (0.25% v/v) and applied with CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 24 gal/a, 15 psi. Other application information is presented in Table 1. Plot size was 10 feet by 30 feet.

Visual evaluations compared to non-treated control plots were taken on October 4, 1990; June 26 and October 21, 1991. The site was mistakenly mowed by landowner on July 15, 1990. Most treatments 1 year after application maintained fair to good CIRAR control. On June 26, 1991 metsulfuron (>0.15 oz) and chlorsulfuron at 0.38 oz fall-applied provided more effective control than when applied in late spring during bud stage. However, by the October 21, 1991 evaluation only metsulfuron at 0.45 and 0.6 oz and chlorsulfuron at 0.38 oz fall-applied provided better CIRAR control than these treatments spring-applied. Picloram provided excellent (>90%) control which carried through 1 year after treatment. No differences in CIRAR control occurred between the two 2,4-D formulations combined with metsulfuron and chlorsulfuron and control was not improved with split applications compared to fall-applied treatments.

Table 1. Application information for Canada thistle control with metsulfuron, chlorsulfuron, picloram, 2,4-D, and applications of 2,4-D and the sulfonylureas.

Environmental data		
Application date	July 2, 1990	October 16, 1990
Application time	8:00 am	10:00 am
Air temperature, C	22	20
Cloud cover, %	10	25
Relative humidity, %	45	42
Wind velocity, mph	0 to 2	0 to 4
Soil temperature (2.0 in.), C	24	12

Weed data

Application date	species	growth stage	height (in.)	density (shoot/ft^2)
July 2, 1990	CIRAR	flowering	16 to 32	1 to 6
Oct. 16, 1990	CIRAR	vegetative	2 to 10	1 to 2

Table 2. Canada thistle control with metsulfuron, chlorsulfuron, picloram, 2,4-D, & split applications of 2,4-D and the sulfonylureas.

Herbicide	Rate	Timing	Canada thistle June 26 1991	Canada thistle October 21 1991
	(oz ai/A)		(%)	(%)
metsulfuron[1]	0.15	bud	34	19
metsulfuron	0.3	bud	43	41
metsulfuron	0.45	bud	58	41
metsulfuron	0.6	bud	53	55
chlorsulfuron	0.38	bud	40	28
chlorsulfuron	0.75	bud	80	66
2,4-D amine[2]	2.0 lb	bud		
+ metsulfuron	0.15	fall	82	63
2,4-D amine	2.0 lb	bud		
+ metsulfuron	0.3	fall	80	70
2,4-D amine	2.0 lb	bud		
+ metsulfuron	0.45	fall	77	76
2,4-D amine	2.0 lb	bud		
+ metsulfuron	0.6	fall	96	86
2,4-D[3]	2.0 lb	bud		
+ metsulfuron	0.3	fall	71	65
2,4-D amine	2.0 lb	bud		
+chlorsulfuron	0.38	fall	98	86
2,4-D amine	2.0	bud		
+chlorsulfuron	0.75	fall	99	88
2,4-D	2.0 lb	bud		
+chlorsulfuron	0.37	fall	81	79
metsulfuron	0.15	fall	38	40
metsulfuron	0.3	fall	81	64
metsulfuron	0.45	fall	91	74
metsulfuron	0.6	fall	100	95
chlorsulfuron	0.38	fall	96	73
chlorsulfuron	0.75	fall	99	88
picloram	0.5 lb	bud	91	95
picloram	1.0 lb	bud	98	99
picloram	0.5 lb	fall	95	96
LSD (0.05)			27	26

[1] X-77 surfactant added at 0.25% v/v.
[2] dimethylamine formulation of 2,4-D.
[3] prepackaged formulation of dimethylamine and diethanolamine salts of 2,4-D.

Control of common crupina in advanced growth stages. Lass, L.W. and R.H. Callihan. Previous studies have shown 2,4-D, dicamba, picloram, and clopyralid will effectively eradicate common crupina (*Crupina vulgaris* Cass.) when applied over a two year period. This study compared the effects of newer herbicides with currently registered herbicides on plants in advanced growth stages.

The site was a non-grazed south facing slope located near Kamiah, Idaho. The slope ranged from 30 to 40% and was covered with approximately 700 common crupina plants per m^2. The plot design was a split plot with four replications. Herbicides used in this test were metsulfuron at 0.023, 0.035, and 0.052 kg ai/ha, picloram at 0.14, 0.28, and 0.42 kg ai/ha, triclopyr at 0.14, 0.28, 0.42 kg ai/ha, clopyralid at 0.035, 0.07, and 0.14 kg ai/ha, imazapyr at 0.07, 0.14, and 0.28 kg ai/ha, UBI-C4243 at 0.14, 0.21, and 0.28 kg ai/ha, chlorsulfuron at 0.052 kg ai/ha, dicamba at 1.12 kg ai/ha, and 2,4-D at 2.24 kg ai/ha. The herbicides were applied on May 30, 1990 using a back pack sprayer calibrated to deliver 207 l/ha. at 4 km/hr. At the time of spraying, 95% of the common crupina had bolted and flower buds were present. Plant heights ranged from 7 to 15 cm. The air temperature was 20 C with soil temperatures ranging from 15 C at surface to 17 C at a depth of 15 cm. Relative humidity was 49% and wind was 0 to 3 km/hr from varying directions. The cloud cover was 10% to 50%. There was no dew present. Other weeds present were field bindweed (*Convolvulus arvensis* L.), poison ivy (*Rhus radicans* L.), and yellow starthistle (*Centaurea solstitialis* L.). Plots were evaluated for chlorosis, and plant height was measured on June 25 and July 9. Seed production was estimated on July 9. The amount of live cover was estimated on June 25. Seedling produced from treated plants were counted on March 20, 1991. LSD or Duncan's multiple range tests were used to separate the means.

In 1990, untreated plants ranged in height from 31 to 46 cm at the time of evaluation. Plants were erect, flowering and producing seed. Average seed production in check plots was over 1000 seeds per 10 by 40 ft. plot. Growth of common crupina was suppressed by the application of all herbicides, when compared to the check (Table). Seed production was reduced 100% by all picloram rates, by the tested 2,4-D rate, and higher rates of Imazapyr. Dicamba, metsulfuron, triclopyr, and UBI-C4243 reduced seed production by about 75% or more. The vegetation remaining after herbicide treatment was largely undesirable forage for wildlife, cattle, or sheep. Surviving vegetation consisted of Japanese brome (*Bromus japonicus*), Palouse thistle (*Cirsium brevifolium*), common dogbane (*Apocynum cannabinum*), field bindweed (*Convolvulus arvensis*), yellow starthistle (*Centaurea solstitialis*) and poison ivy (*Rhus radicans*). Failure to establish desirable cover in such conditions will result in erosion until these undesirable weeds become established.

Eradication of common crupina requires preventing all seed production for at least two generations. This project has shown that common crupina seed production can be prevented for one generation by applying some herbicides as late as bud formation. In 1991, plots with significant reduction in seed in the treatment year also had lower seedling numbers the following spring. All rates of picloram and higher rates of clopyralid, imazapyr, triclopyr, UBI-C4243 and the tested rate of 2,4-D had less than one seedling per m^2 (Table). Japanese brome and field bindweed tended to dominate the community after the common crupina was chemically removed. This study shows late application of some herbicides will greatly reduce seed production and subsequent seedling production of common crupina. (University of Idaho, Dept. of Plant, Soils, and Ent. Sci., Moscow, 84843).

Crupina control in a non-crop site.

Herbicide		1990 Height 6/25	1990 Height 7/9	1990 Injury 6/25	1990 Injury 7/9	1990 Seed Produced[2]	Seedlings produced from treated plants 3/20/91
	(kg/ha)	--(cm)---		---(%)---		(No./Plot)	(plts/m2)
Clopyralid	0.00	35	32	5	3	755 B A	31
	0.04	21	27	8	9	330 C	12
	0.07	24	20	8	13	238 C	22
	0.14	22	23	8	15	315 C	9
Imazapyr	0.00	31	34	1	0	1000 A	22
	0.07	20	20	33	13	250 C	10
	0.14	15	16	15	15	0 C	1
	0.28	16	18	24	23	0 C	1
Metsulfuron	0.00	36	31	0	0	1000 A	23
	0.02	24	21	48	63	205 C	5
	0.04	24	25	13	25	440 B C	14
	0.05	15	15	91	95	2 C	3
Picloram	0.00	34	34	0	0	1000 A	30
	0.14	20	22	15	55	0 C	1
	0.28	20	19	20	15	0 C	0
	0.42	16	19	90	99	0 C	0
Triclopyr	0.00	35	35	0	0	975 A	9
	0.14	25	26	1	0	950 A	12
	0.28	20	20	10	10	256 C	10
	0.42	19	19	49	13	179 C	1
UBIC4243	0.00	35	35	0	0	900 A	26
	0.14	25	22	45	57	268 C	9
	0.21	6	11	99	98	4 C	5
	0.28	6	7	99	98	1 C	0
Check	0.00	42	46	0	0	1000 A	17
2,4-D	2.24	9	16	58	49	0 C	1
Dicamba	1.12	22	25	20	23	31 C	15
Chlorsulfuron	0.05	38	33	4	0	975 A	31
LSD		12	12	32	27		20

[1]Seeds were counted if numbers were less than 100, but estimated when counts were greater than 100. 1000 indicates 1000 or more.

[2]Any two means with a common letter are not significantly different at the 5% level using the Protected Duncan's test.

Effects of herbicides on seed production and survival of common crupina and other plants in a former pasture site. Lass, L.W. and R.H. Callihan. Common crupina (*Crupina vulgaris* Cass CJNVU)is a federal noxious weed found in about 60,000 acres in four states in the western U.S.A. Because of the limited extent and weedy nature of this plant U.S.D.A. A.P.H.I.S. has designated it a Federal Noxious Weed and as an eradication candidate. The failure to fully implement an eradication program has allowed this plant to continue to spread. This study examines alternative herbicides useful for the control, suppression and eradication of common crupina in agronomic and non-crop areas.

The site was a non-grazed south facing slope located near Kamiah, ID. The slope ranged from 30 to 40% and was covered with approximately 700 common crupina plants per m^2. The plot design was a split plot with four replications. Herbicides used in this test were metsulfuron at 0.023, 0.035, and 0.052 kg ai/ha, picloram at 0.14, 0.28, and 0.42 kg ai/ha, triclopyr at 0.14, 0.28, 0.42 kg ai/ha, clopyralid at 0.035, 0.07, and 0.14 kg ai/ha, imazapyr at 0.07, 0.14, and 0.28 kg ai/ha, UBI-C4243 at 0.14, 0.21, and 0.28 kg ai/ha, chlorsulfuron at 0.052 kg ai/ha, dicamba at 1.12 kg ai/ha, and 2,4-D at 2.24 kg ai/ha. The application dates were May 28 and 29, 1991.

Herbicides were applied with a water carrier at 195 L/ha using 8002 flat fan nozzles in a backpack CO_2 sprayer traveling at 3.9 km/hr. The air temperature was 23C and the soil temperature at the surface was 34C, at 5 cm depth was 23C and at 15 cm depth was 18C. The relative humidity was 40% and the sky was hazy. The wind averaged 0 to 4 km/hr mainly from the south. No dew was present. The water used in the sprayer was from a well at the Experiment Station at the University of Idaho. The common crupina was in the bud stage of growth but had not started to bloom. Common crupina represented 85 to 100% of the cover present with a range of 100 to 400 common crupina plants per m^2. Poison ivy was present in many plots at levels ranging from 1 to 30 plants per plot. Japanese brome, field bindweed, and yellow starthistle were also present. Forage quality of plants on this site was near zero. Visual evaluations of herbicide treatments were made on July 11, 1991.

Seed production was stopped in all clopyralid and UBI-C4243 treatments (Table). Seed production was stopped in 3 of 4 replicates of metsulfuron at 0.023 kg ai/ha, picloram at 0.28 kg ai/ha, and triclopyr 0.14 and 0.28 kg ai/ha treatments. Seed production completely was stopped by the other metsulfuron, picloram, and triclopyr treatments in all replicates.

Common crupina plants in the UBI-C4243 treatments turned brown six weeks after application. Symptom expression was slower in the common crupina present in other treatments because of the late application of herbicides near the mature stage. Plants in the clopyralid and picloram treatments tended to remain green with twisted branches. In the metsulfuron and imazapyr plots, common crupina plants were yellow green with brown buds.

Japanese brome (*Bromus japonicus* Thumb. ex Murr. BROJA) was severly injured by UBI-C4243 but was tolerant of the other herbicides. Arrow-leaf balsamroot (*Balsamorhiza sagittata* (Pursh) Nutt.) was dead in the 2,4-D, UBI-C4243, picloram, and triclopyr treatments. Although un-replicated because of poor distribution in all plots, it was noted that triclopyr and UBI-C4243 at all rates, and 2,4-D at the tested rate killed the poision ivy (*Rhus radicans* L.) in the treated plots.

Subequent evaluations will be necessary to determine long-term control and eradication potential of the tested herbicides. (University of Idaho, Dept. of Plant, Soils, & Ent. Sci., Moscow 83843)

Effects of herbicides on common crupina seed production, survival, and other plants.

Treatment	(kg ai/ha)	No. of reps producing seed.	Injury: Common crupina	Injury: Arrow-leaf Balsamroot	Injury: Grasses
			------(%)------		
Clopyralid	0	4	0 I	0 A	0 A
Clopyralid	0.035	0	33 H F E G	6 A	0 A
Clopyralid	0.07	0	41 F E D	0 A	0 A
Clopyralid	0.14	0	35 H F E D G	28 B D A C	9 A
Imazapyr	0	4	0 I	16 B D A C	20 B A
Imazapyr	0.07	3	6 H I	20 B D A C	18 B A
Imazapyr	0.14	2	9 H I G	24 B D A C	46 C
Imazapyr	0.28	2	30 H F I G	41 E B D C	40 B C
Metsulfuron	0	4	0 I	0 A	0 A
Metsulfuron	0.023	0	81 B A C	44 E D	10 A
Metsulfuron	0.035	1	61 B E D C	33 E B D A C	0 A
Metsulfuron	0.052	0	84 B A	43 E D C	1 A
Picloram	0	4	0 I	10 B A C	0 A
Picloram	0.14	0	41 F E D	78 G F	0 A
Picloram	0.28	1	37 F E D G	63 E F	0 A
Picloram	0.42	0	55 F E D C	90 G F	0 A
Triclopyr	0	4	0 I	29 B D A C	0 A
Triclopyr	0.14	1	43 F E D	98 G	3 A
Triclopyr	0.28	1	44 F E D	100 G	3 A
Triclopyr	0.42	0	64 B D C	100 G	3 A
UBIC4243	0	4	0 I	9 B A	0 A
UBIC4243	0.14	0	100 A	100 G	100 D
UBIC4243	0.21	0	100 A	100 G	100 D
UBIC4243	0.28	0	100 A	100 G	100 D
Check	0	4	0 I	3 A	0 A
2,4-D	2.24	2	35 H F E D G	89 G F	18 B A
Dicamba	1.12	3	32 H F E G	24 B D A C	3 A
Chlorsulfuron	0.052	4	10 H I G	0 A	0 A

Any two means having a common letter within a column are not significantly different at the 5% level of significance, using the Protected Duncan's Test.

Some effects of selected aquatic herbicides on seedling common crupina. Lass, L.W. and R.H. Callihan. Control of common crupina near aquatic sites is limited to hand weeding, mechanical removal, or herbicides registered for wet sites. Hand weeding has limited use in large areas of high plant populations, and mechanical control is not possible in many areas. This study examines the effects of three herbicides that may be used near water, compared to four standards currently used for common crupina control.

The experiment was established on March 28, 1991 near Kamiah, Idaho. The site was on Lawyers Canyon with a south facing slope of 50 to 70% slope. Treatments were glyphosate applied as RODEO (0.42, 0.84, and 1.26 kg ai/ha plus untreated check); 2,4-D (0.56, 1.12, and 1.68 kg ai/ha plus untreated check), MCPA (0.28, 0.56, and 0.84 kg ai/ha plus untreated check, and standards. The standards were Metsulfuron (0.052, 0.07, and 0.105 kg ai/ha plus untreated check); Picloram (0.28 kg ai/ha); dicamba (0.56 kg ai/ha); clopyralid plus 2,4-D applied as CURTAIL (0.106 + 0.56 kg ai/ha) and a combined check for picloram, dicamba, and clopyralid. The plot size was 3 by 9 m and were organized in a split-plot design. The herbicides were applied with a CO_2 pack sprayer in a water carrier at a rate of 209 L/ha. All treatments used a surfactant (R-11) at the rate of 5 ml/L except glyphosate which used the rate of 100 ml/L carrier.

The air temperature at the time of application was 12C and the soil temperature was 14C at the surface, 9C at 5 cm, and 7C at 15 cm. The relative humidity was 50% and the sky was mostly cloudy. The wind was 0 to 5 km from all directions. No dew was present. The water was from a well at the University of Idaho experiment station in Moscow. The common crupina was about 2 to 5 cm in diameter with 3 to 4 leaves and averaged 800 plants per m^2 or more. Foothills bedstraw (*Galium pedamontanum* All.) was present in all plots at an average 70 to 80 plants per plot. Yellow starthistle (*Centaurea solstitialis* L.) was present in many areas through the plots, but not sufficiently uniform to evaluate. Visual evaluations of control and injury to other plants were made on May 28, 1991.

Common crupina seedlings did not survive any rates of glyphosate, metsulfuron, clopyralid + 2,4-D, dicamba, and picloram. Higher doses of 2,4-D (above 1 kg/ha) had no surviving common crupina. MCPA tended to reduce common crupina populations by 50%, when compared to the check.

Japanese Brome (*Bromus japonicus* Thunb. ex Murr.) cover was increased or remained the same as the check when common crupina was controlled by 2,4-D, MCPA, clopyralid + 2,4-D, dicamba, and picloram. As expected, glyphosate severely reduced the grass cover to 3% or less in the treatment. Metsulfuron treatments tended to have about 50% less grass cover than the check.

Acceptable control of seedlings was achieved with 2,4-D and glyphosate, but not MCPA. This would indicate a potential use of these herbicides registered for near water conditions. (University of Idaho, Dept. of Plant, Soils, and Ent. Sci., Moscow, 83843).

The effects of aquatic herbicides in comparison with standards on common crupina control on a terrestrial non-crop site.

Herbicide		Survival: Common Crupina Control	Cover: Yellow Star-thistle	Cover: Grass	Counts: Foothills Bedstraw
	(kg ai/ha)	(%)	(%)	(%)	(Plts/Plot)
2,4-D	0	100 A	3	15 B C D	83 B A
2,4-D	0.56	6 D	3	41 B C D	68 B A
2,4-D	1.12	0 D	0	50 B C	58 B A
2,4-D	1.68	0 D	0	40 B C D	49 B
Glyphosate	0	100 A	1	25 B C D	75 B A
Glyphosate	0.42	0 D	3	3 C D	8 B
Glyphosate	0.84	0 D	0	2 C D	2 B
Glyphosate	1.26	0 D	3	1 D	3 B
MCPA	0	100 B A	5	28 B C D	83 B A
MCPA	0.28	51 B C	5	26 B C D	75 B A
MCPA	0.56	38 C	1	98 A	43 B
MCPA	0.84	56 B C	0	28 B C D	73 B A
Metsulfuron	0	100 A	8	23 B C D	73 B A
Metsulfuron	0.052	0 D	6	9 C D	1 B
Metsulfuron	0.07	0 D	0	11 C D	0 B
Metsulfuron	0.105	0 D	1	6 C D	1 B
Check	0	100 A	5	13 B C D	80 B A
Clopyralid + 2,4-D	0.106 + 0.56	0 D	0	60 B A	163 A
Dicamba	0.56	0 D	0	35 B C D	19 B
Picloram	0.28	0 D	0	33 B C D	3 B

Clopyralid + 2,4-D was formulated Curtail applied as 2.33 l/ha product, and glyphosate was formulated Rodeo.
Any two means having a common letter within a column are not significantly different at the 5% level of significance, using the Protected Duncan's test.

Dalmatian toadflax control and crested wheatgrass injury with picloram, fluroxypyr, and picloram plus fluroxypyr on Colorado rangeland. Sebastian, J.R. and K.G. Beck. An experiment was established in 1988 near Livermore, CO to evaluate Dalmatian toadflax (LINDA) control with picloram, fluroxypyr, and picloram plus fluroxypyr. The design was a randomized complete block with four replications. Vegetative (June 7), flower (July 11), and fall (October 7) applications were sprayed for timing comparison. All treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 24 gal/a, 15 psi. Other application information is presented in Table 1. Plot size was 10 by 45 feet.

Visual evaluations compared to non-treated control plots were taken in September 1989, 1990, and 1991. All picloram and picloram plus fluroxypyr treatments provided excellent (93 to 100%) LINDA control in September 1989 while fluroxypyr failed (Table 2). Picloram plus fluroxypyr tank mixes (all timings) were not different from picloram applied alone. Crested wheatgrass (AGRDE) stand reduction increased with picloram rate above 0.5 lb (20 to 28%). AGRDE stand losses at these rates were compounded by severe drought conditions in 1990-91. In 1990, LINDA seedlings appeared in all plots where AGRDE stand loss was severe; i.e. all picloram treatments > 0.5 lb.

In September 1990, picloram at 2.0 lb provided poor LINDA control (50 to 53%) whereas picloram alone at 0.5 lb provided 78 to 87% control. Fluroxypyr had no LINDA control in 1990 or 1991. Residual LINDA control with picloram and AGRDE competition was still apparent in 1991 as picloram 0.5 lb provided fair control when applied alone at vegetative (73%) and poor to fair control at flower or fall applications (34 to 57%). Picloram 1.0 to 2.0 lb provided poor LINDA control September 1991 (all timings). The crested wheatgrass stand had fully recovered by September 1991 in all treatments except picloram 2.0 lb (flower and fall) and 1.0 lb.

Herbicide treatments will be evaluated again in 1992 for control longevity and grass injury. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

Table 1. Application data

Environmental data			
Application date	June 7, 1988	July 11,1988	Oct 7, 1988
Application time	11:00 AM	12:00 AM	9:00 AM
Air temperature, C	34	28	9
Cloud cover, %	0	35	0
Relative humidity, %	29	35	86
Wind speed/direction, mph	5 to 7/S	5 to 6/s	0
Soil temperature (2.0 in.), C	12	20	8

Application date	species	growth stage	height (in.)	density (shoots/ft^2)
June 7, 1988	LINDA	vegetative	6 to 18	2 to 3
July 11, 1988	LINDA	flowering	12 to 26	2 to 3
October 7, 1988	LINDA	fall	12 to 26	2 to 3

Table 2. Dalmation toadflax control and crested wheatgrass injury with picloram, fluroxpypr, and picloram plus fluroxypyr on Colorado rangeland.

Herbicide	Rate	Timing	Dalmation toadflax and crested wheatgrass					
			Sept. 21, 1989		Sept. 25, 1990		Sept. 27, 1991	
	(lb ai/acre)		control	injury	control	injury	control	injury
picloram	0.5	veg	98	20	87	0	73	0
picloram	1.0	veg	96	78	81	67	38	0
picloram	2.0	veg	97	65	53	84	24	23
fluroxypyr	0.5	veg	0	0	0	0	0	0
fluroxypyr	1.0	veg	0	0	0	0	0	0
picloram + fluroxypyr	1.0 0.5	veg	99	66	56	26	30	10
picloram + fluroxypyr	0.5 1.0	veg	96	20	80	3	56	0
picloram	0.5	flwr	96	28	78	10	57	0
picloram	1.0	flwr	99	59	71	30	39	8
picloram	2.0	flwr	99	83	50	59	0	0
fluroxypyr	0.5	flwr	5	0	0	0	0	0
fluroxypyr	1.0	flwr	5	0	0	0	0	0
picloram + fluroxypyr	1.0 0.5	flwr	97	46	69	25	24	0
picloram + fluroxypyr	0.5 1.0	flwr	93	24	65	0	31	0
picloram	0.5	fall	100	26	83	0	34	0
picloram	1.0	fall	100	60	53	18	23	8
picloram	2.0	fall	97	77	53	56	11	13
fluroxypyr	0.5	fall	0	0	0	0	0	0
fluroxypyr	1.0	fall	0	0	0	0	0	0
picloram + fluroxypyr	1.0 0.5	fall	97	63	40	4	5	0
picloram + fluroxypyr	0.5 1.0	fall	95	44	75	0	45	0
LSD (0.05)			7	17	25	17	34	4

Response of yellow hawkweed to range herbicides in a non-crop site. Lass, L.W., and R.H. Callihan. This experiment examines herbicides which may be useful in control of the aggressive weed, yellow hawkweed (*Hieracium pratense* TauschHIECA) when the plants start to spread on roadsides and other undesired areas. This experiment was established to confirm results of previous work started in 1986.

The experiment was initiated on a Helmer silt loam, June 5, 1991 at Fernwood, Idaho. Plots measured 10 by 30 ft, with four replications of a split-strip block design. Plots were treated with a strip-plot application of 16-16-16 at a rate of 53 lbs ai/a on June 5, 1991. Treatments consisted of single applications of metsulfuron and sulfometuron (each at 0.75, 1.0, 1.5 oz ai/a); 2,4-D (32 oz ai/a); clopyralid (1 and 2 oz ai/a); clopyralid + 2,4-D (1.52 + 8 oz ai/a) applied as CURTAIL, dicamba (16 oz ai/a); and picloram (1.6, 6.4 and 9.6 oz ai/a). A surfactant (R11) was used (0.5% v/v) on all treatments. Treatments were applied on July 7, in 21 gal/a water carrier with flat-fan 8002 nozzles at 43 psi from a CO2-pressurized backpack sprayer operated at 3.4 mph. The air temperature at the time of treatment was 80F, the soil temperature at 2 and 6 inches were 64F and 59F and the relative humidity was 40%. The sky was clear and no dew was present. The wind was 0 to 1 mph from the west. The hawkweed was 3 to 6 inches tall and represented 90 to 100% of ground cover. At the time of herbicide application hawkweed plants in the fertilized strips were green while the unfertilized strips were yellow green with a purple tinge. Herbicide treatment effects were evaluated on July 30, 1991.

Fertilizing prior to herbicide treatment produced healthier hawkweed, therefore herbicide treatments were generally slower acting in fertilized treatments (Table). Metsulfuron, sulfometuron, dicamba, and clopyralid treatments did not show any response 23 days after application due to slow symptom expression. Both picloram and 2,4-D or the herbicide combinations with 2,4-D showed plant die-back ranging from 50% to 100% (Table). The results of the early evaluation shows hawkweed treated with 2,4-D and picloram will rapidly express injury symptoms. Only subsequent evaluations will examine the long term control potential of yellow hawkweed. (University of Idaho, Dept. of Plant, Soils, & Ent. Sci., Moscow, 83843)

Effects of herbicides on yellow hawkweed control in a non-crop site.

Herbicide	Rate	Living Plants
	(oz ai/A)	(%)
Check		100 A
+ Fertilizer		100 A
Metsulfuron	0.75	100 A
+ Fertilizer		100 A
Metsulfuron	1	100 A
+ Fertilizer		100 A
Metsulfuron	1.5	100 A
+ Fertilizer		100 A
Sulfometuron	0.75	100 A
+ Fertilizer		100 A
Sulfometuron	1	100 A
+ Fertilizer		100 A
Sulfometuron	1.5	100 A
+ Fertilizer		100 A
Check	0	100 A
+ Fertilizer		100 A
2,4-D	32	18 C E D
+ Fertilizer		30 C B D
Clopyralid	1	98 A
+ Fertilizer		100 A
Clopyralid	2	80 A
+ Fertilizer		98 A
Clopyralid + 2,4-D		
	1.52 + 8	38 C B
+ Fertilizer		49 B
Dicamba	16	85 A
+ Fertilizer		98 A
Picloram	1.6	5 E
+ Fertilizer		8 E D
Picloram	6.4	3 E
+ Fertilizer		8 E D
Picloram	9.6	0 E
+ Fertilizer		5 E

Fertilizer rate was 53 lb ai/A of 16%-N 16%-P 16%-K. Mean separation by LSmeans and means with the same letters are not significantly different at P=0.05.

Response of yellow hawkweed to sulfonylurea and pyridine herbicides. Lass, L.W. and R.H. Callihan. The purpose of this experiment was to determine the effects of six different herbicides at three rates on established meadow hawkweed (Hieracium pratense Tausch. HIECA) in a grass pasture. The experiment was initiated on a Helmer silt loam, June 19, 1986 at Fernwood, Idaho. Plots measured 10 by 25 ft, with four replications of a split-strip block design. Treatments consisted of single applications of chlorsulfuron, sulfometuron, metsulfuron, and DPX-L5300 (each at 0.5, 1.0, 2.0 oz ai/a and check), picloram (0.1, 0.4 and 0.6 lb ae/a and check) and clopyralid (0.25, 0.5 and 1 lb ae/a and check). Treatments were applied in 23 gal/a water carrier with flat-fan 8002 nozzles at 40 psi from a CO2-pressurized backpack sprayer operated at 3 mph. The air temperature at the time of treatment was 66F, the soil temperature at 6 inches was 59F and the relative humidity was 55%. There was 50% cloud cover and dew was present. The plots were treated with a strip-plot application of ammonium nitrate solution (check and 50 lbs N/a) on March 17, 1987 during a rain. Plots were mowed and clippings removed September 20, 1987.

Plots were evaluated for the first year's results by estimating percent chlorosis of treated yellow hawkweed on July 17, 1986. The second and third year's evaluation consisted of gravimetric vegetative sampling. Evaluations of the fourth and fifth year consisted of visual estimates of the hawkweed control expressed as percent of check and grass biomass estimated on July 31, 1989, and June 29, 1990 and only hawkweed biomass in July 15, 1991 (year 6). Complete results of previous years evaluations were reported in past WSWS progress reports.

Results of the five previous years showed 70 to 100% hawkweed control with picloram and clopyralid, but suppression started to decline in 1989. Other herbicides either failed to control yellow hawkweed or suppression was for less than 3 years. In 1991, clopyralid was the only herbicide providing yellow hawkweed control greater than 50% (Table).

Results of this project indicate six years of yellow hawkweed control with clopyralid at rates of 0.5 and 1.0 lb/a and four years control with picloram at rates of 0.4 and 0.6 lb/a. Both the clopyralid and picloram treatments substantially increased the yield of grass. (University of Idaho, Dept. of P.S.& E.S., Moscow 83843)

Response of pasture vegetation to a pyridine herbicide 4, 5, and 6 years after application.

Herbicide	Rate (lb ae/A)	Hawkweed[1] 1989	1990	1991
		(%)	(%)	(%)
Clopyralid	0	100 A	100 A	100 A
	0.25	20 B	20 B	70 B A
	0.50	0 C	23 B	40 B
	1.00	0 C	21 B	49 B

1 Hawkweed biomass expressed as percent of check. Data not shown for other herbicides because of lack of hawkweed suppression in 1991. Means with the same letter are not significantly different at the 5% level of the Duncan's multiple-range test.

Russian knapweed control with herbicides on Colorado rangeland. Sebastian, J.R. and K.G. Beck. Two rangeland experiments were established near Eagle and Pagosa Springs, CO to evaluate Russian knapweed (CENRE) control with picloram, dicamba, picloram plus dicamba, chlorsulfuron, and metsulfuron. Fall (September 12 or November 17, 1989) and spring (June 18 or May 31, 1990) applications were sprayed for timing comparison. The design was a randomized complete block with four replications. Chlorsulfuron and metsulfuron treatments were sprayed with X-77 surfactant (0.25% v/v). All treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 24 gal/a, 15 psi. Other application information is presented in Table 1. Plot size was 10 feet by 30 feet.

Visual evaluations compared to non-treated control plots were taken at Eagle in June and August 1990 and October 1991; and at Pagosa Springs in May and September 1990, and October 1991. At both sites picloram fall applied at 1.0 lb provided excellent CENRE control approximately 6 and 11 months after treatment (MAT), respectively (Table 2). Control provided by this treatment 2 years after application was 92 and 72% at Eagle and Pagosa Springs, respectively. Picloram at 0.5 lb ai/a fall-applied provided 81 and 56% control 11 MAT and 72 and 18% 24 MAT at Eagle and Pagosa Springs, respectively. Picloram at 0.5 and 1.0 lb spring-applied provided 71 and 92% control 16 MAT at Eagle. However only picloram at 1.0 lb spring-applied at Pagosa Springs provided acceptable long-term control. Chlorsulfuron and metsulfuron did not provide acceptable long-term control. There were no differences within a herbicide treatment between fall and spring applications.

Drought conditions at application contributed to control failure at Pagosa Springs, although picloram at 1.0 lb was not affected as much as other treatments. Herbicide treatments will be evaluated again in 1992 for control longevity. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

Table 1. Application information for Russian knapweed control with herbicides on Colorado rangeland.

Environmental data				
Location	Eagle, CO		Pagosa Springs, CO	
Application date	Sep 12 1989	Jun 18 1990	Nov 17 1989	May 31 1990
Application time	1:00 P	9:00 A	10:00 A	10:00 A
Air temperature, C	12	16	13	18
Cloud cover, %	100	10	40	65
Relative humidity, %	60	44	40	35
Wind speed/direction, mph	0	0	0 to 2 SW	5 to 7/W
Soil temperature (2.0 in), C	11	16	10	12

Weed data Application date	Species	Growth stage	Height (in.)	Density (shoots/ft^2)
Eagle, CO				
September 12, 1989	CENRE	fall vegetative	10 to 12	1 to 6
June 18, 1990	CENRE	bolting	6 to 10	1 to 6
Pagosa Springs, CO				
November 17, 1989	CENRE	post flwr/dorm	12 to 24	1 to 15
May 31, 1990	CENRE	bolting	6 to 10	1 to 6

Table 2. Russian knapweed control on Colorado rangeland.

Treatment	Rate	Timing	Russian knapweed control					
			Eagle, CO			Pagosa Springs, CO		
			June 1990	August 1990	October 1991	May 1990	September 1990	October 1991
	(lb ai/a)		(% of check)					
picloram	0.25	fall	75	60	46	92	20	8
picloram	0.5	fall	92	81	72	100	56	18
picloram	1.0	fall	100	94	92	100	90	70
dicamba	0.5	fall	51	13	8	50	9	0
dicamba	1.0	fall	77	41	8	75	0	0
picloram	0.25							
+ dicamba	0.5	fall	92	49	38	97	28	14
picloram	0.13							
+ dicamba	1.0	fall	96	71	49	97	4	5
chlorsulfuron[1]	0.38	fall	63	31	6	45	0	0
chlorsulfuron	0.75	fall	86	59	0	71	0	0
metsulfuron[1]	0.3	fall	78	48	0	68	0	5
picloram	0.25	bolting	-	59	44	-	45	5
picloram	0.5	bolting	-	70	71	-	54	28
picloram	1.0	bolting	-	80	92	-	81	69
dicamba	0.5	bolting	-	50	4	-	0	4
dicamba	1.0	bolting	-	67	15	-	34	8
picloram	0.25							
+ dicamba	0.5	bolting	-	72	58	-	51	16
picloram	0.13							
+ dicamba	1.0	bolting	-	65	25	-	26	3
chlorsulfuron	0.38	bolting	-	39	0	-	21	4
chlorsulfuron	0.75	bolting	-	68	24	-	6	0
metsulfuron	0.3	bolting	-	56	10	-	25	8
LSD (0.05)			11	20	26	12	24	15

1 X-77 surfactant added at 0.25% v/v to all chlorsulfuron and metsulfuron treatments.

Spotted knapweed control in a non-crop site. Lass, L.W. and R.H. Callihan. This experiment evaluated the effects of six herbicides at three rates each on mature spotted knapweed (*Centaurea maculosa* Lam. CENMA) in non-crop land.

The experiment was established at Farragut State Park, west of Athol, ID. on June 9, 1986. Plots measured 10 by 40 ft with four replicates in a split-block design. The treatments consisted of single applications of metsulfuron (0.5, 1.0, 2.0 oz ai/a and a check), DPX-L5300 (0.5, 1.0, 2.0 oz ai/a and a check), clopyralid (0.45, 0.9, 1.8 lb ai/a and a check), chlorsulfuron (0.5, 1.0, 2.0 oz ai/a and a check), sulfometuron (0.5, 1.0, 2.0 oz ai/a and a check), and picloram (0.5, 1.0, 2.0 lb ai/a and a check).

Treatments were applied in 23 gal/a water carrier, with TeeJet 8002 nozzles at 43 psi, from a backpack sprayer operated at 3 mph. The plots were sprayed on June 9, 1986. The air temperature at the time was 83F, soil temperature at 3 inch depth was 70F, and relative humidity was 46%. The sky was 80% cloudy, and no dew was present. Visual estimates of biomass were recorded July 17 and October 22, 1986; April 28 and August 11, 1987; July 11, 1988; August 1, 1989; August 8, 1990; and August 16, 1991.

The metsulfuron, DPX-L5300, chlorsulfuron, and sulfometuron did not reduce seed production or biomass after the second year (Data shown in previous WSWS Progress Reports). Evaluations of picloram and clopyralid plots in the first five years of the project showed excellent control with a slight reduction in control starting the third year. In 1990, the highest rates of picloram and clopyralid controlled 62 to 79% of the spotted knapweed.
In 1991, about 40 to 50% of the area within the picloram and clopyralid plots remained free of spotted knapweed. Long term activity of lower rates may not be a result of long term herbicide carry-over, but of reductions in the seed bank. (University of Idaho, Dept. of Plant, Soils, & Ent. Sci., Moscow 83843)

Spotted Knapweed Control in Non-crop.

		Summer Spotted Knapweed Biomass					
Herbicide	Rate	7/86	8/87	7/88	8/89	8/90	8/91
	(ai/A)	-------------	(% of Check)	-------------			
Clopyralid	0.0 lb	100 a	100 a	100 a	100 a	100 a	100 a
	0.4 lb	2 b	4 b	4 b	8 b	52 b	68 bc
	0.9 lb	1 b	4 b	1 b	10 b	55 bc	83 ba
	1.8 lb	0 b	4 b	1 b	5 b	38 c	56 cd
Picloram	0.0 lb	100 a	100 a	100 a	100 a	100 a	100 a
	0.5 lb	5 b	0 b	2 b	6 b	40 bc	65 bcd
	1.0 lb	2 b	0 b	1 b	10 b	40 bc	66 bcd
	2.0 lb	1 b	0 b	3 b	12 b	21 d	40 d

1. Any two means having a common letter within a column are not significantly different at the 5% level of significance, using Protected Duncan's Test. Tested herbicides not showing control of spotted knapweed are not included in this table.

Herbicide tolerance of seedling grasses for erosion control in a spotted knapweed infested parkland. Lass, L.W., and R.H. Callihan. Grass establishment practices on parkland infested with spotted knapweed (Centaurea maculosa Lam.) allow weeds to dominate during and after grass establishment unless rigorous weed suppression is practiced. Early application of certain herbicides may cause injury to some seedling grasses. The tolerance of 21 seedling grass taxa to picloram (0.25, and 0.5 lb ai/a) and clopyralid (0.25 and 0.5 lb ai/a) were tested in Farragut State Park.

Grass seedlings were:

bluebunch x quackgrass	(Agropyron spicatum (Pursh)Scribn.&Smith x A. repens (L.)Beauv.
bluegrass, Canada	(Poa compressa L. cv. Reubens)
bluegrass, Kentucky	(Poa pratensis L. cv. Kenblue)
brome, meadow	(Bromus erectus Huds cv. Regar)
brome, smooth	(Bromus inermis Leyss. cv. Manchar)
fescue, creeping red	(Festuca rubra L. cv. Logro)
fescue, hard	(Festuca ovina L. spp. duriuscula cv. Durar)
fescue, sheep	(Festuca ovina L. cv. Covar)
fescue, sheep	(Festuca ovina L. cv. Mecklenburg)
fescue, tall	(Festuca arundinacea Schreb. cv. Alta)
fescue, tall	(Festuca arundinacea Schreb. cv. Fawn)
orchard grass	(Dactylis glomerata L. cv. Paiute)
redtop	(Agrostis alba L. cv. Exerata)
redtop	(Agrostis alba L. cv. Streaker)
timothy, common	(Phleum pratense L. cv. Climax)
wheatgrass, crested	(Agropyron cristatum Gaertn. cv. Ephraim),
wheatgrass, intermediate	(Agropyron intermedium (Host)Beauv. cv. Rush)
wheatgrass, intermediate	(Agropyron intermedium (Host)Beauv. cv. Tegmar)
wheatgrass, pubescent	(Agropyron trachycaulum (Link)Malte cv. Luna)
wheatgrass, streambank	(Agropyron riparium Scribn. & Smith cv. Sodar)
wheatgrass, western	(Agropyron smithii Rybd. c.v. Arriaba).

The experiment was initiated on a Farragut silt loam on Oct. 1, 1987. Plots were treated with 0.5 lb ai/a glyphosate to kill living vegetation. Plots were disked on November 1, 1987 and April 5 to 15, 1988. Prior to the spring disking 41 lbs/a nitrogen fertilizer was spread on March 22, 1988. Individual plots measured 16 by 30 ft, randomized in a split-strip block design with four replications. Grasses were planted on April 18, 1988 using a 8 ft drill with drag chains, calibrated to deliver 9 lb/a rice hulls. The row spacing was 7 inches and the depth of planting was 1/2 to 3/4 inch. Rice hulls were used to adjust seed volume to a constant seeding rate to compensate for different grass seed sizes.

Treatments were applied in 35 gal/a water carrier, with TeeJet 8003 nozzles at a pressure of 32 psi, from a tractor-mounted sprayer with a 25 ft boom operated at 1.8 mph. The application dates were July 18 and 19, 1988. The air temperature following application on July 19 was 86F, soil temperature was 107F at surface, 100F at the depth of 2 inches. The relative humidity was 40% and the sky was clear. The wind was from the east at 1 to 2 mph. A visual estimate of the percentage of the grass leaves showing necrosis or browning of leaf edges was made in the second week in August of 1988. Plant population found in 3 feet of row and height of the grasses were measured at the same time as the necrosis estimate. Percent grass and knapweed cover were visually estimated on July 24, 1989 and August 8, 1990.

Manchar smooth brome was the only grass to establish in 1988 in all plots where it was planted (data not shown). Ephraim crested wheatgrass established in 19 of the 20 planted plot areas. Regar meadow brome was present in 18 of the 20 treatment areas. Paiute orchard grass established in 17 of the 20 planted plots. Luna pubescent wheatgrass was present in 15 of the 20 plots. Kenblue Kentucky bluegrass, Reubens Canada bluegrass, Logro creeping red fescue, Streaker redtop, Exerata redtop, and Arriaba western wheatgrass failed to establish in more than 6 of the 20 plots.

In 1989, spotted knapweed populations were significantly reduced (95 to 100%) in the clopyralid and picloram treatments, when compared to the untreated checks (data not shown). Rush intermediate wheatgrass was the only grass to provide more than 50% cover in the plots. Grasses providing more than 30% cover were Regar meadow brome, Mecklenburg sheep fescue, Paiute orchard grass, Luna pubescent wheatgrass, and Sodar streambank wheatgrass. Grasses failing to provide more than 10% cover were Reubens Canada bluegrass, Logro creeping red fescue, Exerata redtop, and Streaker redtop. The chance of establishing a grass species was 5 to 7 times greater in the herbicide treatments than in the check plots.

In 1990, sheep fescues were dropped from the study since considerable contamination from the original plant community occurred. Results of the 1990 evaluation shows five grass species have established well in all replicates (data shown in previous WSWS progress report). Average estimated cover, in the herbicide treatments, provided by Luna pubescent wheatgrass was 61%, by Manchar smooth brome was 37%, by Paiute orchard grass was 30%, by Reubens Canada bluegrass was 28%, and by Rush intermediate wheatgrass was 69%. Without herbicides less than 8% of the plant cover was provided by the planted grasses. Most of the vegetation which was classified as "other plant cover" was the sheep fescue from the original community. Although pre-treated with glyphosate, the sheep fescue survived and was stimulated by the reduced weed competition and fertilization. Spotted knapweed in the herbicide treatments constituted 16% or less of the plant cover in 1990.

In 1991, effects of herbicide treatments continued to reduce spotted knapweed plants by 83% or more (Table). None of the planted grasses survived in the non-chemically-treated checks. Luna pubescent wheatgrass and Rush intermediate wheatgrass established the best of all planted grasses, but still provided less than 60% cover. None of the planted grasses appeared vigorous or well suited for the site.

Without herbicides to reduce spotted knapweed competition all grasses failed to establish in this site. The rocky nature of this Farragut silt loam was too harsh for some grass species to establish. The success of sheep fescue from the original community would suggest renovation and maintenance of perennial grass communities may be preferable to establishment of a new species. (University of Idaho, Dept. of Plant, Soils, and Ent. Sci., Moscow, 83843)

The 1991 effects of herbicides on estimated percentages of grass and spotted knapweed.

Herbicide	Rate	Check	Blueb.X Quack	Bluegrass Kent.	Bluegrass Canada Reubens	Brome Meadow Regar	Brome Smooth Manchar	Fescue Creep. Red	Fescue Tall Alta	Fescue Tall Fawn	Orchard Grass Paiute	Redtop Exerata	Redtop Streak.	Tim. Com.	Wheatgrass Crest. Ephr.	Wheatgrass Int. Rush	Wheatgrass Int. Tegm.	Wheatgrass Pub. Luna	Wheatgrass Str. Sodar	Wheatgrass Western
A. Control (%)																				
Spotted Knapweed																				
Check	0	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A	100 A
Clopyralid	0.25	3 B	1 CB	1 B	4 B	1 B	2 B	1 C	2 B	1 C	2 C	8 B	3 B	1 B	1 C	1 C	2 B	1 CB	3 CB	2 B
Clopyralid	0.5	4 B	1 CB	2 B	1 C	1 B	1 B	2 C	1 B	2 CB	2 C	1 B	4 B	3 B	2 CB	1 C	0 C	1 CB	1 C	2 B
Picloram	0.25	3 B	2 B	3 B	2 CB	15 B	14 B	8 B	3 B	3 B	15 B	6 B	3 B	3 B	3 B	3 B	2 CB	2 B	5 B	3 B
Picloram	0.5	3 B	0 C	1 B	2 CB	1 B	0 B	2 C	1 B	1 C	1 C	1 B	3 B	1 B	1 C	1 C	0 C	0 C	1 C	1 B
B. Native Grass Cover (%)																				
(Sheep Fescue)																				
Check	0	9 B	12 B	8 B	10 B	10 B	7 B	11 B	15 B	11 B	12 B	13 B	32 B	15 B	24 B	30 A	17 B	13 B	13 B	15 B
Clopyralid	0.25	100 A	100 A	100 A	100 A	70 A	100 A	100 A	78 A	85 A	88 A	90 A	85 A	95 A	100 A	48 A	73 A	50 A	100 A	98 A
Clopyralid	0.5	100 A	100 A	100 A	100 A	98 A	95 A	100 A	93 A	93 A	95 A	95 A	99 A	83 A	98 A	20 A	73 A	55 A	98 A	80 A
Picloram	0.25	98 A	95 A	100 A	100 A	70 A	100 A	100 A	80 A	93 A	95 A	98 A	100 A	83 A	100 A	33 A	80 A	63 A	95 A	95 A
Picloram	0.5	100 A	100 A	100 A	100 A	88 A	85 A	100 A	88 A	90 A	80 A	100 A	99 A	83 A	100 A	21 A	60 A	26 B	98 A	80 A
C. Planted Grass Cover (%)																				
Check	0	0 A	0 A	0 A	0 A	0 A	0 A	0 A	0 B	0 A	0 B	0 A	0 A	0 A	0 A	3 B	0 B	0 B	0 A	0 A
Clopyralid	0.25	0 A	0 A	0 A	0 A	30 A	0 A	0 A	23 A	15 A	13 B A	10 A	15 A	5 A	0 A	53 A	28 B	50 A	0 A	3 A
Clopyralid	0.5	0 A	0 A	0 A	0 A	1 A	5 A	0 A	8 B	8 A	5 B A	5 A	1 A	18 A	3 A	80 A	28 B	45 A	3 A	20 A
Picloram	0.25	0 A	5 A	0 A	0 A	30 A	0 A	0 A	20 A	8 A	3 B A	3 A	0 A	18 A	0 A	68 A	20 B	38 A	5 A	5 A
Picloram	0.5	0 A	0 A	0 A	0 A	13 A	15 A	0 A	13 B	10 A	20 A	0 A	4 A	18 A	0 A	79 A	38 A	74 A	3 A	20 A

Any two means having a common leter within a column are not significantly different at the 5% level of significance, using the Portected Duncan's test.

Effects of picloram on germination and cotyledon length of 1991 yellow starthistle seedlots. Northam, F.E., R.H. Callihan and R.O. Schirman. An experiment was conducted to test yellow starthistle (*Centaurea solstitialis* L. CENSO) germination in picloram solutions. This experiment is part of an ongoing program to evaluate whether germination tests can be used to screen yellow starthistle populations for susceptibility to picloram.

Seeds were harvested from six yellow starthistle populations in August and September 1991. The first seedlot was collected from a population known to be susceptible to 0.25 lb ae/ac picloram; this population was located in northwest Nez Perce County, Idaho and is designated NZP in the table. The remaining collections were from Columbia County, Washington near Dayton. One collection was from a rangeland site with yellow starthistle plants known to survive 0.5 lb ae/ac picloram and is designated D2 in the table. The D3 seedlot was collected approximately 20 feet beyond a fence separating the D2 and D3 populations. The D3 site has not been sprayed with picloram during the past 10 years. The D4 population was harvested from the same pasture as D3, but it was 0.5 mile beyond the D2/D3 fence. The D5 site was a roadside gravel pit approximately 2.5 miles from the D2 site. The final collection (D6) was from another rangeland site approximately 25 miles from the D2 area. The D6 area had been periodically sprayed with picloram during the last few years, and was suspected of having genotypes that survive picloram applications at a rate of 0.25 lb ae/ac.

The seeds were germinated in 100 mm plastic petri plates containing two germination pads that required 10-11 mls of solution to become saturated. Thirty seeds were put in each plate; separate plates were prepared for each of the two seed types: plumed or pappus bearing and unplumed or pappus absent. An individual plate was considered one replication and five replications were prepared for each treatment. The treatments consisted of saturating the germination pads of each plate with one of the following solutions: 0 (distilled water control), 100, 200, 300 and 400 ppb picloram. The seeds were germinated under florescent lights with a 14 hr light/10 hr dark photoperiod.

A seed was considered completely germinated when embryonic structures emerged to the point that a root could be visually identified and green cotyledons were free from the seed coat. The cotyledon lengths of three seedlings were measured in each plate. Germination counts and cotyledon measurements were recorded after seven days in the germinator. A completely randomized design GLM analysis of variance was used to analyze the counts and measurements.

The analysis of variance did not detect any differences between the plumed and unplumed seeds, so the means reported in the table are the combined means of the two seed types. The overall model did find significant germination and cotyledon length differences among populations and picloram concentrations. Germination counts decreased as picloram concentration increased, but the actual germination counts were not significantly different among populations within the 100 ppb and 200 ppb picloram concentrations (Table). Only the D2 population had significantly higher germination counts than the Nez Perce population at 300 ppb, but at 400 ppb the germination counts of the Nez Perce population was significantly lower (P=0.01) than all of the Columbia County germination counts.

When germination was expressed as a proportion of the control counts (0 ppb picloram), the proportion of the D2, D5 and D6 germination counts at 200 ppb were significantly greater than were those of the Nez Perce County population (Table). All of the Columbia County germination count proportions in the 400 ppb treatment were significantly greater (P=0.01) than the proportion of the Nez Perce accession counts.

Cotyledon length decreased as the picloram concentration increased (Table). Even at 100 ppb the proportion of the cotyledon length to the control length was significantly in all Columbia County populations than in the Nez Perce population. Both actual cotyledon length and proportion of control length of the D2, D4, D5 and D6 populations in the 200 ppb treatment were significantly greater than in the Nez Perce population, but at 400 ppb only the D2 and D5 populations had cotyledon lengths significantly greater than the Nez Perce cotyledon length.

Fewer actual cotyledon lengths from Columbia County actual cotyledon lengths were significantly different from the Nez Perce cotyledon lengths at the 100 ppb and 200 ppb treatments (Table). The D2 population was the only population that consistently had both a significantly longer cotyledon length and a significantly greater cotyledon length proportion than did the Nez Perce population at 300 ppb and 400 ppb. This suggests that at higher picloram concentrations, populations D3, D5 and D6 are more susceptible to picloram than D2, but less susceptible than the Nez Perce population.

This study indicates that the germination of all the Columbia County yellow starthistle populations are less susceptible to picloram than was the Nez Perce population. Both complete germination counts and cotyledon lengths detected significant differences among populations, but cotyledon length was the most sensitive indicator. Expressing each population's germination counts and cotyledon lengths as a proportion of the population control enhanced the ability to detect significant differences (P=0.01) at lower picloram concentrations. (Dept. of Plant, Soil and Entomol. Sci., Univ. of Idaho, Moscow, ID, 83843)

Effects of picloram on germination and cotyledon length of 1991 yellow starthistle seedlots

Picloram	Accession	Germination		Cotyledon	
		percent	proportion of control	length	proportion of control
(ppb)		(%)	(proportion)	(mm)	(proportion)
0	NZP	90.7	1.00	5.3	1.00
	D2	93.0	1.00	4.5	1.00
	D3	87.0	1.00	5.0	1.00
	D4	82.0	1.00	4.9	1.00
	D5	85.7	1.00	5.3	1.00
	D6	90.3	1.00	5.3	1.00
100	NZP	81.7	.90	3.6	.70
	D2	92.0	.99	4.2	.93*
	D3	86.7	.98	4.4	.87*
	D4	81.3	.97	4.6*	.94*
	D5	83.7	.97	4.5	.85*
	D6	91.7	1.01*	4.4	.85*
200	NZP	74.3	.82	2.9	.56
	D2	92.3	.99*	4.3*	.95*
	D3	71.0	.81	3.2	.64
	D4	76.3	.91	4.2*	.87*
	D5	82.0	.95*	4.4*	.82*
	D6	87.7	.97*	3.9*	.75*
300	NZP	61.7	.68	2.8	.54
	D2	79.3*	.85*	3.9*	.85*
	D3	68.7	.78	3.7*	.74*
	D4	67.7	.80*	3.6	.73*
	D5	67.3	.78	3.3	.61
	D6	65.0	.72	3.9*	.74*
400	NZP	50.7	.56	2.6	.49
	D2	76.0*	.82*	3.5*	.78*
	D3	71.0*	.81*	3.3	.65*
	D4	70.0*	.83*	3.0	.61
	D5	72.7*	.84*	3.5*	.66*
	D6	67.0	.74*	3.0	.57

* Means followed by asterisks within a picloram concentration column are significantly different from the Nez Perce County population according to LSMEANS (SAS, 1988; P=0.01).

ystpic91

The effects of pyridine herbicides in combination with atrazine for grass establishment in yellow starthistle habitat. Lass, L.W., R.H. Callihan, and F.E. Northam. Yellow starthistle (Centaurea solstitialis L. (CENSO)) is becoming a dominant species within the Columbia River drainages in the Pacific Northwest, and has entered the Great Basin. Yellow starthistle easily invades range sites and co-habit with annual weedy grasses like downy brome (Bromus tectorum L.) and medusahead (Taeniatherum caput-medusae (L.)Nevski). Controlling yellow starthistle with herbicides often releases undesirable annual grasses that are poor forages. The aggressive reinvasion by yellow starthistle in such annual grass sites has prevented effective economical range rehabilitation with a single herbicide application. Competitive grasses should be established to reduce the frequency of herbicide applications and prevent reinvasion by the weeds. The purpose of this study was to evaluate the tolerance of selected grasses to a herbicide for controlling annual grasses used to revegetate rangeland.

The grasses used in the study were:

bluegrass, Canby, (Poa secunda Presl.)

fescue, sheep, (Festuca ovina L. cv. Covar) (L).

fescue, hard, (Festuca ovina (L.) Koch var. duriuscula cv. Durar)

oatgrass, tall, (Arrhenatherum elatius (L.) Presl. cv. Tualatin)

wheatgrass, tall, (Thinopyrum ponticum (Podp.) Barkw. and D.R. Dewey (Agropyron elongatum) cv. Alkar)

wheatgrass, crested, (Agropyron cristatum (L.) Gaertner cv. Ephraim)

wheatgrass, crested, (Agropyron cristatum Gaerthn. cv. Hycrest)

wheatgrass pubescent, (Thinopyrum intermedium spp barbulatum (Schu) Barkw. cv. Luna (Agropyron tricophorum))

wheatgrass, crested (Agropyron desertorum (Fisher ex link) Shultes cv. Nordan)

wheatgrass, intermediate, (Thinopyrum intermedium spp intermedium (Host) Bark. and D.R. Dewey (Agropyron intermedium) cv. Oahe)

wheatgrass bluebunch, (Pseuderogneria spicata (Nevski) A. Love (Agropyron spicatum) cv. Secar)

wheatgrass, Siberian, (Agropyron fragile (Roth) Candargy (A. sibiricum) cv. P-27)

wheatgrass, streambank (Elymus lanceolatus (Scribner & J.G. Smith) Gould (Agropyron riparium) cv. Sodar).

The grasses were planted in randomized strips measuring 12 ft by 150 ft in four replications. The herbicide main effects in the strip block split-strip plot design consisted of single applications of clopyralid (2 oz ai/a), picloram (1 lb ai/a) and an untreated check. The four herbicide sub-plot treatments were single applications of atrazine (0.5, 1.0, and 1.5 lb ai/a) and a check.

The experiment was established near Lapwai, ID. on a Linville-Waha silt loam. The field was in wheat production in 1988 and was placed in the U.S.D.A. Conservation Reserve Program (CRP) in 1989. The soil pH was 5.89 and organic matter was 2.92%. The field slope was 20 to 35%, facing SE. The field was plowed, harrowed, and rodweeded prior to planting. The grasses were planted at a depth of 1 inch on May 12 to 15, 1989 using a drill seeder with 7 inch spacing and packer wheels. Prior to grass emergence, 0.5 lb ai /a glyphosate was applied on May 20, for control of emerged weeds. Pyridine and atrazine herbicides were applied on June 21 using a tractor sprayer with a 25 ft boom. The herbicides were applied without a surfactant. The sprayer delivered 31 gal/a water and travelled 1.13 mph. The air temperature was 71F and the sky was clear; the wind was 0 to 3 mph. Soil temperatures were 104F at surface, 68F at a depth of 2 inches, and 64F at 6 inches. The relative humidity was 50% and no dew was present.

Yellow starthistle and grass stands were estimated by counting the number of plants in two 0.74 m^2 (8 sq ft) rectangular quadrats in each plot in mid-July 1989. Visual estimate of chlorophyll loss were recorded on July 12, 1989. Visual estimates of grass and yellow starthistle density were recorded on March 27, 1990 and June 29, 1991. Complete results of the 1989 and 1990 evaluations were reported in past WSWS progress reports.

1989. The average number of yellow starthistle in the untreated check was 7.5 plants per 1 m^2. The number of living yellow starthistle plants in the clopyralid- and picloram-treated areas were fewer than 1 per m^2. The addition of atrazine at 1.5 lb ai/a decreased living yellow starthistle plants by more than 75%. The numbers of grass plants in clopyralid and picloram treatments were not different from those in check. Atrazine at 0.5 and 1.0 lb ai/a did not reduce the number of grass plants (data shown in WSWS 1990 Research progress report pp. 83).

Atrazine symptoms were detected in 12 of 13 established grasses in the picloram main plots, in 10 of 13 established grasses in the clopyralid plots, and in 7 of 13 established grasses, where no pyridine herbicides was applied. Atrazine did not appear to interact with pyridine herbicides to the detriment of the seedling grasses, and additive effects were not apparent. All grasses showed 50% or more chlorosis except for Tualatin tall oatgrass, Paiute orchard grass, Alkar tall wheatgrass, Nordan crested wheatgrass, and Sodar streambank wheatgrass when treated with atrazine at 1.0 lb ai/a in combination with clopyralid or picloram. In 1989, Canby bluegrass failed to establish.

1990. The picloram and clopyralid treatments controlled 100% of the yellow starthistle in 1990. Atrazine alone at rates of 1.0 lb ai/a reduced yellow starthistle density by about 50% and 1.5 lb ai/a suppressed the yellow starthistle density by 33% or more. Paiute orchard grass, Alkar tall wheatgrass, Ephraim intermediate wheatgrass, Luna pubescent wheatgrass, Nordan crested wheatgrass, and Oahe intermediate wheatgrass in combination with 1.5 lb ai/a atrazine suppressed 99% of the yellow starthistle when compared to the density of the check.

1991. The pyridine treatments continued to control 90 to 100% of the yellow starthistle in 1991. Yellow starthistle plants were in the clopyralid treatments but levels were low and generally inconsistent amoung replicates (Table). After three years, the direct residual affects of atrazine alone were not visible. Grasses treated with only atrazine at 1.0 and 1.5 lb ai/a tended to have less yellow starthistle if grasses were tall and/or provided a more dense cover than the checks. When compared to the untreated check, the only grass showing reduced yellow starthistle when treated with 1.5 lb ai/a atrazine alone was Luna pubescent wheatgrass. The lack of significant reduction of yellow starthistle populations in Alkar tall wheatgrass, Tualatin tall oatgrass, and Oahe intermediate wheatgrass was due in part to lower yellow starthistle populations in the non-chemical-treated check plots planted to these grasses.

Since yellow starthistle has not re-established in the pyridine treatments, further evaluations will be necessary to fully determine the competitive nature of the grasses in combination with the herbicides.
(Univ. of Idaho, Dept. of Plant, Soils, & Ent. Sci., Moscow, 83843)

Effects of pyridine herbicides in combination with atrazine on grasses as measured by chlorosis in 1991.

Herbicide	(lb ai/A)	Canby Blueg.	Covar Sheep Fescue	Durar Hard Fescue	Tutal. Tall Oatg.	Paiu. Orch. Grass	Alkar Tall Wheatg.	Ephr. Inter. Wheatg.	Hycr. Wheatg.	Luna Pub. Wheatg.	Nord. Wheatg.	Oahe Int. Wheatg.	Secar Wheatg.	P-27 Sib. Wheatg.	Sodar Stream. Wheatg.
Check +															
Atrazine	0	100 B A	100 B A	100 B A	100 A	100 A	100 B A	100 B	100 A	100 A	100 B A	100 A	88 B	100 A	80 B A
Atrazine	0.5	78 B A	78 B	60 B	95 A	106 A	109 B A	96 B	78 A	52 B A	93 B A	103 A	116 B A	101 A	86 B A
Atrazine	1	113 A	63 B C	93 B A	109 A	117 A	140 A	118 B A	101 A	58 B A	128 A	74 A	104 B A	120 A	186 A
Atrazine	1.5	62 B	153 A	128 A	124 A	46 B A	78 B	150 A	79 A	27 B	55 B C	107 A	150 A	113 A	186 A
Clopyralid 0.12 +															
Atrazine	0	0 C	0 C	0 C	0 B	0 B	0 C	0 C	1 B	0 B	0 C	1 B	0 C	0 B	0 B
Atrazine	0.5	0 C	0 C	13 C	0 B	0 B	5 C	0 C	1 B	0 B	0 C	3 B	8 C	8 B	0 B
Atrazine	1	0 C	0 C	0 C	0 B	0 B	0 C	0 C	1 B	0 B	0 C	2 B	0 C	0 B	0 B
Atrazine	1.5	0 C	0 C	0 C	0 B	0 B	0 C	0 C	3 B	0 B	25 C	1 B	0 C	0 B	0 B
Picloram 1.0 +															
Atrazine	0	0 C	0 C	0 C	0 B	0 B	0 C	0 C	0 B	0 B	0 C	0 B	0 C	0 B	0 B
Atrazine	0.5	0 C	0 C	0 C	0 B	0 B	0 C	0 C	0 B	0 B	0 C	0 B	0 C	0 B	0 B
Atrazine	1	0 C	0 C	0 C	0 B	0 B	0 C	0 C	0 B	0 B	0 C	0 B	0 C	0 B	0 B
Atrazine	1.5	0 C	0 C	0 C	0 B	0 B	0 C	0 C	0 B	0 B	0 C	0 B	0 C	0 B	0 B

Control expressed as a percent of untreated plot containing 132 yellow starthistle plants per square meter.

Any two means having a common letter within a column are not significantly different at the 5 % level of significance, using the Protected Duncan's Test.

Evaluation of various herbicides and herbicide-insecticide combinations for leafy spurge control. Lym, Rodney G., and Calvin G. Messersmith. Over 100 herbicides were screened for activity on leafy spurge in a series of greenhouse experiments conducted at North Dakota State University. The herbicides that showed potential for leafy spurge control were evaluated in field trials and compared to picloram, 2,4-D, and glyphosate applied alone or in various combinations. Certain herbicide-insecticide combinations, especially with ALS-inhibiting herbicides cause excessive broadleaf crop injury. It was hypothesized that adding an insecticide to an ALS-inhibiting herbicide that is phytotoxic to leafy spurge would increase control. The purpose of these experiments was to evaluate various herbicides applied alone and combined with other herbicides or insecticides for leafy spurge control.

The first screening experiment was established at West Fargo, ND, on June 14, 1990, in a dense stand of leafy spurge in the flower to early seed-set growth stage. The weather was partly cloudy with 65 F and 70% relative humidity. The soil was a loamy-clay with 7.5 pH. The second screening trial was established on September 24, 1990 near Amenia, ND. The leafy spurge was a dense stand in the fall regrowth stage, and vigorous. The weather was clear, 87 F, with 34% relative humidity, and the soil was similar to the West Fargo site. The herbicide-insecticide experiment was established on June 13, 1990 near Chaffee, ND, on a sandy soil with 7.8 pH. The weather was clear, 84 F, and 44% relative humidity, and the leafy spurge was in the flower to seed-set growth stage and vigorous.

Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 ft in a randomized complete block design with four replications. Leafy spurge control evaluations were based on a visual estimate of percent stand reduction as compared to the untreated check.

No herbicide treatment in the June applied screening experiment provided satisfactory leafy spurge control 3 or 12 months after treatment (MAT) (Table 1). However, several compounds provided good to excellent control when fall applied. Imazaquin at 4 oz/A provided 99 and 88% control 9 and 10 MAT with no grass injury. Nicosulfuron at 1 to 2 oz/A and quinclorac at 16 oz/A averaged 85% control 9 MAT but nicosulfuron injured grass severely, especially at the 2 oz/A rate. Glyphosate plus 2,4-D plus picloram provided 98% control 9 MAT but also caused 94% grass injury. Imazaquin at 4 oz/A, nicosulfuron at 1 and 2 oz/A, quinclorac at 16 oz/A, and the glyphosate plus 2,4-D plus picloram treatments fall-applied all provided better leafy spurge control 11 MAT than the standard treatment of picloram plus 2,4-D at 8 plus 16 oz/A, respectively. The addition of 2,4-D to most herbicides decreased control compared to the herbicides alone except when applied with glyphosate or picloram.

Imazamethabenz, AC-310488, EPTC, thifensulfuron plus tribenuron and primisulfuron did not provide satisfactory leafy spurge control either spring or fall applied (Table 1). The insecticides malathion and disulfoton applied with various herbicides in June did not increase leafy spurge control 3 or 12 MAT compared to the herbicides applied alone (Table 2).

Imazethapyr, imazaquin, nicosulfuron and quinclorac provided good to excellent leafy spurge control when fall applied and maintained control longer than picloram plus 2,4-D. Of these, only glyphosate plus 2,4-D and nicosulfuron injured grass which would limit their use in a leafy spurge control program. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo).

Table 1. Evaluation of various herbicide treatments spring or fall applied for leafy spurge control (Lym and Messersmith).

		Application date/evaluation (MAT)							
		14 June 90		24 Sept 90			24 Sept 1990		
Treatment	Rate	3	12	9	10	11	9	10	11
	oz/A	% control					% grass inj		
Imazamethabenz + X-77	1 + 0.5%	10	0	6	..	..	0	..	..
Imazamethabenz + X-77	2 + 0.5%	0	0	13	..	..	0	..	..
Imazamethabenz + 2,4-D + X-77	2 + 16 + 0.5%	30	5	28	..	..	0	..	..
AC-310488 + X-77	1 + 0.5%	9	5	5	..	..	0	..	..
AC-310488 + X-77	2 + 0.5%	3	0	0	..	..	0	..	..
AC-310488 + 2,4-D + X-77	1 + 16 + 0.5%	19	9	20	..	..	0	..	..
Imazethapyr + X-77	1 + 0.5%	10	0	67	39	27	0	0	0
Imazethapyr + X-77	2 + 0.5%	1	0	79	56	11	0	0	0
Imazethapyr + 2,4-D + X-77	1 + 16 + 0.5%	10	6	59	23	8	0	0	0
Imazaquin + X-77	2 + 0.5%	0	0	92	62	33	5	0	4
Imazaquin + X-77	4 + 0.5%	0	0	99	88	54	0	0	1
Imazaquin + 2,4-D + X-77	2 + 16 + 0.5%	20	8	69	33	28	0	0	0
EPTC + X-77	96 + 0.5%	0	0	9	..	28	0	..	..
EPTC + picloram	96 + 8 + 0.5%	49	35	81	..	..	0	..	..
Nicosulfuron + X-77	1 + 0.5%	5	0	85	68	53	38	11	10
Nicosulfuron + X-77	2 + 0.5%	0	0	85	79	67	76	26	28
Nicosulfuron + 2,4-D + X-77	1 + 16 + 0.5%	72	28	80	59	24	48	10	21
Quizalofop + X-77	1 + 0.5%	0	0	21	..	..	19	..	..
Quizalofop + X-77	2 + 0.5%	0	0	8	..	..	46	..	..
Quizalofop + 2,4-D + X-77	1 + 16 + 0.5%	23	23	15	..	..	0	..	..
Thifensulfuron + tribenuron	0.65 + 0.35 + 0.5%	14	0	0	..	..	0	..	..
Thifensulfuron + tribenuron	1.5 + 0.5 + 0.5%	5	0	5	..	..	0	..	..
Thifensulfuron + 2,4-D + X-77	0.65 + 0.35 + 16 + 0.5%	17	9	6	..	..	0	..	..
Primisulfuron + Agridex	0.29 + 1 qt	0	5	0	..	..	0	..	..
Primisulfuron + Agridex	0.6 + 1 qt	0	0	4	..	..	0	..	..
Primisulfuron + 2,4-D + Agridex	0.6 + 1 + 1 qt	11	5	23	..	..	0	..	..
Quinclorac	16	27	21	100	86	68	0	0	0
Quinclorac + Surftac (BAS-090)[a]	16 + 0.5%	3	4	85	80	67	3	0	0
Glyphosate + 2,4-D + X-77	0.4 + 0.7 + 0.5%	37	50	69	40	31	91	40	58
Glyphosate + 2,4-D + picloram + X-77	0.2 + 0.3 + 6 + 0.5%	57	75	..	..	..	11	..	..
Glyphosate + 2,4-D + picloram + X-77	0.4 + 0.7 + 8 + 0.5%	..	..	98	81	54	94	54	52
Picloram + 2,4-D	4 + 16	24	10	76	27	19	0	0	0
Picloram + 2,4-D	8 + 16	41	34	94	52	25	4	1	0
LSD (0.05)		18	18	21	24	28	15	17	14

[a]The additive BAS-090 at 1 qt/A was applied in place of Surftac with quinclorac applied in September.

Table 2. Evaluation of herbicide plus insecticide mixtures for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Control/MAT 3	Control/MAT 12
	oz/A	%	
Picloram + X-77	4 + 0.5%	49	21
Dicamba + X-77	32 + 0.5%	36	10
Imazethapyr + X-77	1 + 0.5%	4	0
Imazaquin + X-77	2 + 0.5%	0	3
Sulfometuron + X-77	1 + 0.5%	2	0
Picloram + malathion + X-77	4 + 8 + 0.5%	21	6
Dicamba + malathion + X-77	32 + 8 + 0.5%	28	0
Imazethapyr + malathion + X-77	1 + 8 + 0.5%	5	0
Imazaquin + malathion + X-77	2 + 8 + 0.5%	0	0
Sulfometuron + malathion + X-77	1 + 8 + 0.5%	0	0
Picloram + disulfoton + X-77	4 + 8 + 0.5%	51	9
Dicamba + disulfoton + X-77	32 + 8 + 0.5%	57	13
Imazethapyr + disulfoton + X-77	1 + 8 + 0.5%	6	3
Imazaquin + disulfoton + X-77	2 + 8 + 0.5%	5	0
Sulfometuron + disulfoton + X-77	1 + 8 + 0.5%	2	0
Malathion + X-77	8 + 0.5%	0	0
Disulfoton + X-77	8 + 0.5%	0	0
LSD (0.05)		17	8

Various spray additives applied with picloram and 2,4-D for leafy spurge control. Lym, Rodney G., and Frank A. Manthey. Picloram is the most effective herbicide for leafy spurge control and when applied with 2,4-D provides better control than picloram applied alone. Previous research at North Dakota State University has shown that less than 40% of the picloram applied to leafy spurge is absorbed and approximately 5% reaches the roots. The increased control from the addition of 2,4-D is due to decreased picloram metabolism, not increased absorption or translocation. A likely approach for increased picloram efficiency for leafy spurge control is to increase absorption and thereby increase the amount of picloram translocated to the roots. The purpose of these experiments was to evaluate various additives applied with picloram and picloram plus 2,4-D for increased leafy spurge control compared to the herbicides applied alone. Many spray additives were screened for potential to increase leafy spurge control with picloram and 2,4-D in greenhouse studies. Compounds with the most potential were evaluated in a series of field trials.

The first experiment evaluated picloram alone or applied with various spray additives as spring or fall applied treatments. The experiment was established on June 7 and September 19, 1990 near Valley City, ND, and June 24 and September 12, 1990 on the Sheyenne National Grasslands. A second experiment evaluated picloram plus 2,4-D applied alone or with various spray additives and was established at the same locations and dates as the picloram experiment. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 ft in a randomized complete block design with four replications. Leafy spurge control evaluations were based on a visual estimate of percent stand reduction as compared to the untreated check.

The additives evaluated included the commercial surfactants, X-77, LI-700, Silwett L-77, Triton CS-7, Triton X-100, Triton N-57 and Surftac. Industrial surfactants evaluated were Gafac RA-600 (free acids of a complex organic phosphate ester), Emulphor ON-877 (polyoxyethylated fatty alcohol), Mapeg 400 MO (PEG 400 Monooleate), Pluronic L63 (block copolymers of propylene oxide and ethylene oxide), and Tetronic 1504 (block copolymers of ethylene oxide and propylene oxide).

Leafy spurge control for the June-applied treatments averaged over both locations 15 months after the first treatment (MAFT) increased or tended to increase when picloram at 0.25 lb/A was applied with all additives evaluated except Surftac compared to picloram alone (Table 1). Leafy spurge control with picloram at 0.25 lb/A alone was 54% averaged over both locations compared to 77% when applied with the spray additives (except Surftac). Control for the September-applied treatments was similar regardless whether picloram at 0.5 lb/A was applied alone or with a spray additive.

In the second experiment leafy spurge control averaged over both locations 15 MAFT for the June-applied treatments tended to increase when picloram plus 2,4-D at 0.25 plus 1 lb/A was applied with Pluronic L63 (Table 2). Control was similar with all other additives applied with picloram plus 2,4-D compared to the herbicide alone in June except Triton X-100 which tended to decrease control. As with picloram alone, control for picloram plus 2,4-D applied in September was similar regardless of the additive.

In general, leafy spurge control was increased slightly when a spray additive was added to picloram or picloram plus 2,4-D applied in June but not in September. The additives that did increase short-term control with picloram or picloram plus 2,4-D represent several groups of chemicals. Thus, it is not yet possible to narrow the focus for the "ideal" spray additive with these herbicides for leafy spurge control. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

Table 1. Evaluation of picloram plus various additives applied in spring or fall for leafy spurge control (Lym and Manthey).

Application time and additive	Rate[a]	Location/evaluation date (MAFT)[b] Valley City 3/9	12	15	Sheyenne 3/9	12	15	Mean[c] 15/12
	- % -	%						
June								
None	..	36	5	28	64	11	80	54
Pluronic L63	0.5	47	3	76	74	26	87	81
Tetronic 1504	0.5	57	7	66	77	22	79	72
Triton X-100	0.5	50	4	58	78	15	91	75
Triton CS-7	0.5	66	9	54	69	16	90	75
Surftac	0.5	50	11	33	56	16	85	59
X-77 + L-77	0.25 + 0.25	62	10	60	74	44	95	77
Mapeg 400 MO	0.5	63	12	66	78	27	96	81
LI-700	0.5	56	3	43	80	31	93	72
X-77	0.5	54	6	56	80	21	96	76
Gafac RA-600	0.5	57	6	65	86	40	96	81
Emulphor ON-877	0.5	60	7	70	78	16	96	83
LSD (0.05)		21	NS	18	20	NS	14	11
September								
None	..	74	9	..	93	45	..	27
Pluronic L63	0.5	79	12	..	97	45	..	28
Tetronic 1504	0.5	84	14	..	95	35	..	24
Triton X-100	0.5	81	13	..	97	39	..	26
Triton CS-7	0.5	83	10	..	97	62	..	36
Surftac	0.5	86	12	..	96	26	..	19
X-77 + L-77	0.25 + 0.25	83	11	..	93	23	..	17
Mapeg 400 MO	0.5	83	9	..	90	43	..	26
LI-700	0.5	83	6	..	97	35	..	21
X-77	0.5	90	13	..	92	39	..	26
Gafac RA-600	0.5	78	5	..	93	58	..	31
Emulphor ON-877	0.5	82	21	..	95	63	..	42
LSD (0.10)		9	NS		NS	NS		NS

[a]Picloram was applied at 0.25 lb/A in June or 0.5 lb/A in September.

[b]Months after first treatment.

[c]Mean 15 or 12 MAFT for spring or fall applied treatments, respectively, (LSD = 0.15).

Table 2. Evaluation of picloram plus 2,4-D applied in the spring or fall with various additives for leafy spurge control (Lym and Manthey).

Application time/ additive	Rate[a]	Valley City 3/9	Valley City 12	Valley City 15	Sheyenne 3/9	Sheyenne 12	Sheyenne 15	Mean 15/12
		Location/evaluation date (MAFT)[b]						
	- % -	%						
June								
None	..	47	18	28	84	51	43	61
Pluronic L63	0.5	56	13	62	90	39	94	78
Tetronic 1504	0.5	36	12	31	88	48	94	62
Triton X-100	0.5	31	13	18	91	44	94	45
Triton CS7	0.5	39	7	44	80	19	92	68
Surftac	0.5	38	9	31	87	31	93	62
X-77 + L-77	0.25 + 0.25	31	9	17	83	46	93	55
Mapeg 400 MO	0.5	38	13	30	84	43	92	61
LI-700	0.5	34	9	25	77	24	92	58
X-77	0.5	36	8	39	81	25	92	66
Gafac RA-600	0.5	38	3	25	85	40	92	58
Triton N57	0.5	35	12	28	79	36	94	50
LSD (0.05)		NS	NS	25	NS	NS	NS	17
September								
None	..	79	10	..	92	20	..	15
Pluronic L63	0.5	91	18	..	94	27	..	22
Tetronic 1504	0.5	87	8	..	95	10	..	9
Triton X-100	0.5	84	13	..	94	3	..	8
Triton CS7	0.5	82	11		96	23		17
Surftac	0.5	79	3	..	95	46	..	25
X-77 + L-77	0.25 + 0.25	85	24	..	96	23	..	24
Mapeg 400 MO	0.5	82	15	..	97	26	..	21
LI-700	0.5	89	18	..	96	27	..	23
X-77	0.5	88	12	..	93	25	..	19
Gafac RA-600	0.5	82	6	..	93	13	..	10
Triton N57	0.5	86	13	..	97	21	..	17
LSD (0.05)		NS	NS		NS	NS		NS

[a]Picloram was applied at 0.25 or 0.5 lb/A plus 2,4-D at 1 lb/A in June and September, respectively.

[b]Months after original treatment

[c]Mean 15 or 12 MAFT for spring or fall applied treatments, respectively, (LSD = 0.15).

Leafy spurge control with quinclorac applied with various additives. Lym, Rodney G. Quinclorac is an auxin type herbicide with moderate soil residual. Previous greenhouse research at North Dakota State University has shown quinclorac will injure leafy spurge and may be more effective when applied with a seed oil additive rather than alone. The purpose of this research was to evaluate quinclorac applied alone and in combination with picloram or various spray additives at several leafy spurge growth stages.

