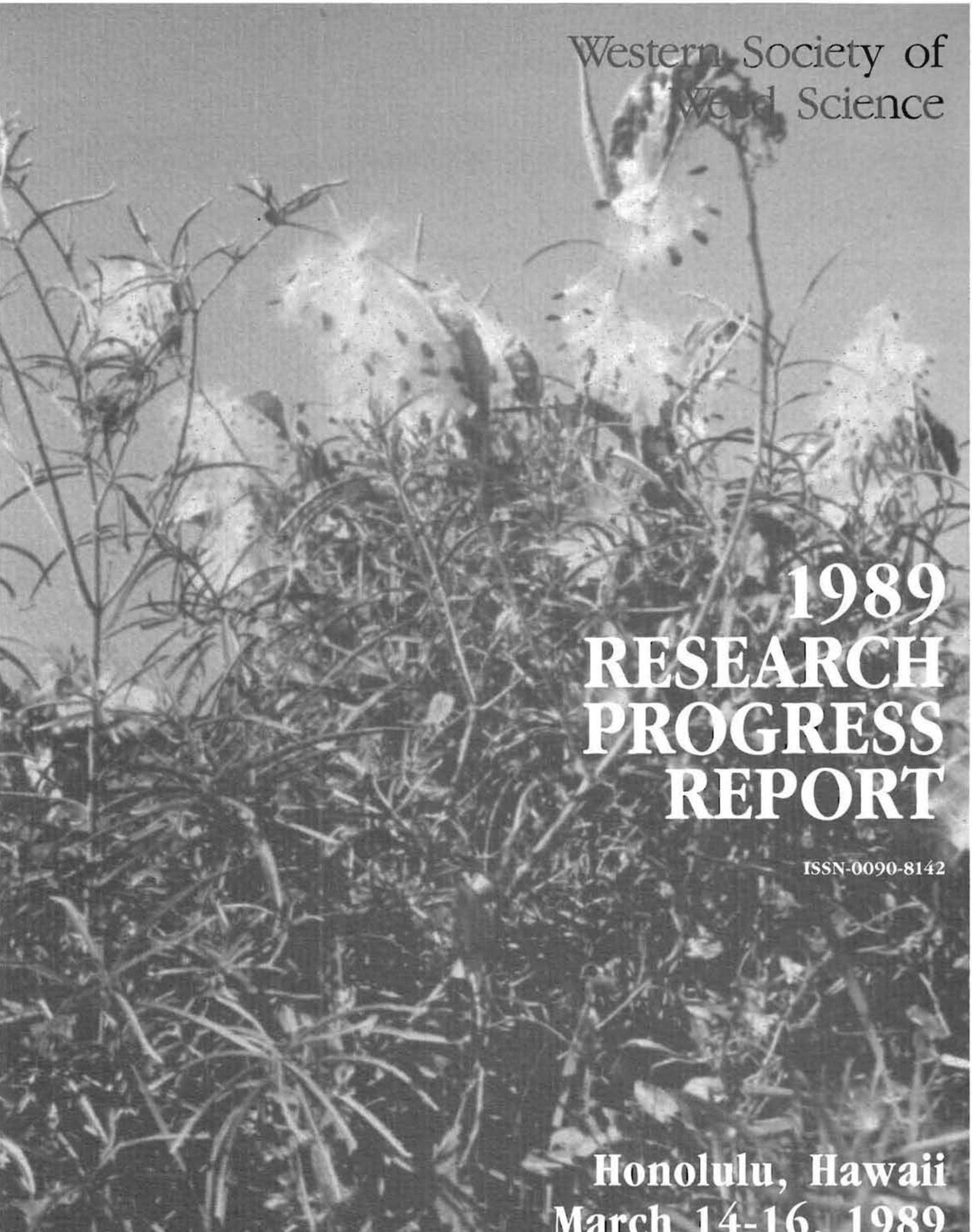

Western Society of
Weed Science

1989
RESEARCH PROGRESS REPORT

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FOREWORD

The Western Society of Weed Science (WSWS) 1989 Research Progress Report is a compilation of brief reports and recent investigations by weed scientists in the Western United States. The primary function of this volume is to facilitate interchange of information within the weed science community: it is not meant to serve as a means of presenting conclusions, endorsements or recomendations to the general public or anyone else. In this report, information contained herein is meant to be considered in a preliminary sense, and NOT FOR PUBLICATION. This represents an effort by the WSWS to make available effective research, improve communication among scientists having common interests, minimize duplication of effort and to promote a sharing of ideas.

This 1989 Western Society of Weed Science Research Progress Report is prepared by photoreproduction of reports as submitted by the authors, without retyping or significant editorial changes. Content, format, and style of each paper or report are the sole responsibility of the author(s). In the interest of information exchange, reports were accepted for printing, except for profound deviations from WSWS editorial rules.

The accumulation of the project reports and some index work was the responsibility of the seven (7) project chairmen. Final responsibility for compiling the report and developing the indices belongs to the research section chairman.

Recognition and credit must go to the members of the Western Society of Weed Science whose efforts are reflected in the reports contained herein.

Steven R. Radosevich
Chairman, Research Section
Western Society of Weed Science
1989

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PROJECT 1.

PERENNIAL HERBACEOUS WEEDS

George Beck - Project Chairman

Western wild cucumber control with herbicides. Burrill, L., and J. Leffel. Western wild cucumber is a perennial vine that regrows each year from an enormous root. It is common to fields of Western Oregon and causes serious economic loss by competing with crops or reducing crop quality as is the case with Christmas trees deformed by the weight of the vines.

Research done in 1981 showed that plants treated with glyphosate did not regrow one year later. Grower results have not been this good and in many cases the infestation is so thick that a broadcast application is needed. For these situations a selective herbicide is required.

A field experiment was conducted near Gaston in Washington County, Oregon, to test the effectiveness of several herbicides in controlling wild cucumber in the season following application. In an area uniformly infested with wild cucumber, plots 12 by 25 ft. and replicated three times were treated on July 2, 1987. Thirty gallons of water per acre was used as the carrier and was sprayed through four 8002 flat fan nozzles. The wild cucumber was mature and had produced mature fruits.

Evaluation of control was done on May 30, 1988. A mature crop of Italian ryegrass was growing in the field and made evaluation difficult. This may explain the two cases of different results among replications although the observations were rechecked to confirm results.

We were surprised that all of the herbicides gave acceptable control. This may indicate that growers are getting control for one year but are not making follow-up applications until the plants have fully recovered (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Wild cucumber control with herbicides

Herbicide	Rate	% Control			
	lbs ai/a	R1	R2	R3	Aug
glyphosate	1.5	90	90	100	93
glyphosate	3.0	100	90	100	97
picloram	0.5	90	80	100	90
picloram	1.0	50	95	100	82
dicamba	1.0	100	80	75	85
dicamba	2.0	100	90	90	93
triclopyr (ester)	0.5	80	30	100	70
triclopyr (ester)	1.0	95	100	100	98
triclopyr + 2,4-D (Crossbow)	0.5 + 1.0	90	0	100	63
triclopyr + 2,4-D (Crossbow)	1.0 + 2.0	95	75	90	87

Some factors affecting the development of tuber oatgrass. Tanphiphat K. and A.P. Appleby. Tuber oatgrass (*Arrhenatherum elatius* var. bulbosum (Willd.) Spenn.) is a perennial grass that has become an increasingly serious weed problem. Although not widely spread nationally, it has been difficult to control in Oregon. Little is known about the biology of this weed. The objective of this study was to investigate some factors affecting its development.

Corm formation study: Corms are the main source of shoots produced in the following season. The effects of light and temperature on corm formation were studied on plants started from corms. A study was conducted in growth chambers at the light intensity of 250 $uE \cdot m^{-2} \cdot s^{-1}$ with the following treatments:

1. 30/20C day/night temperature at 16/8h photoperiod.
2. 30/20C day/night temperature at 8/16h photoperiod.
3. 20/10C day/night temperature at 16/8h photoperiod.
4. 20/10C day/night temperature at 8/16h photoperiod.

Random samples of 10 plants were excavated at 2-week intervals and evaluated for corm formation. T_{50} (time required to obtain 50% of plants forming corm), the parameter used by Le Clerch (1975)*, was estimated from the graphs.

Corm formation was influenced by both photoperiod and temperature (Figure 1). Corm formation was faster in plants growing under long days as indicated by the T_{50} values (Table 1.). Increasing temperature hastened corm formation in plants growing under short days but not in plants growing under long days. The time required to obtain 100% corm formation was longest for plants growing under short days and low temperature, and shortest for plants growing under long days.