The first experiment was established in June and July 1989 near Hunter, ND, when leafy spurge was in the true flower and late seed-set growth stages, respectively. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 25 ft in a randomized complete block design with four replications. Evaluations were based on a visual estimate of percent stand reduction as compared to the control. Quinclorac was applied with soybean oil plus Atplus 300F emulsifier rather than the recommended oil additive BAS-090 because that additive caused rapid injury to leafy spurge leaves in greenhouse trials. However, in subsequent field research, BAS-090 alone did not injure leafy spurge severely and was included in the second experiment. The second experiment was established near West Fargo on September 14, 1990, when leafy spurge was in the fall regrowth stage, 20 to 30 inches tall with 2 to 3 inch new fall growth. The experimental design was as previously described except the plots were 10 by 30 ft.

Quinclorac provided an average of 50% and 35% leafy spurge control in August when applied in June and July, respectively (Table 1). Adding soybean oil plus Atplus 300F or Silwett L-77 generally did not improve control compared to quinclorac applied alone. Picloram plus 2,4-D and picloram plus quinclorac when applied in June or July provided similar leafy spurge control.

Quinclorac provided much better leafy spurge control when applied in September compared to June or July (Tables 1 and 2). Quinclorac at 1 lb/A plus BAS-090 provided better leafy spurge control than quinclorac applied alone or with the seed-oil-based additive Scoil (Table 2). Control with quinclorac plus BAS-090 was similar to picloram plus 2,4-D at 0.5 plus 1 lb/A, the most commonly used fall-applied treatment. Quinclorac applied with picloram or picloram plus BAS-090 provided similar control to picloram plus 2,4-D and quinclorac plus BAS-090. Scoil applied with picloram did not improve leafy spurge control compared to picloram alone and reduced control when applied with picloram plus 2,4-D. Leafy spurge control declined rapidly after the July 1991 evaluation and all treatments were reapplied in September 1991.

Quinclorac plus BAS-090 fall-applied provided good leafy spurge control and may be an alternative to picloram plus 2,4-D. There was no grass injury with any treatment. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo, 58105).

Table 1. Quinclorac alone, with various additives, or with picloram for leafy spurge control (Lym).

Application date and treatment	Rate	Evaluation date Aug 89	June 90	Aug 90
	—— lb/A ——	——	% control	——
June 1989				
Quinclorac + soybean oil + Atplus 300F	0.5 + 1 qt + 1%	60	4	0
Quinclorac + soybean oil + Atplus 300F	1 + 1 qt + 1%	26	1	1
Quinclorac + Silwett L-77	1 + 0.25%	55	38	16
Quinclorac	1	55	41	31
Picloram + quinclorac	0.25 + 0.5	72	26	10
Picloram + 2,4-D	0.25 + 0.5	80	14	4
July 1989				
Quinclorac + soybean oil + Atplus 300F	0.5 + 1 qt + 1%	34	3	0
Quinclorac + soybean oil + Atplus 300F	1 + 1 qt + 1%	53	6	1
Quinclorac + Silwett L-77	1 + 0.25%	28	22	2
Quinclorac	1	28	17	3
Picloram + quinclorac	0.25 + 0.5	66	9	0
Picloram + 2,4-D	0.25 + 0.5	80	0	0
LSD (0.05)		24	NS	17

Table 2. Quinclorac and picloram with various additives applied in September 1990 for leafy spurge control (Lym).

Treatment	Rate	Evaluation date June 91	July 91
	—— lb/A ——	— % control	—
Quinclorac + BAS-090	1 + 1 qt	90	63
Quinclorac + Scoil	1 + 1 qt	74	56
Quinclorac	1	49	26
Quinclorac + picloram	1 + 0.5	85	64
Quinclorac + picloram + BAS-090	1 + 0.5 + 1 qt	91	77
Picloram + 2,4-D	0.5 + 1	81	67
Picloram + 2,4-D + Scoil	0.5 + 1 + 1 qt	43	22
Picloram + 2,4-D + BAS-090	0.5 + 1 + 1 qt	57	19
Picloram + Scoil	0.5 + 1 qt	71	34
Picloram	0.5	60	12
LSD (0.05)		28	36

The control of leafy spurge (*Euphorbia esula* L.) with various rates of picloram. M.A. Ferrell. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of various rates of picloram on the control of leafy spurge. Retreatments are light rates of picloram or picloram/2,4-D tankmixes and will be applied as needed to attain or maintain 80% control. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. The initial herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 40 psi May 24, 1989 (air temp. 56 F, soil temp. 0 inch 74 F, 1 inch 77 F, 2 inch 76 F, 4 inch 75 F, relative humidity 45%, wind west at 3-5 mph, sky partly cloudy). Retreatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi June 6, 1990 (air temp. 72 F, soil temp. 0 inch 87 F, 1 inch 85 F, 2 inch 83 F, 4 inch 75 F, relative humidity 51%, wind south at 10 mph, sky partly cloudy). The soil was classified as a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in the full bloom stage and 12 to 14 inches in height, for the initial treatments and in full bloom and 20 inches in height for the retreatments. Infestations were heavy throughout the experimental area. Visual weed control evaluations were made June 6, 1990 and June 13, 1991.

Plots with initial treatments of 1.25 lb ai/a picloram and greater gave 80% or better leafy spurge control and did not require retreatment in 1990. All other plots required retreatment. Retreatments were 0.25 lb or 0.5 lb ai/a picloram or 0.25 lb picloram plus 1.0 lb ai/a 2,4-D amine. Initial treatments maintaining 80% control or better in 1991 were two 1.5 lb picloram treatments, one 1.75 lb picloram treatment and all 2.0 lb picloram treatments. The only 1990 retreatment attaining 80% control or better in 1991 was 0.5 lb picloram over an initial treatment of 1.0 lb picloram. Plots with less than 80% control in 1991 were retreated. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1635.)

Leafy spurge control

Treatment[1]	Rate (lb ai/a)	Retreatment[2]	Rate (lb ai/a)	Percent control[3] 1990	1991
picloram	0.25	picloram	0.25	30	43
picloram	0.5	picloram	0.25	48	53
picloram	0.5	picloram	0.5	50	79
picloram	0.5	picloram + 2,4-D amine	0.25 + 1.0	44	71
picloram	0.75	picloram	0.25	60	78
picloram	0.75	picloram	0.5	65	71
picloram	0.75	picloram + 2,4-D amine	0.25 + 1.0	63	65
picloram	1.0	picloram	0.25	76	75
picloram	1.0	picloram	0.5	74	81
picloram	1.0	picloram + 2,4-D amine	0.25 + 1.0	71	74
picloram	1.25	picloram	0.25	84	74
picloram	1.25	picloram	0.5	87	75
picloram	1.25	picloram + 2,4-D amine	0.25 + 1.0	81	63
picloram	1.5	picloram	0.25	89	80
picloram	1.5	picloram	0.5	91	80
picloram	1.5	picloram + 2,4-D amine	0.25 + 1.0	87	75
picloram	1.75	picloram	0.25	93	78
picloram	1.75	picloram	0.5	93	84
picloram	1.75	picloram + 2,4-D amine	0.25 + 1.0	92	79
picloram	2.0	picloram	0.25	95	84
picloram	2.0	picloram	0.5	97	85
picloram	2.0	picloram + 2,4-D amine	0.25 + 1.0	98	87
picloram + 2,4-D amine	0.25 + 1.0	picloram + 2,4-D amine	0.25 + 1.0	35	74
(LSD 0.05)				10	16
(CV)				10	16

[1]Treatments applied May 24, 1989.
[2]Retreatments applied to maintain or attain 80% control June 6, 1990
[3]Visual evaluations June 6, 1990 and June 13, 1991.

Picloram with various additives for control of leafy spurge. Ferrell, M.A. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of picloram with or without various additives on the control of leafy spurge. Plots were 10 by 13.5 ft. with four replications arranged in a randomized complete block. Spring treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 40 gpa at 40 psi June 6, 1990 (air temp. 66 F, soil temp. 0 inch 83 F, 1 inch 78 F, 2 inch 73 F, 4 inch 65 F, relative humidity 53%, wind south at 10 mph, sky partly cloudy). Late summer treatments were applied September 13, 1990 (air temp. 68 F, soil temp. 0 inch 90 F, 1 inch 90 F, 2 inch 83 F, 4 inch 80 F, relative humidity 48%, wind north at 10 mph, sky clear). The soil was classified as a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in the full bloom stage and 12 to 14 inches in height, for the spring treatments and past seed production and 14 to 20 inches in height, for the late summer treatments. Infestations were heavy thoughout the experimental area. Visual evaluations were made September 13, 1990 and June 13, 1991.

Several spray additives plus picloram increased supression of leafy spurge compared to picloram alone 3 months after spring treatment. However, by the following spring no difference was shown between any treatments, whether spring or late summer applied. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1640.)

Leafy spurge control with 0.5 lb ai/a picloram with various additives

		1990 aplication date/evaluation date		
Treatment	Rate	June 6/ Sept 13, 1990	June 6/ June 13, 1991	Sept 13/ June 13, 1991
		----------(percent control[1])----------		
Surphtac	2 qt/a	81	30	40
Sprayfus 90	1 qt/a	84	30	40
Aacess Penetrator	1 qt/a	83	30	40
Sulfac DG	2 lb/a	83	30	40
Silwet	0.1% v/v	85	33	40
Enhance	0.5% v/v	81	33	38
picloram	0.5 lb ai/a	73	33	40
(LSD 0.05)		9	4	3
(CV)		9	10	5

[1]Percent control by visual evaluation.

Control of leafy spurge with retreatments of picloram and 2,4-D LVE. Ferrell, M.A. and T.D. Whitson. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of retreatments of picloram and 2,4-D LVE on the control of leafy spurge. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. The original herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 35 psi May 28, 1987 (air temp. 60 F, soil temp. 0 inch 60 F, 1 inch 55 F, relative humidity 75%, wind west at 10 mph, sky cloudy). Retreatment information is as follows: July 6, 1988 (air temp. 93 F, soil temp. 0 inch 110 F, 1 inch 95 F, 2 inch 83 F, 4 inch 80 F, relative humidity 38%, wind south at 5 mph, sky partly cloudy): June 6, 1989 (air temp. 80 F, soil temp. 0 inch 100 F, 1 inch 97 F, 2 inch 80 F, 4 inch 73 F, relative humidity 45%, wind south at 3 mph, sky clear): and June 6, 1990 (air temp. 70 F, soil temp. 0 inch 83 F, 1 inch 78 F, 2 inch 75 F, 4 inch 65 F, relative humidity 50%, wind south at 10, sky partly cloudy). The soil was classified as a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in the full bloom stage and 8 to 12 inches in height, for the original treatments and in seed set and 12 to 16 inches in height, for the retreatments. Infestations were heavy thoughout the experimental area. Visual weed control evaluations were made June 8, 1988, May 25, 1989, June 6, 1990 and June 12, 1991.

Leafy spurge control in 1988 was 80% or better with picloram at rates greater than 1.0 lb ai/a. No 1988 retreatments increased leafy spurge control to 80% or better. Picloram at 0.25 lb ai/a and 2,4-D LVE at 1.0 and 2.0 lb ai/a were the only 1989 retreatments that didn't increase leafy spurge control to 80% or better. Picloram at 0.25 lb and 2,4-D at 1.0 lb were the only 1990 retreatments that did not increase leafy spurge control to 80% or better. Picloram at 2.0 lb ai/a maintained 80% or better shoot control through 1990 before retreatment was needed. Picloram at 1.0, 1.25, 1.5, 1.75 and picloram + 2,4-D maintained 80% control or better in 1991. Plots with less than 80% control were retreated again June 13, 1991. Retreatments will be applied as needed to maintain or attain 80% leafy spurge shoot control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1634.)

Leafy spurge control

	Rate (lb ai/a)							
		Retreatment			Percent control[2]			
Treatment[1]	Original	1988	1989	1990	1988	1989	1990	1991
picloram	0.25	0.25	0.25	0.25	5	13	54	54
picloram	0.5	0.5	0.5	none	48	28	89	73
picloram	0.75	0.5	0.5	none	59	50	88	75
picloram	1.0	0.5	0.5	none	75	68	96	86
picloram	1.25	none	0.5	none	83	76	94	86
picloram	1.5	none	0.5	none	80	65	93	85
picloram	1.75	none	0.5	none	83	73	96	88
picloram	2.0	none	none	none	89	81	82	76
picloram + 2,4-D LVE	0.25 + 1.0	0.25 + 1.0	0.25 + 1.0	none	25	51	92	85
2,4-D LVE	1.0	1.0	1.0	1.0	0	15	70	74
2,4-D LVE	2.0	2.0	2.0	2.0	18	34	78	85
Check	none	none	none	none	0	0	0	0
(LSD 0.05)					17	21	11	14
(CV)					25	32	10	14

[1]Original treatments applied May 28, 1987. Retreatments applied July 6,1988; June 6, 1989; and June 6, 1990.
[2]Visual evaluations June 8, 1988; May 25, 1989; June 6, 1990; and June 12,1991.

Control of leafy spurge with initial treatments of glyphosate and retreatment with various herbicides. Ferrell, M.A. and T.D. Whitson. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of initial treatments of glyphosate and retreatment with picloram, 2,4-D LVE, dicamba, glyphosate and fluroxypyr on the control of leafy spurge. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Three initial glyphosate treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi June 6, 1989 (air temp. 76 F, soil temp. 0 inch 97 F, 1 inch 90 F, relative humidity 45%, wind south at 3 mph, sky clear), July 19, 1989 (air temp. 75 F, soil temp. 0 inch 108 F, 1 inch 90 F, relative humidity 55%, wind calm, sky clear), and September 12, 1989 (air temp. 48 F, soil temp. 0 inch 78 F, 1 inch 65 F, relative humidity 55%, wind southeast at 5 mph, sky clear). Retreatments were applied September 13, 1990 (air temp. 65 F, soil temp. 0 inch 80 F, 1 inch 75 F, relative humidity 50%, wind north at 5 mph, sky clear). The soil was classified as a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in the full bloom stage and 12 to 16 inches in height, for the initial treatments and in seed set and 14 to 24 inches in height, for the retreatments. Infestations were heavy thoughout the experimental area. Visual evaluations were made June 6, 1990; July 12, 1990; September 13, 1990 and June 18, 1991.

The first and second treatments of glyphosate slightly stunted the leafy spurge two and one months after treatment, respectively. Leafy spurge also failed to develop seed. There was little perennial grass injury with glyphosate, however, seed development was inhibited with all treatments.

June 6, 1990 evaluations found all glyphosate treated plots maintaining 100% leafy spurge control. Grass damage was approximately 50%. However, by July 12, 1990 leafy spurge control had dropped to 60% and by September 13, 1990 had dropped to 0% control.

Retreatments were applied September 13, 1990. The only retreatments attaining 80% leafy spurge control or better June 18, 1991 were 0.75 (90%) and 1.0 (88%) lb of picloram and 2.0 (81%) lb of dicamba. Initial treatments of picloram at 0.75 and 1.0 lb only attained 60 and 74% control, respectively. Initial treatments of 2.0 lb of dicamba usually provide little or no control of leafy spurge one year after application. There was no grass damage in 1991. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1637.)

Leafy spurge control

Treatment[1]	Rate	Retreatment[2]	Rate	Control[3] June 6 1990	Control[3] July 12 1990	Control[3] Sept. 13 1990	Control[3] June 18 1991	Grass Damage June 6 1990
	lb ai/a		lb ai/a	%				
glyphosate	0.38	2,4-D LVE	1.0	100	60	0	33	50
glyphosate	0.38	2,4-D LVE	2.0	100	60	0	35	50
glyphosate	0.38	picloram	0.25	100	60	0	63	54
glyphosate	0.38	picloram	0.5	100	60	0	71	55
glyphosate	0.38	picloram	0.75	100	60	0	90	54
glyphosate	0.38	picloram	1.0	100	60	0	88	53
glyphosate	0.38	dicamba	1.0	100	60	0	56	50
glyphosate	0.38	dicamba	2.0	100	60	0	81	50
glyphosate	0.38	fluroxypyr	0.5	100	60	0	56	50
glyphosate	0.38	glyphosate	0.38	100	60	0	37	50
fluroxypyr	0.5	----	----	----	----	----	10	----
picloram	0.25	----	----	----	----	----	13	----
picloram	0.5	----	----	----	----	----	30	----
picloram	0.75	----	----	----	----	----	60	----
picloram	1.0	----	----	----	----	----	74	----
picloram	2.0	----	----	99	79	79	81	----
(LSD .05)				0.2	4	4	19	5
(CV)				0.2	6	56	26	11

[1]0.38 lb glyphosate applied 6/6/89, 7/19/89 and 9/12/89. Other treatments applied 9/13/90.
[2]Retreatments applied 9/13/90.
[3]Percent control and grass damage by visual estimation.

Dicamba tankmixes for control of leafy spurge. Ferrell, M.A. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of tankmixes of dicamba or 2,4-D LVE or picloram on the control of leafy spurge. Treatments and retreatments have been applied to maintain or attain 80% leafy spurge control. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 40 psi May 24, 1989 (air temp. 56 F, soil temp. 0 inch 74 F, 1 inch 77 F, relative humidity 45%, wind west at 3 mph, sky partly cloudy). Retreatments were applied June 7, 1990 (air temp. 62 F, soil temp. 0 inch 55 F, 1 inch 53 F, relative humidity 55%, wind south at 3 mph, sky partly cloudy). The soil was classified as a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in the full bloom stage and 12 to 20 inches high, for both initial treatments and retreatments. Infestations were heavy thoughout the experimental area. Visual evaluations were made June 6, 1990 and June 18, 1991.

No initial 1989 treatments attained 80% control in 1990. 1990 retreatments attained 80% control or better in all plots, except where the initial treatment was 2.0 lb dicamba or 2.0 lb dicamba plus 1.0 lb 2,4-D LVE, one year after application. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1636.)

Leafy spurge control

				Percent control[3]	
Treatment[1]	Rate	Retreatment[2]	Rate	June 6 1990	June 18 1991
	lb ai/a		lb ai/a		
dicamba	2.0	dicamba	2.0	58	73
dicamba + 2,4-D LVE	1.0 + 1.0	dicamba + 2,4-D LVE	1.0 + 1.0	50	79
dicamba + picloram	1.0 + 0.25	dicamba + picloram	1.0 + 0.25	58	80
dicamba + picloram	1.0 + 0.5	dicamba + picloram	1.0 + 0.5	65	86
dicamba + picloram + 2,4-D LVE	1.0 + 0.5 + 1.0	dicamba + picloram + 2,4-D LVE	1.0 + 0.5 + 1.0	73	88
(LSD 0.05)				9	5
(CV)				12	5

[1]Treatments applied May 24, 1989.
[2]Retreatments applied June 7, 1990.
[3]Percent control by visual estimation.

Imazethapyr for control of leafy spurge. Ferrell, M.A. This research was conducted near Devil's Tower, Wyoming to evaluate leafy spurage control with imazethapyr alone or in combination with dicamba or 2,4-D LVE or picloram. Plots were 10 by 13.5 ft. with four replications arranged in a randomized complete block. Spring treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 40 gpa at 40 psi June 6, 1990 (air temp. 62 F, soil temp. 0 inch 80 F, 1 inch 78 F, 2 inch 73 F, 4 inch 65 F, relative humidity 60%, wind south at 3 mph, sky partly cloudy). Late summer treatments were applied September 12, 1990 (air temp. 86 F, soil temp. 0 inch 85 F, 1 inch 87 F, 2 inch 83 F, 4 inch 80 F, relative humidity 20%, wind south at 5 mph, sky clear). The soil was classified as a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in the full bloom stage and 12 to 14 inches in height, for the spring treatments and past seed production and 14 to 20 inches in height, for the late summer treatments. Infestations were heavy thoughout the experimental area. Visual evaluations were made September 13, 1990 and June 18, 1991.

Supression of leafy spurge was evident 3 months after treatment and none of the spurge in the treated plots had produced seed. However, by the following spring the only treatment showing any effective control was 2.0 lb ai/a picloram. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1639.)

Leafy spurge control

		1990 aplication date/evaluation date		
Treatment	Rate	June 6/ Sept 13, 1990	June 6/ June 18, 1991	Sept 12/ June 18, 1991
	(lb ai/a)	-----------	(percent control[1])	-----------
imazethapyr[2]	0.063	0	0	5
imazethapyr[2]	0.094	1	0	8
imazethapyr[2]	0.125	0	0	13
imazethapyr + 2,4-D LVE[2]	0.063 + 1.0	68	4	20
imazethapyr + picloram[2]	0.063 + 0.25	55	8	10
imazethapyr + dicamba[2]	0.063 + 1.0	30	5	13
imazethapyr + 2,4-D LVE[2]	0.094 + 1.0	70	10	35
imazethapyr + picloram[2]	0.094 + 0.25	33	13	23
imazethapyr + dicamba[2]	0.094 + 1.0	35	13	18
imazethapyr + 2,4-D LVE[2]	0.125 + 1.0	81	5	25
imazethapyr + picloram[2]	0.125 + 0.25	53	10	20
imazethapyr + dicamba[2]	0.125 + 1.0	43	5	20
picloram	2.0	96	91	95
(LSD 0.05)		20	11	14
(CV)		34	67	44

[1]Percent control by visual estimation.
[2]Surfactant (X-77) added at 0.25% v/v. 32-0-0 liquid fertilizer added at 1.0 quart N/acre.

Control of leafy spurge with sulfosate. Ferrell, M.A. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of sulfosate on the control of leafy spurge. Plots were 10 by 13.5 ft. with four replications arranged in a randomized complete block. Spring treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 40 gpa at 40 psi June 6, 1990 (air temp. 66 F, soil temp. 0 inch 83 F, 1 inch 78 F, 2 inch 72 F, 4 inch 65 F, relative humidity 53%, wind south at 8 mph, sky partly cloudy). Late summer treatments were applied September 12, 1990 (air temp. 90 F, soil temp. 0 inch 100 F, 1 inch 90 F, 2 inch 83 F, 4 inch 80 F, relative humidity 20%, wind calm, sky clear). The soil was classified as a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in the full bloom stage and 12 to 14 inches in height, for the spring treatments and past seed production and 14 to 20 inches in height, for the late summer treatments. Infestations of leafy spurge were heavy thoughout the experimental area. Visual evaluations were made September 13, 1990 and June 13, 1991.

Sulfosate in combination with picloram or 2,4-D LVE only provided supression of leafy spurge 3 months after spring treatments were applied. By the following spring no treatments, whether spring or late summer applied, provided adequate leafy spurge control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1641.)

Leafy spurge control

		1990 aplication date/evaluation date		
Treatment	Rate	June 6/ Sept 13, 1990	June 6/ June 13, 1991	Sept 12/ June 13, 1991
	(lb ai/a)	(percent control)[1]		
sulfosate	0.25	10	0	0
sulfosate	0.5	15	0	0
sulfosate	0.75	20	0	8
sulfosate + picloram	0.25 + 0.5	75	18	18
sulfosate + picloram	0.5 + 0.5	79	26	18
sulfosate + picloram	0.75 + 0.5	78	28	26
sulfosate + dicamba	0.25 + 1.0	19	8	5
sulfosate + dicamba	0.5 + 1.0	21	3	3
sulfosate + dicamba	0.75 + 1.0	25	0	0
sulfosate + 2,4-D LVE	0.25 + 1.0	76	3	3
sulfosate + 2,4-D LVE	0.5 + 1.0	68	5	3
sulfosate + 2,4-D LVE	0.75 + 1.0	60	0	0
(LSD 0.05)		24	9	11
(CV)		40	96	117

[1]Percent control by visual evaluation.

Quinclorac activity on leafy spurge. M.A. Ferrell. This research was conducted near Devil's Tower, Wyoming to evaluate various rates of quinclorac alone and in combination with 2,4-D LVE, dicamba, or picloram on the control of leafy spurge. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. The initial herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 40 psi September 25, 1990 (air temp. 65 F, soil temp. 0 inch 70 F, 1 inch 65 F, 2 inch 60 F, 4 inch 60 F, relative humidity 34%, wind south at 3 mph, sky clear). The soil was classified as a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was past the seed production stage of growth and 14 to 20 inches in height. Infestations were heavy throughout the experimental area. Visual weed control evaluations were made June 18, 1991.

Quinclorac at 0.5 lb and combinations of 0.5 lb quinclorac with 2,4-D LVE, dicamba or picloram showed very poor leafy spurge control eight months after application. Quinclorac at 1.0 lb gave 64% control. Combinations of 1.0 lb quinclorac with 2,4-D LVE, dicamba, or picloram gave 71, 75, and 80 percent control, respectively. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1643.)

Leafy spurge control

Treatment[1]	Rate	Control[2] 1991
	(lb ai/a)	(%)
quinclorac[3]	0.5	25
quinclorac + 2,4DLVE[3]	0.5 + 1.0	35
quinclorac + dicamba[3]	0.5 + 1.0	36
quinclorac + picloram[3]	0.5 + 0.5	46
quinclorac[3]	1.0	64
quinclorac + 2,4-DLVE[3]	1.0 + 1.0	71
quinclorac + dicamba[3]	1.0 + 1.0	75
quinclorac + picloram[3]	1.0 + 0.5	80
(LSD 0.05)		11
(CV)		16

[1]Treatments applied September 25, 1990.
[2]Visual evaluations June 18, 1991.
[3]Crop oil concentrate (Sunit) added at 1 quart per acre.

The control of leafy spurge (*Euphorbia esula* L.) by the interaction of herbicides and perennial grasses. M.A. Ferrell, T.D. Whitson, D.W. Koch, and A.E. Gade. Plant competition has long been recognized as an important method of weed control. This experiment was established near Sundance, WY to evaluate the effects of eleven perennial grass species on leafy spurge. Two applications of glyphosate at 0.75 lb ai/A were broadcast with a truck-mounted sprayer delivering 15 gpa at 35 psi, before seeding grasses in 1986. The first application was June 2, 1986 (temperature: air 69F, soil surface, 65F, 1 inch 64, 2 inch 63F, 4 inch 63F, relative humidity: 58%, wind: calm) and the second application was July 1, 1986 (temperature: air 85F, soil surface, 85F, 1 inch 84, 2 inch 81F, 4 inch 80F, relative humidity: 40%, wind: 2 to 3 mph from the west). Soils were classified as a slit loam (22% sand, 58% silt, 20% clay) with 1.8% organic matter and 6.3 pH. Pendimethalin at 2.0 and fluroxypyr at 0.5 lb ai/A were applied postemergent May 16, 1988 with a tractor mounted sprayer delivering 20 gpa at 35 psi. (Temperature: air 73F, 1 inch 68F, 2 inch 67F, 4 inch 64F. Relative humidity: 64%. Wind: 2 to 3 mph from the northwest). Plots (60 by 90 ft) were arranged in a split plot design with four replications. One half of the plot was tilled and the other half left untilled. Plots were tilled with a rototiller on August 12, 1986 and grasses were seeded with a John Deere powertill drill on August 12, 1986. Evaluations on percent grass stand, percent leafy spurge control, and pounds of air dry grass per acre have been taken yearly since 1988.

Grasses included in the study were wheatgrass, pubescent; var. Luna *Aropyron intermedium* var. *trichophorum* (Link) Halac.: wheatgrass, crested; var. Ephraim *Agropyron cristatum* (L.) Gaertn.: rye, mountain *Secale montanum* Guss.: bluegrass, big; var. Sherman *Poa ampla* Merr.: wheatgrass, hybrid (experimental line RS1); quackgrass x bluebunch wheatgrass *Elytrigia repens* (L.) Nevski x *Pseudoroegneria spicata* (Pursh) A.Love: bromegrass, smooth; var. Manchar *Bromus inermis* Leyss.: wheatgrass, intermediate; var. Oahe *Elytrigia intermedia* (Host) Nevski: wheatgrass, bluebunch; var. Secar *Pseudoroegneria spicata* (Pursh) A.Love: wheatgrass, western; var. Rosana *Pascopyrum smithii* (Rydb.) A.Love: wildrye, Russian; var. Bozoisky *Psathyrostachys juncea* (Fisch.) Nevski: wheatgrass, thickspike; var. Critana *Elymus lanceolatus* (Scribn. & J.G. Smith) Gould.

Grass stands were 70% or better in 1991 for all grasses, except mountain rye, in rototilled plots and Sherman and Luna in the no-till plots. Leafy spurge control was 80% or greater for all grasses, except mountain rye and Secar, in rototilled plots. Luna and Sherman had 69 and 60% control, respectively, in the no-till plots; however, none of the grasses in the no-till plots have maintained adequate leafy spurge control compared to the tilled areas. Grass yields correlated with grass stand and leafy spurge control and were considerably better in the rototilled compared to the no-till areas (Table 1).

Bozoisky had the highest crude protein and TDN of all grasses sampled. There were no differences in nutritive value between tilled and no-till plots (Table 2). (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1633.)

Table 1. The control of leafy spurge by the integration of herbicides and perennial grasses

Grass Species (Variety)[1]	Percent Grass Stand[2]								Percent Leafy Spurge Control								Pounds of Air Dry Grass per Acre							
	Rototilled				No-till				Rototilled				No-till				Rototilled				No-till			
	88	89	90	91	88	89	90	91	88	89	90	91	88	89	90	91	88	89	90	91	88	89	90	91
Pubescent wheatgrass (Luna)	90	90	94	93	70	71	74	76	97	93	93	90	84	72	75	69	497	2074	1102	1910	274	1062	727	1162
Crested wheatgrass (Ephraim)	83	86	84	84	55	14	14	20	95	90	87	89	79	56	45	55	474	1434	836	1080	218	413	466	564
Mountain rye	18	11	1	2	5	4	0	0	79	50	49	64	58	31	20	8	368	436	793[4]	0	224	119	483[4]	0
Big bluegrass (Sherman)	74	88	89	84	79	83	80	79	96	91	90	86	89	78	65	60	594	2297	922	1881	336	2118	762	894
Hybrid wheatgrass (RS1)	74	85	85	90	13	10	6	5	94	89	88	88	60	33	15	11	518	2886	1281	1518	142	619	382	586
Smooth bromegrass (Manchar)	80	80	78	73	18	23	16	11	92	79	78	80	68	40	25	10	294	1263	639	780	152	605	171	260
Intermediate wheatgrass (Oahe)	71	91	93	91	16	53	48	43	97	91	86	86	68	51	46	39	652	3173	1235	2329	152	2053	734	1099
Bluebunch wheatgrass (Secar)	64	64	58	75	15	2	3	5	83	76	65	76	64	35	24	24	194	968	871	1447	128	169	282	242
Western wheatgrass (Rosana)	76	58	61	74	26	19	18	18	91	88	88	85	65	48	34	25	464	1348	729	1222	174	387	284	122
Russian wildrye (Bozoisky)	83	90	88	88	30	10	13	13	97	93	93	94	63	44	41	28	552	1283	564	932	160	220	229	438
Thickspike wheatgrass (Critana)	81	61	64	70	29	15	20	33	94	78	78	86	70	29	36	50	484	1587	695	991	210	690	449	431
least significant difference at 0.05[3]	13	21	23	19	13	21	23	19	16	18	21	21	16	18	21	21	151	630	335	421	151	630	335	421

[1]Grasses seeded August 12, 1986.
[2]Evaluations - % Grass stand: September 14, 1988; August 8, 1989; September 13, 1990; June 20, 1991. % leafy spurge control: September 14, 1988; August 8, 1989; September 13, 1990; June 20, 1991. Pounds of air dry grass per acre: September 14, 1988; August 8, 1989; September 13, 1990; September 12, 1991.
[3]Comparison of variety means is valid between rototilled and no-till within the same year and column.
[4]Mountain rye production was 0 pounds of air dry grass per acre for 1990 for rototilled and no-till. Production values are for blue grass/intermediate wheatgrass mix which invaded the plot.

Table 2. Nutritive value of eleven grasses seeded into pasture for long-term competition and control of leafy spurge.

Grass Species (Variety)[1]	Crude Protein Percent	TDN Percent
Pubescent wheatgrass (Luna)	4.1	43
Crested wheatgrass (Ephraim)	4.6	45
Mountain rye	3.3	45
Big bluegrass (Sherman)	3.8	40
Hybrid wheatgrass (RS1)	4.3	42
Smooth bromegrass (Manchar)	4.9	46
Intermediate wheatgrass (Oahe)	3.8	42
Bluebunch wheatgrass (Secar)	4.7	45
Western wheatgrass (Rosana)	5.8	45
Russian wildrye (Bozoisky)	5.8	49
Thickspike wheatgrass (Critana)	4.4	38
least significant difference at 0.05	0.8	4

[1]Grasses sampled August 8, 1989. Grasses were hand-sampled at ground level. Analyses are on a dry-matter basis. Values are means of five samples. There were no differences between tilled and no-till plots.

The comparison of three 2,4-D formulations applied by airplane for control of leafy spurge (Euphorbia esula L.) . Whitson, T.D., D.A. Austin and M.A. Ferrell. Leafy spurge commonly grows on rangeland that cannot be treated by ground equipment; therefore, airplanes are commonly used for application. This experiment was established near Sundance, WY to compare three 2,4-D formulations applied by airplane. Treatment areas 227 by 1089 ft. were applied as single blocks with four permanently-located line transects within each block. Live canopy cover of leafy spurge was determined by making 100 point-frame counts within each line transect before treatment on May 26, 1989 and after two annual treatments on June 10, 1991. Application information: May 26, 1989, temperature: air 41F, soil surface 40F, 1 inch 50F, 2 inches 50F, 4 inches 53F with 90% relative humidity and west winds 2 to 3 mph. May 17, 1990, temperature: air 65F, soil surface 65F, 1 inch 58F, 2 inches 60F, 4 inches 62F with 80% relative humidity and west winds 4 to 5 mph. Herbicides were applied by airplane equipped with a 24-nozzle airfoil 3-inch drop nozzle boom with 010 nozzles and 46 corners delivering 3 gal/A at 120 mph. Soils, silt loam (22% sand, 58% silt nd 20% clay) with 1.8% organic matter and a 6.3 pH.

Leafy spurge control was greater than 60% following two annual treatments of 2,4-D (dimethylamine+diethanolamine)+picloram at 2.0 and 0.5 lb ai/A and 2,4-D (butoxyethlester+picloram). When 2,4-D was applied alone, 2,4-D dimethaylamine+diethanolamine at 2.0 lb ai/A provided the highest leafy spurge control of 57%. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1649)

The comparison of three 2,4-D formulations applied by airplane for control of leafy spurge.

Herbicide[1]	lb ai/A	% Control[2] Leafy Spurge	% Live Canopy Increase perennial grasses	% Change bare ground
2,4-D amine	2.0	38	+4	0
2,4-D amine+picloram	2.0+0.5	45	+22	-29
2,4-D (dimethylamine+ diethanolamine)	2.0	57	+9	+14
2,4-D (dimethylamine+) diethanolamine)+picloram	2.0+ 0.5	69	+10	+12
2,4-D (butoxyethyl ester)	1.4	45	+8	+12
2,4-D (butoxyethyl ester+ picloram)	1.4+ 0.5	63	+9	+8
(LSD 0.05)				

[1] Herbicides were applied May 26, 1989, May 17, 1990, June 13, 1991.
[2] Evaluations were made June 11, 1991.

Leafy spurge control with reduced rates of picloram, picloram plus 2,4-D, dicamba, and dicamba plus 2,4-D applied for 1 to 3 consecutive years. Sebastian, J.R. and K.G. Beck. An experiment was established near Pagosa Springs, CO to evaluate leafy spurge (EPHES) control with reduced rates of picloram, picloram + 2,4-D, dicamba, and dicamba + 2,4-D. The experiment was designed as a split-plot with four replications. Herbicides and rates comprised the main plots (arranged as a randomized complete block) and treatments applied for 1,2, or 3 consecutive years constituted the split.

Flowering applications were sprayed June 1, 1989 (year 1), May 31, 1990 (year 2), and June 6, 1991 (year 3). All treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 24 gal/a, 15 psi. Other application information is presented in Table 1. Main plot size was 10 by 60 feet and sub-plots were 10 by 20 feet.

Visual evaluations compared to non-treated control plots were taken in May and September 1990, and June and October 1991. All first year treatments provided poor (4 to 59%) EPHES control in May 1990, approximately 12 months after treatment (MAT) and little to no control was observed 16,24, and 29 MAT (Table 2). In June 1991, approximately 1 year after 2nd year treatments, picloram at 0.5 lb and picloram plus 2,4-D (0.5 + 1.0 lb) provided mariginal (66 to 68%) EPHES control. Third year treatments of picloram at 0.5 lb and picloram plus 2,4-D (0.5 + 1.0 lb) provided fair EPHES control 4 months after the third year application.

Lack of grass competition and severe drought conditions existed in 1989 and 1990 and may have decreased control from residual herbicide activity. Herbicide treatments will be evaluated again in 1992 for control longevity (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

Table 1. Application data for leafy spurge control with reduced rates of picloram, picloram + 2,4-D, dicamba, and dicamba + 2,4-D applied for 1 to 3 consecutive years.

Environmental data			
Application date	June 1, 1989	June 31, 1990	June 6, 1991
Application time	10:00 AM	2:00 PM	7:00 PM
Air temperature, C	26	18	10
Cloud cover, %	5	0	80
Relative humidity, %	14	24	85
Wind speed, mph	3 to 5	2 to 5	0
Soil temperature, (2.0 in.), C	17	11	15

Application date	species	growth stage	height (in.)	density (shoots/ft^2)
June 1, 1989	EPHES	open bract	8 to 16	10 to 20
June 31, 1990	EPHES	flowering	13 to 16	10 to 20
June 6, 1991	EPHES	flowering	12 to 16	10 to 20

Table 2. Leafy spurge control with reduced rates of picloram, picloram + 2,4-D, dicamba, dicamba + 2,4-D applied for 1 to 3 consecutive years.

Herbicide	Rate	Year of treatment	Leafy spurge			
			May 1990	Sept 1990	June 1991	Oct 1991
	(lb ai/a)		%			
picloram	0.25	1	38	0	4	0
picloram	0.25	2	-	74	38	39
picloram	0.25	3	-	-	-	55
picloram	0.5	1	59	0	11	0
picloram	0.5	2	-	80	66	55
picloram	0.5	3	-	-	-	75
picloram + 2,4-D	0.25 + 1.0	1	36	0	0	0
picloram + 2,4-D	0.25 + 1.0	2	-	66	43	54
picloram + 2,4-D	0.25 + 1.0	3	-	-	-	59
picloram + 2,4-D	0.5 + 1.0	1	55	0	0	0
picloram + 2,4-D	0.5 + 1.0	2	-	78	68	66
picloram + 2,4-D	0.5 + 1.0	3	-	-	-	76
dicamba	2.0	1	14	0	4	0
dicamba	2.0	2	-	53	20	20
dicamba	2.0	3	-	-	-	39
dicamba + 2,4-D	1.0 + 2.0	1	19	0	4	0
dicamba + 2,4-D	1.0 + 2.0	2	-	34	23	4
dicamba + 2,4-D	1.0 + 2.0	3	-	-	-	54
LSD (0.05)			10	10	11	18

Survey and removal of mat-grass plants in an eradication program. Northam, F. E. and R. H. Callihan. An infestation of mat-grass (*Nardus stricta* L.) is located in forest and meadow habitats four miles north of Bovill, Idaho. Scattered, disjunct colonies of this grass have spread from the original site into adjacent forest and meadow habitats. This is the only known occurrence of this alien species in Idaho. The University of Idaho and the U.S. Forest Service are continuing a research-based integrated plan to eradicate this invader from the Clearwater National Forest. One component of the plan is the detection and elimination of mat-grass colonies.

Surveys for disjunct colonies were conducted around the main infestation in the autumn of 1986 to 1991. Colonies were defined as individual mat-grass plants, or clumps of mat-grass plants separated by more than six feet. The number of disjunct colonies located during the surveys were 36 in 1986, 22 in 1987, 28 in 1988, 41 in 1989, 40 in 1990, and 8 in 1991. Removal of the colonies began in 1987 (including those located in 1986), with a total of 175 disjunct colonies removed since then.

A total of 567 acres were surveyed in 1988, 636 acres in 1989, 130 acres in 1990 and 110 acres in 1991. The 1990 and 1991 surveys included 70 acres adjacent to the meadows where the infestation is centered. The distance from the northern-most to the southern-most colony found so far is 1.76 miles. The distance from the eastern-most to western-most disjuncts found so far is approximately one mile.

The main meadow infestation was intensively searched for the first time in 1990. Previous surveys concentrated on locating disjunct colonies outside of the main infestation. The 1991 survey focused primarily on intensive examination of the meadow infestation and areas adjacent to it. Approximately 2800 established plants were removed from the originally infested meadows in 1990 and 1127 plants were removed in 1991.

A creek forms the southern boundary of the infestation. One disjunct colony was found south of this creek in 1991; a total of 26 disjunct colonies have been removed south of the creek since 1987. Immediately north of this stream (for approximately 0.5 mi) nearly 4000 plants were removed during 1990 and 1991. This stream therefore appears to have been a dispersal barrier.

The six years of survey outside of the original meadow infestation have confirmed that the main body of the infestation remains north of the creek. The number of disjuncts removed since 1987 indicates that surveys for disjuncts should continue for several more growing seasons. Future surveys should include searches of meadows and forest land further north and south of the main infestation. Four disjunct colonies have been found within 50 yards of a state highway that forms the eastern boundary of the infestation. Meadow areas east of this highway should be surveyed.

Visual detection of mat-grass in dense vegetation is the most critical and difficult factor in the hand removal portion of the eradication program. Visual detection during the 1991 survey was hampered by dense plant cover. During past surveys cattle grazing removed much of the grass and forb cover, making detection of the smaller mat-grass plants possible. In 1991 cattle were in the area only one week before the survey, so most of the vegetative cover remained during the survey.

Disjunct colonies are expected to be discovered in the survey area for at least three to four more years, but the number is expected to decrease substantially during that time. Annual surveys will need to continue for several years to ensure that disjunct removal is accomplished before this portion of the eradication program is completed. (Idaho Agricultural Experiment Station, Moscow 83843)

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Control of tall larkspur (Delphinium occidentale (Wats.) Wats.) at two growth stages with various herbicides. Whitson, T.D., G.E. Fink and J.R. Gill. Tall larkspur, a perennial rangeland species growing in high elevation rangeland, contains toxic alkaloids that are often poisonous to cattle. These studies were established near Barnum, Wyoming to determine the effectiveness of various herbicides applied at two growth stages. The first study was initiated May 23, 1989 when T. larkspur was in the 4 to 6 leaf growth stage, and the second was initiated July 19, 1989 when T. larkspur was 2 to 3 ft. tall and in the bud to early bloom stage. Plots 10 by 27 ft. were arranged in a randomized complete block design with four replications. Herbicides were broadcast with a CO_2 pressurized knapsack unit delivering 30 gpa at 45 psi. Application information May 23, 1989: temperature air 74F, soil surface 61F, 1 inch 62F, 2 inches 60F, 4 inches 60F with 18% relative humidity and 0-5 mph NE winds, and July 18, 1989: temperature air 85F, soil surface 87F,1 inch 77F, 2 inches 79F and 4 inches 85F with 30% relative humidity and calm winds. Soil was a silty clay (28% sand, 46% silt and 26% clay) with 7.9% organic matter and a pH of 6.3. Treatments applied in the 4 to 6 leaf stage which controlled greater than 80% of the t. larkspur were metsulfuron at 0.063 lb ai/A and the combinations of metsulfuron+picloram at 0.063+0.75 and 0.125++1.0 lb ai/A and metsulfuron+dicamba at 0.125+0.5 lb ai/A. Treatments applied during early bloom controlling greater than 80% of T. larkspur were picloram at 2.0 lb ai/A, and the combination of methsulfuron+picloram at 0.125+1.0 lb ai/A. Reductions were based on plant count and do not reflect biomass reductions which were often evident. These studies show that considerably higher herbicide applications are required in soils high in organic matter. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1653)

Tall larkspur suppression with various herbicides.

Herbicide[1]	Rate lb ai/A	% Control Applied 4-6 leaf	early bloom
Picloram	0.75	28	0
Picloram	1.0	27	29
Picloram	1.5	61	58
Picloram	2.0	30	81
2,4-D (LVE)	1.0	33	0
2,4-D (LVE)+	1.0+		
picloram	.25	33	38
Triclopyr+	0.5+		
2,4-D (LVE)	1.0	23	0
Triclopyr+	0.5+		
2,4-D (LVE)+	1.0+		
picloram	0.25	37	0
Picloram+	0.75+		
L-77	0.25%	23	0
Triclopyr+	.05+		
2,4-D (LVE)+	1.0+		
L-77	0.25%	31	0
Metsulfuron+	0.053+		
X-77	0.25%	81	0
Metsulfuron+	0.063+		
picloram+	0.75+		
X-77	0.25%	87	65
Metsulfuron+	0.063+		
picloram+	1.0+		
X-77	0.25%	67	62
Metsulfuron+	0.125+		
picloram	1.0+		
X-77	0.25	84	93
Metsulfuron+	0.063+		
dicamba+	0.5+		
X-77	0.25%	78	19
Metsulfuron+	0.125+		
dicamba+	0.5+		
X-77	0.25%	93	48
Check		0	0
(LSD 0.05)			
(CV)			

[1] Herbicides were applied May 23, 1989 and July 19, 1989.

[2] Evaluations (% control) calculated from original counts were made June 19, 1991.

Control of geyer larkspur (Delphinium geyeri Greene) at two growth stages with various herbicides. Whitson, T.D., W.R. Tatman and R.J. Swearingen. Geyer larkspur is a native of the Rocky Mountain Region and contains toxic alkaloids which cause poisoning in cattle. Two experiments were established near Laramie, WY to test the effects of various herbicides applied to geyer larkspur at two growth stages. The first experiment was initiated May 5, 1989 when geyer larkspur was in the 3 to 5 leaf stage while the second was established June 12, 1989 when geyer larkspur was in the bud stage. G. larkspur plants were counted in each plot before herbicide application, then again at the times of evaluation. Plots 10 by 27 ft. were arranged in a randomized complete block design with four replications. Herbicides were broadcast with a CO_2 pressurized knapsack unit delivering 30 gpa at 45 psi. Temperatures on May 5, 1989 were: air 60F, surface 60F, 1 inch 61F, 2 inches 63F, 4 inches 60F with 85% relative humidity and 0-5 mph NW winds, on June 12, 1989: air 60F, soil surface 63F, 1 inch 61F, 2 inches 62F, 4 inches 65F, with 40% relative humidity and 2 to 3 mph S winds. Soils were loam sand (75% sand, 10% silt and 15% clay) with 1.5% organic matter and a pH of 7.8.

Treatments providing >90% control when applied at the 3 to 5 leaf stage included picloram at 0.25, 0.5 and 0.75 lb ai/A and the combinations of metsulfuron+picloram at 0.0126+0.25 lb ai/A and picloram+dicamba at 0.25+0.25 and at the bud stage, picloram at 0.5 and 0.75 lb ai/A and the combination of picloram+dicamba at 0.5+0.5 lb ai/A. All treatments controlling greater than 90% of g. larkspur at one of the two growth stages included at least 0.25 lb ai/A picloram. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1651).

Geyer larkspur control with two application timings of various herbicides.

Herbicide[1]	Appl. Rate (lb ai/A)	Application Timing (3-5 leaf stage) 1990	(3-5 leaf stage) 1991	(Early bud stage) 1990	(Early bud stage) 1991
		%			
Picloram	0.25	80	90	94	70
Picloram	0.50	95	95	95	90
Picloram	0.75	100	90	86	100
Metsulfuron+X-77	0.0063+0.25%	26	35	0	10
Metsulfuron+X-77	0.0126+0.25%	20	35	30	40
Metsulfuron+X-77	0.0189+0.25%	45	40	43	45
Metsulfuron+X-77	0.0252+0.25%	27	50	37	55
Metsulfuron+X-77	0.0315+0.25%	62	50	25	75
Metsulfuron+	0.0126+				
2,4-D (LVE)	2.0+				
X-77	0.25%	47	40	22	55
Metsulfuron+	0.0252+				
2,4-D (LVE)	2.0+				
X-77	0.25%	76	30	13	60
Metsulfuron+	0.0126+				
Picloram+	0.25+				
X-77	0.25%	80	90	79	60
Picloram+	0.25+				
Dicamba	0.25	80	90	79	80
Picloram+	0.05+				
Dicamba	0.50	97	100	89	100
check	- - - -	0	0	0	0
(LSD 0.05)					
(CV)					

[1] Herbicides were applied 5/5/89 for the 3-5 leaf timing and 6/12/89 for the early bud timing.
[2] Evaluations were made 5/30/90 and 6/10/91.

Control of wild licorice (Glycyrrhiza lepidota) at two growth stages with various herbicides. Whitson, T.D., and W.R. Tatman. Wild licorice is a deep-rooted perennial commonly found along waterways and meadows. The species is highly competitive, produces burs and is spreading. Two experiments were established near Rock River, Wyoming to test the effects of various herbicide treatments at two application timings. The first was initiated July 17, 1990 when wild licorice was in the bloom stage, the second was initiated when seed pods had ripened but leaves were green. The experimental area was uniformly infested with wild licorice. Plots 10 by 27 ft were arranged in a randomized complete block design with four replications. Herbicides were broadcast with a CO_2 pressurized knapsack unit delivering 30 gpa at 41 psi. Temperatures on July 17, 1990 were: air 80F, surface 90F, 1 inch 77F, 2 inches 76F, 4 inches 73F with 56% relative humidity and 0-2 mph NW winds. Temperatures on August 21, 1990 were: air 69F, surface 80F, 1 inch 80F, 2 inches 70F, 4 inches 69F with 75% relative humidity and 2-3 mph N winds. The soil was a sandy loam (70% sand, 17% silt and 13% clay) with 1.3% organic matter and a pH of 8.5 on the July experiment and a loam (43% sand, 34% silt and 23% clay) with 13.6% organic matter and a pH of 7.7 on the August experiment.

A single picloram treatment at .5 lb ai/A provided 99% control when applied at the bloom stage while treatments providing greater than 95% control at the seed stage were clopyralid at .125 and .188 lb ai/A, dicamba at 1.0 lb ai/A and the combination of dicamba+2,4-D at 1.0 and 1.0 lb ai/A, dicamba+picloram at 0.5+0.125, 0.5+.25 and 1.0+.125 lb ai/A dicamba+clopyralid at 0.5+.125 and 0.5+.25 lb ai/A. All applications except picloram at 0.5 lb ai/A and metsulfuron at .0075 lb ai/A provided considerably greater control when applied at the mature seed stage of growth. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1646)

Control of Wild Licorice At Two Growth Stages
With Various Herbicides

Herbicide	Rate lb ai/A	Ave. % Control 7/17/90	8/21/90
clopyralid+2,4-D	.14+.6	31	55
clopyralid+2,4-D	.19+1.0	48	93
clopyralid	.125	23	98
clopyralid	.188	21	100
picloram	.125	38	66
picloram	.125+.5	51	60
picloram	.25	83	85
picloram	.50	99	90
dicamba	1.0	66	98
dicamba	2.0	75	94
dicamba+2,4-D	.5+1.0	39	94
dicamba+2,4-D	1.0+1.0	33	96
dicamba+picloram	.5+.125	66	98
dicamba+picloram	.5+.25	81	96
dicamba+picloram	1.0+.125	79	98
dicamba+fluroxypyr	.5+.5	41	89
dicamba+clopyralid	.5+.125	75	96
dicamba+clopyralid	.5+.25	65	98
2,4-D	2.0	15	51
metsulfuron+X-77	.0075+.25%	0	0
metsulfuron+X-77	.015+.25%	0	23
metsulfuron+X-77	.225+.25%	10	69

[1] Evaluated 8/5/91

The effect of various herbicides on Wyeth lupine (Lupinus wyethii S. Wats.). Whitson, T.D, L. Justensen and D.A. Reynolds. Many lupine species are common throughout the western U.S. which are especially toxic to sheep. This experiment located near Saratoga, Wyoming was conducted as a screening trial to determine which of the currently registered herbicides on rangeland have activity on W. lupine. Herbicides were applied with a six-nozzle knapsack unit delivering 30 gpa at 41 psi. Plots were 10x108' blocks with a single replication. The soil was a sandy loam (63% sand, 23% silt and 14% clay) with 3.9% organic matter and a pH of 6.6. Application information on July 30, 1990 when W. lupine was in full bloom; temperature: air 72F, soil surface 66F, 1 inch 70F, 2 inches 68F and 4 inches 63F with 45% relative humidity and calm winds.

Treatments controlling more than 85% of the W. lupine were 2,4-D (LVE) at 2.0 lb ai/A and combinations of dicamba+2,4-D at 0.5+1.0 and 1.0+1.0 lb ai/A. At the bloom stage control was attained only when 2,4-D was used alone or in combinations. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1652)

Control of W. lupine with various herbicides (screening study).

Herbicide[1]	Rate lb ai/A	% control[2]
clopyralid+2,4-D	.12+.63	50
clopyralid+2,4-D	.19+1.0	70
clopyralid	.13	0
clopyralid	.19	0
picloram	.13	0
picloram+2,4-D	.13+0.5	70
picloram	.25	0
picloram	.5	50
dicamba	1.0	50
dicamba	2.0	80
dicamba+2,4-D	.05+1.0	90
dicamba+2,4-D	1.0+1.0	95
dicamba+picloram	0.5+.13	20
dicamba+picloram	0.5+.25	20
dicamba+picloram	1.0+.125	30
dicamba+fluroxypyr	0.5+0.5	80
dicamba+clopyralid	0.5+.13	20
dicamba+clopyralid	0.5+.25	20
2,4-D (LVE)	2.0	85
metsulfuron+X-77	.0075+.025%	0
metsulfuron+X-77	.015+.025%	0
metsulfuron+X-77	.023+.25%	0
check	---	0

[1] Herbicides were applied July 30, 1990.
[2] Evaluations were made June 26, 1991.

Control of silky crazyweed (Oxytropis sericea) with various herbicides applied at two growth stages. Whitson, T.D., D.C. Myers and R.J. Swearingen. Silky crazyweed is toxic to cattle, sheep and horses causing nervous disorders and abortions. Oxytropis species are common in rangelands throughout the West. These studies were established near Buford, Wyoming to determine the effectiveness of various herbicides when applied at two growth stages for control of silky crazyweed. Herbicides were applied with a six-nozzle knapsack unit delivering 30 gpa at 41 psi. Plots were 10 by 27 ft. arranged in a randomized complete block design with four replications. The soil was a loam (53% sand, 30% silt and 17% clay) with 3.2% organic matter and a pH of 6.8. Application information on June 9, 1990 when locoweed was in the vegetative stage, temperature: air 65F, surface 81F, 1 inch 75F, 2 inches 58F, and 4 inches 52F with 55% relative humidity and calm winds. Application information on July 4, 1990 when locoweed was in the early bloom stage, temperature: air 58F, soil surface 60F, 1 inch 65F, 2 inches 65F and 4 inches 59F with 79% relative humidity and 3 to 5 mph northwest winds.

Only one treatment 2,4-D at 2.0 lbs ai/A provided significantly greater s. crazyweed control at the later treatment date. All other treatments provided excellent control at both growth stages.

Because of the large population of cushion community plants, such as threetip sagebrush (Artemisia tripartita), fringed sagebrush (Artemisia frigida), wild and spoonleaf milkvetch (Astragalus spatulatus), growing in association with s. crazyweed and the herbicide effects on these species, grass yields were variable among treatments. Metsulfuron had little effect on associated species but provided greater than 99% control of s. crazyweed. In those areas perennial grass yields were nearly twice those in the untreated check. Combined treatments with 2,4-D controlled the greatest number of cushion species, therefore, when s. crazyweed was adequately controlled with all treatments, a herbicide selection would be based on the least cost treatment that also had the greatest control of cushion species which resulted in the greatest perennial grass yields such as dicamba+2,4-D at 0.5+1.0 lb ai/A. With this combination perennial grass production was three times that of the untreated control. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1645)

Control of Silky Crazyweed At Two Growth Stages

Herbicide	Rate lb ai/A	% Control Date of Application 6/9/90	% Control Date of Application 7/4/90	Grass Yields lb/D.M./A[2] 6/9/90	Grass Yields lb/D.M./A[2] 7/4/90
clopyralid+2,4-D	0.13+0.61	99	98	419	590
clopyralid+2,4-D	0.18+1.0	100	100		
clopyralid	0.13	96	100		
clopyralid	0.19	100	98		
picloram	.125	100	100	391	623
picloram+2,4-D	0.125+0.5	100	100		
picloram	0.25	100	98		
picloram	0.5	100	100		
check	---	0	0	168	220
dicamba	1.0	97	98	478	381
dicamba	2.0	100	97		
dicamba+2,4-D	0.5+1.0	100	100	719	535
dicamba+2,4-D	1.0+1.0	100	100		
dicamba+picloram	0.5+.125	100	100	518	329
dicamba+picloram	0.5+.25	100	100		
dicamba+picloram	1.0+.125	100	94		
dicamba+fluroxypyr	0.5+0.5	100	100		
dicamba+clopyralid	0.5+.125	100	100		
dicamba+clopyralid	0.5+.25	100	100		
2,4-D	2.0	67	100	483	584
metsulfuron+X-77	.0075	99	100	302	407
metsulfuron+X-77	.015	100	100		
metsulfuron+X-77	.0225	100	100		

[1] Evaluations were made by counting plants before and after treatment then calculating % control in each plot.
[2] Yields were based on (2) 0.25m² areas/plot, yields were determined on only those treatments providing near complete control for the least cost.

Gray rabbitbrush (Chrysothanus nauseosus (Pall. ex Pursh) Britt.) control at two growth stages with various herbicides. Whitson, T.D. and D.A. Reynolds. Herbicide treatments have usually resulted in poor control of g. rabbitbrush. Two studies were initiated to determine if possible timing differences would result in better control. Studies were initiated near Saratoga, Wyoming. Treatments were applied to 10 by 27 ft. plots arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized knapsack unit delivering 30 gpa at 45 psi. Application information: May 19, 1989, temperature: air 45F, soil surface 62F, 1 inch 62F, 2 inches 55F and 4 inches 60F with 64% relative humidity and west winds 2-3 mph. Gray rabbitbrush was in early leaf development. July 6, 1989 temperature: air 82F, soil surface 64F, 1 inch 60F, 2 inches 75F and 4 inches 70F, with 32% relative humidity and calm winds. Gray rabbitbrush was in the full leaf stage prior to bud. The soil was a sand (90% sand, 5% silt and 5% clay) with 1.4% organic matter and a 7.0 pH. Evaluations were made August 29, 1991.

The highest percent control was 15% with the May 19, 1989 application of 2,4-D at 4.0 lb ai/A. Control was not adequate at either application or with any herbicide in the experiment. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1655)

Gray rabbitbrush control with two application timings of various herbicides.

Herbicide[1]	Appl. Rate lb ai/A	Application Date 5/19/89	7/6/89
		% control	
2,4-D+	2.0		
picloram	.05	4	0
2,4-D	4.0	15	0
dicamba	3.0	6	0
dicamba	4.0	3	0
picloram+	0.25+		
silwet	0.25%	0	1
picloram	0.25	3	0
picloram	0.5	1	1
picloram	0.75	1	0
clopyralid	0.29	0	1
clopyralid	0.38	1	0
2,4-D+	1.51+		
clopyralid	0.29	1	0
2,4-D+	1.51+		
clopyralid+	0.29+		
silwet	0.25%	1	1
2,4-D+	2.0		
clopyralid	0.38	1	0
2,4-D+	1.51+		
clopyralid	0.29+		
picloram	0.25	4	1
2,4-D+	2.0+		
clopyralid+	0.38+		
picloram	0.25	4	1
2,4-D+	1.0+		
triclopyr	0.5	3	3
2,4-D+	1.0+		
triclopyr+	0.5+		
picloram	0.25	9	3
2,4-D+	1.0+		
triclopyr+	0.5+		
silwet	0.25%	6	1
check	- - -	0	0

[1] Evaluations were made 8/29/91.

Silver sagebrush control on rangeland following yearly sequential applications of various herbicides. Whitson, T.D., D.A. Reynolds and R. Cox. Silver sagebrush (Artemisia cana (Pursh) is a resprouting species after the top growth has been disturbed by mowing, burning or spraying. Therefore, a single herbicide treatment or burning or mowing without successive retreatments will not effectively control this woody plant. This experiment was initiated to determine if successive retreatments would be effective control measures for silver sagebrush. The experimental site was located near Saratoga, WY on an area that had been burned in October, 1987. Herbicides were applied to plots 10 by 27 ft. arranged in randomized complete block design with four replications. The soil was a sandy loam (87% sand, 8% silt and 5% clay) with 1.8% organic matter and a 5.6 pH. Applications were made June 24, 1988 to 8 to 10 inch s. sagebrush regrowth. Application information: temperature: air 85F, soil surface 90F, 1 inch 100F, 2 inches 103F and 4 inches 85F with 35% relative humidity and calm winds. Herbicide treatments were reapplied July 6, 1989. Application information: temperature: 82F, soil surface 64F, 1 inch 60F, 2 inches 75F and 4 inches 70F with 32% relative humidity and calm winds. Evaluations were made August 8, 1990 and August 29, 1991.

Only two treatments controlled greater than 60% of the s. sagebrush two years following the final retreatment in 1989. These treatments were 2,4-D (LVE) at 2.0 lb ai/A and 2,4-D+tebuthiuron at 2.0+0.5 lb ai/A. (Department of Plant, Soil and Insect Sciences, Laramie, WY 82071 SR 1654)

Silver sagebrush control with various herbicides.

Herbicide[1]	Appl. Rate lb ai/A	% Control[1] Applied 1990	1991
fluroxypyr	0.5	15	23
fluroxypyr	1.0	48	25
fluroxypyr	2.0	74	46
triclopyr	.05	34	30
triclopyr	1.0	50	31
triclopyr	2.0	64	40
2,4-D+	0.5+		
triclopyr	1.0	59	44
2,4-D+	1.0+		
triclopyr	2.0	84	59
metsulfuron	0.063		
+LI700	+0.25%	23	16
chlorsulfuron	0.062		
+LI700	+0.25%	0	10
2,4-D	2.0	71	63
tebuthiuron	.05	61	35
tebuthiuron	0.75	72	53
PPG 1259	0.5	37	28
fluroxypyr+	0.5+		
triclopyr	1.0	39	14
2,4-D+	2.0+		
tebuthiuron	0.5	72	61
chlorsulfuron+	0.062		
2,4-D	+2.0	62	40
check	- - -	0	0
(LSD 0.05)		25	
(CV)		37	

[1] Herbicides were applied 6/24/88 and 7/6/89.
[2] Evaluations weer made 8/8/90 and 8/29/91.

Control of western snowberry (*Symphoricarpos occidentalis* Hook.) with various herbicides. Ferrell, M.A. Western snowberry is a shrub that invades pastureland, crowding out more desirable forage. Research was conducted near Aladdin, Wyoming on an unimproved pasture to compare the efficacy of various herbicides on western snowberry. Plots were 10 by 20 ft. with three replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi June 7, 1989 (air temp. 66 F, soil temp. 0 inch 93 F, 2 inch 85 F, 4 inch 80 F, relative humidity 62%). Glyphosate at 0.375 lb ae/a was applied June 7, July 14, and August 8. The soil was classified as sandy loam (65% sand, 17% silt, and 18% clay) with 2.0% organic matter and a 7.3 pH. Western snowberry was in full leaf and 15 to 20 inches high. Infestations were heavy thoughout the experimental area.

Western snowberry control in 1991 continues to be 100% with all rates of metsulfuron and 98% or better with all rates of chlorsulfuron. Control is decreasing in plots treated with glyphosate or fosamine. The split treatments of glyphosate resulted in 60 percent grass damage one year after application; however, the grass recovered in 1991. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1638.)

Western snowberry control

		Control[2]		Grass Damage[2]
Treatment[1]	Rate	1990	1991	1990
	ai/a	------------%------------		%
glyphosate[3]	1.125 lb	95	85	60
fosamine	6.0 lb	13	0	0
fosamine	12.0 lb	82	67	0
fosamine	24.0 lb	96	87	0
metsulfuron[4]	0.3 oz	100	100	0
metsulfuron[4]	0.6 oz	100	100	0
metsulfuron[4]	1.2 oz	100	100	0
chlorsulfuron[4]	0.4 oz	100	100	0
chlorsulfuron[4]	0.8 oz	100	98	0
chlorsulfuron[4]	2.2 oz	100	100	0
check		0	0	0
LSD (O.05)		12	8	9
CV		9	7	96

[1]Treatments applied June 7, 1989.
[2]Visual evaluations June 7, 1990 and June 19, 1991.
[3]Glyphosate treatment was split into three 0.375 lb applications: June 7, July 14, and August 8, 1989.
[4]Surfactant (X-77) applied at 0.5% v/v.

Control of western snowberry (*Symphoricarpos occidentalis* Hook.) with metsulfuron. Ferrell, M.A. Western snowberry is a shrub that invades pastureland, crowding out more desirable forage. Research was conducted near Aladdin, Wyoming on an unimproved pasture to compare the efficacy of spring and late summer treatments of metsulfuron on western snowberry. Plots were 10 by 15 ft. with three replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 40 gpa at 40 psi. Spring treatments were applied June 7, 1990 (air temp. 72 F, soil temp. 0 inch 100 F, 1 inch 88 F, 2 inch 80 F, 4 inch 75 F, relative humidity 52%). Fall treatments were applied September 13, 1990 (air temp. 59 F, soil temp. 0 inch 70 F, 1 inch 70 F, 2 inch 75 F, 4 inch 80 F, relative humidity 57%). The soil was classified as sandy loam (65% sand, 17% silt, and 18% clay) with 2.0% organic matter and a 7.3 pH. Western snowberry was in full leaf and 12 to 20 inches high for the spring treatments and begining to drop leaves and 15 to 36 inches high for the late summer treatments. Infestations were heavy thoughout the experimental area.

Western snowberry control in 1991 was 100% with all rates of spring applied metsulfuron. However, late summer applied metsulfuron only provided 50% western snowberry control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1642.)

Western snowberry control

		Control[2]	
Treatment[1]	Rate	Spring applied	Late summer applied
	(ai/a)	-----------------(%)-----------------	
metsulfuron[3]	0.2 oz	100	50
metsulfuron[3]	0.3 oz	100	50
metsulfuron[3]	0.4 oz	100	50
metsulfuron[3] + 2,4-D LVE	0.2 oz + 1.0 lb	100	50
metsulfuron[3] + 2,4-D LVE	0.3 oz + 1.0 lb	100	50
metsulfuron[3] + 2,4-D LVE	0.4 oz + 1.0 lb	100	50
check		0	0
LSD (O.05)		NA	NA
CV		NA	NA

[1]Spring treatments applied June 7, 1990. Late summer treatments applied September 13, 1990.
[2]Visual evaluations June 19, 1991.
[3]Surfactant (X-77) applied at 0.5% v/v.

Site preparation treatments for control of vine maple. Cole, E.C. and M. Newton. Vine maple is a common competitor with conifers in the Cascade Mountains of western Oregon. This research was conducted near Cascadia, Oregon to compare the efficacy of a variety of site preparation herbicide treatments.

The area was clearcut five years ago and planted to Douglas-fir. After clearcutting, vine maple and bigleaf maple resprouted and became the predominant vegetation.

All treatments were completely randomized, with three replications per treatment. Plot size is 15 by 29 feet (0.01 acre). Treatments were applied using a backpack sprayer with a single adjustable nozzle and using the "waving wand" technique. Prior to application, the sprayer was calibrated for delivery rate, and each plot was sprayed in two timed passes, usually in opposite directions. Volume per acre for all herbicide treatments was 10 gallons, and the carrier was water. Treatment dates were June 27 and September 11, 1990.

Plots were evaluated for percent crown reduction and percent stem dieback for vine maple in June 1991. Douglas-fir injury was evaluated on a 6-point scale:

0--no visible injury;
1--slight injury to foliage;
2--injury to buds;
3--slight top dieback;
4--major top dieback and loss of greater than 1/3 of the crown;
5--dead.

Vine Maple

All of the glyphosate treatments resulted in significantly greater crown reduction (94 to 100 percent) and stem dieback (54 to 99 percent) than the other herbicide treatments (Table 1). In most instances, the addition of imazapyr to triclopyr ester resulted in significantly greater crown reduction and stem dieback than the triclopyr ester only treatments. Effects with these treatments were additive, rather than synergistic. Treatments with imazapyr only or with triclopyr amine plus imazapyr were generally poor (less than 40 percent crown reduction and less than 10 percent stem dieback).

Douglas-fir Injury

As expected with site preparation treatments, most of the treatments resulted in some top dieback of Douglas-fir (Table 2). Injury was highly variable within treatments. Part of this was due to the position of the Douglas-fir at the time of treatment. Those within vine maple clumps at the time of spraying tended to sustain less injury than those seedlings in the open.

The glyphosate in September treatments resulted in less than expected injury to Douglas-fir. Most injury was limited to slight chlorosis of needles and slight stunting of current height growth. Seedlings were recovering from injuries. With the high rates of glyphosate used, greater injury was expected. The slight degree of injury was probably a result of the seedlings having completely finished the growing season and "hardened off" prior to application on September 11. In a different year or in a different area, seedling injury could be greater (or even less) depending upon the degree of dormancy of the seedlings.

Conclusions

Among the herbicide treatments tested, the treatments which included glyphosate offered the best control of vine maple. The June applications of most herbicides resulted in slight to major top dieback of Douglas-fir. In September, the glyphosate-alone treatments in this zone of the Cascades will provide excellent site preparation without sacrificing any advanced regeneration. This conclusion should not be extended to coastal areas without local trials and corroborating data. (Department of Forest Science, Oregon State University, Corvallis, OR 97331-5705)

Table 1. Cascadia vine maple crown reduction and stem dieback

Chemical	Rate ae/Acre	Month	% Crown Reduction	% Stem Dieback
Glyphosate	3.75 lbs	June	94 a[1]	54 c
	5.62 lbs		100 a	98 a
	7.5 lbs		100 a	99 a
	3.75 lbs	Sept	99 a	81 b
	5.62 lbs		98 a	80 b
	7.5 lbs		100 a	90 ab
Imazapyr	0.1875 lb	June	11 jk	1 jk
	0.25 lb		19 ij	3 ijk
	0.375 lb		36 gh	6 hijk
Imazapyr + glyphosate	0.25+1.12 lb	June	96 a	54 c
Triclopyr amine + imazapyr	2.0+0.25 lb	June	28 hi	5 ijk
Triclopyr ester	1.0 lb	June	41 fg	14 fghij
	1.5 lbs		46 efg	12 ghijk
	2.0 lbs		49 ef	16 efghi
Triclopyr ester + glyphosate	1.0+1.5 lbs	June	62 cd	22 defg
	1.5+1.1 lbs		42 fg	12 ghijk
	1.5+1.5 lbs		64 cd	30 d
	2.0+1.1 lbs		55 de	24 defg
Triclopyr ester + imazapyr	1.0+0.25 lbs	June	56 de	19 defgh
	1.0+.375 lbs		61 cd	23 defg
	1.5+.25 lbs		57 de	19 defgh
	1.5+.375 lbs		76 b	28 de
	2.0+.25 lbs		71 bc	26 def
	2.0+.375 lbs		63 cd	21 defg
Untreated			0 k	0 k

[1] Means within columns followed by the same letter are not significantly different at alpha=0.05 using Tukey's.

Table 2. Injury to Douglas-fir.

Chemical	Rate ae/Acre	Month	Douglas-fir Injury Rating	
Glyphosate	3.75 lbs	June	2.55	abcd[1]
	5.62 lbs		2.75	abc
	7.5 lbs		3.47	a
	3.75 lbs	Sept	1.12	cdefg
	5.62 lbs		1.00	defg
	7.5 lbs		0.79	efg
Imazapyr	0.1875 lb	June	0.75	fg
	0.25 lb		0.80	efg
	0.375 lb		1.56	bcdefg
Imazapyr + glyphosate	0.25+1.12 lb	June	2.67	abc
Triclopyr amine + imazapyr	2.0+0.25 lb	June	0.71	fg
Triclopyr ester	1.0 lb	June	0.67	fg
	1.5 lbs		1.80	bcdef
	2.0 lbs		3.14	ab
Triclopyr ester + glyphosate	1.0+1.5 lbs	June	3.00	ab
	1.5+1.1 lbs		2.43	abcde
	1.5+1.5 lbs		3.18	ab
	2.0+1.1 lbs		2.14	abcdef
Triclopyr ester + imazapyr	1.0+0.25 lbs	June	1.86	abcdef
	1.0+0.375 lbs		2.83	ab
	1.5+0.25 lbs		2.00	abcdef
	1.5+0.375 lbs		2.50	abcd
	2.0+0.25 lbs		3.12	ab
	2.0+0.375 lbs		2.92	ab
Untreated			0	g

[1] Means within columns followed by the same letter are not significantly different at alpha=0.05 using Tukey's.

<u>Dormant and foliar treatments for controlling vine maple.</u> Cole, E.C. and M. Newton. Vine maple can become a serious competitor with conifers in the Cascade Mountains of western Oregon. This research examined several dormant treatments plus two foliar treatments for releasing conifers from vine maple.

The site is located approximately one mile northeast of Cascadia, Oregon. The area was clearcut five years ago and planted to Douglas-fir. After clearcutting, vine maple and bigleaf maple resprouted and became the predominant vegetation.

All treatments were completely randomized, with three replications per treatment. Plot size is 15 by 29 feet (0.01 acre). Treatments were applied using a backpack sprayer with a single adjustable nozzle and using the "waving wand" technique. Prior to application, the sprayer was calibrated for delivery rate, and each plot was sprayed in two timed passes, usually in opposite directions. Volume per acre for all treatments was 10 gallons. Carrier for all triclopyr ester and fluroxypyr treatments was diesel; the carrier for the glyphosate and imazapyr treatments was water. Treatments were applied March 26 and June 27, 1990.

At the time of the March treatment, Douglas-fir had no bud swell. For the June treatments, Douglas-fir had elongated 10 to 40 centimeters. Some of the Douglas-fir had been browsed and had little current foliage.

Plots were evaluated in June 1991 for percent crown reduction and percent stem dieback on vine maple. Injury to Douglas-fir was evaluated on a 6-point scale:

0--no visible injury;
1--slight injury to foliage;
2--injury to buds;
3--slight top dieback;
4--major top dieback and loss of greater than 1/3 of the crown;
5--dead.

Vine Maple

All of the triclopyr ester and fluroxypyr treatments and the glyphosate treatment resulted in similar levels of crown reduction (54 to 62 percent, see table). Stem dieback was significantly higher with the 2.0 lbs/acre rates of both triclopyr ester and fluroxypyr. The imazapyr treatment had significantly less crown reduction (45 percent) than the triclopyr ester treatments and stem dieback did not differ significantly from the untreated plots.

Douglas-fir Injury

Slight top dieback occurred in all herbicide treatments except for the triclopyr ester treatments (see table). On the average, the triclopyr ester treatments resulted in only minor injury to foliage. In the previous growing season, injury appeared more severe, and seedlings exhibited foliage dieback and some stunting in height growth. Seedlings in these treatments had recovered, and current foliage exhibited no signs of injury. For the other herbicide treatments, injury was more severe and longer lasting.

Conclusions

Most of the treatments resulted in similar levels of crown reduction. Stem dieback was higher with the higher rates of triclopyr ester and fluroxypyr than with the lower rates. Although seedlings showed major signs of injury last year in the triclopyr ester treatments, seedlings were recovering this year. In the other treatments, some top dieback still occurred, and seedlings were recovering more slowly. (Department of Forest Science, Oregon State University, Corvallis, OR 97331-5705)

Cascadia vine maple crown reduction and stem dieback and Douglas-fir injury

Chemical	Rate	Month	% Crown Reduction		% Stem Dieback		PSME Injury Rating	
	(lbs ae/acre)							
Fluroxypyr	0.5	March	54	ab[1]	42	de	2.17	ab
	1.0		55	ab	47	cd	2.33	ab
	2.0		62	a	87	a	2.50	a
Triclopyr ester	1.0	March	59	a	62	bc	0.83	abc
	1.5		60	a	69	b	0.60	bc
	2.0		60	a	87	a	1.00	abc
Glyphosate	1.1	June	57	ab	26	e	2.62	a
Imazapyr	0.25	June	45	b	4	f	2.29	ab
Untreated			1	c	0	f	0.17	c

[1] Means within the columns followed by the same letter are not significantly different at alpha=0.05 using Tukey's.

Effects of metsulfuron on forage production and fertility in the wheatgrasses, Russian wildrye, and Great Basin wildrye. Waldron, B.L., J.O. Evans, and K.H. Asay. Metsulfuron, with its new registration for use on grasses could become very important for the Conservation Reserve Program and other rangeland improvements. Currently it is not registered for use on wheatgrass stands grown for seed production. The objective of this study was to evaluate the safety of metsulfuron for wheatgrass forage and seed production. Grasses were drilled into five-row plots on August 23, 1990. Each grass entry was planted in plots 15.2 meters long and 1.5 meters wide. Preemergence application of metsulfuron was made on August 25, 1990 using a four-nozzle logarithmic sprayer unit delivering 29.2 gpa at 40 psi. A logarithmic sprayer linearly increases the amount of active ingredient applied as it proceeds the length of the plot. The sprayer was set to begin applying 0 g/ha and reach 110 g/ha at the end of the plot. After initial visual evaluation, data was collected at six herbicide rates. Postemergence application of metsulfuron was made on April 30, 1991 with a four-nozzle bicycle sprayer delivering 16.2 gpa at 40 psi. Each herbicide rate was applied in 2.1 meter wide strips perpendicular to the grass plots. Dosages for postemergence treatment were selected to correspond with selected preemergence rates. Table 1 contains the application data. Both the pre- and postemergence studies were arranged in a randomized block, split-plot design with four replications.

Forage was harvested the third week of September 1991. Increasing rates in the preemergence application caused a decrease in dry matter for all grass entries. Most of this decrease can be explained using a linear regression model. Dry matter in most of the grass entries was not affected by increasing rates in the postemergence application. Weed competition reduced dry matter in the controls of the postemergence study. Preemergence controls lacked this high weed population. Spike production followed similar trends as the dry matter. Further studies are underway on fertility (seed set) and pollen viability. (Utah Agricultural Experiment Station, Logan, 84322-4820.)

Table 1. Application data for metsulfuron treatments on common range grasses. Logan UT 1990-91

	Preemergence	Postemergence
Application date	08/25/90	04/30/91
Air/soil temp. (F)	75/85	51/65
Relative humidity (%)	26	43
Wind (mph)	6.2	7.0
Sky/soil conditions	clear/dry	clear/wet
Soil texture	Silt-loam	Silt-loam
pH	8.0	7.9

Table 2. Evaluation of preemergence application of metsulfuron on common range grasses

Cultivar	Common Name[1]	0.0	12.6	Rate (g ai/ha) 25.2	37.8	50.4	63.0
		average dry matter (g/m^2)					
Alkar	TWG	1091.1	692.5	291.3	178.6	111.9	43.7
Bozoisky	RWR	276.3	125.4	77.2	32.5	16.4	18.1
Cris-28[2]	CWG	736.7	614.5	434.3	264.8	243.5	182.2
Goldar	BBWG	310.0	221.8	179.1	122.8	86.5	86.0
Hycrest	CWG Hy	1069.4	868.2	673.2	484.9	484.9	463.9
Luna	PWG	1476.8	1195.3	1081.3	722.4	698.6	578.4
Magnar	GBWR	394.5	168.2	79.6	72.7	39.6	37.8
Nordan	CWG	931.0	848.0	630.4	643.1	604.3	355.9
T21076	TSWG	789.8	402.7	374.4	298.8	190.8	154.4
Pryor	SWG	799.4	658.2	327.4	374.8	282.4	262.2
Rosana	WWG	366.5	233.0	158.4	126.6	78.6	63.0
Secar	SRWG	266.8	211.4	135.6	102.4	82.2	83.2

Table 3. Evaluation of postemergence application of metsulfuron on common range grasses

Cultivar	Common Name[1]	0.0	12.6	Rate (g ai/ha) 25.2	37.8	50.4	63.0
		average dry matter (g/m^2)					
Alkar	TWG	491.5	498.5	526.7	552.0	455.9	525.5
Bozoisky	RWR	47.2	68.9	63.5	67.0	52.7	60.2
Cris-28[2]	CWG	289.0	291.4	339.1	359.4	295.1	278.2
Goldar	BBWG	84.8	102.7	111.6	147.4	91.8	67.5
Hycrest	CWG Hy	510.3	521.0	580.3	526.5	477.5	501.7
Luna	PWG	541.7	558.4	578.2	635.2	630.2	568.1
Magnar	GBWR	31.8	76.5	91.4	110.1	119.6	95.8
Nordan	CWG	351.2	392.3	411.4	402.5	355.0	444.4
T21076	TSWG	272.8	323.8	362.1	320.1	330.9	317.5
Pryor	SWG	296.4	295.3	319.7	457.1	343.8	383.5
Rosana	WWG	182.8	168.6	209.8	249.2	222.8	222.2
Secar	SRWG	80.5	135.1	147.5	140.1	109.3	131.0

1. Abbreviations - Grass common names: TWG = Tall wheatgrass, RWR = Russian wildrye, CWG = Crested wheatgrass, BBWG = Bluebunch wheatgrass, CWG Hy = Crested wheatgrass hybrid, PWG = Pubescent wheatgrass, GBWR = Great Basin wildrye, TSWG = Thickspike wheatgrass, SWG = Slender wheatgrass, WWG = Western wheatgrass, SRWG = Snake River wheatgrass.

2. Used here to refer to non-certified tetraploid _Agropyron cristatum_

PROJECT II

WEEDS OF HORTICULTURAL CROPS

Bob Mullen - Project Chairperson
Jill Schroeder - Project Chairperson-Elect

Annual weed control in almonds. Vargas, Ron. A one year old almond orchard, planted two rows Nonpareil and one Fritz, was divided into plots seven ft. by 44 ft. and replicated three times in a randomized complete block design. The herbicides were applied on December 19, 1991 with a CO_2 plot sprayer calibrated at 20 psi delivering 26 gallons per acre. At the time of application there were no weed seedlings present. A 0.25 in. of rainfall occurred immediately after application.

An evaluation on April 4, 1991, 105 DAT indicated 100 percent control of shepherdspurse, lambsquarters, henbit, chickweed and knotweed with all herbicides and rates applied except the oryzalin + oxyfluorfin tank mix which exhibited 93 percent control. An evaluation of barnyardgrass on June 21, 1991 indicated 100 percent control with Mon - 21640 at all rates. Barnyardgrass control was poor at the 0.75 and 1 lb ai/A rate of Mon - 13211. The 2 lb ai/A rate of Mon 13211 provided 100 percent control of barnyardgrass.

Annual Weed Control in Almonds

Herbicide	Rate lb ai/A	Percent Control April 4, 1991 Shepherds purse	Lambs quarter	Henbit	Chick weed	Knot weed	6/21/91 Barnyard grass
Mon - 13211	0.75	100	100	100	100	100	20
Mon - 13211	1.0	100	100	100	100	100	40
Mon - 13211	1.5	100	100	100	100	100	75
Mon - 13211	2.0	100	100	100	100	100	100
Mon - 21640	0.5	100	100	100	100	100	100
Mon - 21640	0.75	100	100	100	100	100	100
Mon - 21640	1.0	100	100	100	100	100	100
Mon - 21640	1.5	100	100	100	100	100	100
Mon - 21640	2.0	100	100	100	100	100	100
oryzalin	4.0	100	100	100	100	100	-
oryzalin + oxyfluorfin	4.0 + 1.2	93	100	100	100	100	-
control	-	0	0	0	0	0	-

Effect of orchard floor management on sour cherry blossom development. Anderson, J.L. Montmorency sour cherry trees on mazzard and mahaleb rootstocks were planted April 11, 1986 in a Draper gravelly loam having a firm, restrictive layer at the 30 to 40 cm depth. A solid-set mini-sprinkler system was installed the following month and orchard floor management systems included clean cultivation, vegetation-free glyphosate-treated non-cultivation, and permanent Elka perennial ryegrass and Ensylva creeping red fescue sod plots were established in June, 1986. Grass cover plots were subdivided into single-tree solid sod, 1 m vegetation-free square around the tree trunk, and 1 m vegetation-free strip down the tree row. Tree growth as measured by trunk diameter increase was greatest in plots with the largest vegetation-free area and is reported elsewhere. Tree yields during 1991 were correlated with tree size; trees in the glyphosate-treated vegetation-free plots were the largest and had the heaviest yields.

Tree blossoming in the spring of 1991 was delayed 3 to 4 days in the sodded plots as compared to the corresponding vegetation-free plots. These differences in bloom time were attributed to differences in heat reflected from the orchard floor. In addition, Montmorency trees on mazzard rootstock blossomed 3 days later than trees on mahaleb rootstock. (Plants, Soils and Biometeorology Department, Utah State University, Logan, UT 84322-4820).

Effects of rootstock and orchard floor management on Montmorency sour cherry time of blossoming

Rootstock	Orchard floor management	Percent bloom[1] (May 11, 1991)
mahaleb	bare soil	76 a
mahaleb	grass sod	46 b
mazzard	bare soil	39 b
mazzard	grass sod	9 c

[1]Values followed by a common letter are not significantly different (.05)

Pre-Emergence Weed Control in Newly Planted Asparagus Crowns. Mullen, R.J. and T. Viss. A post-plant, pre-emergence weed control trial in newly planted one-year-old asparagus crown beds was established at Victoria Island Farms near Byron, California on February 26, 1991. The soil type was an Egbert muck and the asparagus field variety was Viola. All treatments were applied with a CO_2 backpack sprayer calibrated at 30 gal/a water using 8002 nozzles at 40 psi. Weather at the time of trial establishment was clear, 63°F, and a southwest wind of 2 mph. Six herbicides and/or combination treatments were applied with four replications of each treatment in a randomized complete block design. The soil incorporation of all treatments was accomplished by winter rainfall.

An evaluation of weed control efficacy and crop phytotoxicity took place on March 28, 1991 and again on April 12, 1991. Best overall weed control resulted from the combination treatment of MON-13211 + simazine, followed by MON 13211 used alone. terbacil alone, and the combination treatment of norflurazon + simazine. Weeds present at evaluation included barnyardgrass, swamp smartweed, and annual sowthistle. Crop phytotoxicity ratings were not made on March 28, 1991 as the crop was just emerging. At the April 12, 1991 evaluation, all treatments demonstrated excellent safety to the crop.

Pre-Emergence Weed Control in Newly Planted Asparagus Crowns

Herbicide	Rate lb A.I./A	Weed Control (%)1/ Barnyardgrass		Swamp Smartweed		Annual Sowthistle		Crop1/ Injury (%)
		3/28	4/12	3/28	4/12	3/28	4/12	4/12
norflurazon	4.00	89	90	66	50	100	100	5
norflurazon + diuron	2.00 + 4.00	94	100	88	90	100	100	4
norflurazon + napropamide	2.00 + 4.00	100	100	78	60	100	88	5
norflurazon + simazine	2.00 + 2.00	93	100	91	90	100	100	5
simazine + napropamide	2.00 + 4.00	100	100	89	89	100	95	5
MON-13211	2.00	100	100	93	95	100	100	9
MON-13211 + simazine	2.00 + 2.00	100	100	100	100	100	100	7
terbacil	3.00	93	97	100	95	100	100	5
control	-----	13	0	10	0	13	0	4

1/ 0 = No weed control, no crop injury

100 = Complete weed control, crop dead

Herbicide evaluations in carrots. Bell, C.E. and H.L. Kempen. This research discusses two experiments testing herbicide use in fresh market carrots. Trials were conducted at the UC Desert Research and Extension Center in Holtville, CA.

Trial One compared trifluralin, pendamethalin, and linuron. Experimental design was a randomized complete block with four replications. Plot size was 2 beds (1 m wide each) by 7.5 m. The crop was sown on October 18, 1990. Preplant incorporated and preemergence treatments were made on the same day. Mechanical incorporation was with a PTO driven rototiller, set to mix 7 cm deep. Postemergence treatments were made on November 29 when the crop was 7.5 cm tall. Application was made at 375 l/ha carrier volume, at 275 kPa pressure using a single 8004E nozzle per bed. The most prevalent weed was common purslane.

Yield data were collected on April 9, 1991. Two meters of each bed from each plot were harvested and weighed wet. Results are shown in Table 1. below. According to ANOV, there was no significant difference between treatments, although the untreated control was significantly different then the treated plots ($P = 0.016$).

Trial Two was designed to evaluate possible carrot phytotoxicity from EPTC applied preplant incorporated immediately before planting. The herbicide was applied at a carrier volume of 375 l/ha at 275 kPa, using a single 8004E flat fan nozzle per bed. Incorporation was with the same PTO driven rototiller set at 7 cm depth. Plot size was 2 beds by 7.5 m, experimental design was a randomized complete block with four replications. Yield data, shown in Table 2, was collected on April 9, 1991, using a sample from 2 beds by 2 m per plot. There was no significant difference between any treatment for carrot freah weight.

Table 1. Weed control in carrots.

Treatment	Rate kgai/ha	Timing	Yield
trifluralin	.84	PPI	16.5
trifluralin	.84	PREE	14.7
pendimethalin	.84	PPI	17.3
pendimethalin	.84	PREE	17.7
linuron	.84	POST	19.5
linuron + COC	.84	POST	16.8
linuron	1.68	POST	17.7
linuron + COC	1.68	POST	17.4
untreated control			12.5

Class comparisons	F	P
treated vs. untreated	6.68	0.016
trifluralin vs. pendimethalin	1.27	0.271
PPI vs PREE	0.16	ns
linuron, .84 vs 1.68	0.13	ns
linuron, COC vs no COC	0.80	ns

Timing: PPI = preplant incorporated; PREE = preemergence; POST = postemergence, crop 7.5 cm tall.
COC = crop oil concentrate at 2.3 l/ha
Yield: kg/ 2 m of bed by two beds.

Table 2. EPTC effect on carrot number and yield.

EPTC rate kgai/ha	Count	Yield
0	149	12.4
1.7	129	12.4
3.4	131	12.2
5.0	149	12.4
6.7	142	11.7

Count and Yield: kg/2m of bed by two beds

Screening vegetables for phytotoxicity to BAS 56216H. McReynolds, R.B., C. Ishida and L. Darlington. Field trials were established in selected vegetables in order to screen a new formulation of sethoxydim, BAS 56216H, for phytotoxicity. Sethoxydim, BAS 90526H, was included in the trials in order to compare the new formula to the performance of a known standard. All the trials were located in production fields.

Trials were established in snap beans, green peas, broccoli, zucchini squash, pumpkin, carrots and onions at various locations in the Willamette Valley of Oregon. Trial sites were selected based upon the uniformity of crop growth rather than for the presence of grassy weeds. Herbicide treatments were applied with a CO_2 powered backpack sprayer set at 241 KPa pressure. The spray boom was equipped with four 8002 flat fan nozzles spaced at either 30 cm or 48 cm depending upon the plot dimensions. The total spray solution volume for each treatment of 750 ml was applied broadcast over the top of the crop. All trials were randomized complete block design with three replications. Visual observations for phytotoxicity symptoms were made following both applications. Yield data were not collected.

Table 1. Herbicide treatments and application times

Treatment	Rate kg ai/ha	Application time
1. Untreated	---	---
2. BAS 56216H	3.36	Post-emergence
3. BAS 56216H +	3.36	Post-emergence
BAS 81525S	1.16 l/ha	
4. BAS 56216H +	3.36	Post-emergence
COC[a]	2.32 l/ha	
5. BAS 56216H	3.36	Post-emergence
2nd application		14-21 days later
6. BAS 56216H +	3.36	Post-emergence
BAS 81525S	1.16 l/ha	
2nd application		14-21 days later
7. BAS 905261H +	3.36	Post-emergence
COC	2.32 l/ha	
2nd application		14-21 days later

[a]Crop oil concentrate

Phytotoxicity was not observed in any crops following the first herbicide applications. However, minor phytotoxicity symptoms were observed in onions and green beans following the second application of BAS 56216H in combination with BAS 81525S, a new crop oil formulation. It was expressed on the onions as a slight twisting and yellowing at the base of the youngest leaves. Phytotoxicity was exhibited on green beans as a bronzing on the leaves. Phytotoxicity was not observed in any of the other trials.

The results demonstrated that single applications of BAS 56216H provide acceptable levels of safety for the crops included in these trials. Two applications of BAS 56216H combined with BAS 81525S or COC also exhibited good safety, except on onions and green beans. However, before final conclusions are made regarding any of these crops, trials should be conducted to measure the herbicide effect on yields.

The cause of the phytotoxicity in beans and onions needs to be investigated further. Additional trials should include the treatments, BAS 81525S applied twice, as well as, BAS 56216H + COC applied twice, in order to determine if the phytotoxicity is caused by BAS 81525S alone, by a reaction of the new formulation with the oil or because of conditions at the time of application.

(North Willamette Research & Extension Center, Oregon State University, Aurora, OR 97002)

Table 2. Phytotoxicity ratings[b]

Crop	Variety	Treatment Number 1	2	3	4	5	6	7
Green beans	Easy Pick	0	0	0	0	0	3	0
Green peas	Misty	0	0	0	0	0	0	0
Onions	Cache	0	0	0	0	0	3	0
Carrots	Top Pack	0	0	0	0	0	0	0
Broccoli	Gem	0	0	0	0	0	0	0
Squash	Midnight	0	0	0	0	0	0	0
Pumpkin	Spooky	0	0	0	0	0	0	0

[b]Phytotoxicity, 0 = no injury, 10 = plant death. Ratings are the average of 3 replicates.

Table 3. Herbicide application data, green beans

	1st Application	2nd application
	6/24	7/17
Growth stage	2-3 leaf	1st flower
Date of rating	7/2	7/26
Air temperature (F)	64	70
Cloud cover (%)	100	0
Wind (mph) direction	2 E	4 S
Relative humidity (%)	75	64
Soil surface	moist	dry
Soil temperature (F)	65	70
Rows/treatment	2	
Treatment area	25.1 m^2	

Economics of manual and chemical weed control in bell peppers. Lanini, W. Thomas and M. Le Strange. Preemergence herbicides available to California bell pepper growers decreased to only napropamide with the loss of diphenamid in 1988, with no indications of new registrations to replace these losses. Many growers have questioned whether bell peppers can be grown profitably if napropamide was also withdrawn. This study was conducted at Davis and Five Points, California, to compare napropamide treatments to hand cultivation in transplanted bell peppers in terms of weed control and cost, yield, crop quality, and harvest cost.

Experiments utilized a randomized complete block with four replications. Plots were 1 m wide by 8 m long. Skilled farm laborers were utilized for hand weeding and harvest, with each operation timed for each plot for comparison of production costs. All plots had the sides of the beds and furrows maintained free of weeds by machine cultivation as needed to maintain irrigation. Data was pooled from both sites for analysis.

Labor cost was estimated by converting the time required to weed or harvest a plot to the equivalent time required to do a hectare of the same crop. Crop value was estimated based on 1990 average values published by the California Agricultural Statistics Service. Variable cost are those associated with the hand weeding and harvesting only and do not include irrigation, fertilization, machine cultivation (furrows and sides of beds), costs of capital, or other expenses. Therefore profit, which is crop value minus the variable costs in this study, is an overestimate of the real profit from these crops. Cost efficiency is derived from dividing the variable cost as calculated in this study by the units of vegetable produced.

Bell Pepper yields were highest when weeds were excluded for the full season (Table 1). The long growing season (18 weeks) and low competitive ability of bell peppers allowed weeds to establish and compete with bell peppers even after the 8 week cultivation. Napropamide was effective against the grass weeds, but failed to control the broadleaf weeds, particularly black nightshade. Hand weeding at 4 and 8 weeks was needed on the napropamide plots to avoid severe weed competition and yield loss. Napropamide treatments at either rate reduced the grass weed density and cut hand weeding time and cost by over 50 percent at the 4 week hand weeding, but only marginally reduced hand weeding cost at the 8 week hand weeding. Hand weeding at 2 week intervals was more efficient than four week intervals. Bell peppers were especially sensitive to the root disturbance associated with the removal of large weeds, resulting in some plant death or reduced yields.

Harvest cost was highest on plots with the highest yields ($r = 0.94^{***}$), with some slowing of the harvest crew associated with high weed cover ($r = -0.831^{***}$), (Table 1). Weeds heavily reduced or eliminated bell pepper fruit formation when plots were either untreated or not cultivated after the napropamide application. Crop quality was better (lower percent of culls) on plots with greater weed cover (Table 2). The major crop quality problem in bell peppers is sunburn, and plots with less weeds were more prone to sunburn. Disease and insect attack were not common in any of the plots.

Profit was greatest when napropamide was used at either rate and hand weeding was done at both 4 and 8 weeks or hand weeding was done for full season (Table 2). The cost efficiency however, favored napropamide with two hand weedings compared to hand weeding full season, as the overall input costs was much lower.
(Botany Department, University of California, Davis 95616)

Table 1. Average bell pepper yield, weed control and harvest costs[1], and weed cover at harvest, in 1990 at West Side Field Station and Davis, CA.

Treatment	Yield	Weed Control Costs		Harvest Costs	Variable Costs	Weed Cover
		Labor	Chemical			
	(kg/ha)	($/ha)		($/ha)	($/ha)	(%)
Weed free 8 weeks - Hand weed at 2, 4, 6 and 8 wks	26,700	514	0	761	1275	22
Weed free 8 weeks - Hand weed at 4 and 8 wks	22,640	519	0	717	1236	31
Napropamide @ 2.2 kg/ha	3,340	0	99	286	385	99
Napropamide @ 2.2 kg/ha - Hand weed at 4 wks	16,470	106	99	616	821	87
Napropamide @ 2.2 kg/ha - Hand weed at 4 and 8 wks	24,860	299	99	627	1025	29
Hand weed full season at 2 week intervals	33,680	683	0	896	1579	2
Untreated Check	160	0	0	278	278	98
Weed free 2 weeks - Hand weed at 2 wks	3,870	143	0	372	515	96
Weed free 4 weeks - Hand weed at 2 and 4 wks	11,760	266	0	576	841	96
Weed free 4 weeks - Hand weed at 4 wks	8,230	312	0	451	762	96
Weed free 6 weeks - Hand weed at 2, 4 and 6 wks	26,270	424	0	835	1259	61
Napropamide @ 1.1 kg/ha	1,430	0	49	316	366	100
Napropamide @ 1.1 kg/ha - Hand weed at 4 wks	14,210	141	49	568	759	87
Napropamide @ 1.1 kg/ha - Hand weed at 4 and 8 wks	28,900	338	49	778	1165	28
LSD .05	6,510	70		155	156	8

[1] Cost estimates are based on $5.00/h for weeding crews and $6.00/h for harvest crews. Costs are intended for relative comparisons only as actual cost for large fields may be less compared to weeding or harvesting small plots. Herbicide costs were assumed to be $20.00 per pound of active ingredient including application.

Table 2. Average bell pepper quality, value and profit in 1990 at West Side Field Station and Davis, CA.

Treatment	Grade 1&2's (%)	Culls (%)	Crop[1] Value ($/ha)	Variable Costs ($/ha)	Profit[1] ($/ha)	Cost Efficiency ($/good kg)
Weed free 8 weeks - Hand weed at 2, 4, 6 and 8 wks	60	40	2136	1275	861	.080
Weed free 8 weeks - Hand weed at 4 and 8 wks	62	38	1872	1236	636	.088
Napropamide @ 2.2 kg/ha	94	6	419	385	34	.150
Napropamide @ 2.2 kg/ha - Hand weed at 4 wks	74	26	1625	821	804	.069
Napropamide @ 2.2 kg/ha - Hand weed at 4 and 8 wks	70	30	2320	1025	1295	.062
Hand weed full season at 2 week intervals	63	37	2829	1579	1250	.082
Untreated Check	97	3	21	278	- 257	1.214
Weed free 2 weeks - Hand weed at 2 wks	82	18	423	515	- 92	.235
Weed free 4 weeks - Hand weed at 2 and 4 wks	69	31	1082	841	241	.116
Weed free 4 weeks - Hand weed at 4 wks	66	34	724	762	- 38	.143
Weed free 6 weeks - Hand weed at 2, 4 and 6 wks	66	34	2312	1259	1053	.075
Napropamide @ 1.1 kg/ha	83	17	158	366	- 208	.331
Napropamide @ 1.1 kg/ha - Hand weed at 4 wks	71	29	1345	759	586	.084
Napropamide @ 1.1 kg/ha - Hand weed at 4 and 8 wks	65	35	2505	1165	1340	.064
LSD .05	12	12				.103

[1] Crop value is estimated at $300.00 per ton for grade 1&2's, and $0 for culls.
[2] Profit is what is left after removing weed control costs and therefore is only a relative value.

Pre-Emergence Weed Control in Processing Tomatoes. Mullen, R.J. and T. Viss, and S. Whitely. A pre-plant, pre-emergence weed control trial in processing tomatoes was established at Bacchetti Farms near Tracy, California on April 17, 1991. The soil type was a Sacramento clay loam/Piper fine sandy loam mix and the tomato variety was Brigade. The calcium cyanamide treatment was applied to the bed surface with a granular applicator. The metham soil drench was applied as two 9-inch bands in 3000 gal/a of water with a hand held plot applicator. Two other metham treatments were applied by sub-surface spray blades two inches below the bed surface. The napropamide application was made with a CO_2 backpack sprayer using 8004 nozzles at 30 psi in 50 gal/a water. The calcium cyanamide and napropamide treatments were soil incorporated three inches deep with a power driven rotary tiller. Two weeks after treatments were made, the field was seeded and furrow irrigation was used throughout the growing season. Weather at the time of treatment was clear, 78°F, and a northwest wind of 2 to 3 mph. There were four replications of each treatment in a randomized complete block design.

An evaluation of weed control efficacy and crop phytotoxicity took place on May 30, 1991. Weeds present included black nightshade and yellow nutsedge. Best overall control of both weed species present occurred witht the combination of metham (sub-surface spray blade) + napropamide (mechanical incorporation). Metham as a soil drench provided excellent control of black nightshade. All treatments exhibited excellent crop safety.

The trial was harvested on September 10, 1991 and all treatments led by the combination of metham + napropamide, outyielded the control. No differences in crop maturity at harvest between the treatments was noted.

Pre-Emergence Weed Control in Processing Tomatoes

		Weed Control (%)[1/]			
Herbicide	Rate lb or gal/A	Black Nightshade	Yellow Nutsedge	Crop[1/] Injury (%)	Yield T/A
calcium cyanamide (mechanical incorporation)	1,000 lb	79	50	6	42.9
metham (soil drench)	50 gal	93	65	5	42.1
metham (sub-surface blade)	50 gal	83	58	5	42.1
metham (sub-surface blade + napropamide (mechanical incorporation)	50 gal + 1 gal	89	75	7	44.6
control	-----	3	0	4	36.3
				LSD @ 5%:	7.9
				CV=	12.3%

1/ 0 = No weed control, no crop injury

100 = Complete weed control, crop dead

Response of melons to herbicides under clear plastic mulch. Soltani, N. and J.L. Anderson. Previous studies have shown that while clear plastic mulch tended to promote early watermelon and muskmelon transplant growth and development in Utah, early season weed growth under the clear plastic frequently lifted the mulch thereby limiting soil heating and melon growth responses to the plastic. This study was designed to evaluate herbicide effectiveness under clear plastic mulch and melon transplant response to herbicide treatment. Plots consisted of 3 Crimson Sweet watermelon and 3 Summit Hybrid muskmelon seedlings transplanted 1 m apart in rows 2 m apart. Herbicide treatments, replicated 4 times, included ethalfluralin, oryzalin, and trifluralin, each at 1 lb ai/a; naptalam + bensulide, 2 + 6 lb ai/a; and an untreated control. Melons were transplanted May 28, 1991 and herbicide and clear plastic mulch treatments were completed May 29. As the plastic mulch maintains moisture near the soil surface, none of the herbicides were soil-incorporated. Weeds between the rows were controlled mechanically until melon vine growth precluded tilling.

Ethalfluralin, oryzalin, trifluralin, and naptalam + bensulide treatments provided nearly complete control of annual weeds under the clear plastic. Oryzalin stunted both watermelon and muskmelon plant growth, delayed fruit maturity and reduced crop yield. Plants in trifluralin plots were also slightly stunted. Ethalfluralin and naptalam + bensulide treated plot yields exceeded that of plots with clear plastic but no herbicide treatment. (Plants, Soils and Biometeorology Department, Utah State University, Logan, UT 84322-4820).

Watermelon and muskmelon response to herbicides and clear plastic mulch

Herbicide	Rate (lb ai/a)	Melon vigor[1]	Early season yield[2] Muskmelon	Watermelon
ethalfluralin	1	10	8	1.75
oryzalin	1	4.3	4.5	0.5
trifluralin	1	7.5	5.25	0.75
naptalam + bensulide	2 6	10	6.25	1
untreated	0	10	5.25	0.75

[1]Rated 1 to 10 on July 2, 1991, 10 = no reduction in crop vigor.

[2]Average number of melons/plot, August 3 through August 19, 1991.

The effect of preemergence herbicides on three turf cultivars. Cudney, D.W., V.A. Gibeault, and J.S. Reints. A trial was initiated on the University of California, Riverside experiment station to evaluate the effects of four applications of preemergence herbicides over a two year period on turf phytotoxicity and rooting of three cool season turf cultivars (Kentucky bluegrass - blend, tall fescue - var Bonsai, and perennial ryegrass - var Manhattan II). The cultivars had been established eight months prior to the first herbicide treatments. The soil type was a sandy loam with less than one percent organic matter.

Herbicide treatments were applied as granular applications or as spray applications (30 gallon spray volume /a with a constant pressure CO_2 backpack sprayer) depending on their formulation. The four applications were made on 7/16/90, 10/11/90, 3/5/91, and 10/9/91. The herbicide treatments consisted of dithiopyr (0.5), isoxaben + oryzalin (0.5 + 1.5), oxadiazon (2 and 4), isoxaben (0.5 and 1), bensulide (10), pendimethalin (2), benefin + trifluralin (1.33 + 0.67 lbs/a).

Phytotoxicity ratings were taken in one month after the fall herbicide application in both years (November). A plug sampler was designed to measure rooting strength. The sampler extracted a 3 by 5 inch plug from the sod at a two inch depth. The plugging device was attached to a scale which in turn was attached to a lever mounted on a tripod. When sufficient force was applied to the lever, the plug would break loose from the sod. The scale would record this force. The plug strength correlated well to root mass at the two inch depth in a separate comparison. Thus the sampler was used in this test as a measure of rooting one month after the third application.

Dithiopyr, isoxaben, bensulide and pendimethalin were not phytotoxic to any of the turf species, nor did they reduce rooting strength. Oxadiazon at the high rate was somewhat phytotoxic to Kentucky bluegrass and reduced rooting strength of both Kentucky bluegrass and tall fescue. Oxadiazon was also somewhat phytotoxic to perennial ryegrass and rooting strength was reduced by both rates of application. The combination of isoxaben and oryzalin was phytotoxic to Kentucky bluegrass and perennial ryegrass and reduced rooting strength of all three species. The combination of benefin and trifluralin was phytotoxic to Kentucky bluegrass and reduced rooting strength of both Kentucky bluegrass and perennial ryegrass.

Of the three turf types tall fescue was affected least by herbicide treatment. Tall fescue and perennial ryegrass had greater plug strength than Kentucky bluegrass. (University of California, Riverside, CA 92521)

Effect of preemergence herbicides on three turf cultivars.

Treatments	Rate	Phytotoxicity[1] Rating 11/90	Phytotoxicity[1] Rating 11/91	Plug Strength[2] (lbs force) 4/91
	lb ai/a			
Kentucky bluegrass				
dithiopyr	1.0	0.3	0.3	55.9
isoxaben + oryzalin	0.5+1.5	5.5	5.5	42.4
oxadiazon	2.0	0.3	2.0	48.5
oxadiazon	4.0	1.5	3.6	45.6
isoxaben	.5	0.3	0.3	51.5
isoxaben	1.0	0.8	0.3	51.0
bensulide	10.0	0	0	57.0
pendimethalin	2.0	0	0	55.5
benefin + trifluralin	1.3+0.7	1.5	3.5	43.8
Control		0	0.3	54.8
Tall fescue				
dithiopyr	1.0	0.3	0	71.3
isoxaben + oryzalin	0.5+1.5	0.8	0.3	59.9
oxadiazon	2.0	0	0	63.3
oxadiazon	4.0	0	0	59.6
isoxaben	.5	0	0	73.5
isoxaben	1.0	0	0	64.6
bensulide	10.0	0	0	65.9
pendimethalin	2.0	0.3	0	70.0
benefin + trifluralin	1.3+0.7	0	0	70.8
Control		0.3	0	71.1
Perennial ryegrass				
dithiopyr	1.0	0.3	0	71.1
isoxaben + oryzalin	0.5+1.5	3.0	2.3	60.5
oxadiazon	2.0	2.0	1.6	54.0
oxadiazon	4.0	3.3	3.0	44.0
isoxaben	.5	0.5	0	69.5
isoxaben	1.0	0.5	0	68.8
bensulide	10.0	0.5	0.3	65.8
pendimethalin	2.0	0	0	75.8
benefin + trifluralin	1.3+0.7	0.5	1.3	59.5
Control		0	0.3	78.3
LSD 0.05		0.8	0.9	9.2

[1]Phytotoxicity 0 = no effect 10 = all turf dead
[2]lbs force necessary to break loose a 2 inch deep plug

Pyridate WP phytotoxicity in dry bulb onions. McReynolds, Robert B. Field trials conducted in bulb onions in 1990 with the EC formulation of pyridate resulted in severe crop injury and stand reductions. Greater crop safety has been reported with the wettable powder formulation. Therefore, phytotoxicity of the wettable powder was evaluated on onions grown in mineral soil in western Oregon in 1991.

A randomized complete block trial with four replications was established on May 31 in a production field of "Cache" bulb onions direct-seeded on April 21. The pyridate treatments were applied with a CO_2-powered backpack sprayer at 241 kPa pressure. The spray boom was equipped with four 8002 flat fan nozzles, spaced at 30.5 cm. Replicate size was 6.1 m x 1.32 m and consisted of four rows of onions spaced 33 cm apart. Carrier volume was 308 l/ha. The treatments were applied broadcast to a moist soil surface at the 1 to 2 true leaf stage of crop growth and the 3 to 4 leaf stage for the weeds. The primary weed species present was a prostrate ornamental which had spread into the field from a nearby garden. Weed densities were approximately 1/30 cm^2. Weeds were allowed to grow in the untreated control for 21 days before they were cultivated.

The plot was evaluated for phytotoxicity two weeks after herbicide applications. Crop injury at both rates of pyridate was observed on the onions as leaf tip burn and more severely as wilting of the plants. Many of the injured onions did not recover and died within two weeks. The plot was maintained by the grower for the remainder of the season and was managed following practices common for the area. The onions were lifted on September 5, and field cured for one week. Following field curing, the onions were weighed and the number of onions per plot was recorded. Total yield, bulb number and mean bulb weight were analyzed using an ANOVA.

Results from the ANOVA showed significant decreases in bulb number and mean bulb weight at both rates of pyridate. These two components of yield contributed to a significant decrease in total yield in comparison to the untreated and hand weeded controls. Mean bulb weight, bulb number and total yield did not vary significantly between the 0.50 and the 1.0 kg ai/ha rates.

Based upon the results from this trial, pyridate WP at rates of 0.50 kg ai/ha or higher are not safe for use in onions in western Oregon. These results are consistent with those obtained with the EC formulation in 1990. Additional field studies are required to establish the threshold for onion damage selectivity in onions. (North Willamette Research & Extension Center, Oregon State University, Aurora, OR 97002)

Pyridate effects on bulb onion yields in western Oregon[a]

Rate kg ai/ha	Yield kg/32.2m^2	Bulbs/32.2m^2	Mean weight kg/bulb
Untreated	55.8 a	242 a	0.23 a
Hand weeded	51.2 a	227 a	0.22 a
0.50 WP	34.1 b	193 b	0.19 b
1.00 WP	30.9 b	163 b	0.19 b
LSD (0.05)	10.5	28	0.02

[a] Values followed by the same letter are not significantly different at the 5% level.

PROJECT III

WEEDS OF AGRONOMIC CROPS

Rick Arnold - Project Chairperson
Chris Boerboom - Project Chairperson-Elect

Weed control in dormant alfalfa. Arnold, R.N., E.J. Gregory and M.W. Murray. Research plots were established on December 4, 1990 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of alfalfa (var. W.L. 309) and weeds to herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Downy brome (BROTE) infestations were heavy and tansymustard (DESPI) infestations were moderate throughout the experimental area.

Visual evaluations of weed control and crop injury were made May 13, 1991. Plots were harvested for yield on May 28, 1991 and a grab sample taken to determine protein content. All treatments gave good to excellent control of DESPI except prodiamine applied at 0.75 lb ai/A. BROTE control was good to excellent with all treatments. Diuron applied at 3.0 lb ai/A caused the highest injury rating of 8. Yields ranged from a high of 2.4 to a low of 1.7 t/A. All treatments resulted in a higher protein content than the check. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Downy brome and tansymustard evaluations in dormant alfalfa

Treatment	Rate lb ai/A	Crop[1] Injury	Weed Control[1] DESPI	BROTE	Yield[2]	Protein
		-----------%---------				---%--
norflurazon	2.5	0	100	99	2.3	20.6
norflurazon + metribuzin	1.5+0.5	0	100	100	1.8	20.9
norflurazon + imazethapyr	1.5+0.094	0	100	98	2.1	21.4
imazethapyr	0.063	0	100	93	2.0	21.3
diuron	2.0	5	100	95	1.9	20.4
diuron + metribuzin	1.5+0.25	0	100	98	2.0	21.7
diuron	3.0	8	100	100	1.7	23.1
metribuzin	0.5	0	100	100	1.8	20.5
hexazinone	0.5	0	100	100	2.3	20.6
imazethapyr	0.126	5	99	98	2.1	20.5
diuron + hexazinone	1.5+0.25	0	99	100	2.3	21.8
norflurazon	1.5	0	93	93	2.3	21.2
norflurazon + hexazinone	1.5+0.5	0	93	98	2.4	20.2
norflurazon + prodiamine	1.5+0.75	0	85	97	2.1	18.0
prodiamine	0.75	0	78	87	2.2	17.0
check		0	0	0	2.3	14.7
av weeds/M^2			12	25		

1. Based on a visual scale from 0 to 100, where 0 = no control or crop injury and 100 = dead plants.
2. Yields expressed on a 20% moisture basis and in t/A.

Creeping wartcress control with imazethapyr in alfalfa. Bell, C.E. Creeping wartcress (Coronopus squamatus) is a weed that was introduced to the Imperial Valley of southeastern California in 1981 and has been increasing it's range every year. It is particularly troublesome in alfalfa and difficult to control. This project was initiated to study the efficacy of imazethapyr and imazethapyr plus 2,4-DB for control of creeping wartcress in seedling alfalfa. This trial was conducted in a commercial alfalfa field near El Centro, CA.

The alfalfa field was in the second year of production. Experimental design was a randomized complete block with four replications. Plot size was 1.5 m by 3.0 m. Application of herbicides was on November 19, 1990. Carrier volume was 215 l/ha at 138 kPa pressure using 8002LP flat fan nozzles. The alfalfa had been grazed by sheep before treating and had regrown to 14 cm tall. The weed was in the cotyledon to 2 true leaf stage.

Crop yield was assessed at the next harvest by taking a .75 m^2 sample per plot on January 17, 1991. Weed control appeared to be 100% regardless of treatment at that time. Yield was again estimated with a .5 m^2 sample on April 8, 1991, before the second harvest. Visual evaluations of weed control and creeping wartcress seedling emergence were also made at this time. There was no significant differences between treatments according to ANOV for yield at either harvest. Although visual evaluations are not very consistent, most treatments appeared to provide adequate weed control and suppression of seedling emergence until April, 1991. (Cooperative Extension, University of California, Holtville, CA 92250.)

Alfalfa yield and creeping wartcress control in El Centro, CA

Treatment	Rate kgai/ha	Yield[a] Jan 17	Yield[a] April 8	Weed Control[b] Estab	Weed Control[b] Seedl
imazethapyr + COC[c]	.052	130.1	106.1	8.8	9.0
imazethapyr + COC	.070	112.5	102.7	6.3	4.3
imazethapyr + COC	.105	128.6	128.3	8.8	8.3
imazethapyr + COC	.140	116.1	96.0	8.8	9.0
imazethapyr + 2,4-DB	.052 + 1.1	110.3	102.1	8.3	8.3
imazethapyr + 2,4-DB	.070 + 1.1	107.3	104.1	6.8	6.8
untreated control		128.4	117.0	0.0	0.0

a - yield = grams m^{-2}
b - weed control, 0 = no control, 10 = all weeds dead, estab = established weeds, seedl = seedling weeds.
c - COC = crop oil concentrate at 2.3 l/ha

Herbicide injury evaluation in alfalfa. Bell, C.E. Seedling alfalfa under the warm conditions of the Imperial Valley can be susceptible to injury from herbicides. The purpose of this trial was to evaluate experimental herbicides for their injury potential in seedling alfalfa. This trial was conducted in a commercial alfalfa field near Holtville, CA.

The alfalfa field was in the first year of production. Experimental design was a randomized complete block with four replications. Plot size was 1.5 m by 3.0 m. Application of herbicides was on November 19, 1990. Carrier volume was 187 l/ha at 138 kPa pressure using 8002LP flat fan nozzles. The alfalfa had been planted on November 1, 1990, herbicide application was on November 15. Air temperature at time of application was 21 C. The alfalfa had 3-4 trifoliate leaves.

Crop injury was assessed by a visual evaluation 4 days after treatment. Imazethapyr seemed to have a slight effect on crop growth. Injury from bromoxynil and imazethapyr plus bromoxynil were greater and commercially unexceptable. Crop yield estimates were made at the second harvest, on April 3, 1991, by taking two .25 m^2 samples from each plot. These samples were combined and dried for three days at 50 C before weighing. The bromoxynil treatment and one imazethapyr plus bromoxynil had a significantly deleterious effect on yield. The other treatments were not significantly different than the untreated. (Cooperative Extension, University of California, Holtville, CA 92250.)

Alfalfa yield and injury in Holtville, CA

Treatment	Rate kgai/ha	Yield[a] April 3	Crop injury[b]
bromoxynil	0.42	36.2 c	3.0
imazethapyr + COC[c]	0.052	52.2 ab	0.5
imazethapyr + COC	0.070	48.2 ab	1.0
imazethapyr + COC	0.105	49.3 ab	1.0
imazethapyr + COC	0.140	48.9 ab	0.8
imazethapyr + bromoxynil	0.070+ 0.28	45.5 ab	2.3
imazethapyr + bromoxynil	0.070+ 0.42	44.5 bc	3.0
imazethapyr + 2,4-DB	0.052+ 1.12	54.5 a	1.3
imazethapyr + 2,4-DB	0.070+ 1.12	50.2 ab	0.3
untreated control		51.5 ab	0.0

[a] - yield = grams/.5 m^2
[b] - crop injury, 0 = no injury, 10 = crop dead
[c] - COC = crop oil concentrate at 2.3 l/ha
Numbers in a column followed by the same letter are not significantly different according to the Least Significant Difference Test (P = 0.05).

Sandbur control in established alfalfa. Tickes, B. R. Southern sanbur (Cenchrus echinatus) is widespread in alfalfa grown in western Arizona. The stiff spines of this weed cause physical damage to animals eating and people handling infested hay. This weed is confined to sandy soils and often survives mild winter climatic conditions and comes back the year after germination from established crowns. A test was conducted on the Yuma Mesa in southwestern Arizona to evaluate the efficacy of two preemergence herbicides for the control of southern sandbur in a first year stand of Arizona common alfalfa. Soil type at this location is rosita sand which was low in organic matter (less than 1%) and well drained. The alfalfa was flood irrigated and intensively managed. The test contained four herbicide treatments including 1 lb. ai/A of trifluralin 10 percent granules, 2 lb. ai/A of trifluralin 10 percent granules, 2 lb. ai/A of EPTC 10 percent granules, 3 lb. ai/A of EPTC and an untreated check. The trifluralin treatments were applied once on February 5, 1991 prior to the emergence of the sandbur. Four applications of both EPTC treatments were made, one on February 5, April 10, June 14 and July 15 for a total of 8 and 12 lbs. ai/A. The herbicides were applied with a Valmar airflo ground driven applicator with a 16.5 ft. boom. Plot size was 33 by 600 ft. with 4 replications of each treatment. Evaluations of control consisted of both weed counts and visual evaluations. Counts were made using a 0.0001 acre grid. Eight 0.0001 subplots were counted per plot. Counts were made on June 19, August 1 and September 6. A visual evaluation of percent control was made on September 12. A moderate to heavy infestation of southern sandbur was present in this test. Variable levels of control of from 55 to 90 percent were observed from the trifluralin treatments. Visual estimates of control correlated well with weed counts and were at averages of 63 and 73 percent for the 1 and 2 lb. ai/A treatments respectively. Variable levels of control of 55 to 90 percent were also observed for the EPTC treatments. Visual estimates of control correlated well with weed counts and were at averages of 79 and 85 percent for the 8 and 12 lbs. ai/A treatments respectively.

Sandbur Control in Established Alfalfa

Herbicide	Rate (ai/A)	Number of Applications	Number of Sandbur Plants Counted in 8 0.0001/A Subplots[1] on: 6-19	8-1	9-6	Visual Evaluation on 9-12[1] (% Control)
Trifluralin 10% Granules	1	1	2.5	3.8	6	63
Trifluralin 10% Granules	2	1	4.6	3.3	2	73
EPTC 10% Granules	2	4	0.5	1.3	3	79
EPTC 10% Granules	3	4	0	0.5	2.2	85
Untreated	-	-	10.3	13	13	0

[1]Average of 4 replications.

Purple nutsedge control in alfalfa with norflurazon. Tickes, B. R. Purple nutsedge (Cyperus rotundus L.) has become an increasingly widespread weed in western Arizona due to the lack of an effective herbicide to control it. This test was conducted to evaluate the efficacy of norflurazon in controlling a heavy infestation of purple nutsedge in a two year old alfalfa field. This test was conducted at Waits Farms on the Yuma Mesa in southwestern Arizona. Plots were established in a two year old stand of Arizona common alfalfa grown on rosita sand soils under intensive irrigation and management. A heavy (10-40/ft^2) and uniform infestation of purple nutsedge was present in this location but had not yet emerged at the time of herbicide application. Herbicide treatments were 2.0, 3.0 and 4.0 lb. ai/A of norflurazon and untreated check. These treatments were replicated four times and set in a randomized complete block design. Plot size was 20 by 14 ft. Treatments were applied on February 20, 1991 with a CO_2 backpack sprayer calibrated to apply 20 gallons per acre. The field had been grazed by sheep which were removed on February 18, 1991 and little alfalfa foliage was present at the time of application. Purple nutsedge had not yet germinated when the herbicide treatments were applied. The herbicide was incorporated with a 5 inch flood irrigation on February 24, 1991. Visual evaluations of percent control were made on March 29, 1991, May 2, 1991 and August 7, 1991. Percent stunt of purple nutsedge from the 4.0 lb. ai/A treatment was an average of 65 percent on March 29. It had dropped to 35 percent on May 2 and to 14 percent on August 7. Percent stunt of purple nutsedge from the 3.0 lb. ai/A treatment was an average of 45 percent on March 29. It had dropped to 20 percent on May 2 and to 11 percent on August 7. Percent stunt of purple nutsedge from the 2.0 lb. ai/A treatment was an average of 14 percent on March 29. It had dropped to 5 percent on May 2 and to 1 percent on August 7.

Established alfalfa weed control. Vargas, Ron. A two year old stand of Falcon nondormant alfalfa was divided into plots 8 by 30 ft and replicated four times in a randomized complete block design. Herbicides were applied on November 13, 1990 and on December 17, 1990 with a hand pushed granular applicator and a CO_2 plot sprayer calibrated at 20 psi delivering 11.5 gallons per acre. No weeds were present at the November 13 application whereas shepherdspurse and chickweed seedlings were present on the December 17 application.

An evaluation on March 11 indicated effective control of shepherdspurse and chickweed with all herbicides tested except trifluralin. The 0.5 percent granular formation of Mon-13288 provided 87 to 97 percent control with the greatest control occurring at the 2.0 lb ai/A rate. The 2EC formulation of Mon - 13211 also provided acceptable control of shepherdspurse and chickweed. Diuron and hexazinone exhibited 100 percent control of shepherdspurse. No control was achieved with the 10 percent granular formulation of trifluralin.

An evaluation on July 17, 7 to 8 months after treatment for summer grass control indicated acceptable control with all herbicides, except diuron and hexazinone. Mon - 13288 provided 95 to 100 percent control of both crabgrass and yellow foxtail at all rates tested. Mon - 13211 provided up to 95 percent control at the 1.5 lb ai/A rate. Trifluralin exhibited 100 percent control of both grasses. Both diuron and hexazinone provided little to no control of either grass species.

Winter Weed and Summer Grass Control

Herbicide	Rate lb ai/A	App. Date	Percent Control 3/11 shepherds purse	chick weed	7/17 crabgrass and yellow foxtail
Mon - 13288, .5% granule	0.5	11/13	87	87	97
Mon - 13288	0.75	11/13	95	95	95
Mon - 13288	1.0	11/13	100	97	95
Mon - 13288	1.5	11/13	97	97	100
Mon - 13288	2.0	11/13	100	100	100
Mon - 13211, 2EC	0.5	12/17	100	100	82
Mon - 13211	1.0	12/17	85	85	87
Mon - 13211	1.5	12/17	82	82	95
diuron	1.5	12/17	100	73	0
hexazinone	0.9	12/17	100	100	10
trifluralin, 10% granule	2.0	12/17	0	0	100
control	-	-	0	0	0

Weed control in fall-seeded alfalfa. Arnold, R.N., E.J. Gregory and M.W. Murray. Research plots were established on August 21, 1991 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of fall-seeded alfalfa (var. Commander) and weeds to herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 10 by 30 ft in size. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi. Preplant incorporated treatments were applied August 21, 1991 and immediately incorporated with a power-driven rototiller to a depth of 2 to 4 in. Postemergence treatments were applied on September 17, 1991 when alfalfa was in the 2nd trifoliolate leaf stage and weeds were small. A crop oil concentrate was added to all postemergence treatments at 0.25% v/v. Barnyardgrass (ECHCG) infestations were heavy, redroot pigweed (AMARE), prostrate pigweed (AMABL), green foxtail (SETVI), and Russian thistle (SASKR) infestations were moderate throughout the experimental area.

Visual evaluations of weed control and stand count were made on October 21, 1991. Pendimethalin and trifluralin applied alone or in combination with imazethapyr yielded the lowest alfalfa plants/M^2 than any other treatments. All treatments gave good to excellent control of AMARE and AMABL. SASKR control was good to excellent with all treatments except EPTC applied at 2.0 lb ai/A and pendimethalin applied at 0.5 lb ai/A. Imazethapyr applied alone at 0.047 and 0.063 lb ai/A, bromoxynil applied at 0.25 and 0.38 lb ai/A and 2,4-DB applied at 0.5 and 0.75 lb ai/A gave poor control of both grasses. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Weed control in fall-seeded alfalfa

Treatment	Rate lb ai/A	Plants/ ft^2	AMARE	AMABL	SASKR	ECHCG	SETVI
			Weed Control[1]				
			---------------%---------------				
imazethapyr[2]	0.047	25	100	100	99	52	56
2,4-DB[2]	0.75	17	100	90	96	0	0
pendimethalin[3]	1.0	6	100	100	100	84	100
pendimethalin[3]/ imazethapyr[2]	0.5/0.063	10	100	100	100	99	97
EPTC[3]	2.0	24	100	99	70	99	100
trifluralin[3]	0.75	8	100	99	100	99	100
EPTC[3]/ imazethapyr[2]	2.0/0.063	24	100	100	100	100	100
trifluralin[3]/ imazethapyr[2]	0.75/0.063	8	100	100	100	99	99
imazethapyr[2]	0.063	25	99	99	100	55	63
pendimethalin[3]/ imazethapyr[2]	1.0/0.063	7	99	100	99	100	99
bromoxynil[2]	0.38	21	98	93	98	0	0
pendimethalin[3]	0.5	9	98	100	72	99	98
2,4-DB[2]	0.5	17	96	79	88	0	0
bromoxynil[2]	0.25	14	90	82	88	0	0
handweeded check		25	100	100	100	100	100
check		24	0	0	0	0	0
av weeds/M^2			9	10	4	16	7

1. Based on a visual scale from 0-100, where 0 = no control and 100 = dead plants.
2. Treatments applied postemergence.
3. Treatments applied preplant incorporated.

<u>Wild oat control with imazethapyr in seedling alfalfa.</u> Bell, C.E. Wild oat can be a serious weed problem in seedling alfalfa, sometimes appearing to be allelopathic to the crop. The purpose of this project was to evaluate imazethapyr for control of wild oat in seedling alfalfa. This research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

The alfalfa field was planted on November 1, 1990. Plot size was 1.5 m by 1.7 m. Experimental design was a randomized complete block with four replications. Application of herbicides was on November 29, 1990 when the wild oats had 6-8 leaves or on January 3, 1991 when the weed was 30 to 40 cm tall. Carrier volume was 150 l/ha at 138 kPa pressure using 8002LP flat fan nozzles.

Crop and wild oat biomass were assessed by sampling 1 m^2 on February 7, 1991. Samples were seperated by species and dried at 50C for three days before weighing. The early treatments had a significantly better alfalfa biomass then the later treatments. These treatments also provided much better control of wild oat. (Cooperative Extension, University of California, Holtville, CA 92250.)

Alfalfa and wild oat yield in Holtville, CA

Treatment	Rate kgai/ha	Application[a] date	Biomass[b] alfalfa	wild oat
imazethapyr + COC[c]	.052	1	74.4 a	86.1 c
imazethapyr + COC	.070	1	91.1 a	16.9 c
imazethapyr + COC	.052	2	15.4 bc	271.3 b
imazethapyr + COC	.070	2	36.5 b	113.3 c
untreated control			1.8 c	508.3 a

[a] - Application date = 1 - November 29, 1990, 2 - January 3, 1991
[b] - biomass = grams m^{-2}
[c] - COC = crop oil concentrate at 2.3 l/ha
Numbers in columns followed by the same letter are not significantly different at the 5% level according to the Least Significant Difference Test.

Grass and broadleaf weed control in seedling alfalfa. Downard, R.W. and D.W. Morishita. An experiment was conducted at the Kimberly Research and Extension Center to determine crop safety and efficacy of several sexthoxydim tank mix combinations. Alfalfa 'WL 312' and tame oats were seeded together on May 14. Plots 8 ft by 30 ft, were established under sprinkler irrigation in a randomized complete block design with four replications. Herbicides were applied with a hand-held sprayer at 10 gpa using 11001 flat fan nozzles. Application data are shown in Table 1. Soil texture was a silt loam with a pH of 8.1, 1.6% om and CEC of 16 meg/100 g soil. Crop injury and weed control were evaluated on June 18, July 3 and July 24, 1991.

Sethoxydim at 0.28 lb ai/A + 2,4-DB at 0.75 lb ai/A + adjuvant (Dash), sethoxydim at 0.28 lb ai/A + bromoxynil at 0.38 lb ai/A , sethoxydim at 0.28 lb ai/A + bromoxynil at 0.38 lb ai/A + adjuvant (Dash) and bromoxynil at .38 lb ai/A had caused crop injury that was still visible on July 3 (Table 2). In addition, sethoxydim at 0.28 lb ai/A + bromoxynil at 0.38 lb ai/A + adjuvant (Dash), and bromoxynil at 0.38 lb ai/A alone continued to exhibit serious crop injury symptoms on July 24. Tame Oat (AVESA) control was higher than 90% with all treatments containing sethoxydim and imazethapyr at 0.094 and 0.0625 lb ai/A + surfactant. Common lambsquarters (CHEAL) control was highest with all treatments except sethoxydim at 0.28 lb ai/A, sethoxydim + adjuvant (Dash), and imazethapyr at 0.0944 and 0.0625 lb ai/A + surfactant. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83301)

Table 1. Application data.

Application date	6/12/91
Air temperature (F)	75
Soil temperature (F)	80
Relative humidity (%)	43
Wind velocity (mph)	8-12

Table 2. Crop injury and weed control with several tank mix combinations near Kimberly, Idaho.

					Weed control[4]					
		Crop injury			AVESA			CHEAL		
Treatment	Rate	6/18	7/3	7/24	6/18	7/3	7/24	6/18	7/3	7/24
	lbs ai/A	%								
Check		0	0	0	0	0	0	0	0	0
Sethoxydim[1]	0.28	0	0	0	5	80	90	0	0	0
Sethoxydim[1]	0.28	0	0	0	10	87	97	0	0	0
Sethoxydim[1,2] +	0.28									
2,4-DB	0.75	5	5	0	7	83	95	62	83	98
Sethoxydim[1,2] +	0.28									
2,4-DB	0.75	3	13	7	5	88	97	64	87	98
Sethoxydim[1] +	0.28 +									
bromoxynil	0.38	27	50	0	5	70	3	73	82	95
Sethoxydim[1,2] +	0.28									
bromoxynil	0.38	23	47	20	3	87	92	75	90	77
2,4-DB	0.75	0	0	0	2	0	0	53	75	100
Bromoxynil	0.38	17	40	13	2	0	0	72	90	100
Imazethapyr[3]	0.094 +	0	0	0	2	3	0	8	0	0
Imazethapyr[3]	0.0625	0	0	0	2	0	0	7	0	0
Imazethapyr[2]	0.094	2	0	0	5	73	100	12	72	7
Imazethapyr[2]	0.0625	0	0	0	3	75	97	20	73	7
LSD (0.05)		4	12	12	5	13	6	10	13	12

[1]Sethoxydim = Poast plus
[2]Adjuvant (Dash) added at 1 pt/A.
[3]Surfactant R-11 added at 0.25% V/V.
[4]Weed species evaluated were cultivated oats (AVESA) and common lambsquarters (CHEAL).

Effect of additives on weed control with imazethapyr in seedling alfalfa. Miller, S.D. and T. Neider. Plots were established under sprinkler irrigation at the Research and Extension Center, Torrington, WY to evaluate the effect of additives on weed control and crop tolerance with imazethapyr. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Alfalfa (var. DeKalb 120) was seeded April 1, 1991 in a sandy loam soil (78% sand, 12% silt and 10% clay) with 1.4% organic matter and pH 7.6. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 20, 1991 (air temp. 82F, relative humidity 47%, wind SE at 3 mph, sky partly cloudy and soil temp. - 0 inch 84F, 2 inch 79F and 4 inch 73F) to 2nd trifoliolate leaf alfalfa and 0.5 to 1.5 inch weeds. Visual weed control and crop damage evaluations were made June 10 and plots harvested July 10 and August 19, 1991. Common lambsquarters (CHEAL) and green foxtail (SETVI) infestations were heavy and common sunflower (HELAN) infestations moderate but variable throughout the experimental area.

Treatments containing bromoxynil injured alfalfa 23 to 30% and reduced stands 8 to 13% depending on rate. Common sunflower control was excellent (92 to 100%) with all treatments except 2,4-DB; common lambsquarters control excellent (93 to 100%) with bromoxynil and 2,4-DB and green foxtail control excellent (92 to 100%) with imazethapyr. Common sunflower and green foxtail control with imazethapyr was not influenced by additive or rate; however, common lambsquarters control was 17 to 23% and 7 to 18% greater at 0.047 and 0.063 lb/A; respectively, when imazethapyr was applied with crop oil and nitrogen than when applied with other additives. Alfalfa yields were closely related to weed control and/or crop injury. Alfalfa yields exceeded 4 T/A the year of seeding with all imazethapyr treatments. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1792)

Additives with imazethapyr in seedling alfalfa.

Treatment[1]	Rate	Alfalfa[2] Inj	SR	lb/A yield		Weed Control[3] HELAN	CHEAL	SETVI	Weeds[3] lb/A yield	
	lb ai/A	%	%	1st	2nd	%	%	%	1st	2nd
imazethapyr(imaz)+X-77	0.047	0	0	3154	5233	93	57	93	1115	333
imaz+X-77+N	0.047	0	0	3166	5097	93	60	93	1126	95
imaz+oc	0.047	3	0	3160	5044	95	63	95	1073	59
imaz+oc+N	0.047	3	0	3215	5097	95	80	97	673	83
imaz+ms	0.047	0	0	3227	5079	92	62	92	1187	83
imaz+X-77	0.063	0	0	3215	5204	95	63	98	1081	166
imaz+X-77+N	0.063	2	0	3215	5073	95	73	98	612	77
imaz+oc	0.063	0	0	3135	5115	95	68	98	896	89
imaz+oc+N	0.063	3	0	3392	5008	98	80	100	461	71
imaz+ms	0.063	3	0	3215	5133	95	73	97	866	71
bromoxynil(brom)+X-77	0.38	30	13	2257	4706	100	100	0	544	927
2,4-DB+X-77	1.0	0	0	3276	5162	83	93	0	730	582
imaz+brom+X-77	0.047+0.25	23	8	2599	5346	100	100	100	0	59
imaz+2,4-DB+X-77	0.047+0.5	8	0	3160	5109	100	97	97	4	65
weedy check	- - -	0	0	1354	4902	0	0	0	4929	594

[1] Treatments applied May 20,1991; X-77 at 0.25% v/v, oc = Prime oil at 1 qt/A, N (28-0-0) at 1 qt/A and ms = Scoil at 1 qt/A.
[2] Alfalfa injury (inj) and stand reduction (SR) visually evaluated June 10 and plots harvested July 10 and August 19,1991.
[3] Weed control visually evaluated June 10 and weed yield determined July 10 and August 19, 1991.

Weed control in seedling alfalfa with bromoxynil and 2,4-DB. Miller, S.D. and T. Neider. Plots were established under sprinkler irrigation at the Research and Extension Center, Torrington, WY to evaluate weed control and alfalfa tolerance with bromoxynil and 2,4-DB alone or in combination with imazethapyr. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Alfalfa (var. DeKalb 120) was seeded April 1, 1991 in a sandy loam soil (78% sand, 12% silt and 10% clay) with 1.4% organic matter and pH 7.6. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 20, 1991 (air temp. 86F, relative humidity 45%, wind calm, sky partly cloudy and soil temp. - 0 inch 89F, 2 inch 79F and 4 inch 74F) to 2nd trifoliolate leaf alfalfa and 0.5 to 1.5 inch weeds. Visual weed control and crop damage evaluations were made June 11 and plots harvested July 9 and August 19, 1991. Common lambsquarters (CHEAL) and green foxtail (SETVI) infestations were heavy, common sunflower (HELAN) infestations moderate and volunteer corn (ZEMAY) infestations light and variable throughout the experimental area.

Treatments containing bromoxynil injured alfalfa 15 to37% and reduced stands 3 to 15% depending on rate. Common sunflower control was good to excellent (85 to 100%) with all treatments, common lambsquarters control excellent (92 to 100%) with all treatments except imazethapyr and green foxtail control excellent (93 to 100%) with imazethapyr. No treatment provided adequate control of volunteer corn. Alfalfa yields were closely rated to weed control and/or crop injury and exceeded 4 T/A the year of seeding with imazethapyr or 2,4-DB treatments. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1793)

Weed control in seedling alfalfa with bromoxynil and 2,4-DB.

Treatment[1]	Rate lb ai/A	Alfalfa[2] Inj %	Alfalfa[2] SR %	Alfalfa[2] lb/A yield 1st	Alfalfa[2] lb/A yield 2nd	Weed control[3] HELAN %	Weed control[3] CHEAL %	Weed control[3] SETVI %	Weed control[3] ZEMAY %	Weeds[3] lb/a yield 1st	Weeds[3] lb/a yield 2nd
bromoxynil(brom)	0.19	15	3	2251	4883	100	100	0	0	758	848
bromoxynil	0.25	22	5	2421	4912	100	100	0	0	640	695
bromoxynil	0.38	28	10	2259	4693	100	100	0	0	659	976
2,4-DB	1.0	0	0	3096	5215	85	93	0	0	763	354
2,4-DB+X-77	1.0	2	0	3167	5061	88	92	0	0	635	299
2,4-DB+X-77+N	1.0	3	0	3011	5049	90	95	0	0	678	506
2,4-DB+oc	1.0	7	0	3089	5328	90	95	0	0	521	403
2,4-DB+ms	1.0	3	0	3142	5130	92	97	0	0	559	293
imazethapyr(imaz)+X-77	0.063	0	0	3057	5233	95	78	97	10	1019	55
bromoxynil+2,4-DB	0.25+0.5	30	10	2174	4859	100	100	0	0	493	488
brom+imaz+X-77	0.125+0.063	22	8	2953	5239	100	100	100	10	62	31
brom+imaz+X-77	0.19+0.047	31	10	2356	5031	100	100	97	0	52	31
brom+imaz+X-77	0.25+0.032	37	15	2447	4966	100	100	93	0	52	49
2,4-DB+imaz+X-77	0.5+0.063	3	0	3161	5007	100	98	98	7	81	165
weedy check	- - -	0	0	1467	4824	0	0	0	0	5892	494

[1] Treatments applied May 20, 1991; X-77 at 0.25% v/v, oc = Prime oil at 1 qt/A, N(28-0-0) at 1 gal/A and ms = Scoil at 1 qt/A.

[2] Alfalfa injury (inj) and stand reduction (SR) visually evaluated June 11 and plots harvested July 9 and August 19, 1991.

[3] Weed control visually evaluated June 11 and weed yeild determined July 9 and August 19, 1991.

Seedling alfalfa 2,4-DB ester replacement study. Orloff, S.B. and D.W. Cudney. Broadleaf weeds can be extremely competitive with seedling alfalfa, lowering quality and reducing alfalfa stand density. 2,4-DB ester was the standard broadleaf herbicide in the high desert and was very effective. The ester formulation of 2,4-DB is no longer commercially available. The purpose of this trial was to evaluate alternative herbicides and compare their performance with 2,4-DB ester.

The trial was established in a seedling alfalfa field in the three trifoliate leaf stage. The herbicides were applied on 11/16/90, unless otherwise noted. Weeds present included tansy mustard (1-2 inches in diameter), London rocket (2-3 inches in diameter), and filaree (3-4 inches in diameter). The herbicides evaluated included: 2,4-DB ester (0.75), 2,4-DB amine (1.0 and 1.5), bromoxynil (0.38), and imazethapyr (0.063 lb/a). Paraquat was evaluated at 0.125, 0.25, and 0.5 lb/a, with the increasing rates corresponding to increasing alfalfa growth stage. They were applied on 11/16/90, 1/18/91, and 2/23/91 when the alfalfa had 3, 6, and 9 trifoliate leaves, respectively. Hexazinone was tested at 0.3 and 0.45 lb/a and was applied on 2/23/91, when the alfalfa had nine trifoliate leaves and a root system of at least six inches. Treatments were replicated four times. Evaluations of alfalfa injury and weed control were taken 60 and 120 days after initial treatment.

Both application rates of hexazinone caused significant alfalfa injury. The 0.5 rate of paraquat caused initial injury, which was no longer apparent 30 days later. None of the other treatments caused alfalfa injury.

London rocket was controlled by all treatments except the intermediate rate of paraquat (applied when weeds were larger in comparison to the low rate of paraquat which was applied when the weeds were smaller). Filaree and tansy mustard was controlled by all treatments except for bromoxynil and paraquat. Paraquat had its greatest effect when applied to small weeds at the low rate of application or at the highest rate of application later to larger weeds.

The results of this trial indicated that imazethapyr, hexazinone and 2,4-DB amine when applied at the proper time could replace 2,4-DB ester. However, hexazinone caused significant alfalfa injury. 2,4-DB amine has not adequately controlled filaree and tansy mustard in other trials particularly when applied to larger weeds. (University of California Cooperative Extension, Lancaster CA 93535 and University of California, Riverside CA 92521).

Seedling alfalfa 2,4-DB ester replacement study

Treatment	Rate lb/a	Alfalfa Injury 3/19	Alfalfa Injury 4/23	Weed Control[1] London Rocket 1/25	London Rocket 3/19	Filaree 1/28	Filaree 3/19	Tansy Mustard 1/28	Tansy Mustard 3/19
2,4-DB ester	0.75	0.1	0.5	10.0	10.0	10.0	10.0	9.5	9.6
2,4-DB amine	1.0	0.0	0.0	10.0	10.0	8.0	9.3	8.5	8.8
2,4-DB amine	1.5	0.3	0.0	10.0	10.0	9.5	9.8	9.3	9.4
Bromoxynil	0.38	0.0	0.8	10.0	9.5	1.3	1.8	1.3	2.8
Imazethapyr	0.063	0.8	0.0	10.0	10.0	10.0	10.0	10.0	10.0
Hexazinone	0.3	3.6	4.8	--	9.3	--	8.8	--	9.0
Hexazinone	0.45	3.8	6.8	--	9.8	--	9.3	--	9.1
Paraquat	0.125	0.5	0.0	10.0	8.5	7.3	7.5	2.0	5.3
Paraquat	0.25	0.0	0.0	6.5	3.3	2.5	2.0	2.3	2.8
Paraquat	0.5	2.9	0.0	--	9.8	--	5.5	--	6.3
Check	---	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5
LSD 0.05		0.7	1.1	0.3	1.5	2.3	1.9	2.2	1.4

[1] Control Rating 0 = no effect 10 = all plants dead

The effect of adjuvants on the activity of sethoxydim for the control of foxtail barley and downy brome in seedling alfalfa. Orloff, S.B. and D.W. Cudney. Winter annual grasses, primarily foxtail barley, downy brome, and volunteer cereals can be extremely competitive with seedling alfalfa in the high desert. Pronamide has been found to be effective for the control of these weeds, however, it is costly and is only effective on sprinkler irrigated alfalfa fields in the high desert. An alternative, sethoxydim, has only provided partial control of these grass species. A trial was conducted to compare pronamide with sethoxydim and to determine if the efficacy of sethoxydim could be improved with the addition of various adjuvants.

The trial was established on November 16 in a fall-planted, seedling alfalfa field 12 miles east of Lancaster, California. The experimental design was a randomized complete block. Each plot measured 10 by 20 ft and was replicated four times. The herbicides were applied with a constant pressure CO_2 backpack sprayer with a spray volume of 20 gallons/A. Sethoxydim (0.25) and pronamide (0.75 lb/a) were applied to foxtail barley and downy brome, both of which were in the three tiller stage and were two to five inches in diameter. The trade names of the adjuvants tested were Suphtac, Super Dash, and Booster Plus (coc). Additional comparisons were made using the commercial formulation of sethoxydim with an adjuvant (Poast Plus) and this formulation combined with Booster Plus (coc). The application rates of the adjuvants are listed in the table.

Adjuvants had a significant effect on the activity of sethoxydim. This was evident at both evaluation dates and for both weed species. Sethoxydim applied without an adjuvant did not control foxtail barley or downy brome. The addition of Surphtac improved control slightly but, the improvement was only significant for foxtail barley on the last evaluation date. The crop oil concentrate (Booster Plus) also improved control over no adjuvant, but the control of both grass species was still unacceptable (less than 80 percent control). Foxtail barley control was 100 percent when Dash was used as the adjuvant. However, downy barley was less - approximately 80 percent. Grass control with the formulation of sethoxydim with an adjuvant (Poast Plus) was similar to that of sethoxydim plus Super Dash. Adding a crop oil concentrate to the formulation of sethoxydim already containing an adjuvant did not improve control. Pronamide provided excellent control of both grass species.

These data indicate that adjuvants have a significant effect on the activity of sethoxydim. When the proper adjuvant is added to sethoxydim, foxtail barley control comparable to pronamide can be accomplished. However, downy brome control was not enhanced to a level comparable to pronamide. (University of California Cooperative Extension, Lancaster, CA 93535 and University of California, Riverside, CA 92521)

The effect of adjuvents on the activity of sethoxydim for the control of foxtail barley and downy brome in seedling alfalfa.

				Ratings[1]			
	Rate			Foxtail Barley		Downy Brome	
Treatment	lb ai/a	Adjuvant	Rate	3/19	4/23	3/19	4/23
Sethoxydim	0.25	None	--	3.0	1.3	3.0	2.5
Sethoxydim	0.25	Booster Plus	2 pt	6.6	7.6	6.9	5.8
Sethoxydim	0.25	Surphtac	0.5%	4.0	5.0	4.3	3.8
Sethoxydim	0.25	Super Dash	1 pt	8.9	10.0	8.9	8.0
Sethoxydim[2]	0.25	None	--	8.4	9.7	8.3	7.8
Sethoxydim[2]	0.25	Booster Plus	2 pt	7.9	9.1	7.9	6.8
Pronamide	0.75	None	--	6.8	9.9	9.8	9.9
Check	--	None	--	0.8	0.0	0.8	1.0
LSD 0.05				2.2	1.3	1.9	2.0

[1]Ratings 0 = no grass control 10 = all grass dead

[2] Sethoxydim formulated with adjuvant (Poast Plus)

Postemergence herbicide combinations for grass and broadleaf weed control in seedling alfalfa. Orloff, S.B. and D.W. Cudney. It is often necessary to apply both broadleaf and grass postemergence herbicides for weed control in seedling alfalfa. A trial was established to evaluate weed control achieved when using broadleaf and grass control herbicides alone and in combination. The trial was established on December 4, 1990 in a fall-planted, seedling alfalfa field in Newberry Springs, CA. The experimental design was a randomized complete block. Each plot measured 10 by 20 ft and was replicated four times. The herbicides were applied with a constant pressure CO_2 backpack sprayer with a spray volume of 20 gallons/A. The broadleaf herbicides tested were 2,4-DB amine and ester, and imazethapyr. The grass herbicides were sethoxydim and pronamide. The alfalfa was in the third trifoliate leaf stage at the time of application. The weeds were London rocket (4 inches in diameter), tansy mustard (2-3 inches in diameter) and volunteer barley (2-3 tillers and 3 inches tall). The plots were evaluated on 1/25/91 and 3/6/91.

Only the combination treatments containing 2,4-DB amine and sethoxydim or pronamide caused significant alfalfa injury and this injury was short-lived and was not apparent at the time of the later evaluation. Any treatment containing imazethapyr, alone or in combination, controlled 100 percent of the tansy mustard. 2,4-DB amine at either rate (0.75 or 1.0 lb/a) did not control tansy mustard (less than 60 percent control). However, when the ester formulation was used, or when sethoxydim plus a crop oil concentrate were added to 2,4-DB amine, tansy mustard control improved to greater than 90 percent. London rocket was easier to control than tansy mustard. All rates and combinations of the broadleaf herbicides provided 100 percent London rocket control except the low rate of 2,4-DB amine (a rating of 9.3). Shepherd's purse control was similar, with all treatments containing a broadleaf herbicide controlling greater than 90 percent of the shepherd's purse. Imazethapyr alone partially controlled volunteer barley. Barley control improved when 2,4-DB amine was added to Imazethapyr. As expected, the broadleaf weed control herbicides (2,4-DB amine and ester) did not control volunteer barley. Sethoxydim and pronamide controlled volunteer barley alone and when used in combination with 2,4-DB amine. The best treatments for complete control of all the species in this trial were the combination treatments of 2,4-DB amine plus imazethapyr, sethoxydim, or pronamide. (University of California Cooperative Extension, Lancaster. CA 93535 and University of California, Riverside, CA 92521)

Postemergence herbicide combinations for grass and broadleaf weed control in seedling alfalfa

Treatment	Rate lb/a	Alfalfa Injury 1/25	Alfalfa Injury 3/6	Weed Control[1] Mustards[2] 1/25	Tansy Mustard 3/6	London Rocket 3/6	Shepherd's Purse 3/6	Vol. Barley 3/6
Imazethapyr	0.063	0.6	0.8	9.9	10.0	10.0	9.8	7.3
2,4-DB amine	0.75	0.3	0.5	2.8	5.5	9.3	9.5	0.0
2,4-DB amine	1.0	0.8	0.6	5.8	5.8	10.0	10.0	0.0
2,4-DB ester	0.75	1.1	0.4	8.8	9.3	10.0	9.6	0.0
Imaz. + 2,4-DBa	0.063 + 0.25	0.6	0.6	9.8	10.0	10.0	10.0	9.5
Imaz. + 2,4-DBa	0.063 + 0.5	1.4	0.8	10.0	10.0	10.0	10.0	10.0
Imaz. + 2,4-DBa	0.063 + 0.75	1.9	1.0	9.9	10.0	10.0	10.0	10.0
Sethoxydim	0.375	0.0	0.1	0.0	1.5	1.3	1.3	9.8
Pronamide	0.75	0.3	0.4	0.0	2.5	3.3	2.3	10.0
2,4-DBa + seth.	0.75 + 0.375	2.9	0.9	8.1	9.5	10.0	10.0	10.0
2,4-DBa + pron.	0.75 + 0.75	2.6	0.8	4.5	5.8	10.0	9.5	9.0
Check	---	0.5	0.1	0.0	1.5	0.8	0.0	0.0
LSD 0.05		1.4	0.5	1.3	1.5	2.0	1.6	2.3

[1] Control Rating 0 = no effect 10 = all plants dead

[2] Mustards - any early evaluation where individual species were not separated.

Legume response to imazethapyr and bromoxynil. Miller, S.D. and T. Neider. Plots were established under sprinkler irrigation at the Research and Extension Center, Torrington, WY to evaluate the response of six legume species to postemergence applications of imazethapyr or bromoxynil. Plots were 9 by 11 ft. with three replications arranged in a split block with a randomized complete block design. Legume species (cultivars listed in table) were seeded April 2, 1991 in a sandy loam soil (76% sand, 14% silt and 10% clay) with 1.4% organic matter and pH 7.6. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 20,1991 (air temp. 78F, relative humidity 47%, wind SE at 10 mph, sky mostly cloudy and soil temp. - 0 inch 86F, 2 inch 84F and 4 inch 80F) to 1 to 2 inch legumes (alfalfa 2nd trifoliolate leaf). Legume stand counts and visual crop damage evaluations made July 10, plant height measured July 15 and plots harvested July 16 and August 28, 1991.

Legume species differed considerably in their tolerance to postemergence applications of bromoxynil or imazethapyr (Table 2). The low rate of bromoxynil caused severe (50 to 95%) injury to sainfoin, sweetclover and birdsfoot trefoil while the high rate severely damaged all species but alfalfa. Legume tolerance to imazethapyr was excellent at 0.063 lb/A and only moderate (<25%) injury was observed on several species at 0.125 lb/A. Legume yields reflected crop injury (Table 3). Legume yields were higher at 2nd rather than 1st cutting with all species except sweetclover. Alfalfa appeared to be the most competitive and cicer miklvetch the least competitive legume species with weeds. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1794)

Table 1. Legume species and cultivars planted in 1991

Legume species	Cultivar
alfalfa	Apollo II
cicer milkvetch	Monarch
red clover	Kenland
sainfoin	Remount
sweetclover	Yellow blossom
birdsfoot trefoil	common

Table 2. Legume injury following treatment with imazethapyr or bromoxynil

Treatment[1]	Rate lb ai/A	% Injury[2] Legume species alfalfa	milkvetch	r. clover	sainforn	s. clover	trefoil	Mean
imazethapyr+X-77	0.063	0	0	0	0	0	0	0
imazethapyr+X-77+N	0.063	0	5	2	0	0	0	1
imazethapyr+X-77	0.125	3	10	13	0	10	12	8
imazethapyr+X-77	0.125	3	20	22	0	12	20	13
bromoxynil	0.25	12	32	15	50	93	95	50
bromoxynil	0.38	23	80	87	97	100	100	81
	Mean	7	25	23	25	36	38	

[1] Treatments applied May 20, 1991; X-77 at 0.25% v/v and N (28-0-0) at 1 qt/A.
[2] Crop injury evaluated July 10, 1991.

Table 3. Legume yield at 1st and 2nd harvest following treatment with imazethapyr or bromoxynil

Treatment[1]	Rate lb ai/A	Yield lb/A[2] Legume species alfalfa	milkvetch	r.clover	sainfoin	s.clover	trefoil	Mean
					1st			
imazethapyr+X-77	0.063	3654	915	860	2033	4550	1266	2213
imazehtapyr+X-77	0.063	3308	915	1398	2379	4761	1329	2348
imazethapyr+X-77	0.125	3270	840	814	2259	4561	1496	2207
imazethapyr+X-77+N	0.125	3188	771	785	2457	4160	1180	2090
bromoxynil	0.25	2696	482	814	1172	40	97	884
bromoxynil	0.38	2350	230	17	21	0	0	436
	Mean	3078	692	781	1720	3012	895	
check	---	2192	150	372	960	3157	544	1229
					2nd			
imazethapyr	0.063	5628	1768	2641	3651	2598	2022	3051
imazethapyr+X-77+N	0.063	5554	2134	2696	3641	2727	2046	3133
imazethapyr+X-77	0.125	5610	2713	2918	3872	2804	2328	3374
imazethapyr+X-77+N	0.125	5628	2702	2952	4025	2715	2191	3369
bromoxynil	0.25	5492	2318	2540	1781	323	76	2088
bromoxynil	0.38	4786	1121	163	310	0	0	1063
	Mean	5450	2126	2318	2880	1861	1444	
check	---	5185	170	887	2460	2226	989	1986

[1] Treatments applied May 20, 1991; X-77 at 0.25% v/v and N (28-0-0) at 1 qt/A.
[2] Yield determined July 16 and August 28, 1991.

Reduced herbicide rates in spring barley. Boerboom, C.M. To determine whether full herbicide rates are required for broadleaf weed control in spring barley, two trials were conducted where three postemergence herbicides were applied at 0.33X, 0.67X, and 1X of full labeled rates. Herbicides evaluated were MCPA, bromoxynil plus MCPA, and thifensulfuron plus tribenuron. The experimental design was a split-plot with four replications with herbicides as main plots and rates as subplots. Plots measure 10 by 30 ft. The first trial was on the WSU Spillman farm and was seeded with 80 lb/a of 'Harrington' spring barley in 7 in. rows on May 8, 1991. The second trial was on the McGreevy farm near Pullman, WA and was seeded with 85 lb/a 'Gallitin' spring barley on April 23, 1991.

Herbicides were applied with a CO_2 pressurized backpack sprayer to both sites on June 4 (Table 1). Barley on the Spillman farm had five leaves and two tillers and was 10 in. tall. Barley on the McGreevy farm had six leaves and one tiller and was 10 to 14 in. tall. The Spillman farm had 1 to 1.5 in. tall henbit at 47 plants/ft^2. The McGreevy farm had 0.5 to 4 in. tall common lambsquarters at 1 to 5 plants/ft^2, 0.5 to 2 in. tall henbit at 1 to 3 plants/ft^2, and sparse populations of field pennycress, mayweed chamomile, and wild buckwheat.

At the Spillman farm, herbicides did not control the henbit completely, so at 36 days after treatment, two subsamples of henbit were harvested from each plot. Nontreated plots averaged 258 lb/a of dry henbit biomass. The dense infestation of henbit did not reduce spring barley yields in nontreated plots.

At the McGreevy farm, all herbicides provided 99 to 100% control when combined with the barley competition. Likewise, nontreated plots had few weeds remaining at harvest due to the competition from the spring barley. As a result, yield did not increase with any of the herbicide treatments. (Department of Crop and Soil Sciences, Washington State Univ., Pullman, WA 99164).

Table 1. Application data

Site	Spillman	McGreevy
Date	June 4, 1991	June 4, 1991
Air temperature (F)	60	61
Soil temperature (F)	74	68
Relative humidity (%)	52	50
Wind direction/speed (mph)	NW/3-5	NW/0-3
Volume (gpa)	10	10
Soil OM (%)	2.4	4.1
Soil texture	silt loam	silt loam

Table 2. Reduced herbicide rates in spring barley

Herbicide	Rate	Spillman farm Henbit biomass	Spillman farm Barley yield	McGreevy farm Barley yield
	(lb/a)	(% of check)	(T/a)	(T/a)
MCPA	0	100	3.00	1.89
	0.25	79	2.84	1.87
	0.5	51	2.93	1.97
	0.75	38	2.96	2.06
bromoxynil + MCPA	0	100	2.83	1.94
	0.08 + 0.08	69	2.93	1.91
	0.17 + 0.17	50	2.77	1.87
	0.25 + 0.25	61	2.95	1.92
thifensulfuron + tribenuron + surfactant[1]	0	100	2.96	1.84
	0.004 + 0.002	48	2.96	1.87
	0.008 + 0.004	39	2.96	1.89
	0.012 + 0.006	35	2.97	1.93
LSD (0.05)		35	n.s.	n.s.

[1]Surfactant was R-11 and was added at 0.25% v/v.

MCPA and 2,4-D formulations for broadleaf weed control in spring barley. Carpenter, T.L., C.R. Thompson, and D.C. Thill. Dry soluble concentrate (DSC) formulations of MCPA and 2,4-D were evaluated in 'Russel' spring barley on the University of Idaho Plant Science Farm near Moscow, Idaho. Two rates of each DSC formulation were compared to equivalent (lb ae/a) liquid soluble concentrate (LSC) formulations of MCPA and 2,4-D. In addition to an untreated control, a tank mix of thifensulfuron-tribenuron + bromoxynil was applied as a treated control.

The predominate broadleaf weeds were henbit (LAMAM), mayweed chamomile (ANTCO), pineapple weed (MATMT), field pennycress (THLAR), prickly lettuce (LACSE), hairy nightshade (SOLAS), and pigweeds (AMARS). All treatments were applied to barley with 3 to 4 leaves, henbit with no more than 4 leaves, mayweed chamomile and pineappleweed 1 inch in diameter, field pennycress 1 to 3 inches tall, prickly lettuce 4 inches in diameter, hairy nightshade with two leaves, and pigweeds (redroot pigweed and tumble pigweed) with 2 leaves.