Table 1. Effect of light and temperature on corm formation.

Treatments	T_{50}[a] (weeks)
high temperature, long day	5.4
high temperature, short day	6.8
low temperature, long day	5.2
low temperature, short day	13.3

[a] T_{50} = time required for 50% of plants to form corms.

Vernalization study: A study was conducted to investigate vernalization requirements for flowering of tuber oatgrass plants started from seeds and corms. Seeds and corms were placed in plastic boxes containing filter-paper (seeds) or sponge (corms) moistened with distilled water. The boxes were kept in the refrigerator at 5C for 0, 1, 2, 3, and 4 weeks. There were six replications per treatment. After vernalization, both seeds and corms were allowed to acclimate at room temperature for 2 days prior to transplanting into the 3.7-L plastic pots and placed in the greenhouse. Greenhouse

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* Le Clerch (1971). Tuberisation of oat strings. Acad Sci (Paris) C R Ser D,272(17):2174-2176.

temperature was 18/15C day/night with 16/8h photoperiod. Number of days before plants produced flowers and the number of panicles produced 6 months after planting were recorded. Data were analyzed by regression analysis.

Vernalization was not required for plants started from seeds or corms. Both vernalized and nonvernalized plants produced flowers. Vernalization neither hastened the flowering process nor did it significantly increase panicle formation.

Table 2. Vernalization of tuber oatgrass plants started from seeds and corms

	Period of vernalization (weeks)				
	0	1	2	3	4
seeds					
Days to flower	58±10	35±10	48±2	57±4	53±8
Panicle numbers	30±20	39±10	38±21	36±10	51±16
corms					
Days to flower	52±6	50±2	46±6	53±6	48±5
Panicle numbers	28±6	38±5	30±13	26±6	24±6

Seed germination study: Seeds were collected from plants grown in the greenhouse. Germination tests were conducted on freshly harvested seeds. The experimental design was a completely randomized design replicated four times with four by two by two factorial arrangement of treatments. There were four levels of temperature(8, 15, 25, and alternating 20/30C at 16/8h), two light treatments (light and dark), and two germination solutions (water and 0.2% KNO_3 (v/v)). The light treatment was approximately 250 $uE \cdot m^{-2} \cdot s^{-1}$. Twenty-five seeds were placed on blotter papers moistened with either germination solution in covered plastic boxes. For the dark treatment, the boxes were wrapped in aluminium foil before being placed into the germinators. Radical emergence was counted weekly and the experiment was terminated after 8 weeks.

Light and KNO_3 did not significantly affect tuber oatgrass seed germination. Germination was fastest at 15C (Figure 2). At this temperature, the maximum germination was achieved after 4 weeks. Germination was delayed at 25C and the total germination after 8 weeks was significantly reduced. The delay in the initial germination was also observed at 8C. However, the total germination was higher than at 25C.

Corm sprouting study: The effect of light and temperature on corm sprouting was studied. The treatments were similar to those used in the seed germination study. The KNO_3 treatment, however, was not included. Ten corms were placed into sponges soaked with distilled water and put in plastic boxes before being placed into the germinators. Shoot emergence was counted weekly.

Light and temperature did not significantly affect the total number of corm sprouted. Most corms sprouted after 3 weeks. The initial sprouting during the first week was delayed at 8C. Most corms unsprouted after 3 weeks were dead. Corms were less sensitive to higher temperature than seeds. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Table 3. Percent sprouting of tuber oatgrass corms at different temperatures.

Temperature	days after initiation 7	 14	 21
8	49	95	96
15	93	96	97
25	88	93	93
30/20	91	93	96
LSD	9	NS	NS

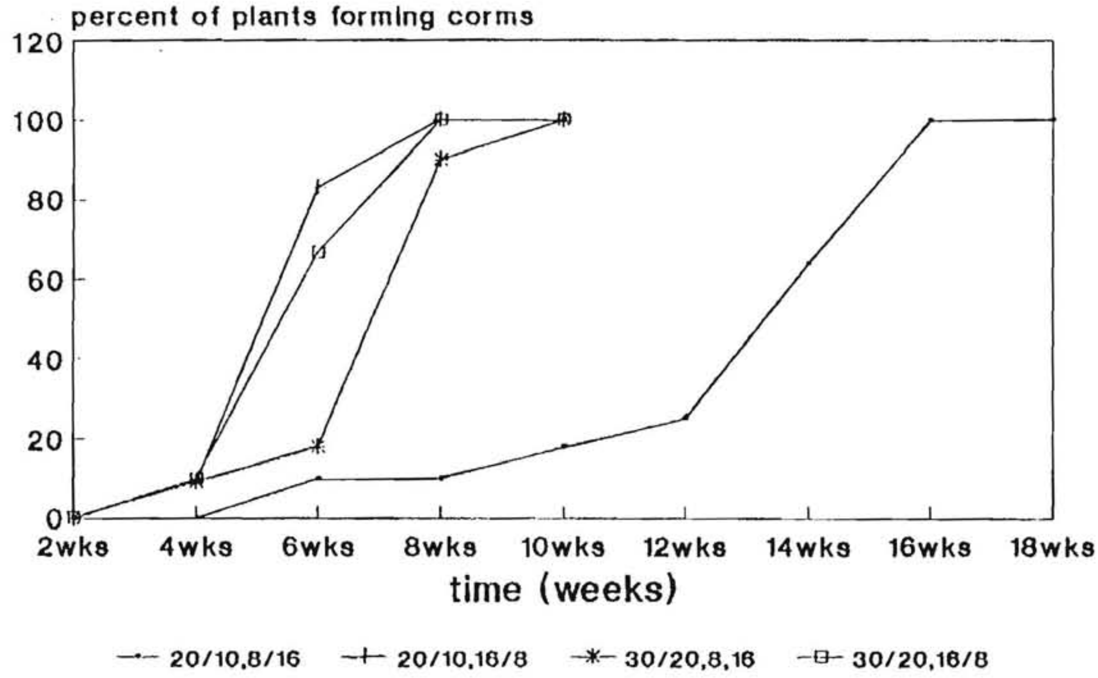

Figure 1. Effect of photoperiod and temperature on corm formation.

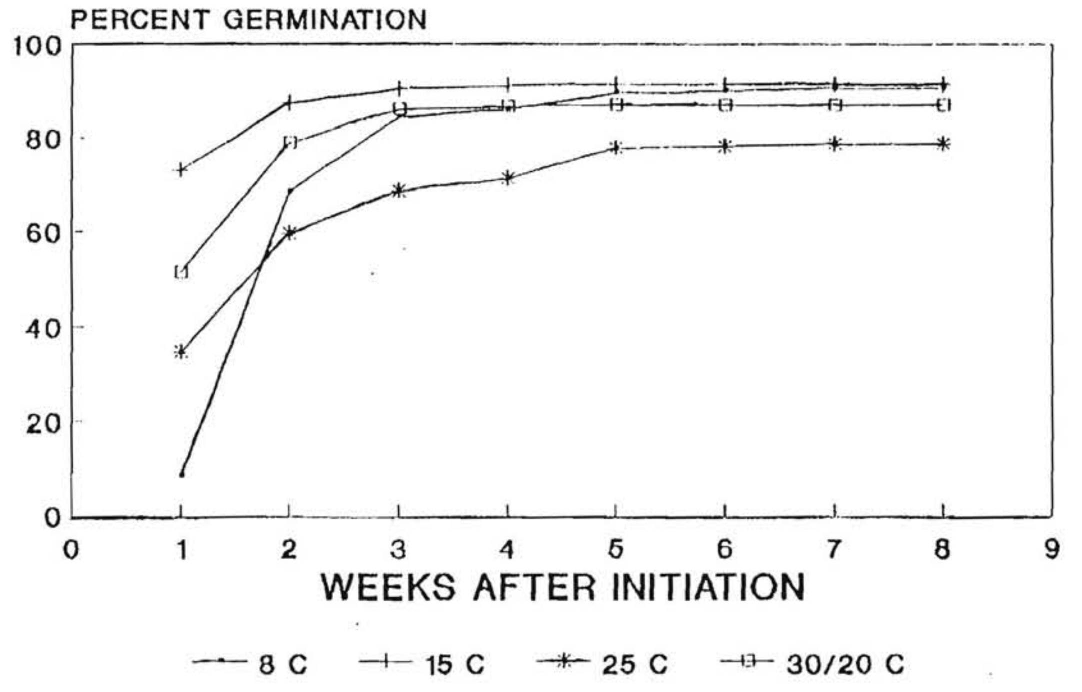

Figure 2. Tuber oatgrass seed germination at different temperatures.

Perennial pepperweed control with metsulfuron, chlorsulfuron, and 2,4-D on Colorado rangeland. Sebastian, J.S., K.G. Beck, and D.E. Hanson. A rangeland experiment was established near Greeley, CO. to evaluate perennial pepperweed (LEPLA) control with metsulfuron, chlorsulfuron, and 2,4-D applied in spring and fall. The design was a randomized complete block with three replications. Spring (May 18) and fall (Oct 10) applications were sprayed for timing comparison (Table 2). Split applications of 2,4-D were applied in spring and fall (2 lb ai/acre). 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 calibrated to deliver 24 gpa at 15 psi. Plot size was 10 ft by 30 ft. Other application data is presented in Table 1.

Visual evaluations for control were taken on June 17, July 18, and Aug 18, 1988 (no fall applications were evaluated). All metsulfuron and chlorsulfuron treatments provided moderate to excellent LEPLA control and 2,4-D (2.0 lb ai/acre) provided poor control. All herbicide treatments will be evaluated in 1989 for control longevity.
(Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

Table 1. Application information and weed data for perennial pepperweed control with metsulfuron, chlorsulfuron, and 2,4-D on Colorado rangeland.

Environmental data		
Application date	May 18, 1988	Oct 10, 1988
Application time	2:30 pm	11:00 pm
Air temperature, C	29	20
Cloud cover, %	65	0
Relative humidity, %	52	58
Wind speed/direction, mph	5 to 8/E	0 to 2/W
Soil temperature (2 in), C	16	12

Weed data

Application date (plt/ft^2)	Species	Growth Stage	Height	Density (in)
May 18, 1988	LEPLA	vegetative	1 to 2	15 to 20
Oct 10, 1988	LEPLA	vegetative	-	2 to 5

Table 2. Perennial pepperweed control with metsulfuron, chlorsulfuron, and 2,4-D on Colorado rangeland.

Treatment	Rate	Timing	LEPLA Control		
	(oz ai/acre)		June 17	July 18	Aug 17
			--------(% of Check)-------		
metsulfuron[1]	0.20	spring	80	90	89
metsulfuron	0.35	spring	72	88	94
metsulfuron	0.50	spring	77	88	91
chlorsulfuron[1]	0.70	spring	92	99	99
chlorsulfuron	1.00	spring	74	97	96
2,4-D[3]	2.00	spring	47	50	50
+ 2,4-D	2.00	fall[2]	0	0	0
metsulfuron	0.20	fall	0	0	0
metsulfuron	0.35	fall	0	0	0
metsulfuron	0.50	fall	0	0	0
chlorsulfuron	0.70	fall	0	0	0
chlorsulfuron	1.00	fall	0	0	0
LSD (0.05)			19	10	10

[1] X-77 surfactant added at 0.25% v/v.
[2] Fall applications not evaluated until 1989.
[3] 2,4-D applied at lb ai rather than oz ai.

Leafy spurge control with fluroxypyr, picloram, and 2,4-D on Colorado rangeland. Beck, K.G., J.R. Sebastian, and D.E. Hanson. An experiment was established near Meeker, Colorado to test the efficacy of picloram, fluroxypyr, 2,4-D, picloram plus fluroxypyr, and picloram plus 2,4-D (Table 2). A randomized complete block design with four replications was used. Herbicides were applied at flowering or seed set. All treatments were applied with a CO_2 pressurized backpack sprayer equipped with 11003LP flat fan nozzles calibrated to deliver 24 gpa at 15 psi. Other application information is presented in Table 1. Plot size was 10 by 30 feet.

Visual evaluations were taken on August 2, August 30, and September 26, 1988 approximately 1, 2, and 3 months after applications at flowering, respectively. Picloram plus 2,4-D at 0.25+1.0 and 0.50+1.0 lb ai/a applied at flowering provided better control than 2,4-D at 1.0 lb ai/a 1 month after application (Table 2). Fluroxypyr alone and picloram plus fluroxypyr tank mixes applied at seed set allowed fair to excellent control whereas picloram alone at seed set provided the poorest control 1 and 2 months after seed set applications.

Visual evaluations will be taken again in 1989. (Weed Research Laboratory, Colorado State University, Fort Collins, CO).

Table 1. Application information and weed data for Leafy spurge control with fluroxypyr, picloram, and 2,4-D in Colorado rangeland.

Environmental data		
Application date	Jun 30, 1988	Aug 2, 1988
Application time	4:00 pm	4:00 pm
Air temperature, C	30	30
Cloud cover, %	10	80
Relative humidity, %	24	58
Wind speed/direction, mph	6/NE	0 to 2/SE
Soil temperature (2 in), C	24	24

Weed data

Application date	Species	Growth Stage	Density (plt/ft^2)
Jun 30, 1988	EPHES	flowering	3 to 10
Aug 2, 1988	EPHES	seed set	3 to 10

Table 2. Leafy spurge control with fluroxypyr, picloram, and 2,4-D on Colorado rangeland.

Herbicide	Rate	Timing	EPHES Control		
	(lb ai/a)		Aug 2	Aug 31	Sep 26
			(% of Check)		
picloram	0.13				
+ 2,4-D	1.0	flowering	66	74	75
picloram	0.25				
+ 2,4-D	1.0	flowering	78	78	76
picloram	0.50				
+ 2,4-D	1.0	flowering	80	83	84
2,4-D	1.0	flowering	63	64	61
fluroxypyr	0.13	seed set	0	80	75
fluroxypyr	0.25	seed set	0	74	78
fluroxypyr	0.50	seed set	0	100	100
picloram	0.13	seed set	0	24	13
picloram	0.25	seed set	0	11	10
picloram	0.50	seed set	0	48	38
fluroxypyr	0.13				
+ picloram	0.13	seed set	0	79	75
fluroxypyr	0.13				
+ picloram	0.25	seed set	0	66	69
fluroxypyr	0.13				
+ picloram	0.50	seed set	0	74	83
fluroxypyr	0.25				
+ picloram	0.25	seed set	0	90	94
fluroxypr	0.25				
+ picloram	0.50	seed set	0	90	96
LSD (0.05)			14	20	19

Leafy spurge control on Colorado rangeland with picloram, dicamba, fluroxypyr, and sulfometuron mixed with chlorflurenol. Beck, K.G., J.R. Sebastian, and D.E. Hanson. An experiment was established near Meeker, Colorado to test leafy spurge control when various rates of picloram, dicamba, fluroxypyr, and sulfometuron were tank-mixed with chlorflurenol (Table 2). A randomized complete block design with four replications was used. Herbicides were applied at flowering or seed set using a CO_2 pressurized backpack sprayer equipped with 11003LP flat fan nozzles calibrated to deliver 24 gpa at 15 psi. Other application information is presented in Table 1. Plot size was 10 by 30 feet.

Visual evaluations were taken August 2, August 30 and September 28, 1988. Chlorflurenol (0.07 and 0.13 lb ai/a) mixed with picloram at 0.50 lb ai/a provided better control than picloram applied alone at 0.50 lb ai/a at all evaluation dates (Table 2). Chlorflurenol (0.07 and 0.13 lb ai/a) mixed with dicamba at 2.0 lb ai/a provided better control than dicamba applied alone at 2.0 lb ia/a at all evaluation dates. Chlorflurenol mixed with picloram (0.25 lb ai/a) or dicamba (1.0 lb ai/a) at lower rates did not improve control over picloram or dicamba applied alone at these rates at any evaluation. Chlorflurenol mixed with fluroxypyr or sulfometuron at any rate did not improve leafy spurge control over these compounds applied alone at similar rates. Chlorflurenol applied alone did not effectively control leafy spurge. Western wheatgrass (*Agropyron smithii* Rydb.) injury ranged from 2 to 14% and 5 to 22% on August 2 and 30, respectively. No injury data were taken September 28.

Visual evaluations will be taken again in 1989. (Weed Research Laboratory, Colorado State University, Fort Collins, CO).

Table 1. Application information for leafy spurge control with picloram, dicamba, fluroxypyr, and sulfometuron mixed with chlorflurenol on Colorado rangeland.

Environmental data		
Application date	Jun 30, 1988	Aug 2, 1988
Application time	2:00 pm	6:00 pm
Air temperature, C	28	30
Cloud cover, %	0	80
Relative humidity, %	18	58
Wind speed/direction, mph	0 to 2/SE	0 to 2/SE
Soil temperature (2 in), C	18	24

Weed/crop data

Application date	Species	Growth Stage	Density (plt/ft^2)
Jun 30, 1988	EPHES	flowering	3 to 10
	AGRSM	vegetative	-
Aug 2, 1988	EPHES	seed set	3 to 10
	AGRSM	flowering	-

Table 2. Leafy spurge control with picloram, dicamba, fluroxypyr, and sulfometuron mixed with chlorflurenol on Colorado rangeland.