Herbicide treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 10 gal/a at 40 psi and 3 mph (Table 1). Plots were 10 by 30 ft. Treatments were arranged in a randomized complete block design and were replicated four times. Herbicide efficacy was estimated visually on July 1, 1991. Grain from a 4.5 by 27 ft area in each plot was harvested on August 20.

Table 1. Application and soil analysis data

Application date	June 12
Air temperature (F)	54
Soil temperature at 2 in. (F)	51
Relative humidity (%)	69
Wind speed (mph) - direction	2-W
Soil pH	5.7
OM (%)	2.9
CEC (meq/100g soil)	18.2
Texture	silt loam

All herbicide treatments controlled field pennycress, prickly lettuce, and the two pigweed species 88% or better. All treatments controlled hairy nightshade 88% or better except dry soluble MCPA at 0.25 lb ae/a. Thifensulfuron-tribenuron + bromoxynil controlled henbit, mayweed chamomile, and pineappleweed 98% or better.

Barley in the treated control, and barley treated with the low rate of LSC formulations of MCPA and 2,4-D, yielded more grain than did the untreated barley. No crop injury was observed (data not shown). (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. MCPA and 2,4-D formulations for broadleaf weed control in spring barley

Treatment[1]	Rate	Grain yield	LAMAM	ANTCO MATMT[2]	THLAR	LACSE	SOLAS	AMARS[3]
			Weed species					
	lb ae/a	lb/a	% control[4]					
control	--	2672	--	--	--	--	--	--
MCPA (DSC)	0.25	2962	9	5	99	99	73	88
MCPA (DSC)	0.50	2937	31	17	99	99	95	93
MCPA (LSC)	0.25	3116	13	8	99	99	88	93
MCPA (LSC)	0.50	2661	30	19	99	99	95	94
2,4-D (DSC)	0.31	2975	11	53	99	99	88	94
2,4-D (DSC)	0.62	2769	18	35	99	99	95	93
2,4-D (LSC)	0.31	3043	9	28	99	99	95	94
2,4-D (LSC)	0.62	2856	19	43	99	99	95	95
thifensulfuron-tribenuron + bromoxynil + R-11	0.008[5] 0.187 0.25%[6]	3127	98	99	99	99	99	99
$LSD_{(0.05)}$		353	10	28	--	--	20	6
Weed density (plants/ft^2)			8	<1	2	1	<1	1

[1] dimethylamine salt (all MCPA and 2,4-D treatments)
[2] both mayweed chamomile and pineappleweed
[3] AMARS = both redroot pigweed and tumble pigweed
[4] visual estimate of % reduction in weed density compared to untreated check
[5] herbicide tank mixture expressed as active ingredient
[6] nonionic surfactant applied on a % v/v

Evaluation of two formulations of endothall for broadleaf and grass weed control and crop injury in the greenhouse. Dial, M.J., C.R. Thompson, D.C. Thill, and B. Shafii. Using 15 by 3 by 23 in. plastic flats, eight broadleaf and two grass weed species, 'Morex' spring barley, and 'WS-88' sugarbeet were seeded in individual 15 in. rows into a commercially prepared planting media (Table 1). Fifteen days after emergence, the plants were sprayed with commercially available endothall at 0.75, 0.563, and 0.375 lb ae/a or encapsulated endothall at 0.8, 0.6, and 0.4 lb ai/a with an enclosed, movable track, greenhouse sprayer, calibrated to deliver 15 gal/a spray solution at 40 psi. The sprayed flats were returned to the greenhouse and arranged on benches in a randomized complete block split plot design with plant species as main plots and herbicide and rate combinations as subplots. The treatments were replicated four times. Herbicide efficacy and crop injury were evaluated visually 3, 7, and 14 days after treatment (DAT).

Table 1. Weed and crop species growth stage at herbicide application.

Plant	Bayer code	Growth stage
kochia	KCHSC	2 in. tall with 6 leaves
common cocklebur	XANST	2 in. tall with 4 leaves
red sorrel	RUMAA	1 in. tall with 4 leaves
redroot pigweed	AMARE	1 in. tall with 4 leaves
wild buckwheat	POLCO	2 in. tall with 5 leaves
cheat	BROSE	3 in. tall with 2 leaves
shepherdspurse	CAPBP	1 in. tall with 4 leaves
tall morningglory	PHBPU	3 in. tall with 3 leaves
annual bluegrass	POAAN	3 in. tall with 3 leaves
common purslane	POPOL	2 in. tall with 4 leaves
spring barley (cv. Morex)	HORVU	6 in. tall with 5 leaves
sugarbeet (cv. WS-88)	BETVU	2 in. tall with 4 leaves

Common cocklebur, red sorrel, redroot pigweed, and wild buckwheat were controlled 85 percent or greater 3 DAT Table 2). Redroot pigweed, shepherdspurse, and tall morningglory control decreased at 7 DAT and 14 DAT. No visible symptoms of crop injury were observed on spring barley or sugarbeets. Percent weed control was higher when the high and the intermediate rates of herbicide were applied (Table 3).

The plant species by herbicide interaction was significant at 3 and 7 DAT (Table 2). Encapsulated endothall usually controlled each weed species the same as or better than the commercially available endothall formulation. However, the commercially available endothall controlled tall morningglory 55 percent compared to 11 percent ($P = 0.0001$) with the encapsulated product (Table 2). The ranking of control remained the same 7 DAT ($P = 0.0001$). The plant species by herbicide interaction was not observed 14 DAT. The plant species by herbicide rate and the plant species by herbicide by herbicide rate interactions were not significant at any evaluation date. (Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Effect of commercially available endothall vs. encapsulated endothall on 12 plant species in greenhouse experiments

Plant species	Percent control[1] 3 DAT H1[2]	H2	7 DAT H1	H2	14 DAT H1	H2
	(--------------% of check					---------------)
kochia	0	0	0	0	0	0
common cocklebur	88	99	89	96	82	73
red sorrel	85	86	93	92	85	80
redroot pigweed	88	96	72	82	41	40
wild buckwheat	89	97	89	97	87	90
cheat	0	0	0	0	0	0
shepherdspurse	47	55	23	23	10	7
tall morningglory	55	11	30	11	8	3
annual bluegrass	0	0	0	0	0	0
common purslane	0	0	0	0	0	0
spring barley	0	0	0	0	0	0
sugarbeet	0	0	0	0	0	0
LSD (0.05) species	7	7	6	6	7	7
LSD (0.05) herbicide by species	11		10		ns	

[1] Visual estimate of percent reduction in plant density compared to the check.
[2] H1=commercially available endothall H2=encapsulated endothall.

Table 3. Effect of herbicide rate of commercially available endothall and encapsulated endothall on ten weed species in greenhouse experiments

Rate[1]	Percent control[2] 3 DAT	7 DAT	14 DAT
	(------------% of check		-----------------)
high	41	36	30
intermediate	40	35	28
low	32	29	20
LSD (0.05)	3	3	4

[1] Herbicide rate mean is calculated by summing across herbicide rate combinations.
[2] Visual estimate of percent reduction in plant density compared to the check.

Wild oat control in malting barley. Downard, R.W., D.W. Morishita and W. Ying. The study was established in Blaine county to compare the imazamethabenz formulations and adjuvants for wild oat control in malting barley. Soil texture was a loam with 1.4% OM and pH 8.1. Plot size was 8 by 25 ft established under sprinkler irrigation in a randomized complete block with four replications. Herbicides were applied with hand-held sprayer at 10 gpa using 11001 flat fan nozzles at the 1 to 3 leaf, 3 to 5 leaf and 5 to 7 leaf growth stage of wild oat. Crop injury and wild oat control were evaluated July 22 and August 12, 1991. Grain was harvested September 9 with a small plot combine.

There was no apparent crop injury with any treatment. Wild oat control was excellent (86-99%) with all treatments except imazamethabenz plus difenzoquat plus surfactant applied when wild oat at 5-7 leaf stage. Barley yield was also lowest (66 Bu/A) with this treatment. Barley yield was lower in untreated check plots compared to other treated plots. In addition, there was no significant differences in wild oat control and barley yield between different formulations and adjuvants. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83301)

Table 1. Application data.

Application timing (wild oat)	1-3 lv	3-5 lv	5-7 lv
Application date	6/10/91	6/18/91	6/24/91
Air temperature (F)	79	73	66
Soil temperatue (F)	60	60	59
Relative humidity (%)	60	51	61
Wind velocity (mph)	0	0	0

Table 2. Crop injury, wild oat control and barley yield.

Treatment	Formulation	Rate	Application stage	Crop injury 7/22/91	AVEFA[1] control 7/22/91	AVEFA[1] control 8/12/91	Yield
		lb ai/A		%	%	%	Bu/A
Check				0	0	0	71
Imazamethabenz[2]	LC	0.47	1-3 lf	0	98	97	87
Imazamethabenz[2]	LC	0.38	1-3 lf	0	100	93	83
Imazamethabenz[2]	LC	0.31	1-3 lf	0	98	89	82
Imazamethabenz[3]	LC	0.47	1-3 lf	0	97	97	89
Imazamethabenz[3]	LC	0.38	1-3 lf	0	100	98	82
Imazamethabenz[2]	LC	0.31	1-3 lf	0	99	99	90
Imazamethabenz[2]	DF	0.47	1-3 lf	0	94	93	85
Imazamethabenz[2]	DF	0.38	1-3 lf	0	93	86	79
Imazamethabenz[2]	DF	0.31	1-3 lf	0	96	88	74
Imazamethabenz[3]	DF	0.94	1-3 lf	0	100	100	88
Imazamethabenz[3]	DF	0.47	1-3 lf	0	99	98	91
Imazamethabenz[3]	DF	0.38	1-3 lf	0	97	95	86
Imazamethabenz[3]	DF	0.31	1-3 lf	0	100	98	82
Imazamethabenz[2] difenzoquat	DF	0.23 0.50	1-3 lf	0	99	96	83
Imazamethabenz+ difenzoquat	DF	0.23+ 0.50	1-3 lf	0	98	91	82
Imazamethabenz[2]+ difenzoquat	DF	0.23+ 0.50	3-5 lf	0	98	93	80
Imazamethabenz[2]+ difenzoquat	DF	0.23+ 0.50	3-5 lf	0	99	98	87
Imazamethabenz+ difenzoquat	DF	0.23+ 0.50	5-7 lf	0	97	79	66
Imazamethabenz+ $NaHSO_4$	SC	0.38+ 0.25	1-3 lf	0	95	87	80
Imazamethabenz+ $NaHSO_4$	SC	0.31+ 0.31	1-3 lf	0	96	91	71
LSD (.05)				0	5	8	11

[1]AVEFA=wild oat.
[2]Surfactant X-77 added at 0.25% v/v.
[3]Surfactant Sunit II added at 1.5% pt/A.

Wild oats control in irrigated barley. Miller, S.D., T. Neider and J.G. Lauer. Plots were established under furrow irrigation on Heart Mountain which is near Cody, WY to evaluate wild oats control with postemergence herbicides applied at several stages. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Barley (var. Moravian III) was seeded April 11, 1991 in a sandy loam soil (67% sand, 17% silt and 16% clay) with 2.1% organic matter and pH 8.1. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 10 gpa at 40 psi May 23 (air temp. 69F, relative humidity 55%, wind E at 6 mph, sky partly cloudy and soil temp. - 0 inch 80F, 2 inch 72F and 4 inch 60F) to 3-leaf barley and 2-leaf wild oats or May 30, 1991 (air temp. 65F, relative humidity 45%, wind calm, sky cloudy and soil temp. - 0 inch 67F, 2 inch 58F and 4 inch 52F) to 2-tiller barley and 3 to 4-leaf wild oats. Visual weed control, crop damage and plant height measurements were made July 18 and plots harvested August 14, 1991. Wild oats (AVEFA) infestations were heavy and quackgrass (AGGRE) infestations moderate but variable throughout the experimental site.

No treatment reduced barley stand; however, fenoxaprop combinations with MCPA and 2,4-D injured barley 0 to 10% depending on formulation and rate. Wild oats control was excellent (97 to 100%) with all treatments except difenzoquat. Quackgrass control was not adequate with any treatment (0 to 40%). Barley yields reflected wild oats control and were 20 to 30 bu/A higher in herbicide treated compared to weedy check plots. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1805)

Wild oats control in barley

		Barley[2]				Weed control[3]	
Treatment[1]	Rate lb ai/A	Inj %	SR %	Height inches	Yield bu/A	AVEFA %	AGRRE %
2-leaf							
imazamethabenz+X-77	0.38	0	0	35	110	100	7
imazamethabenz+X-77	0.47	0	0	35	109	100	13
diclofop	1.0	0	0	36	111	100	27
diclofop+oc	0.75	0	0	35	111	97	20
4-leaf							
feno/MCPA/2,4-D(45)	0.47	0	0	35	111	99	23
feno/MCPA/2,4-D(45)	0.53	7	0	33	106	100	33
feno/MCPA/2,4-D(45)	0.59	10	0	31	104	100	43
feno/MCPA/2,4-D(45)	0.66	8	0	31	104	100	40
feno/MCPA/2,4-D(40)	0.47	0	0	35	114	97	23
feno/MCPA/2,4-D(40)	0.53	7	0	34	114	100	27
feno/MCPA/2,4-D(40)	0.59	5	0	32	106	100	33
feno/MCPA/2,4-D(40)	0.66	7	0	33	106	100	33
difenzoquat+X-77	0.63	0	0	35	100	70	0
difenzquat+X-77	1.0	0	0	35	104	83	0
weedy check	- - -	0	0	35	84	0	0

[1] Treatments applied May 23 and 30, 1991; X-77 included at 0.25% v/v, oc = At Plus 411 F at 1 qt/A and / = package mix.
[2] Barley injury (inj) and stand reduction visually evaluated July 18, height measured July 18 and plots harvested August 14, 1991.
[3] Weed control visually evaluated July 18, 1991.

Weed control in furrow irrigated barley. Miller, S.D., T. Neider and J.G. Lauer. Plots were established under furrow irrigation at the Research and Extension Center, Powell, WY to evaluate broadleaf weed control and barley tolerance with postemergence herbicide treatments. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Barley (var. B1202) was seeded April 11, 1991 in a clay loam soil (42% sand, 24% silt and 34% clay) with 1.4% organic matter and pH 7.9. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 30, 1991 (air temp. 63F, relative humidity 56%, wind calm, sky cloudy and soil temp. - 0 inch 63F, 2 inch 54F and 4 inch 50F) to 4-leaf barley and 0.5 to 2 inch weeds. Visual weed control, crop damage and plant height measurements were made July 18 and plots harvested August 13, 1991. Wild mustard (SINAR) and wild buckwheat (POLCO) infestations were heavy and uniform throughout the experimental site.

No treatment reduced barley stand and only slight injury (2 to 7%) was observed with several treatments containing dicamba. Wild mustard control was excellent (97 to 100%) with all treatments except dicamba or bromoxynil and wild buckwheat control good to excellent (85 to 100%) with all treatments except 2,4-D, MCPA or the low rate of HOE-032. Barley yields were 11 to 23 bu/A higher in herbicide treated compared to weedy check plots and related closely to weed control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1803)

Broadleaf weed control in barley

Treatment[1]	Rate lb ai/A	Barley[2] Inj %	SR %	Height inches	Yield bu/A	Weed control[3] SINAR %	POLCO %
tribenuron(trib)+X-77	0.019	0	0	35	108	100	85
thifensulfuron/trib+X-77	0.019	0	0	36	110	100	90
bromoxynil(brom)	0.38	0	0	36	102	77	100
brom/MCPA	0.75	0	0	36	111	100	100
clopyralid(clop)/2,4-D	0.59	0	0	37	108	99	96
clop/MCPA	0.59	0	0	36	108	100	100
dicamba(dica)	0.063	0	0	36	102	53	100
dica+X-77	0.063	5	0	35	101	58	100
fluroxypyr(flur)	0.063	0	0	37	100	42	92
2,4-D	0.5	0	0	37	109	100	72
MCPA	0.75	0	0	36	105	98	57
HOE-032+X-77	0.03	0	0	36	100	99	80
HOE-032+X-77	0.045	0	0	36	106	99	90
dica+MCPA	0.063+0.5	2	0	35	113	100	100
dica+trib+X-77	0.063+0.019	5	0	35	102	100	97
dica+thif/trib+X-77	0.063+0.019	7	0	35	102	100	100
dica+clop/MCPA	0.063+0.59	2	0	36	106	100	98
brom+trib+X-77	0.25+0.019	0	0	36	110	100	97
brom+thif/trib+X-77	0.25+0.019	0	0	36	110	100	100
brom+clop/MCPA	0.25+0.59	0	0	37	106	100	99
brom+clop/2,4-D	0.25+0.59	0	0	37	106	100	100
brom/MCPA+trib+X-77	0.5+0.019	0	0	36	108	100	97
brom/MCPA+thif/trib+X-77	0.5+0.019	0	0	36	106	100	99
2,4-D+trib+X-77	0.25+0.019	0	0	36	106	100	95
2.4-D+thifensulfuron(thif)+X-77	0.25+0.019	0	0	36	105	100	93
2,4-D+HOE-032+X-77	0.25+0.03	0	0	36	114	100	87
2,4-D+HOE-032+X-77	0.25+0.045	0	0	36	113	100	95
2,4-D+flur	0.38+0.063	0	0	37	105	98	93
weedy check		0	0	37	91	0	0

[1] Treatments applied May 30, 1991; X-77 included at 0.25% v/v and / = package mix.
[2] Barley injury (inj) and stand reduction (SR) visually evaluated and plant height measured July 18 and plots harvested August 13, 1991.
[3] Weed control visually evaluated July 18, 1991.

Broadleaf weed control in barley. Miller, S.D., T. Neider and J.M. Krall. Plots were established under sprinkler irrigation at the Research and Extension Center, Torrington, WY to evaluate weed control and barley tolerance with postemergence herbicide treatments. Plots were 9 by 45 ft. with three replications arranged in a randomized complete block. Barley (var. Steptoe) was seeded April 1, 1991 in a sandy loam soil (81% sand, 9% silt and 10% clay) with 1.3% organic matter and pH 7.7. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 13, 1991 (air temp. 76F, relative humidity 28%, wind SW at 5 mph, sky partly cloudy and soil temp. - 0 inch 78F, 2 inch 79F and 4 inch 65F) to 4-leaf barley and 0.5 to 1.5 inch weeds. Visual weed control and crop damage evaluations were made May 29, plant height measured June 18 and plots harvested July 22, 1991. Common lambsquarters (CHEAL) and wild buckwheat (POLCO) infestations were moderate and hairy nightshade (SOLSA) infestations light but uniform through the experimental site.

No herbicide treatment reduced barley stand and only slight injury (2 to 8%) was observed with dicamba treatments containing X-77. Common lambsquarters control was good to excellent (88 to 100%) with all treatments except MCPA, hairy nightshade control good to excellent (92 to 100%) with all treatments except tribenuron alone or in combination with thifensulfuron and wild buckwheat control good to excellent (93 to 100%) with all treatments containing bromoxynil, clopyralid or dicamba. Barley yields generally reflected weed control and were 5 to 12 bu/A higher in herbicide treated compared to weedy check plots. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1802)

Broadleaf weed control in barley

Treatment[1]	Rate	Barley[2]				Weed control[3]		
		Inj	SR	Height	Yield	CHEAL	SOLSA	POLCO
	lb ai/A	%	%	inches	bu/A	%	%	%
tribenuron(trib)+X-77	0.019	0	0	38	82	90	43	77
thifensulfuron(thif)/trib+X-77	0.019	0	0	38	82	95	40	83
bromoxynil(brom)	0.38	0	0	39	84	100	100	100
dicamba(dica)	0.063	0	0	37	83	88	95	97
dicamba+X-77	0.063	5	0	36	82	90	93	95
2,4-D	0.75	0	0	39	82	92	97	62
MCPA	0.75	0	0	39	80	82	90	40
brom/MCPA	0.75	0	0	40	84	100	100	100
clopyralid/2,4-D(clop/2,4-D)	0.59	0	0	40	82	92	95	93
clopyralid/MCPA(clop/MCPA)	0.59	0	0	40	84	88	92	93
trib+2,4-D+X-77	0.019+0.25	0	0	38	82	97	95	83
trib+dica+X-77	0.019+0.063	8	0	36	86	99	98	97
trib+dica	0.019+0.063	0	0	37	84	97	97	97
trib+brom/MCPA+X-77	0.019+0.5	0	0	39	83	100	100	100
thif/trib+2,4-D+X-77	0.019+0.25	0	0	39	86	95	93	85
thif/trib+dica+X-77	0.019+0.063	7	0	37	83	100	100	98
thif/trib+dica	0.019+0.063	0	0	38	84	100	98	100
thif/trib+brom+X-77	0.019+0.125	0	0	38	83	100	100	100
thif/trib+brom+X-77	0.019+0.19	0	0	38	86	100	100	100
thif/trib+brom+X-77	0.019+0.25	0	0	39	85	100	100	100
thif/trib+brom/MCPA+X-77	0.019+0.38	0	0	38	86	100	100	100
thif/trib+brom/MCPA+X-77	0.019+0.5	0	0	38	87	100	100	100
clop/2,4-D+brom	0.59+0.25	0	0	40	83	100	100	100
clop/MCPA+brom	0.59+0.25	0	0	39	87	100	100	100
clop/MCPA+dica	0.59+0.063	0	0	36	87	98	98	100
dica+MCPA	0.063+0.5	0	0	38	87	97	98	100
weedy check	- - - - -	0	0	39	75	0	0	0

[1] Treatments applied May 13, 1991; X-77 included at 0.25% v/v and / = package mix.
[2] Barley injury (inj) and stand reduction (SR) visually evaluated May 29, plant height measured June 18 and plots harvested July 22, 1991.
[3] Weed control visually evaluated May 29, 1991.

Kochia control in spring barley. Tonks, Dennis J. and Philip Westra. Kochia (KCHSC) is a very common and troublesome weed in small grain producing areas of the United States. Research was initiated near Fort Collins CO, to evaluate the response of kochia to various combinations of herbicides.

Barley was seeded in the spring of 1991 at the Colorado State University agronomy research farm. The experiment was a randomized complete block design with three replications. Plots were 10 by 30 feet. Treatments were applied when barley was in the early tiller stage (6-8"). Kochia density was approximately 10 plants per square foot and were about one half inch in diameter. Herbicide applications were made with a CO_2 powered backpack sprayer with 11002 LP tips at 18 psi delivering 22 gpa.

Evaluations of kochia control and barley injury were made at 16 and 54 days after treatment (DAT) and barley yields were determined upon maturity. All herbicide treatments gave excellent control of kochia. The treatment containing trisulfuron + dicamba caused substantial barley injury which reduced barley height and yield (Table 1). None of the other herbicide treatments injured barley and yields were all greater than the untreated check. Residual control of kochia in treated plots throughout the growing season was excellent. A second study in barley at the same location used fluroxypyr at several different rates. Kochia control ranged from 43 to 75% control. Kochia control was greatest when fluroxypyr was applied at the 1.5 and 2.0 oz/A rate. (Department of Plant Pathology and Weed Science, Colorado State University, Fort Collins, CO 80523).

Response of kochia and barley to various herbicides[1].

Treatment	Rate	Barley Injury	Kochia Control 16 DAT	Kochia Control 54 DAT	Barley Ht. Red.	Barley Yield
	(lb ai/A)	-----------------(%)-----------------				bu/A
Check		0 b	0 c	0 b	0 b	67 d
Trisulfuron[2]	0.013	0 b	100 a	100 a	0 b	90 c
Trisulfuron + 2,4-D Ester	0.013 0.5	0 b	100 a	100 a	0 b	98 abc
Trisulfuron + Dicamba	0.01 0.25	50 a	100 a	100 a	33 a	72 d
Bromoxynil/MCPA	0.75	0 b	98 a	100 a	0 b	105 ab
Bromoxynil + Thifensulfuron/ Tribenuron	0.187 0.019	0 b	99 a	100 a	0 b	104 ab
Bromoxynil + Clopyralid/2,4-D	0.25 0.625	0 b	72 b	100 a	0 b	109 a
Bromoxynil/MCPA + Thifensulfuron/ Tribenuron	0.38 0.0375	0 b	100 a	100 a	0 b	106 ab
Bromoxynil/MCPA + Thifensulfuron/ Tribenuron	0.50 0.0375	0 b	100 a	100 a	0 b	95 bc

[1]Means followed by same letter do not significantly differ (Duncan's MRT, P=.05).
[2]Surfactant X-77 was added at 0.25% v/v to treatments containing Amber and Harmony Extra.

Weed control in pinto beans with preplant incorporated, preemergence, postemergence or sequential treatments. Miller, S.D., T. Neider and L. Hackleman. Plots were established under sprinkler irrigation at the Research and Extension Center, Torrington, WY to evaluate the efficacy of individual or combination treatments for weed control in pinto beans. Plots were 10 by 30 ft. with three replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi. Preplant incorporated treatments were applied May 21, 1991 (air temp. 78F, relative humidity 45%, wind SE at 5 mph, sky mostly cloudy and soil temp. - 0 inch 90F, 2 inch 80F and 4 inch 78F) and incorporated twice immediately after application with a roller harrow operating 2 to 3 inches. Pinto beans (var. UI-114) were planted May 22, 1991 in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.3% organic matter and pH 7.6 and preemergence treatments applied (air temp. 58F, relative humidity 100%, wind NW at 7 mph, sky cloudy and soil temp. - 0 inch 60F, 2 inch 60F and 4 inch 62F). Postemergence treatments were applied to two trifoliolate leaf beans and 0.75 to 1.5 inch weeds June 17, 1991 (air temp. 89F, relative humidity 25%, wind N at 6 mph, sky clear and soil temp. - 0 inch 114F, 2 inch 86F and 4 inch 77F). Weed counts, crop stand counts and visual crop injury ratings were made July 1, visual weed control ratings August 7 and plots harvested September 3, 1991. Common lambsquarters (CHEAL) and redroot pigweed (AMARE) infestations were heavy and kochia (KCHSC), stinkgrass (ERACN) and field sandbur (CCHIN) infestations light but uniform throughout the experimental site.

Treatments containing imazethapyr injured pinto beans 0 to 15% and caused 0 to 14% stand reduction. Preplant applications of imazethapyr were generally more injurious than pre- or postemergence applications. Broad spectrum weed control was excellent with ethafluralin, pendimethalin or metholachlor combinations with imazethapyr regardless of imazethapyr application method. Pinto bean yields related closely to weed control and/or early season injury and were 404 to 1505 lb/A higher in herbicide treated compared to weedy check plots. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1799)

Weed control in dry beans

Treatment[1]	Rate lb ai/A	Pinto beans[2] Inj %	SR %	Yield lb/A	% Weed control[3] July CHEAL	AMARE	KCHSC	ERACN	CCHIN	August CHEAL	AMARE	KCHSC	ERACN	CCHIN
Preplant														
EPTC	3.0	0	0	1165	77	85	80	100	87	40	30	60	100	77
etha	0.94	0	1	1948	100	100	100	100	100	93	100	95	100	100
etha+EPTC	0.94+2.0	0	1	2021	100	100	100	100	100	96	100	98	100	100
etha+meto	0.94+2.0	0	0	1883	100	100	100	100	100	97	100	96	100	100
etha+imaz	0.94+0.047	10	0	1785	100	100	100	100	100	97	100	100	100	100
pend+EPTC	1.0+2.0	0	8	1991	100	100	100	100	100	99	100	97	100	100
pend+imaz	1.0+0.047	15	14	1733	100	100	100	100	100	100	100	100	100	100
meto+imaz	2.0+0.047	13	6	1806	97	100	100	100	100	93	99	100	100	100
imaz	0.063	10	0	1557	63	100	100	50	100	83	100	99	47	87
preplant/preemergence														
etha+imaz	0.94+0.047	8	0	2060	100	100	100	100	100	99	100	100	100	100
pend+imaz	1.0+0.047	10	6	2043	100	100	100	100	100	100	100	100	100	100
preplant/postemergence														
etha+imaz+X-77+N	0.94+0.047	0	5	2154	100	100	100	100	100	98	100	100	100	100
pend+imaz+X-77+N	1.0+0.047	2	6	2107	100	100	100	100	100	99	100	100	100	100
preemergence														
meto+imaz	2.0+0.047	7	0	2030	100	100	100	100	100	98	100	100	100	100
imaz	0.063	5	3	1746	58	100	100	0	100	90	100	100	43	80
preemergence/postemergence														
meto+imaz+X-77+N	2.0+0.047	2	0	2159	92	100	100	100	100	95	100	100	100	100
postemergence														
flua+imaz+X-77+N	0.19+0.047	0	0	1918	47	100	100	100	100	83	100	100	97	100
flua+bent+oc	0.19+0.5	0	0	981	42	73	67	50	80	25	65	63	97	100
seth+imaz+X-77+N	0.2+0.047	0	3	1931	35	100	100	100	100	83	100	100	97	97
seth+bent+oc	0.2+0.75	0	3	1084	52	72	67	80	87	33	65	60	90	90
seth+acif+oc	0.2+0.25	0	0	1058	37	65	53	100	100	33	67	70	100	100
seth+bent/acif+oc	0.2+0.92	0	0	1092	42	71	67	100	87	35	62	60	100	93
imaz+X-77+N	0.063	0	0	1699	42	97	100	0	80	73	98	100	43	80
weedy check	- - - -	0	0	654	0	0	0	0	0	0	0	0	0	0
plants/ft row 6-inch band		- -	5.3	- -	2.0	2.3	0.3	0.2	0.3	- -	- -	- -	- -	- -

[1] Treatments applied May 21, 22 and June 17, 1991; / = package mix, X-77 at 0.25% v/v and N (28-0-0) at 1 qt/A.
[2] Crop stand counts (SR = stand reduction) and visual injury (inj) evalauted July 1 and plots harvested September 3, 1991.
[3] Weed stand counts July 1 and visual weed control rating August 7, 1991.

Comparison of preemergence, preplant, postemergence, and sequential treatments in kidney beans. Mitich, L.W., J.A. Roncoroni, and G.B. Kyser. Seven herbicides in 18 treatments were evaluated for weed control and crop phytotoxicity in 'Linden' kidney beans at the UC Davis Farm. Three strips of the field were treated preplant incorporated with either trifluralin (0.75 lb/a), metolachlor (2.5 lb/a), or no treatment. The following treatments were then randomized on each strip within each of four replications:

oxyfluorfen	0.38	lb	preemergence
pendimethalin	1.5	lb	preemergence
bentazon	1.0	lb	postemergence
clethodim	0.125	lb	postemergence
sethoxydim	0.3	lb	postemergence
untreated check			

Blocks were replicated 4 times. Plots were 10 ft (four 30-inch rows) by 20 ft.

All treatments were applied with a CO_2 backpack sprayer delivering 25 gal/a at 30 psi through 8002 nozzles. Preplant incorporated herbicides were applied 17 June 1991 in 90 F weather. Beans were planted into moisture 19 June. Preemergence treatments were applied 20 June in 75 F weather. Postemergence treatments were applied 17 July in temperatures of 80 F to 90 F; at time of application, bean plants were 4 to 6 inches tall and barnyardgrass (ECHCG) was 2 to 4 inches.

On July 24 and August 14, visual evaluations were made for crop phytotoxicity and barnyardgrass control. In oxyfluorfen plots, rain shortly after bean plant emergence caused crop kill of all emerged plants. Bentazon produced an average of 38% phytotoxicity.

In combination with overlay treatments, metolachlor and trifluralin each improved barnyardgrass control by 15% to 20% over plots with no preplant treatment, with no increase in phytotoxicity. Averaged over all preplant treatments, pendimethalin was the most successful of the overlay treatments, producing about 90% barnyardgrass control in both evaluations. Clethodim and sethoxydim produced nearly complete barnyardgrass control at the second evaluation. The population of broadleaf weeds was too sparse to allow full evaluation of bentazon, though this treatment showed good control of velvetleaf (ABUTH) when present.

Beans were harvested 4 October. Preplant incorporated treatment with trifluralin produced highest yields; overlay treatments of pendimethalin, sethoxydim, and clethodim also contributed to high yields, probably owing to superior barnyardgrass suppression. (Department of Botany, University of California, Davis, CA 95616)

Table 1. Summation of individual treatment effects

Treatment	Rate (lb/a)	Crop[1] phytotoxicity (%)	Barnyardgrass[1] control (%) 7/24	8/14	Yield[2] (g)
FOR ALL OVERLAY TREATMENTS COMBINED[3]					
no preplant treatment		30	45	54	893 B
metolachlor	2.5	30	65	68	1076 A B
trifluralin	0.75	31	70	69	1242 A
FOR ALL PREPLANT TREATMENTS COMBINED[4]					
oxyfluorfen	0.38	99	68	33	----
pendimethalin	1.5	10	92	87	1312 A
bentazon	1.0	38	46	36	805 B
clethodim	0.125	13	53	98	1309 A
sethoxydim	0.3	14	60	99	1267 A
no overlay treatment		10	42	28	659 B

[1] 100% = complete crop or weed kill.
[2] Values followed by the same letter are not significantly different at the 5% level.
[3] Each value is an average of 24 ratings (6 overlay treatments X 4 replications).
[4] Each value is an average of 12 ratings (3 preplant treatments X 4 replications).

Table 2. Comparison of combination treatments for crop phytotoxicity and barnyardgrass control

Treatment	Rate (lb/a)	Crop[1,2] phytotoxicity (%)	Barnyardgrass[1,2] control (%) 7/24	8/14	Yield[1] (g)
NO PPI TREATMENT					
oxyfluorfen	0.38	98	45	23	----
pendimethalin	1.5	10	88	78	1255
bentazon	1.0	38	25	18	516
clethodim	0.125	10	43	98	1122
sethoxydim	0.3	15	53	98	1170
untreated check	----	10	18	10	405
METOLACHLOR APPLIED PREPLANT INCORPORATED at 2.5 lb/a					
metolachlor	2.5	10	38	30	570
+ oxyfluorfen	0.38	100	80	45	----
+ pendimethalin	1.5	10	95	90	1242
+ bentazon	1.0	38	60	45	953
+ clethodim	0.125	13	55	98	1307
+ sethoxydim	0.3	13	65	100	1309
TRIFLURALIN APPLIED PREPLANT INCORPORATED at 0.75 lb/a					
trifluralin	0.75	10	70	45	1002
+ oxyfluorfen	0.38	100	80	33	----
+ pendimethalin	1.5	10	93	93	1438
+ bentazon	1.0	38	53	45	947
+ clethodim	0.125	15	60	100	1499
+ sethoxydim	0.3	15	63	100	1321

[1] All values average of 4 replications.
[2] 100% = complete crop or weed kill.

Dry bean response to imazethapyr and alachlor + trifluralin. Westra, P. and T. D'Amato. Dry beans are sensitive to herbicide application timing and rates. Herbicide injury symptoms to dry beans are difficult to characterize but important to document in order to diagnose crop injury problems in the field. These trials were conducted at Ft. Morgan and Ft. Collins, Colorado, to assess dry bean injury symptoms and yield reduction resulting from various herbicide application timings and rates.

The three experiments were randomized complete blocks with three replications. Plots were 10 feet wide by 20 feet long. Treatments were applied through a CO_2 pressured backpack sprayer delivering 20 gpa through 11002LP nozzles, with a boom pressure of 22 psi.

The early post (EP) and late post (LP) treatments were applied at the Ft. Morgan site on July 11 and July 29, 1991 (table 1). The early post treatments caused some stunting and necrosis, but the dry beans grew out of those symptoms which were not evident by the end of the growing season. A reduction in yield was probably due to a delay in dry bean maturity in the treated plots. No bean injury symptoms were observed in those plots at the Ft. Collins site (table 2).

Injury symptoms from alachlor + trifluralin were assessed on 2 dry bean varieties in Ft. Collins (table 3). The 3 lb ai/a rate was considered the standard rate, the other treatments were 1.5X, 2X, and 3X rates. The higher rates caused some canopy reduction, particularily with the Bill Z variety. There were no significant differences in yields. (Department of Plant Pathology and Weed Science, Colorado State University, Ft. Collins, CO 80523)

Table 1. Dry bean response to imazethapyr at Ft. Morgan, CO.

Treatment	Rate	Bean injury stunting 7-29-91	Bean injury necrosis 7-29-91	Bean yield 9-11-91
	(lbs ai/a)	(%)		(cwt/a)
check		0.0 c	0.0 b	14 ab
imazethapyr	.063 EP	8.3 b	13.3 a	11 c
imazethapyr	.126 EP	11.7 ab	15.0 a	12 bc
imazethapyr	.189 EP	15.0 a	13.3 a	10 cd
imazethapyr	.063 LP	0.0 c	0.0 b	15 a
imazethapyr	.126 LP	0.0 c	0.0 b	8 de
imazethapyr	.189 LP	0.0 c	0.0 b	6 e

Table 2. Dry bean response to imazethapyr at Ft. Collins, CO.

Treatment	Rate	Bean height reduction 8-22-91	Bean height reduction 8-22-91	Bean Yield 9-10-91
	(lbs ai/a)	(%)		(cwt/a)
check		0.0 a	0.0 a	7 a
imazethapyr	.063 EP	0.0 a	0.0 a	7 a
imazethapyr	.126 EP	0.0 a	0.0 a	7 a
imazethapyr	.189 EP	0.0 a	0.0 a	6 a
imazethapyr	.063 LP	0.0 a	0.0 a	6 a
imazethapyr	.126 LP	0.0 a	0.0 a	7 a
imazethapyr	.189 LP	0.0 a	0.0 a	6 a

Table 3. Dry bean response to alachlor + trifluralin at Ft. Collins, CO.

Treatment	Rate	Bill Z variety 8-1-91	Olathe variety 8-1-91	Bill Z variety 9-10-91	Olathe variety 9-10-91
	(lbs ai/a)	(% canopy reduction)		yield(cwt/a)	
check		0.0 b	0.0 b	20 a	21 a
alachlor + trifluralin	3	6.7 ab	1.7 b	24 a	28 a
alachlor + trifluralin	4.5	13.3 a	3.3 b	29 a	23 a
alachlor + trifluralin	6	8.3 ab	0.0 b	22 a	26 a
alachlor + trifluralin	9	15.0 a	10.0 a	27 a	25 a

Herbicide evaluation in fall planted sugarbeets. Bell, C. E. and J. Richardson. This research was conducted in the Imperial Valley of southeastern California to compare two postemergence herbicides, clorpyralid and Betamix, in sugarbeets. Betamix is a commercial mixture of desmedipham and phenmedipham.

Experimental design was a randomized complete block with four replications. The experiment was conducted in a commercial sugarbeet field, utilizing plot sizes of two beds (each 1 M wide) by 6 M. Herbicide treatments were made first when the crop had 2 to 4 true leaves on October 31, 1990. Some plots were retreated, when the crop had 4 to 6 true leaves on November 6, 1990. Herbicides were applied in a carrier volume of 515 l/ha at 138 kPa pressure with 8002LP nozzles. Weeds present at time of application were nettleleaf goosefoot, silversheath knotweed, london rocket, shepherd's-purse, and little mallow. These weeds were in the cotyledon to 2 leaf growth stage.

Visual evaluations were made on November 13, 1990, ranking crop phytotoxicity and weed control by species. Yield estimates were made on May 9, 1991 from a sample from 1.6 m by two beds. This sample was of the wet weight of the crop, including leaves and roots. These data were subjected to ANOV and orthogonal comparisons. There was no significant difference between treatments for yield. None of the orthogonal comparisons were significant, although there was a suggestion that the combination treatment of Betamix + clorpyralid reduced sugarbeet yield. (Cooperative Extension, University of California, Holtville, CA 92250 and Dow-Elanco Corporation).

Sugarbeet yield and injury and weed control with Betamix and clorpyralid in the Imperial Valley of California

Treatment	Rate kgai/ha	Visual Evaluation					Yield
		P[1]	SSYIR	POLAG	CHEMU	MALPA	
Betamix	.56	1.8	7.5	4.3	10.0	6.8	27.4
Betamix (split)	.56 + .56	2.3	10.0	8.8	8.8	7.0	27.5
Clorpyralid	.10	0.3	0.0	0.0	0.0	0.0	28.3
Clorpyralid	.20	0.3	0.0	0.0	0.0	0.0	28.3
Clorpyralid	.30	1.8	5.5	1.0	3.0	0.5	25.5
Clorpyralid (split)	.10 + .10	1.5	0.0	0.0	0.0	0.0	28.4
Clorpyralid (split)	.10 + .20	1.3	2.3	3.3	2.5	5.0	27.8
Betamix + Clorpyralid	.28 + .10	1.3	9.5	3.5	6.5	0.8	25.0
Betamix + Clorpyralid	.56 + .10	1.3	10.0	5.0	3.8	5.8	25.7
Betamix + Clorpyralid	.28 + .20	1.3	7.5	5.8	6.8	2.5	26.9
Betamix + Clorpyralid	.56 + .20	1.8	10.0	7.5	7.0	5.5	26.4
Untreated control		0.0	0.0	0.0	0.0	0.0	27.8

Orthogonal Comparisons:	F	P
treated vs. untreated	0.244	ns
Betamix vs. clorpyralid	0.026	ns
clorpyralid vs Betamix + clorpyralid	2.403	0.131
Betamix, low vs high rate	0.003	ns
clorpyralid, single vs split application	0.282	ns
Betamix vs Betamix + clorpyralid	0.304	ns
clorpyralid, .27 vs .09 + .18	0.300	ns
Betamix or clorpyralid vs Betamix + clorpyralid	2.552	0.120

Visual Evaluation system; 0 = no weed control or crop injury, 10 = all plants dead.

[1]: P = phytotoxicity, SSYIR = london rocket, POLAG = silversheath knotweed, CHEMU = nettleleaf goosefoot, MALPA = little mallow.
Yield = kg/1.6m of bed by two beds, wet weight, average of 4 replications.
All treatments applied on October 31, 1990, split indicates second application on November 6.

Effects of replanting sugarbeets after DPX-66037 applications. Downard, R.W. and Morishita, D.W. Frost injury and/or blowing soil due to high winds often force sugarbeet growers to replant their crop. Occasionally, sugarbeet herbicides that have been applied prior to replanting can injure or reduce the emergence of the replanted sugarbeets. An experiment was initiated near Kimberly, Idaho at the University of Idaho Research and Extension Center to determine the effects of previously applied DPX-66037 on the emergence, root growth, and yield of replanted sugarbeets. On bedded plots, DPX-66037 alone and in combination with phenmedipham & desmedipham was applied 1, 3, 5, 8, 10, and 12 days before planting (DBP) sugarbeets. Due to inclement weather, the 8 and 10 DBP treatments were applied 7 and 9 DBP. Sugarbeets were planted May 16 on 22-inch row spacings and at a seeding rate of 71,280 seeds/A. Each treatment was replicated four times in a randomized complete block design. Plots were 4-rows wide by 30 ft long. Soil texture was a silt loam with a pH of 8.0, 1.6% om and a CEC of 15 meq/100 g soil. The chemical treatments were applied in a 10 inch band with a hand-held sprayer equipped with four 8001 even fan nozzles on a 22 inch spacing. The sprayer was calibrated to deliver 20 gpa at 38 psi. Application information is listed in Table 1. On June 20 a postemergence application of DPX-66037 at a 0.25 oz ai/A was sprayed over one of the two data rows. Sugarbeet stand counts were taken 15 and 30 days after emergence. Root injury and yield were taken on August 1.

Sugarbeet emergence, as measured by stand counts 15 days after emergence was not reduced by herbicide treatments. However, sugarbeet stand was different among some herbicide treatments but not between the untreated check and the herbicide treatments. There were no significant differences in root injury or root yield among the treatments. These data indicate that previous DPX-66037 or phenmedipham & desmedipham applications will not injure replanted sugarbeets.

Table 1. Application information.

Application date	5/4/91	5/7/91	5/9/91	5/11/91	5/13/91	5/15/91
Days before planting	12	9	7	5	3	1
Air temperature(F)	44	67	38	43	61	65
Soil temperature(F)	36	60	40	42	48	54
Relative humidity(%)	56	42	74	72	59	41
Wind velocity (mph)	6	4	14	0	0	12

Table 2. Sugarbeet stand counts, root injury and yield near Kimberly, Idaho.

Treatment	Rate	Application timing	Stand count[1]	Root injury[2]	Root yield[3]
	lb ai/A		2 m row	%	lb/A
Check			9	0	15428
Handweeded check			9	0	13613
DPX-66037[4]	0.0156	1 DBP[5]	10	1	12705
DPX-66037[4]	0.0156	3 DBP	10	0	13613
DPX-66037[4]	0.0156	5 DBP	9	0	9075
DPX-66037[4]	0.0312	1 DBP	9	3	8894
DPX-66037[4]	0.0312	3 DBP	10	0	10709
DPX-66037[4]	0.0312	5 DBP	10	3	10346
DPX-66037[4]	0.0468	1 DBP	10	0	12887
DPX-66037[4]	0.0468	3 DBP	10	0	11798
DPX-66037[4]	0.0468	5 DBP	8	0	11435
DPX-66037 +	0.0156+	1 DBP	10	0	12342
phen & des[6]	0.33				
DPX-66037 +	0.0156+	3 DBP	10	0	12887
phen & des	0.33				
DPX-66037 +	0.0156+	5 DBP	9	0	9257
phen & des	0.33				
DPX-66037+	0.0312+	1 DBP	8	0	10527
phen & des	0.66				
DPX-66037+	0.0312+	3 DBP	8	0	10346
phen & des	0.66				
DPX-66037+	0.0312+	5 DBP	10	0	15428
phen & des	0.66				
Phen & des	0.50	1 DBP	8	0	12705
Phen & des	0.50	3 DBP	10	4	11072
Phen & des	0.50	5 DBP	10	0	10527
Phen & des	1.0	1 DBP	9	0	11435
Phen & des	1.0	3 DBP	8	0	15609
Phen & des	1.0	5 DBP	10	0	9801
DPX-66037+	0.0156+	8 DBP	10	0	12705
phen & des/	0.50				
DPX-66037+	0.0156+	1 DBP			
phen & des	0.50				
DPX-66037+	0.0156+	10 DBP	9	0	10164
Phen & des/	0.50				
DPX-6603+	0.0156+	3 DBP			
phen & des	0.50				
DPX-66037+	0.0156+	12 DBP	10	0	10890
phen & des/	0.50				
DPX-66037+	0.0156+	5 DBP			
phen & des	0.50				
DPX-66037+	0.0156+	8 DBP	10	0	9257
phen & des/	0.33				
DPX-66037+	0.0156+	1 DBP			
phen & des	0.50				

Table 2 cont.

Treatment	Rate	Application timing	Stand count[1]	Root injury[2]	Root yield[3]
	lb ai/A		2 m row	%	lb/A
DPX-66037+	0.0156+	10 DBP	11	0	11616
phen & des/	0.33				
DPX-66037+	0.0156+	3 DBP			
phen & des	0.50				
DPX-66037+	0.0156+	12 DBP	10	0	10890
phen & des/	0.33				
DPX-66037+	0.0156+	5 DBP			
phen & des	0.50				
DPX-66037+	0.0312+	8 DBP	9	0	12705
phen & des/	1.0				
DPX-66037+	0.0312+	1 DBP			
phen & des	1.0				
DPX-66037+	0.0312+	10 DBP	9	0	14702
phen & des/	1.0				
DPX-66037+	0.0312+	3 DBP			
phen & des	1.0				
DPX-66037+	0.0312+	12 DBP	9	0	11979
phen & des/	1.0				
DPX-66037+	0.0312+	5 DBP			
phen & des	1.0				
DPX-66037+	0.0312+	8 DBP	9	0	12161
phen & des/	0.66				
DPX-66037+	0.0312+	1 DBP			
phen & des	1.0				
DPX-66037+	0.0312+	10 DBP	9	0	13068
phen & des/	0.66				
DPX-66037+	0.0312+	3 DBP			
phen & des	1.0				
DPX-66037+	0.0312+	12 DBP	8	0	11253
phen & des/	0.66				
DPX-66037+	0.0312+	5 DBP			
phen & des	1.0				
Phen & des/	1.0/	8 DBP	11	0	11435
phen & des	1.0	1 DBP			
Phen & des/	1.0/	10 DBP	9	0	12887
phen & des	1.0	3 DBP			
Phen & des/	1.0/	12 DBP	8	0	13794
phen & des	1.0	5 DBP			
LSD (0.05)			2	NS	NS

[1]Stand count was taken June 27, 1991.
[2]Root injury was evaluated August 1, 1991.
[3]Yield was measured August 1, 1991.
[4]Surfactant R-11 added at 0.25% v/v.
[5]DBP = Day(s) before planting.
[6]Phen & des = Phenmedipham & Desmedipham

Comparison of broadleaf weed control and crop tolerance with phenmedipham and desmedipham formulations. Downard, R.W., D.W. Morishita and W. Ying. This trial was conducted in sugarbeets 'WS-88' near Rupert, Idaho to evaluate broadleaf weed control and crop injury with phenmedipham and desmedipham emulsifiable concentrate (EC) and wettable powder (WP) formulations applied with different adjuvants. Soil texture was a sandy loam with a pH of 8, 0.9% om and CEC of 11 meq/100 g soil. Sugarbeets were planted April 8 on a 22 inch row spacing. Plots were 4 rows wide by 25 ft long and established under sprinkler irrigation in a randomized complete block design replicated four times. Herbicides were applied with a hand-held sprayer at 10 gpa using 8001 even fan nozzles. Application data are shown in Table 1. Crop injury and weed control were evaluated May 20 and June 11, 1991.

There was no severe crop injury with any of the treatments (Table 2). Common lambsquaters control was excellent (92 to 100%) with all treatments on both evaluations. Sunflower control was better than 85% with all treatments except phenmedipham and desmedipham WP plus adjuvant (Sylgard). Herbicide formulation and adjuvant had little or no apparent effect on crop tolerance or weed control. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83301)

Table 1. Application data.

Application timing (crop)	cotyledon	7 days later
Application date	5/6/91	5/13/91
Air temperature (F)	66	71
Soil temperature (F)	56	-
Relative humidity (%)	78	43
Wind velocity (mph)	3	4

Table 2. Crop injury and weed control in sugarbeets with phenmedipham plus desmedipham near Rupert, Idaho.

Treatment	Rate	Timing	Crop injury		Weed control[1]		
					CHEAL		HELAN
			5/20	6/11	5/20	6/11	5/20
	lb ai/A		%				
Check			0	0	0	0	0
Phen & des EC[2]/	0.25	cotyledon	0	3	100	92	93
phen & des EC	0.25	7 days later					
Phen & des WP[3,4]/	0.25	cotyledon	4	2	99	92	89
phen & des WP[4]	0.25	7 days later					
Phen & des WP[5]/	0.25	cotyledon	0	1	100	94	81
phen & des WP[5]	0.25	7 days later					
Phen & des WP[6]/	0.25	cotyledon	0	5	100	91	100
phen & des WP[6]	0.25	7 days later					
Phen & des EC/	0.38	cotyledon	5	3	100	95	98
phen & des EC	0.38	7 days later					
Phen & des WP[4]/	0.38	cotyledon	1	1	100	94	100
phen & des WP[4]	0.38	7 days later					
Phen & des WP[5]/	0.38	cotyledon	1	0	100	98	89
phen & des WP[5]	0.38	7 days later					
Phen & des WP[6]/	0.38	cotyledon	0	1	100	97	99
phen & des WP[6]	0.38	7 days later					
Phen & des EC/	0.50	cotyledon	1	1	100	95	100
phen & des EC	0.50	7 days later					
Phen & des WP[4]/	0.50	cotyledon	1	1	100	99	91
phen & des WP[4]	0.50	7 days later					
Phen & des WP[5]/	0.50	cotyledon	0	5	100	95	95
phen & des WP[5]	0.50	7 days later					
Phen & des WP[6]/	0.50	cotyledon	6	5	100	100	100
phen & des WP[6]	0.50	7 days later					
LSD (.05)			4	6	1	11	11

[1]Weed species evaluated were common lambsquarter (CHEAL) and sunflower (HELAN).
[2]phen & des EC = phenmedipham & desmedipham Emulisfiable concentrates.
[3]phen & des WP = phenmedipham & desmedipham wettable powder.
[4]Surfactant R-11 added at 0.25% v/v.
[5]Adjuvant Sylgard added at 0.40% v/v.
[6]Crop oil concentrate Mor-Act added at 1 qt/A.

Postemergence weed control with DPX-66037 alone and in combination in sugar beets. Morishita, D.W. and R.W. Downard. An experiment was established near Kimberly and Parma, Idaho to evaluate DPX-66037 applied alone and in combination with phenmedipham and desmedipham for broadleaf weed control in sugar beets 'HH-32 and WS-88'. Both experiments were established as randomized complete block designs with four replications. Plots were 4-rows wide by 30 ft long. At Kimberly, the soil texture was a sandy loam with a pH of 8.0, 1.6% om, and CEC of 15 meq/100 g soil. Soil texture at Parma was a silt loam with a pH of 7.8, 1.5% om, and CEC of 21 meq/100 g soil. Application information is presented on Table 1. Crop injury and weed control was evaluated four times at Parma and three times at Kimberly. However, data presented include only the third evaluations at both locations. Sugar beet was hand-harvested at Kimberly September 30. The crop was not harvested at Parma.

Crop injury observed at either location generally was related to applications made at the 2-leaf growth stage compared to the cotyledon growth stage (Tables 2 and 3). Overall, early injury symptoms were not eflected in sugar beet yield reductions (Table 3). DPX-66037 applied alone did not satisfactorily control any of the weed species at either location. Several DPX-66037 and phenmedipham & desmedipham tank mixtures controlled all weed species at both locations. Compared to the untreated check, which had a yield of 2 tons per acre, all herbicide treatments had higher sugar beet yields. (Dept. of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls, ID 83301).

Table 1. Application information.

	Parma				Kimberly			
Applic. date	4/24	5/1	5/10	5/22	5/10	5/16	5/23	5/31
Growth stage[1]	Cotyl	7dltr	2 lf	7dltr	Cotyl	7dltr	2 lf	7dltr
Air temp (F)	55	70	46	81	52	75	71	52
Soil temp (F)	57	56	40	71	46	62	61	48
Rel humid (%)	70	18	60	40	-	46	41	62
Wind speed (mph)	5	3	12	5	9	7	9	8

[1]Growth stages at time of application were Cotyl = cotyledon, 7dltr = 7 days later, and 2 lf = 2 leaf.

Table 2. Crop injury and weed control in sugar beets near Parma, Idaho.

Treatment	Rate	Growth stage	Crop injury	Weed control[1]		
				AMARE	CHEAL	SOLSA
	oz ai/A		%			
Check			0	0	0	0
Handweeded			0	100	100	100
DPX-66037[2]/	0.125/	Cotyledon	0	4	0	0
DPX-66037	0.125	7 days later				
DPX-66037/	0.125/	2 leaf	0	10	10	10
DPX-66037	0.125	7 days later				
DPX-66037/	0.25/	Cotyledon	0	24	16	19
DPX-66037	0.25	7 days later				
DPX-66037/	0.25/	2 leaf	0	33	26	26
DPX-66037	0.25	7 days later				
DPX-66037+ phen&desp[3]/	0.125+ 5.3/	Cotyledon	0	60	67	70
DPX-66037+ phen&desp	0.12+5 5.3	7 days later				
DPX-66037+ phen&desp/	0.125+ 5.3/	2 leaf	0	85	83	88
DPX-66037+ phen&desp	0.12+5 5.3	7 days later				
DPX-66037+ phen&desp/	0.25+ 5.3/	Cotyledon	0	64	62	63
DPX-66037+ phen&desp	0.25+ 5.3	7 days later				
DPX-66037+ phen&desp/	0.25+ 5.3/	2 leaf	1	79	79	83
DPX-66037+ phen&desp	0.25+ 5.3	7 days later				
DPX-66037+ phen&desp/	0.25+ 5.3/	Cotyledon	0	59	55	57
DPX-66037+ phen&desp	0.25+ 8.0	7 days later				
DPX-66037+ phen&desp/	0.25+ 5.3/	2 leaf	1	68	63	58
DPX-66037+ phen&desp	0.25+ 8.0	7 days later				
DPX-66037+ phen&desp/	0.25+ 8.0/	Cotyledon	5	64	65	65
DPX-66037+ phen&desp	0.25+ 8.0	7 days later				
DPX-66037+ phen&desp/	0.25+ 8.0/	2 leaf	5	84	83	86
DPX-66037+ phen&desp	0.25+ 8.0	7 days later				
DPX-66037+ phen&desp/	0.50+ 1.0/	Cotyledon	1	81	73	71
DPX-66037+ phen&desp	0.50+ 1.0	7 days later				
DPX-66037+ phen&desp/	0.50+ 1.0/	2 leaf	3	95	94	96

Table 2. continued

Treatment	Rate	Growth stage	Crop injury	Weed control[1]		
				AMARE	CHEAL	SOLSA
	oz ai/A		------------------	------------------ %	------------------	------------------
DPX-66037+	0.50+	7 days later				
phen&desp	1.0					
Phen&desp/	8.0/	Cotyledon	0	63	59	62
phen&desp	8.0	7 days later				
Phen&desp/	5.3/	Cotyledon	0	70	67	66
phen&desp+	5.3+	7 days later				
clopyralid	1.5					
LSD (0.05)			5	21	20	21

[1]Weed control evaluation made June 20, 1991. AMARE = redroot pigweed, CHEAL = common lambsquarters, and SOLSA = hairy nightshade.

[2]All DPX-66037 treatments applied without Phenmedipham & desmedipham applied with 0.25% v/v nonionic surfactant.

[3]Phen & desp = phenmedipham and desmedipham.

Table 3. Crop injury, weed control, and root yield near Kimberly, Idaho.

Treatment	Rate	Growth stage[2]	Crop injury	Weed control[1] AMARE	CHEAL	KOCSC	Yield
	oz ai/A		----------	---------- %	----------	----------	T/A
Check			0	0	0	0	2
Handweeded			0	100	100	100	30
DPX-66037[3]/	0.125	Cotyl	0	25	24	38	5
DPX-66037	0.125	7d ltr					
DPX-66037/	0.125	2 lf	5	60	47	81	8
DPX-66037	0.125	7d ltr					
DPX-66037/	0.25	Cotyl	0	40	37	77	10
DPX-66037	0.25	7d ltr					
DPX-66037/	0.25	2 lf	2	69	62	79	9
DPX-66037	0.25	7d ltr					
DPX-66037/	0.25	Cotyl	1	73	70	75	12
DPX-66037/	0.25	7d ltr					
DPX-66037	0.25	7d ltr					
DPX-66037+	0.125	Cotyl	1	79	81	89	15
phen&desp[4]/	5.3						
DPX-66037+	0.125	7d ltr					
phen&desp	5.3						
DPX-66037+	0.125	2 lf	1	96	96	95	18
phen&desp/	5.3						
DPX-66037+	0.125	7d ltr					
phen&desp	5.3						
DPX-66037+	0.25	Cotyl	0	86	89	95	18
phen&desp/	5.3						
DPX-66037+	0.25	7d ltr					
phen&desp	5.3						
DPX-66037+	0.25	2 lf	0	99	98	95	21
phen&desp/	5.3						
DPX-66037+	0.25	7d ltr					
phen&desp	5.3						
DPX-66037+	0.125	Cotyl	0	86	87	89	20
phen&desp/	5.3						
DPX-66037+	0.125	7d ltr					
phen&desp	8.0						
DPX-66037+	0.125	2 lf	3	100	99	94	22
phen&desp/	5.3						
DPX-66037+	0.125	7d ltr					
phen&desp	8.0						
DPX-66037+	0.25	Cotyl	0	87	90	88	21
phen&desp/	5.3						
DPX-66037+	0.25	7d ltr					
phen&desp	8.0						
DPX-66037+	0.25	2 lf	6	99	100	95	22
phen&desp/	5.3						
DPX-66037+	0.25	7d ltr					
phen&desp	8.0						
DPX-66037+	0.125	Cotyl	2	91	96	91	20
phen&desp/	8.0						
DPX-66037+	0.125	7d ltr					
phen&desp	8.0						

Table 3. continued.

Treatment	Rate	Growth stage[2]	Crop injury	Weed control[1] AMARE	CHEAL	KOCSC	Yield
	oz ai/A		-------	------- %	-------	-------	T/A
DPX-66037+	0.125	2 lf	6	97	99	94	18
phen&desp/	8.0						
DPX-66037+	0.125	7d ltr					
phen&desp	8.0						
DPX-66037+	0.25	Cotyl	0	81	87	91	18
phen&desp/	8.0						
DPX-66037+	0.25	7d ltr					
phen&desp	8.0						
DPX-66037+	0.25	2 lf	10	100	100	98	19
phen&desp/	8.0						
DPX-66037+	0.25	7d ltr					
phen&desp	8.0						
DPX-66037+	0.50	Cotyl	4	94	93	96	23
phen&desp/	16.0						
DPX-66037+	0.50	7d ltr					
phen&desp	16.0						
DPX-66037+	0.5	2 lf	19	100	98	100	21
phen&desp/	16.0						
DPX-66037+	0.5	7d ltr					
phen&desp	16.0						
Phen&desp/	8.0	Cotyl	0	86	92	83	17
phen&desp	8.0	7d ltr					
Phen&desp/	5.3	Cotyl	16	85	91	78	15
phen&desp+	5.3	7d ltr					
clopyralid	1.5						
LSD (0.05)			5	16	15	11	4

[1]Weed control evaluations taken June 13, 1991. AMARE = redroot pigweed, CHEAL = common lambsquarters, KOCHSC = kochia.

[2]Growth stage at time of application was Cotyl = cotyledon, 7d ltr = 7 days later, 2 lf = 2 leaf.

[3]DPX-66037 applied with 0.25% v/v nonionic surfactant except when tank mixed with phenmedipham & desmedipham.

[4]Phen&desp = phenmedipham and desmedipham.

Evaluation of preplant incorporated and postemergence herbicides for weed control in canola. Brennan, J.S., C.R. Thompson, and D.C. Thill. Trifluralin is the only herbicide currently registered in the United States for weed control in canola. Field experiments were conducted to evaluate the preplant incorporated (PPI) herbicides trifluralin, ethalfluralin, and pendimethalin alone and trifluralin (PPI) in combination with sethoxydim and ethametsulfuron applied postemergence (POST) for weed control in canola.

Plots were 10 by 30 ft and the experimental design was a randomized complete block with four replications. Treatments were applied with a CO_2 pressurized backpack sprayer at 38 psi and 3 mph. Preplant incorporated treatments were applied in 20 gal/a and postemergence treatments in 10 gal/a. Preplant incorporated herbicides were incorporated twice with a spike toothed harrow. Canola was seeded with a Velmar air seeder at 6 lb/a, 1 in. deep, and harrowed twice on April 22, 1991. Weed control and crop injury were evaluated visually on June 24. Canola seed was direct combine harvested on August 22 from a 4.5 by 27 ft area.

Table 1. Herbicide application data

Application date	April 20	June 1
Growth stage:		
canola	--	3 to 4 leaf
henbit (LAMAM)	--	0.5 to 1.5 in.
mayweed chamomile (ANTCO)	--	0.5 to 2.0 in.
field pennycress (THLAR)	--	0.5 to 2.0 in.
common lambsquarters (CHEAL)	--	0.5 to 1.5 in.
Air temperature (F)	62	74
Soil temperature at 2 in. (F)	52	66
Relative humidity (%)	68	54
Wind (mph) - direction	1 - E	1 - E
Cloud cover (%)	20	5
Soil pH	5.5	
organic matter (%)	7.9	
CEC (meq/100g soil)	37.3	
texture	silt loam	

Trifluralin and ethalfluralin applied alone controlled henbit and common lambsquarters greater than 83% (Table 2). Trifluralin, ethalfluralin, and pendimethalin did not control mayweed chamomile or field pennycress. Trifluralin (PPI) plus ethametsulfuron (POST) and trifluralin alone controlled henbit and common lambsquarters 80 to 92%. Ethametsulfuron + R-11 tank mixed with sethoxydim + Sun-It II controlled mayweed chamomile and field pennycress 11 to 24% more than ethametsulfuron + R-11. This increase may be from the addition of Sun-It II to ethametsulfuron. Ethalfluralin at 0.5 and 0.75 lb ai/a injured canola 15% and 23%, respectively. Grass weeds or volunteer cereal populations were low or not present. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Weed control in canola with preplant incorporated and postemergence herbicides

Treatment	Rate	Canola injury	LAMAM	ANTCO	THLAR	CHEAL	Canola yield
	(lb ai/a)	---%--	--------% Control			---------	(lb/a)
check	---	---	---	---	---	---	1905
trifluralin (PPI)[1]	0.5	0	83	28	0	88	1845
trifluralin (PPI)	0.75	0	85	33	0	87	1838
ethalfluralin (PPI)	0.5	15	90	30	0	90	1639
ethalfluralin (PPI)	0.75	23	92	44	3	89	1767
pendimethalin (PPI)	0.75	0	65	20	0	67	1891
pendimethalin (PPI)	1.0	0	76	16	0	75	1890
trifluralin (PPI) sethoxydim + Sun-It II[2] (POST)[1]	0.5 0.28 1 pt	0	86	39	0	87	1886
trifluralin (PPI) ethametsulfuron + R-11[3] (POST)	0.5 0.018 0.2% v/v	0	92	79	74	80	1938
trifluralin (PPI) ethametsulfuron + sethoxydim + Sun-It II R-11 (POST)	0.5 0.018 0.28 1 pt 0.2% v/v	0	95	90	98	81	1940
ethametsulfuron + sethoxydim + Sun-It II R-11 (POST)	0.018 0.28 1 pt 0.2% v/v	0	95	90	98	76	1886
weed density (plants/ft^2)			6	2	2	2	
LSD (0.05)		5	11	15	22	15	181

[1]preplant incorporated (PPI), postemergence (POST)
[2]Sun-It II is a methylated crop seed oil.
[3]R-11 is a nonionic surfactant.

Evaluation of postemergence herbicides for weed control in canola. Brennan, J.S., C.R. Thompson, and D.C. Thill. Canola, an edible oil seed crop, is being grown on a limited acreage in Northern Idaho and Eastern Washington as an alternative to spring grains and legumes. Trifluralin, the only herbicide registered to control weeds in canola, does not adequately control many important grass and broadleaf weeds. Field experiments were conducted near Nezperce, Idaho and Garfield, Washington to evaluate postemergence grass and broadleaf herbicides in canola.

Plots were 10 by 30 feet and were arranged as a randomized complete block design with four replications. Canola was planted 1 in. deep on April 22, 1991 at Nezperce at 6 lb/a and on May 5, 1991 at Garfield at 15 lb/a. Herbicides were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 38 psi and 3 mph (Table 1). Weed control and crop injury were evaluated visually on June 24 and July 2 at Nezperce and Garfield, respectively. Canola seed was direct combine harvested at Nezperce on August 22 and Garfield on August 21 from a 4.5 by 27 ft area. Volunteer cereals and grass weeds were not present at either site and weed control and seed yield data were analyzed for broadleaf herbicide treatments only.

Table 1. Herbicide application data

Location	Nezperce	Garfield
Application date	June 1	June 4
Growth stage:		
canola	3 to 4 leaf	3 leaf
catchweed bedstraw (GALAP)	0.5 to 3 in.	------
mayweed chamomile (ANTCO)	0.5 to 2 in.	------
field pennycress (THLAR)	0.5 to 1.5 in.	0.5 to 1.5 in.
common lambsquarters (CHEAL)	0.5 to 2 in.	0.5 to 1.5 in.
henbit (LAMAM)	0.5 to 1.5 in.	------
mustard species (BRSSP)	------	0.5 to 2 in.
Air temperature (F)	70	60
Soil temperature (F), 2 in. depth	67	64
Relative humidity (%)	51	38
Wind (mph) - direction	1 - E	3 - N
Clouds (%)	5	85
Soil pH	5.5	5.5
OM (%)	7.9	3.6
CEC (meq/100g soil)	37.3	21.4
texture	silt loam	silt loam

Bedstraw, henbit, and field pennycress control at Nezperce and mustard species control at Garfield were 90% or greater with ethametsulfuron. (Table 2). Field pennycress control at Garfield ranged from 60 to 90% with ethametsulfuron. Clopyralid did not control these weed species. Mayweed chamomile control was 94% with clopyralid and ranged from 79 to 86% with ethametsulfuron. Common lambsquarters control at Nezperce was 59 to 75% with ethametsulfuron alone and 83 to 89% when Sun-It II or clopyralid were added to the mix. Common lambsquarters control was always less than 70% at Garfield. Seed yield from herbicide treated canola was not different from the untreated check at Nezperce and Garfield except for ethametsulfuron at 0.018 lb/a and sethoxydim + ethametsulfuron + R-11 + Sun-It II at Nezperce. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Weed control in canola with postemergence herbicides

Treatment	Rate	Nezperce GALAP	LAMAM	CHEAL	ANTCO	THLAR	Canola yield	Garfield BRSSP	THLAR	CHEAL	Canola yield
	(lb ai/a)	% control					(lb/a)	% control			(lb/a)
check		--	--	--	--	--	1841	--	--	--	1342
sethoxydim + Sun-It II[1]	0.19 1 pt	--	--	--	--	--	1819	--	--	--	1406
sethoxydim + Sun-It II	0.28 1 pt	--	--	--	--	--	1879	--	--	--	1609
sethoxydim + Sun-It II	0.38 1 pt	--	--	--	--	--	1872	--	--	--	1389
quizalofop + Sun-It II	0.063 1 pt	--	--	--	--	--	1896	--	--	--	1279
quizalofop + Sun-It II	0.094 1 pt	--	--	--	--	--	1893	--	--	--	1315
quizalofop + Sun-It II	0.125 1 pt	--	--	--	--	--	1812	--	--	--	1327
clopyralid	0.094	3	19	48	94	0	1841	0	0	24	1398
clopyralid	0.19	3	20	63	94	0	1888	0	5	29	1414
sethoxydim + clopyralid + Sun-It II	0.28 0.094 1 pt	3	21	56	94	0	1871	0	0	28	1345
ethamet[2] + R-11[3]	0.018 0.2% v/v	90	92	59	79	99	2034	95	70	40	1391
ethamet + R-11	0.027 0.2% v/v	90	93	75	86	99	1973	94	84	46	1407
sethoxydim + ethamet + Sun-It II + R-11	0.28 0.018 1 pt 0.2% v/v	94	95	83	86	99	2022	95	90	53	1408
sethoxydim + ethamet + clopyralid + Sun-It II + R-11	0.28 0.018 0.094 1 pt 0.2% v/v	95	93	88	96	97	1945	95	85	69	1448
quizalofop + ethamet + Sun-It II + R-11	0.094 0.018 1 pt 0.2% v/v	95	95	85	84	99	1981	95	82	50	1363
ethamet + clopyralid + Sun-It II + R-11	0.018 0.094 1 pt 0.2% v/v	96	95	89	96	99	1896	95	60	26	1282
weed density (plants/ft^2)		6	8	3	1	2		7	4	3	
LSD (0.05)		24	13	18	6	24	160	4	19	18	159

[1]Sun-It II is a methylated crop seed oil.
[2]ethamet = ethametsulfuron
[3]R-11 is a nonionic surfactant.

Evaluation of canola variety and herbicides on weed control in canola. Brennan, J.S., C.R. Thompson, and D.C. Thill. Field experiments were conducted near Nezperce, Idaho and Dayton and Farmington, Washington to evaluate the effect of canola varieties and herbicides on weed control in canola. Plots were 10 by 20 feet and treatments were arranged in a randomized complete block split plot design, with canola variety as main plots and herbicides as subplots. The treatments were replicated four times. Canola varieties were planted on April 16, 1991 at Nezperce, April 4, 1991 at Dayton, and May 2, 1991 at Farmington. Canola varieties were planted 1 inch deep with a double-disk cone plot seeder at a seeding rate of 3.0 lb/a. The insecticide, carbofuran, was applied with the seed at 0.35 lb ai/a as 'Furadan CR10' for flea beetle control.

Herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 38 psi and 3 mph (Table 1). Weed control and crop injury were evaluated visually on June 24, July 11, and June 4 at Nezperce, Dayton, and Farmington, respectively. Canola seed was direct combine harvested from a 4.5 by 17.5 ft area at Nezperce and Farmington on August 19 and 21, respectively. Canola was not harvested at Dayton due to poor stand establishment.

Table 1. Herbicide application data

Location	Nezperce	Dayton	Farmington
Application date	June 1	May 11	June 4
Growth stage:			
canola	4 leaf	3 leaf	3 to 4 leaf
field pennycress (THLAR)	1 to 3 in.	---	0.5 to 2 in.
henbit (LAMAM)	0.5 to 2 in.	---	---
catchweed bedstraw (STEME)	1 to 3 in.	---	---
common lambsquarters (CHEAL)	---	0.5 to 3 in.	1 to 2.5 in.
wild oat (AVEFA)	---	1 to 3 in.	---
mayweed chamomile (ANTCO)	---	---	0.5 to 1.5 in.
Air temperature (F)	58	49	62
Soil temperature at 2 in. (F)	56	54	72
Relative humidity (%)	78	85	40
Wind (mph) - direction	0	0	3 - W
Cloud cover (%)	0	100	99
Soil data:			
pH	5.4	5.2	5.0
organic matter (%)	5.3	2.4	3.4
CEC (meq/100g soil)	29.8	18.1	22.7
texture	silt loam	silt loam	silt loam

No treatment interactions were significant and only main effects are reported (Tables 2 and 3). Common lambsquarters control at Farmington was greater when 'Legend' was seeded compared to the other varieties (Table 2). MM3200 and IMC01 yielded less seed at Nezperce, with a similar trend at Farmington, compared to the other varieties. Sethoxydim + ethametsulfuron + clopyralid controlled weeds best at all sites (Table 3). Canola yielded more seed when handweeded or treated with ethametsulfuron + clopyralid than the untreated check or sethoxydim applied alone. Handweeding injured canola 5 to 8%. (Idaho Argicultural Experiment Station, Moscow, Idaho 83843)

Table 2. Weed response to canola varieties averaged over herbicide treatments

	Dayton		Nezperce				Farmington			
Variety	AVEFA	CHEAL	THLAR	LAMAM	STEME	Canola yield	CHEAL	THLAR	ANTCO[1]	Canola yield
	-----%[2]-----		---------%[2]---------			(lb/a)	---------%[2]--------			(lb/a)
IMC129	62	19	56	56	55	784	34	39	56	537
MM3200	60	19	58	57	56	690	34	36	56	442
IMC01	61	17	57	56	56	618	34	39	54	452
IMC144	59	16	56	56	56	784	38	44	57	579
LEGEND[3] (control)	60	17	55	56	56	808	42	42	56	613
density (plants/ft^2)	4	3	4	5	4	---	22	3	3	---
LSD (0.05)	4	3	3	1	1	60	5	6	2	104

[1]ANTCO data from two replications.
[2]% control.
[3]Legend is a registered canola variety included for comparison.

Table 3. Evaluation of postemergence herbicides averaged over canola varieties

		Dayton		Nezperce					Farmington				
Treatment	Rate	AVEFA	CHEAL	Crop injury	THLAR	LAMAM	STEME	Crop yield	Crop injury	CHEAL	THLAR	ANTCO[1]	Crop yield
	(lb ai/a)	----%[5]-----		---%--	-------%[5]--------			(lb/a)	---%--	--------%[5]--------			(lb/a)
check		---	---	---	---	---	---	673	---	---	---	---	420
Handweed[2]		99	80	5	95	95	94	815	8	95	97	98	654
sethoxydim + Sun-It II[3]	0.28 1 pt	99	0	0	0	0	0	639	0	0	0	0	479
ethametsulfuron + clopyralid + R-11[4]	0.018 0.094 0.2% v/v	7	0	0	90	92	91	760	0	27	40	89	519
sethoxydim + ethametsulfuron + clopyralid + Sun-It II + R-11	0.28 0.018 0.094 1 pt 0.2% v/v	99	7	0	93	93	93	751	0	60	64	92	570
density (plants/ft^2)		6	100	---	4	5	4	---	---	22	3	3	---
LSD (0.05)		4	3	1	3	1	1	60	1	5	6	2	104

[1]ANTCO data from two replications.
[2]Handweeded plus a postemergence treatment of sethoxydim + ethametsulfuron + clopyralid + Sun-It II + R-11 with the same rates as in this table.
[3]Sun-It II is a methylated seed oil.
[4]R-11 is a nonionic surfactant.
[5]% control.

Weed control in canola. Miller, S.D., T. Neider and J.G. Lauer. Plots were established under furrow irrigation at the Research and Extension Center, Powell, WY to evaluate weed control and canola response with DPX-A7881. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Canola (var. Globe) was seeded April 7, 1991 in a clay loam soil (40% sand, 27% silt and 33% clay) with 1.4% organic matter and pH 7.7. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 22 (air temp. 68F, relative humidity 47%, wind NW at 5 mph, sky clear and soil temp. - 0 inch 90F, 2 inch 60F and 4 inch 58F) to 2-leaf canola and 2 to 4-leaf wild mustard or June 3, 1991 (air temp. 80F, relative humidity 41%, wind E at 7 mph, sky clear and soil temp. - 0 inch 98F, 2 inch 84F and 4 inch 80F) to 4-leaf canola and 6 to 10 inch wild mustard. Visual weed control and crop damage evaluations were made July 18 and plots harvested August 13, 1991. Wild mustard (SINAR) infestations were heavy and black nightshade (SOLNI) and green foxtail (SETVI) infestations light but uniform throughout the plot area.

No injury or stand reduction was observed with any treatment. Wild mustard control was excellent (100%) with all treatments containing DPX-A7881 and green foxtail control excellent (100%) with all treatments containing sethoxydin. No treatment provided adequate control of black nightshade. Canola yields were 189 to 1537 lb/A higher in herbicide treated compared to weedy check plots and related closely to weed control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1809)

Weed control in canola

Treatment[1]	Rate lb ai/A	Canola[2] Inj %	SR %	Yield lb/A	Weed control[3] SINAR %	SOLNI %	SETVI %
DPX-A7881+X-77	0.016	0	0	1755	100	0	0
DPX-A7881+ms	0.016	0	0	1726	100	0	0
DPX-A7881+X-77	0.032	0	0	2001	100	0	0
DPX-A7881+ms	0.032	0	0	1885	100	0	0
sethoxydim+ms	0.2	0	0	1117	0	0	100
benazolin	0.375	0	0	885	13	7	0
benazolin	0.5	0	0	914	20	10	0
DPX-A7881+sethoxydim+ms	0.016+0.2	0	0	2132	100	0	100
DPX-A7881+X-77/sethoxydim+ms	0.016/0.2	0	0	2233	100	0	100
weedy check	- - - -	0	0	696	0	0	0

[1] Treatments applied May 22 and June 3, 1991; X-77 at 0.25% v/v, ms = Scoil at 1 qt/A and / = split treatment.
[2] Crop injury (inj) and stand reduction (SR) visually evaluated July 18, 1991 and plots harvested August 13, 1991.
[3] Weed control visually evaluated June 11, 1991.

Broadleaf weed control in field corn with postemergence herbicide tank mixes. Arnold, R.N., E.J. Gregory and M.W. Murray. Research plots were established on May 3, 1991 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. NK-S5340) and broadleaf weeds to herbicide tank mixes. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied postemergence on May 21, 1991 when corn was in the 3 to 4 leaf stage and weeds were small. Prostrate pigweed (AMABL) and redroot pigweed (AMARE) infestations were heavy, black nightshade (SOLNI) infestations were moderate, kochia (KCHSC) and Russian thistle (SASKR) infestations were light throughout the experimental area.

Visual evaluations of crop injury and weed control were made July 2, 1991. All treatments gave good to excellent control of SASKR, KCHSC, AMARE, and AMABL. SOLNI control was excellent with all treatments except dicamba + 2,4-D applied at 0.25 + 0.25 lb ai/A. Yields were 106 to 62 bu/A higher in the herbicide treated plots as compared to the check. Dicamba + cyanazine + pendimethalin applied at 0.38 + 1.0 + 1.0 lb ai/A caused the highest injury rating of 6. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Broadleaf weed control evaluations in field corn with herbicide tank mixes.

Treatment	Rate lb ai/A	Crop[1] Injury	SASKR	KCHSC	AMARE	AMABL	SOLNI	Yield[2]
		--------Weed Control[1]--------						
		%						bu/A
atrazine + dicamba[3] (pm)	0.8	0	100	100	100	99	100	170
atrazine + dicamba[3] (pm)	1.2	0	100	100	100	100	100	178
atrazine + dicamba (pm)	0.8	0	100	100	100	99	100	193
atrazine + dicamba (pm)	1.2	0	100	100	100	100	100	204
atrazine + dicamba (pm) + cyanazine	0.8+1.0	3	100	100	100	100	100	173
atrazine + dicamba (pm) + pendimethalin	0.8+1.0	0	100	100	100	100	100	160
atrazine + dicamba (pm) + DPX-V9360	0.8+0.047	0	100	100	100	100	100	177
atrazine + dicamba (pm) + DPX-79406	0.8+0.047	0	100	100	100	100	100	181
atrazine + dicamba (pm) + CGA-136872	0.8+0.032	3	100	100	100	100	100	166
dicamba + cyanazine	0.38+1.0	3	100	100	96	90	98	172
dicamba + pendimethalin + cyanazine	0.38+1.0+1.0	6	100	100	100	100	100	169
dicamba + pendimethalin	0.38+1.0	5	100	100	100	100	100	181
dicamba + DPX-79406	0.38+0.047	0	100	100	100	100	100	181
dicamba + 2,4-D	0.25+0.25	0	100	100	92	84	81	162
handweeded check		0	100	100	100	100	100	189
check		0	0	0	0	0	0	98
av weeds/M^2			4	3	15	21	7	

1. Based on a visual scale from 0 to 100, where 0 = no control or crop injury and 100 = dead plants.
2. Bu/A = bushels per acre
3. A crop oil concentrate was added at 0.25% v/v.