Herbicide	Rate	Timing	EPHES Control			AGRSM Injury	
	(lb ai/a)		Aug 2	Aug 30	Sep 28	Aug 2	Aug 30
			---------------(% of Check)---------------				
picloram	0.25	flowering	23	26	30	3	11
picloram	0.50	flowering	31	34	30	12	12
dicamba	1.0	flowering	15	11	14	11	8
dicamba	2.0	flowering	4	5	5	5	7
chlorflurenol	0.07	flowering	19	15	15	4	10
chlorflurenol	0.13	flowering	6	4	9	4	16
sulfometuron	0.09	flowering	21	25	20	4	13
fluroxypyr	0.13	seed set	0	61	63	0	5
fluroxypyr	0.25	seed set	0	79	86	0	6
chlorflurenol + picloram	0.07 0.25	flowering	20	46	50	2	15
chlorflurenol + picloram	0.07 0.50	flowering	51	58	60	10	12
chlorflurenol + picloram	0.13 0.25	flowering	26	33	44	10	11
chlorflurenol + picloram	0.13 0.50	flowering	60	69	76	10	15
chlorflurenol + dicamba	0.07 1.0	flowering	29	28	33	8	7
chlorflurenol + dicamba	0.07 2.0	flowering	46	51	58	14	22
chlorflurenol + dicamba	0.13 1.0	flowering	19	20	26	4	5
chlorflurenol + dicamba	0.13 2.0	flowering	60	70	68	8	13
chlorflurenol + sulfometuron	0.07 0.09	flowering	13	15	19	5	15
chlorflurenol + sulfometuron	0.13 0.09	flowering	13	21	25	4	19
chlorflurenol + fluroxypyr	0.07 0.13	seed set	0	71	75	0	6
chlorflurenol + fluroxypyr	0.07 0.25	seed set	0	92	95	0	12
chlorflurenol + fluroxypyr	0.13 0.13	seed set	0	76	82	0	9
chlorflurenol + fluroxypyr	0.13 0.25	seed set	0	92	95	0	6
LSD (0.05)			17	21	25	7	8

Late season leafy spurge control with sulfometuron and picloram. Lym, Rodney G. and Calvin G. Messersmith. Previous research has shown the best time to apply herbicides for leafy spurge control is the true flower growth stage in mid-June or during fall regrowth. Late-fall treatments generally provide good control of many perennial weeds, but leafy spurge shows more visible changes due to cold temperatures and changes in daylength than most other perennial weeds. Many landowners often are unable to treat all of the infestations present before a light frost occurs and/or the leaves lose chlorophyll and turn red. The purpose of this research was to determine if frost or changes in leafy physiology prior to herbicide application would prevent satisfactory leafy spurge control the following growing season.

The experiment was established in dense leafy spurge stands at West Fargo and Hunter, ND in 1987. Treatments were applied on four dates from September 1 to October 14, and leafy spurge ranged from vigorous fall regrowth to senescence (Table 1). Fall 1987 was warmer than average as there were no temperatures colder than 38 F in September, and the coldest overnight temperatures during the experiment were 31 and 24 F on October 2 and 7, respectively. The herbicides were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 10 by 30 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.

Leafy spurge control was better at Hunter than West Fargo regardless of treatment on application date (Table 2). The environmental conditions were similar at the two locations, except leafy spurge at Hunter was growing more vigorously, probably due to higher soil moisture available than at West Fargo. Leafy spurge control at West Fargo was similar when herbicides were applied on September 1 and 15, and averaged 73% in May 1988. Leafy spurge leaves had turned red by September 15 but were firmly attached to the stem (Table 1). However, the plants were beginning to defoliate when the treatments were applied on October 1 and the stems were bare by October 14. Control declined accordingly and averaged only 49 and 30%, respectively. Leafy spurge control with picloram at 16 oz/A tended to be better than with sulfometuron plus picloram at 1 + 8 oz/A, but both treatments were better than picloram plus 2,4-D at 8 + 16 oz/A. The plots were burned during a grass fire in July 1988 and could not be reevaluated.

Leafy spurge leaves at Hunter had turned red by September 15, but did not defoliate during the experiment despite the temperature dropping to 24 F on October 7 (Table 1). Leafy spurge control was similar in May 1988 regardless of treatment date at Hunter except for picloram plus 2,4-D at 8 + 16 oz/A which averaged only 36% control when applied on October 1 (Table 2). The reason for the decline is not known, since this treatment was applied prior to frost and the October 15 treatment averaged 81% control. Sulfometuron plus picloram at 1 + 8 oz/A and picloram at 16 oz/A provided better long-term control than picloram plus 2,4-D at 8 + 16 oz/A when applied on September 15 or later.

Soil and air temperature (including below 32 F) and relative humidity did not affect leafy spurge control with these herbicides. Good control can be expected the following spring if fall treatments are applied when leafy spurge leaves are green or red but still firmly attached to the stem. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo, 58105).

Table 1. Growth and environmental conditions during late-season leafy spurge control treatments (Lym and Messersmith).

1987 treatment date	West Fargo					Hunter				
	Leafy spurge		Temperature			Leafy spurge		Temperature		
	Stems	Leaves	Air	Soil 1 inch	Relative humidity	Stems	Leaves	Air	Soil 1 inch	Relative humidity
			----(F)----		(%)			----(F)----		(%)
September 1	branched	green	68	70	51	branched	slightly red	67	71	53
September 15	red	red	81	74	45	yellow	red	79	72	58
October 1	red	senescence	59	60	65	red	red	61	60	60
October 15	bare	-	50	48	60	red	red	48	48	60

Table 2. Leafy spurge control from late-season herbicide treatments (Lym and Messersmith).

Location/ treatment	Rate	Sept 1		Sept 15		Oct 1		Oct 15	
		May	Aug	May	Aug	May	Aug	May	Aug
	(oz/A)								
West Fargo									
Picloram + 2,4-D	8 + 16	54	..	60	..	24	..	10	..
Sulfometuron + picloram	1 + 8	54	..	80	..	56	..	43	..
Picloram	16	77	..	94	..	67	..	38	..
LSD (0.05) May = 38									
Hunter									
Picloram + 2,4-D	8 + 16	92	47	91	18	36	0	81	23
Sulfometuron + picloram	1 + 8	100	59	99	79	98	39	93	61
Picloram	16	94	57	92	42	91	38	86	56
LSD (0.05) May = 26; Aug = 25									

<u>Leafy spurge control with picloram plus dicamba or various 2,4-D formulations applied annually</u>. Lym, Rodney G., and Calvin G. Messersmith. Picloram remains the most effective herbicide for leafy spurge control. Previous research at North Dakota State University has shown picloram + 2,4-D at 0.25 + 1 lb/A applied annually to be more cost effective than picloram at 1 to 2 lb/A applied once. The purpose of these experiments was to compare the effect of dicamba and/or various 2,4-D formulations applied with picloram for leafy spurge control.

The initial 2,4-D formulation experiments were established on the Sheyenne National Grasslands near McLeod, ND, on June 15, 1984, and near Hunter, ND, on May 30, 1985. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 10 by 30 ft in a randomized complete block design with four replications. Evaluations were based on visible percent stand reduction as compared to the control.

Picloram + 2,4-D mixed amine provided better leafy spurge control than picloram + 2,4-D alkanolamine (Table 1). Leafy spurge control from picloram + 2,4-D mixed amine at 0.25 + 1 lb/A was similar to control from picloram at 0.5 lb/A alone, but picloram + 2,4-D is approximately 30% less expensive. Similarly, leafy spurge control from picloram + dicamba was greater when applied with 2,4-D mixed amine than with the alkanolamine. Neither 2,4-D formulation alone controlled leafy spurge.

Picloram + dicamba + 2,4-D mixed amine provided 72% leafy spurge control 2 yr after application at Hunter (Table 1). This level of control was similar to that attained with picloram at 2 lb/A in North Dakota but is 70% less expensive. Therefore, similar experiments were begun in 1986 to evaluate this combination treatment further. Experiments were established on June 11 and 18, near Dickinson and Valley City, respectively, and on August 28 on the Sheyenne National Grasslands and September 3 and 15 near Valley City and Dickinson, respectively. Treatments were applied annually as previously described in the spring or fall through 1988.