Broadleaf weed control in field corn with postemergence herbicides. Arnold, R.N., E.J. Gregory and M.W. Murray. Research plots were established on May 3, 1991 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. NK-S5340) and broadleaf weeds to herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied postemergence on May 21, 1991 when corn was in the 3 to 4 leaf stage and weeds were small. Prostrate pigweed (AMABL) and black nightshade (SOLNI) infestations were heavy, redroot pigweed (AMARE) infestations were moderate, and kochia (KCKSC), and Russian thistle (SASKR) infestations were light throughout the experimental area.

Visual evaluations of crop injury and weed control were made July 2, 1991. All treatments gave good to excellent control of KCHSC and AMARE. AMABL control was good to excellent with all treatments except cyanazine applied at 0.75 lb ai/A. SASKR control was good to excellent with all treatments except DPX-V9360 applied at 0.1 lb ai/A. All treatments gave good to excellent control of SOLNI except metribuzin + bentazon applied at 0.06 and 0.5 lb ai/A. Yields were 89 to 60 bu/A higher in the herbicide treated plots as compared to the check. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Broadleaf weed control evaluations in field corn with postemergence herbicides.

Treatment	Rate lb ai/A	Crop[1] Injury	KCHSC	AMARE	AMABL	SASKR	SOLNI	Yield[2]
			---------Weed Control[1]-------					
		------------------%------------------						bu/A
metribuzin + bentazon[3]	0.06+0.5	0	100	98	98	95	70	188
metribuzin + 2,4-D amine	0.06+0.38	0	100	91	84	99	100	195
cyanazine	0.75	0	100	91	73	94	98	201
cyanazine	1.5	4	100	98	90	100	100	186
CGA-136872[3]	0.035	1	100	99	97	91	96	185
CGA-136872[3]	0.07	5	100	98	97	97	100	177
dicamba	0.38	0	100	91	91	100	90	175
cyanazine + dicamba	1.0+0.38	0	100	98	97	100	99	180
cyanazine + metolachlor	1.25+1.25	0	100	98	86	100	100	204
cyanazine + DPX-V9360	1.0+0.05	0	100	97	97	97	95	190
cyanazine + CGA-136872	1.0+0.35	0	100	99	99	98	100	188
DPX-V9360[3]	0.05	0	98	97	97	87	100	188
DPX-V9360[3]	0.1	0	97	99	98	68	100	160
metribuzin	0.06	0	93	94	93	88	83	191
handweeded check		0	100	100	100	100	100	202
check		0	0	0	0	0	0	115
av weeds/M^2			4	12	22	3	15	

1. Based on a visual scale from 0 to 100, where 0 = no control or crop injury and 100 = dead plants.
2. Yields adjusted to a 15.5 percent moisture basis.
3. A crop oil concentrate was added at 0.25% v/v.

Weed control in field corn with postemergence herbicides. Arnold, R.N., E.J. Gregory and M.W. Murray. Research plots were established on May 3, 1991 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. NK-S5340) and annual grasses to postemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content less than 1%. The experimental design was a randomized complete block with four replications. Individual treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied on May 21, 1991 when corn was in the 3 to 4 leaf stage and weeds were small. Barnyardgrass (ECHCG) and green foxtail (SETVI) infestations were moderate throughout the experimental area.

Stand counts were made on June 7, 1991 by counting individual plants per 10 ft of the third row of each plot. Visual evaluations for weed control were made on July 1, 1991. Plant heights were taken on October 15, 1991 by recording the height of three plants per plot. Dicamba was applied to all plots on May 28, 1991 for broadleaf weed control. All treatments gave excellent control of SETVI and ECHCG. Stand count and plant height were not effected by any of the treatments. NM-852 applied at 2.0 lb ai/A and metolachlor applied at 3.0 lb ai/A yielded less bu/A than any other treatments including the check. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Weed control evaluations in field corn with postemergence herbicides.

Treatment	Rate lb ai/A	Stand Count	Plant Height in	Weed Control[1] SETVI	ECHCG	Yield bu/A
				------%	-----	
NM-852	1.0	16	95	100	100	204
NM-852	1.125	15	94	100	100	212
NM-852	2.0	15	92	100	100	172
alachlor	4.0	16	93	100	100	201
metolachlor	1.5	17	95	100	100	193
metolachlor	3.0	16	92	100	100	173
NM-852	0.75	16	95	100	100	207
alachlor	2.0	16	95	100	99	210
NM-852	0.88	16	95	98	97	209
NM-852	0.64	17	96	98	99	207
handweeded check		15	94	100	100	206
check		15	94	0	0	178
av weeds/M^2				15	18	

1. Based on a visual scale from 0 to 100, where 0 = no control and 100 = dead plants.

Weed control in field corn with delayed preemergence herbicides. Arnold, R.N., E.J. Gregory, and M.W. Murray. Research plots were established on May 3, 1991 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. NK-S5340) and annual grasses to delayed preemergence herbicides. Soil type was Wall sandy loam with a pH of 7.8 and an organic matter content less than 1%. The experimental design was a randomized complete block with four replications. Individual treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied on May 10, 1991 and immediately incorporated with 0.75 in of sprinkler applied water. Barnyardgrass (ECHCG) and green foxtail (SETVI) infestations were moderate throughout the experimental area.

Stand counts were made on May 30, 1991 by counting individual plants per 10 ft of the third row of each plot. Visual evaluations for weed control were made on July 1, 1991. Plant heights were taken on October 14, 1991 by recording the height of three plants per plot. Dicamba was applied to all plots on May 28, 1991 at 0.25 lb ai/A for broadleaf weed control. All treatments gave excellent control of SETVI and ECHCG. NM-852 applied at 0.64 and 1.125 lb ai/A and alachlor applied at 4.0 lb ai/A gave the lowest stand count of any other treatment including the check. Metolachlor applied at 1.5 lb ai/A gave the lowest plant height of any other treatment including the check. Yields were 49 to 14 bu/A higher in herbicide treated plots than the check. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Weed control evaluations in field corn with delayed preemergence herbicides.

Treatment	Rate lb ai/A	Stand Count	Plant Height in	Weed Control[1] SETVI	ECHCG	Yield bu/A
				------%	-----	
NM-852	0.75	15	91	100	100	168
NM-852	0.88	16	92	100	99	167
NM-852	1.0	15	89	100	100	161
NM-852	1.125	14	87	100	100	156
NM-852	2.0	15	86	100	100	164
alachlor	2.0	15	88	100	100	179
alachlor	4.0	14	85	100	100	177
metolachlor	1.5	15	84	100	100	144
metolachlor	3.0	15	88	100	100	154
NM-852	0.64	14	90	96	96	166
handweeded check		17	88	100	100	174
check		16	89	0	0	130
av weed/M^2				16	19	

1. Based on a visual scale from 0 to 100, where 0 = no control and 100 = dead plants.

Weed control in field corn with preemergence herbicides. Arnold, R.N, E.J. Gregory and M.W. Murray. Research plots were established on May 3, 1991 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. NK-S5340) and annual grasses to preemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with four replications. Individual treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied on May 7, 1991 and immediately incorporated with 0.75 in of sprinkler applied water. Barnyardgrass (ECHCG) and green foxtail (SETVI) infestations were moderate throughout the experimental area.

Stand counts were made on May 30, 1991 by counting individual plants per 10 ft of the third row of each plot. Visual evaluations for weed control were made on July 1, 1991. Plant heights were taken on October 14, 1991 by recording the height of three plants per plot. Dicamba was applied to all plots on May 28, 1991 at 0.25 lb ai/A for broadleaf control. All treatments gave excellent control of SETVI and ECHCG. NM-852 gave the lowest stand count and plant height of any other treatment including the check. NM-852 applied at 2.0 lb ai/A and alachlor applied at 4.0 lb ai/A yielded less bu/A than any other treatment including the check. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Weed control evaluations in field corn with preemergence herbicides.

Treatment	Rate lb ai/A	Stand Count	Plant Height in	Weed Control[1] SETVI	ECHCG	Yield bu/A
				------%-----		
NM-852	0.88	15	96	100	100	195
NM-852	1.0	15	93	100	100	178
NM-852	1.125	14	87	100	100	158
NM-852	2.0	15	88	100	100	150
alachlor	2.0	16	90	100	100	171
alachlor	4.0	15	89	100	100	154
metolachlor	1.5	15	89	100	100	175
metolachlor	3.0	15	92	100	100	159
NM-852	0.75	14	95	100	99	203
NM-852	0.64	16	93	98	97	187
handweeded check		17	89	100	100	180
check		16	92	0	0	155
av weed/M^2				14	16	

1. Based on a visual scale from 0 to 100, where 0 = no control and 100 = dead plants.

Weed control in field corn with preplant incorporated herbicides. Arnold, R.N., E.J. Gregory and M.W. Murray. Research plots were established on May 2, 1991 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. NK-S5340) and annual grasses to preplant incorporated herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with four replications. Individual treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied on April 30, 1991 and immediately incorporated with a tractor mounted rototiller to a depth of 2 to 4 in. Barnyardgrass (ECHCG) and green foxtail (SETVI) infestations were moderate throughout the experimental area.

Stand counts were made on May 30, 1991 by counting individual plants per 10 ft of the third row of each plot. Visual evaluations for weed control were made July 1, 1991. Plant heights were taken on October 11, 1991 by recording the height of three plants per plot. Dicamba was applied to all plots on May 28, 1991 at 0.25 lb ai/A for broadleaf weed control. All treatments gave good to excellent control of SETVI and ECHCG. Alachlor applied at 2.0 lb ai/A had the lowest stand count and alachlor applied at 4.0 lb ai/A had the lowest plant height of any other treatment including the check. Metolachlor applied at 3.0 lb ai/A yielded less bu/A than any other treatment including the check. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Weed control evaluations in field corn with preplant incorporated herbicides.

Treatment	Rate lb ai/A	Stand Count	Plant Height in	Weed Control[1] SETVI	ECHCG	Yield bu/A
				------%	-----	
NM-852	0.88	16	95	100	92	215
NM-852	1.125	15	91	100	100	162
alachlor	2.0	14	88	100	97	168
alachlor	4.0	15	87	100	99	172
metolachlor	1.5	15	89	100	100	197
metolachlor	3.0	16	88	100	100	157
NM-852	1.0	15	93	100	98	209
NM-852	2.0	15	90	100	99	178
NM-852	0.75	16	94	99	98	196
NM-852	0.64	16	94	96	96	200
handweeded check		16	89	100	100	201
check		15	91	0	0	159
av weeds/M^2				15	18	

1. Based on a visual scale from 0 to 100, where 0 = no control and 100 = dead plants.

Efficacy of acetochlor plus safener in field corn. Brewster, B.D., W.S. Donaldson, and A.P. Appleby. Acetochlor + safener (ICIA5676) was evaluated for weed control and crop tolerance at the Hyslop research farm near Corvallis, Oregon. The trial designed was a randomized complete block with three replications and 5 by 14 m plots. Proso millet seed was broadcast across each plot prior to planting the corn ('NK 9540'). The soil was a Woodburn silt loam with 2.2% organic matter and 5.5 pH.

The herbicides were applied in a water carrier volume of 234 L/ha through XR 8003 flat fan nozzle tips at a pressure of 172 kPa. The corn was seeded on May 24, 1991, and the herbicide treatments were applied the same day. The soil surface was dry on May 24, and the first significant rain (11 mm) occurred 6 days later.

Acetochlor caused some minor crop stunting, but no stand reduction. Although proso millet control was good at the higher rates of acetochlor through June, none of the treatments provided adequate control through July. Acetochlor was more effective than alachlor or metolachlor on common lambsquarters, while metolachlor was the only herbicide that did not maintain adequate control of Powell amaranth through July. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002)

Corn injury and weed control on July 30, 1991.

Herbicide	Rate	Corn	Proso millet	Common lambsquarters	Powell amaranth
	(kg a.i./ha)	(%)			
acetochlor + safener	1.1	0	37	63	95
acetochlor + safener	1.4	7	67	65	97
acetochlor + safener	1.8	7	73	70	100
acetochlor + safener	2.0	10	78	82	97
alachlor	3.1	0	73	0	98
metolachlor	2.2	0	30	0	47
check	0	0	0	0	0

Effect of postemergence johnsongrass control on yield of corn silage. Campbell, M. L. and R. C. Leavitt. Johnsongrass is becoming a very severe problem in the corn silage production areas of central California where fields associated with dairies are not rotated to cotton. Fields are commonly infested with both rhizomes and seeds, with seedling johnsongrass the more difficult to control because of the sheer numbers of seeds present. In this study, nicosulfuron was applied in three fields with differing amounts of johnsongrass in the Hilmar area of Merced County. In field 1, 9% of the total biomass at harvest (dry matter basis) was johnsongrass. Field 2 had 20% johnsongrass and field 3 had 35%.

A single application of nicosulfuron at 0.5 oz ai/a in 15 gal/a water was applied using commercial application equipment on August 2, 1991, to fields 1 and 3. Plots were replicated 5 times. Corn was 12 in. tall in field 1 and 24 in. in field 3. Johnsongrass in field 1 ranged to 7 in. at 6.7 seedlings/ft^2. Johnsongrass in field 3 ranged to 20 in. and was solid in the row. Row centers had been cultivated. All 3 fields had been treated with a preemergence herbicide to control johnsongrass.

In field 2, two application dates of nicosulfuron were compared. The first application was on August 6, 1991, when the corn was about 12 in. and the second on August 15 when the corn was about 24 in. All applications were made at 0.5 oz ai/a in 27 gal/a water using a CO_2 backpack sprayer.

Plots were replicated 4 times with 3 reps reported due to insufficient weed pressure in the last rep. Weed density was 5.3 johnsongrass seedlings/ft^2. There was no significant difference in either johnsongrass control or corn yield between the two treatment dates.

Johnsongrass control by nicosulfuron was excellent in all locations. All plots were harvested by cutting and weighing 4/1000 of an acre with a machete. Corn was harvested and weighed, then johnsongrass from the same area was cut and weighed. Dry matter samples were taken either from the hand cut material or from commercially chopped silage if hand and commercial harvest occurred on the same day. Twenty or twenty-five ears (including cobs and husks) were pulled from each plot and weighed. Ear weights are reported on a fresh weight basis.

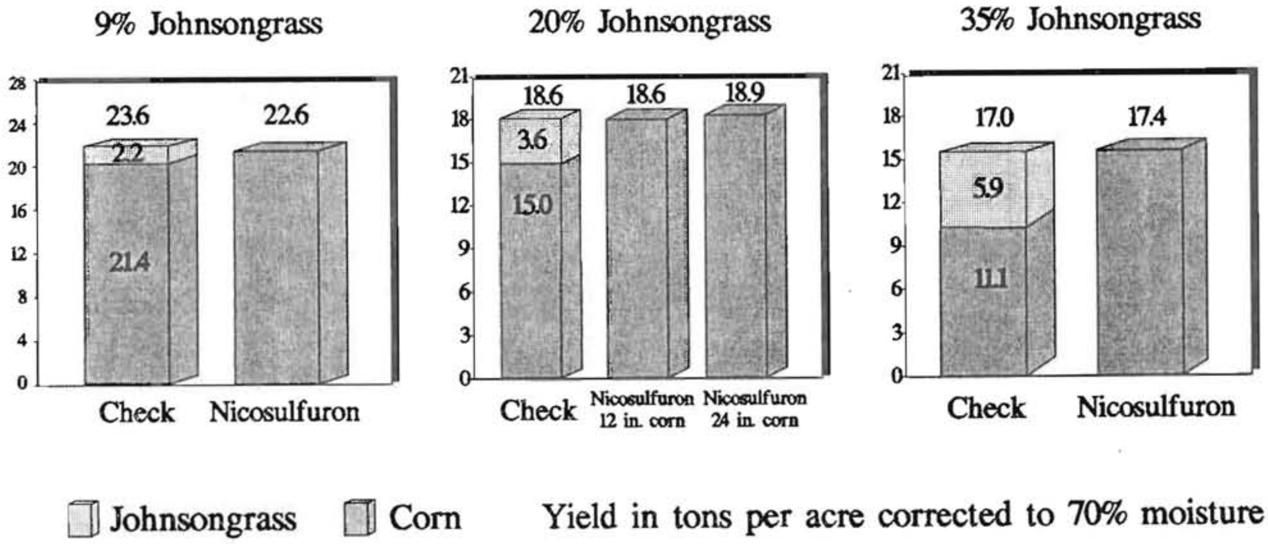
The presence of johnsongrass reduced the yield of the corn by about the same amount as the percentage of johnsongrass in the total biomass. Ear weights were also reduced by about the same proportion. The johnsongrass did not significantly affect the total biomass of the silage crop. (University of California Cooperative Extension, Stanislaus County, 733 County Center 3, Modesto, CA, 95355)

Yield of corn silage as affected by johnsongrass biomass

Proportion of johnsongrass in biomass of check	Reduction in corn yield	Reduction in whole ear weight	Difference in total biomass treated vs check
9.3%	5.4%$^{+}$	3.5%	4.2% increase^{++}
19.6%	20.2%*	23.8%**	same (0.8% decrease)
34.7%	36.2%**	37.0%**	same (2.3% decrease)

$^{+}$Probability = .093
$^{++}$Probability = .121

*Probability < .05
**Probability < .01



Yield in tons per acre corrected to 70% moisture

Shattercane control in field corn. D'Amato, T.D. and P. Westra. Shattercane is a major grassy weed problem in corn in certain areas of Colorado. This field trial was conducted near Burlington, Colorado, to assess the efficacy of seven herbicide treatments for control of shattercane.

The experiment was a randomized complete block with three replications. Plots were 10 ft wide by 30 ft long. Treatments were applied with a CO_2 powered backpack sprayer delivering 20 gpa through 11002LP flat fan nozzles, with a boom pressure of 22 psi. Preplant treatments were applied May 14, 1991 and incorporated immediately to a depth of 2-3" with a rototiller. An imazethapyr tolerant corn variety was planted on May 14. The post emergent herbicide treatments were applied 14 days later at which time the corn was 2-4" tall and in the 3-4 leaf stage. The shattercane was 2-4" tall and in the 2-4 leaf stage with an average density of 10 plants per square foot.

The most effective treatment was the ppi application of EPTC followed by a post emergent application of imazethapyr. Excellent residual control was observed in those plots throughout the growing season. The post emergent applications of imazethapyr were generally more effective for shattercane control than the preplant treatments.

Overall corn yields were low due to extreme weather conditions that occurred at the study site through the 1991 growing season. The untreated check plots yielded no corn due to competition from high infestation levels of shattercane. No herbicide injury to the corn was observed. (Department of Plant Pathology and Weed Science, Colorado State University, Ft. Collins, CO 80523)

Shattercane control in field corn

Herbicide	Rate	Appl stage	SORVU 6-17-91	SORVU 7-18-91	Corn yield
	(lb ai/a)		(% control)		(bu/a)
CHECK			0.0 e	0.0 d	0 b
imazethapyr	.063	PPI	81.7 cd	63.3 b	44 ab
imazethapyr atrazine	.063 .5	PPI PPI	80.0 d	70.0 b	62 a
imazethapyr EPTC	.063 4.0	PPI PPI	6.7 c	86.7 a	61 a
EPTC atrazine	4.0 1.0	PPI PPI	86.7 c	50.0 c	45 ab
EPTC imazethapyr 28% nitrogen	4.0 .063	PPI POST POST	99.0 a	97.0 a	72 a
imazethapyr surfactant 28% nitrogen atrazine	.063 .5	POST POST POST POST	92.3 b	85.7 a	74 a
imazethapyr surfactant 28% nitrogen	.063	POST POST POST	96.3 ab	85.0 a	26 ab

Wild proso millet control in field and sweet corn with nicosulfuron. Downard, R.W. and Morishita, D.W. Experiments were conducted in field corn near Jerome and in sweet corn near Castleford, Idaho to evaluate nicosulfuron with several adjuvants for wild proso millet control. Plots were 4 rows wide on 30 inch row spacing and 25 ft long. The Jerome location was sprinkler irrigated and furrow irrigated at Castleford. Twenty two treatments were arranged in a randomized complete block design with four replications. Soil texture at Jerome was a sandy loam with a pH of 7.7, 1.0% om and a CEC of 11 meg/100 g soil. At Castleford the soil was a silt loam with a pH of 7.8, 1.45% OM and a CEC of 19 meg/100 g soil.

Chemical treatments were applied with a hand-held sprayer equipped with eight flat fan nozzles. Application data for each location is listed in Table 1. Wild proso millet in all treatments was harvested 56 days after early postemergence applications. Harvest area was 2 ft by 2 ft.

Crop injury was not significant in any of the evaluations at either location. On July 30 wild proso millet control on field corn at Jerome was 89%-100% with all treatments except EPTC & dichlormid at 96 oz ai/A PPI (Table 2). On sweet corn wild proso millet control with nicosulfuron was better with the postemergence applications, than early postemergence applications. Early postemergence applications were applied when soil moisture was not optimum and may have contributed to reduced control.

Wild proso millet control was better when a combination of adjuvants were added to nicosulfuron rather than one individually. Results indicate 28% nitrogen solution added to nicosulfuron plus surfactant early postemergence can significantly increase the activity of nicosulfuron for wild proso millet control. (Department of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls, ID 83301).

Table 1. Application data.

	Jerome	Cast[1]	Jerome	Cast[1]	Jerome	Cast[1]
Application timing	PPI	PPI	Epost	Epost	Post	Post
Application date	5/2/91	5/21/91	6/17/91	6/28/91	7/1/91	7/8/91
Air temperature (F)	46	63	61	75	68	90
Soil temperature (F)	44	63	61	75	68	78
Relative humidity (%)	98	-	43	60	60	13
Wind velocity (mph)	0	0	4-10	6-10	0	4-6

[1]Cast=Castleford

Table 2. Crop injury, wild proso millet control and biomass in field corn (Jerome) and sweet corn (Castleford).

			Jerome			Castleford		
Treatment	Rate	Applic.[2]	PANMI[1] control	Fresh weight	Dry weight	PANMI[1] control	Fresh weight	Dry weight
	oz ai/A		%	----------lb/A----------		%	----------lb/A----------	
check			0	8046	1589	0	6593	1405
Nicosulfuron + surf[3]	0.50	Epost	90	40	7	35	7368	1387
Nicosulfuron + surf + 28% N[4]	0.50	Epost	98	0	0	73	1567	414
Nicosulfuron + COC[5]	0.50	Epost	95	396	72	45	2918	540
Nicosulfuron + 28% N + COC	0.50	Epost	95	0	0	48	9151	1387
Nicosulfuron + adj[6]	0.50	Epost	96	803	181	78	468	198
Nicosulfuron + 28% N + COC	0.75	Epost	99	143	18	68	2666	496
Nicosulfuron + 28% N + COC	1.0	Epost	99	0	0	80	342	180
Nicosulfuron + 28% N + COC	0.50	Post	99	399	109	88	0	0
Nicosulfuron + 28% N + COC	0.75	Post	94	294	72	86	1657	234
Nicosulfuron + 28% N + COC	1.0	Post	93	125	54	88	1261	306
Nicosulfuron/ + 28% N + COC nicosulfuron + 28% N + COC	0.50/ 0.50	Epost Epost	100	0	0	83	847	198
Nicosulfuron + surf	0.50	Post	98	0	0	73	3477	666
Nicosulfuron + surf + 28% N	0.50	Post	96	0	0	89	667	146
Nicosulfuron + COC	0.50	Post	94	612	90	79	2648	541
Nicosulfuron + adj	0.50	Post	94	1852	351	81	1225	306
Nicosulfuron + surf	0.75	Post	93		0	85	1729	310
Nicosulfuron + surf + 28% N	0.75	Post	93	475	145	78	829	216
Nicosulfuron + COC	0.75	Post	89	173	20	73	3495	649
Nicosulfuron + adj	0.75	Post	93	0	0	85	414	144
EPTC & dichlormid	96.0	PPI	3	1916	1228	25	20067	4017
EPTC & dichlormid/ nicosulfuron + 28% N + COC	96.0/ .50	PPI Post	98	0	0	80	2306	468
LSD (0.05)			7	2441	739	20	7048	1418

[1]PANMI = Wild proso millet.

[2]Application timing based on wild proso millet growth stage. Epost = 1 to 2 inches tall; Post = 3 to 5 inches tall; and PPI = preplant incorporated.

[3]Surfactant R-11 added to 0.25% v/v.

[4]28% N added at 4. 0% v/v.

[5]Crop oil concentrate Mor-Act added at 1.0% v/v.

[6]Adjuvant Scoil added at 1.0 % v/v.

<u>Postemergence weed control in corn</u>. Miller, S.D., J.M. Krall and T. Neider. Plots were established under sprinkler irrigation at the Research and Extension Center, Torrington, WY to evaluate the efficacy of postemergence herbicide treatments for weed control in corn. Plots were 10 by 30 ft. with three replications arranged in a randomized complete block. Corn (var. Pioneer 3902) was seeded in a sandy loam soil (80% sand, 12% silt and 8 clay) with 1.3% organic matter and pH 7.8 April 30, 1991. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 29, 1991 (air temp. 62F, relative humidity 90%, wind SE at 5 mph, sky clear and soil temp. - 0 inch 65F, 2 inch 62F and 4 inch 58F) to 4-leaf corn and 1 to 2 inch weeds. Weed counts, crop stand counts and visual injury ratings were made June 19, visual weed control ratings July 23 and plots harvested September 30, 1991. Kochia (KCHSC), common lambsquarters (CHEAL), redroot pigweed (AMARE) and green foxtail (SETVI) infestations were moderate and field sandbur (CCHIN) infestations light and variable throughout the experimental area.

No treatment significantly reduced corn stand (0 to 4%); however, corn injury ranged from 0 to 30% with the various treatments. Treatments containing cyanazine generally caused the greatest injury (8 to 30%) and injury with dicamba or bromoxynil was influenced by additive. Common lambsquarters and redroot pigweed control was >90% with all treatments except bromoxynil and grass control >80% with all treatments containing atrazine, cyanazine or pendimethalin. Corn yields related closely to weed control (but not early injury) and were 66 to 104 bu/A higher in herbicide treated compared to weedy check plots. (Wyoming Agric. Exp. Stn., Laramie, WY 82071 SR 1798)

Weed control with postemergence herbicide treatments in corn

Treatment[1]	Rate lb ai/A	Corn[2] Inj %	Corn[2] Sr %	Corn[2] Yield bu/A	% Weed control[3] June KCHSC	June CHEAL	June AMARE	June SETVI	June CCHIN	July KCHSC	July CHEAL	July AMARE	July SETVI
bromoxynil(brom)	0.25	0	0	132	86	100	93	0	0	85	100	97	0
brom+X-77	0.25	0	0	132	86	90	100	0	0	83	100	97	0
brom+X-77+N	0.25	3	0	132	86	90	93	0	0	83	100	100	0
brom+oc	0.25	3	0	123	91	100	100	0	0	88	100	100	0
brom+oc+N	0.25	7	2	132	100	100	93	0	0	87	98	97	0
bromoxynil	0.38	2	0	137	86	90	100	0	0	87	100	100	0
dicamba(dica)	0.38	0	2	151	100	100	100	0	0	95	100	100	0
dica+X-77	0.38	0	0	147	100	100	100	0	0	100	100	100	0
dica+X-77+N	0.38	3	0	142	91	100	93	0	0	100	99	100	0
dica+oc	0.38	8	2	147	100	100	93	0	0	100	100	100	0
dica+oc+N	0.38	10	0	156	100	100	93	0	0	100	100	100	0
brom/atrazine(atra)	0.75	0	4	166	91	100	100	100	83	90	100	100	90
brom+dica	0.25+0.125	0	2	156	100	100	100	0	0	100	100	100	0
brom+dica	0.25+0.25	3	0	151	100	100	100	0	0	100	100	100	0
brom/atra+dica	0.75+0.125	0	2	166	100	100	100	100	83	100	100	100	92
dica+pendimethalin(pend)	0.38+1.0	5	0	170	100	100	100	15	0	95	100	100	83
dica+cyanazine(cyan)	0.38+1.0	15	2	156	100	100	100	100	83	97	100	100	97
dica+pend+cyan	0.38+1.0+1.0	25	2	156	100	100	100	100	100	100	100	100	100
dica/atra	1.0	0	4	147	100	100	100	100	89	100	100	100	92
dica/atra+X-77	1.0	0	0	151	100	100	100	100	83	100	100	100	93
dica/atra+X-77+N	1.0	0	2	151	100	100	100	100	89	99	100	100	92
dica/atra+oc	1.0	3	0	147	100	100	100	100	83	100	100	100	90
dica/atra+pend	1.0+1.0	0	2	156	100	100	100	100	100	100	100	100	100
dica/atra+cyan	1.0+1.0	8	2	147	100	100	100	100	100	100	100	100	100
dica/atra+pend+cyan	1.0+1.0+1.0	20	4	147	100	100	100	100	100	100	100	100	100
pyridate(pyri)+atra+oc	0.45+0.6	8	2	166	91	100	100	100	83	97	100	100	93
pyri+atra+oc	0.7+0.6	10	2	161	100	100	100	100	83	100	100	100	93
pyri+atra+oc	0.9+0.6	13	2	161	100	100	100	100	89	100	100	100	93
pyri+cyan	0.45+1.0	25	4	151	100	100	93	100	100	98	100	98	95
pyri+cyan	0.7+1.0	30	4	151	100	100	100	100	89	97	98	100	100
pyri+cyan	0.9+1.0	30	2	142	100	100	100	100	100	98	98	100	100
brom/atra+X-77	0.75	0	0	156	100	100	100	100	83	90	100	100	90
brom/atra+X-77+N	0.75	0	0	161	100	100	100	100	83	95	100	100	90
brom/atra+oc	0.75	0	0	156	100	100	100	100	89	92	100	100	95
weedy check		0	0	66	0	0	0	0	0	0	0	0	0
plants/ft row 6-inch band		--	1.5	- -	0.4	0.4	0.8	0.4	0.2	- -	- -	- -	- -

[1] Treatments applied May 29, 1991; X-77 at 0.25% v/v, N(28-0-0) at 1 gal/A, oc = Prime oil at 1 qt/A and / = package mix.

[2] Corn stand counts (SR = stand reduction) and visual injury (inj) evaluated June 19 and plots harvested September 30, 1991.

[3] Weed stand counts June 19 and visual weed control ratings July 23, 1991.

Weed control in corn with preplant incorporated or preemergence herbicide treatments. Miller, S.D., T. Neider and J.M. Krall. Plots were established under sprinkler irrigation at the Research and Extension Center, Torrington, WY to evaluate the efficacy of preplant incorporated or preemergence herbicide treatments for weed control in corn. Plots were 10 by 30 ft. with three replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi. Preplant incorporated treatments were applied April 30, 1991 (air temp. 42F, relative humidity 90%, wind NW at 10 mph, sky partly cloudy and soil temp. - 0 inch 42F, 2 inch 41F and 4 inch 40F), incorporated twice immediately after application with a roller harrow operating 2 to 3 inches, corn (var. Pioneer 3902) seeded and preemergence treatments applied (air temp. 57F, relative humidity 35%, wind NW at 7 mph, sky clear and soil temp. - 0 inch 62F, 2 inch 50F and 4 inch 46F). The soil type was a sandy loam (81% sand, 12% silt and 7% clay) with 1.5% organic matter and pH 7.8. Weed counts, crop stand counts and visual crop injury ratings were made May 22 and visual weed control ratings July 10, 1991. Green foxtail (SETVI) infestations were moderate and redroot pigweed (AMARE), Russian thistle (SASKR) and kochia (KCHSC) infestations light but uniform throughout the experimental area. Plots were not harvested for yield because of uneven corn growth due to water puddling.

Corn stands were reduced slightly (1 to 4%) by several treatments; however, no visual injury was observed. Early season weed control was excellent (90 to 100%) and late season weed control fair to excellent (75 to 100%) with ICIA-5676 combinations with cyanazine. Increasing the ICIA-5676 or cyanazine rate above 1.0 lb/A in the combination treatments generally did not enhance weed control further. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1795)

Weed control with preplant incorporated and preemergence treatments in corn

Treatment[1]	Rate lb ai/A	Corn[2] Inj %	Corn[2] SR %	% Weed control[3] May AMARE	May SASKR	May KCHSC	May SETVI	July SASKR	July KCHSC	July SETVI
<u>preplant incorporated</u>										
EPTC(+)G	4.0	0	1	0	71	70	100	47	60	92
EPTC(+)G	6.0	0	4	33	71	80	100	48	62	95
EPTC(+)	4.0	0	0	0	71	80	100	42	57	88
butylate(+)	5.0	0	0	33	71	80	100	20	47	82
alachor	2.5	0	4	33	71	70	100	37	60	92
alachor WG	2.5	0	1	33	29	50	100	40	57	92
<u>preemergence</u>										
ICIA-5676	0.75	0	0	100	29	70	93	53	57	87
ICIA-5676	1.0	0	0	100	71	100	97	53	70	93
ICIA-5676	1.25	0	0	100	57	100	100	63	72	93
ICIA-5676	1.5	0	0	100	100	100	100	62	75	100
alachor	2.5	0	0	33	71	80	100	53	60	93
alachor WG	2.5	0	4	33	57	80	100	57	63	93
metolachor	2.5	0	4	33	71	100	100	57	47	90
ICIA-5676+cyanazine	0.75+0.75	0	0	100	100	90	100	75	80	90
ICIA-5676+cyanazine	0.75+1.0	0	0	100	100	100	100	85	83	92
ICIA-5676+cyanazine	0.75+1.5	0	0	100	100	100	100	85	85	93
ICIA-5676+cyanazine	1.0+0.75	0	0	100	100	90	100	90	82	92
ICIA-5676+cyanazine	1.0+1.0	0	0	100	100	100	100	90	80	93
ICIA-5676+cyanazine	1.0+1.5	0	0	100	100	100	100	90	83	95
ICIA-5676+cyanazine	1.25+0.75	0	0	100	100	100	100	90	85	97
ICIA-5676+cyanazine	1.25+1.0	0	0	100	100	100	100	92	87	100
ICIA-5676+cyanazine1.25+1.5	0	0	100	100	100	100	92	85	100	
ICIA-5676+cyanazine	1.5+0.75	0	1	100	100	100	100	90	85	98
ICIA-5676+cyanazine	1.5+1.0	0	0	100	100	100	100	92	85	100
ICIA-5676+cyanazine	1.5+1.5	0	0	100	100	100	100	93	90	100
weedy check	- - -	0	0	0	0	0	0	0	0	0
plants/ft row 6-inch row	--	1.6	0.1	0.2	0.2	2.1	--	--	--	

[1] Treatments applied April 30, 1991; G = granule and WG = water dispersible granule.
[2] Corn stand counts (SR = stand reduction) and visual injury (inj) evaluated May 22.
[3] Weed stand counts May 22 and visual weed control ratings July 10, 1991.

Weed control in corn with nicosulfuron and primisulfuron alone or in combination with broadleaf herbicides. Miller, S.D., T. Neider and J.M. Krall. Plots were established under sprinkler irrigation at the Research and Extension Center, Torrington, WY to evaluate the efficacy of nicosulfuron and primisulfuron alone or in combination with broadleaf herbicides for weed control in corn. Plots were 10 by 30 ft. with three replications arranged in a randomized complete block. Corn (var.Pioneer 3902) was seeded in a sandy loam soil (81% sand, 12% silt and 7% clay) with 1.5% organic matter and pH 7.8, April 30, 1991. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 28, 1991 (air temp. - 65F, relative humidity 85%, wind SE at 5 mph, sky cloudy and soil temp. 0 inch 66F, 2 inch 66F and 4 inch 64F) to 4-leaf corn and 0.5 to 2 inch weeds. Weed counts, crop stand counts and visual crop injury ratings were made June 18 and visual weed control ratings July 23, 1991. Field sandbur (CCHIN) infestations were heavy; common lambsquarters (CHEAL), kochia (KCHSC), Russian thistle (SASKR) and green foxtail (SETVI) infestations moderate and redroot pigweed (AMARE) infestations light but uniform throughout the experimental area. Plots were not harvested for yield because of uneven corn growth due to water puddling.

No treatment significantly reduced corn stands. Corn injury was slight and ranged from 0 to 3% with treatments containing nicosulfuron and 5 to 10% with treatments containing primisulfuron. Late season broadleaf weed control was excellent (100%) with all treatments containing dicamba, bromoxynil, pyridate or atrazine and grass control good (85 to 93%) with all treatments containing nicosulfuron. Late season grass control with primisulfuron was 17 to 22% less than with nicosulfuron. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1796)

Weed control with postemergence grass herbicides alone or in combination with other herbicides

Treatment[1]	Rate lb ai/A	Corn[2] Inj %	Corn[2] SR %	% Weed control[3] June CHEAL	KCHSC	AMARE	SASKR	SETVI	CCHIN	July CHEAL	KCHSC	SASKR	CCHIN
nico+X-77	0.032	0	0	49	76	100	8	100	96	40	40	0	87
nico+X-77+N	0.032	2	0	58	78	100	23	100	96	50	70	20	87
nico+oc	0.032	0	0	47	76	100	23	98	95	57	60	13	88
nico+oc+N	0.032	2	0	58	76	100	23	100	96	60	70	30	90
prim+X-77	0.036	7	6	77	94	94	23	98	77	75	70	55	70
prim+X-77+N	0.036	5	4	72	96	94	23	95	73	80	80	57	70
prim+oc	0.036	7	0	81	100	100	23	98	74	80	73	53	70
prim+oc+N	0.036	7	0	81	100	100	23	100	78	87	83	67	70
prim+ms	0.036	10	0	85	100	96	8	95	80	80	80	67	68
prim+X25309	0.036	7	4	85	100	100	23	100	78	82	83	63	70
nico+dica+X-77	0.032+0.38	2	0	100	100	100	100	98	93	100	100	100	85
nico+dica/atra+X-77	0.032+1.0	3	0	100	100	100	100	100	100	100	100	100	91
nico+brom+X-77	0.032+0.25	2	0	100	100	100	100	100	94	100	100	100	87
nico+brom+X-77+N	0.032+0.25	3	4	100	100	100	100	100	94	100	100	100	87
nico+brom+oc	0.032+0.25	2	0	97	100	100	100	98	93	100	100	100	90
nico+brom+oc+N	0.032+0.25	3	0	100	100	100	100	100	93	100	100	100	91
nico+brom/atra+X-77	0.032+0.75	2	0	100	100	100	100	100	93	100	100	100	93
nico+brom+dica+X-77	0.032+0.25+0.125	0	0	100	96	100	100	100	95	100	100	100	85
nico+pyridate+X-77	0.032+0.45	0	4	100	100	100	100	100	93	100	100	100	88
nico+pyridate+X-77	0.032+0.9	3	4	100	100	100	100	96	95	100	100	100	90
prim+atra+oc	0.036+0.5	7	4	100	100	100	100	99	89	100	100	100	88
prim+atra+N	0.036+0.5	7	4	100	96	100	100	100	87	100	100	100	92
prim+atra+oc+N	0.036+0.5	5	0	100	100	100	100	94	89	100	100	100	87
prim+brom+X-77	0.036+0.25	7	4	97	100	100	100	98	76	100	100	100	72
prim+brom/atra+X-77	0.036+0.75	10	0	100	100	100	100	98	82	100	100	100	85
prim+dica+X-77	0.036+0.38	7	0	100	100	100	100	100	65	100	100	100	60
prim+dica/atra+X-77	0.036+1.0	7	0	100	100	100	100	98	86	100	100	100	82
weedy check	- - - -	0	0	0	0	0	0	0	0	0	0	0	0
plants/ft row 6-inch band		- -	1.7	1.6	1.1	0.2	0.9	2.6	7.6	- -	- -	- -	- -

[1] Treatments applied May 28, 1991; X-77 at 0.25% v/v, N (28-0-0) at 1 gal/A, oc = Prime oil at 1 qt/A, ms = Sun-It at 1 qt/A, X25309 at 0.5% v/v and / = package mix.
[2] Corn stand counts (SR=stand reduction) and visual injury evaluated June 18, 1991.
[3] Weed stand counts June 18 and visual weed control ratings July 23, 1991.

Postemergence control of wild proso millet in corn. Miller, S.D. and T. Neider. Plots were established under furrow irrigation near Cassa, WY to evaluate the influence of additives on wild proso millet control with nicosulfuron in corn. Plots were 10 by 30 ft. with three replications arranged in a randomized complete block. Corn (var. Golden Harvest 2445) was seeded May 13, 1991 in a silt loam soil (52% sand, 34% silt and 14% clay) with 2.1% organic matter and pH 7.7. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 10 gpa at 40 psi June 7 (air temp. 63F, relative humidity 84%, wind SE at 8 mph, sky cloudy and soil temp. - 0 inch 62F, 2 inch 60F and 4 inch 58F) to 2 to 3-leaf corn and 1 to 2-leaf wild proso millet or June 14, 1991 (air temp. 73F, relative humidity 61%, wind SW at 4 mph, sky partly cloudy and soil temp. - 0 inch 82F, 2 inch 66F and 4 inch 62F) to 4 to 5-leaf corn and 3 to 4-leaf wild proso millet. Weed counts were made June 21, visual injury and crop stand counts July 8, visual weed control ratings June 28, July 8 and August 2 and plots harvested September 11, 1991. Wild proso millet (PANMI) infestations were heavy (11.1 plants/linear ft.) and uniform throughout the experimental site.

No corn injury or stand reduction was observed with any nicosulfuron treatment; however, imazethapyr reduced corn stands 9 to 11% and caused 28 to 33% injury. Late season wild proso millet control was excellent (93 to 94%) with imazethapyr and good to excellent (78 to 97%) with nicosulfuron. Wild proso millet control with nicosulfuron was slightly less at the 2 to 3 than 4 to 5-leaf application stage and with X-77 compared to the other additives. Corn yields were 4.7 to 9.7 T/A higher in herbicide treated compared to weedy check plots and related closely to wild proso millet control and/or crop injury. (Wyoming Agric. Exp. Stn., Laramie, WY 82071 SR 1797)

Postemergence control of wild proso millet in corn

		Corn[2]			PANMI[3]		
	Rate lb ai/A	Inj %	SR %	Yield T/A	SR %	June	
2 to 3-leaf							
nicosulfuron+X-77	0.032	0	0	18.6	42		
nicosulfuron+X-77+N	0.032	0	0	18.9	42	70	8181
nicosulfuron+oc	0.032	0	0	20.6	49	67	8283
nicosulfuron+oc+N	0.032	0	0	21.7	61	73	8888
nicosulfuron+ms	0.032	0	0	21.2	61	70	8485
nicosulfuron+oc+N	0.047	0	0	20.8	51	68	8486
nicosulfuron+oc+N	0.063	0	0	19.4	53	77	8987
imazethapyr+X-77+N	0.063	33	9	16.7	52	78	9893
4 to 5-leaf							
nicosulfuron+X-77	0.032	0	0	19.4	69	78	7883
nicosulfuron+X-77+N	0.032	0	0	19.6	76	85	8487
nicosulfuron+oc	0.032	0	0	20.5	62	80	8585
nicosulfuron+oc+N	0.032	0	0	20.5	84	83	7888
nicosulfuron+ms	0.032	0	0	20.8	80	83	8788
nicosulfuron+oc+N	0.047	0	0	20.0	86	90	8994
nicosulfuron+oc+N	0.063	0	0	20.6	79	86	9297
imazethapyr+X-77+N	0.063	28	11	19.6	82	82	9494
2 to 3/4 to 5-leaf							
nicosulfuron/nicosulfuron+oc+N	0.032/0.032	0	0	20.7	67	83	8889
weedy check	- - - -	0	0	12.0	0	0	00
plants/ft. row 6-inch band		--	1.9	- -	11.1	--	---

[1] Treatments applied June 7 and 14, 1991; X-77 at 0.25% v/v, oc = Prime oil at 1% v/v, N=(28-0-0) at 4% v/v and ms = Scoil at 1% v/v.

[2] Corn stand counts (SR = stand reduction) and visual injury determined July 8 and plots harvested September 11, 1991.

[3] Wild proso millet counts (SR = stand reduction) June 21 and visual weed control ratings June 28, July 8 and August 2, 1991.

Comparison of early and late application of pyridate and atrazine in field corn. Mitich, L.W., J.A. Roncoroni, and G.B. Kyser. Pyridate and atrazine were evaluated in 5 treatments in early and late postemergence applications in NK '3377' field corn at the UC Davis Farm. Corn was planted 13 May 1991 at 30,000 seeds/a, in plots 10 ft (four 30-inch rows) by 20 ft in a randomized complete block design split into early and late treatments. Early postemergence treatments were applied 11 June, when corn was 12 to 16 inches tall and weeds were 2 to 4 inches; temperature was 80 F rising to 100 F, with low winds. Late postemergence treatments were applied 2 July, when corn was 18 to 24 inches tall and weeds were 6 to 8 inches; temperature was 75 F rising to 108 F, with low winds. All treatments were applied with a CO_2 backpack sprayer delivering 25 gal/a at 30 psi through 8002 nozzles. On 20 June, corn was fertilized with 160 units/a of nitrogen as ammonium nitrate.

Visual evaluation for crop vigor and weed control was conducted 9 July. No significant differences were found for crop vigor or barnyardgrass (ECHCG) control; however, these results are not conclusive with regard to the late postemergence treatments, because evaluation was performed relatively soon after the late application. Early treatments with atrazine produced good control (80% to 88%) of common purslane (POROL); early treatments with pyridate + atrazine produced fair control (78% to 83%) of redroot pigweed (AMARE). Late treatments produced unacceptable control of these species.

Corn was harvested 21 October from the center 5 ft by 10 ft of each plot. Yields from early-treated plots were, on the whole, significantly higher than yields from late-treated plots. (Department of Botany, University of California, Davis, CA 95616)

Comparison of early and late application of pyridate and atrazine in field corn, UC Davis, 1991

		Early postemergence application			Late postemergence application		
		Weed control (%)[1,2]			Weed control (%)[1,2]		
Treatment	Rate (lb/a)	purslane	pigweed	yield (kg)[1]	purslane	pigweed	yield (kg)[1]
pyridate	0.45	13	55	8.30	48	45	7.80
pyridate	0.9	15	60	8.97	43	43	6.61
atrazine	1.2	80	10	8.47	40	43	7.83
pyridate + atrazine	0.45 1.2	88	78	8.85	33	33	7.67
pyridate + atrazine	0.9 1.2	88	83	8.63	45	55	7.69

[1] Average of four replications.
[2] 0 = no control, 100 = complete control.

Comparison of herbicides in field corn under conventional cultivation and noncultivated regimes. Mitich, L.W., J.A. Roncoroni, and G.B. Kyser. Pyridate, cyanazine, and primisulfuron were evaluated in 8 treatments in conventional and noncultivated plots of NK '3377' field corn at the UC Davis Farm. Corn was planted 13 May 1991 at 30,000 seeds/a in plots 10 ft (four 30-inch rows) by 20 ft in a randomized complete block design split into cultivated and noncultivated sections. The cultivated section was treated with alachlor before planting; the noncultivated section was treated with alachlor + glyphosate after planting.

Preemergence treatments were applied 13 May; temperature was 70 F, with low winds. Postemergence treatments were applied 11 June, when corn was 12 to 16 inches tall and weeds were 2 to 4 inches; temperature was 80 F rising to 100 F, with wind 5 to 10 mph. All treatments were applied with a CO_2 backpack sprayer delivering 25 gal/a at 30 psi through 8002 nozzles. On 20 June, corn was fertilized with 160 units/a of nitrogen as ammonium nitrate.

Visual evaluation for crop vigor and weed control was conducted 9 July. No significant differences were found for crop vigor. Treatments under conventional cultivation produced, on the whole, significantly better control of barnyardgrass (ECHCG) than treatments under noncultivated conditions. Similar results were obtained for redroot pigweed (AMARE), though this was only significant to the 10% level. Common purslane (POROL) showed significantly better control under noncultivated conditions, probably due to its ability to re-root after cultivation.

Corn was harvested 21 October from the center 5 ft by 10 ft of each plot. Yields did not vary significantly. (Department of Botany, University of California, Davis, CA 95616)

		Noncultivated				Cultivated			
	Rate	weed control (%)[1,2]			yield[1]	weed control (%)[1,2]			yield[1]
Treatment	(lb/a)	POROL	AMARE	ECHCG	(kg)	POROL	AMARE	ECHCG	(kg)
pyridate	0.45	33	55	53	8.58	23	73	63	8.06
pyridate	0.9	35	80	33	8.70	20	80	65	7.87
cyanazine	1.2	48	30	38	7.77	40	58	70	7.85
primisulfuron	0.04	65	85	25	7.76	43	93	58	8.25
pyridate + cyanazine	0.45 1.2	85	68	33	7.66	70	80	83	8.51
pyridate + cyanazine	0.9 1.2	85	93	55	7.96	78	88	73	8.80
pyridate + primisulfuron	0.45 0.04	88	88	35	8.78	85	95	75	8.65
pyridate + primisulfuron	0.9 0.04	93	98	60	8.70	90	98	60	8.76
check	----	28	13	48	7.59	23	18	40	8.38

[1]Average of four replications.

Wild proso millet control with nicosulfuron. Westra, P. and W.L. Stump. As part of a multi state project the effects of nicosulfron at three rates, two application timings and five surfactants on wild proso millet control was conducted. The study was conducted at two corn sites near Lasalle and Barnsville Colorado.

The experiments were randomized complete block designs with four replications. Plots were 10 ft wide by 30 ft long. Carrier volume was 20 gal/a delivered at 22 psi pressure through 11002 flat fan nozzles. At the Lasalle site, early post treatments were applied May 29 with the corn in the 4-6 lf stage and panmi in the 2-4 lf stage. Postemergent treatments were applied on June 10 with corn in the 6 lf stage and panmi in the 3-5 lf stage. At the Barnsville site, early post treatments were applied May 30 with corn in the 3-4 lf and panmi in the 2 lf stages. The postemergent treatments were applied June 12 with corn in the 4-5 lf and panmi in the 2-4 leaf stages.

At the Lasalle site, the early post treatments provided the best control of the millet with 85 to 90% control 58 DAT. There were no significant differences between rates or surfactants. Later post treatments gave poor results with only 30 to 50% control. Again no big differences were noted with varying rates and surfactants. A possible explanation is that the panmi was too large at the time of the later application.

At the Barnsville site the later post treatments provided better control than the early post treatments. This was due to panmi emergence differences in the two study areas. At Lasalle the field was worked and planted three weeks earlier than at the Barnsville site; thus at the time of the early post treatments the panmi was up and at a susceptible size for control. There was not a large additional flush of panmi in the field and the remaining panmi reached a greater size that was difficult to control especially with an increased crop canopy intercept of the application. At Barnsville there was an additional flush of panmi after the early post treatment so reduced ratings were most likely due to a new flush. Also please note that the first rating was not until 36 DAT, so efficacy of early treatments before the flush is not known. By the time of the later post treatments most of the panmi was up and smaller in size (due to intraspecific competition) than at the Lasalle site providing better control. At this site there was more differences between treatments but nothing that was consistent. (Department of Plant Pathology and Weed Science, Colorado State University, Ft. Collins, CO 80523).

Table 1.

WILD PROSO MILLET CONTROL IN CORN - Barnesville Site

Treatment	Rate	Application	PANMI CONTROL % 36 DAT	PANMI CONTROL % 48 DAT
CHECK			0.0 k	0.0 j
Nicosulfuron	.50	EP	68.3 d-g	66.7 fg
X-77		EP		
Nicosulfuron	.50	EP	70.0 c-g	85.0 a-e
X-77		EP		
28% NITROGEN		EP		
Nicosulfuron	.50	EP	51.7 ij	68.3 efg
SCOIL		EP		
Nicosulfuron	.50	EP	70.0 c-g	81.7 a-f
SCOIL		EP		
AMMON SULFATE		EP		
Nicosulfuron	.50	EP	66.7 e-h	76.7 b-g
SCOIL		EP		
28% NITROGEN		EP		
Nicosulfuron	.50	EP	60.0 g-j	63.3 g
COC		EP		
Nicosulfuron	.50	EP	60.0 g-j	75.0 c-g
COC		EP		
AMMON SULFATE		EP		
Nicosulfuron	.50	EP	61.7 f-i	70.0 d-g
COC		EP		
28% NITROGEN		EP		
Nicosulfuron	.50	EP	91.7 a	91.7 abc
COC		EP		
28% NITROGEN		EP		
Nicosulfuron	.50	POST		
COC		POST		
28% NITROGEN		POST		
Nicosulfuron	.50	POST	75.0 b-f	86.7 a-d
COC		POST		
28% NITROGEN		POST		
Nicosulfuron	.75	POST	78.3 a-e	78.3 b-g
COC		POST		
28% NITROGEN		POST		
Nicosulfuron	1.0	POST	81.7 a-d	93.3 ab
COC		POST		
28% NITROGEN		POST		
Nicosulfuron	.50	POST	76.7 b-e	88.3 abc
X-77		POST		
Nicosulfuron	.50	POST	78.3 a-e	90.0 abc
X-77		POST		
28% NITROGEN		POST		
Nicosulfuron	.50	POST	83.3 abc	94.0 ab
SCOIL		POST		
Nicosulfuron	.75	POST	76.7 b-e	94.0 ab
X-77		POST		
Nicosulfuron	.75	POST	86.7 ab	93.3 ab
X-77		POST		
28% NITROGEN		POST		
Nicosulfuron	.75	POST	85.0 ab	96.3 a
COC		POST		
Nicosulfuron	.75	POST	86.7 ab	96.3 a
SCOIL		POST		

Table 2.

WILD PROSO MILLET CONTROL WITH NICOSULFURON -LaSalle Site

Treatment	Rate	Application Timing	PANMI CONTROL % 7DAT	PANMI CONTROL % 21 DAT	PANMI CONTROL % 37 DAT	PANMI CONTROL % 58 DAT
UNTREATED CK			0.0 d	0.0 g	0.0 e	0.0 e
Nicosulfuron X-77	.5	oz ai/A EP	57.5 c	90.0 ab	87.5 a	88.8 a
Nicosulfuron X-77 28 % NITROGEN	.5 .25 4	oz ai/A EP % v/v % v/v	61.3 b	98.3 a	91.3 a	85.0 a
Nicosulfuron PRIME OIL	.5 1	oz ai/A EP % v/v	65.0 ab	96.0 ab	88.8 a	90.0 a
Nicosulfuron PRIME OIL 28 % NITROGEN	.5 1 4	oz ai/A EP % v/v % v/v	63.8 ab	93.5 ab	86.3 a	88.8 a
Nicosulfuron SCOIL	.5 1	oz ai/A EP % v/v	65.0 ab	93.8 ab	90.0 a	86.3 a
Nicosulfuron PRIME OIL 28 % NITROGEN	.75 1 4	oz ai/A EP % v/v % v/v	66.3 a	93.8 ab	87.5 a	88.8 a
Nicosulfuron PRIME OIL 28 % NITROGEN	1 1 4	oz ai/A EP % v/v % v/v	66.3 a	96.0 ab	86.3 a	86.3 a
Nicosulfuron PRIME OIL 28 % NITROGEN	.5 1 4	oz ai/A POST % v/v % v/v	0.0 d	47.5 c	53.8 bc	62.5 bc
Nicosulfuron PRIME OIL 28 % NITROGEN	.75 1 4	oz ai/A POST % v/v % v/v	0.0 d	30.0 def	43.8 cd	51.3 cd
Nicosulfuron PRIME OIL 28 % NITROGEN	1 1 4	oz ai/A POST % v/v % v/v	0.0 d	27.5 ef	45.0 cd	46.3 cd
Nicosulfuron Nicosulfuron PRIME OIL 28 % NITROGEN	.5 .5 1 4	oz ai/A EP oz ai/A POST % v/v % v/v	57.5 c	82.5 b	78.8 a	77.5 ab
Nicosulfuron X-77	.5 .25	oz ai/A POST % v/v	0.0 d	42.5 cd	42.5 cd	43.8 d
Nicosulfuron X-77 28 % NITROGEN	.5 .25 4	oz ai/A POST % v/v % v/v	0.0 d	47.5 c	46.3 cd	48.8 cd
Nicosulfuron PRIME OIL	.5 1	oz ai/A POST % v/v	0.0 d	37.5 cde	36.3 d	43.8 d
Nicosulfuron SCOIL	.5 1	oz ai/A POST % v/v	0.0 d	35.0 cde	48.8 cd	46.3 cd
Nicosulfuron X-77	.75 .25	oz ai/A POST % v/v	0.0 d	40.0 cde	40.0 cd	45.0 d
Nicosulfuron X-77 28 % NITROGEN	.75 .25 4	oz ai/A POST % v/v % v/v	0.0 d	45.0 c	43.8 cd	40.0 d
Nicosulfuron PRIME OIL	.75 1	oz ai/A POST % v/v	0.0 d	20.0 f	36.3 d	42.5 d
Nicosulfuron SCOIL	.75 1	oz ai/A POST % v/v	0.0 d	42.5 cd	63.8 b	51.3 cd

Preplant incorporated nightshade control in cotton. Vargas, Ron. A fine sandy loam field, known to be infested with hairy nightshade (Solanum sarrachoides Sendter) was divided into plots 20 ft. by 40 ft., with buffer zones between plots and replicated four times in a randomized complete block design. The herbicides were applied on February 23, 1990 with a CO_2 plot sprayer calibrated at 30 psi delivering 20 gallons per acre. One day after application, the herbicides were incorporated with an offset disc. The field was listed, preirrigated and planted to GC-356 cotton on April 5, 1990.

An evaluation of nightshade control indicated 97 percent control with both the 0.7 and 1 lb. ai/A rate of Mon - 13202, with the trifluralin + prometryn tank mix providing 92 percent control. Trifluralin by itself and diuron exhibited 57 and 62 percent control. Yield data indicated no significant difference in seed cotton between treatments, although lowest yields were found with Mon - 13202 at the 1 lb. ai/A rate and diuron at the 1.5 lb. ai/A rate.

Hairy Nightshade Control

Herbicide	Rate lb. ai/A	% Hairy Nightshade Control 5/23	Yield - 9/29 lbs. Seed Cotton
trifluralin	0.75	57	3775
trifluralin + prometryn	0.75 + 2	92	3575
Mon - 13202	0.5	92	3425
Mon - 13202	0.7	97	3575
Mon - 13202	1	97	3250
diuron	1.5	62	3250
control	-	0	3575

Postemergence hairy nightshade control in cotton. Vargas, Ron. A uniform stand of GC-356 cotton infested with hairy nightshade was divided into plots 15 feet by two 38 in. rows and replicated three times in a randomized complete design. DPX-PE350 was applied early post-emergence (EP) over the top of cotyledonary cotton when the hairy nightshade was in the two to four leaf stage. A sequential late postemergence (LP) over the top application was applied when the cotton was nine to ten inches tall and the nightshade 12 to 16 in. tall and flowering. All treatments were applied with a CO_2 plot sprayer calibrated at 30 psi delivering 20 gallons per acre. All treatment contained 0.25% V/V X-77.

There was a direct relationship with increasing rates of DPX-PE350 and increasing nightshade control. The single early postemergence applications of 0.25 and 0.50 oz ai/A exhibited unacceptable control at both 50 and 100 DAT. The single 1 oz ai/A rate exhibited fair control at 50 DAT but was unacceptable at 56 percent control 100 DAT. The 2 oz ai/A single rate provided acceptable control at both 50 and 100 DAT.

Sequential postemergence applications increased control, except the 0.25 oz ai/A application. Sequential applications of 0.25 and 0.50 oz ai/A provided poor control. The 1 oz ai/A sequential application provided 90 percent control of hairy nightshade 100 DAT. Best control was obtained with the 2 oz ai/A sequential application with hairy nightshade being completely controlled 100 DAT.

Cotton phytotoxicity and injury symptoms were insignificant. All treatments exhibited slight interveinal yellowing and leaf crinkling when evaluated seven days after the EP application. Injury symptoms were non-existent 50 DAT. Cotton plant map data indicated no effect to plant height or vigor.

Hairy Nightshade Control

Herbicide	Timing	Rate oz. ai/A	Percent Control	
			50DAT	100DAT
DPX-PE350	EP	0.25	56	0
DPX-PE350	EP	0.50	56	0
DPX-PE350	EP	1.0	76	56
DPX-PE350	EP	2.0	90	80
DPX-PE350	EP + LP	0.25	50	40
DPX-PE350	EP + LP	0.50	56	63
DPX-PE350	EP + LP	1.0	76	90
DPX-PE350	EP + LP	2.0	90	100
Control		-	0	0

EP - early postemergence
LP - late postemergence

Johnsongrass control in cotton. Vargas, Ron. An uniform stand of GC-356 cotton infested with johnsongrass was divided into plots 25 ft by four 38 in. rows and replicated three times in a randomized complete block design. The selective grass herbicides were applied on July 16, 1991 with a CO_2 plot sprayer calibrated at 28 psi delivering 20 gallons per acre. All treatments contained a surfactant at one quart per acre. At the time of application the cotton was 16 to 20 inches tall and the johnsongrass 48 to 50 inches tall with seedheads. The johnsongrass was growing vigorously due to crop irrigation.

An evaluation on August 8, 1991, 14 DAT, indicated poor to fair control with all herbicides. Clethodim at the 0.50 lb ai/A rate was providing 73 percent control. Control with both fluazifop-P and sethoxydim was poor at the lower rates with fluazifop-P at the 0.375 lb ai/A rate providing 70 percent control. At 21 DAT enhanced control of johnsongrass was noted will all rates of clethodim whereas control with fluazifop-P and sethoxydim was still poor. 35 DAT, clethodim was providing 80 to 83 percent control. Fluazifop-P was providing 46 to 66 percent control and sethoxydim 23 to 60 percent control, both unacceptable.

Johnsongrass Control in Cotton

Herbicide	Rate lb ai/A	Percent Control 14DAT	21DAT	35DAT
clethodim	0.125	60	63	80
clethodim	0.25	70	76	80
clethodim	0.50	73	76	83
fluazifop-P	0.125	43	33	46
fluazifop-P	0.25	40	43	60
fluazifop-P	.0375	70	66	66
sethoxydim	0.125	30	20	23
sethoxydim	0.25	40	36	36
sethoxydim	0.468	66	50	60
control	-	0	0	0

Layby tall morningglory control in cotton. Wright, S.D. The objective of this study was to evaluate several herbicides at varying rates, herbicide combinations, and combinations with liquid nitrogen UN-32, for control of annual morningglory as a layby treatment in cotton.

Research plots were established on July 27, 1991 near Visalia, California. The experimental design was a randomized complete block with three replications. Individual plots were 6.5 by 25 ft in size. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 20 gal/a at 28 psi. Tall morningglory was moderate throughout the experimental area (5-15 plants/plot area) and was 1 to 2 inches tall. Cotton was 32 inches tall with 17 main-stem nodes.

All treatments gave good control of annual morningglory at 6 days after application. By 5 weeks after application all treatments gave excellent weed control. Adding UN-32 to herbicides enhanced weed control slightly. The .5 lb rate of oxyfluorfen gave greater control on tall morningglory than the .25 lb rate. Differences between other treatments were mostly insignificant.

All treatments showed some cotton injury to the bottom leaves when evaluated on August 2. Symptoms were difficult to accurately assess after this with cotton going into cutout. For most treatments there was only a slight difference between the untreated control on cotton injury.

(Univ. of Calif. Cooperative Extension, County Civic Center, Visalia, CA 93291-4584)

Table 1. Tall morningglory control and cotton injury

Treatment	Rate (lbs ai/ac)	------ 8/2 ------ T. morning-glory	Cotton	------ 8/9 ------ T. morning-glory	Cotton	------ 8/28 ------ T. morning-glory	Cotton
1 oxyfluorfen	.25	6.23	2.00	7.08	1.00	8.04	0.00
2 oxyfluorfen	.50	8.83	3.17	8.67	0.33	9.67	1.00
3 cyanazine	1.00	8.67	2.33	8.00	0.67	10.00	0.00
4 oxyfluorfen + cyanazine	.25 + .60	9.00	3.33	9.00	1.33	9.33	0.00
5 prometryn	.65	6.33	2.17	8.00	0.00	10.00	0.67
6 prometryn + oxyfluorfen	.65 + .25	7.17	2.67	8.67	1.33	9.67	1.00
7 oxyfluorfen + UN-32 (3 gal)	.25	9.00	2.33	7.67	1.33	10.00	0.00
8 oxyfluorfen + UN-32 (6 gal)	.25	8.33	3.00	8.67	1.33	8.33	0.00
9 prometryn + UN-32 (3 gal)	.65	7.00	2.00	8.67	0.33	10.00	0.00
10 prometryn + UN-32 (6 gal)	.65	8.67	2.67	8.67	0.33	8.67	0.00
11 cyanazine + UN-32 (3 gal)	1.00	8.83	2.00	7.67	0.67	8.67	0.00
12 cyanazine + UN-32 (6 gal)	1.00	8.83	2.33	9.00	0.00	10.00	0.00
13 lactofen	.2	9.17	2.67	8.33	1.67	10.00	0.00
14 HOE-39866	.5	9.00	3.50	8.33	0.33	9.33	1.00
15 DPX-PE350	.5 oz ai	7.67	1.33	8.00	0.00	10.00	0.00
16 DPX-PE350	1.0 oz ai	6.67	1.33	8.00	0.67	10.00	0.00
17 Untreated control		0.00	0.00	0.00	0.00	0.00	1.00
LSD .05		1.82	1.16	1.53	1.43	2.03	NS
CV %		14.36	28.8	11.82	129.0	13.70	319.0

.25% v/v AG-98 included with all treatments.

Scale: 0-10 (0 = no control or injury; 10 = dead).

Grass tolerance to imazethapyr. M.A. Ferrell, D.W. Koch, P.J. Ogg and F. Hruby. Imazethapyr was applied postemergence at the Research and Extension Center, Archer, Wyoming to evaluate grass tolerance and weed control. Plots were established without irrigation and were 10 by 30 ft. with four replications arranged in a randomized complete block. Perennial grasses were seeded, without tillage, with a no-till drill, in a loam soil (54% sand, 23% silt, 23% clay) with 1.4% organic matter and pH 7.2 March 6 and 7, 1991. Seeded grasses were wheatgrass, crested (Hycrest); wheatgrass, intermediate (Oahe); fescue, tall (Fawn); bluegrass, big (Sherman); wildrye, Russian (Bozoisky); and bromegrass, smooth (Manchar).

Imazethapyr with or without liquid nitrogen was applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi June 25, 1991 (air temp. 82 F, soil temp. 0 inch 110 F, 1 inch 97 F, 2 inch 90 F, 4 inch 78 F, relative humidity 27%, wind south at 3 mph, sky clear) to 2.5 to 5 leaf grasses with 1 to 2 tillers. Visual grass stand ratings, visual weed control ratings, and visual grass injury ratings were made September 3, 1991. Prostrate knotweed and kochia infestations were heavy throughout the experimental area.

Imazethapyr did not reduce grass stands and there were no visible signs of injury when applied to 2.5 to 5 leaf grasses. Grass stands were better in treated versus untreated plots. Oahe (72%) had very good establishment, followed by Manchar (65%). Fawn (50%) and Hycrest (47%) had equal stands with moderate establishment and Sherman (18%) and Bozoisky (8%) had poor establishment. Prostrate knotweed control was excellent for all rates of imazethapyr. Kochia control was between 75 and 79% for all treatments. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1644.)

Grass tolerance to imazethapyr

Treatment[1]	Rate	Perennial grass cultivar[2]						Average of all grasses	Weed species	
		Hycrest	Oahe	Fawn	Sherman	Bozoisky	Manchar		Knotweed, prostrate	kochia
	(oz ai/a)	(percent grass stand)[3]							(percent control)[3]	
imazethypyr + X-77[4]	1	51	75	53	16	8	65	44	97	75
imazethypyr + N + X-77[4]	1	45	71	55	21	5	64	44	97	78
imazethypyr + X-77[4]	2	50	75	53	23	11	65	46	96	76
imazethypyr + N + X-77[4]	2	48	74	47	21	8	67	44	97	79
check		43	63	40	8	5	65	37	0	0
LSD 0.05		NS	NS	NS	NS	NS	NS	4	2	2
CV		16	16	16	16	16	16	16	2	3

[1]Treatments applied June 6, 1991.
[2]Wheatgrass, crested (Hycrest); wheatgrass, intermediate (Oahe); fescue, tall (Fawn); bluegrass, big (Sherman); wildrye, Russian (Bozoisky); and bromegrass, smooth (Manchar). Grasses seeded March 6 and 7, 1991.
[3]Evaluations made September 3, 1991.
[4]Surfactant (X-77) added at 0.25% v/v. N = liquid nitrogen (28-0-0) added at 1 quart per acre.

Weed control in small-seeded red lentils. Ball, D. A. A study was established at the Columbia Basin Ag. Research Center, Pendleton to evaluate postplant incorporated (POPI) and preemergence (PRE) herbicides on weed control in red lentils. All POPI and PRE applications were made on April 2, 1991 with a hand held CO_2 sprayer delivering 15 gpa at 30 psi. POST treatments were made on May 29 with the same hand held sprayer. POPI treatments were incorporated with a flex-tine harrow, 2 passes at 1.5 inch depth. Red Lentil, var. "Crimson", planted April 2, 1991 at 10 seeds/ft^2 in 12 inch rows with a double disk drill set for 2.5 inch seeding depth. PRE treatments were applied immediately after incorporation and planting. All POST treatments received R-11 at 0.125% v/v. Plots were 10 ft by 30 ft, in an RCB arrangement, with 3 replications.

POPI and PRE Application details:	Date: April 2, 1991
Air temp: 60F	Sky: cloudy, showery
Wind: W @ 5-10 MPH	Soil temp (surface): 54F
Relative humidity: 46%	Soil moisture: good 0 to 12 inches
Organic Matter: 1.9%	Soil pH:
Soil type: Walla Walla silt loam	

POST Application details:	Date May 29, 1991
Air temp: 71F	Sky: cloudy
Wind: N @ 2 MPH	Soil temp (surface): 96F
Relative humidity: 42%	Soil moisture: good to 0 to 12 inches
Crop growth Stage: 8 node (6 inch height)	
Weed growth Stage: Heavy infestation of cutleaf nightshade (SOLTR) 2 inch dia. rosettes	

Percent stand reduction, and percent visual cutleaf nightshade control were evaluated on June 11. Yield of lentils (lb/A) were obtained July 25 (see table). POPI and PRE applications of UBI-C4243 provided excellent cutleaf nightshade control, but caused unacceptable stand reductions. No other treatment alone provided exceptional cutleaf nightshade control, but imazethapyr plus ethalfluralin applied POPI provided very good control with negligible stand reduction. (Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, OR 97801).

Weed control in small-seeded red lentils.

Treatment	(lb.a.i./A) Rate	--(11 June)-- % Std Red.	% control SOLTR	(lb/A) Yield
POPI				
imazethapyr	0.031	0	68	1594
imazethapyr	0.047	0	75	1760
ethalfluralin	0.75	3	56	1351
pendimethalin	0.75	3	20	1064
metribuzin	0.25	5	0	1090
ethalfluralin + imazethapyr	0.56 + 0.031	5	80	1439
ethalfluralin + metribuzin	0.56 + 0.25	10	43	1048
pendimethalin + metribuzin	0.5 + 0.25	10	20	765
imazethapyr + metribuzin	0.031 + 0.25	6	70	1225
UBI-C4243	0.12	20	91	884
PRE				
imazethapyr	0.031	0	56	1752
metribuzin	0.25	0	3	1145
imazethapyr + metribuzin	0.031 + 0.25	0	53	1531
UBI-C4243	0.12	2	99	1528
POPI/POST[1]				
imazethapyr/imazethapyr	0.031/0.031	5	71	1358
ethalfluralin/imazethapyr	0.56/0.031	5	63	1180
metribuzin/metribuzin	0.25/0.19	10	0	904
untreated check	-	0	0	1260
LSD (0.05)				334

[1] Post treatments received R-11 @ 0.125% v/v.

Broadleaf weed control in lentils. Boerboom, C.M. Several herbicides were evaluated for broadleaf weed control and lentil tolerance to identify potential new herbicides for lentils at a site near Oaksdale, WA.

On April 15, 1991, 'Brewer' lentils were seeded at 80 lb/a by the cooperating farmer. The experimental design was a randomized complete block with four replications; plots measured 10 by 30 ft. Triallate was applied preplant incorporated (PPI) to the entire trial for wild oat control. Other PPI herbicides were tank mixed with triallate as required. PPI and postplant incorporated (PoPI) treatments were incorporated twice with a spring-tine harrow. Lentils were 3 to 4 in. tall, common lambsquarters (CHEAL) were 1 to 2 in. tall, and wild mustard was 1 to 4 in. in diameter when postemergence applications were made.

The split application of metribuzin, pendimethalin applied preemergence, ethalfluralin, and preemergence applications of cyanazine gave good common lambsquarters control. All herbicides except pendimethalin and ethalfluralin controlled wild mustard (SINAR). Only preemergence applications of cyanazine gave excellent control of mayweed chamomile (ANTCO). None of the herbicides caused excessive lentil injury and yield differences reflect differences in weed control. (Department of Crop and Soil Sciences, Washington State Univ., Pullman, WA 99164).

Table 1. Application data

Date	April 4, 1991	April 4, 1991	May 26, 1991
Application	PPI	PRE, PoPI	POST
Air temperature (F)	53	46	59
Soil temperature (F)	47	44	63
Relative humidity (%)	50	67	52
Wind direction/speed	E/5	SW/8	W/0-2
Volume (gpa)	10	10	10

Soil pH	5.6
OM (%)	3.1
CEC (meq/100g soil)	20.5
Texture	silt loam

Table 2. Broadleaf weed conrtol in lentils

			Control[1]			Lentil		
Treatment	Rate	Time	CHEAL	SINAR	ANTCO	Inj.[2]	Stand[3]	Yield
	(lb ai/a)		(%)					(lb/a)
check	-	-	0	0	0	0	100	1406
metribuzin	0.25	PRE	84	83	76	0	86	1817
metribuzin metribuzin	0.19 0.19	PRE POST	96	97	51	6	107	2115

Table 2. continued

Treatment	Rate	Time	Control[1] CHEAL	SINAR	ANTCO	Lentil Inj.[2]	Stand[3]	Yield
	(lb ai/a)		--------------		(%)		-------------	(lb/a)
imazethapyr	0.047	PPI	84	91	21	0	93	1930
imazethapyr	0.047	PoPI	60	73	6	0	107	1728
imazethapyr	0.047	PRE	50	72	9	0	121	1852
imazethapyr metribuzin	0.047 0.25	PRE PRE	79	90	70	0	118	2002
pendimethalin	0.75	PPI	73	23	18	11	75	1142
pendimethalin	0.75	PRE	99	57	4	0	100	1557
ethalfluralin	0.75	PPI	93	18	0	0	89	1152
pendimethalin metribuzin	0.75 0.25	PRE PRE	99	70	71	0	96	1650
cyanazine	1.0	PRE	69	77	95	0	93	1951
cyanazine	2.0	PRE	86	96	95	0	104	2288
cyanazine	3.0	PRE	94	99	100	0	93	2219
cyanazine	0.5	POST	6	99	23	6	100	1765
cyanazine	1.0	POST	16	100	58	5	111	1714
cyanazine	1.5	POST	0	100	66	10	89	1696
lactofen	0.1	PRE	24	92	68	3	93	1881
lactofen	0.2	PRE	44	98	88	10	107	1845
lactofen	0.25	PRE	55	100	83	10	100	1833
LSD (0.05)			19	16	23	7	n.s.	322

[1]CHEAL (common lambsquarter), SINAR (wild mustard), and ANTCO (mayweed chamomile) control based on plants per plot and expressed as percent of check; counts were made July 31.
[2]Lentil injury was rated visually on July 4.
[3]Lentil stand based on plants per 2 m of row and expressed as percent of check; counts were made July 4.

Evaluation of selected herbicides for use in lentils. Miller, T.W., B.B. Barstow, and R.H. Callihan. The purpose of this experiment was to determine the effectiveness of several herbicides for use in lentils. The primary weed of concern was mayweed chamomile (*Anthemis cotula* L.).

Plots were established on farmer-prepared and seeded fields at 2 sites in north central Idaho (Troy and Grangeville). Plots measured 10 x 30 feet, and treatments were arranged in a randomized complete block design and replicated 4 times at each location. All pre-emergent and post-plant incorporated treatments were applied the same day at each site, with the post-plant incorporated treatments hand-raked into the top 2 inches of the seedbed. All post-emergent applications for a site were made on the same day, after plants were at least at the 4-node stage of growth. Treatments were applied in a carrier volume of 19 gal water/a using a 9-foot boom plot sprayer equipped with flat fan nozzles. Weed control percentage was based on weed density (100% = no weeds), and was estimated to the nearest 5% after mayweed flowering. Crop injury was estimated on a 10-point scale (0 = no injury, 10 = dead). Statistical analysis was performed using an analysis of variance procedure. Means were separated using Fisher's LSD test.

The top treatments were the two rates of cyanazine which resulted in 100% mayweed control and excellent lentil yields. Metolachlor + metribuzin showed good to excellent control of mayweed while treated lentils also yielded well. Metribuzin applied either pre-emergence or as a split application (pre + post) controlled mayweed effectively at Grangeville, although the split application caused early crop injury and reduced lentil yield. At Troy, the pre-emergence metribuzin application alone controlled only 71% of the mayweed compared to 91% control by the split application.

Pre-emergence lactofen treatments caused significant early crop injury and reduction in yield. Pendimethalin + metribuzin provided excellent mayweed control at Grangeville, but poor control in Troy. Although pendimethalin alone did not effectively control mayweed at either site, the 0.5 lb/a rate resulted in the third highest yields. (University of Idaho Cooperative Extension System, Moscow, Idaho 83843)

Mayweed chamomile control in lentils at two locations in northern Idaho (1991).

Herbicide[1]	Rate	Timing[2]	Location[3] TR	Location[3] GR	Crop Injury[4] at GR	Yield at GR	
	(ai or ae/a)		(% control)			(lbs/a)	rank[5]
Cyanazine	1.35 lb	pre	-	100	1	1635	(6)
Cyanazine	0.9 lb	pre	-	100	2	2011	(1)
Metolachlor +	1.64 lbs +						
Metribuzin	0.36 lb	pre	95	100	2	1638	(5)
Metribuzin +	0.25 lb +	pre					
Metribuzin	0.2 lb	post	91	100	5	1176	(13)
Metribuzin	0.25 lb	pre	71	99	1	1599	(7)
Imazethapyr +	0.042 lb +						
Metribuzin	0.2 lb	pre	54	98	5	1651	(4)
Lactofen	0.25 lb	pre	-	98	9	761	(15)
Lactofen	0.125 lb	pre	-	90	8	1477	(9)
Lactofen	0.125 lb	post	63	-	-	-	
Pendimethalin +	0.5 lb +						
Metribuzin	0.2 lb	popi	36	89	1	1739	(2)
Bentazon	0.5 lb	post	-	76	4	1165	(14)
Metolachlor +	1.06 lbs +						
Metribuzin	0.24 lb	pre	94	73	2	1524	(8)
Bentazon	0.25 pt	post	-	69	4	1335	(10)
Pendimethalin	0.5 lb	popi	10	41	1	1702	(3)
Pendimethalin	0.75 lb	popi	23	-	-	-	
Metribuzin	0.2 lb	post	49	34	4	1309	(11)
Imazethapyr	0.042 lb	popi	30	-	-	-	
MCPA	0.38 lb	post	19	-	-	-	
MCPB	0.75 lb	post	9	-	-	-	
Check	-	-	0	0	0	1261	(12)
R2			0.79	0.75	0.75	0.71	
lsd (0.05)			29	29	2	252	
C.V.			43.6	26.5	26.5	23.3	

[1]Pre-plant incorporated applications of 1.3 lbs triallate per acre were used at all plots.
[2]Popi = post-plant incorporated, pre = pre-emergent, and post = post-emergent.
[3]TR = Troy and GR = Grangeville.
[4]Crop injury was measured on 6/19; 0 = no injury, 10 = dead.
[5]Number in parentheses is the yield ranking of the herbicide treatment.

Weed control in white lupine. Ball, D. A. A trial was initiated at the Columbia Basin Ag. Research Center, Sherman Station to evaluate preplant incorporated (PPI), preemergence (PRE) and complimentary postemergence (POST) herbicide treatments for weed control and crop tolerance in spring planted white lupine. White lupine (var. "Ultra") was seeded 2 inches deep with a small plot double disk drill and herbicides applied on March 29, 1991. Preplant herbicides were incorporated twice with a flex tine harrow to a depth of 2.5 inches. POST herbicides were applied to lupine at the 5 node stage (6 inch lupine height) on May 24th.

PPI and PRE Application details:	Date: March 29, 1991
Air temp: 53F	Sky: clear
Wind: W @ 5-10 MPH	Soil temp (surface): 45F
Relative humidity: 54%	Soil moisture: good 1 to 12 inches
Organic Matter: 1.9%	Soil pH:
Soil type: Walla Walla silt loam	

POST Application details:	Date May 24, 1991
Air temp: 71F	Sky: cloudy
Wind: W @ 4-8 MPH	Soil temp (surface): 55F
Relative humidity: 61%	Soil moisture: good at 2 to 12 inches

Crop growth Stage: 8 node (6 inch height)
Weed growth Stage: Cutleaf nightshade densities high, 2 inch dia. rosettes.
Russian thistle densities light, but uniform.
Prostrate knotweed densities moderate , 2 to 4 inches.

Percent visual injury and weed control (0 to 100%) were evaluated on June 24, 1991. Lupine seed was harvested by plot combine on August 16, 1991 (see table). Results indicate that the ethalfluralin plus metolachlor PPI treatment combination provided very good control of prostrate knotweed, Russian thistle, and cutleaf nightshade with no apparent crop injury. UBI-C4243 provided acceptable control applied PPI with no crop injury. Bentazon applied POST produced severe injury to the crop, but MCPB applied POST cause negligible crop injury. (Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, OR 97801).

Weed control and crop tolerance in white lupine

Tmt Compound	(lb.ai or ae/A) Rate	% inj	----% control----- POLAV	SOLTR	SASKR[1]	(lb/A) Yield
PPI						
trifluralin	0.75	0	91	62	100	562
ethalfluralin	0.75	0	94	29	100	596
pendimethalin	0.75	0	90	64	94	467
metolachlor	2.0	0	29	22	7	368
ethalfluralin + metolachlor	0.75 + 2.0	0	100	80	100	632
pendimethalin + metolachlor	0.75 + 2.0	0	92	37	77	578
UBI-C4243	0.12	0	90	74	100	524
PRE						
imazethapyr	0.063	0	12	40	74	395
UBI-C4243	0.12	0	55	39	80	508
PPI/POST[2]						
trifluralin/bentazon	0.75/0.5	39	90	77	89	435
trifluralin/imazethapyr	0.75/0.063	0	90	75	97	656
trifluralin/MCPB[3]	0.75/0.33	0	96	69	100	575
untreated check	-	0	0	0	0	331
LSD (0.05)						131

[1] POLAV - prostrate knotweed, SOLTR - cutleaf nightshade, SASKR - Russian thistle
[2] All POST treatments received R-11 at 0.125% v/v
[3] MCPB was applied as the sodium salt formulation

Evaluation of preemergence herbicides in grain lupine. Mitich, L.W., J.A. Roncoroni, and G.B. Kyser. Four herbicides in 8 treatments were evaluated for crop tolerance and weed control at the UC Davis Farm.

Inoculum was applied to lupine seeds on 5 November 1990. Lupine was planted 6 November. Ten ft by 40 ft plots were arranged in randomized complete blocks. On 8 November, plots were treated with a CO_2 backpack sprayer delivering 20 gal/a at 30 psi through 8002 nozzles. Weather at application was clear and cool (55-65 F, no wind). No weeds were present. The field was sprinkler irrigated 9 November, and the crop was 50% germinated by 23 December.

Visual ratings on 30 April 1991 detected no significant variations in crop vigor between treatments. Ratings were hindered by the fact that, at time of evaluation, much of the weed population was only present as undergrowth.

No treatment produced significant control of volunteer wheat (Triticum aestivum); other grasses, including volunteer oats (AVESA) and yellow foxtail (SETLU), were too sporadic for evaluation. All treatments produced good to excellent control of groundsel (SENVU), minerslettuce (CLAPE), shepherdspurse (CAPBP), and chickweed (STEME). Control of these weeds did not vary significantly between treatments.

Weight of harvested lupine seed did not vary significantly, owing in part to a severe infestation of volunteer wheat, which was unaffected by the treatments. Both crop vigor and seed yield showed significant inverse correlation with wheat stand. (Department of Botany, University of California, Davis, CA 95616)

Evaluation of preemergence herbicides in grain lupine, UC Davis, 1991

Treatment	Rate (lb ai/a)	Visual evaluations, 30 April[1]: crop vigor	wheat percent of stand	weed control: SENVU	CLAPE	CAPBP	STEME	Lupine wt[2] (g)
linuron	1.0	78	25.0	83	95	100	83	5399
linuron	2.0	75	9.2	89	95	99	89	5149
linuron + metolachlor	1.0 2.0	58	3.8	98	83	100	88	6159
pendimethalin + metolachlor	1.0 2.0	63	13.0	95	95	95	100	5173
pendimethalin + linuron	1.0 1.0	73	13.3	88	100	100	83	5881
pendimethalin + cyanazine	1.0 1.0	55	17.5	95	98	100	100	3632
pendimethalin + cyanazine	1.0 2.5	58	15.0	98	100	100	98	5188
pendimethalin + cyanazine	1.0 3.5	70	9.5	100	100	100	100	6235
check	---	68	16.3	53	33	40	13	4087

[1]Average of 4 replications. Ratings are in percentages; 100% = perfect crop vigor, complete weed control.
[2]Average of 4 replications. Weight for 220 f^2 (5.5 ft x 40 ft harvested).

Susceptibility of wild oat accessions to diclofop-methyl. Brewster, B.D., W.S. Donaldson, and A.P. Appleby. Wild oat seeds were collected from fields in western Oregon where diclofop-methyl had failed to provide complete wild oat control. A trial, designed as a randomized complete block with three replications, was conducted to evaluate the susceptibility of the wild oat accessions and 'Cayuse' oats to diclofop-methyl. Each plot consisted of a 10 by 10 cm fiber pot with five plants. The seeds were sown on April 8, 1991, diclofop-methyl treatments were applied April 26, and fresh weights were obtained on May 22.

Diclofop-methyl was applied in a water carrier volume of 234 L/ha through XR 8003 flat fan spray tips at a pressure of 172 kPa. The study was conducted outdoors at the Hyslop research farm near Corvallis.

A GR_{50} was obtained for each accession by linear regression analysis of a portion of the dose-response curve that contained 50 percent reduction in growth compared to the untreated. The GR_{50} values and linear correlation coefficients are included in the data table. The fresh weight means were converted to percent of the check because of considerable growth differences among the accessions. The accessions reported here were collected in Polk, Yamhill, Marion, and Linn Counties. Several other accessions that were tested in this trial were more susceptible to diclofop-methyl than the ones reported here.

All six wild oat accessions reported here required at least 1.0 kg a.i./ha to reduce wild oat fresh weight by 50 percent. The accession from Yamhill County was not reduced in growth 50 percent by the highest rate of diclofop-methyl. 'Cayuse' oats was 10 to at least 80 times more susceptible to diclofop-methyl than were the wild oat accessions. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002)

Fresh weights of six wild oat accessions and 'Cayuse' oats following treatment with diclofop-methyl.

Rate	Polk 1	Polk 2	Polk 3	Yamhill	Marion	Linn	'Cayuse'
(kg a.i./ha)				(% of check)			
0	100 CD	100 E	100 CB	100 C	100 A	100 C	100 D
0.125	112 D	93 E	110 C	93 CB	86 C	88 C	41 C
0.25	96 CD	90 ED	115 C	93 CB	90 CD	87 C	6 C
0.5	83 CB	76 D	100 CB	93 CB	84 C	91 C	5 AB
1.0	73 B	50 C	94 CB	94 CB	83 C	99 C	1 A
2.0	39 A	22 B	81 B	90 CB	65 B	83 C	0 A
4.0	32 A	6 A	29 A	85 B	50 A	54 B	0 A
8.0	25 A	3 A	12 A	70 A	45 A	34 A	0 A
GR_{50} (kg a.i./ha)	2.3	1.2	3.2	>8.0	6.0	5.7	0.12
r =	0.79	0.99	1.0	---	0.87	0.96	0.99

[1]Means within a column followed by the same letter are not different at p = 0.05 according to Duncan's multiple range test.

Preplant incorporated and preemergence herbicide treatments for weed control in green peas for processing. Ball, D. A. A study was established at the Columbia Basin Ag. Research Center, Pendleton to evaluate preplant incorporated (PPI) and preemergence (PRE) herbicides on weed control in green peas for processing. All applications were made on April 3, 1991 with a hand held CO_2 sprayer delivering 15 gpa at 30 psi. PPI treatments were incorporated with a Calkins 4x4, 1 pass at 2.5 inch depth. Peas, var. "Dual", were planted April 3, 1991 at 150 lb/A, 7 inch rows, 2 inch seeding depth. PRE treatments were applied and plots rolled. Plots were 10 ft by 30 ft, in an RCB arrangement, with 3 replications. The soil was a Walla Walla silt loam with pH of 6.7 and 1.9% organic matter. At time of applications the air temperature was 56F, relative humidity 46%, sky cloudy, and wind W at 2 to 5 mph.

Percent crop injury was evaluated on May 9. Percent crop stand reduction compared to control plots, and percent visual cutleaf nightshade (SOLTR) control were evaluated on June 11. Yields (lb/A of dry peas) were obtained July 21 (see table).

Control of cutleaf nightshade was excellent with UBI-C4243 and lactofen applied as PRE treatments. Both materials cause slight early crop injury, but this was not visually evident later in the growing season. Ethalfluralin and trifluralin also caused stand reductions which reduced pea yield. Combinations containing imazethapyr improved control of cutleaf nightshade compared to any material applied alone. (Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, OR 97801).

Preplant incorporated and preemergence herbicide treatments for weed control in green peas for processing

Treatment	(lb ai/A) Rate	% injury	% stand reduct.	% control SOLTR	(lb/A) Yield
PPI					
imazethapyr	0.031	0	0	70	1651
imazethapyr	0.047	0	0	83	1833
trifluralin	0.75	7	6	56	1289
trifluralin + imazethapyr	0.5 + 0.031	0	3	80	1477
ethalfluralin	0.75	7	16	60	1023
ethalfluralin + imazethapyr	0.56 + 0.031	12	10	85	1495
pendimethalin	0.75	1	0	45	1675
pendimethalin + imazethapyr	0.5 + 0.031	0	0	90	2306
imazethapyr + metribuzin	0.031 + 0.25	0	5	86	1836
PRE					
imazethapyr	0.031	0	0	83	1935
imazethapyr	0.047	0	0	86	1767
metolachlor	1.5	0	0	50	1905
metolachlor + imazethapyr	1.5 + 0.031	0	0	81	2029
metribuzin	0.25	0	0	0	1766
metribuzin + imazethapyr	0.25 + 0.031	0	0	55	2109
lactofen	0.05	0	0	90	2084
lactofen	0.10	6	0	99	1960
lactofen	0.20	13	0	100	1875
UBI-C4243	0.09	3	0	98	1906
UBI-C4243	0.12	2	0	99	1861
untreated check	-	0	0	0	1887
LSD (0.05)					445

Postemergence and complimentary herbicide treatments for weed control in green peas for processing. Ball, D. A. A study was established at the Columbia Basin Ag. Research Center, Pendleton to evaluate postemergence (POST) and complimentary preplant incorporated (PPI), preemergence (PRE) and postemergence herbicides on weed control in green peas for processing. All PPI and PRE applications were made on April 3, 1991 with hand held CO_2 sprayer delivering 15 gpa at 30 psi. POST treatments were made on May 15 with the same hand held sprayer. PPI treatments were incorporated with a Calkins 4x4, 1 pass at 2.5 inch depth. Peas, var. "Dual", were planted April 3, 1991 at 150 lb/A, 7 inch rows, and 2 inch seeding depth. PRE treatments were applied and plots rolled. All post treatments received R-11 at 0.25% v/v. Plots were 10 ft by 30 ft, in an RCB arrangement, with 3 replications.

PPI and PRE Application details:	Date: April 3, 1991
Air temp: 56F	Sky: cloudy, showery
Wind: W @ 2-5 MPH	Soil temp (surface): 50F
Relative humidity: 46%	Soil moisture: good 0 to 12 inches
Organic Matter: 1.9%	Soil pH: 6.7
Soil type: Walla Walla silt loam	

POST Application details:	Date May 15, 1991
Air temp: 67F	Sky: clear
Wind: W @ 3-5 MPH	Soil temp (surface): 90F
Relative humidity: 32%	Soil moisture: good 0 to 12 inches
Pea growth Stage: 7 node stage	
Weed growth Stage: Moderate infestation of cutleaf nightshade (SOLTR) 2 inch dia. rosettes	

Percent visual injury, and percent visual nightshade control were evaluated on June 11. Yield of dry peas were obtained July 21, and converted to lb/A dry pea weight (see table). Complimentary PPI, PRE, and POST applications improved control of cutleaf nightshade compared to single application timings. Bentazon, in particular, improved control particularly following PRE treatments of metolachlor or metribuzin. (Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, OR 97801).

Postemergence and complimentary herbicide treatments for weed control in green peas for processing

Treatment	(lb.ai or ae/A) Rate	(6-11-91) % Injury	Control SOLTR[1]	(lb/A) Yield
PPI/POST[2]				
trifluralin	0.75	7	56	1289
trifluralin/MCPA[3]	0.5/0.25	22	70	1360
trifluralin/bentazon	0.5/0.5	2	91	1718
ethalfluralin	0.75	7	60	1023
ethalfluralin/MCPA	0.56/0.25	25	78	1034
ethalfluralin/bentazon	0.56/0.5	12	87	1392
pendimethalin	0.75	1	45	1675
pendimethalin/MCPA	0.5/0.25	7	68	1560
pendimethalin/bentazon	0.5/0.5	0	89	1630
PRE/POST				
metolachlor	1.5	0	50	1905
metolachlor/MCPA	1.5/0.25	17	45	1444
metolachlor/bentazon	1.5/0.5	0	98	2054
imazethapyr	0.031	0	83	1935
imazethapyr/MCPA	0.031/0.25	12	86	1701
imazethapyr/bentazon	0.031/0.5	2	87	2050
metribuzin	0.25	0	0	1766
metribuzin/MCPA	0.25/0.25	15	35	1528
metribuzin/bentazon	0.25/0.5	0	98	1901
POST				
bentazon	0.5	2	70	1900
bentazon	0.75	2	83	1872
MCPA	0.25	17	57	1664
bentazon + MCPA	0.75 + 0.25	8	76	1757
metribuzin	0.25	7	17	1655
metribuzin +bentazon	0.25 + 0.5	10	93	1199
untreated check	-	0	0	2117
LSD (0.05)				435

1 SOLTR - cutleaf nightshade
2 All POST treatments received R-11 at 0.25% v/v
3 MCPA applied as the dimethylamine salt formulation.

Broadleaf weed control in dry peas. Boerboom, C.M. Several herbicides were evaluated for broadleaf weed control and dry pea tolerance in two trials to identify potential new broadleaf herbicides for dry peas. In addition, the trials were established on a toeslope and summit to evaluate the effect of organic matter on herbicide activity.

The trials were located in the same field near Pullman, WA, and seeded with 180 lb/a of 'Columbia' dry peas on April 29, 1991. The experimental design was a randomized complete block with four replications; plots measured 10 by 30 ft. Triallate was applied preplant incorporated (PPI) to both trials for wild oat control. Triallate was not applied when sethoxydim was to be applied postemergence. Other PPI herbicides were tank mixed with triallate as required. PPI and postplant incorporated (PoPI) treatments were incorporated twice with a spring-tine harrow. Postemergence applications were made when the peas had four to five pairs of leaves and common lambsquarters (CHEAL) were 0.5 to 3 in. tall. Common lambsquarters were only present in the toeslope trial at 8 plants/ft^2.

All herbicides controlled the common lambsquarters except the preemergence application of imazethapyr and postemergence applications of cyanazine. UBI-C4243 injured and reduced the stand of peas, but due to the favorable growing conditions, pea yields were only reduced in the summit trial. Lactofen caused early injury and delayed pea emergence, but the peas recovered with slight or no yield loss. In the summit location, metribuzin and the highest preemergence rate of cyanazine also caused significant injury and yield loss. (Department of Crop and Soil Sciences, Washington State Univ., Pullman, WA 99164).

Table 1. Application data

Date	April 4, 1991	May 2, 1991	June 4, 1991
Applications	PPI	PRE, PoPI	POST
Air temperature (F)	67	45	48
Soil temperature (F)	60	-	58
Relative humidity (%)	58	52	55
Wind direction/speed	SW/5	NE/3	N/3-5
Volume (gpa)	10	10	10

	Toeslope	Summit
Soil pH	5.38	5.5
OM (%)	4.77	1.72
CEC (meq/100g soil)	24.8	22.0
Texture	silt loam	silt loam

Table 2. Broadleaf weed control in dry peas

			Toeslope				Summit		
			CHEAL[2]	Pea			Pea		
Treatment	Rate	Application	control	Injury[3]	Stand[4]	Yield	Injury[3]	Stand[4]	Yield
	(lb ai/a)		---------(%)--------			(lb/a)	----(%)----		(lb/a)
check	-	-	0	0	100	2574	0	100	1637
metribuzin	0.25	PRE	96	14	106	2685	26	87	1276
metribuzin metribuzin	0.19 0.19	PRE POST	100	18	114	2942	59	73	1106
UBI-C4243	0.063	PRE	100	39	58	2719	68	49	1238
UBI-C4243 sethoxydim COC[1]	0.063 0.29 2.5	PRE POST POST	100	33	54	2567	66	62	1267
UBI-C4243 sethoxydim COC	0.094 0.29 2.5	PRE POST POST	100	56	58	2650	70	50	1154
imazethapyr	0.047	PPI	92	8	111	2823	0	98	1664
imazethapyr	0.047	PoPI	91	13	82	2773	5	88	1559
imazethapyr	0.047	PRE	68	13	85	2736	0	97	1708
imazethapyr metribuzin	0.047 0.25	PRE PRE	99	11	122	2819	33	81	1446
pendimethalin	0.75	PPI	87	10	94	2647	21	79	1622
pendimethalin	0.75	PRE	100	6	93	2844	5	81	1552

Table 2. continued

Treatment	Rate	Application	Toeslope CHEAL[2] control	Toeslope Pea Injury[3]	Toeslope Pea Stand[4]	Toeslope Yield	Summit Pea Injury[3]	Summit Pea Stand[4]	Summit Yield
	(lb ai/a)		(%)	(%)	(%)	(lb/a)	(%)	(%)	(lb/a)
ethalfluralin	0.75	PPI	94	10	116	2886	18	92	1509
pendimethalin metribuzin	0.75 0.25	PRE PRE	100	15	111	2754	38	78	1465
cyanazine	1.0	PRE	97	8	109	2799	0	79	1580
cyanazine	2.0	PRE	100	13	101	2854	15	83	1471
cyanazine	3.0	PRE	100	15	79	2699	41	57	1303
cyanazine	0.5	POST	17	0	99	2411	5	100	1602
cyanazine	1.0	POST	37	4	90	2742	0	88	1484
cyanazine	1.5	POST	51	9	113	2736	3	92	1512
lactofen	0.1	PRE	98	14	99	3053	11	98	1512
lactofen	0.2	PRE	98	23	84	2700	21	91	1479
lactofen	0.25	PRE	99	37	79	2550	30	79	1444
LSD (0.05)			12	10	33	287	20	25	246

[1]COC (crop oil concentrate) was Mor-act; rate is expressed as % v/v.
[2]CHEAL (common lambsquarters) control was based on plants per plot and expressed as percent of check; counts were made July 30.
[3]Pea injury was visually rated on July 1.
[4]Pea stand was based on plants per 2 ft^2 expressed as percent of check; counts were made July 1.

Simulated thifensulfuron-tribenuron drift injury to spring peas. Mallory-Smith, C.A. and D.C. Thill. Injury to spring peas from off-target movement of thifensulfuron-tribenuron (DPX-R9674) has been reported at several sites in the Pacific Northwest within the last 4 years. This problem is of particular concern because the herbicide is often applied to cereal grains in the early spring when peas are emerging. Therefore, greenhouse and field experiments were conducted to determine the herbicide rates at which injury symptoms would appear and seed yield loss would result.

Two pea varieties, 'Columbian' and 'Green Giant 274', were used in the experiments. The greenhouse experiment was designed as a randomized complete block with four replications. The experiment was repeated. Pea seeds were planted in 440-ml styrofoam cups in the greenhouse. Treatments were applied with a custom built greenhouse sprayer calibrated to deliver 140 L/ha at 275 kPa. Peas were treated in the 5 to 6 node stage. Symptoms were evaluated visually (data not shown). Pea herbage biomass was harvested 2 weeks after treatment, dried, and weighed.

The field experiment was designed as a split split plot with four replications. Pea varieties were the main plots with application dates randomized within variety, and herbicide treatments randomized within application dates. Plots were 3 by 6 m. Pea seeds were planted at 200 kg/ha on May 16. Metribuzin at 0.3 kg ai/ha was applied on May 16 immediately after seeding. Treatments were applied with a CO_2 pressurized, half step log sprayer calibrated to deliver 93 L/ha at 275 kPa and 5 km/h (Table 1). Symptoms were evaluated visually (data not shown). Herbage biomass was sampled on July 10. Plants were harvested from 1 m of row, counted, dried, and weighed. Pea seed was harvested on August 16.

Table 1. Field application data

Treatment date	June 8	June 13	June 19
Pea growth stage (nodes)	4 to 5	5 to 6	6 to 7
Air temperature (C)	18	1	13
Soil temperature at 5 cm (C)	21	26	13
RH (%)	76	82	76
Wind (km/h-direction)	0 to 10 N	calm	3 to 8 E

Greenhouse pea biomass means were averaged over experiments because there was no experimental interaction. Peas treated with 0.068 g ai/ha or higher rates of DPX-R9674 produced less biomass per plant than the untreated control plants (Table 2). Chlorosis appeared on the new growth of the treated peas 2 to 3 days after treatment. Plants sprayed with 1.095 g/ha and higher rates were stunted, chlorotic, and had deformed new growth. Peas produced secondary branches when treated with all but the 17.52 g/ha rate. Branches per plant were greatest with the 0.548, 1.095, and 2.19 g/ha treatments (data not shown).

Field experiment means were averaged over treatment dates because there was no interaction of treatment date and variety. 'Columbian' pea biomass per plant from the 0.034, 0.068, and 0.137 g/ha treatments was not different from the untreated control (Table 2). 'Green Giant' peas treated with 0.548 g/ha and higher rates produced less biomass per plant than the untreated control plants. 'Columbian' peas treated with 0.137 g/ha and higher rates yielded less seed than the untreated control. 'Green Giant' peas treated with 0.274 g/ha and higher rates yielded less seed than the untreated control. The highest seed yields for both varieties was with the 0.034 g/ha treatment, although they were not different from the untreated control. Secondary branch production was similar to peas grown in the greenhouse experiment. The most branches per plant were produced on peas treated with the 1.095 and 2.19 g/ha (data not shown). (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Effect of simulated thifensulfuron-tribenuron drift on pea biomass and seed yield

Treatment[1]	Greenhouse biomass[2]		Field biomass[3]		Seed yield[4]	
	Columbian	Green Giant	Columbian	Green Giant	Columbian	Green Giant
(g ai/ha)	-------(g/plant)-------		-------(g/plant)-------		---------(kg/ha)-------	
control	0.88 a	0.75 cd	2.13 ab	1.56 cde	1142 abc	955 cde
0.034	0.84 ab	0.66 de	2.43 a	1.52 def	1309 a	1154 abc
0.068	0.77 bc	0.62 ef	2.25 ab	1.62 cd	1238 ab	1074 bcd
0.137	0.77 bc	0.54 fg	2.12 ab	1.72 cd	1026 bcd	1052 bcd
0.274	0.66 e	0.48 gh	1.94 bc	1.36 defg	856 de	773 e
0.548	0.66 e	0.42 hi	1.42 defg	1.10 gh	406 f	488 f
1.095	0.54 fg	0.42 hi	1.37 defg	0.71 ij	325 fg	304 fgh
2.190	0.48 gh	0.36 ijk	0.87 hi	0.57 ij	181 gh	185 gh
4.380	0.40 hij	0.31 kl	0.69 ij	0.38 j	110 gh	94 h
8.760	0.35 ijk	0.28 kl	0.87 hi	0.43 j	258 fgh	194 gh
17.520	0.32 jk	0.24 l				

[1] All treatments included a nonionic surfactant at 0.25% v/v. The 17.520 g ai/ha treatment was not used in the field study.
[2] Means sharing the same letter designations are not different at the 5% level based on Fisher's LSD Test.
[3] Means for field biomass sharing the same letter designations are not different at the 5% level based on the Least Squares Means Test.
[4] Means for seed yield sharing the same letter designations are not different at the 5% level based on the Least Squares Means Test.

Evaluation of selected herbicides for use in chickpeas. Miller, T.W. and R.H. Callihan. The purpose of this experiment was to determine the effectiveness of several herbicides for use in chickpeas by evaluating crop yield and weed control. The primary weed of concern was mayweed chamomile (*Anthemis cotula* L.).

Plots were established on a farmer-prepared and seeded field at Culdesac, Idaho. Plots measured 10 x 30 feet, and treatments were arranged in a randomized complete block design and replicated 4 times. Pre-emergent and post-plant incorporated treatments were applied May 14, with the post-plant incorporated treatments hand-raked into the top 2 inches of the seedbed. Post-emergent applications were made on June 6, after plants were at least at the 4-node stage of growth. All treatments were applied in a carrier volume of 19 gal water/a using a 9-foot boom plot sprayer equipped with flat fan nozzles. Weed control percentage was based on weed density (100% = no weeds), and was estimated to the nearest 5% after mayweed flowering. Plots were harvested at maturity and the crop seed was cleaned and weighed. Statistical analysis was performed using analysis of variance procedure. Means were separated using Fisher's LSD test.

The cyanazine treatments both resulted in excellent mayweed chamomile control and high chickpea yields. Lactofen applied pre-emergence also gave excellent weed control and good chickpea yields. Post-emergence lactofen, however, significantly reduced chickpea yield. Metolachlor + metribuzin at either rate (1.64 + 0.36 and 1.09 + 0.24 lbs/a) effectively controlled mayweed chamomile (100 and 96%, respectively), although chickpeas treated at the lower rate showed reduced yield. Metribuzin applied pre-emergence showed excellent mayweed chamomile control, but all metribuzin treatments resulted in lower chickpea yields. Chickpeas were particularly susceptible to post-emergence metribuzin treatments.

Pendimethalin alone or with metribuzin resulted in good chickpea yield, but mayweed control ranged from good to poor (85% from pendimethalin + metribuzin, 75% for 1 lb pendimethalin/a, and 39% for 0.5 lb pendimethalin/a). Imazethapyr alone or with metribuzin, and bentazon at 0.5 lb/a showed good to excellent weed control (80, 97, and 100%, respectively) and good chickpea yield. Neither MCPA nor MCPB showed promise as a chickpea herbicide as they did not control mayweed and caused substantial crop injury. (University of Idaho Cooperative Extension System, Moscow, Idaho 83843)

Mayweed chamomile control and yield of chickpeas at Culdesac, Idaho (1991).

Herbicide	Rate	Timing[1]	Control	Yield	
	(ai or ae/a)		(%)	(lbs/a)	(rank[2])
Cyanazine	1.35 lbs	pre	100	1642	(2)
Cyanazine	0.9 lbs	pre	100	1624	(3)
Lactofen	0.25 lb	pre	100	1442	(6)
Metolachlor +	1.64 lbs +				
Metribuzin	0.36 lbs	pre	100	1427	(7)
Bentazon	0.5 lb	post	100	1406	(8)
Metribuzin	0.25 lb	pre	100	1137	(12)
Metribuzin +	0.25 lb +	pre			
Metribuzin	0.2 lb	post	100	921	(14)
Imazethapyr +	0.047 lb +				
Metribuzin	0.2 lb	pre	97	1331	(9)
Metolachlor +	1.09 lbs +				
Metribuzin	0.24 lbs	pre	96	1056	(13)
Lactofen	0.125 lb	pre	95	1455	(5)
Lactofen	0.125 lb	post	89	601	(15)
Pendimethalin +	1 lb +				
Metribuzin	0.2 lb	popi	85	1606	(4)
Imazethapyr	0.047 lb	popi	80	1285	(11)
Pendimethalin	1 lb	popi	75	1294	(10)
Pendimethalin	0.5 lb	popi	39	1670	(1)
Metribuzin	0.2 lb	post	24	524	(17)
Check	-	-	0	534	(16)
Check	-	-	0	410	(18)
MCPB	1 lb	post	0	354	(19)
MCPA	0.38 lb	post	0	306	(20)
R2			0.90	0.46	
lsd (0.05)			14	489	
c.v.			12.5	11.1	

[1]Popi = post-plant incorporated, pre = pre-emergent, and post = post-emergent.
[2]Number in parentheses is the yield ranking of the herbicide treatment.

Evaluation of selected herbicides for use in dry peas. Miller, T.W., B.B. Barstow, and R.H. Callihan. The purpose of this experiment was to determine the effectiveness of several herbicides for use in dry peas. The primary weed of concern was mayweed chamomile (Anthemis cotula L.), a late-season competitor.

Plots were established on farmer-prepared and seeded fields at 3 locations in north central Idaho. Plots measured 10 x 30 feet, and treatments were arranged in a randomized complete block design and replicated 4 times at each location. Pre-emergent and post-plant incorporated treatments were applied the same day at each site, with the post-plant incorporated treatments hand-raked into the top 2 inches of the seedbed. All post-emergent applications for a site were made on the same day, after plants were at least at the 4-node stage of growth. Treatments were made in a carrier volume of 19 gal water/a using a 9-foot boom plot sprayer equipped with flat fan nozzles. Weed control percentage was based on weed density (100% = no weeds), and was estimated to the nearest 5% after mayweed flowering. Plots at one location were harvested at maturity and the seed was cleaned and weighed. Statistical analysis was performed using an analysis of variance procedure. Means were separated using Fisher's LSD test.

Plots were at Nezperce and Moscow, Idaho (20, 24, and 23 treatments, respectively). Mayweed chamomile populations at the Culdesac and Moscow sites were not widespread enough to accurately measure control, so only the Nezperce site was evaluated for weed control. The Moscow site was, however, harvested for yield comparisons between herbicide treatments. Mayweed chamomile control results and pea yields are listed in the table.

Both cyanazine treatments controlled 100% of the mayweed, but the 0.9 lb/a treatment resulted in higher pea yield than did the 1.35 lb/a treatment. Metribuzin applied pre-emergence or as a split application controlled mayweed equally well (100%), although the split application may have reduced pea yield. Metolachlor + metribuzin at either rate (1.64 + 0.36 and 1.09 + 0.24 lbs/a) effectively controlled mayweed (100 and 98%, respectively) and treated peas yielded similarly.

The lactofen treatments all appeared to cause crop injury initially, particularly the post emergence treatment (data not shown), although by harvest this injury was not apparent. Both pre-emergence lactofen treatments provided excellent control of mayweed chamomile. Imazethapyr + metribuzin gave excellent mayweed control, but imazethapyr alone gave only fair control.

Bentazon was extensively tested in this study. Excellent mayweed control was obtained at the 0.75 lb/a rate alone or in combination with crop oil. The 0.5 lb/a rate of bentazon with crop oil was slightly more effective than the bentazon used alone at the same rate. In tank mixes with MCPA or MCPB, treatments with higher rates of bentazon more effectively controlled mayweed. Bentazon with added crop oil appeared to be more likely to cause crop injury than bentazon mixed with MCPA or MCPB. (University of Idaho Cooperative Extension System, Moscow, Idaho 83843)

Mayweed chamomile control and yield in dry peas.

Herbicide[1]	Rate	Timing[2]	Control at Nez Perce	Yield at Moscow	
	(ai or ae/a)		(%)	(lbs/a)	rank[3]
Cyanazine	1.35 lbs	pre	100	2949	(17)
Cyanazine	0.9 lbs	pre	100	3463	(1)
Metribuzin +	0.25 lb +	pre			
Metribuzin	0.2 lb	post	100	2899	(19)
Metolachlor +	1.64 lbs +				
Metribuzin	0.36 lbs	pre	100	3080	(15)
Metribuzin	0.25 lb	pre	100	3342	(3)
Lactofen	0.125 lb	pre	100	3244	(10)
Imazethapyr +	0.047 lb +				
Metribuzin	0.2 lb	pre	99	3167	(14)
Metolachlor +	1.09 lbs +				
Metribuzin	0.24 lbs	pre	98	3054	(16)
Lactofen	0.25 lb	pre	97	3296	(5)
Pendimethalin +	1 lb +				
Metribuzin	0.2 lb	popi	94	2935	(18)
Bentazon + COC	0.5 lb + 2 pts	post	93	2717	(22)
Bentazon	0.75 lb	post	92	3244	(9)
Bentazon + COC	0.75 lb + 1 pt	post	91	2784	(20)
Lactofen	0.125 lb	post	89	3234	(11)
Bentazon + MCPB	0.5 lb + 0.5 lb	post	88	3312	(4)
Bentazon + MCPA	0.5 lb + 0.25 lb	post	84	2776	(21)
Bentazon	0.5 lb	post	83	3267	(8)
Imazethapyr	0.047 lb	popi	73	-	
Pendimethalin	1 lb	popi	69	3291	(6)
Bentazon + MCPA	0.25 lb + 0.38 lb	post	63	3287	(7)
Bentazon + MCPB	0.25 lb + 1 lb	post	43	3211	(12)
Pendimethalin	0.5 lb	popi	35	3183	(13)
Metribuzin	0.2 lb	post	31	2709	(23)
Check	-	-	0	3384	(2)
R^2			0.90	0.46	
lsd (0.05)			14	489	
c.v.			12.5	11.1	

[1]Pre-plant incorporated applications of 1 lb triallate/a were used at all plots; Moscow plots also received 0.375 lb ethalfluralin/a.
[2]Popi = post-plant incorporated, pre = pre-emergent, and post = post-emergent.
[3]Number in parentheses is the yield ranking of the herbicide treatment.

Effect of imazamethabenz residual and imazethapyr treatment on spring pea. Thompson, C.R., M.J. Dial, and D.C. Thill. An experiment was established to determine the potential injury to spring pea from soil residual of imazamethabenz applied to winter and spring wheat during the year prior to the spring pea planting. Evaluation of imazethapyr application on spring pea was made also. Imazethapyr, a herbicide for weed control in peas, has the same mechanism of action as imazamethabenz, thus, could enhance pea injury from the imazamethabenz residual. Experiments were established at two locations, a winter wheat site 4 miles west of Potlatch, Idaho and a spring wheat site 5 miles north of Moscow. Two experiments were established in each field. One experiment was located on a non-eroded low area (deep A horizon) and a second experiment was located on an eroded hill top (B horizon exposed). The purpose of these experiments was to determine if within field and between field variation in soil characteristics affect carryover of imazamethabenz. Imazamethabenz and diclofop (check) treatments were applied to winter and spring wheat on April 17, and June 5, 1990, respectively. Refer to the 1990 Idaho Weed Control Report p. 35 for application data.

Winter and spring wheat stubble were plowed in the fall of 1990. Seedbeds at both locations were prepared with several cultivations and packed prior to pea planting. The winter wheat ground was treated with triallate at 1.25 lb ai/a prior to planting pea. The non-eroded flat on the spring wheat location was treated with a post-plant surface application of metribuzin at 0.25 lb ai/a. Green 'B-160' and yellow 'Umatilla' pea were planted on the winter and spring wheat sites, respectively, in late April. Imazethapyr was applied to one half of each plot at 0.047 lb ai/a to fully extended third bifoliate green pea on the winter wheat low and hill top sites on May 23. Coast fiddleneck and palouse tarweed (*Amsinckia* species) and common lambsquarters (CHEAL) were 1 to 2 in. tall. Imazethapyr was not applied at the spring wheat sites. Bentazon at 1.0 lb ai/a and dimethylamine salt of 2,4-DB at 0.03 lb ae/a were applied broadcast at all locations to 8 to 12 in. pea on June 13 for broadleaf weed control. All postemergence treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 40 psi and 3 mph. Plots were 10 by 40 ft. Imazethapyr application and soil analysis data are found in Table 1.

Pea injury was evaluated visually on June 13. Pea and weed shoot biomass were harvested from a 10 ft^2 area in each plot at the winter and spring wheat sites on June 27 and July 8, respectively. Pea biomass was taken when the pea were in full bloom and had very early pod set. Pea grain was harvested with a small plot combine from a 4.5 by 37 ft area at all locations on August 16.

Table 1. Imazethapyr application and soil analysis data

1990 crop	winter wheat		spring wheat	
Site location	low	hill	low	hill
Temperature (F)	59	59	--	--
Soil temperature at 2 in. (F)	50	50	--	--
Relative humidity (%)	68	68	--	--
Wind speed (mph) - direction	0	0	--	--
Soil pH	5.5	5.4	5.8	5.5
OM (%)	3.9	1.6	3.0	3.3
CEC (meq/100g soil)	22.9	23.9	20.2	20.5
Texture	silt loam	silt clay loam	--- silt loam --	

Imazamethabenz at 0.94 lb ai/a applied to spring wheat injured pea planted 10.5 months later (Table 2). Visual injury was first observed on June 13, 1991; however, injury was not evident on July 8 during pea biomass sampling. Pea planted on the eroded hill top tended to show more injury symptoms than pea planted on the low site. Pea on the low site yielded slightly more grain than pea planted on the hill top. No significant yield differences were observed between 1990 herbicide treatments. Pea biomass was similar regardless of herbicide treatment or site. Weed biomass, primarily common lambsquarters, was lowest on the low site because metribuzin had been applied for weed control.

Imazamethabenz applied to winter wheat did not visibly injure pea planted 12 months later (data not shown). The 1990 herbicide treatment did not affect pea grain yield, pea biomass, or weed biomass (Table 3). Pea produced more shoot biomass and grain yield, and weeds produced more biomass on the low non-eroded site compared to pea and weeds grown on the eroded hill top. Imazethapyr at 0.047 lb ai/a reduced weed biomass on the low non-eroded site. Imazethapyr reduced pea height slightly (observation only); however, did not reduce pea biomass or grain yield. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Pea and common lambsquarters response to imazamethabenz soil residual from application of imazamethabenz to spring wheat

		Pea grain yield			Pea shoot biomass		
		Site			Site		
1990 Treatment	Rate	Low	Hill	Mean	Low	Hill	Mean
	lb ai/a		lb/a			lb/a	
diclofop	1.0	3099	2922	3011	2441	2272	2361
imazamethabenz	0.235	2992	2396	2694	2637	3038	2842
imazamethabenz	0.47	3067	2452	2759	2735	2557	2646
imazamethabenz	0.94	3028	2648	2838	2219	3172	2691
Site mean		3047	2605		2504	2762	
$LSD_{(0.05)}$		Site = 340 Trt[1] = 481 Site by Trt = NS			Site = 401 Trt = 561 Site by Trt = NS		

		Visual pea injury			CHEAL biomass		
		Site			Site		
1990 Treatment	Rate	Low	Hill	Mean	Low	Hill	Mean
	lb ai/a		%			lb/a	
diclofop	1.0	0	0	0	9	339	169
imazamethabenz	0.235	0	4	2	27	62	45
imazamethabenz	0.47	0	11	6	9	223	116
imazamethabenz	0.94	20	34	27	9	134	71
Site mean		5	12		9	187	
$LSD_{(0.05)}$		Site = 6 Trt = 9 Site by Trt = NS			Site = 62 Trt = 107 Site by Trt = NS		

[1] 1990 treatment

Table 3. Pea and weed species response to imazethapyr application and imazamethabenz soil residual following application to winter wheat

1990 Treatment	Rate	Imazethapyr rate	Pea grain yield Site Low	Pea grain yield Site Hill	Pea grain yield Mean	Pea shoot biomass Site Low	Pea shoot biomass Site Hill	Pea shoot biomass Mean
	lb ai/a	lb ai/a	------ lb/a		-------	------ lb/a		------
diclofop	1.0	0	1715	640	1178	1337	731	1034
diclofop	1.0	0.047	1986	476	1231	1238	517	882
		mean	1850	558	1204	1292	624	953
imazamethabenz	0.235	0	1574	513	1043	1363	383	873
imazamethabenz	0.235	0.047	2175	509	1342	1684	392	1042
		mean	1875	511	1193	1524	392	953
imazamethabenz	0.47	0	1839	586	1213	1328	534	927
imazamethabenz	0.47	0.047	2173	591	1382	1372	463	918
		mean	2006	588	1298	1345	499	927
imazamethabenz	0.94	0	1810	623	1217	1337	437	882
imazamethabenz	0.94	0.047	2005	578	1291	1443	561	1007
		mean	1908	601	1254	1390	499	944
		Site mean	1910	564		1390	499	
Imazethapyr rate mean			0.047 = 1312			0.047 = 962		
			0.0 = 1163			0.0 = 927		
LSD $_{(0.05)}$			Site = 782 Imazethapyr = 174			Site = 178 Others[1]=NS		
			Site by Imazethapyr = 246			Site by Trt[2] = 205		
			Others = NS					

1990 Treatment	Rate	Imazethapyr rate	*Amsinckia* and CHEAL shoot biomass Site Low	Site Hill	Mean
	lb ai/a	lb ai/a	--------------	lb/a	-------------
diclofop	1.0	0	766	45	401
diclofop	1.0	0.047	392	27	205
		mean	579	36	303
imazamethabenz	0.235	0	998	53	526
imazamethabenz	0.235	0.047	437	9	223
		mean	713	27	374
imazamethabenz	0.47	0	1051	0	526
imazamethabenz	0.47	0.047	339	0	178
		mean	704	0	347
imazamethabenz	0.94	0	1194	0	597
imazamethabenz	0.94	0.047	650	223	437
		mean	918	107	517
		Site mean	731	45	
Imazethapyr rate mean			0.047 = 258		
			0.0 = 517		
LSD $_{(0.05)}$			Site = 526 Imazethapyr = 160 Trt = 258		
			Site by Imazethapyr = 223 Others = NS		

[1] Includes all possible interactions not listed
[2] 1990 treatment

Broadleaf weed control in field potatoes. Arnold, R.N., E.J. Gregory and M.W. Murray. Research plots were established on April 23, 1991 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of Atlantic potatoes and broadleaf weeds to herbicides. The experimental design was a randomized complete block with three replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Atlantic potatoes were planted at 3000 lb/A on April 23, 1991. Preemergence surface treatments were applied on May 15, 1991 after drag-off and immediately incorporated with 0.75 in of sprinkler-applied water. Postemergence treatments were applied with a crop oil concentrate at 0.25% v/v on June 3, 1991. Prostrate pigweed (AMABL) infestations were heavy, redroot pigweed (AMARE) and black nightshade (SOLNI) infestations were moderate, and kochia (KCHSC) and Russian thistle (SASKR) infestations were light throughout the experimental area.

Visual evaluations of crop injury and weed control were made June 19, 1991. All treatments gave good to excellent control of broadleaf weeds. Potato yields were 27 to 244 cwt/A higher in the herbicide treated plots as compared to the check. Metribuzin + metolachlor applied at 3.3 + 0.7 lb ai/A and metribuzin applied at 0.5 lb ai/A gave the highest injury ratings of 58 and 57, respectively. (Agricultural Science Center, New Mexico State University, Farmington, NM 87499)

Weed control evaluations in field potatoes.

Treatment	Rate lb ai/A	Crop[1] Injury	KCHSC	SASKR	AMARE	AMABL	SOLNI	Yield cwt/A
		%						
DPX-E9636	0.015	10	100	97	100	98	98	252
metribuzin	0.25	0	100	100	100	99	98	348
DPX-E9636 + metribuzin	0.015+0.25	15	100	99	99	99	99	217
DPX-E9636 + metribuzin	0.023+0.25	15	100	100	100	100	99	206
DPX-E9636 + metribuzin	0.031+0.25	5	100	100	100	100	99	333
metribuzin + metolachlor	0.36+1.63	2	100	100	100	100	99	398
metribuzin + metolachlor	0.7+3.3	58	100	100	100	100	100	181
trifluralin + metolachlor	0.5+2.0	12	100	90	100	94	99	285
metribuzin	0.5	57	100	100	100	98	98	199
DPX-E9636[2]	0.015	3	100	97	99	100	99	217
DPX-E9636[2]	0.023	5	100	93	100	91	99	348
DPX-E9636[2]	0.031	8	100	87	100	97	100	280
DPX-E9636	0.015	7	98	97	100	100	100	318
DPX-E9636	0.031	12	98	96	100	100	100	316
handweeded check		0	100	100	100	100	100	295
check		0	0	0	0	0	0	154
av weeds/M^2			3	4	10	40	16	

Weed Control[1] spans KCHSC through SOLNI.

1. Based on a visual scale from 0 to 100, where 0 = no control or crop injury and 100 = dead plants.
2. Treatments applied postemergence with a crop oil concentrate at 0.25% v/v.

Control of annual wild barley in perennial ryegrass pasture. **Aldrich-Markham, Susan, and Larry C. Burrill.** Annual wild barley invades pastures starting from areas where the competition from perennial grasses is low, i.e. overgrazed areas, dry knolls, livestock trails and camping spots, etc. Once established, it spreads by seed into good pasture areas. Unlike most other annual grass weeds, it is not crowded out by a thick, well-fertilized stand of perennial grass. Because wild barley matures early, producing seedheads with long awns, livestock avoid grazing it. Plants only 3 in tall can make seedheads, so mowing is not an effective control.

Six herbicides were tested at three rates on a perennial ryegrass pasture invaded by annual wild barley in Yamhill County of Western Oregon. The experimental design was a randomized complete block with three replications and 6 by 20 ft plots. The herbicides were applied on November 28, 1990, using a CO_2 backpack sprayer with a four-nozzle boom. The nozzles were 8006 flat fans, and spray volume was 34 gal/a. Plots were evaluated visually on July 30, 1991.

Paraquat, glyphosate, diuron and metribuzin did not prevent invasion of wild barley. The paraquat treatments, in fact, made the problem worse by damaging the perennial ryegrass and reducing the competition. Little or no wild barley was found in the metribuzin plots in the first replication, but the adjacent control plot had very little wild barley, so this apparent weed control was probably coincidental. Two herbicides, pronamide and ethofumesate, reduced the wild barley populations. Ethofumesate at the 1.5 lb ai/a rate gave 100% control. Ethofumesate and pronamide are unfortunately not labeled for use in pasture. (Oregon State University Extension Service, Yamhill County, 2050 Lafayette Avenue, McMinnville, OR 97128, and Crop Science Department, Oregon State University, Corvallis, OR 97331.)

Annual wild barley control in perennial ryegrass pasture

Herbicide	Rate	Rep 1	2	3	Average
	(lbs ai/a)		(% control)		
paraquat	0.13	0	0	0	0
	0.25	0	0	0	0
	0.50	0	0	0	0
glyphosate	0.06	0	50	0	17
	0.13	50	0	50	33
	0.25	60	0	0	20
diuron	1.0	0	0	0	0
	1.5	0	0	0	0
	2.0	0	60	0	20
pronamide	0.25	80	50	70	67
	0.38	60	80	100	80
	0.50	60	60	80	67
ethofumesate	0.75	60	100	95	85
	1.0	70	70	70	70
	1.5	100	100	100	100
metribuzin	0.25	90	0	0	30
	0.50	100	0	0	33
	1.0	100	50	0	50
check	0	0	0	0	0

Control of diclofop-resistant Italian ryegrass. Brewster, B.D., W.S. Donaldson, and A.P. Appleby. Diclofop-resistant Italian ryegrass has developed into a major production problem in western Oregon. This research was undertaken to compare the efficacy of herbicides with mechanisms of action similar to that of diclofop-methyl in two fields in the Willamette Valley. Pronamide was included since it is selective in several legume crops grown in the region. The trials were conducted as randomized complete blocks with three replications and 2.5 by 8 m plots. The water carrier volume was 234 L/ha applied at 172 kPa pressure through XR 8003 flat fan nozzle tips.

The herbicide treatments were applied in November, 1990, when the ryegrass had three to four leaves; the visual evaluations were conducted in February, 1991.

Diclofop-methyl, quizalofop-P-ethyl, fluazifop-P-butyl, and haloxyfop-methyl were ineffective at both locations. Sethoxydim and clethodim were effective at the Washington County site but failed at the Polk County site. Pronamide was the only herbicide treatment to control the Italian ryegrass at both sites. These results indicate that cross-resistance to sethoxydim and clethodim may be present in the Polk County field. If so, this would be the first occurrence of this phenomenon in western Oregon. Cross-resistance to the other herbicides has been documented in both Italian ryegrass and wild oats in western Oregon.

Control of Italian ryegrass at sites
in Polk and Washington Counties, Oregon

Herbicide	Rate	Polk	Washington
	(kg a.i./ha)	---------- (%)	----------
diclofop-methyl	1.1	0	47
sethoxydim	0.32	33	98
quizalofop-P-ethyl	0.11	20	27
fluazifop-P-butyl	0.21	0	27
pronamide	1.1	100	93
clethodim	0.11	47	98
haloxyfop-methyl	0.11	23	23
check	0	0	0

Weed control in irrigated sorghum. Miller, S.D. and T. Neider. Plots were established under sprinkler irrigation at the Research and Extension Center Torrington, WY to evaluate the efficacy of preemergence, postemergence or complementary herbicide treatments for weed control in sorghum. Plots were 10 by 40 ft. with three replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi. Sorghum (Dekalb 18) was seeded in a sandy loam soil (76% sand, 14% silt and 10% clay) with 1.3% organic matter and pH 7.6 and preemergence treatments applied May 20, 1991 (air temp. 60F, relative humidity 70%, wind calm , sky mostly cloudy and soil temp. - 0 inch 64F, 2 inch 60F and 4 inch 62F). Postemergence treatments were applied June 4, 1991 (air temp. 69F, relative humidity 64%, wind calm, sky clear and soil temp. - 0 inch 79F, 2 inch 70F and 4 inch 64F) to 2-leaf sorghum and 0.5 to 1 inch weeds. Weed counts, crop stand counts and visual crop injury ratings were made June 20, visual weed control ratings July 23 and yield determined October 15, 1991. Green foxtail (SETVI) and common lambsquarters (CHEAL) infestations were moderate and redroot pigweed (AMARE) and stinkgrass (ERACN) infestations light but uniform throughout the experimental site.

Treatments containing pyridate severely injured sorghum (53 to 60%) and caused moderate (18 to 34%) sorghum stand loss. Late season broadspectrum weed control was good to excellent (80 to 100% control of all weed species) with treatments containing atrazine. Sorghum yields were 29 to 54 bu/A higher in herbicide treated compared to weedy check plots and related closely to weed control and/or crop injury. (Wyoming Agric. Exp. Stn., Laramie, WY 82071 SR 1810)

Weed control in sorghum

Treatment[1]	Rate	Sorghum[2]				% Weed control[3]						
						June			July			
	lb ai/A	Inj %	SR %	Height inches	Yield bu/A	AMARE	CHEAL	SETVI	AMARE	CHEAL	SETVI	ERACN
<u>preemergence</u>												
BAS-514	0.5	0	0	44	121	0	97	55	60	70	90	60
atrazine(atra)	1.0	7	0	43	121	100	100	93	100	100	93	97
propoachlor(prop)	3.0	0	0	44	115	91	86	92	60	53	83	88
prop+atra	3.0+1.0	3	0	43	125	100	100	97	100	100	98	100
BAS-514+atra	0.5+1.0	10	0	44	125	100	100	100	100	98	100	100
<u>preemergence/postemergence</u>												
prop/pyridate	3.0/0.9	53	18	40	105	100	100	92	100	90	80	87
prop/pyridate+atra	3.0/0.9+0.5	60	34	40	105	100	100	100	100	100	95	100
<u>postemergence</u>												
BAS-514+ms	0.38	0	0	45	121	43	88	77	60	70	90	63
BAS-514+atra+ms	0.38+0.5	0	0	44	129	100	100	93	100	100	98	100
bentazon-atra+ms	1.0	0	0	43	128	100	100	78	100	100	82	90
bromoxynil-atra	0.75	0	0	43	130	100	100	87	100	100	87	93
dicamba-atra	0.8	0	0	43	121	100	100	85	100	100	87	93
weedy check	- - -	-	-	40	76	0	0	0	0	0	0	0
plants/ft row 6-inch band		--	6.2	- -	- -	0.5	1.1	2.0	- -	- -	- -	

[1] Treatments applied May 21 and June 4, 1991; ms = Sun-It at 1 qt/A and - = package mix.

[2] Sorghum stand counts (SR = stand reduction) and visual injury (inj) evaluated June 20, plant height measured August 7 and plots harvested October 15, 1991.

[3] Weed stand counts June 20 and visual weed control ratings July 23, 1991.

Littleseed canarygrass control in cereal grains. Bell, C. E. Littleseed canarygrass in the most important weed problem in cereal grains in the Lower Colorado River Desert areas of California and Arizona. This research was conducted at the University of California Desert Research and Extension Center in Holtville, CA. The purpose of the trials were to compare trifluralin and pendimethalin for control of littleseed canarygrass when applied preemergence.

Two trials were conducted, one on durum wheat (cv WB881) and the other on a common barley. Both crops were planted on flat ground on December 12, 1990 between raised borders and flood irrigated. Trial design was a randomized complete block with four replications. Plot size was 1.5 m by 3 m. Treatments consisted of each herbicide applied at three rates (.56, .84, and 1.12 kgai/ha) and in both a liquid and a granular formulation. All treatments were applied on December 12, 1990. Liquid treatments were applied at a 196 l/ha carrier volume at 138 kPa pressure through 8002LP flat fan nozzles. Granules were applied with a small jar with holes punched in the lid, salt shaker style.

Data collection for the barley planted trial was a .5 m^2 sample from each plot. The sample was taken after crop anthesis, but before maturity on April 23, 1991. There was a heavy weed population in the trial and the decision was made to take biomass samples instead of yield before the weed seed heads started to shatter. The weed and the crop was separated in each sample, dried at 50 C for three days and weighed. For the wheat trial, a 1.2 m by 2 m yield sample was taken at maturity with a small plot harvester on June 7, 1991.

Analysis of variance (ANOV), mean separation (LSD), and single degree of freedom orthogonal comparisons were performed on these data. For the wheat yield, there was no difference between the treatments and the untreated according to ANOV. Single degree of freedom orthogonal comparisons did show that the granular formulations did reduce yield when compared to the liquid formulation ($P = .103$). With the barley data, there was a difference in the crop biomass among treatments. Orthogonal comparisons show that the pendimethalin reduced barley biomass compared to the trifluralin treatments ($P < .001$) and that the granule formulation may have been more injurious than the liquid formulations ($P = .141$). Also, littleseed canarygrass control was significantly better in all treatments compared to the untreated according to LSD. Orthogonal comparisons of these data indicate that trifluralin was better than the pendimethalin ($P = .011$), and the liquid formulation was better than the granule ($P = .011$). (Cooperative Extension, University of California, Holtville, CA 92250).

Littleseed canarygrass control in wheat and barley with trifluralin and pendimethalin in Holtville, CA

Treatment	Rate kgai/ha	Wheat kg	Barley gms	PHAMI gms
pendimethalin 4E	.56	2.84	407.2	15.8 c
pendimethalin 4E	.84	2.84	443.2	15.0 c
pendimethalin 4E	1.12	2.78	458.9	9.9 c
trifluralin 5E	.56	2.72	479.6	3.8 c
trifluralin 5E	.84	2.84	543.4	3.5 c
trifluralin 5E	1.12	3.00	492.8	5.1 c
pendimethalin 5G	.56	2.78	377.1	41.9 b
pendimethalin 5G	.84	2.54	433.8	24.8 bc
pendimethalin 5G	1.12	2.77	430.0	22.6 bc
trifluralin 10G	.56	2.90	412.1	23.3 bc
trifluralin 10G	.84	2.61	469.0	10.4 c
trifluralin 10G	1.12	2.67	554.0	7.1 c
untreated control		2.72	324.9	79.3 a
	LSD	ns	82.03	24.04

Single degree of freedom orthogonal comparisons

	F	P
pendimethalin vs trifluralin		
wheat yield	0.149	ns
barley biomass	16.26	<.001
PHAMI biomass	6.99	.011
granule vs liquid formulation		
wheat yield	2.81	.103
barley biomass	2.25	.141
PHAMI biomass	7.01	.011

PHAMI = littleseed canarygrass.
Numbers in a column followed by the same letter are not significantly different at the 5% level according to the Least Significant Difference test.

Russian thistle control in spring wheat. Boerboom, C.M. Several herbicide treatments were applied at two Russian thistle (SASKR) growth stages to determine if applications could be delayed to control late germinating Russian thistle while still providing control of larger Russian thistle which may have germinated earlier.

Spring wheat (var. 'Penawawa') was seeded at 75 lb/a on March 20, 1991 at a site near LaCrosse, WA. Russian thistle density averaged 13 plants/ft^2 and emerged as a single flush. The experimental design was a randomized complete block with four replications. Plots measured 10 by 30 ft. Early treatments were applied when the Russian thistle was 1 to 3 in. tall and the spring wheat had four to five leaves and one to two tillers. Late treatments were applied when the Russian thistle was 4 to 6 in. tall and the spring wheat had one node and three to five tillers. Herbicides were applied with a CO_2 pressurized backpack sprayer (Table 1).

Early treatments were visually rated 14 days after treatment for crop injury, which included stunting and slight chlorosis. Dicamba injury included prostrate growth. Russian thistle control, crop height, and injured wheat heads were rated on July 15. Reduced crop height was noticeable with late treatments of thifensulfuron plus tribenuron and tribenuron alone. All early 2,4-D treatments caused phenoxy injury symptoms to the wheat heads, but caused little or no yield reduction. All treatments provided good to excellent Russian thistle control except early applications of tribenuron, pyridate, and dicamba. Competition from the Russian thistle did not reduce wheat yields because of the adequate rain and a competitve crop. However, late applications of thifensulfuron plus tribenuron, tribenuron, and pyridate reduced yields. (Department of Crop and Soil Sciences, Washington State Univ., Pullman, WA 99164).

Table 1. Application data

Date	May 10, 1991	May 24, 1991
Timing (SASKR height)	early (1-3 in.)	late (4-6 in.)
Air temperature (F)	63	51
Soil temperature (F)	68	100
Relative humidity (%)	55	58
Wind direction/speed	N/3	-/0
Volume (gpa)	10	10
Soil pH	5.6	
OM (%)	1.71	
CEC (meq/100g soil)	14.4	
Texture	silt loam	

Table 2. Russian thistle control in spring wheat - LaCrosse, WA

Treatment[1]	Rate[2]	SASKR height	Early[3] injury	SASKR[4] control	Height[5] reduct.	Inj.[6] heads	Yield
	(lb ai/a)	(in.)	------------	------------(%)	------------	------------	(bu/a)
check	-	-	0	0	0	0	48
triasulfuron surfactant	0.018 0.25	1-3	0	90	0	0	47
triasulfuron surfactant	0.018 0.25	4-6	-	92	0	0	45
triasulfuron 2,4-D surfactant	0.013 0.5* 0.25	1-3	10	93	1	83	47
triasulfuron 2,4-D surfactant	0.013 0.5* 0.25	4-6	-	100	0	0	48
thifensulfuron + tribenuron surfactant	0.015 0.008 0.25	1-3	24	99	1	0	47
thifensulfuron + tribenuron surfactant	0.015 0.008 0.25	4-6	-	100	15	0	39
thifensulfuron + tribenuron 2,4-D surfactant	0.009 0.005 0.5 0.25	1-3	10	100	0	50	48
thifensulfuron + tribenuron 2,4-D surfactant	0.009 0.005 0.5* 0.25	4-6	-	100	0	0	47
tribenuron surfactant	0.016 0.25	1-3	8	84	0	0	48
tribenuron surfactant	0.016 0.25	4-6	-	97	14	0	42
tribenuron 2,4-D surfactant	0.008 0.5* 0.25	1-3	10	99	3	53	47

Table 2. continued

Treatment[1]	Rate[2]	SASKR height	Early[3] injury	SASKR[4] control	Height[5] reduct.	Inj.[6] heads	Yield
	(lb ai/a)	(in.)	----	----	(%)	----	(bu/a)
tribenuron 2,4-D surfactant	0.008 0.5* 0.25	4-6	-	100	0	0	49
chlorsulfuron + metsulfuron 2,4-D surfactant	0.012 0.002 0.5* 0.25	1-3	18	100	1	60	46
chlorsulfuron + metsulfuron 2,4-D surfactant	0.012 0.002 0.5* 0.25	4-6	-	100	0	0	48
pyridate	0.9	1-3	4	66	0	0	48
pyridate	0.9	4-6	-	89	0	0	42
2,4-D	1.0	1-3	20	97	6	100	46
2,4-D	1.0	4-6	-	98	3	0	50
bromoxynil	0.38	1-3	8	100	0	0	50
bromoxynil	0.38	4-6	-	97	0	0	49
bromoxynil + MCPA	0.25 0.25*	1-3	0	98	0	0	50
bromoxynil + MCPA	0.25 0.25*	4-6	-	87	0	0	50
dicamba	0.125*	1-3	8	79	0	0	49
LSD (0.05)			6	15	3	15	3

[1]Surfactant was R-11; rate is expressed as % v/v.
[2]Rates with * are lb ae/a.
[3]Early injury was rated May 24 as visible crop injury.
[4]Russian thistle control rated visually July 15.
[5]Height reduction of fully headed wheat was visually rated July 15.
[6]Injury to wheat heads was rated July 15 and is expressed as percent of heads with visible injury.

Wild oat control in spring wheat. Downard, R.W., D.W. Morishita and W. Ying. An experiment was conducted to evaluate the efficacy of reduced rate wild oat herbicide tank mixes in irrigated hard red spring wheat 'Nomad' near Paul, Idaho. Treatments were arranged in a randomized complete block design with four replications. Plot size was 8 ft by 25 ft. Herbicides were applied with a hand-held sprayer at 10 gpa using 11001 flat fan nozzles. Wild oat plants were sprayed at the 1 to 4 leaf stage. Application data aes shown in Table 1. Soil texture was a silt loam with a pH of 7.8, 1.5% om and a CEC of 15 meq/100 g soil. Crop injury and wild oat control were evaluated July 26. Plots were harvested September 3 with a small-plot combine.

None of the chemical treatments injured the crop (Table 2). Of the herbicides applied alone at the reduced rate, only imazamethabenz controlled (88%) wild oat. Tank mixtures of imazamethabenz at 0.23 lb ai/A plus diclofop, difenzoquat, or HOE 7125 at 0.50, 0.50 or 0.094 lb ai/A, respectively controlled wild oat 91 to 96%. These same tank mixtures tended to have yields higher than the check. Although not significantly different both rates of imazamethabenz had yield trends greater than the check. (Department of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls, ID 83301)

Table 1. Application data.

Application timing	1-4 leaf
Application date	5/24/91
Air temperature (F)	76
Soil temperature (F)	72
Relative humidity (%)	46
Wind velocity (mph)	5

Table 2. Crop injury, wild oat control and grain yield near Paul, Idaho.

Treatment	Rate	Crop injury[1]	Wild oat control	Grain yield
	lb ai/A	--------------- %	--------------	bu/A
Check		0	0	85
Diclofop	0.50	0	26	100
Imazamethabenz[2]	0.23	0	88	108
Difenzoquat[2]	0.50	0	25	100
HOE 7125	0.094	0	25	92
Diclofop + imazamethabenz	0.50 + 0.23	0	93	109
Diclofop+ difenzoquat	0.50+ 0.50	0	73	107
Imazamethabenz+ difenzoquat	0.23+ 0.50	0	91	109
HOE 7125+ imazamethabenz	0.094+ 0.23	0	96	116
HOE 7125+ difenzoquat	0.094+ 0.50	0	34	97
Diclofop	1.0	0	81	93
Difenzoquat[2]	1.0	0	43	90
Imazamethabenz[2]	0.50	0	99	114
HOE 7125	0.189	0	30	97
LSD (0.05)		NS	26	NS

[1]Crop injury and wild oat control evaluated July 26, 1991.
[2]Surfactant X-77 added at 0.25% v/v.

Effect of wheat seeding rate on broadleaf weed management. Downard, R.W., D.W. Morishita, and W. Ying. A study was initiated at the Kimberly Research and Extension Center to determine the effect of four seeding rates as a means of broadleaf weed management in spring wheat 'fieldwin'. Soil texture was a silt loam with a pH of 8, 1.5% om and CEC of 17 meq/100 g soil. Grain was planted on April 16, 1991. Experimental design was a 2 by 4 factorial arrangement of treatments replicated four times in a randomized complete block design. Herbicides were applied with a hand-held sprayer at 10 gpa using 11001 flat fan nozzles. Application data are shown in Table 1. Crop injury and weed control were evaluated August 8. Plots were harvested September 16, 1991 and one thousand seed weight was measured for each plot.

There were no apparent differences in crop injury or weed control among the treatments (data not shown). The weed population was very low due to dry soil-surface conditions even in untreated plots throughout the season. As a result, there were no significant differences in weed control, grain yield or thousand seed weight among treatments. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83301)

Table 1. Application data.

Application date	5/24/91
Air temperature (F)	85
Soil temperature (F)	65
Relative humidity (%)	-
Wind velocity (mph)	6

Table 2. Grain yield and one thousand seed weight.

Treatment	Seeding rate	Rates	Grain yield	1000 seed weight
	lb/A	ai/A	bu/A	grams
Check	60		58	38
Check	90		58	37
Check	120		61	38
Check	150		58	37
Thifensulfuron[1]/ tribenuron + 2,4-D	60	0.25 oz + 0.25 lb	58	38
Thifensulfuron[1]/ tribenuron + 2,4-D	90	0.25 oz + 0.25 lb	58	37
Thifensulfuron[1]/ tribenuron + 2,4-D	120	0.25 oz + 0.25 lb	59	37
Thifensulfuron[1]/ tribenuron + 2,4-D	150	0.25 oz + 0.25 lb	58	37
LSD (0.05)			NS	NS

[1]Surfactant R-11 added at 0.25% v/v.

Broadleaf weed control in irrigated spring wheat. Miller, S.D., T. Neider and K.J. Fornstrom. Plots were established under sprinkler irrigation near Pine Bluffs, WY to evaluate weed control and spring wheat response with postemergence herbicide treatments. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Spring wheat (var. Era) was seeded March 27, 1991 in a sandy loam soil (75% sand, 13% silt and 12% clay) with 1.5% organic matter and pH 7.8. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 17, 1991 (air temp. 63F, relative humidity 80%, wind NW at 5 mph, sky cloudy and soil temp. - 0 inch 65F, 2 inch 58F and 4 inch 57F) to 4-leaf wheat and 0.5 to 1 inch weeds. Visual weed control and crop damage evaluations were made June 10, plant height measured July 1 and plots harvested August 15, 1991. Common sunflower (HELAN) and Russian thistle (SASKR) infestations were moderate and kochia (KCHSC) infestations light but uniform throughout the experimental site.

No treatment reduced spring wheat stand and only slight injury (2 to 10%) was observed with several treatments containing dicamba. Common sunflower control was good to excellent (90 to 100%) with all treatments, Russian thistle control good to excellent (85 to 100%) with all treatments except 2,4-D and MCPA and kochia control excellent (100%) with all treatments containing dicamba or bromoxynil. Wheat yields were 3 to 11 bu/A higher in herbicide treated compared to weedy check plots and related closely to weed control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1804)

Broadleaf weed control in spring wheat

Treatment[1]	Rate	S. wheat[2]				Weed control[3]		
	lb ai/A	Inj %	SR %	Height inches	Yield bu/A	HELAN %	SASKR %	KCHSC %
tribenuron(trib)+X-77	0.019	0	0	29	77	90	87	83
bromoxynil(brom)	0.38	0	0	29	78	100	93	100
dicamba(dica)	0.063	0	0	28	76	95	90	98
dicamba+X-77	0.063	7	0	29	77	97	90	100
2,4-D	0.75	0	0	29	74	92	82	80
MCPA	0.75	0	0	29	73	90	75	73
brom/MCPA	0.75	0	0	29	77	100	100	100
clopyralid/2,4-D(clop/2,4-D)	0.59	0	0	30	76	95	87	83
clopyralid/MCPA(clop/MCPA)	0.59	0	0	29	75	95	85	75
trib+2,4-D+X-77	0.019+0.25	0	0	29	79	94	90	90
trib+dica+X-77	0.019+0.063	8	0	29	77	100	95	100
trib+dica	0.019+0.063	2	0	29	78	100	90	100
trib+brom/MCPA+X-77	0.019+0.5	0	0	29	79	100	100	100
thif/trib+2,4-D+X-77	0.019+0.25	0	0	29	79	96	90	85
thif/trib+dica+X-77	0.019+0.063	10	0	30	79	100	95	100
thif/trib+dica	0.019+0.063	3	0	29	77	100	92	100
thif/trib+brom+X-77	0.019+0.125	0	0	29	79	100	100	100
thif/trib+brom+X-77	0.019+0.19	0	0	30	79	100	100	100
thif/trib+brom+X-77	0.019+0.25	0	0	30	80	100	100	100
thif/trib+brom/MCPA+X-77	0.019+0.38	0	0	30	79	100	100	100
thif/trib+brom/MCPA+X-77	0.019+0.5	0	0	29	81	100	100	100
clop/2,4-D+brom	0.59+0.25	0	0	28	79	100	100	100
clop/MCPA+brom	0.59+0.25	0	0	30	78	100	100	100
clop/MCPA+dica	0.59+0.063	2	0	29	75	100	93	97
dica+MCPA	0.063+0.5	3	0	29	77	97	90	97
weedy check	- - -	0	0	30	70	0	0	0

[1] Treatments applied May 17, 1991; X-77 included at 0.25% v/v and / = package mix.
[2] Wheat injury (inj) and stand reduction (SR) visually evaluated June 10, plant height measured July 1 and plots harvested August 15, 1991.
[3] Weed control visually evaluated June 10, 1991.

Wild oat control in spring wheat with imazamethabenz formulations and adjuvants. Stallings, G.P., C.R. Thompson, and D.C. Thill. Wild oat (AVEFA) control with different imazamethabenz formulations combined with spray adjuvants and various herbicide tank mixtures was compared in spring wheat at Moscow and Bonners Ferry, Idaho. Liquid concentrate (LC), dry flowable (DF), and soluble concentrate (SC) formulations of imazamethabenz were applied at rates ranging from 0.23 to 0.94 lb ai/a. Plots were 10 by 30 ft and were arranged in a randomized complete block design with four replications. Herbicides were applied to 2 to 3, 4 to 5, or 6 to 7 leaf (lf) wild oat plants (Table 1). Herbicide treatments were applied with a pressurized CO_2 backpack sprayer calibrated to deliver 10 gal/a at 38 psi at 3 mph. Wild oat control and wheat injury were evaluated on July 26 at the Moscow location. Wild oat control was evaluated on July 11 and August 6, and wheat injury was evaluated on August 6 at the Bonners Ferry site. Bromoxynil and clopyralid were broadcast applied postemergence to the Moscow site for mayweed chamomile, common lambsquarters, and wild buckwheat control. Wheat grain was harvested from a 4.5 by 27 ft area within each plot on August 28 at Moscow and September 9 at Bonners Ferry. The effect of imazamethabenz on yellow sweet clover (MEUOF), which was underseeded with the wheat, was evaluated at Bonners Ferry.

Table 1. Application data and soil analysis

Moscow, ID			
Application date	May 31	June 12	June 24
Wild oat leaf stage	2 to 3	4 to 5	6 to 7
Wild oat density (plants/ft^2)	4	15	45
Wheat leaf stage	2.5	4.5	7
Air temperature (F)	60	45	68
Relative humidity (%)	80	66	80
Wind speed (mph) - direction	0	1-W	0
Soil temperature (F)	66	51	72
pH	4.7		
organic matter (%)	6.5		
CEC (meq/100g)	45.0		
texture	clay loam		
Crop	'Edwall' soft white spring wheat		
Bonners Ferry, ID			
Application date	May 29	June 10	
Wild oat leaf stage	2 to 3	4 to 5	
Wild oat density (plants/ft^2)	4	5	
Wheat leaf stage	2.5	5	
Air temperature (F)	64	51	
Relative humidity (%)	70	83	
Wind speed (mph) - direction	4-N	2-N	
Soil temperature (F)	72	60	
pH	7.6		
organic matter (%)	9.9		
CEC (meq/100g)	29.6		
texture	silt loam		
Crop	'Westbred 906R' hard red spring wheat		

Wheat treated with herbicides yielded significantly more grain than untreated wheat (Tables 2 and 3). Imazamethabenz applied with Sun-It II tended to enhance wild oat control compared to imazamethabenz applied with R-11 at both locations.

Wheat treated at the wild oat 2 to 3 lf growth stage generally yielded more grain than wheat from plots treated at the wild oat 4 to 5 or 6 to 7 lf growth stage at Moscow (Table 2). Imazamethabenz DF combined with difenzoquat and applied to wild oat at the 4 to 5 or 6 to 7 lf growth stage arrested new terminal growth of wild oat, with no plant death, and maintained wild oat growth stage from application through harvest. Wild oat densities at Moscow averaged 40 to 60 plants/ft^2 with areas as high as 80 to 100 plants/ft^2 at the time of evaluation.

Increased wheat injury and reduced grain yield occurred when difenzoquat was applied to 906R at Bonners Ferry because this variety is sensitive to difenzoquat (Table 3). Wheat was injured 15% when MCPA ester (0.5 lb/a) was combined with imazamethabenz DF (0.31 lb/a) and applied at the 2 lf growth stage. Imazamethabenz DF (0.31 lb/a) and R-11 (0.25% v/v), when combined with AC182227 at 0.2 or 0.1 lb/a, appeared to antagonize wild oat control when compared to imazamethabenz and R-11 applied without AC182227 (Table 3). All imazamethabenz formulations and rates controlled sweet clover (Table 3). (Idaho Agricultural Experiment Station, Moscow, ID 83843).

Table 2. Wild oat control in soft white spring wheat with imazamethabenz formulations combined with difenzoquat and various adjuvants, Moscow, Idaho

Treatment	Rate	AVEFA stage	Wheat Yield	Wheat Injury	AVEFA control
	(lb ai/a)	(lf)	(bu/a)	(%)	(%)
control I			17.4	-	-
control II			18.8	-	-
imazamethabenz LC +	0.47				
R-11[1]	0.25%	2-3	45.2	0	81
imazamethabenz LC +	0.38				
R-11	0.25%	2-3	43.0	0	77
imazamethabenz LC +	0.31				
R-11	0.25%	2-3	46.3	0	75
imazamethabenz DF +	0.47				
R-11	0.25%	2-3	48.3	0	86
imazamethabenz DF +	0.38				
R-11	0.25%	2-3	46.0	0	76
imazamethabenz DF +	0.31				
R-11	0.25%	2-3	41.4	0	74
imazamethabenz DF +	0.94				
Sun-It II[2]	1.5pt	2-3	49.1	4	97
imazamethabenz DF +	0.47				
Sun-It II	1.5pt	2-3	45.1	1	85
imazamethabenz DF +	0.38				
Sun-It II	1.5pt	2-3	44.6	0	80
imazamethabenz DF +	0.31				
Sun-It II	1.5pt	2-3	46.3	0	83
imazamethabenz DF +	0.23				
difenzoquat +	0.5				
R-11	0.25%	2-3	47.1	0	79
imazamethabenz DF +	0.23				
difenzoquat	0.5	2-3	42.6	0	70
imazamethabenz DF +	0.23				
difenzoquat +	0.5				
R-11	0.25%	4-5	34.0	0	80
imazamethabenz DF +	0.23				
difenzoquat	0.5	4-5	29.4	5	77
imazamethabenz DF +	0.23				
difenzoquat +	1.0				
R-11	0.25%	6-7	30.6	1	63
imazamethabenz SC +	0.31				
NaHSO4	0.31	2-3	43.3	0	71
imazamethabez SC +	0.38				
NaHSO4	0.38	2-3	44.7	0	76
difenzoquat	1.0	4-5	32.0	5	93
diclofop	1.0	2-3	49.6	0	99
LSD $_{(0.05)}$			6.9	5	13

[1]R-11 nonionic surfactant added at 0.25% v/v.
[2]Sun-It II methylated crop seed oil.

Table 3. Wild oat control in hard red spring wheat with imazamethabenz formulations combined with tank mixtures and various adjuvants, Bonners Ferry, Idaho

Treatment	Rate	AVEFA stage	Wheat Yield	Wheat Injury	AVEFA 7/11	AVEFA 8/6	MEUOF 8/6
	(lb ai/a)	(lf)	(bu/a)	(%)	----(% control)---		
control I			27.4	–	–	–	–
control II			24.9	–	–	–	–
imazamethabenz LC	0.47	2-3	40.1	0	90	85	72
imazamethabenz LC +	0.41						
Sun-It II[1]	1.5pt	2-3	46.6	0	99	96	92
imazamethabenz LC +	0.38						
Sun-It II	1.5pt	2-3	41.4	0	96	91	90
imazamethabenz LC +	0.31						
Sun-It II	1.5pt	2-3	43.0	0	96	91	89
imazamethabenz DF +	0.41						
R-11[2]	0.25%	2-3	41.9	0	93	87	83
imazamethabenz DF +	0.38						
R-11	0.25%	2-3	41.8	1	90	88	86
imazamethabenz DF +	0.31						
R-11	0.25%	2-3	42.4	0	88	86	74
imazamethabenz DF +	0.41						
Sun-It II	1.5pt	2-3	44.3	0	97	97	96
imazamethabenz DF +	0.38						
Sun-It II	1.5pt	2-3	48.9	1	97	95	96
imazamethabenz DF +	0.31						
Sun-It II	1.5pt	2-3	47.3	0	98	93	92
imazamethabenz DF +	0.31						
MCPA ester +	0.5						
R-11	0.25%	2-3	40.2	15	90	86	71
imazamethabenz DF +	0.31						
2,4-D ester +	0.5						
R-11	0.25%	4-5	38.9	1	86	69	88
imazamethabenz DF +	0.31						
bromoxynil-MCPA +	0.5						
R-11	0.25%	2-3	36.9	5	88	74	80
imazamethabenz DF +	0.31						
thifen-triben[3] +	0.019						
R-11	0.25%	2-3	42.8	0	92	83	86
imazamethabenz DF +	0.31						
HOE 7125 EC +	0.39						
R-11	0.25%	4-5	44.2	1	84	76	91
imazamethabenz DF +	0.31						
AC182227 DF +	0.1						
R-11	0.25%	2-3	41.8	0	79	71	90
imazamethabenz DF +	0.31						
AC182227 DF +	0.2						
R-11	0.25%	2-3	40.2	0	70	69	90
imazamethabenz DF +	0.94						
R-11	0.25%	2-3	53.9	0	97	97	95
HOE 7125 EC	0.78	4-5	50.8	0	92	92	50
difenzoquat[4]	1.0	4-5	29.9	66	96	93	0
diclofop	1.0	2-3	43.0	1	90	87	10
LSD $_{(0.05)}$			6.3	6	8	7	23

[1]Sun-It II methylated crop seed oil.
[2]R-11 nonionic surfactant added at 0.25% v/v.
[3]thifensulfuron-tribenuron, in a commercial mixture.
[4]difenzoquat is not labeled for use on wheat variety 906R.

BAS 514 34 H tank mixes to control broadleaf weeds in spring wheat. Thompson, C.R. and D.C. Thill. Broadleaf weed control with BAS 514 34 H (BAS 514) combined with broadleaf herbicides was evaluated in soft white spring wheat 5 miles west of Potlatch, Idaho. Treatments were applied on May 23 with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 38 psi and 3 mph (Table 1). Treatments were arranged in a randomized complete block design with four replicates. Plots were 10 by 30 ft. Weed control and wheat injury were evaluated visually on June 19. Grain was harvested from a 4.5 by 27 foot area with a small plot combine on August 29.

Table 1. Application and soil analysis data

Stage at application	
wheat leaves	3.5 to 4.0
field pennycress (THLAR)	1.0 to 3.0 in.
henbit (LAMAM)	0.5 to 1.0 in.
ladysthumb (POLPE)	1.0 to 3.0 in.
mayweed chamomile (ANTCO)	0.5 to 1.0 in.
Temperature (F)	70
Soil temperature at 2 in. (F)	65
Relative humidity (%)	45
Wind speed (mph) - direction	4-W
Soil pH	5.8
OM (%)	3.8
CEC (meq/100g soil)	21.2
Texture	silt loam

BAS 514 controlled henbit 62% but did not control field pennycress, ladysthumb, or mayweed chamomile (Table 2). Thifensulfuron-tribenuron alone or tank mixed with BAS 514 controlled broadleaf weeds 88 to 99%. Henbit control with 2,4-D, MCPA, or dicamba increased 74 to 86% when BAS 514 and Sun-It were added.