Leafy spurge control was similar regardless of the 2,4-D formulation applied with picloram + dicamba in the spring (Table 2). Control was only 20% when averaged across all treatments and both locations 1 yr after the second application. This is much lower than would be expected with picloram + 2,4-D at 0.25 + 1 lb/A which averages 60% or more based on long-term observations.

Leafy spurge control with picloram at 0.5 lb/A averaged 32% 1 yr following the second fall application (Table 2). Control improved to 49% when applied with dicamba at 2 lb/A. Leafy spurge control with picloram + dicamba was not improved by adding 2,4-D regardless of the 2,4-D formulation.

In general, leafy spurge control was similar with all 2,4-D formulations in combination with picloram and dicamba. However, the 2,4-D mixed amine formulation occasionally did provide better leafy spurge control in a combination treatment than the alkanolamine or ester formulations. These experiments will be continued to evaluate the long-term effect of picloram combined with various 2,4-D formulations and dicamba on leafy spurge control. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo, 58105)

Table 1. Leafy spurge control with picloram applied with various formulations of 2,4-D (Lym and Messersmith).

Location/ application date		Months after treatment				
Treatment	Rate	3	12	15	24	27
	(lb/A)	---------(% control)---------				
Sheyenne, June 1984						
Picloram	0.25	76	23	4	1	..
Picloram	0.5	95	75	43	10	..
Picloram + 2,4-D alkanolamine	0.25 + 1	78	14	6	3	..
Picloram + 2,4-D mixed amine[a]	0.25 + 1	94	72	23	21	..
2,4-D mixed amine[a]	4	47	7	13	0	..
2,4-D alkanolamine	4	42	20	7	5	..
LSD (0.05)		15	25	15	12	
Hunter, June 1985						
Picloram + dicamba + 2,4-D mixed amine[a]	0.25 + 1 + 2	99	98	89	72	60
Picloram + dicamba + 2,4-D alkanolamine	0.25 + 1 + 2	51	51	25	25	18
2,4-D mixed amine[a]	4	6	3	0	0	0
2,4-D alkanolamine	4	5	0	0	0	0
Picloram + dicamba	0.25 + 1	53	38	15	0	7
LSD (0.05)		15	15	15	15	20

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[a] Mixed amine salts of 2,4-D (2:1 dimethylamine:diethanolamine)-EH 736.

Table 2. Leafy spurge control with picloram applied with dicamba and various formulations of 2,4-D applied annually since 1986 for leafy spurge control (Lym and Messersmith).

Application date/ treatment	Rate	Location/1988 evaluation date						
		Valley City		Dickinson		Sheyenne		
		June	Aug	June	Sept	June	Sept	Mean[a]
	(lb/A)	(% control)						
Spring								
2,4-D mixed amine +[b] dicamba+picloram	0.25+1.25	24	63	10	79	..	..	17
2,4-D mixed amine+[b] dicamba+picloram	2+0.5+0.25	17	59	26	88	..	..	22
2,4-D mixed amine+[b] picloram+dicamba	1+0.5+0.12	15	52	12	76	..	..	13
2,4-D alkanolamine+ dicamba+picloram	2+1+0.25	25	54	18	84	..	..	22
Dicamba+picloram	1+0.25	32	56	20	86	..	..	26
LSD (0.05)		NS	NS	NS	NS			NS
Fall								
2,4-D mixed amine +[b] dicamba+picloram	2+1+0.25	84	31	66	8	73	38	26
2,4-D alkanolamine+ dicamba+picloram	2+1+0.25	89	29	..	..	73	54	42
2,4-D mixed amine +[b] dicamba+picloram	4+2+0.5	96	61	94	45	93	67	56
2,4-D ester[c] + 2,4-DP +picloram +dicamba	2+2+0.5+0.25	74	14	49	8	74	46	22
2,4-D ester[c] + 2,4-DP +picloram +dicamba	2+2+0.5+0.5	96	47	82	35	93	67	50
2,4-D alkanolamine+ dicamba+picloram	4+2+0.5	94	50	81	39	90	61	50
Dicamba+picloram	2+0.5	95	41	93	51	83	56	49
Picloram	0.5	95	46	57	15	65	33	32
LSD (0.05)		6	20	32	36	17	27	11

[a] Mean 24 months after first treatment.

[b] Mixed amine salts of 2,4-D (2:1 dimethylamine:diethanolamine)-EH 736.

[c] 2,4-D isooctyl ester:2,4-DP butoxyethanol ester:dicamba (4:4:1)-EH 680.

Evaluation of sulfometuron applied in mid-summer and fall for leafy spurge control. Lym, Rodney G., and Calvin G. Messersmith. Previous research at North Dakota State University has shown that sulfometuron delays, and sometimes stops, bud growth on leafy spurge roots. A herbicide that prevents or delays bud regrowth should improve long-term control, since leafy spurge reestablishes by growth from the root buds following top growth control. The purpose of these experiments was to evaluate sulfometuron alone and in combination with auxin herbicides applied from mid-July to mid-September for leafy spurge control.

All herbicides were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 10 by 30 ft in a randomized complete block design. The sulfometuron experiment establishment dates in 1986 and leafy spurge growth stages were: July 22 and August 27 near Chaffee, ND, at the mature seed and fall regrowth stages, respectively; September 3 near Valley City, ND, well branched and in the fall regrowth stage; and September 15 near Dickinson, ND, in the fall regrowth stage with most leaves chlorotic or bright red. As leafy spurge control declined, a retreatment of picloram at 4 oz/A was applied 12 months after the original treatment as a split-block treatment to the back one-third of each plot at Chaffee and Dickinson and at 8 oz/A at Valley City. Evaluations were based on visible percent stand reduction as compared to the control.

Sulfometuron plus auxin herbicide treatments applied in July near Chaffee provided 82 to 100% top growth control 1 month after treatment (MAT) (Table 1). Sulfometuron alone did not provide satisfactory leafy spurge control. When evaluated in May 1987, grass injury tended to increase as the sulfometuron rate increased and was higher when sulfometuron was applied with picloram or dicamba compared to sulfometuron alone. When evaluated in August 1987, control was similar whether sulfometuron was applied alone or with an auxin herbicide prior to the picloram retreatment (62%). Control decreased rapidly and no treatment provided satisfactory leafy spurge control in 1988.

Leafy spurge control tended to be better when sulfometuron plus an auxin herbicide was applied in August or September (Table 2) compared to July (Table 1). However, grass injury also was higher. Long-term leafy spurge control tended to be higher as the sulfometuron rate increased up to 2 oz/A. The dicamba and 2,4-D rate had little effect on control over the ranges evaluated, but control tended to increase as the picloram application rate increased. Long-term control was much higher at Valley City compared to the other two locations. The best treatment for long-term control at Valley City was sulfometuron plus picloram at 2 + 16 oz/A which averaged 80% 22 MAT compared to 32% control with picloram at 16 oz/A alone. Retreatment with picloram at 4 or 8 oz/A increased leafy spurge control at Chaffee and Valley City but not at Dickinson. In general, control was similar regardless of the original sulfometuron treatment rate. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105)

Table 1. Leafy spurge control by sulfometuron plus auxin herbicides applied in July at Chaffee, ND (Lym and Messersmith).

		Evaluation date								
		Aug 86	May 87		Aug 87		May 88		Aug 88	
Treatment	Rate	Control	Control	Grass injury	Control	Retreatment[a]	Control	Retreatment[a]	Control	Retreatment[a]
	(oz/A)	(%)								
Sulfometuron + picloram	0.5 + 8	100	40	11	15	52	6	16	0	10
Sulfometuron + dicamba	0.5 + 16	83	5	0	7	54	10	16	7	6
Sulfometuron + 2,4-D	1 + 8	97	18	3	8	53	10	43	1	19
Sulfometuron + picloram	1 + 8	99	60	20	16	54	10	27	6	13
Sulfometuron + dicamba	1 + 16	82	47	11	14	76	4	28	0	6
Sulfometuron + picloram	2 + 32	99	97	30	60	66	53	65	38	35
Sulfometuron + dicamba	2 + 128	100	96	49	59	69	26	37	11	15
Sulfometuron	1	31	18	10	7	66	6	41	1	9
Sulfometuron	2	13	16	15	8	72	0	33	3	19
Control	0	0	0	0	0	48	0	26	0	11
LSD(0.05)		15	32	21	22	NS	NS	NS	NS	24

[a] Picloram at 4 oz/A applied as a split-block treatment to the back one-third of each plot on June 29, 1987.

Table 2. Sulfometuron plus auxin herbicides applied in August or September for leafy spurge control (Lym and Messersmith).