Wheat treated with 2,4-D, thifensulfuron-tribenuron, dicamba, or a BAS 514 at 0.15 lb ai/a tank mixed with 2,4-D at 0.3 lb ae/a yielded 15 to 18 bu/a more grain than the untreated wheat. Wheat treated with 2,4-D at 0.25 lb ae/a, thifensulfuron-tribenuron at 0.0188 lb ai/a, or dicamba at 0.125 lb ae/a tended to yield more grain (7 to 10 bu/a) than wheat treated with these herbicides tank mixed with BAS 514 at 0.2 lb ai/a and Sun-It. Herbicides did not injure wheat visibly. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. BAS 514 34 H for broadleaf weed control in spring wheat

Treatment	Rate	Wheat Yield	Wheat Injury	THLAR	LAMAM	POLPE	ANTCO
	lb ai/a	bu/a	%	% control			
control	0.0	53	--	--	--	--	--
BAS 514 34 H + Sun-It II[1]	0.2 2 pt	59	0	2	62	1	0
2,4-D LVE	0.25[2]	69	0	99	7	66	30
MCPA LVE	0.25[2]	61	0	99	5	18	6
thifensulfuron-tribenuron + R-11[3]	0.0188 0.25% v/v	71	3	99	88	99	99
dicamba SGF[4]	0.125[2]	69	0	6	12	83	3
BAS 514 34 H + 2,4-D LVE + Sun-It II	0.2 0.25 2 pt	61	1	99	88	79	31
BAS 514 34 H + 2,4-D LVE + Sun-It II	0.15 0.3 2 pt	68	4	99	82	48	33
BAS 514 34 H + MCPA LVE + Sun-It II	0.2 0.25 2 pt	62	1	76	92	4	20
BAS 514 34 H + thifensulfuron-tribenuron + Sun-It II	0.2 0.0188 2 pt	64	3	98	95	99	99
BAS 514 34 H + dicamba SGF + Sun-It II	0.2 0.125 2 pt	59	3	10	86	93	19
$LSD_{(0.05)}$		10	NS	22	21	19	15
Weed density (plants/ft^2)				7	10	2	2

[1] methylated crop seed soil
[2] 2,4-D and MCPA rate lb ae/a
[3] non ionic surfactant
[4] sodium salt formulation

BAS 514 34 H tank mixed with wild oat herbicides for weed control in soft white spring wheat. Thompson, C.R. and D.C. Thill. Wild oat and broadleaf weed control with BAS 514 34 H (BAS 514) and wild oat herbicide tank mixes were evaluated 5 miles northwest of Potlatch, Idaho, in 'Penewawa' spring wheat. Treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 38 psi and 3 mph (Table 1). Dew was present when May 23 treatments were applied. Treatments were arranged in a randomized complete block design and replicated four times. Plots were 10 by 30 feet. Wheat injury and weed control were evaluated visually on July 24, 1991. Grain was harvested on August 27 from a 4.5 by 27 foot area with a small plot combine in blocks one and two and from a 2.5 by 27 ft area with a two-row binder in blocks three and four. Blocks three and four were on a slope too steep for the small plot combine.

Table 1. Application and soil analysis data

Application date	May 23	June 4
Application stage		
wheat leaves	3.0 to 3.5	5.5 to 6.0
wild oat leaves (AVEFA)	2.5 to 3.0	4.5 to 6.5
common lambsquarters (CHEAL)	0.5 to 1 in.	1 to 5 in.
field pennycress (THLAR)	0.5 to 2 in.	1 to 8 in.
volunteer lentil	0.5 to 2 in.	2 to 4 in.
cowcockle (VAAPY)	0.5 to 2 in.	3 to 5 in.
Temperature (F)	60	50
Soil temperature at 2 in. (F)	56	58
Relative humidity (%)	58	46
Wind speed (mph) - direction	3-SW	0
Soil pH	5.1	
OM (%)	3.8	
CEC (meq/100g soil)	20.3	
Texture	silt loam	

BAS 514 combined with diclofop reduced wild oat control about 15% compared to diclofop applied alone (Table 2). BAS 514 tended to decrease wild oat control with imazamethabenz and increase wild oat control with difenzoquat when combined with each herbicide in a tank mixture. BAS 514 marginally controlled common lambsquarters, volunteer lentil, and cowcockle when applied alone. BAS 514 did not control wild oat or field pennycress.

No wheat injury was observed with any treatment; however, wheat yielded 20 bu/a less when treated with BAS 514 at 0.3 lb ai/a applied alone than wheat treated with BAS 514 at 0.15 lb ai/a. In general, wheat treated with difenzoquat yielded less grain than wheat treated with imazamethabenz or diclofop. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. BAS 514 34 H combined with wild oat herbicides for weed control in soft white spring wheat

Treatment	Rate	AVEFA stage	Wheat yield	AVEFA	CHEAL	THLAR	Volunteer lentil	VAAPY
	lb ai/a	leaf	bu/a	------------		% control		-----------
control	0.0	--	30	--	--	--	--	--
BAS 514 34 H + Sun-It II[1]	0.15 2 pt	2-3	42	0	46	3	70	40
BAS 514 34 H + Sun-It II	0.2 2 pt	2-3	33	0	46	2	73	46
BAS 514 34 H + Sun-It II	0.3 2 pt	2-3	22	0	70	4	84	70
diclofop + bromoxynil	0.75 0.375	2-3	72	93	93	85	51	81
diclofop	0.75	2-3	63	95	0	0	0	0
diclofop + BAS 514 34 H + Sun-It II	0.75 0.15 2 pt	2-3	62	79	63	8	70	35
diclofop + BAS 514 34 H + Sun-It II	0.75 0.2 2 pt	2-3	64	78	55	5	73	66
imazamethabenz + R-11[2]	0.375 0.25%	2-3	72	95	40	95	85	19
imazamethabenz + BAS 514 34 H + Sun-It II	0.375 0.15 2 pt	2-3	70	83	45	97	89	38
imazamethabenz + BAS 514 34 H + Sun-It II	0.375 0.2 2 pt	2-3	69	85	76	95	81	52
difenzoquat	0.75	4-6	51	56	0	0	0	0
difenzoquat + BAS 514 34 H + Sun-It II	0.75 0.15 2 pt	4-6	42	71	39	4	84	16
difenzoquat + BAS 514 34 H + Sun-It II	0.75 0.2 2 pt	4-6	49	78	33	5	85	31
	LSD $_{(0.05)}$		16	17	28	6	21	35
Weed density (plants/ft^2)				20	5	3	3	1

[1] methylated crop seed oil
[2] nonionic surfactant applied as a % v/v

UBI-C4243 combinations with wild oat herbicides for weed control in soft white spring wheat. Thompson, C.R. and D.C. Thill. Wild oat and broadleaf weed control with UBI-C4243 combined with triallate or diclofop was evaluated at the University of Idaho Plant Science Farm 1 mile east of Moscow, Idaho. Ammonium nitrate fertilizer (34-0-0) at 270 lb product/a was applied broadcast for 80 bu/a wheat and was incorporated twice with a cultivator. Preplant incorporated (PPI) treatments were applied and incorporated twice with a spike tooth harrow, 'Edwall' spring wheat was seeded 1.5 in. deep at 90 lb/a, and postplant preemergence surface (POPES) treatments were applied on May 3 (Table 1). Postemergence treatments were applied to 2.5 leaf (lf) wheat, 2 lf wild oat (AVEFA), 0.5 to 1 in. mayweed chamomile (ANTCO), wild buckwheat (POLCO), common lambsquarters (CHEAL), and henbit (LAMAM) on May 31, 1991. All treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 20 (PPI and POPES) or 10 (POST) gal/a at 38 psi and 3 mph. Plots were 10 by 30 ft. Treatments were arranged in a randomized complete block and replicated four times. Wheat stand and injury, and broadleaf weed control were evaluated on June 6. Wild oat control was evaluated in the PPI and POPES treatments on June 6 and in all treatments on August 30. Grain was harvested with a small plot combine from a 4.5 by 27 ft area on September 4.

Table 1. Application and soil analysis data

	PPI	POPES	POST
Application timing	PPI	POPES	POST
Nozzle size	8002	8002	8001
Temperature (F)	65	67	60
Soil temperature at 2 in. (F)	62	62	66
Relative humidity (%)	42	40	80
Wind speed (mph) - direction	3-NE	1-NE	0
Soil pH	4.7		
OM (%)	6.6		
CEC (meq/100g soil)	45.0		
Texture	silt loam		

All herbicide treated wheat yielded more grain than the untreated wheat except when treated with UBI-C4243 at 0.06 lb ai/a alone (Table 2). Wheat treated with triallate or diclofop alone yielded less grain than wheat treated with UBI-C4243 combined with triallate or diclofop. UBI-C4243 alone and combined with triallate reduced wheat stand and caused early crop injury, but did not reduce grain yield. Injury from UBI-C4243 appeared to be greatest in tractor wheel tracks created at seeding. Diclofop tank mixed with Sunit II injured wheat initially after treatment; however, injury was not evident later in the season. Thifensulfuron-tribenuron + bromoxynil injured wheat 21%. UBI-C4243 at all rates controlled mayweed chamomile, common lambsquarters, wild buckwheat and henbit 98% or greater. The late evaluation of wild oat control indicates that UBI-C4243 tank mixed with triallate or applied to the surface following soil incorporated triallate increased wild oat control 8 to 15% compared to triallate applied alone. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. UBI-C4243 combined with wild oat herbicides for weed control in soft white spring wheat

Treatment	Rate	Stage	Wheat Yield	Wheat Testwt	Wheat Str[1]	Wheat Inj[2]	ANTCO	CHEAL	POLCO	LAMAM	AVEFA[3] 1	AVEFA[3] 2
	lb ai/A		bu/A	lb/bu	%	%	---------	% control		---------		
control			12	58	--	--	--	--	--	--	--	--
UBI-C4243 + diclofop + Sun-It II[4]	0.045 0.75 1.0 pt	POPES 2-3 lf 2-3 lf	64	60	9	21	100	99	100	99	6	98
UBI-C4243 + diclofop + Sun-It II	0.06 0.75 1.0 pt	POPES 2-3 lf 2-3 lf	56	59	11	20	100	100	99	100	11	94
UBI-C4243 + diclofop + Sun-It II	0.09 0.75 1.0 pt	POPES 2-3 lf 2-3 lf	63	60	16	29	100	100	100	100	13	97
triallate + UBI-C4243	1.25 0.09	PPI POPES	58	59	19	23	100	99	100	100	97	88
triallate + UBI-C4243	1.25 0.06	PPI POPES	54	59	18	14	100	99	98	100	96	81
triallate + thifensulfuron-tribenuron + bromoxynil + R-11[5]	1.25 0.008 0.187 0.25%	PPI 2-3 lf 2-3 lf 2-3 lf	41	58	6	21	99	100	99	94	93	67
triallate + UBI-C4243	1.25 0.06	PPI PPI	56	58	7	8	99	98	99	100	97	82
triallate	1.25	PPI	36	58	10	4	0	0	0	0	94	73
UBI-C4243	0.06	POPES	19	58	11	13	100	99	99	100	14	0
diclofop + Sun-It II	0.75 1.0 pt	2-3 lf 2-3 lf	39	57	0	20	0	0	0	0	--	99
$LSD_{(0.05)}$			8	2	5	7	0.5	1	1	4	10	9
Weed density (plants/ft^2)							20	15	5	<1	15-25	

[1] stand reduction
[2] injury
[3] 1 effects of PPI and POPES treatments on June 6, 2 evaluation of all treatments on August 30
[4] methylated crop seed oil
[5] nonionic surfactant applied on a % v/v.

Effect of triasulfuron tank mixed with diclofop and HOE6001 on wild oat control in winter and spring wheat. Thompson, C.R. and D.C. Thill. Wild oat control can be reduced when certain broadleaf herbicides are tank mixed with diclofop compared to wild oat control with diclofop applied alone. Wild oat control with diclofop and HOE6001 (aryloxyphenoxy) applied alone or tank mixed with triasulfuron was evaluated 1 mile northwest of Bonners Ferry, Idaho in 'Westbred 906R' hard red spring wheat and two miles east of Potlatch in 'Madsen' soft white winter wheat. Each study was arranged in a split plot design and replicated four times. The main plots were aryloxyphenoxy (diclofop or HOE6001) rates and the subplots were triasulfuron rates. Plots were 8 by 30 ft at Bonners Ferry and 10 by 30 ft at Potlatch. Treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 38 psi and 3 mph (Table 1). Herbicide treatments were applied with R-11, a nonionic surfactant, at 0.25% v/v. Dark, low, cloud cover and wind halted treatment application at the Potlatch site; thus, treatments with HOE6001 were applied on April 30. Grain was harvested from a 4.5 by 27 ft area on August 28 and September 3 at Potlatch and Bonners Ferry, respectively.

Table 1. Application and soil analysis data

Location	Bonners Ferry	Potlatch	
Application date	May 29	April 23	April 30
Wheat stage	2.5 to 3 lf	5.5 to 6 lf	6 to 6.5 lf
Wild oat stage	1 to 3 lf	1 to 3 lf	1 to 3.5 lf
Broadleaf weed stage	--	0.5 to 2.5 in.	0.5 to 3 in.
Relative humidity (%)	58	50	96
Air temperature (F)	75	68	38
Soil temperature at 2 in. (F)	72	62	40
Wind (mph) - direction	2-S	4-W	4-E
Soil pH	7.6	6.6	
OM (%)	9.9	3.9	
CEC (meq/100g soil)	29.6	25.3	
Texture	silt loam	silt loam	

The experiments will be discussed separately because the location interaction was significant (combined analysis not shown).

At Potlatch, triasulfuron tank mixed with diclofop or HOE6001 did not reduce wild oat control compared to control with diclofop or HOE6001 applied alone (Table 2). Wild oat control with diclofop at 0.5 lb ai/a increased when triasulfuron at 0.0067 lb ai/a was added to the mix compared to diclofop at 0.5 lb ai/a applied alone. Triasulfuron controlled field pennycress and prickly lettuce 94 to 99% and mayweed chamomile 4 to 24%. Treatments containing the aryloxyphenoxy alone plus the residual triasulfuron in the spray equipment from the preceding treatment injured field pennycress and prickly lettuce 5 to 57%. Wheat treated with HOE6001 at 0.0375 lb ai/a yielded more grain than untreated wheat or wheat treated with diclofop at 0.5 to 0.75 lb ai/a. The grain yield and broadleaf weed control averages for each triasulfuron rate, averaged over aryloxyphenoxy rates, indicate that the application of triasulfuron reduced broadleaf weed competition and increased wheat grain yield. Wheat was not injured with any herbicide treatment.

At Bonners Ferry, triasulfuron tank mixed with diclofop or HOE6001 reduced wild oat control 5 to 12% compared to control with diclofop and HOE6001 applied alone when data were averaged over the aryloxyphenoxy rates (Table 3). Wheat grain yield was lower when triasulfuron at 0.0134 or more was applied when data were averaged over aryloxyphenoxy rates. Wheat was injured 4 to 6% with diclofop at 0.75 and 1.0 lb ai/a and 8 to 10% with HOE6001 at 0.0375 and 0.074 lb ai/a.

The inconsistent findings between the two locations indicate that triasulfuron antagonism of wild oat control with diclofop or HOE6001 may be environmentally influenced. Triasulfuron antagonized wild oat control with diclofop and HOE6001 when applications were made to spring wheat in late May when the air temperature was 75 F (Table 1). Wild oat control was not antagonized when treatments were applied to winter wheat and air temperatures were 68 and 38 F. (Idaho Agricultural Experiment Station, Moscow, ID 83843).

Table 2. Effect of triasulfuron on wild oat control with diclofop and HOE6001 in winter wheat, Potlatch, Idaho

Aryloxyphenoxy[1] Herbicide	Rate	Triasulfuron[1] rate	Wheat Yield	Wheat Inj[2]	AVEFA 7/3	AVEFA 8/13	THLAR	ANTCO	LACSE
	----lb ai/a----		bu/a	%	----------% control-----------				
None	0.0	0.0	77	0	0	0	0	0	0
		0.0067	80	0	1	0	99	4	98
		0.0134	77	0	1	0	99	11	99
		0.0268	81	0	6	0	99	30	99
		mean	78	0	2	0	74	11	74
diclofop	0.5	0.0	86	0	44	39	15	0	30
		0.0067	86	0	70	59	99	10	99
		0.0134	90	0	65	53	99	24	99
		0.0268	85	0	58	61	99	34	99
		mean	86	0	59	53	78	17	82
diclofop	0.75	0.0	74	0	82	66	23	0	17
		0.0067	85	0	78	73	99	11	99
		0.0134	87	0	78	60	99	6	99
		0.0268	84	0	84	68	99	19	99
		mean	83	0	80	67	80	9	78
diclofop	1.0	0.0	80	0	92	89	5	0	7
		0.0067	95	0	88	84	96	8	94
		0.0134	93	0	89	84	99	13	99
		0.0268	97	0	86	82	99	23	99
		mean	91	0	89	85	75	11	75
HOE6001	0.0185	0.0	83	0	88	73	23	0	13
		0.0067	94	0	88	75	99	6	99
		0.0134	94	0	89	73	99	16	99
		0.0268	93	0	87	66	99	20	99
		mean	91	0	88	72	80	11	78
HOE6001	0.0375	0.0	103	0	98	94	46	0	57
		0.0067	102	0	99	97	99	23	99
		0.0134	102	0	96	92	99	21	99
		0.0268	107	0	93	91	99	15	99
		mean	103	0	96	93	86	15	88
HOE6001	0.074	0.0	85	0	99	97	24	0	32
		0.0067	94	0	99	95	99	3	99
		0.0134	97	0	99	98	99	18	99
		0.0268	97	0	99	97	99	14	99
		mean	93	0	99	97	80	8	82
triasulfuron	mean[3]	0.0	84	0	72	66	19	0	22
	mean	0.0067	91	0	75	66	99	9	98
	mean	0.0134	91	0	74	66	99	16	99
	mean	0.0268	92	0	73	69	99	22	99
$LSD_{(0.05)}$	aryloxyphenoxy		12	--	12	19	NS	NS	NS
	triasulfuron		4	--	NS	NS	10	5	11
	aryloxyphenoxy by triasulfuron		NS	--	8	11	NS	NS	NS

[1] herbicide treatments applied with 0.25% v/v nonionic surfactant 'R-11'
[2] injury
[3] averaged over aryloxyphenoxy rates

Table 3. Effect of triasulfuron on wild oat control with diclofop or HOE6001 in spring wheat, Bonners Ferry, Idaho

Aryloxyphenoxy[1]		Triasulfuron[1]	Wheat		AVEFA	
Herbicide	Rate	rate	Yield	Injury	7/11	8/5
	------ lb ai/a	------	bu/a	%	-% control-	
none	0.0	0.0	26	0	0	0
		0.0067	25	0	0	0
		0.0134	26	0	0	0
		0.0268	26	0	0	1
		mean	26	0	0	0
diclofop	0.5	0.0	30	0	16	28
		0.0067	30	0	10	23
		0.0134	28	0	16	29
		0.0268	29	0	15	26
		mean	29	0	14	26
diclofop	0.75	0.0	35	4	67	80
		0.0067	38	5	64	73
		0.0134	34	5	54	62
		0.0268	32	1	39	56
		mean	35	4	56	68
diclofop	1.0	0.0	44	6	78	86
		0.0067	46	5	73	81
		0.0134	46	5	76	78
		0.0268	38	6	60	71
		mean	43	6	72	79
HOE6001	0.0185	0.0	36	0	19	25
		0.0067	33	0	17	21
		0.0134	33	0	11	19
		0.0268	29	0	3	12
		mean	33	0	13	19
HOE6001	0.0375	0.0	41	8	80	90
		0.0067	37	8	69	78
		0.0134	35	9	67	80
		0.0268	36	8	66	76
		mean	37	8	70	81
HOE6001	0.074	0.0	46	10	95	97
		0.0067	46	10	92	85
		0.0134	44	9	86	95
		0.0268	47	9	92	95
		mean	46	9	91	93
triasulfuron	mean[2]	0.0	37	4	51	58
	mean	0.0067	37	4	46	52
	mean	0.0134	35	4	44	52
	mean	0.0268	34	4	39	48
$LSD_{(0.05)}$	aryloxyphenoxy		7	3	23	9
	triasulfuron		2	NS	5	4
	aryloxyphenoxy by triasulfuron		NS	NS	NS	NS

[1] herbicide treatments applied with 0.25% v/v nonionic surfactant 'R-11'
[2] averaged over aryloxyphenoxy rates

Control of annual bromes and Italian ryegrass using triallate in winter wheat with varying levels of crop residue. Aldrich-Markham, Susan. The purpose of the study was to evaluate the effectiveness of triallate for controlling annual bromes (cheat, soft brome and ripgut brome) and Italian ryegrass in winter wheat planted in fields with crop residue on the soil surface. The triallate label indicates that fields should be worked to remove as much surface residue as possible before applying the herbicide, because residue will inactivate the herbicide. Two cultivations are recommended prior to spraying a field that is not plowed. Growers with fields classified by the Soil Conservation Service as "Highly Erodible Land," however, are required under the Farm Bill to use minimum tillage, leaving at least 30% residue on the soil surface. For controlling annual bromes and Italian ryegrass that is resistant to diclofop-methyl, triallate applied pre-emergence, followed (if the weed population is high) by metribuzin applied later in the fall, is the best herbicide option. Since these weeds are significant problems in winter wheat in Western Oregon, it was important to learn whether this weed control program could work for wheat growers using minimum tillage.

Three growers in Yamhill and Polk counties cooperated in the study. The treatments were high, medium and low levels of residue. Control plots had low residue and no triallate. The plots were the width of the grower's boom by 30 ft long. The three replications were laid end-to-end, so the triallate could be sprayed in one pass, shutting off the sprayer over the control plots. Before the triallate was applied, the residue levels in the plots were adjusted by spreading straw on the soil surface. The "low" treatment was the original residue level of the field, and the "medium" and "high" treatments were 20 and 40 percent higher. The levels were measured by the Soil Conservation Service method -- laying a 50-ft tape diagonally across the plots, counting the pieces of residue intersecting the 12-in marks, then dividing that number by 50 and multiplying by 100 to get the percent ground cover.

Two growers planted the wheat, then applied the triallate at 1.25 lb ai/a, incorporating it into the soil by pulling a harrow behind the boom. The third grower (Field 3) pulled the boom and the harrow directly behind the planter. Some wheat injury (30%) occurred in this field, because the seed was not planted below the zone of triallate in the soil. The fields were planted in mid-October, and all received a good rain within a week of the triallate application (triallate effectiveness is reduced if it is applied to dry soil and a good rainfall does not occur within 7 days of application).

The plots were evaluated visually in mid-December 1990. The table shows the percent control of Italian ryegrass and annual bromes. In Field 1, diuron was applied in November, prior to the evauation. In Field 3, metribuzin was applied in November, and evaluations made both before and after the application are included. Average density of the grass weeds in the control plots is also shown. In Fields 1 and 2 there was no significant difference among the treatments in the performance of triallate at three levels of crop residue. In Field 3 the Least Significant Difference was 14. The trend in the three fields was a decrease in the performance of triallate as the level of crop residue increased, but it was not statistically significant, due to the large variation in the percent control among the plots.

Based on these data, triallate appears to be a good option for controlling annual bromes or diclofop-resistant Italian ryegrass in minimum-till fields at the 30% level of residue. Triallate alone, however, will not give adequate control if there is a high population of these weeds in the field. It needs to be followed with another herbicide such as metribuzin. The stand of brome was so dense in Field 3 that even triallate plus metribuzin did not give adequate control. (Oregon State University Extension Service, Yamhill County, 2050 Lafayette Avenue, McMinnville, OR 97128)

Italian ryegrass and brome control using triallate in winter wheat with crop residue

Field 1		Field 2		Field 3		
Residue	Control	Residue	Control	Residue	Control	
-------- %	----------	-------- %	---------	--- % ---	----- %	-----------
	w/diuron					w/metribuzin
10	90	1	90	10	62	75
30	85	20	73	30	57	67
50	78	40	83	50	47	62
LSD_{05}	NS	LSD_{05}	NS	LSD_{05}	14	
Italian ryegrass 15-25 plants/ft^2		Italian ryegrass 20-30 plants/ft^2		Bromes 100-400 plants ft^2 30% wheat injury		

Control of wild oats in winter wheat. Aldrich-Markham, Susan, and Paul Camuso. Growers have limited crop rotation options in the season following an application of imazamethabenz for wild oat control. Wheat, barley, sunflowers, corn, soybeans, safflower, edible beans and potatoes are the only crops that may be planted within 15 months. If imazamethabenz were effective at a reduced rate when combined with another wild oat herbicide, the rotation interval might be reduced.

A combination of imazamethabenz plus difenzoquat at half rates was compared to diclofop-methyl, difenzoquat and imazamethabenz at maximum labeled rates in two winter wheat fields in Polk County of Western Oregon. The experimental design was a randomized complete block with four replications and 9 by 25 ft plots. The herbicides were applied using a CO_2 backpack sprayer with a six-nozzle boom. The nozzles were 8003 flat fans, and the spray volume was 27 gal/a. The Moritz field was treated on March 26, 1991, when the wild oats were at the 3- to 4-leaf stage. The DeJong field was treated on April 11, 1991, when the wild oats had 3 tillers, with 5 to 6 leaves on the main tiller. The fields were evaluated visually July 1, 1991.

The combination of difenzoquat and imazamethabenz at half rates did not give acceptable wild oat control in either field. In the DeJong field diclofop-methyl gave zero control in all four replications, indicating a possibility of herbicide resistance -- a growing problem in the area. Difenzoquat performed the best in the DeJong field, giving an average of 98% wild oat control, while imazamethabenz gave an average of 58% control. In the Mortiz field the reverse occurred; imazamethabenz gave an average of 91% control, while difenzoquat gave an average of 53% control. A difference between the fields that could explain this difference in performance was the stage of wild oat growth when the herbicides were applied. The difenzoquat worked better in the field where the wild oats were larger, and the imazamethabenz worked better where the wild oats were small. (Oregon State University Extension Service, Yamhill County, 2050 Lafayette Avenue, McMinnville, OR 97128, and West Valley Farmers, Sheridan, OR 97378.)

Wild oat control in winter wheat

Herbicide	Rate	DeJong	Moritz
	(lb ai/a)	------(% Control)------	
diclofop-methyl	1.0	0	75
difenzoquat[1]	1.0	98	53
imazamethabenz[1]	0.47	58	91
difenzoquat + imazamethabenz[1]	0.5 + 0.24	45	55
check	0	0	0

[1] Spray Booster S surfactant (non-ionic, 90% ai) was added at 0.25% v/v.

Blackgrass control in winter wheat. Brewster, B.D., W.S. Donaldson, Susan Aldrich-Markham, and A.P. Appleby. Blackgrass is a European winter annual weed infesting fields in Yamhill County of western Oregon. The weed infestation has been slowly spreading for several years. Herbicide treatments were applied at two timings to assess their effectiveness. The same treatments were applied on the Rossner and Harding farms. The trial design was a randomized complete block with four replications and 2.5 by 8 m plots. The herbicides were applied in a water carrier volume of 234 L/ha at a pressure of 172 kPa through XR 8003 flat fan nozzle tips. The EPOE treatments were applied at the two-leaf stage and the LPOE treatments at the three- to five-tiller stage of growth on the blackgrass. The application dates for the EPOE treatments were November 6, 1990, at the Harding site and November 16, 1990, at the Rossner site. The LPOE treatments were applied on January 22, 1991, at both sites.

Diclofop-methyl was more effective at the EPOE timing at both sites, but control at the Harding site was not adequate at either timing. The repeated metribuzin treatment was more effective than the single application at both sites. The most effective herbicide at both timings at both sites was fenoxaprop-ethyl. None of the treatments caused significant injury to the wheat. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002)

Blackgrass control at two sites in western Oregon

Herbicide	Rate	Timing	Blackgrass Control Rossner	Blackgrass Control Harding
	(kg a.i./ha)		(%)	(%)
diclofop-methyl	1.1	EPOE	93	65
fenoxaprop-ethyl	0.08	EPOE	99	94
metribuzin +	0.16	EPOE		
metribuzin	0.4	LPOE	100	84
metribuzin	0.6	LPOE	94	59
diclofop-methyl	1.1	LPOE	83	33
fenoxaprop-ethyl	0.08	LPOE	99	99
check	0		0	0

Blackgrass control in winter wheat. Boerboom, C.M. Blackgrass (ALOMY), a winter annual grass, has the potential to become a serious threat to winter wheat production in Eastern Washington. An experiment was established to evaluate the efficacy of several herbicides in controlling blackgrass in winter wheat.

A site near Pullman, WA with a heavy infestation of blackgrass was seeded with 100 lb/a of 'Cashup' winter wheat on October 10, 1990 in seven inch rows by the cooperating farmer. The experimental design was a randomized complete block with four replications. Plots measured 10 by 20 ft. Blackgrass density ranged from 200 plants/ft^2 in the first replication to 30 plants/ft^2 in the fourth replication. Early treatments were applied on April 1, 1991 when the blackgrass ranged from seedlings to plants with six leaves and three tillers; winter wheat had five leaves and two tillers. Late treatments were applied on April 21 when the blackgrass had two to five tillers and was 2 to 6 in. tall; winter wheat had four to six tillers and was 8 to 10 in. tall. Herbicides were applied with CO_2 pressurized backpack sprayer (Table 1).

Both early and late treatments that included fenoxaprop gave excellent blackgrass control. Fenoxaprop treatments that included 2,4-D and MCPA also controlled the occasional field pennycress, mayweed chamomile, and prickly lettuce present in the trial. Although diclofop-methyl and imazamethabenz did not provide complete blackgrass control, the suppression increased wheat yields. (Department of Crop and Soil Sciences, Washington State Univ., Pullman, WA 99164).

Table 1. Application data

Date	April 1, 1991	April 21, 1991
Timing	early	late
Air temperature (F)	63	73
Soil temperature (F)	66	66
Relative humidity (%)	50	42
Wind direction/speed	N/5-7	W/4
Volume (gpa)	10	10
Soil pH	5.8	
OM (%)	2.73	
CEC (meq/100g soil)	20.3	
Texture	silt loam	

Table 2. Blackgrass control in winter wheat

Treatment	Rate[1]	Time[2]	ALOMY control	Yield
	(lb ai/a)		(%)	(bu/a)
check	-	-	0	69
diclofop-methyl	1.0	early	48	84
imazamethabenz	0.47	early	51	89
fenoxaprop-ethyl + fenchlorazole	0.048 0.026	early	100	90
fenoxaprop-ethyl + fenchlorazole	0.048 0.026	late	100	89
fenoxaprop-ethyl + fenchlorazole	0.058 0.032	late	100	88
fenoxaprop-ethyl + 2,4-D + MCPA	0.16 0.12* 0.38*	early	95	86
fenoxaprop-ethyl + 2,4-D + MCPA	0.16 0.12* 0.38*	late	100	90
fenoxaprop-ethyl + 2,4-D + MCPA	0.19 0.15* 0.44*	late	100	95
LSD (0.05)			10	12

[1]Rates with * are lb ae/a.
[2]Early treatments were applied on April 1; late treatments on April 21.

Field bindweed control in fallow and winter wheat with early summer treatments. Miller, S.D. and T. Neider. Plots were established under dryland conditions near Wheatland, WY to evaluate the efficacy of prebloom herbicide treatments for field bindweed control in fallow and the subsequent crop. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi May 25, 1990 (air temp. 75F, relative humidity 13%, wind calm, sky clear and soil temp. - 0 inch 85F, 2 inch 78F and 4 inch 61F) to field bindweed with 4 to 6 inch runners. Winter wheat (var. Buckskin) was seeded September 17, 1990 in a sandy loam soil (67% sand, 18% silt and 15% clay) with 1.4% organic matter and pH 7.9. Visual weed control ratings were made June 18 and July 20, 1990 and June 11 and July 23, 1991. Winter wheat tolerance was evaluated June 11, plant height measured July 23 and plots harvested July 23, 1991. Field bindweed (CONAR) infestations were heavy and uniform throughout the experimental site.

Field bindweed control, 15 months following herbicide application, exceeded 80% with all BAS-514 treatments and picloram treatments at 0.25 lb/A. Wheat injury was evident with picloram at 0.125 lb/A or higher. Wheat yields related closely to field bindweed control and were 10 to 32 bu/A higher in herbicide treated compared to weedy check plots. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1807)

Field bindweed control in fallow with early summer treatments and subsequent wheat response

Treatment[1]	Rate lb ai/A	% CONAR Control[2] months after treatment 1	2	13	15	Winter wheat[2] Inj %	SR %	Height inches	Yield bu/A
BAS-514+BCH864	0.25	70	87	80	83	0	0	38	41
BAS-514+BCH864	0.5	75	99	85	92	0	0	38	44
BAS-514+glyp/2,4-D+BCH864	0.25+1.4	93	93	82	83	0	0	37	43
BAS-514+glyp/2,4-D+BCH864	0.5+1.4	97	97	93	94	0	0	37	44
BAS-514+2,4-D+BCH864	0.25+1.0	95	94	80	82	0	0	38	41
BAS-514+2,4-D+BCH864	0.5+1.0	97	96	92	93	0	0	38	45
BAS-514+dicamba+BCH864	0.25+0.5	94	96	80	85	0	0	37	42
BAS-514+dicamba+BCH864	0.5+0.5	94	97	93	96	0	0	39	44
BAS-514+picloram+BCH864	0.25+0.063	91	95	80	83	0	0	37	43
BAS-514+picloram+BCH864	0.5+0.063	96	100	95	95	2	0	37	44
BAS-514+picloram+BCH864	0.25+0.125	98	98	85	90	7	0	38	43
picloram+2,4-D	0.125+1.0	99	95	73	78	5	0	38	41
picloram+2,4-D	0.25+1.0	99	98	88	88	12	3	38	38
picloram+dicamba	0.125+0.5	91	96	70	75	5	0	39	44
picloram+dicamba	0.25+0.5	93	96	85	90	13	7	39	40
picloram+glyp/2,4-D	0.125+1.4	93	94	80	80	3	0	39	44
picloram+glyp/2,4-D	0.25+1.4	97	98	87	90	12	7	39	40
sulphosate+X-77	1.0	20	13	7	7	0	0	34	24
sulphosate+X-77	1.0*	20	20	13	13	0	0	33	24
sulphosate+X-77	1.5	22	17	20	23	0	0	34	23
sulphosate+X-77	2.0	33	17	27	30	0	0	34	25
sulphosate+X-77	2.5	32	22	47	50	0	0	33	31
glyphosate	2.0	40	25	53	60	0	0	33	28
untreated check	- - - -	0	0	0	0	0	0	30	13

[1] Treatments applied May 25, 1990; X-77 applied at 0.5% v/v except* treatment at 0.25% v/v, BCH864 applied at 3 pt/A and / = package mix.
[2] Field bindweed control visually evaluated June 18 and July 20, 1990 and June 11 and July 23, 1991.
[3] Wheat injury (inj) and stand reduction (SR) visually evaluated June 11, plant height measured July 23 and plots harvested July 23, 1991.

Winter wheat response to clomazone with and without phorate. Miller, S.D., T. Neider and F. Hruby. Plots were established under dryland conditions at the Research and Extension, Archer, WY to evaluate downy brome control and winter wheat tolerance with preplant and preemergence applications of clomazone with and without in furrow applications of phorate. Plots were 9 by 30 ft. with three replications in a factorial arrangement. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi. Phorate treatments were applied in furrow at the time of planting with a Gandy applicator mounted on the backside of a Haybuster drill. Preplant treatments were applied, winter wheat (var. Buckskin) seeded and preemergence treatments applied September 6, 1990 (air temp. 77F, relative humidity 40%, wind calm, sky partly cloudy and soil temp. - 0 inch 85F, 2 inch 72F and 4 inch 68F). The soil was a loam (49% sand, 27% silt and 24% clay) with 1.5% organic matter and pH 7.4. Downy brome control was visually evaluated April 29, winter wheat damage visually evaluated April 29 and May 23, plant height measured June 25 and plots harvested July 29, 1991. Downy brome (BROTE) infestations were heavy but variable throughout the experimental site.

Winter wheat tolerance to clomazone was greater with preplant than preemergence applications. Phorate reduced wheat damage with clomazone. Phorate safening of wheat to clomazone was almost complete with preplant applications but only partial with preemergence applications. Downy brome control was similar with preplant or preemergence applications of clomazone and was not influenced by phorate. Wheat yields reflected wheat injury and/or downy brome control. Future studies need to be conducted under weed-free conditions. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1800)

Winter wheat response to clomazone with and without phorate

Clomazone[1] lb ai/A	Appli- cation	% Injury April	% Injury May	Wheat[2] SR %	Height inches	Yield bu/A	Brote[3] Control %
none							
0.0	- -	0	0	0	27	16	0
0.125	PP	8	2	10	26	27	88
0.25	PP	15	5	13	28	25	93
0.125	PE	50	15	28	26	18	90
0.25	PE	60	15	33	26	16	92
	Mean	27	7	17	27	20	73
phorate 0.8 oz/1000 ft							
0.0	- -	2	0	0	27	14	0
0.125	PP	2	0	3	27	28	88
0.25	PP	3	0	7	29	28	93
0.125	PE	30	12	23	27	24	92
0.25	PE	57	17	32	28	20	93
	Mean	19	6	13	28	23	73
phorate 1.6 oz/1000 ft							
0.0	- -	3	0	3	27	14	0
0.125	PP	0	0	0	26	26	88
0.25	PP	5	0	10	27	28	95
0.125	PE	17	0	17	27	22	90
0.25	PE	50	13	33	26	21	92
	Mean	15	3	13	27	22	73
Application mean:							
	PP	6	1	7	27	27	91
	PE	44	12	28	27	20	92
Rate mean:							
	0.125	18	5	14	27	24	89
	0.25	31	8	21	27	23	93

[1] Preplant (PP) and preemergence (PE) treatments applied September 6, 1990.
[2] Wheat injury visually evaluated April 29 and May 23, stand reduction April 29, plant height measured June 25 and plots harvested July 29, 1991.
[3] Downy brome control visually evaluated April 29, 1991.

Winter wheat response to picloram at various plant back intervals. Miller, S.D., T. Neider and F. Hruby. Picloram was applied at rates of 0.125 to 0.5 lb/A at several dates during the fallow period to evaluate the tolerance of winter wheat at various plant back intervals. Plots were established under dryland conditions at the Research and Extension Center, Archer, WY and were 9 by 30 ft. with three replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi June 5 (air temp. 63F, relative humidity 43%, wind NE at 3 mph, sky clear and soil temp. - 0 inch 95F, 2 inch 66F and 4 inch 59F), July 9 (air temp. 75F, relative humidity 70%, wind SW at 5 mph, sky clear and soil temp. - 0 inch 89F, 2 inch 76F and 4 inch 73F) or August 16, 1990 (air temp. 80F, relative humidity 30%, wind NW at 4 mph, sky cloudy and soil temp. - 0 inch 90F, 2 inch 84F and 4 inch 80F). These application dates corresponded to treatments applied 12, 6 and 2 weeks before wheat seeding. Winter wheat (var. Buckskin) was seeded no-till September 6, 1990 in a loam soil (49% sand, 27% silt and 24% clay) with 1.5% organic matter and pH 7.2. Visual crop damage was evaluated April 29, May 23 and June 12, plant height determined June 25 and plots harvested July 29, 1991. Plots were maintained weed free throughout the season by hand hoeing.

Winter wheat tolerance to picloram was influenced by plant back interval and rate. Greatest injury and stand reductions were observed with picloram at 0.25 and 0.5 lb/A applied 2 weeks before planting. Wheat damage was also substantial with the high rate applied 6 weeks before planting. Wheat yields were 8 to 19 bu/A lower in these treatments than in the untreated check. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1808)

Winter wheat response to picloram at various plant back intervals

		Wheat[2]					
	Rate	% Injury			SR	Height	Yield
Treatment[1]	lb ai/A	April	May	June	%	inches	bu/A
2 week before planting							
picloram+2,4-D	0.125+1.0	13	7	7	0	35	43
picloram+2,4-D	0.25+1.0	20	17	23	13	34	33
picloram+2,4-D	0.5+1.0	40	28	33	15	29	25
	Mean	24	17	21	12	33	34
6 week before planting							
picloram+2,4-D	0.125+1.0	5	0	2	0	36	43
picloram+2,4-D	0.25+1.0	5	3	5	0	34	44
picloram+2,4-D	0.5+1.0	13	7	13	10	32	36
	Mean	8	3	7	3	34	41
12 week before planting							
picloram+2,4-D	0.125+1.0	0	0	0	0	35	43
picloram+2,4-D	0.25+1.0	2	0	0	0	36	44
picloram+2,4-D	0.5+1.0	5	0	7	0	33	42
	Mean	3	0	3	0	35	43
untreated check		0	0	0	0	35	44

[1] Treatments applied June 5, July 9 and August 16, 1990.
[2] Wheat injury visually evaluated April 29, May 23 and June 12, stand reduction April 29, plant height measured June 25 and plots harvested July 29, 1991.

Application method and weed control with sulfonyl urea herbicides in winter wheat. Miller, S.D., T. Neider and J.M. Krall. Plots were established under dryland conditions at the Research and Extension Center, Torrington, WY to evaluate the influence of application method on weed control and crop response with several sulfonyl urea herbicides. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Winter wheat (var. Buckskin) was seeded September 17, 1990 in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2% organic matter and pH 7.5. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi preemergence (PE) September 18 (air temp. 78F, relative humidity 43%, wind NW at 3 mph, sky partly cloudy and soil temp. - 0 inch 101F, 2 inch 78F and 4 inch 62F) or postemergence (Post) October 19, 1990 (air temp. 61F, relative humidity 45%, wind E at 5 mph, sky cloudy and soil temp. - 0 inch 60F, 2 inch 48F and 4 inch 45F) to 3 to 4-leaf winter wheat and emerging weeds. Half of the preemergence treatments were incorporated (PEI) immediately after application with a rake operating at a depth of 0.5 to 1 inch. Visual weed control evaluations were made May 2, visual crop damage evaluations April 11 and May 2, plant height measured June 18 and plots harvested July 15, 1991. Downy brome (BROTE) and tansymustard (DESPI) infestations were heavy and uniform throughout the experimental site.

PE and PEI applications of trisulfuron, chlorsulfuron or chlorsulfuron plus metsulfuron caused 0 to 40% injury and reduced winter wheat stands 15 to 85%. PEI applications were more injurious than PE applications and chlorsulfuron/metsulfuron or chlorsulfuron more injurious than trisulfuron. Tansymustard control was excellent with all herbicides regardless of application method; however, downy brome control was 16 to 30% better with PEI than PE applications. Post applications had very little activity on downy brome regardless of herbicide. Wheat yields ranged from 7 bu/A lower to 10 bu/A higher in herbicide treated compared to weedy check plots and related closely to injury and/or weed control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1801)

Application method and weed control in winter wheat

			Wheat[2]					Weed control[3]	
	Appli-	Rate	% Injury		SR	Height	Yield	BROTE	DESPI
Treatment[1]	cation	lb ai/A	April	May	%	Inches	bu/A	%	%
trisulfuron	PEI	0.026	15	15	65	37	42	87	100
trisulfuron	PE	0.026	0	0	15	36	54	67	100
trisulfuron+X-77	POST	0.026	0	0	0	34	50	20	100
chlorsulfuron(CLSU)	PEI	0.023	23	30	80	34	33	30	100
chlorsulfuron	PE	0.023	17	23	48	33	44	0	100
chlorsulfuron+X-77	POST	0.023	0	0	0	34	50	0	100
clsu/metsulfuron	PEI	0.023	28	40	85	35	35	83	100
clsu/metsulfuron	PE	0.023	15	22	60	36	39	67	100
clsu/metsulfuron+X-77	POST	0.023	0	0	0	35	50	23	100
weedy check	- - -	- - -	0	0	0	35	44	0	0

[1] Preemergence incorporated (PEI), preemergence (PE) and postemergence (POST) treatments applied September 18, 18 and October 19, 1990; respectively. X-77 included at 0.25% v/v with all postemergence treatments and / = package mix.
[2] Crop injury visually evaluated April 11 and May 2, stand reduction (SR) April 11, plant height measured June 18 and plots harvested July 15, 1991.
[3] Weed control visually evaluated May 2, 1991.

Application time and rate of UBI-C4243 affect weed control in winter wheat. Thompson, C.R., M.J. Dial, and D.C. Thill. An experiment was established in the fall of 1990 to determine the optimum UBI-C4243 application rate and time in winter wheat. All soil applied herbicide treatments were applied with a CO_2 backpack sprayer equipped with 80015 nozzles delivering 112 L/ha at 186 kPa and wheat was seeded on October 18, 1990. Preplant incorporated (PPI) treatments were applied and incorporated twice with a spike-tooth harrow and preplant surface (PPS) treatments were applied (Table 1). 'Hill-81' soft white winter wheat was seeded at 90 kg/ha in 18 cm rows 5 cm deep. Postplant, preemergence incorporated (POPI) treatments were applied and incorporated twice with a spike-tooth harrow followed by application of postplant preemergence surface (POPS) treatments. Postemergence treatments were applied with a CO_2 backpack sprayer equipped with 8001 nozzles delivering 112 L/ha at 276 kPa to 1 to 4 cm volunteer rape and mayweed chamomile (ANTCO) and to 5-leaf (lf) wheat on April 18, 1991.

Wheat plants/m of row and weed species plant number/0.1 m^2 were counted on May 2. Wheat spikes, wheat biomass, and weed species biomass/0.16 m^2 were determined on August 5. Two density and biomass samples were taken from each experimental plot. Wheat grain was harvested from a 15.5 m^2 area on August 23.

The study was a split plot design with application times as the main plots and herbicide treatments as the subplots. An untreated control and a thifensulfuron-tribenuron (DPX-9674) + bromoxynil treatment were included within each main plot for comparison as a standard treatment. Experimental units were 3.0 by 12.2 m.

Table 1. Application and soil analysis data

Application timing	PPI	PPS	POPI	POPS	POST
Air temperature (C)	13	13	9	9	13
Soil temperature at 2 in. (C)	8	8	8	8	13
Relative humidity (%)	41	41	50	50	74
Wind speed (km/h)-direction	0	0	5-NW	5-NW	3-NW
Soil moisture condition	wet	wet	wet	wet	wet
pH	5.6				
OM (%)	2.9				
CEC (meq/100g soil)	19.4				
Texture	silt loam				

All UBI-C4243 treatments reduced wheat density compared to the untreated control (Table 2). All herbicide treated wheat produced more spikes and biomass/m^2 than untreated wheat. Wheat treated with UBI-C4243 at 70 or 101 g ai/ha or thifensulfuron-tribenuron + bromoxynil yielded more grain than the untreated wheat. These data indicate that although UBI-C4243 reduced wheat stand, it provided weed control which allowed the crop to compensate for the fewer plants, thus grain yield was not reduced. UBI-C4243 controlled henbit (LAMAM), field pennycress (THLAR), prickly lettuce (LACSE), common lambsquarter (CHEAL), and red sandspurry (SPBRU) (Table 3). Mayweed chamomile (ANTCO) plant number and biomass were reduced by all herbicide treatments compared to the untreated mayweed chamomile (Table 3). (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Wheat response to UBI-C4243 rates and application times

Treatment	Rate	Grain yield: Application timing PPI	PPS	POPI	POPS	Trt Mean	Grain test weight: Application timing PPI	PPS	POPI	POPS	Trt Mean
	g ai/ha	kg/ha					g/L				
control	0	3492	4004	3869	4017	3845	745	741	744	743	743
UBI-C4243	70	4062	4581	4284	4300	4306	745	743	737	732	739
UBI-C4243	101	4088	4542	4099	4368	4274	727	736	744	735	736
UBI-C4243	140	3828	4029	3956	4170	3996	729	731	735	736	733
thifensulfuron-tribenuron+brox[1,2]	280+26	3750	4469	4141	4312	4168	728	725	730	726	727
Timing Mean		3844	4325	4070	4233		735	735	738	734	

$LSD_{(0.05)}$ Trt[3]=239 Timing=NS Trt by Timing=NS; Trt=9 Timing=NS Trt by Timing=NS

Treatment	Rate	Wheat density: Application timing PPI	PPS	POPI	POPS	Trt Mean	Spike density: Application timing PPI	PPS	POPI	POPS	Trt Mean
	g ai/ha	plants/m²					spikes/m²				
control		135	150	110	106	125	404	487	411	443	436
UBI-C4243	70	103	129	71	111	103	491	592	516	498	524
UBI-C4243	101	89	117	103	105	103	566	551	383	566	516
UBI-C4243	140	85	97	80	98	90	523	471	511	595	525
thifensulfuron-tribenuron+brox[1,2]	280+26	115	102	103	122	110	559	555	526	568	552
Timing Mean		105	119	93	108		509	531	469	534	

$LSD_{(0.05)}$ Trt=20 Timing=NS Trt by Timing=NS; Trt=65 Timing=NS Trt by Timing=NS

Treatment	Rate	Shoot biomass: Application timing PPI	PPS	POPI	POPS	Trt Mean
	g ai/ha	g/m²				
control		1396	1764	1455	620	1559
UBI-C4243	70	1769	2177	1779	1872	1899
UBI-C4243	101	1910	1924	1542	2039	1854
UBI-C4243	140	2133	1654	1927	2148	1965
thifensulfuron-tribenuron+brox[1,2]	26+280	1858	1988	1759	1948	1888
Timing Mean		1813	1901	1692	1925	

$LSD_{(0.05)}$ Trt=215 Timing=NS Trt by Timing=NS

[1] bromoxynil
[2] Herbicide treatment was applied with R-11 at 0.25% v/v.
[3] Treatment

Table 3. Weed species response to herbicide treatments averaged over application times

Treatment	Rate	Plant density					
		LAMAM	ANTCO	THLAR	Rape[1]	CHEAL	LACSE
	g ai/ha	plants/m^2					
control	0	8	236	7	10	1	2
UBI-C4243	70	0	31	1	1	0	0
UBI-C4243	101	0	45	0	1	0	0
UBI-C4243	140	0	26	0	0	0	0
thifensulfuron-tribenuron + bromoxynil[2]	26+280	2	26	0	0	0	0
LSD $_{(0.05)}$		3	53	3	3	1	1

Treatment	Rate	Shoot biomass					
		ANTCO	THLAR	Rape[1]	CHEAL	LACSE	SPBRU
	g ai/ha	g/m^2					
control	0	174	4	55	8	49	14
UBI-C4243	70	39	1	22	0	0	0
UBI-C4243	101	51	0	22	1	0	1
UBI-C4243	140	21	0	4	0	0	0
thifensulfuron-tribenuron + bromoxynil[2]	26+280	9	0	1	0	0	0
LSD $_{(0.05)}$		73	4	40	3	0	6

Treatment	Rate	Visual evaluation			
		ANTCO	Rape[1]	LACSE	THLAR
	g ai/ha	% control			
control	0	--	--	--	--
UBI-C4243	70	85	92	99	93
UBI-C4243	101	95	98	100	100
UBI-C4243	140	98	99	100	100
thifensulfuron-tribenuron + bromoxynil[2]	26+280	97	100	100	100
LSD $_{(0.05)}$		8	3	<1	7

[1] Volunteer *Brassica napus* and *Brassica compestris*
[2] Herbicide treatment was applied with R-11 at 0.25% v/v.

Winter annual brome control in winter wheat. Thompson, C.R., M.J. Dial, and D.C. Thill. Poverty, ripgut and downy brome (*Bromus* species) control were evaluated in winter wheat south of Lewiston, Idaho in the Tammany area. Preplant surface (PPS) treatments were applied on November 1, 1990, 'Hawk' hard red winter wheat was seeded at 105 lb/a on November 2, and postplant surface (POPES) treatments were applied on November 3. Spring postemergence treatments were applied to 3.5 to 4-leaf (1f) wheat, 1 to 3-tiller *Bromus* species, and 1 to 3-in. pinnate tansymustard (DESPI) and bur chervil (ANRCA) on April 2, 1991 (Table 1). All treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 3 mph. The fall (PPS and POPES) treatments were applied with 80015 nozzles and 20 psi and the spring treatments were applied with 8001 nozzles and 40 psi. Treatments were arranged in a randomized complete block design and replicated four times. Plots were 10 by 30 ft. Wheat injury and brome control were evaluated visually on April 29 and brome and broadleaf weed control were evaluated visually on May 24. Grain was harvested with a small plot combine from a 4.5 by 27 ft area on August 9.

Table 1. Application and soil analysis data

Application timing	PPS	POPES	3 1f
Temperature (F)	44	38	50
Soil temperature at 2 in. (F)	46	36	50
Relative humidity (%)	60	68	73
Wind speed (mph) - direction	2-S	5-S	5-S
Soil pH	5.3		
OM (%)	3.7		
CEC (meq/100g soil)	25.3		
Texture	silt loam		

Hail damaged the wheat on June 19; thus, grain yield was lower than expected. UBI-C4243 treated wheat yielded more grain than untreated or other herbicide treated wheat (Table 2). UBI-C4243 controlled the *Bromus* species 85 to 95% on April 29 and 60 to 90% on May 24. UBI-C4243 controlled tansymustard but did not control bur chervil. Atrazine injured wheat 5% on April 29. Hexazinone did not control brome and broadleaf species adequately. Chlorsulfuron-metsulfuron alone or combined with hexazinone controlled tansymustard and bur chervil. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Winter annual brome and broadleaf weed control in no-till winter wheat

Treatment	Rate	Stage	Wheat Yield	Wheat Inj[1]	*Bromus* sp.[2] 4/29	*Bromus* sp.[2] 5/24	DESPI	ANRCA
	lb ai/a		bu/a	%	% control			
control	0.0		16	--	--	--	--	--
atrazine	0.5	PPS	24	5	34	20	0	0
UBI-C4243	0.188	PPS	34	0	85	78	99	9
diclofop	1.0	POPES	22	0	14	8	0	0
UBI-C4243	0.188	POPES	32	0	88	61	99	4
UBI-C4243	0.38	POPES	36	1	95	90	99	4
hexazinone	0.0313	3-lf	19	0	5	10	1	8
hexazinone	0.0625	3-lf	17	0	3	5	1	18
hexazinone	0.125	3-lf	16	0	0	1	0	0
hexazinone + chlorsulfuron-metsulfuron[3] + R-11[4]	0.0625 0.0188 0.25% v/v	3-lf	18	0	14	6	99	99
chlorsulfuron-metsulfuron + metribuzin + R-11	0.0156 0.25 0.25% v/v	3-lf	19	0	18	26	99	89
$LSD_{(0.05)}$			6	4	17	15	2	14
Weed density (plants/ft^2)					100		<1	<1

[1] injury
[2] species (poverty, ripgut, and downy brome)
[3] chlorsulfuron-metsulfuron commercial mixture
[4] nonionic surfactant

Postemergence herbicides for control of wild oat in soft white winter wheat. Thompson, C.R. and D.C. Thill. A study was established in soft white winter wheat 2 miles east of Potlatch, Idaho, to determine the efficacy of several postemergence wild oat (AVEFA) herbicides. Early treatments were applied to 5.5-leaf (lf) wheat and 1 to 3-lf wild oat on April 23. Later treatments were applied to 7-lf, one node winter wheat, and 4 to 4.5-lf wild oat on May 10 (Table 1). All treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 38 psi and 3 mph. Treatments were arranged in a randomized complete block and were replicated four times. Plots were 10 by 30 ft. Wheat injury was evaluated visually on May 16 and July 3. No wheat injury was observed on July 3. Wild oat control was evaluated visually on July 3 and August 13. Grain was harvested with a small plot combine from a 4.5 by 27 ft area on August 28.

Table 1. Application and soil analysis data

Application stage (AVEFA) leaves	2 to 3		4 to 5
Temperature (F)	73		63
Soil temperature at 2 in. (F)	61		63
Relative humidity (%)	48		62
Wind speed (mph) - direction	1-W		2-W
Soil pH		6.6	
OM (%)		3.7	
CEC (meq/100g soil)		25.3	
Texture		silt loam	

All herbicides, except imazamethabenz, controlled wild oat 89% or greater (Table 2). The SC formulation of imazamethabenz was applied without $NaHSO_4$ which was required to optimize the SC formulation's activity on wild oat. Difenzoquat burned wheat leaves initially; however, no wheat injury was observed on July 3. A light dew was present when difenzoquat was applied. Wheat treated with imazamethabenz or HC91-13 did not yield more grain than the untreated wheat. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Wild oat control in soft white winter wheat

Treatment	Rate	AVEFA Stage	Wheat Yield	Wheat Injury	AVEFA 7/3	AVEFA 8/13
	lb ai/a		bu/a	%	--- % control ---	
control			95	--	--	--
diclofop	1.0	1-3 lf	105	0	97	89
HOE6001	0.082	1-3 lf	102	0	99	97
imazamethabenz[1] + R-11[2]	0.47 0.25%	1-3 lf	99	0	79	55
HOE6001	0.082	4-5 lf	104	0	99	99
HOE7125	0.66	4-5 lf	103	0	99	99
HC91-13	0.08	4-5 lf	100	0	99	99
difenzoquat + R-11	1.0 0.25%	4-5 lf	103	8	99	92
LSD $_{(0.05)}$			7	1	7	13
Wild oat density (plants/ft^2)					6 to 9	

[1] SC formulation
[2] R-11 is a nonionic surfactant applied on a % v/v.

Interrupted windgrass and broadleaf weed control in soft white winter wheat. Thompson, C.R. and D.C. Thill. Interrupted windgrass (APEIN) and broadleaf weed control with various herbicides and herbicide tank mixes were evaluated in 'Stephens' soft white winter wheat in two experiments 2 miles north of Potlatch, Idaho. Treatments were applied to 5.5-leaf (lf) wheat with two tillers, flowering 5 to 6-in. ivyleaf speedwell (VERHE), 0.5 to 2-in. mayweed chamomile (ANTCO), 1 to 3-in. field pennycress (THLAR), 1 to 2-in. coast fiddleneck and palouse tarweed, *Amsinckia* species (AMSIS), and 1 to 1.5-in. interrupted windgrass on April 18, 1991 (Table 1). All treatments were applied with a CO_2 backpack sprayer calibrated to deliver 10 gal/a at 38 psi and 3 mph. Diclofop at 1.0 lb ai/a was applied broadcast to control wild oat in both studies on May 10. Plots in both studies were 10 by 30 ft and were arranged in a randomized complete block design and replicated four times. Wheat injury was evaluated on June 13. Broadleaf and grass weed control were evaluated on June 13 and July 29, respectively. Grain was harvested with a small plot combine from a 4.5 by 27 ft area on August 29.

Table 1. Application and soil analysis data

Experiment	Hexazinone	Herbicide tank mixes
Temperature (F)	50	45
Soil temperature at 2 in. (F)	48	48
Relative humidity (%)	62	75
Wind speed (mph) - direction	1-NE	0
Soil pH	5.5	5.5
OM (%)	3.2	3.2
CEC (meq/100g soil)	18.5	18.5
Texture	silt loam	silt loam

Hexazinone alone did not control interrupted windgrass or broadleaf weeds (Table 2). Chlorsulfuron-metsulfuron alone and combined with hexazinone controlled windgrass 85% or greater and broadleaf weeds, except ivyleaf speedwell, 97% or greater. Wheat treated with hexazinone tank mixed with chlorsulfuron-metsulfuron was chlorotic one week after application; however, evidence of wheat injury was not present on June 13. Wheat treated with hexazinone, chlorsulfuron-metsulfuron, or the tank mix yielded more grain than untreated wheat.

Thifensulfuron-tribenuron alone or tank mixed with bromoxynil, bromoxynil-MCPA, MCPA ester, or 2,4-D amine controlled field pennycress, henbit, prickly lettuce, mayweed chamomile, and *Amsinckia* species 85% or greater (Table 3). Ivyleaf speedwell was not controlled adequately with any herbicide treatment. Thifensulfuron at 0.016 lb ai/a, and thifensulfuron-tribenuron at 0.016 combined with MCPA ester or 2,4-D amine controlled windgrass 70 to 83%. Interrupted windgrass control was less when bromoxynil or bromoxynil-MCPA were combined with thifensulfuron-tribenuron at 0.016 lb ai/a than when thifensulfuron-tribenuron at 0.016 lb ai/a was combined with MCPA ester or 2,4-D amine. Crop injury was not observed in the herbicide tank mixture study; thus, values for crop injury were not reported. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Hexazinone for weed control in soft white winter wheat

Treatment	Rate	Wheat Yield	Wheat Injury	VERHE	ANTCO	LAMAM	THLAR	APEIN	MUST[1]	AMSIS[2]	GALAP
	lb ai/a	bu/a	%	% control							
control	0.0	70	0	--	--	--	--	--	--	--	--
hexazinone	0.0313	85	0	3	3	1	15	0	9	0	0
hexazinone	0.0625	92	0	3	9	4	38	3	29	0	0
hexazinone	0.125	82	0	8	19	8	53	64	24	0	0
DPXG8311[3] R-11	0.0188 0.25%[4]	90	1	70	98	97	100	85	100	97	98
DPXG8311 hexazinone R-11	0.0188 0.0313 0.25%	90	0	45	98	98	100	89	100	98	98
DPXG8311 hexazinone R-11	0.0188 0.0625 0.25%	98	0	46	98	98	100	89	100	98	97
DPXG8311 hexazinone R-11	0.0188 0.125 0.25%	99	3	49	99	99	100	87	100	98	98
LSD $_{(0.05)}$			15	2	38	11	4	21	13	12	12
Weed density (plants/ft^2)				4	5	5	7	1	<1	<1	<1

[1] MUST = mustard species (tumble mustard, wild mustard, and flixweed)
[2] AMSIS = *Amsinckia* species (coast fiddleneck and palouse tarweed)
[3] chlorsulfuron-metsulfuron commercial mixture
[4] R-11 is a nonionic surfactant applied on a % v/v.

Table 3. Herbicide tank mixes for weed control in soft white winter wheat

Treatment	Rate	Wheat yield	Weed species						
			THLAR	LAMAM	LACSE	ANTCO	AMSIS[1]	APEIN	VERHE
	lb ai/a	bu/a	% control						
control	0.0	100	--	--	--	--	--	--	--
bromoxynil	0.375	99	56	9	97	10	14	15	3
bromoxynil-MCPA[2]	0.75	104	86	14	100	16	30	8	5
thifensulfuron + R-11	0.016 0.25%[3]	105	100	88	100	91	93	80	15
bromoxynil + thifensulfuron-tribenuron[2] + R-11	0.187 0.008 0.25%	110	100	86	100	85	95	21	43
bromoxynil-MCPA + thifensulfuron-tribenuron + R-11	0.75 0.008 0.25%	102	100	88	100	91	94	20	35
MCPA ester + thifensulfuron-tribenuron + R-11	0.25 0.016 0.25%	110	100	91	100	92	95	83	45
MCPA ester	0.75	101	100	24	100	26	10	5	12
2,4-D amine + thifensulfuron-tribenuron + R-11	0.25 0.016 0.25%	105	100	87	100	90	96	70	43
2,4-D amine	0.75	103	97	15	100	24	20	10	10
bromoxynil + thifensulfuron-tribenuron + R-11	0.187 0.016 0.25%	103	100	90	100	91	88	41	13
bromoxynil-MCPA + thifensulfuron-tribenuron + R-11	0.375 0.016 0.25%	99	100	91	100	92	96	30	13
thifensulfuron-tribenuron + R-11	0.008 0.25%	89	100	85	100	86	96	40	18
control		92	--	--	--	--	--	--	--
LSD $_{(0.05)}$		14	13	11	2	14	11	21	32
Weed density (plants/ft^2)			7	5	<1	5	<1	3	5

[1] AMSIS = *Amsinckia* species (coast fiddleneck and palouse tarweed)
[2] hyphen between herbicides indicates commercial mixture
[3] R-11 is a nonionic surfactant applied as a % v/v

Effect of metsulfuron methyl on seed formation and viability of dyer's woad (Isatis tinctoria L.) in the field. Asghari, J.B. and J.O. Evans. Dyer's woad is a rapidly spreading weed in crops, ranges and forestlands of the intermountain region and its establishment and invasion is solely dependent on seed production. Two experiments were established in Mantua, Utah to determine 1) the extent which metsulfuron methyl applied during blossom inhibits seed production of dyer's woad and 2) the germinability of seed produced with the various herbicide administered dosages. Treatments were randomly assigned to 2.5 by 3 meter plots in a dense stand of dyer's woad that was approximately at the mid-blossom stage. Six treatments, each with four replications were arranged in a completely randomized design in each experiment. Herbicide treatment rates for experiment I were 0, 1, 2, 3, 4, and 5 g ai/ha and experiment II included treatments, 0, 3, 5, 8, 12, and 16 g ai/ha of metsulfuron methyl.

The herbicides were applied broadcast with a pressurized co_2 backpack sprayer calibrated to deliver 187 l/ha on June 4 (Experiment I) and 6 (Experiment II), 1991. Special care was taken to uniformly spray tall plants in each treatment. Phenological and morphological changes of treated plants were recorded weekly until harvest time.

The inflorescence of dyer's woad is a panicle which divides to primary, secondary and tertiary branches depending on the vigor of the plant. Dyer's woad fruits are attached to branches by pedicels which leaves scars when seeds are shed. In this study, three branches from three different panicles of each plot were harvested randomly on July, 17 and 22 from experiment I and II respectively. The number of fruits were counted regardless of the fruit size. Fruits were threshed and percent seed production of each treatment was determined. The germination test for each sample will be conducted. The germination test will indicate the ability of each level of metsulfuron methyl to inhibit dyer's woad viable seed production. The data indicates the average fruit production of each treatment and percent seed formation in the sample. The number of fruits in each experiment significantly decreased by increasing the treatment rates. Seed production was significantly reduced by increasing levels of the herbicide. (Utah Agricultural Experiment Station, Logan 84322-8420).

Effect of metsulfuron methyl on fruit production
and seed development of dyer's woad

Metsulfuron methyl (g/ha)	Fruit production and percent seed development			
	No. Fruit		Seed	
	Exp. 1	Exp. 2	Exp. 1	Exp. 2
			----------%----------	
Control	166	138	92.7	91.0
1	121	---	88.5	----
2	91	---	76.0	----
3	112	94	58.8	47.0
4	69	---	32.0	----
5	99	39	25.5	25.0
8	---	36	----	9.5
12	---	15	----	6.8
16	---	16	----	1.8

Weed control in summer fallow. Boerboom, C.M. Herbicides that can control emerged weeds and provide residual control could reduce the tillage required for summer fallow. Several herbicides were evaluated for downy brome (BROTE) control and residual control of broadleaf weeds at two locations.

Both sites, one near Washtucna, WA and another near LaCrosse, WA, had standing stubble from the previous year's wheat crop. Each experiment was designed as a randomized complete block with four replications. Plots measured 10 by 30 ft. Applications were made on April 12, 1991 with a CO_2 pressurized backpack sprayer (Table 1). At Washtucna, the density of downy brome was 25 plants/ft^2 and plants had four to six leaves and one to four tillers. At LaCrosse, the density of downy brome was 14 plants/ft^2 and the plants had four to five leaves and up to eight tillers.

Plots that had a high density of uncontrolled downy brome had fewer broadleaf weeds as the results of the nontreated check at Washtucna illustrate (Table 2). This probably resulted from the downy brome competition. UBI-C4243 plus glyphosate gave the best overall control of downy brome and residual broadleaf weed control. UBI-C4243 alone did not control downy brome. Triasulfuron plus glyphosate was effective in controlling downy brome, but did not control Russian thistle (SASKR) (Table 2). (Department of Crop and Soil Sciences, Washington State Univ., Pullman, WA 99164).

Table 1. Application data

Site	Washtucna	LaCrosse
Date	April 12, 1991	April 12, 1991
Air temperature (F)	65	65
Soil temperature (F)	60	59
Relative humidity (%)	26	32
Wind direction/speed	E/4-5	E/3-5
Soil pH	5.7	5.8
OM (%)	1.18	1.58
CEC (meq/100g soil)	9.6	13.1
Texture	silt loam	silt loam

Table 2. Weed control in summer fallow, Washtucna.

Treatment[1]	Rate	BROTE Control[2]		Stand count[3]		
		April 28	June 21	SASKR	ERICA	DESPI
	(lb ai/a)	----(%)---				
check	-	0	0	18	1	2
UBI-C4243 crop oil	0.13 2.5	6	0	0	0	1
UBI-C4243 crop oil	0.19 2.5	14	0	0	0	0
UBI-C4243 glyphosate	0.13 0.38	96	80	5	1	0
triasulfuron glyphosate	0.018 0.38	99	89	33	1	0
triasulfuron glyphosate	0.027 0.38	97	80	29	0	0
glyphosate + 2,4-D	0.38 0.6	98	84	38	5	1
paraquat diuron surfactant	0.5 0.25 0.25	96	53	22	4	1
LSD (0.05)		4	5	16	3	1

[1]Crop oil was Mor-act, surfactant was R-11; rate is expressed as % v/v.
[2]BROTE (downy brome) control was visually rated.
[3]Stand counts were made on June 21 and are plants per 10 by 30 ft plot (SASKR = Russian thistle, ERICA = horseweed, and DESPI = pinnate tansymustard)

Table 3. Weed control in summer fallow, LaCrosse.

Treatment[1]	Rate	BROTE Control[2] April 28	BROTE Control[2] June 21	Stand count[3] AMSIN	Stand count[3] SSYAL	Stand count[3] ERICA
	(lb ai/a)	----(%)----				
check	-	35	0	27	21	6
UBI-C4243 crop oil	0.13 2.5	38	0	1	1	1
UBI-C4243 crop oil	0.19 2.5	53	0	0	0	0
UBI-C4243 glyphosate	0.13 0.38	97	71	2	0	1
triasulfuron glyphosate	0.018 0.38	100	91	0	1	0
triasulfuron glyphosate	0.027 0.38	100	86	1	1	0
glyphosate + 2,4-D	0.38 0.6	100	78	11	1	5
LSD (0.05)		23	9	16	7	3

[1]Crop oil was Mor-act; rate is expressed as % v/v.
[2]BROTE (downy brome) control was visually rated.
[3]Stand counts were made on June 21 and are plants per 10 by 30 ft plot (AMSIN = coast fiddleneck, SSYAL = tumble mustard, and ERICA = horseweed).

Field bindweed control in fallow with fall herbicide treatments. Miller, S.D. and T. Neider. Plots were established under dryland conditions near Wheatland, WY to evaluate field bindweed control with fall applications of BAS-514 alone or in combination with other herbicides. Plots were 9 by 30 ft. with three replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 10 gpa at 40 psi August 29, 1990 (air temp. 82F, relative humidity 37%, wind calm, sky clear and soil temp. - 0 inch 134F, 2 inch 76F and 4 inch 70F) to field bindweed with mature seed and 10 to 15 inch runners. The soil was a sandy loam (67% sand, 18% silt and 15% clay) with 1.4% organic matter and pH 7.9. Visual weed control evaluations were made June 11, July 23 and August 21, 1991. Field bindweed (CONAR) infestations were heavy and uniform throughout the experimental site.

Field bindweed control was excellent (95 to 99%) with all treatments containing BAS-514 12 months after application. BAS-514 application rate or companion herbicide had little effect on field bindweed control obtained. Field bindweed control and winter wheat response will be monitored on these plots in 1992. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1806)

Field bindweed control in fallow with post-harvest treatments

		% CONAR Control[2]		
	Rate	Months after treatment		
Treatment[1]	lb ai/A	10	11	12
BAS-514+ms	0.25	98	95	95
BAS-514+ms	0.38	100	99	99
BAS-514+ms	0.5	100	100	99
2,4-D	1.0	70	20	20
dicamba	0.5	80	13	7
picloram	0.25	97	90	77
BAS-514+2,4-D+ms	0.25+0.5	100	100	99
BAS-514+2,4-D+ms	0.38+0.5	100	99	99
BAS-514+2,4-D+ms	0.5+0.5	100	99	98
BAS-514+dicamba+ms	0.25+0.25	100	99	99
BAS-514+dicamba+ms	0.38+0.25	100	100	99
BAS-514+dicamba+ms	0.5+0.25	100	96	97
BAS-514+picloram+ms	0.25+0.05	100	99	99
BAS-514+picloram+ms	0.38+0.05	100	99	99
BAS-514+picloram+ms	0.5+0.05	100	98	99
untreated check	- - - -	0	0	0

[1] Treatments applied August 29, 1990; ms = Sun-It at 1 qt/A.
[2] Field bindweed control visually evaluated June 11, July 23 and August 21, 1991.

UBI-C4243 for weed control in chemical fallow. Thompson, C.R., M.J. Dial, and D.C. Thill. Several rates of UBI-C4243 were tank mixed with the oil adjuvant, Mor-act, to determine weed control efficacy in chemical fallow. Studies were established at Lewiston, Idaho and south of Lewiston, in the Tammany area. All treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a with 38 psi and 3 mph (Table 1). Fall 1990 treatments were applied to the soil surface preemergence (PES) and spring 1991 treatments were applied postemergence (POST). Treatments were arranged in a randomized complete block design and replicated four times. Plots were 10 by 30 feet. Weed control in fall treatments was evaluated visually on April 2, 1991 and in all treatments on April 29.

Table 1. Application and soil analysis data

Location	Lewiston		Tammany	
Application timing	PES	POST	PES	POST
Application date (month/date)	11/3	4/6	11/3	4/2
Temperature (F)	34	60	37	60
Soil temperature at 2 in. (F)	37	52	36	54
Relative humidity (%)	60	45	50	65
Wind speed (mph - direction)	4-S	2-S	8-S	5-S
Weed stage at application				
Bromus species	--	3 to 5 lf	--	2 to 3 lf
blue mustard (COBTE)	--	2 to 3 in.	--	--
Soil pH	5.2		5.0	
OM (%)	3.0		4.2	
CEC (meq/100g soil)	19.4		22.9	
Texture	silt loam		silt loam	

UBI-C4243 did not control *Bromus* species adequately in chemical fallow (Table 2). Heavy surface residue at the Tammany site, due to continuous no-till, appeared to reduce the activity of the fall applied UBI-C4243 on *Bromus* species approximately 30% compared to *Bromus* species control with fall applied UBI-C4243 at the Lewiston site which had much less surface residue. UBI-C4243 applied spring postemergence had little activity on *Bromus* species. UBI-C4243 at all rates controlled blue mustard 100%. Pinnate tansymustard at the Lewiston site was present at very low densities which did not allow for statistical analysis of the data. UBI-C4243 appeared to control tansymustard (data not shown). Glyphosate alone or tank mixed with UBI-C4243 controlled *Bromus* species and blue mustard 98 to 100%. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. UBI-C4243 for weed control control in fallow

Treatment	Rate	Application stage	Tammany *Bromus* species 4/2	Tammany *Bromus* species 4/29	Lewiston *Bromus* species 4/2	Lewiston *Bromus* species 4/29	Lewiston COBTE
	lb ai/a		% control				
UBI-C4243 + Mor-act[1]	0.125 2.5% v/v	Fall PES	30	5	56	34	100
UBI-C4243 + Mor-act	0.188 2.5% v/v	Fall PES	44	8	79	46	100
UBI-C4243 + Mor-act	0.125 2.5% v/v	Spring POST	--	9	--	1	100
UBI-C4243 + Mor-act	0.188 2.5% v/v	Spring POST	--	24	--	9	100
glyphosate[2] + R11[3]	0.28 0.5% v/v	Spring POST	--	98	--	100	100
glyphosate + UBI-C4243 + R11	0.28 0.125 0.5% v/v	Spring POST	--	99	--	100	100
control			--	--	--	--	--
	$LSD_{(0.05)}$		17	13	15	23	0
	weed density (plants/ft^2)		140		100		0.1

[1] petroleum-based oil
[2] lb ae/a
[3] nonionic surfactant

Field bindweed control with BAS-514 . Westra, P. and T. D'Amato. A field experiment in a heavy field bindweed (CONAR) infestation in wheat fallow was established on September 10, 1989. The study was laid out in a randomized complete block design with three replications where each plot was 10' by 30' in size. Treatments were applied in 13 gallons of water per acre with a back-pack CO_2 powered sprayer. Visual evaluations of weed control were made several times over 2 years. BAS-514 applied at 0.25 lb ai/a provided excellent field bindweed control in the first year after application, but by year 2 substantial field bindweed regrowth had occurred in those plots. This would suggest that the 0.25 lb ai/a rate is too low for long term field bindweed control. When applied at 0.50 lb ai/a or higher, either alone or in combination with other labeled field bindweed herbicides, BAS-514 provided excellent long term field bindweed control. Product cost, however, may dictate that a field use rate would fall somewhere between 0.25 and 0.50 lb ai/a. Addition of picloram or banvel to the 0.50 rate of BAS-514 appeared to provide some benefit for long term field bindweed control. Volunteer rye (SECCE), representing a small grain, was not injured by BAS-514. BAS-514 holds excellent potential as a new herbicide for field bindweed control. (Department of Plant Pathology and Weed Science, Colorado State University, Ft. Collins, CO 80523)

Field bindweed control with BAS-514 1 and 2 years after treatment.

Herbicide[1]	Rate	CONAR 6-26-90	SECCE 6-26-90	CONAR 8-3-90	CONAR 7-3-91
	(lb ai/a)	(% control)			
Check		0 c	0 c	0 c	0 c
BAS 514	.25	95 b	0 c	80 b	17 b
BAS 514	.50	99 a	0 c	97 a	87 a
BAS 514	.75	100 a	0 c	99 a	95 a
BAS 514 Landmaster BW	.50 54 oz pr/A	99 a	43 a	99 a	90 a
BAS 514 Picloram	.50 .125	99 a	13 b	99 a	93 a
BAS 514 2,4-D LVE	.50 .50	100 a	0 c	99 a	92 a
BAS 514 Dicamba	.50 .50	100 a	0 c	99 a	96 a

[1] The surfactant BAS-090 at the rate of 1 quart per acre was added to all treatments.

Control of common tansy in pasture. Miller, T.W. and R.H. Callihan. A common pasture weed in northern Idaho is common tansy (Tanacetum vulgare L.).

An experiment was established April 19, 1990, near Potlatch, Idaho, in a field heavily infested with common tansy. Herbicides shown in the table below were applied after the dry weed material had been burned off on April 13, 1991, to eliminate seed stalks from the previous year. Dicamba + 2,4-D and clopyralid + 2,4-D treatments were reapplied on July 3, 1991, and plots were re-evaluated on August 8, 1991. Plants were 6 to 18 inches in height and were beginning to form flower stalks at the time of herbicide application. Treatments were applied in a carrier volume of 20 gal water/a with a CO_2-powered backpack sprayer. Weed control percentage was based on weed density (100% = no weeds), and was estimated to the nearest 5% on June 13, 1991. Data were analyzed using analysis of variance procedure, and means were separated using Fisher's least significant difference test (P=0.05).

One year after application, control in plots treated with dicamba + 2,4-D, picloram, or clopyralid + 2,4-D had subsided substantially. Common tansy control by metsulfuron, however, remained essentially unchanged, even nearly 15 months after treatment. Neither dicamba + 2,4-D nor clopyralid + 2,4-D displayed greater common tansy control in midsummer 1991 resulting from the repeat application as compared to midsummer 1990 control resulting from the initial application.

Grass response to all treatments remained excellent (data not shown). Rapid grass growth may delay re-infestation of common tansy into sprayed plots, although periodic re-application of herbicides will likely be necessary. (University of Idaho Cooperative Extension System, Moscow, Idaho 83843)

Control of common tansy in pasture.

Treatment	Rate	Brand Name	Percent Control		
	(ai or ae/a)		7/31/90	6/13/91	8/9/91[1]
Picloram	0.25 lb	Tordon 22K	99	86	70
Metsulfuron	0.3 oz	Escort	98	95	98
Dicamba + 2,4-D	0.5 lb + 1.44 lbs	Weedmaster	92	60	85
Clopyralid + 2,4-D	0.19 lb + 1 lb	Curtail	65	41	68
R2			0.97	0.94	0.93
lsd (0.05)			13	18	19
c.v.			12	20	19

[1]Dicamba + 2,4-D and clopyralid + 2,4-D were reapplied on 7/3/91.