		Evaluation date						
		May 87		Aug 87		June 88		Sept 88
Treatment	Rate	Control	Grass injury	Control	Grass injury	Control	Retreatment	Retreatment
	(oz/A)	(%)						
Chaffee								
Sulfometuron + picloram	0.5 + 8	89	35	15	..	5	78	11
Sulfometuron + dicamba	0.5 + 16	68	8	16	..	13	72	10
Sulfometuron + 2,4-D	1 + 8	35	83	1	..	0	44	11
Sulfometuron + picloram	1 + 8	95	46	32	..	8	67	16
Sulfometuron + dicamba	1 + 16	81	36	17	..	5	78	11
Sulfometuron + picloram	2 + 32	94	56	70	..	29	68	12
Sulfometuron + dicamba	2 + 128	95	53	56	..	8	78	16
Fosamine	64	43	15	9	..	3	78	16
Fosamine	96	56	13	20	..	6	70	12
Control	..	0	0	0	..	0	63	10
LSD (0.05)		29	19	28		NS	NS	NS
Dickinson								
Sulfometuron + 2,4-D	0.5 + 16	55	61	23	33	0	3	..
Sulfometuron + picloram	0.5 + 12	97	71	67	26	1	25	..
Sulfometuron + 2,4-D	2 + 16	75	73	26	33	1	16	..
Sulfometuron + 2,4-D	2 + 32	78	70	29	33	4	14	..
Sulfometuron + picloram	2 + 8	95	89	83	60	11	14	..
Sulfometuron + picloram	2 + 12	99	94	90	80	8	36	..
Sulfometuron + picloram	2 + 16	99	98	93	91	20	39	..
LSD (0.05)		20	29	22	24	NS	NS	
Valley City								
Sulfometuron + 2,4-D	0.5 + 16	41	0	11	0	6	96	20
Sulfometuron + 2,4-D	0.5 + 32	57	0	9	0	1	91	19
Sulfometuron + picloram	0.5 + 8	96	7	39	0	3	98	43
Sulfometuron + picloram	0.5 + 12	98	3	68	0	15	99	36
Sulfometuron + picloram	0.5 + 16	99	4	81	0	16	99	51
Sulfometuron + 2,4-D	1 + 16	90	5	26	0	5	94	29
Sulfometuron + 2,4-D	1 + 32	93	6	41	0	8	99	34
Sulfometuron + picloram	1 + 8	99	8	85	0	36	97	37
Sulfometuron + picloram	1 + 12	99	6	88	0	34	96	53
Sulfometuron + picloram	1 + 16	99	8	86	0	45	99	43
Sulfometuron + 2,4-D	2 + 16	97	34	68	4	10	99	57
Sulfometuron + 2,4-D	2 + 32	99	29	73	14	13	98	52
Sulfometuron + picloram	2 + 8	99	49	97	20	52	100	68
Sulfometuron + picloram	2 + 12	99	41	95	0	45	100	75
Sulfometuron + picloram	2 + 16	99	37	98	20	80	99	65
Picloram	16	99	0	63	0	32	97	25
Control		..	..	..	..	0	98	29
LSD (0.05)		12	22	22	20	22	7	38

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[a] Picloram at 4 oz/A applied as a split-block treatment to the back one-third of each plot in Aug 1987 at Chaffee and Dickinson and at 8 oz/A at Valley City.

<u>Leafy spurge control with low rate annual picloram and 2,4-D combination treatments</u>. Lym, Rodney G. and Calvin G. Messersmith. Previous research at North Dakota State University has shown that annual treatments of picloram + 2,4-D for 3 to 5 years will give leafy spurge control similar to expensive high rate picloram treatments. Picloram plus 2,4-D at 0.25 + 1 lb/A generally gives 20 to 30% better leafy spurge control than picloram at 0.25 lb/A alone, but the benefit of a herbicide combination declines as the picloram or 2,4-D rate increases. Picloram plus 2,4-D at 0.5 + 1 lb/A tends to give only 5 to 10% better control than picloram at 0.5 lb/A alone. The purpose of this experiment was to evaluate long-term leafy spurge control from annual treatments of picloram plus 2,4-D amine at relatively low application rates.

The experiment was established at four locations in North Dakota. Spring treatments were applied in June 1984 at Dickinson, Hunter, and Valley City, and the fall treatments were applied in September 1984 at Valley City and at the Sheyenne National Grasslands near McLeod. The soil was a loamy fine sand at Dickinson, a silty clay loam at Hunter, Sheldon, and the Sheyenne National Grasslands, and a loam at Valley City. Dickinson, located in western North Dakota, generally receives much less precipitation than the other two sites located in eastern North Dakota. The spring treatments were applied annually in June in 1984 through 1987. The fall treatments were applied in September 1984 and 1985, but were discontinued thereafter. The herbicides were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 10 by 30 ft in a randomized complete block design with four replications except at Hunter which had 8 by 25 ft plots and three replications. Evaluations were based on a visual estimate of percent stand reduction as compared to the control.

The results from the Dickinson location were different than the other sites and will be discussed separately. Picloram at 0.12, 0.25, 0.38, and 0.5 lb/A provided 12, 24, 47 and 59% leafy spurge control, respectively, as a spring-applied treatment at Hunter and Valley City 48 months after treatment (MAT) (Table). Fall-applied treatments at Sheyenne and Valley City resulted in poor leafy spurge control and were discontinued following the 24 MAT evaluation. Table). The addition of 2,4-D to picloram tended to increase leafy spurge control slightly for spring- but not for fall-applied treatments. The slight increase in control was similar regardless of 2,4-D rate. Spring-applied treatments generally maintained control all season and regrowth was typically 0 to 3 inches tall when a killing frost occurred.

Leafy spurge control 48 months after spring-applied treatment averaged 36% with picloram alone and increased slightly to 40% when picloram was applied with 2,4-D (Table). This increase is much less than previously reported when 2,4-D at 1 to 2 lb/A was applied with picloram. Picloram at 0.5 lb/A plus 2,4-D averaged 73% leafy spurge control compared to 59% with picloram at 0.5 lb/A alone and was the best treatment evaluated.

Leafy spurge control averaged 26% 48 months after the initial treatment at Dickinson compared to 41% at Hunter and Valley City (Table). The reason for poor control at Dickinson compared to the other locations is not known. A similar experiment, begun in 1981 at Dickinson, resulted in annual increases in leafy spurge control. Dickinson had received above average precipitation for the first 36 months of the experiment and leafy spurge may be growing more vigorously than previously.

In general, leafy spurge control increased when 2,4-D was applied with picloram at 0.25 to 0.5 lb/A as a spring applied but not as a fall-applied treatment. The 2,4-D application rate did not affect leafy spurge control with picloram. Picloram at 0.25 to 0.5 lb/A plus 2,4-D at 1 lb/A remains the most cost effective application rate for an annual leafy spurge control program. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo, 58105)

Table. Leafy spurge control in 1988 from annual picloram or picloram plus 2,4-D amine treatments spring or fall applied since 1984 at four locations in North Dakota (Lym and Messersmith).

		Application time/location/evaluation date												
		Spring							Fall					
		Hunter		Dickinson		Valley City		Mean[a]	Sheyenne-1987		Valley City 1986/1987			
Treatment	Rate	Aug 87	May 88	Sept 87	June 88	Aug 87	June 88	1988	May 30	Aug 24	June 3	Aug 20	May 20	Mean[b]
	(lb/A)	(% control)												
Picloram	0.12	3	0	2	13	55	23	12	42	0	3	0	1	0
Picloram	0.25	27	12	17	9	62	35	24	67	0	25	1	0	1
Picloram	0.38	67	39	64	29	81	54	47	74	9	56	3	2	6
Picloram	0.5	79	53	74	25	82	64	59	89	16	92	38	43	27
Picloram + 2,4-D	0.12 + 0.12	22	3	3	13	57	21	12	72	0	32	8	17	4
Picloram + 2,4-D	0.12 + 0.25	12	3	3	8	55	7	5	62	8	12	0	0	4
Picloram + 2,4-D	0.12 + 0.5	10	0	7	15	61	27	14	67	2	7	0	0	1
Picloram + 2,4-D	0.25 + 0.12	73	28	40	11	70	28	28	70	5	19	1	0	3
Picloram + 2,4-D	0.25 + 0.25	55	36	42	30	71	34	33	64	0	18	1	0	1
Picloram + 2,4-D	0.25 + 0.5	25	19	30	28	73	23	21	58	2	35	6	6	4
Picloram + 2,4-D	0.38 + 0.12	69	44	45	15	81	49	47	81	15	56	11	14	13
Picloram + 2,4-D	0.38 + 0.25	87	62	84	25	82	63	61	75	6	48	3	4	4
Picloram + 2,4-D	0.38 + 0.5	44	31	52	37	88	59	45	89	18	64	3	4	10
Picloram + 2,4-D	0.5 + 0.12	92	72	94	33	86	78	74	78	15	75	8	8	11
Picloram + 2,4-D	0.5 + 0.25	90	69	87	46	83	78	74	93	22	89	18	19	20
Picloram + 2,4-D	0.5 + 0.5	80	59	79	49	94	82	71	94	18	81	15	7	17
Picloram + 2,4-D	0.25 + 1.0	40	21	22	35	82	46	34	92	12	63	6	7	9
LSD (0.05)		31	26	26	24	19	25	12	28	NS	31	15	18	11

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[a] Average control at Hunter and Valley City 48 months following the original 1984 treatment date.

[b] Average control 24 months following the original 1984 treatment date, fall treatments discontinued after 1985.

Leafy spurge control with various herbicide combinations applied alone or with spray additives. Lym, Rodney G., and Calvin G. Messersmith. The relatively high cost of herbicides limits their use on pasture and rangeland for leafy spurge control, especially when applied at rates that are in excess of $5 to $10/A. Previous research at North Dakota State University has shown that picloram plus 2,4-D at 0.25 + 1 lb/A applied annually is more cost-effective than high rates of herbicides applied once. Picloram or 2,4-D applied alone at relative low rates did not provide satisfactory leafy spurge control. The purpose of this research was to evaluate various herbicide combinations applied alone or with spray additives for leafy spurge control.

Three experiments were established in a dense leafy spurge infestation growing along railroad tracks in West Fargo. The first two were established on June 9, 1987, when leafy spurge was in the true flower growth stage, and the third on September 1, during fall regrowth. A fourth experiment was established on June 16, 1987, near Valley City with leafy spurge in the seed-set growth stage. A retreatment of picloram at 8 oz/A was applied in June 1988 as a split-block treatment to the back one-third of each plot at Valley City. All herbicides were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 10 by 30 ft in a randomized complete block design. Evaluations were based on visible percent stand reduction as compared to the control.

Picloram plus 2,4-D or picloram applied with methylated sunflower oil, with NH_4SO_4 (liquid or granular formulations), or at pH 4.7 buffered with citric acid did not provide satisfactory leafy spurge control (Table 1). Though not evaluated in this experiment, leafy spurge control from similar herbicide treatments applied without additives in adjacent experiments provided better initial and long-term control. Visual observations indicated that inclusion of additives caused rapid desiccation of the upper leaves. The plants recovered quickly and regrowth from the lower portion of the stems resumed. Leafy spurge control with fosamine applied alone or with sulfometuron also was lower than expected and may be due to application during low relative humidity (30%). Fosamine provides fair to good leafy spurge control if applied when relative humidity is high.

Sulfometuron applied with picloram, fluroxypyr, or various formulations of 2,4-D generally provided leafy spurge control similar to the same herbicides applied alone (Table 2). Subsequent research has shown sulfometuron increases leafy spurge control when applied with these herbicides in the fall but not in the spring, when this experiment was established. Leafy spurge control with sulfometuron plus fluroxypyr or picloram decreased as the fluroxypyr rate increased, but increased with increasing rates of picloram.

In August 1987, sulfometuron at 1 to 2 oz/A applied with picloram at 8 oz/A or 2,4-D at 16 oz/A provided an average of 94% leafy spurge control but only 61% when applied with dicamba at 16 oz/A (Table 3). The average control at Valley City was much higher than with similar treatments applied at West Fargo (Table 2). The increase could be due to application at a later growth stage at Valley City than West Fargo, or different experimental conditions during treatment. It was 90 F with 50% relative humidity at Valley City during application compared to 77 F and 30% relative humidity, at West Fargo. The soil pH and organic matter was similar at the two locations.

Dicamba plus sulfometuron at 16 + 2 oz/A and all sulfometuron plus picloram treatments provided good leafy spurge control 12 months after treatment (Table 3). Control declined rapidly, thereafter, and no treatment provided satisfactory control by August 1988 even with a picloram retreatment. In general, no herbicide combination treatment or additive provided longer-term or more cost-effective leafy spurge control than picloram plus 2,4-D. (Published with the approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo, 58105)

Table 1. Leafy spurge control with various herbicides and additives spring or fall applied at West Fargo, ND (Lym and Messersmith).

		1987 Application/evaluation date		
		June 9		September 1
Treatment	Rate	Aug 87	May 88	May 88
	(oz/A)	(%)		
Picloram + 2,4-D + MSW[a]	4 + 16 + 16	27	6	22
Picloram + 2,4-D + MSW[a]	8 + 16 + 16	15	8	23
Picloram + MSW[a]	4 + 16	33	0	..
Picloram + MSW[a]	8 + 16	25	6	34
Picloram + sulfometuron + MSW[a]	8 + 1 + 16	47	18	..
Fosamine	64	0	14	..
Fosamine	96	13	40	..
Fosamine + sulfometuron	64 + 1	6	13	..
Fosamine + sulfometuron	16 + 1	6	0	..
Dicamba + MSW[a]	32 + 16	24	13	36
Picloram + 2,4-D + NH_4SO_4[b]	4 + 16 + 0.13	..	..	15
Picloram + 2,4-D + NH_4SO_4[b]	8 + 16 + 0.13	..	..	21
Picloram + 2,4-D + NH_4SO_4[c]	4 + 16 + 40	..	..	4
Picloram + 2,4-D + NH_4SO_4[c]	8 + 16 + 40	..	..	23
Picloram + 2,4-D + citric acid[d]	4 + 16	..	..	11
Picloram + 2,4-D + citric acid[d]	8 + 16	..	..	10
LSD (0.05)		20	15	NS

[a] MSW = Methylated sunflower oil plus sponto 4K-3158 emulsifier.
[b] 8-0-0-9 liquid fertilizer equivalent to N and S at 0.2 lb/A respectively.
[c] Equivalent to 2.5 lb N/A.
[d] Spray solution buffered to pH 4.7.

Table 2. Leafy spurge control with sulfometuron plus various auxin herbicides at West Fargo, ND (Lym and Messersmith).

		Evaluation date[a]	
Treatment	Rate	9 Aug 87	24 May 88
	(oz/A)	(%)	
Picloram + sulfometuron	4 + 1	6	13
Picloram + sulfometuron	8 + 1	9	5
Picloram + sulfometuron	12 + 1	14	17
Picloram + sulfometuron	16 + 1	49	44
Picloram + sulfometuron	4 + 1.5	0	11
Picloram + sulfometuron	8 + 1.5	22	23
Picloram + sulfometuron	12 + 1.5	54	37
Picloram + sulfometuron	16 + 1.5	65	48
Picloram + sulfometuron	4 + 2	7	0
Picloram + sulfometuron	8 + 2	33	3
Picloram + sulfometuron	12 + 2	29	61
Picloram + sulfometuron	16 + 2	60	74
2,4-D alkanolamine + sulfometuron	8 + 1	7	4
2,4-D alkanolamine + sulfometuron	16 + 1	6	0
2,4-D alkanolamine + sulfometuron	32 + 1	9	0
2,4-D alkanolamine + sulfometuron	8 + 1.5	14	0
2,4-D alkanolamine + sulfometuron	16 + 1.5	20	3
2,4-D alkanolamine + sulfometuron	34 + 1.5	16	0
2,4-D alkanolamine + sulfometuron	8 + 2	17	3
2,4-D alkanolamine + sulfometuron	16 + 2	16	0
2,4-D alkanolamine + sulfometuron	32 + 2	14	7
2,4-D mixed amine[a] + sulfometuron	16 + 1	6	0
2,4-D ester[b] + 2,4-DP + dicamba + sulfometuron	2 + 2 + 0.5	13	0
Picloram	8	9	4
Picloram	16	59	35
2,4-D alkanolamine	16	6	5
Fluroxypyr + sulfometuron	4 + 1	78	48
Fluroxypyr + sulfometuron	8 + 1	38	13
Fluroxypyr + sulfometuron	16 + 1	49	5
Fluroxypyr	16	32	13
LSD (0.05)		25	24

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[a] Mixed amine salts of 2,4-D (2:1 dimethylamine:diethanolamine)-EH 736.

[b] 2,4-D isooctyl ester:2,4-DP butoxyethanol ester:dicamba (4:4:1)-EH 680.