PROJECT IV

EXTENSION, EDUCATION, AND REGULATORY

Don Morishita - Project Chairperson
Stott Howard - Project Chairperson-Elect

Newly reported weed species: potential weed problems in Idaho. Old, R.R., F.E. Northam, and R.H. Callihan. The distribution of weed species submitted from all sources for identification to weed science diagnostic personnel, and of weed species otherwise called to our attention, was examined to discover recent changes in distributions. As in previous years, the distribution was categorized into three groups. Two species were found to be new to the Pacific Northwest (Idaho, Oregon and Washington) in 1991. Two additional species were found to be new records for Idaho in 1991. Extensions of the ranges of several species that have been present in Idaho for several years were also recorded. Twenty-six species, including the two species new to the Pacific Northwest and the two species new to Idaho, were found to be new records for individual counties in 1991. The reporting period for these data was November 31, 1990 to November 31, 1991. The following list cites the scientific name, Bayer code, Weed Science Society of America common name, family name and location(s) of each new record. Additional data are maintained on permanent file. (Idaho Agricultural Experiment Station, Moscow, Idaho, 83843)

GROUP I: New regional records: species not previously reported for Idaho, nor listed in Flora of the Pacific Northwest (new regional, as well as state and county records).

1. *Crucianella angustiflora* L. (*****) narrowleaved crosswort; Rubiaceae; the only previous United States record is from California.
   Counties: Clearwater

2. *Senecio viscosus* L. (SENVI) sticky groundsel; Asteraceae; known from Canada and the northeastern United States.
   Counties: Boundary

GROUP II: New state records: species not previously documented for Idaho, although currently listed in Flora of the Pacific Northwest (new state as well as county records).

1. *Eragrostis tef* (Zuccagni) Trotter (*****) teff; Poaceae; newly introduced crop plant, only previous northwest record is from USDA-ARS Plant Introduction at W.S.U.
   Counties: Canyon

2. *Leontodon nudicaulis* (L.) Banks (LEBNT) rough hawkbit; Asteraceae; known to be weedy west of the Cascades.
   Counties: Boundary

GROUP III: New county records: species not previously reported in the county listed, although previously reported in one or more counties in Idaho.

1. *Abutilon theophrasti* Medicus (ABUTH) velvetleaf; Malvaceae
   Counties: Canyon, Gem

2. *Bryonia alba* L. (BYOAL) white bryony; Cucurbitaceae
   Counties: Fremont

3. *Carduus nutans* L. (CRUNU) musk thistle; Asteraceae
   Counties: Canyon

4. *Carduus acanthoides* L. (CRUAC) plumeles thistle; Asteraceae
   Counties: Boise

5. *Centaurea solstitialis* L. (CENSO) yellow starthistle; Asteraceae
   Counties: Benewah

6. *Cynodon dactylon* (L.) Pers. (CYNDA) bermudagrass; Poaceae
   Counties: Nez Perce

7. *Dracocephalum parviflorum* Nutt. (DRAPA) dragonhead; Lamiaceae
Counties: Idaho

8. *Echium vulgare* L. (EHIVU) blueweed; Boraginaceae
Counties: Clearwater

9. *Eragrostis pectinacea* (Michx.) Nees (ERAPE) tufted lovegrass; Poaceae
Counties: Ada

10. *Euclidium syriacum* (L.) R.Br. (EUISY) Syrian mustard; Brassicaceae
Counties: Gem

11. *Euphorbia supina* Raf. ex Boiss. (EPHMA) spotted spurge; Euphorbiaceae
Counties: Clearwater, Canyon

12. *Euphorbia esula* L. (EPHES) leafy spurge; Euphorbiaceae
Counties: Adams

13. *Galeopsis tetrahit* L. (GAETE) common hempnettle; Lamiaceae
Counties: Bonner

14. *Leonurus cardiaca* L. (LECCA) motherwort; Lamiaceae
Counties: Idaho

15. *Lythrum salicaria* L. (LYTSA) purple loosestrife; Lythraceae
Counties: Madison, Clearwater, Twin Falls

16. *Matricaria maritima* (Knaf) Wilmott (MATIN) scentless chamomile; Asteraceae
Counties: Boundary

17. *Panicum miliaceum* L. (PANMI) wild proso millet; Poaceae
Counties: Nez Perce

18. *Sagina procumbens* L. (SAIPR) birdseye pearlwort; Caryophyllaceae
Counties: Latah

19. *Salvia pratensis* L. (SALPR) meadow sage; Lamiaceae
Counties: Adams

20. *Silene conoidea* L. (SILCD) cone catchfly; Caryophyllaceae
Counties: Idaho

21. *Solanum rostratum* Dun. (SOLCU) buffalobur; Solanaceae
Counties: Gem

22. *Veronica biloba* L. (*****) bilobed speedwell; Scrophulariaceae
Counties: Teton

***** No Bayer code listed

Western Expert Educational Diagnostic System. Old, R.R., F.E. Northam, and R.H. Callihan. A computer-aided expert system was developed and tested using a database of 304 non-grass-like and 60 grass-like plant species. The database contains 56 plant characters and 496 character states for each non-grass-like species, and 26 plant characters and 111 character states for each grass-like species. These characters cover the full range of artificial and technical plant characteristics. The system allows the user to identify plants by describing observable characters of the specimen to be identified. The program has the flexibility for users to make descriptions consistent with their skill levels. The user selects from menus (a) the character to be described and (b) the character state which is most descriptive of the specimen. Each character state selected reduces the number of species remaining in the database. At the completion of the process, the user is provided with either a species identification or a small list of possible species. Each identified species is referenced to its respective page number in the book Weeds of the West, which provides a color photograph for verification of the identification. An example of a plant identification is shown in the table below.

In addition to plant identification, the program allows the user to search for information on any species in the database, (*e.g.*, the flower color, fruit type, family, etc.). The system, therefore, serves a dual function: it is an identification aid and a reference tool.

The program became available for sale to the public in April of 1991. To date it has been sold in over thirty states and Canada. Funding is currently in place to create a similar program for the northeastern and north central states. Databases for several other areas are in progress. (Idaho Agricultural Experiment Station, Moscow, Idaho, 83843)

Example of a plant identification
using W.E.E.D.S.

Character	Character states	Number of species remaining
Initial selection	Non-grass-like	304
Flower color	Yellow	120
Mature plant height	4-8 inches	49
Milky juice	Yes	8
Stem cross-section	Hollow	1*

*SPECIES IDENTIFICATION:

FAMILY	GENUS	SPECIFIC	COMMON NAME	PAGE
Asteraceae	Taraxacum	officinale	dandelion	186

<u>Weed identification for county extension and weed control programs in Idaho</u>. Old, R.R., R.H. Callihan, and F.E. Northam. The occurrence and distribution of weed species is a dynamic phenomenon. Weed science works within a framework of ecological plant geography. Few programs devote resources to systematically surveying weed floras or documenting weed species movements. The weed identification program at the University of Idaho provides data useful in documenting changes in the Idaho weed flora, which include: (1) identifying weed species present in Idaho, (2) determining distribution of weeds, (3) recording weed dispersal into new areas, (4) detecting new alien weeds, (5) recognizing the season(s) that particular weed identification problems arise, (6) identifying educational deficiencies to assist in planning programs for extension and regulatory personnel on weed identification, and (7) an available historical data base. This report also serves the important function of advising research, extension, and regulatory personnel in other states of weed distributions in Idaho that may be significant in their states.

Plants submitted for identification or verification in the reporting period November 31, 1990 to November 31, 1991 are listed below. These data are from identification requests submitted to weed identification personnel by county extension agents and county weed superintendents. Over 1700 plant species have been identified for these two groups during the past seven years (see also WSWS Progress Reports for 1985-1990). This list indicates species of interest that require development of educational material and instruction. In addition, many samples are submitted because of unusual circumstances (novelty, growth stage, sample condition or sample inadequacy) that call for specialist capabilities. This program continues to grow in both extension and non-extension usage; there were about five times more requests this past year than the first year (1985) of the program. (Idaho Agricultural Experiment Station, Moscow, Idaho, 83843).

Identification	County	Date
Abutilon theophrasti, Malvaceae	Canyon	08/12/91
Abutilon theophrasti, Malvaceae	Gem	10/03/91
Agropyron cristatum, Poaceae	Ada	07/17/91
Agropyron intermedium, Poaceae	Lewis	07/30/91
Agrostis tenuis, Poaceae	Idaho	08/27/91
Alnus rubra, Betulaceae	Ada	09/04/91
Amsinckia menziesii, Boraginaceae	Idaho	06/06/91
Anchusa arvensis, Boraginaceae	Kootenai	09/23/91
Arabis holboellii, Brassicaceae	Camas	07/16/91
Aralia nudicaulis, Araliaceae	Kootenai	06/17/91
Artemisia ludoviciana, Asteraceae	Fremont	05/31/91
Artemisia vulgaris, Asteraceae	Boundary	06/27/91
Asperugo procumbens, Boraginaceae	Nez Perce	05/01/91
Aster conspicuus, Asteraceae	Shoshone	08/08/91
Astragalus cusickii, Fabaceae	Idaho	07/01/91
Atriplex hortensis, Chenopodiaceae	Caribou	10/09/91
Balsamorhiza incana, Asteraceae	Idaho	05/28/91
Berteroa incana, Brassicaceae	Boundary	08/30/91
Bidens cernua, Asteraceae	Clearwater	09/11/91
Bidens cernua, Asteraceae	Boundary	10/03/91
Bidens frondosa, Asteraceae	Kootenai	09/09/91
Blepharipappus scaber, Asteraceae	Ada	07/03/91
Bromus commutatus, Poaceae	Lewis	07/18/91
Bromus tectorum, Poaceae	Ada	06/05/91
Bryonia alba, Cucurbitaceae	Fremont	08/05/91
Bryonia alba, Cucurbitaceae	Oneida	10/08/91
Campanula rapunculoides, Campanulaceae	Twin Falls	04/30/91
Campanula rapunculoides, Campanulaceae	Kootenai	08/29/91
Campanula rapunculoides, Campanulaceae	Butte	09/16/91
Carduus acanthoides, Asteraceae	Boise	09/04/91
Centaurea cyanus, Asteraceae	Lewis	08/23/91
Cerastium tomontosum, Caryophyllaceae	Canyon	06/04/91
Cerastium vulgatum, Caryophyllaceae	Latah	04/12/91
Chaenactis douglasii, Asteraceae	Ada	07/03/91
Chaenactis douglasii, Asteraceae	Cassia	07/08/91
Chamaecyparis nootkatensis, Cupressaceae	Ada	05/08/91

Chenopodium ambrosioides, Chenopodiaceae	Boundary	08/28/91
Chenopodium leptophyllum, Chenopodiaceae	Ada	07/19/91
Chorispora tenella, Brassicaceae	Ada	04/05/91
Chorispora tenella, Brassicaceae	Gem	05/03/91
Chorispora tenella, Brassicaceae	Ada	05/20/91
Cirsium arvense, Asteraceae	Gem	10/03/91
Cirsium brevifolium, Asteraceae	Clearwater	07/08/91
Cirsium vulgare, Asteraceae	Boundary	08/16/91
Clarkia pulchella, Onagraceae	Idaho	06/06/91
Clematis ligusticifolia, Ranunculaceae	Gem	09/13/91
Collomia grandiflora, Polemoniaceae	Latah	08/06/91
Collomia linearis, Polemoniaceae	Idaho	06/26/91
Collomia linearis, Polemoniaceae	Kootenai	08/12/91
Collomia linearis, Polemoniaceae	Power	08/28/91
Comandra umbellata, Santalaceae	Payette	07/19/91
Conyza canadensis, Asteraceae	Ada	09/23/91
Conyza canadensis, Asteraceae	Bingham	12/10/90
Cotoneaster foveolata, Rosaceae	Ada	10/09/91
Crepis acuminata, Asteraceae	Canyon	06/10/91
Datura innoxia, Solanaceae	Gem	09/27/91
Descuraina sophia, Brassicaceae	Nez Perce	03/22/91
Digitaria sanguinalis, Poaceae	Ada	08/08/91
Digitaria sanguinalis, Poaceae	Ada	08/08/91
Echinochloa crus-galli, Poaceae	Ada	07/08/91
Echinochloa crus-galli, Poaceae	Ada	07/08/91
Echinochloa crus-galli, Poaceae	Ada	08/08/91
Echinochloa crus-galli, Poaceae	Ada	10/08/91
Echinocystis lobata, Cucurbitaceae	Gem	09/11/91
Elymus giganteus, Poaceae	Gem	03/25/91
Epilobium angustifolium, Onagraceae	Shoshone	06/27/91
Eragrostis cilianensis, Poaceae	Ada	10/24/91
Eragrostis pectinacea, Poaceae	Ada	10/15/91
Erigeron philadelphicus, Asteraceae	Boundary	06/27/91
Euclidium syriacum, Brassicaceae	Gem	05/03/91
Euonymus fortunii, Celastraceae	Ada	10/09/91
Euphorbia cyparissias, Euphorbiaceae	Boundary	06/04/91
Euphorbia myrsinites, Euphorbiaceae	Ada	04/15/91
Euphorbia mysinites, Euphorbiaceae	Minidoka	12/14/90
Euphorbia peplus, Euphorbiaceae	Ada	07/22/91
Euphorbia supina, Euphorbiaceae	Ada	06/17/91
Frasera fastigiata, Gentianaceae	Fremont	06/26/91
Frasera montana, Gentianaceae	Valley	06/27/91
Gaillardia aristata, Asteraceae	Lewis	07/26/91
Galeopsis tetrahit, Lamiaceae	Bonner	08/23/91
Galium aparine, Rubiaceae	Payette	07/08/91
Galium boreale, Rubiaceae	Boundary	06/12/91
Galium boreale, Rubiaceae	Caribou	07/12/91
Galium pedamontanum, Rubiaceae	Lewis	05/30/91
Galium pedamontanum, Rubiaceae	Clearwater	08/28/91
Geum macrophyllum, Rosaceae	Valley	05/03/91
Gleditsia triacanthos, Fabaceae	Ada	03/21/91
Grindelia squarrosa, Asteraceae	Benewah	07/23/91
Grindelia squarrosa, Asteraceae	Twin Falls	09/25/91
Hieracium albiflorium, Asteraceae	Shoshone	06/27/91
Hieracium canadense, Asteraceae	Benewah	07/24/91
Holosteum umbellatum, Caryophyllaceae	Lewis	05/03/91
Hypericum perforatum, Hypericaceae	Idaho	07/24/91
Iva axillaris, Asteraceae	Twin Falls	06/05/91
Iva axillaris, Asteraceae	Twin Falls	09/27/91
Iva xanthifolia, Asteraceae	Twin Falls	08/28/91
Juglans nigra, Juglandaceae	Ada	10/09/91
Juncus effusus, Juncaceae	Nez Perce	10/21/91
Lactuca canadensis, Asteraceae	Shoshone	08/08/91
Lactuca serriola, Asteraceae	Kootenai	08/13/91
Lathyrus pauciflorus, Fabaceae	Nez Perce	06/24/91
Leontodon nudicaulis, Asteraceae	Boundary	08/26/91

Lepidium campestre, Brassicaceae	Canyon	06/06/91
Ligusticum canbyi, Apiaceae	Valley	06/21/91
Linum perenne, Linaceae	Bingham	03/19/91
Lithospermum ruderale, Boraginaceae	Bonneville	10/15/91
Lolium perenne, Poaceae	Canyon	02/27/91
Lolium perenne, Poaceae	Nez Perce	05/15/91
Lolium perenne, Poaceae	Idaho	08/06/91
Lomatium grayii, Apiaceae	Bear Lake	05/24/91
Lotus purshiana, Fabaceae	Adams	08/12/91
Lupinus leucophyllus, Fabaceae	Valley	07/10/91
Lythrum salicaria, Lythraceae	Madison	04/09/91
Lythrum salicaria, Lythraceae	Twin Falls	10/24/91
Machaeranthera canescens, Asteraceae	Owyhee	09/06/91
Madia glomerata, Asteraceae	Power	08/28/91
Madia glomerata, Asteraceae	Nez Perce	09/06/91
Madia gracilis, Asteraceae	Ada	09/09/91
Marrubium vulgare, Lamiaceae	Nez Perce	03/22/91
Matricaria maritima, Asteraceae	Boundary	10/03/91
Mentzelia laevicaulis, Loasaceae	Caribou	08/15/91
Mentzelia laevicaulis, Loasaceae	Bannock	09/17/91
Mimulus guttatus, Scrophulariaceae	Canyon	05/31/91
Mimulus guttatus, Scrophulariaceae	Valley	08/23/91
Monolepis nuttaliana, Chenopodiaceae	Minidoka	06/27/91
Morus alba, Moreaceae	Ada	06/19/91
Navarretia intertexta, Polemoniaceae	Clearwater	07/18/91
Navarretia intertexta, Polemoniaceae	Valley	09/11/91
Oenothera caespitosa, Onagraceae	Gem	05/30/91
Oenothera strigosa, Onagraceae	Kootenai	08/29/91
Oenothera strigosa, Onagraceae	Gem	10/01/91
Origanum vulgare, Lamiaceae	Ada	10/24/91
Panicum dicotomiflorum, Poaceae	Ada	09/20/91
Parthenocissus quinquefolia, Vitaceae	Ada	10/01/91
Penstemon deustus, Scrophulariaceae	Gem	05/30/91
Penstemon perpulcher, Scrophulariaceae	Ada	07/08/91
Phacelia heterophylla, Hydrophyllaceae	Bonner	05/30/91
Phalaris arundinaceae, Poaceae	Ada	06/10/91
Phalaris communis, Poaceae	Bonneville	01/28/91
Phragmites communis, Poaceae	Elmore	08/12/91
Plantago patagonica, Plantaginaceae	Nez Perce	06/24/91
Poa annua, Poaceae	Nez Perce	05/15/91
Poa annua, Poaceae	Latah	10/07/91
Polemonium micranthum, Polemoniaceae	Latah	05/09/91
Polemonium micranthum, Polemoniaceae	Gem	05/13/91
Polygonum convolvulus, Polygonaceae	Gem	05/30/91
Polygonum cuspidatum, Polygonaceae	Bonneville	05/30/91
Polygonum cuspidatum, Polygonaceae	Canyon	06/05/91
Populus trichocarpa, Saliaceae	Ada	11/25/91
Potentilla gracillis, Rosaceae	Valley	07/10/91
Prunella vulgaris, Lamiaceae	Bonner	07/19/91
Prunus emarginata, Rosaceae	Ada	10/08/91
Ranunculus arvensis, Ranunculaceae	Idaho	06/12/91
Ranunculus arvensis, Ranunculaceae	Gem	07/15/91
Ranunculus muricatus, Ranunculaceae	Caribou	07/22/91
Ranunculus testiculatus, Ranunculaceae	Idaho	05/24/91
Ranunculus testiculatus, Ranunculaceae	Bonneville	06/20/91
Rhamnus purshiana, Rhamnaceae	Ada	10/08/91
Rhus copallina, Anacardiaceae	Ada	09/19/91
Ribes cereum, Grossulariaceae	Ada	10/08/91
Ribes hudsonianum, Grossulariaceae	Ada	10/09/91
Robinia pseudo-acacia, Fabaceae	Ada	08/01/91
Rorippa islandica, Brassicaceae	Shoshone	08/08/91
Rumex acetosella, Polygonaceae	Ada	06/20/91
Sambucus cerulea, Caprifoliaceae	Bonner	06/17/91
Saponaria officinalis, Caryophyllaceae	Twin Falls	09/06/91
Scleranthus annuus, Caryophyllaceae	Clearwater	08/16/91
Secale cereale, Poaceae	Franklin	06/05/91

Secale cereale, Poaceae	Nez Perce	06/21/91
Secale cereale, Poaceae	Canyon	08/12/91
Secale cereale, Poaceae	Nez Perce	08/15/91
Senecio foetidus, Asteraceae	Caribou	08/15/91
Senecio integerrimus, Asteraceae	Valley	05/30/91
Senecio serra, Asteraceae	Kootenai	07/01/91
Senecio serra, Asteraceae	Idaho	07/10/91
Senecio viscosus, Asteraceae	Boundary	10/24/91
Sidalcea oregona, Malvaceae	Canyon	06/12/91
Silene conoidea, Caryophyllaceae	Idaho	06/06/91
Silene conoidea, Caryophyllaceae	Idaho	06/26/91
Sisymbrium altissimum, Brassicaceae	Ada	07/03/91
Sitanion hystrix, Poaceae	Idaho	07/12/91
Solanum dulcamara, Solanaceae	Jerome	06/05/91
Solanum dulcamara, Solanaceae	Boundary	10/24/91
Solanum rostratum, Solanaceae	Lincoln	03/26/91
Solanum rostratum, Solanaceae	Idaho	08/27/91
Solanum rostratum, Solanaceae	Gem	09/03/91
Solidago graminifolia, Asteraceae	Ada	05/17/91
Solidago occidentalis, Asteraceae	Ada	10/08/91
Sonchus asper, Asteraceae	Gem	06/19/91
Sonchus asper, Asteraceae	Bonner	08/23/91
Spergula arvensis, Caryophyllaceae	Boundary	08/23/91
Sporobolus cryptandrus, Poaceae	Nez Perce	06/26/91
Sporobolus cryptandrus, Poaceae	Power	08/28/91
Stellaria media, Caryophyllaceae	Idaho	06/06/91
Streptopus amplexifolius, Liliaceae	Payette	08/28/91
Symphoricarpos albus, Caprifoliaceae	Ada	06/10/91
Symphoricarpos albus, Caprifoliaceae	Fremont	08/05/91
Taeniatherum caput-medusae, Poaceae	Lewis	04/26/91
Tanacetum vulgare, Asteraceae	Butte	05/13/91
Thelypodium intergrifolium, Brassicaceae	Minidoka	07/30/91
Thermopsis montana, Fabaceae	Bear Lake	05/17/91
Thlaspi arvense, Brassicaceae	Canyon	04/05/91
Toxicodendron rydbergii, Anacardiaceae	Payette	06/27/91
Ventenata dubia, Poaceae	Benewah	08/15/91
Veronica biloba, Scrophulariaceae	Teton	05/09/91
Veronica officinalis, Scrophulariaceae	Kootenai	08/29/91
Veronica persica, Scrophulariaceae	Clearwater	05/08/91
Veronica serpyllifolia, Scrophulariaceae	Latah	05/13/91
Viburnum opulus, Caprifoliaceae	Ada	10/01/91
Vicia tetrasperma, Fabaceae	Idaho	07/12/91
Vulpia myuros, Poaceae	Nez Perce	07/08/91
Zygophyllum fabago, Zygophyllaceae	Minidoka	10/25/91
x Triticosecale, Poaceae	Nez Perce	06/21/91

Sixteen specimens identified only to genus and over 500 specimens submitted from other sources are not included in this list.

PROJECT V

WEEDS OF AQUATIC, INDUSTRIAL, AND NONCROP AREAS

Vanelle Carrithers - Project Chairperson
Ron Crockett - Project Chairperson-Elect

Long-term non-crop weed control study. Cudney, D.W. and J.S. Reints. A long term non-crop weed control trial was established on the University of California Experiment Station in January of 1990 to evaluate newer herbicides compared to those in common use in the area. The plots were established in an area which had been cleared of brush and weeds and disked to a depth of 6 inches. The soil was a sandy loam with approximately 0.75 percent organic matter. Eleven herbicide treatments and an untreated check plot were then established as 10 by 25 foot plots and replicated four times. The herbicide treatments consisted of isoxaben (2 and 4), isoxaben plus oryzalin (1 + 3 and 2 + 6), tebuthiuron (8), diuron (8), bromacil (4), sulfometuron methyl (0.25), simazine (8), linuron (2), and dichlobenil (4 lbs ai/a). Applications were made with a CO_2 backpack, constant pressure, sprayer at a spray volume of 30 gallons per acre. Plots then received 0.5 inches of water applied as a sprinkler irrigation to incorporate the herbicides and to initiate weed germination. Winter rainfall in 1990 was low, about 6.5 inches after the plots were established. Vegetation was removed from the plots in October and they were lightly harrowed prior to the 1991 rainy season. Rainfall in the winter of 1991 was low until March when approximately 7.5 inches occurred. Weed counts were made on April 17.

All herbicides and herbicide combinations, with the exception of isoxaben, controlled volunteer wheat when evaluated 15 months after application. Tebuthiuron, diuron, bromacil, sulfometuron, and simazine treatments resulted in acceptable control of all weeds in the trial. Linuron and dichlobenil did not control filaree, Russian thistle, and wild radish after 15 months. Isoxaben and the combinations of isoxaben and oryzalin did not adequately control filaree but gave better control of Russian thistle and excellent control of wild radish. (University of California, Riverside, CA 92521).

Long-term non-crop weed control study
at Riverside, California

Herbicide	Rate lbs ai/a	4/17/91 ---weeds per plot--- volunteer wheat	filaree	Russian thistle	wild radish
isoxaben	2.0	28.5	9.3	4.0	0
isoxaben	4.0	8.8	6.0	4.8	0
isox + oryzalin	1.0 + 3.0	4.0	13.5	2.3	0.5
isox + oryzalin	2.0 + 6.0	3.8	7.0	1.3	0
tebuthiuron	8.0	0	0	0	0
diuron	8.0	0	0	2.5	0
bromacil	4.0	0	0	1.3	0
sulfometuron	0.25	1.0	7.0	0.3	3.0
simazine	8.0	0	1.3	1.0	0.5
linuron	2.0	0.5	18.5	14.0	12.5
dichlobenil	4.0	0.5	26.8	10.0	9.0
check	---	34.5	40.5	68.0	58.8
LSD 0.05		13.7	12.9	17.8	19.4

The efficacy of sulfosate when applied with residual preemergence herbicides. Cudney, D.W. and J.S. Reints. A trial was initiated on the University of California, Riverside experiment station to evaluate the performance of sulfosate alone and when applied in combination with preemergence residual herbicides. The concern was whether control of established weeds would be reduced by the addition of the preemergence herbicides to sulfosate in a tank mix. The plots were established in a non-crop area with well established weeds (filaree - 6 to 10 inches in diameter, Russian thistle - 3 to 8 leaves, and volunteer wheat - 3 to 4 tillers). The applications were made on 3/22/91 at a spray volume of 30 gal/a using a constant pressure CO_2 backpack sprayer. Weed control ratings were made four weeks later.

There was no significant difference in the control of sulfosate or glyphosate on the weeds tested. Control of filaree and wild radish with sulfosate increased as the rate of application increased. Volunteer wheat was controlled by all herbicides and herbicide combinations. There was no significant decrease in sulphosate activity when oxyfluorfen, simazine, oryzalin, napropamide, norflurazon, or the combination of diuron and bromacil was tank-mixed with sulfosate.

The efficacy of sulfosate when applied with residual preemergence herbicides

Treatment	Rate lb ae or ai/a	Weed Control Ratings[1] 4/17/91 volunteer wheat	filaree	Wild radish
Sulfosate	1.5	10.0	8.3	6.3
Sulfosate	2	10.0	9.6	8.0
Sulfosate	3	10.0	10.0	9.6
Sulf.+ oxyfluorfen	2+2	10.0	10.0	9.0
Sulf.+ simazine	2+2	10.0	9.0	8.8
Sulf.+ oryzalin	2+2	10.0	9.4	7.8
Sulf.+ napropamide	2+2	10.0	9.0	7.3
Sulf.+	2+			
bromacil +	2+			
diuron	2	10.0	10.0	10.0
Sulf.+ norflurazon	2+2	10.0	8.5	7.8
Glyphosate	2	10.0	9.4	8.0
Control		0	0	0
LSD 0.05		.003	1.2	1.7

[1]Weed control ratings: 0 = no effect 10 = all weeds dead

Field bindweed control/suppression with fall treatments on Colorado CRP. Sebastian, J.R. and K.G. Beck. An experiment was established near Briggsdale, CO to evaluate field bindweed (CONAR) control with picloram, dicamba, 2,4-D, and their tank mixes. The design was a randomized complete block with four replications. All treatments were applied on October 19, 1988 with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 24 gal/a, 15 psi. Other application information is presented in Table 1. Plot size was 10 by 30 feet.

Visual evaluations were compared to non-treated control plots and taken in May 1989, 1990, and 1991 approximately 7, 19, and 31 months after treatments (MAT) were applied, respectively. All picloram, dicamba, and tank mixes of picloram and dicamba provided 100% CONAR control 7 MAT (Table 2). 2,4-D alone provided poor control. Picloram (>0.13 lb ai/a) and all picloram plus dicamba tank mixes maintained 71 to 95% CONAR control 19 MAT. Picloram at 0.5 lb ai/a maintained 89% control 31 MAT.

Herbicide treatments will be evaluated again in 1992 for control longevity (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

Table 1. Application information and weed data for field bindweed control with fall treatments on CRP land in Colorado

Environmental data	
Application date	October 19, 1988
Application time	11:00 AM
Air temperature, C	14
Cloud cover, %	20
Relative humidity, %	60
Wind speed/direction, mph	0 to 2/SE
Soil temperature (2 in.), C	11

Weed data

Application date	Species	Growth stage	Length (in.)	Density (shoots/ft^2)
October 19, 1988	CONAR	vegetative	6 to 12	5 to 10

Table 2. Field bindweed control with fall applied herbicide treatments on Colorado CRP.

Herbicide	Rate	Field bindweed control		
		May 25 1989	May 5 1990	May 10 1991
	(lb ai/a)	(%)		
dicamba	1.0	100	40	29
dicamba	2.0	100	55	46
2,4-D amine	1.0	41	0	0
2,4-D amine	2.0	55	0	0
picloram	0.13	100	35	15
picloram	0.25	100	84	74
picloram	0.50	100	95	89
dicamba + picloram	0.50 0.13	100	71	57
dicamba + picloram	0.50 0.25	100	84	76
dicamba + picloram	1.0 0.13	100	72	65
dicamba + picloram	1.0 0.25	100	92	81
2,4-D amine + dicamba	1.0 0.50	100	11	0
LSD (0.05)		12	21	24

The effects of fall applications of various herbicides on Russian knapweed (Centaurea repens) control. Whitson, T.D., R.J. Swearingen and W.R. Tatman. Russian knapweed is a highly competitive perennial commonly found on overgrazed and disturbed areas. It is common throughout the west. This experiment was conducted to evaluate a fall application of various herbicides for Russian knapweed control. Herbicides were applied with a six-nozzle knapsack unit delivering 30 gpa at 41 psi. Plots were 10 by 27 ft. arranged in a randomized complete block design with four replications. The soil was a loamy sand (74.2% sand, 7.6% silt and 18.2% clay) with 2.8% organic matter and a pH of 7.5. Application information on October 10 when Russian knapweed was going into dormancy following the first frost, temperature: air 55F, soil surface 35F, 1 inch 37F, 2 inches 37F and 4 inches 40F, with 70% relative humidity and 5 mph east winds. Evaluations made July 8, 1991 indicated that all herbicides in the study were very active on Russian knapweed and control ranged from 91 to 100% control. Evaluations made 6 weeks later on August 28, 1991 following abnormally high summer rainfall indicated a considerable loss in control for all of the treatments except areas treated with picloram at 0.5 and 1.0 lb ai/A. Picloram controlled 85 to 97% of the R. knapweed, respectively at the time of the second evaluation. Adjuvants did not influence control with picloram at 0.5 lb ai/A. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071 SR 1648)

The Effects of Fall Applications of Various Herbicides
on Russian Knapweed Control

		% Control	
		Evaluation Date	
Herbicide	Rate lb ai/A	7/8/91	8/28/91
picloram	0.5	99	86
picloram+2,4-D	0.5+2.0	99	85
picloram+Silwet	0.5+.1%	99	70
picloram+Enhanse	0.5+.5%	99	85
picloram+LI700	0.5+.1%	99	85
picloram	1.0	100	97
dicamba	1.0	94	25
dicamba	2.0	97	27
dicamba+picloram	1.0+.5	99	69
picloram	.25	96	51
dicamba+picloram	0.5+.125	93	29
metsulfuron+X-77	.019+.25%	97	0
metsulfuron+X-77	0.38+.25%	99	7
metsulfuron+2-4-D+X-77	.019+2.0+.25%	96	0
chlorsulfuron+X-77	.023+.25%	94	3
chlorsulfuron+X-77	.046+.25%	98	19
clopyralid+2,4-D	.19+1.0	96	18
clopyralid	.19	91	28
check	- - -	0	0

Russian thistle control in abandoned fields. Orloff, S.B. and D.W. Cudney. Russian thistle is a serious weed problem in recently abandoned crop production fields in the high desert region of southern California. The high cost of irrigation in this area has caused a reduction in agriculture and many fields have been abandoned. Russian thistle is well adapted to these disturbed soils and dense populations have developed. In fact, if Russian thistle were a crop, the number of acres infested would make it the number one crop in the area. This creates a problem in late fall and winter when the "tumble weeds" dislodge and begin to roll across highways and accumulate in alfalfa fields, fence lines, and ditches, creating a fire hazard. The following trial was initiated to investigate early postemergence treatments which could be used to reduce or eliminate Russian thistle from these non-crop areas.

The trial was conducted in an abandoned field 12 miles east of Lancaster, California. Russian thistle was in the seedling stage, approximately 8 inches in height. The experimental design was a randomized complete block. Each plot measured 8 by 20 ft. The herbicides were applied with a constant pressure CO_2 backpack sprayer with a spray volume of 20 gallons/A. 2,4-D amine and ester, oxyfluorfen, triclopyr, and dicamba were all evaluated at 0.5 and 1.0 lb ai/a. Paraquat was evaluated at 0.5 and imazethapyr at 0.125 and 0.25 lb ai/a. Glyphosate and sulfosate were tested at 1.0 and 2.0 lb ai/a. A combination of 2,4-D ester and dicamba was also evaluated at 1.0 and 0.5 lb ai/a. Russian thistle control was evaluated on 5/29, 6/11, 7/11, and 8/26.

Herbicides differed in their ability to control Russian thistle and the degree of control over the season varied depending on the mode of action of the different herbicides. 2,4-D ester was superior to the amine formulation at all treatment dates. The 0.5 lb rate of 2,4-D ester tended to be more effective than twice that rate of amine. Oxyfluorfen was ineffective for the control of Russian thistle. The control declined over time, as the Russian thistle recovered from the initial effects of the herbicide treatment. The one lb ai/a rate of oxyfluorfen was no better than the 0.5 lb ai/a rate. Triclopyr and dicamba were similar in their ability to control Russian thistle, however, dicamba at the higher rate was slightly better. Paraquat did not control Russian thistle. Imazethapyr was even less effective. The higher rate (0.25 lb ai/a) was more effective initially, but by the last evaluation control had declined and there was no difference between the two rates. Glyphosate and sulfosate had a similar effect on Russian thistle, with control generally increasing over time. However, glyphosate was significantly more effective than sulfosate.

The highest degree of Russian thistle control was achieved with 2,4-D ester at 1.0 lb ai/a, dicamba at 1.0 lb ai/a, glyphosate at 2.0 lb ai/a and the most effective treatment was the combination of 2,4-D ester and dicamba at 1.0 and 0.5 lb ai/a, respectively. (University of California Cooperative Extension, Lancaster CA 93535, and University of California, Riverside, CA 92521)

Russian thistle control in abandoned fields.

Treatment	Rate lb ai/a	Control[1] 5/29	6/11	7/11	8/26
2,4-D amine	0.5	2.0	1.5	4.0	4.5
2,4-D amine	1.0	7.0	6.5	4.0	4.5
2,4-D ester	0.5	7.5	7.0	6.0	6.8
2,4-D ester	1.0	8.3	9.5	9.5	8.3
Oxyfluorfen	0.5	6.0	3.0	1.5	2.5
Oxyfluorfen	1.0	4.0	2.5	1.0	3.0
Triclopyr	0.5	5.8	6.0	5.3	5.0
Triclopyr	1.0	6.5	7.3	5.0	5.0
Dicamba	0.5	6.5	7.5	4.5	6.3
Dicamba	1.0	6.0	8.3	8.5	8.0
Paraquat	0.5	5.5	5.0	3.5	4.5
Imazethapyr	0.125	2.5	2.0	2.0	2.0
Imazethapyr	0.25	5.3	4.0	3.0	2.5
2,4-D ester+ dicamba	1.0 + 0.5	8.3	9.8	9.9	9.5
Glyphosate	1.0	3.0	3.5	5.8	6.0
Glyphosate	2.0	7.8	8.0	8.8	8.0
Sulfosate	1.0	1.5	1.5	1.0	3.3
Sulfosate	2.0	4.0	5.5	6.3	6.0
LSD 0.05		2.6	1.8	2.5	2.5

[1] Control rating 0 = no effect 10 = all Russian thistle dead.

Saltcedar control with imazapyr. Duncan, Keith. W. Saltcedar is an introduced phreatophyte which occupies millions of hectares of riparian areas throughout the southwestern United States. Saltcedar's ability to not only colonize riparian areas rapidly but also to change its environment by salt exudation often results in monoculture stands of the exotic phreathophyte.

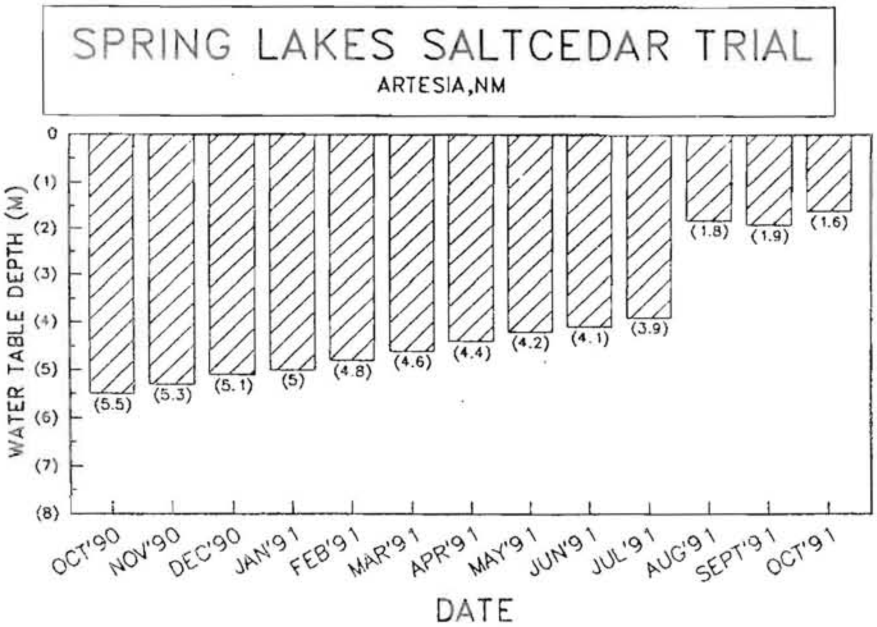
Saltcedar growing in two 5.26 ha dry lakes near Artesia, NM, were aerially sprayed with a fixed-winged aircraft on August 8, 1989. Imazapyr was applied at 1.1 kg ai/ha in a total volume of 65.4 l/ha with 0.25% v/v of Activator surfactant and 0.25% v/v Nalcotrol. The two dry lakes are approximately 30 m apart and were permanent spring-fed lakes prior to invasion of the saltcedar.

On August 15, 1989, a 5.7 cm diameter hole was hand augered into the bottom of one of the two lakes. The hole was bored to a depth of 5.8 m and a 6.1 m joint of 5.1 cm pvc pipe inserted into the hole. A removable cap was placed over the end of the pipe to prevent moisture or debris from entering the hole from above ground. A soil sample was removed from the bottom of the hole and percentage soil moisture content determined gravimetrically. Soil samples were taken and soil moisture determined at approximate 60 day intervals for 12 months (A report of the soil moisture data was included in the 1991 Research Progress Report of the Western Society of Weed Science, Seattle, Washington.)

An attempt was made to collect soil samples in October, 1990, 14 months after application. However, the water table had risen to a point where water occupied the bottom 0.9 m of the hole. Since that date, the depth to the water table has been measured at 30 day intervals.

A graph of the data indicates that the water table at the project site rose approximately 0.2 m each month from October, 1990 to July, 1991. From July to August, 1991, the water table rose 2.1 m. The water table dropped slightly from August to September, then rose 0.3 m from September to October. The graph indicates, the water table on the saltcedar control project area has risen from a depth of greater than 5.8 m below the surface to a depth of 1.6 m below the soil surface within 26 months after application. Measurements of the depth of the water table will continue.

Saltcedar canopy reduction and topkill was estimated on July 17, 1991, to be 99% and 95%, respectively. (Coop. Ext. Serv., New Mexico Univ., Artesia, NM 88210).



PROJECT VI

BASIC SCIENCES: ECOLOGY, BIOLOGY, PHYSIOLOGY, GENETICS, AND CHEMISTRY

Tracy Sterling - Project Chairperson
Bill Dyer - Project Chairperson-Elect

Effect of duration of jointed goatgrass interference on winter wheat grain yield. Anderson, R.L. Researchers are evaluating herbicides for control of jointed goatgrass in winter wheat. Postemergence herbicides are preferred to soil-applied herbicides because producers could treat only the infested areas of their fields and thereby reduce herbicide costs. If postemergence herbicides are developed for jointed goatgrass control, knowledge of the "critical" interference period will aid in deciding when to apply these herbicides.

This 2-year study examined duration of jointed goatgrass interference in winter wheat. Jointed goatgrass was established at 18 plants/m^2 0, 2, 4, and 6 weeks after 'Vona' winter wheat planting (Sep. 22, 1987 and Sep 19, 1988), and also on March 1, 1988 and 1989, to measure effect of time of emergence on wheat yield loss. In an adjacent study, jointed goatgrass established at 18 plants/m^2 at wheat planting was removed near March 1, April 1, May 1, June 1, and June 15. A full-season interference treatment also was included. Winter wheat grain yield loss was determined by comparing interference treatments to a weed-free control. The experimental design for both studies was a randomized complete block with four replications. Plot size was 2 m^2.

The duration of jointed goatgrass interference effect on winter wheat grain yield is shown in the adjacent figure. The yield loss relationship for the time of emergence study was $Y = 30.6 - 0.29X$ (X = days after Sep. 15), and for the removal time study, $Y = 8.7 + 0.15X$ (X = days after March 1). Wheat yields of the weed-free plots were 2200 kg/ha in 1988 and 1250 kg/ha in 1989. Jointed goatgrass at 18 plants/m^2 reduced grain yield by 30% when it emerged with winter wheat. As jointed goatgrass emergence was delayed, yield loss decreased; however, yield loss was still greater than 15% when jointed goatgrass emerged on November 1, approximately 40 days after planting. Yield loss from the March 1 emergence was 8%, demonstrating that jointed goatgrass emergence in the spring also is detrimental to winter wheat yields. The time of removal study indicated that jointed goatgrass caused 10% yield loss when removed on March 1. Based on these relationships, early spring (before March 1) would be the most effective time for a foliar-applied herbicide to control jointed goatgrass. A postemergence herbicide applied during early spring would minimize winter wheat yield loss due to interference of fall-established plants as well as minimize yield loss due to plants emerging after the herbicide application. (USDA-ARS, Central Great Plains Research Station, Akron, CO 80720).

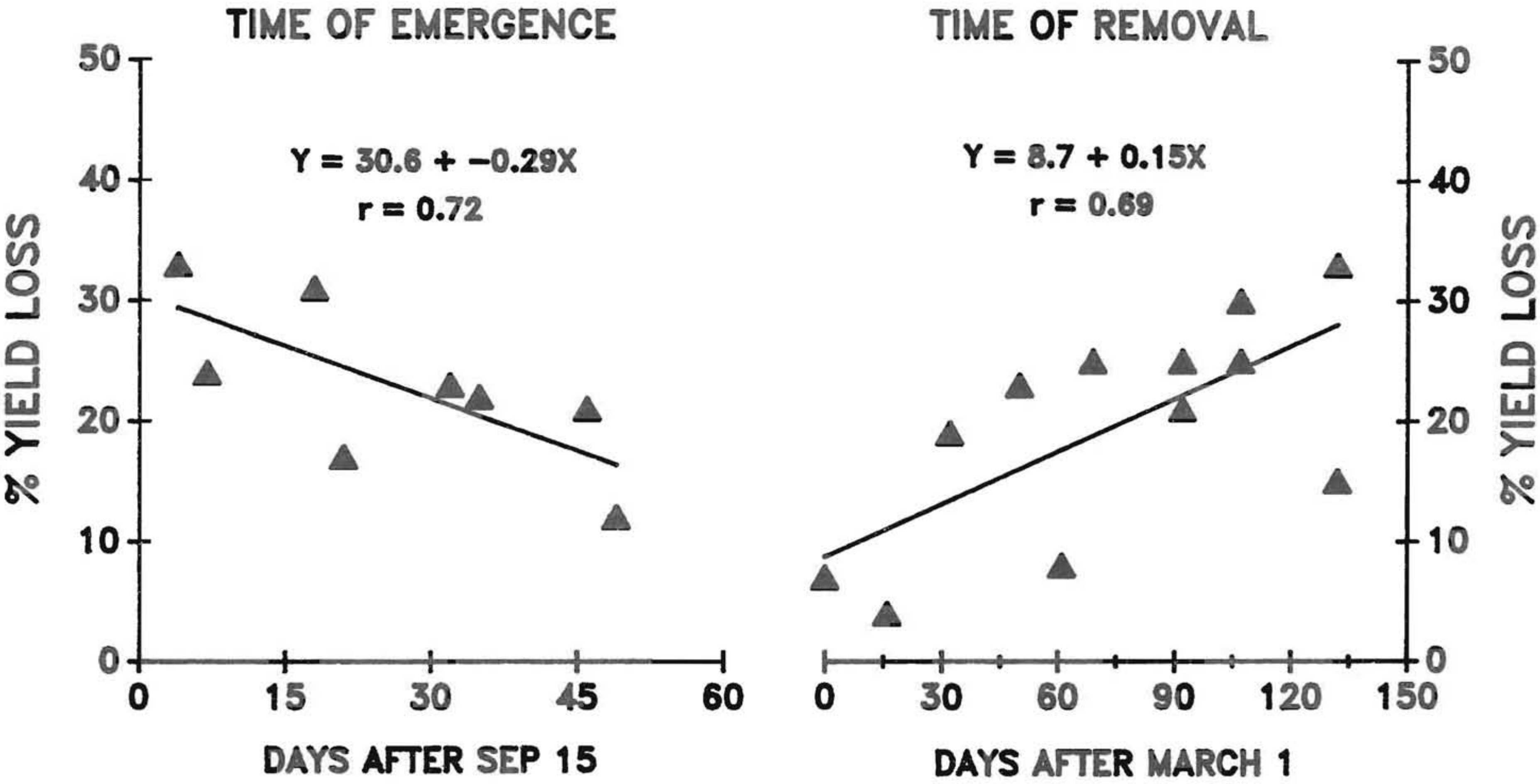


FIGURE. EFFECT OF DURATION OF JOINTED GOATGRASS INTERFERENCE ON WINTER WHEAT YIELD. DENSITY OF JOINTED GOATGRASS WAS 18 PLANTS/M^2.

Dyer's woad (*Isatis tinctoria* L.) pollen viability is reduced by metsulfuron methyl application. Asghari, J.B. and J.O. Evans. Dyer's woad plants growing in the field were transplanted in the rosette stage to 10-liter greenhouse pots and placed in a cold room to be vernalized for 180 days at 4 C in 8 h light and 16 h dark cycles. Subsequent to the low temperature, all pots were taken to a greenhouse with 16 h light and 26/18 C day/night temperature. Plants were allowed to bolt and flower and were selected for uniformity with respect to flower initiation. When the plants reached a stage where one-half of the flowers along an inflorescence were fully open, treatments of metsulfuron methyl were applied. Dosages included 0, 3, 5, 7, 9, and 12 g ai/ha and were applied with an overhead track sprayer equipped with TeeJet 8001 nozzles delivering 187 l/ha. Three pots, each with three plants, were used in each treatment and the experiment was replicated three times. One, 3, 5, 7, 9, and 12 days after herbicide application an inflorescence sample was taken from each treatment and immediately fixed in Carnoy's solution. Twenty four hours later the samples were transferred to 70 percent ethanol until examined.

Pollen grain were determined viable if they stained dark red in one percent acetocarmine in glycerine or dark blue in aniline blue in lactophenol. Results of the two techniques correlated very closely and only the results from the acetocarmine procedure are reported here. Pollen grain analysis was performed with a light microscope and 300X magnification. Two hundred randomly selected pollen grains were evaluated for each treatment. The table reveals that increasing dosage of metsulfuron methyl significantly reduced viability of dyer's woad pollen and may correlate with the reduced seed production at equivalent dosages in the field. The number of non-viable pollen grains also increased with increasing number of days after treatment that the pollen grains remained on the treated plants. (Utah Agricultural Experiment Station, Logan 84322-4820).

Percent viable pollen grains from metsulfuron methyl treated dyer's woad inflorescences.

Metsulfuron methyl (g/ha)	Percent viable pollen* Harvest (days after treatment)					
	1	3	5	7	9	12
0	100	100	100	100	100	100
3	93.7	88.8	54.6	61.9	23.7	18.0
5	75.8	79.8	43.3	53.6	21.6	6.2
8	78.4	68.1	35.1	44.4	16.5	8.2
12	52.1	38.3	37.1	12.8	17.5	7.7

* Viability expressed as a percent of the untreated plants.

Low temperature vernalization forces Dyer's woad (Isatis tinctoria L.) flowering. Asghari, J.B., J.O. Evans, and S.A. Dewey. Dyer's woad is a rapidly spreading mustard weed which is native to cold environments of USSR. This weed is well suited to dry, long cold winters and rocky soils common to many hillsides in the intermountain region of the United State. Its rapid encroachment of ranges, croplands and national forests of the region coincide with reduced desirable plant production. In order to demonstrate dyer's woad vernalization requirement for flowering and seed set which may help predict invasion of several environment within the region, this vernalization study was conducted in the greenhouse and cold room in 1989. Half of the experimental plants were selected from one year old potted dyer's woad plants raised outside that had previously flowered in response to natural light and temperature regimes. Each 10-liter pots contained four vegetatively active rosettes with the old stems and leaves was transferred to the greenhouse on Sep 25, 1989. The dead stems and leaves were removed from the pots prior to vernalization treatments of 0, 23, 47, 70, and 93 day low temperature exposures replicated five times in a completely randomized block design. The exposure chamber maintained 4 C and 8 h light and 16 h dark cycles.

The other half of the plants treated in a duplicate manner were selected from four month old seedlings rosettes without flowering history greenhouse germinated dyer's woad rosettes. Each 10-liter pot contained four young actively growing rosettes and were subjected to 0, 23, 47, 70 and 93 day cold exposure. The experiment was designed so that all plants completed low temperature exposure on January first 1990 and were placed in a greenhouse with 16 h light and 26/18 C day/night temperature to flower.

A positive correlation occurred between length of cold temperature exposure and number of old rosettes that expired.
A similar condition did not occur with seedling rosettes. Plants from both groups failed to flower in the absence of cold exposure and rosettes from both groups required more than three weeks low temperature treatment before they become induced to flower. A quantitative relationship apparently exists between flowering and duration of low temperature exposure since rosettes from bolted quicker and set seed faster than plants near threshold vernalization limits. Locations without sufficiently long cold periods may escape dyer's woad invasion. (Utah Agricultural Experiment Station, Logan 84322-4822).

Effect of length of vernalization period on dyer's woad rosette death and flowering.

Exposure to 4 C (days)	Rosettes (Percent)			
	Surviving exposure		Survivors flowering	
	crown rosettes	seedling rosettes	crown rosettes	seedling rosettes
93	44	100	100	100
70	65	100	100	100
47	72	100	100	100
23	80	100	5	0
0	81	100	0	0

Effects of metsulfuron on meiosis in the wheatgrasses, Russian wildrye, and Great Basin wildrye. Waldron, B.L., J.O. Evans, and K.B. Jensen. Metsulfuron is not registered for use on wheatgrass stands grown for seed production. The objective of this study was to evaluate the effect of metsulfuron on chromosome pairing and disjunction in the wheatgrasses. Grasses were drilled into five-row plots on August 23, 1990. Each grass entry was planted in plots 15.2 meters long and 1.5 meters wide. Preemergence application of metsulfuron was made on August 25, 1990 using a four-nozzle logarithmic sprayer unit delivering 29.2 gpa at 40 psi. A logarithmic sprayer linearly increases the amount of active ingredient applied as it proceeds the length of the plot. The sprayer was set to begin applying 0 g/ha and increase to 110 g/h at the end of plot. After initial visual evaluation, data was collected at six herbicide rates. Postemergence application of metsulfuron was made on April 30, 1991 with a four-nozzle bicycle sprayer delivering 16.2 gpa at 40 psi. Each herbicide rate was applied in 2.1 meter wide strips perpendicular to the grass plots. Dosages for postemergence treatment were selected to correspond with selected preemergence rates. Rates ranged from 0 to 63 g/ha. Table 1 contains the application data. Both the pre- and postemergence studies were arranged in a randomized block, split-plot design with four replications.

Spikes for meiotic analysis were collected between May 28 to July 10, 1991. Growth stages varied from minus two inches emergence from boot to five inches of exposed culm, depending on grass entry. Samples were fixed in Carnoy's fixture and stored in 70 percent alcohol. Meiotic cells were examined for frequencies of univalents, ring and rod bivalents, multivalents, and extra micronuclei. Initial studies on Goldar bluebunch wheatgrass show no significant difference in chromosome pairing and disjunction between the controls and the highest rate. Further studies are underway examining meiosis in other grass entries (table 2). (Utah Agricultural Experiment Station, Logan, 84322-4820.)

Table 1. Application data for metsulfuron treatments on common range grasses. Logan UT. 1990-91.

	Preemergence	Postemergence
Application date	08/25/90	04/30/91
Air/soil temp. (F)	75/85	51/65
Relative humidity (%)	26	43
Wind (mph)	6.2	7.0
Sky/soil conditions	clear/dry	clear/wet
Soil texture	Silt-loam	Silt-loam
pH	8.0	7.9

Table 2. Grass entries used to evaluate metsulfuron effects on meiosis. Logan UT. 1991.

Cultivar	Common Name
Alkar	Tall wheatgrass
Bozoisky	Russian wildrye
Cris-28[1]	Crested wheatgrass
Goldar	Bluebunch wheatgrass
Hycrest	Crested wheatgrass hybrid
Luna	Pubescent wheatgrass
Magnar	Great Basin wildrye
Nordan	Crested wheatgrass
T21076	Thickspike wheatgrass
Pryor	Slender wheatgrass
Rosana	Western wheatgrass
Secar	Snake River wheatgrass

1. Used here to refer to non-certified tetraploid *Agropyron cristatum*

PROJECT VII

ALTERNATIVE METHODS OF WEED CONTROL

Bob Callihan - Project Chairperson
Ed Schweizer - Project Chairperson-Elect

Cover Crops for Weed Suppression in Red Raspberries. Kaufman, D., R. Karow, A. Sheets, and R. William. Recent interest in farming with reduced chemical inputs has revived interest in the potential of cover crops for weed suppression. This research was conducted in a red raspberry field near Sandy, Oregon for the purpose of comparing six cover crop species for adaptability, winter survival, biomass production, and weed suppression, both by the cover between berry rows and by a mulch of the cover placed within the berry row.

Both aisles on each side of a berry row were seeded with one of six cover crops in unreplicated demonstration plots. Cover crops evaluated were: 'Galt' spring barley; 'Amity' winter oat; 'Cayuse' spring oat; 'Flora' triticale; Austrian winter pea; crimson clover, and the natural weed cover. Topography, soil conditions, and predominant weed species were uniform throughout the test area. Plot size was 6,000 ft^2 (600 linear ft X 5 ft wide X 2 sides of the berry row). With the exception of the 'Galt' barley, which was not seeded until October 11, 1990, the covers were seeded on September 25, 1990. Plots were rototilled shallowly after broadcast surface seeding with a Gandy spreader.

Both 'Cayuse' spring oat and 'Galt' spring barley suffered severe winter injury. Crimson clover failed to establish.

Weeds were counted in the 'Amity' winter oat, 'Flora' triticale, Austrian winter pea and natural weed cover plots on May 10, 1991, by randomly taking 20 samples in each 6,000 ft^2 plot. Ladysthumb smartweed was the predominant weed throughout the test area and in the natural weed cover. Each of the covers resulted in reduced ladysthumb smartweed populations.

The covers were mowed on May 14, 1991, and clippings moved to four randomly selected berry rows (30 ft. long) to which no preemergence herbicides had been applied. Each 30 ft. long row of raspberries (panel) was divided into four 7.5 ft. areas over which a 3-4 in. thick mulch of Austrian winter pea, 'Amity' winter oat, or a shredded poplar excelsior was placed, in addition to a non-mulched control. Each of the mulches, at a thickness of 3 in. suppressed weeds. However, in spots where the mulch was less than 2 in. thick, weeds were able to germinate and become established.

After mowing, each two panels down the Austrian winter pea, 'Amity' oat, and 'Flora' triticale rows were alternately incorporated by rototilling or left intact until the end of harvest. Though mowing destroyed the Austrian winter pea, the 'Amity' oat and 'Flora' triticale survived. They remained alive, though not vigorous, until raspberry harvest, when they were killed as a result of mechanical harvester traffic. Mowed covers continued to suppress weeds throughout the summer and no negative effects on raspberry plant growth were observed.

This research is currently being expanded to include additional cover crop species. Cover crops selected from these trials will be evaluated in the future in a replicated trial. (Extension Service, Oregon State University, Corvallis, OR 97331).

Number of weeds in cover crop test in red raspberries near Sandy, Oregon, May 10, 1991

Predominant weed species	Cover Crop: 'Amity' oat	'Flora' triticale	Austrian pea	Natural weed cover
	(No.)			
Common chickweed	25	3	0	3
Mouse ear chickweed	3	4	1	19
Little bittercress	10	14	16	1
Annual bluegrass	2	5	0	7
Cornspurry	0	2	0	16
Common groundsel	0	1	0	0
Wild radish	1	2	1	1
Ladysthumb smartweed	0	15	0	557

Effect of green manure on weed biomass. Bell, C. E. and K. S. Mayberry. Green manures are crops grown to improve soil conditions or fertility. The ability of different green manure species to suppress weed growth is an important agronomic benefit. This research was designed to evaluate the weed suppressive ability of several different green manures. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

The experiment used a randomized complete block design with five replications. Plot size was 8 m by 15 m. The green manures were sown on beds with a hand pushed planter at the appropriate seed rate for each species. Five legume and one grass green manures were used, along with a fallow (non-planted) control. The green manures were sown on October 11, 1990 and irrigated by furrows on the same day. The plots were sampled for green manure and weed biomass twice, on December 28, 1990 and April 1, 1991. Each sample consisted of four 0.25 m^2 random subsamples per plot. Weeds and green manure were separated in each sample, dried at 50 C for three days, and weighed. Weeds present were London rocket and nettleleaf goosefoot.

At the first sample date, three of the green manures had suppressed weed growth significantly compared to the fallow control. These were lana vetch, Austrian winter pea, and annual ryegrass. At the second harvest, all of the green manures had suppressed weed growth significantly in comparison with the fallow control. (Cooperative Extension, University of California, Holtville, CA 92250.)

Green manure and weed biomass in Holtville, CA

Green Manure	Seeding Rate	Biomass Dec. 12 GM[1]	Dec. 12 Weeds	Apr. 1 GM	Apr. 1 Weeds
	(kg/ha)	(g/m^2)			
Lana vetch	89	431.7a	13.1 b	1100.0 b	0.0 b
Purple vetch	89	427.7a	42.9ab	1042.1 bc	20.8 b
Hairy vetch	56	207.5 d	67.2ab	819.3 cd	128.3 b
Austrian winter pea	89	315.1 b	25.0 b	791.8 d	104.3 b
Bell beans	112	223.5 cd	43.2ab	1105.9 b	130.4 b
Annual ryegrass	56	280.2 bc	13.7 b	1524.3a	1.5 b
Fallow control		0.0 e	103.4a	0.0 e	535.0a

1 - GM = green manure

Numbers in columns are not significantly different at the 5% level according to LSD.

Sheep grazing for weed control in seedling alfalfa. Bell, C. E. and J. N. Guerrero. This is a progress report of the second year of a research project to evaluate the efficacy of sheep grazing as compared to standard weed control methods in seedling alfalfa. The experiment is being conducted at the University of California Imperial Valley Research and Extension Center, Holtville, California.

The trial is a modified randomized complete block design, with two blocks and three replications per block. Alfalfa was sown and irrigated on October 29, 1990. Plot size was 0.04 ha (22m by 18m). Treatment one was grazing by sheep, four sheep per plot, from February 18, 1991 until February 28, 1991. Treatment two was EPTC at 3.9 kg/ha applied on October 17, 1990, incorporated by disc to 15 cm, plus 2,4-DB at 1.1 kg/ha and sethoxydim at 0.31 kg/ha applied on January 28, 1991. Treatment three was 2,4-DB at 1.1 kg/ha and sethoxydim at 0.31 kg/ha applied on January 28, 1991 Treatment four was untreated. Herbicide applications were made at 323 l/ha carrier volume at 276 kPa with 8004 flat fan nozzles.

All plots were sampled on February 13, 1991 before sheep were brought in. Five random, $0.25m^2$ quadrat samples were taken per plot. In each sample, alfalfa and weeds were separated by species, counted, and weighed after drying at 54°C for 72 hours. Weeds present were; london rocket, volunteer wheat (*Triticum aestivum* L), little mallow, littleseed canarygrass, prickly lettuce, wild beet (*Beta maritima* L), nettleleaf goosefoot, annual sowthistle, and rescuegrass. After the sheep had finished grazing, all plots were mown, the hay baled, and taken from the field. The sampling protocol was repeated on April 22, 1991. Biomass samples were collected on May 23, June 21, and August 28, 1991.

Treatments two and three controlled all weeds present very well. These treatments also had pronounced 2,4-DB injury symptoms and reduced yield at the first harvest. The data presented in the table below represent the second year of a three year trial. (University of California Cooperative Extension, Holtville, CA 92250.)

Alfalfa and weed density and biomass as affected by weed control method in the Imperial Valley of California

Treatment	1991 Density (#) and Biomass (gm)/m^2 Feb 13		April 22		May 23	June 21	Aug 28
	#	gm	#	gm	gm	gm	gm
Sheep grazing							
Alfalfa	336	108	356	117	150	241	141
Weeds	13	61	19	101	0	0	0
EPTC, 2,4-DB, sethoxydim							
Alfalfa	252	52	230	150	147	235	126
Weeds	8	16	3	34	0	0	0
2,4-DB, sethoxydin							
Alfalfa	308	52	258	156	154	231	142
Weeds	8	22	3	16	0	0	0
Untreated							
Alfalfa	276	111	242	146	159	235	140
Weeds	9	60	9	63	0	0	0

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(by common name or code designation)

This table was compiled from approved nomenclature approved by the Weed Science Society of America Terminology Committee (published in each issue of *Weed Science*) and the Herbicide Handbook of the WSSA (6th edition). "Page" refers to the page where a report about the herbicide begins; actual mention may be on a following page.

Common Name or Designation	Chemical Name	Page
bromacil	5-bromo-6-methyl-3-(1-methyl=propyl)-2,4(1H,3H) pyrimidine=dione	V-2,3
bromoxynil	3,5-dibromo-4-hydroxybenzo=nitrile	III-5,10,13,15,17,19,25,27,29,36,38,40,85,129,133,140,142,150,168,175
butylate	S-ethyl bis(2-methylpropyl) carbamothioate	III-83
CGA-136872	(see primisulfuron)	
calcium cyanamide	$CaCN_2$	II-12
chlorsulfuron	2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] benzenesulfonamide	I-2,10,12,14,22,23,25,73,75; III-133,166,171; V-6
clethodim	(E,E)-(±)-2-[1-[[(3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one	III-43,95,128
clomazone	2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone	III-163
clopyralid	3,6-dichloro-2-pyridinecarboxylic acid	I-9,12,14,16,20,22,25,26,32,66,68,69,71; III-36,38,40,47,61,63,140,142,187;V-6
cyanazine	2-[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]amino]-2-methyl=propanenitrile	III-67,69,81,83,96,101,103,107,113,118,120
desmedipham	ethyl[3-[[(phenylamino) carbonyl]oxy]phenyl]carbamate	III-47,49,52,54

Common Name or Designation	Chemical Name	Page
dicamba	3,6-dichloro-2-methoxybenzoic acid	I-5,7,9,10,12,14, 16,20,23,35,48, 50,51,52,53,59, 62,64,66,68,69, 71;III-36,38,40, 67,69,81,85,129, 133,140,146,161, 183,186,187; V-4,6,8
dichlobenil	2,6-dichlorobenzonitrile	V-2
dichlormid	2,2-dichloro-N-N-di-2-propenylacetamide	III-79
diclofop	(±)-2-[4-(2,4-dichlorophenoxy) phenoxy]propanoic acid	III-35,108,128, 136,142,148,150, 152,157,158,159, 171,173
difenzoquat	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium	III-33,35,136, 142,148,157,173
dithiopyr	S,S-dimethyl 2-(difluoromethyl)-4-(2-methylpropyl)-6-(trifluoro=methyl)-3,5-pyridinedicarbothioate	II-15
diuron	N'-(3,4-dichlorophenyl)-N,N-dimethylurea	II-4;III-2,9,93, 127,180;V-2,3
DPX-66037	not available	III-49,54
DPX-79406	not available	III-67
DPX-A7881	(see ethametsulfuron)	
DPX-E9636	N-[(4,6-dimethoxypyrimidin-2-yl)aminocarbonyl]-3-(ethyl=sulfonyl)-2-pyridinesulfonamide	III-125
DPX-G8311	chlorsulfuron + metsulfuron (5:1)	III-175
DPX-L5300	methyl 2-[[[[N-(4-methoxy-6-methyl-1,3,5-triazin-2-yl) methylamino]carbonyl]amino] sulfonyl]benzoate	I-22,25

Common Name or Designation	Chemical Name	Page
DPX-PE350	not available	III-94,96
DPX-V9360	(see nicosulfuron)	
endothall	7-oxabicyclo[2.2.1]heptane-2, 3-dicarboxylic acid	III-31
EPTC	S-ethyl dipropylcarbamothioate	I-35;II-5;III-6, 10,41,78,79,83; VII-5
ethalfluralin	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl) benzenamine	II-14;III-41,59, 99,101,105,109, 111,113,120
ethametsulfuron	2[[[[[4-ethoxy-6-(methylamino)-1,3,5-triazin-2-yl]amino]carbonyl] amino]sulfonyl]benzoic acid	III-59,61,63,66
ethofumesate	(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate	III-127
fenoxaprop	(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy]phenoxy] propanoic acid	III-35,158,159
fluazifop	(±)2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid	III-41
fluazifop-P	(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid	III-95,128
fluroxypyr	[(4-amino-3,5-dichloro-6-fluoro-2-pyridinyl)oxy]acetic acid	I-7,18,48,54,66, 69,73,81;III-36
glufosinate	2-amino-4-(hydroxymethylphos= phinyl)butanoic acid	III-96
glyphosate	N-(phosphonomethyl)glycine	I-5,16,26,35,48, 54,75,77,81;II-3; III-127,161,180, 184,186;V-3,8

Common Name or Designation	Chemical Name	Page
haloxyfop	2-[4-[[3-chloro-5-(trifluoro= methyl)-2-pyridinyl]oxy]phenoxy] propanoic acid	III-128
HC91-13	not available	III-173
hexazinone	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4 (1H,3H)-dione	III-2,9,19,171, 175
HOE-39866	(see glufosinate)	
HOE-6001	not available	III-152,173
HOE-7125	not available	III-142,173
ICI-A5676	not available	III-83
imazamethabenz	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-4(and 5)-methylbenzoic acid (3:2)	I-35;III-33,35, 122,136,142,148, 157,159,173
imazapyr	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridine= carboxylic acid	I-12,14,77,81; V-10
imazaquin	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-quinolinecarboxylic acid	I-35
imazethapyr	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid	I-35,51;III-2,4, 5,10,12,13,15,17, 19,23,25,41,45, 78,97,99,101, 103,105,109,111, 113,118,120,122; V-8
isoxaben	N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxy= benzamide	II-15;V-2
lactofen	(±)-2-ethoxy-1-methyl-2-oxoethyl 5-[2-chloro-4-(trifluoromethyl) phenoxy]-2-nitrobenzoate	III-96,101,103, 109,113,118,120

Common Name or Designation	Chemical Name	Page
linuron	N'-(3,4-dichlorophenyl)-N- -methoxy-N-methylurea	II-5;III-107;V-2
MCPA	(4-chloro-2-methylphenoxy)acetic acid	I-16;III-27,29, 35,36,38,40,103, 111,118,120,133, 140,142,146,175
MCPB	4-(4-chloro-2-methylphenoxy) butanoic acid	III-103,105,118, 120
metham	methylcarbamodithioic acid	II-12
metolachlor	2-chloro-N-(2-ethyl-6-methyl= phenyl)-N-(2-methoxy-1-methyl= ethyl)acetamide	III-41,69,71,72, 73,74,75,83,103, 105,107,109,111, 118,120,125
metribuzin	4-amino-6-(1,1-dimethylethyl)- 3-(methylthio)-1,2,4-triazin-5 (4H)-one	III-2,69,99,103, 109,111,113,118, 120,125,127,158, 171
metsulfuron	2-[[[[(4-methoxy-6-methyl-1,3, 5-triazin-2-yl)amino]carbonyl] amino]sulfonyl]benzoic acid	I-2,4,7,9,10,12, 14,16,20,22,23, 25,62,64,66,68, 69,73,75,76,83; III-133,166,171, 178,187;V-6; VI-4,8
MON13202	not available	III-93
MONO13211	not available	II-2,4;III-9
MONO13288	not available	III-9
MON21640	not available	II-2
NM-852	not available	III-71,72,73,74
napropamide	N,N-diethyl-2-(1-naphtha= lenyloxy)propanamide	II-4,9,12;V-3
naptalam	2-[(1-naphthalenylamino)= carbonyl]benzoic acid	II-14

Common Name or Designation	Chemical Name	Page
nicosulfuron	2-[[[[(4,6-dimethoxy-2-pyrimidinyl) amino]carbonyl]amino]sulfonyl]-N,N-dimethyl-3-pyridinecarboxamide	I-35;III-67,69, 76,79,85,87,90
norflurazon	4-chloro-5-(methylamino)-2-(3-(trifluoromethyl)phenyl)-3(2H)-pyridazinone	II-4;III-2,8;V-3
oryzalin	4-(dipropylamino)-3,5-dinitro-benzenesulfonamide	II-2,14,15;V-2,3
oxadiazon	3-[2,4-dichloro-5-(1-methylethoxy) phenyl]-5-(1,1-dimethylethyl)-1,3, 4-oxadiazol-2-(3H)-one	II-15
oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitro= phenoxy)-4-(trifluoromethyl) benzene	II-2;III-43,96; V-3,8
paraquat	1,1'-dimethyl-4,4'bipyridinium ion	I-5;III-19,127, 180;V-8
pendimethalin	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine	II-5,15;III-10, 41,43,59,67,81, 99,101,103,105, 107,109,111,113, 118,120,131
phenmedipham	3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate	I-54;III-47,49, 52,54
picloram	4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid	I-7,10,12,14,16, 18,20,22,23,25, 26,29,32,35,38, 41,43,45,46,48, 50,51,52,53,57, 59,62,64,66,68, 69,71;III-161, 165,183,187;V-4,6
PPG-1259	3-[5-(1,1-dimethylethyl)-3-isoxazalyl]-4-hydroxy-1-methyl-2-imidazolidone	I-73
primisulfuron	2-[[[[[4,6-bis(difluoromethoxy)-2-pyrimidinyl]amino]carbonyl] amino]sulfonyl]benzoic acid	I-35;III-67,69,85 87,89

Common Name or Designation	Chemical Name	Page
prodiamine	N/,N/-di-N-propyl-2,4-dinitro-6-(trifluoromethyl)-m-phenylenediamine	III-2
prometryn	N,N'-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine	III-93,96
pronamide	3,5-dichloro(N-1,1-dimethyl-2-propynyl)benzamide	III-21,23,127,128
propachlor	2-chloro-N-(1-methylethyl)-N-phenylacetamide	III-129
pyridate	O-(6-chloro-3-phenyl-4-pyridazinyl)-S-octyl carbamothiate	II-17;III-81,85,88,89,129,133
quinclorac	3,7-dichloro-8-quinoline=carboxylic acid	I-35,41,53;III-129,148,161,183,186
quizalofop	(±)-2-[4-[(6-chloro-2-quinoxa=linyl)oxy]phenoxy]propanoic acid	I-35;III-61,128
sethoxydim	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one	II-7;III-22,23,41,43,59,61,63,66,95,128;VII-5
simazine	6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine	II-4;V-2,3
sulfometuron	2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]benzoic acid	I-20,22,25,35;V-2
sulfosate	not available	I-52;III-161;V-3,8
tebuthiuron	N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N'-dimethylurea	I-73;V-2
terbacil	5-chloro-3-(1,1-dimethylethyl)-6-methyl-2,4(1H,3H)-pyrimidinedione	II-4

Common Name or Designation	Chemical Name	Page
thifensulfuron	3-[[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino] carbonyl] amino]sulfonyl]-2-thiophene=carboxylic acid	I-35;III-27,29,36,38,40,116,133,138,140,142,146,150,168,175
triallate	S-(2,3,3-trichloro-2-propenyl) bis(1-methylethyl)carbamothioate	III-120,150,155
triasulfuron	2-(2-chloroethoxy)-N-[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzene-sulfonamide	III-40,133,152,166,180
tribenuron	2-[[[[(4-methoxy-6-methy-1,3,5-triazin-2-yl)methylamino] carbony]amino]sulfonyl] benzoic acid	I-35;III-27,29,36,38,40,116,133,138,140,142,146,150,168,175
triclopyr	[(3,5,6-trichloro-2-pyridinyl) oxy]acetic acid	I-7,12,14,62,71,73,77,81;V-8
trifluralin	2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)benzenamine	II-5,14,15;III-6,9,10,45,59,93,105,109,111,125,131
2,4-D	(2,4-dichlorophenoxy)acetic acid	I-2,7,9,10,12,14,16,20,35,38,41,43,46,48,50,51,52,53,57,59,62,64,66,68,69,71,73;III-29,35,36,38,40,67,69,133,138,140,142,146,161,165,175,180,183,186,187;V-4,6,8
2,4-DB	4-(2,4-dichlorophenoxy)butanoic acid	III-5,10,13,15,17,19,23,122;VII-5
UBI-C4243	not available	I-2,14;III-105,109,113,150,168,171,180,184

ABBREVIATIONS USED IN 1991 REPORT

A°	angstrom
A, a, or ac	acre(s)
ACCase	acetyl-CoA-carboxylase
acif	acifluorofen
ae	acid equivalent
Agric.	Agricultural
AGRRE	quackgrass
ai or a.i.	active ingredient
ai/a	active ingredient per acre
AMARE	redroot pigweed
AMSIS	*Amsinckia* spp
ANOV	analysis of variance
applic	application
ARS	Agricultural Research Service
ASPOF	asparagus
atra	atrazine
Aug	August
AVEFA	wild oat
avg	average
bb	brush bullet
BBTD	banana bunchy top virus disease
bent	bentazon
blueb	bluebunch
blueg	bluegrass
brom	bromoxynil
BROTE	downy brome
brox	bromoxynil
bu/a	bushel per acre
C	degree(s) Celsius or Centigrade
can	canopy
cc	cubic centimeter
CCHIN	field sandbur
CDA	controlled droplet applicator
CEC	cation exchange capacity
CHEAL	common lambsquarters
CIRAR	Canada thistle
clop	clopyralid
clsu	chlorsulfuron
cm	centimeter
CO	Colorado
Co	county
CO_2 or CO2	carbon dioxide
COC	crop oil concentrate
CONAR	field bindweed
cont	control
Coop.	Cooperative
cotyl	cotyledon
creep	creeping
crest	crested

C.R.P.	conservation reserve program
C.S.P.	cool season phytotoxicity
CV or cv	coefficient of variation
cwt	hundred weight
cwt/A	hundred weight per acre
cyan	cyanazine
°	degree
DAT	days after treatment
DESPI	pinnate tansymustard
dg	dispersable granule
dia	diameter
dica	dicamba
dm	dry matter
dmg	damage
dpm	disintegrations per minute
DSC	dry soluble concentrate
DTT	dithiothreitol
E	east
EC	emulsifiable concentrate
EP	early postemergence
EPA	Environmental Protection Agency
Ephr	Ephraim
EPOE	early postemergence
ERACN	stinkgrass
etha	ethafluralin
ethamel	ethametsulfuron
eval	evaluation
Exer	Exerata
Exp.	Experiment
Ext.	Extension
F	degrees Fahrenheit
fam	family
FC	fruiting cane lower lateral control
feno	fenoxaprop
fesc	fescue
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
flua	fluazifop
flur	fluroxypyr
ft or '	foot or feet
ft^2 or sq ft	square feet
FY	fiscal year
G	granule
g or gm	gram(s)
g/ha	grams per hectare
g/m^2	grams per square meter
g ai/ha	gram(s) active ingredient per hectare
gal	gallon(s)

gal/A, gal/a, G/A GPA or gpa	gallon(s) per acre
GM	green manure
gpa	gallons per acre
GR	Grangeville, Idaho
GR_{50}	herbicide rate for fifty percent growth reduction
>	greater than
h or hr(s)	hour(s)
ha	hectare
HELAN	common sunflower
Hycr	Hycrest
ID	Idaho
imaz	imazethapyr
in or "	inch(es)
inj	injury
inter or interm	intermediate
IPT	individual plant treatment
Jan	January
Jul	July
KCHSC	kochia
K.D.	kikuyugrass density
Kenbl	Kenblue
Kent	Kentucky
kg	kilogram
kg ai/ha	kilograms active ingredient per hectare
kg/ha	kilogram(s) per hectare
kPa	kilopascal
K.S.	kikuyugrass control
L	liter
l/ha	liter(s) per hectare
lab	laboratory
lb or lbs	pound(s)
lb/a	pound(s) per acre
lb ai/A, lb a.i./A or lb ai/a	pound(s) active ingredient per acre
LC	liquid concentrate
lf	leaf
LP	low pressure
LPOE	Late postemergence
LSC	liquid soluble concentrate
LSD	least significant difference
LVE	low volatile ester
m	meter
m^2	square meter

μM	micromolar
Manch	Manchar
Mar	March
MAT	months after treatment
mCi	microcurie
mE	microeinsteins
mead	meadow
Meck	Mecklenburg
meq	milliequivalent
meto	metolachlor
mg	milligram
mg/L	milligrams per liter
Mg	megagrams per hectare
min	minute
ml	milliliter
mm	millimeter
mM	millimolar
mos	months
mph	miles per hour
MRT	multiple range test
ms	methylated sunflower oil
M.W.	molecular weight
N	nitrogen, north
NE	northeast
nico	nicosulfuron
No. or no.	number
Nord	Nordan
Nov	November
NS	nonsignificant
NW	northwest
oatg	oatgrass
oc	oil concentrate
Oct	October
OM	organic matter
OR	Oregon
orch	orchardgrass
oz	ounce(s)
oz/A	ounce(s) per acre
oz pr/A	ounce(s) product per acre
P	probability
p or %	percent
Paiu	Paiute
PANMI	wild proso-millet
PE	preemergence
PEI	preemergence incorporated
pend	pendimethalin
peren'l	perennial
pH	-log hydrogen ion concentration
pl or plt	plant(s)
pls	pure live seed

pm	package mix
POLCO	wild buckwheat
POPES or POPS	postplant preemergence surface
POPI	post-plant incorporated
POST or post	postemergence
PP	preplant
PPI or ppi	preplant incorporated
ppmw	parts per million by weight
PPS	preplant surface
PRE or pre	preemergence
prim	primisulfuron
prop	propachlor
PS	primocane suppression
P.S.&E.S.	Plant, Soil, & Entomological Sciences
PSI or psi	pounds per square inch
pt	pint(s)
pub	pubescent
pubesc	pubescent
pvc	polyvinylchloride
pyri	pyridate
qt	quart(s)
qt/A	quart(s) per acre
r	coefficient of correlation
r. clover	red clover
s	second/seconds
S	south, susceptible
SASKR	Russian thistle
SC	soluble concentrate
s. clover	yellow sweetclover
SE	Southeast
Sep or Sept.	September
Serv.	Service
SETVI	green foxtail
Sib	Siberian
SINAR	wild mustard
SOLNI	black nightshade
SOLSA	hairy nightshade
sp or spp	species
sq	square
sqft	square foot
SR	stand reduction
St	state
Sta.	Station
Str	stand reduction
Streak	Streaker
Stream or Streamb or Strm . . .	Streambank
SW	southwest
T/A or t/A	ton(s) per acre

thif	thifensulfuron
TR	Troy, Idaho
trib	tribenuron
trt	treatment
T.S.	turf score
Tual	Tualatin
univ	university
Uran 32	Ammonium nitrate + urea + water
U.S.	United States
USDA	United States Department of Agriculture
v/v	volume per volume
var.	variety
W	west
w/v	weight to volume
WG	water dispersible granule
wheatg or whtgr	wheatgrass
wks	weeks
WP	wettable powder
wt	weight
ZEMAY	volunteer corn
7d ltr	seven days later
10P	10% active ingredient pellet
20P	20% active ingredient pellet