Table 3. Leafy spurge control with sulfometuron applied with picloram, 2,4-D, or dicamba at Valley City, ND (Lym and Messersmith).

		Evaluation date			
				Aug 88	
Treatment	Rate	Aug 87	June 88	Original	Retreatment[a]
	(oz/A)	(%)			
Picloram + sulfometuron	8 + 1	98	88	19	25
Picloram + sulfometuron	8 + 1.5	99	87	26	39
Picloram + sulfometuron	8 + 2	92	95	15	26
2,4-D alkanolamine + sulfometuron	16 + 1	89	15	8	32
2-4-D alkanolamine + sulfometuron	16 + 1.5	89	26	12	29
2,4-D alkanolamine + sulfometuron	16 + 2	98	56	11	22
Dicamba + sulfometuron	16 + 1	54	34	3	35
Dicamba + sulfometuron	16 + 1.5	45	11	1	40
Dicamba + sulfometuron	16 + 2	84	80	15	36
Untreated	..	0	0	0	28
LSD (0.05)		28	25	NS	NS

[a] Picloram at 8 oz/A applied on June 2, 1988, to the back one-third of each plot.

Canada thistle control with chlorflurenol, dicamba, and clopyralid in a Colorado pasture. Beck, K.G., J.R. Sebastian, and D.E. Hanson. An experiment was established to evaluate control of Canada thistle (CIRAR) with chlorflurenol (a morphactin), dicamba, or clopyralid applied alone or chlorflurenol in combination with dicamba or clopyralid at several rates (Table 2). The design was a randomized complete block with four replications. Applications were made in spring when Canada thistle was in the rosette stage and two treatments were repeated in fall. All treatments were applied with a CO_2 pressurized backpack sprayer through 11003LP nozzles calibrated to deliver 24 gpa at 15 psi. Other application information is presented in Table 1. Plot size was 10 by 30 feet.

Visual evaluations were taken August 25 and November 2, 1987 approximately 12 weeks and 5 months after spring applications, respectively. The November 2 evaluation was 7 weeks after fall applications. Chlorflurenol at 0.13 lb ai/a in combination with clopyralid at both rates provided the best Canada thistle control on August 25 whereas chlorflurenol alone gave poor control (Table 2). Chlorflurenol plus clopyralid at all rates applied in spring followed by chlorflurenol plus dicamba in fall provided the best control on November 2 whereas dicamba at 0.13 lb ai/a and both rates of chlorflurenol applied alone gave poor control. Chlorflurenol at 0.13 lb ai/a in combination with clopyralid at 0.13 lb ai/a provided 25 and 24% greater control on August 25 and November 2, respectively, than clopyralid alone at 0.13 lb ai/a. Visual evaluations were taken again on July 7, 1988 about 1 year after spring applications. Clopyralid at 0.25 lb ai/a mixed with 0.13 lb ai/a chlorflurenol applied in spring at the rosette growth stage provided 55% Canada thistle control (Table 2). Split applications of clopyralid (0.13 lb ai/a) plus chlorflurenol (0.13 lb ai/a) in spring to Canada thistle rosettes followed in fall with dicamba (0.13 lb ai/a) plus chlorflurenol (0.13 lb ai/a) provided 59% control. Higher rates of this same split application provided best Canada thistle control 1 year after application. Clopyralid (0.25 lb ai/a) plus chlorflurenol (0.25 lb ai/a) applied in spring followed by dicamba (0.25 lb ai/a) plus chlorflurenol (0.25 lb ai/a) in fall allowed 97% Canada thistle control. (Weed Research Laboratory, Colorado State University, Fort Collins, CO).

Table 1. Application data for Canada thistle control with chlorflurenol, dicamba, and clopyralid.

Environmental data		
Application date	Jun 2, 1987	Sep 14, 1987
Application time	7:00 am	3:00 pm
Air temperature, C	4	24
Cloud cover, %	0	30
Relative humidity, %	-	40
Wind speed/direction, mph	4 to 7/N	3 to 5/W
Soil temperature (2 in), C	2	14

Weed data

Application date	Species	Growth Stage	Height (in)	Density (plt/ft^2)
Jun 2, 1987	CIRAR	pre-bud to bud	10 to 17	2 to 4
Sep 14, 1987	CIRAR	late flower + fall rosette	4 to 6	2 to 4

Table 2. Canada thistle control with chlorflurenol, dicamba, and clopyralid in a Colorado pasture.

Herbicide	Rate	Timing		CIRAR	
	(lb ai/a)		Aug 25, 1987	Nov 2, 1987	Jul 7, 1988
				(% Control)	
chlorflurenol	0.13	spring	31	25	0
chlorflurenol	0.25	spring	14	8	0
clopyralid	0.13	spring	56	54	5
clopyralid	0.25	spring	79	78	24
dicamba	0.13	spring	36	28	0
dicamba	0.25	spring	50	46	0
dicamba	1.00	spring	60	56	0
dicamba	2.00	spring	68	66	0
chlorflurenol	0.13				
+ clopyralid	0.13	spring	81	76	15
chlorflurenol	0.13				
+ clopyralid	0.25	spring	84	87	55
chlorflurenol	0.25				
+ clopyralid	0.25	spring	69	69	36
chlorflurenol	0.13				
+ dicamba	0.13	spring	49	43	0
chlorflurenol	0.13				
+ dicamba	0.25	spring	51	46	0
chlorflurenol	0.25				
+ dicamba	0.25	spring	54	54	0
chlorflurenol	0.13	spring			
+ clopyralid	0.13	spring	74		
+ chlorflurenol	0.13	fall			
+ dicamba	0.13	fall		89	59
chlorflurenol	0.25	spring			
+ clopyralid	0.25	spring	74		
+ chlorflurenol	0.25	fall			
+ dicamba	0.25	fall		94	97
LSD (0.05)			22	22	28

Plumeless thistle control in rangeland, Ruedi Reservoir, CO. Hanson, D.E., K.G. Beck, and J.R. Sebastian. Research was conducted at Ruedi Reservoir, CO to test the efficacy of several herbicides on plumeless thistle (CRUAC). A randomized complete block design with four replications was used. Plots were 10 ft by 30 ft in size. Treatments were applied with a CO_2 charged backpack sprayer calibrated to deliver 24 gpa at 15 psi and equipped with 11003LP flat fan nozzles. Herbicides were applied on June 15, 1988. Plumeless thistle was in various growth stages at application. Application conditions are listed in Table 1. Visual evaluations were made on July 22, and September 15, 1988.

Picloram, dicamba, and clopyralid treatments applied alone and all tank mixes with dicamba provided excellent plumeless thistle control 30 DAT except dicamba+chlorsulfuron at either 0.5 lb ai/a + 0.38 or 0.75 oz ai/a (Table 2). Mountain brome (BROMG) and bluegrass (POASE) injury ranged from 5% to 15% occurred with all treatments 30 DAT. All treatments except 2,4-D, chlorsulfuron at 0.38 oz ai/a, and metsulfuron at 0.14 oz ai/a provided good to excellent control 90 DAT. Treatments will be evalutated in June, 89 for control longevity. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523)

Table 1. Application data for plumeless thistle control in rangeland.

Environmental Data	
Date treated	6/15/88
Time treated	12:30P
Cloud cover, %	40
Air temperature, C	24
Relative humidity, %	50
Wind speed/direction, mph	5 to 9/W
Soil temperature, (2 in) C	11
Leaf Surface Moisture	Dry

Weed Data

Application Date	Species	Growth Stage	Height/Dia. (in)	Density (pl/ft^2)
June 15, 1988	CRUAC	Bolting	7 to 12	0.1
	CRUAC	2nd Yr Rosette	6 to 7	3 to 10
	CRUAC	1st Yr Rosette	1 to 2	5 to 20

Table 2. Plumeless thistle control and grass injury in rangeland.

TREATMENT	RATE (lb ai/a)	CRUAC	CRUAC[1]	BROMG	POASE	CRUAC	CRUAC[1]
		----(CONTROL)---		----(INJURY)----		----(CONTROL)---	
		------------July, 22------------				--September,15--	
		---------------------(% of check)---------------------					
picloram	0.13	95	100	6	6	100	100
picloram	0.25	98	100	13	10	100	100
picloram	0.5	100	100	14	11	100	100
dicamba	0.5	89	96	8	9	100	100
dicamba	1.0	100	100	16	8	100	100
dicamba picloram	0.5 0.25	100	100	13	6	100	100
dicamba + picloram	1.0 + 0.13	100	100	13	10	100	100
2,4-D amine	1.0	46	58	9	8	68	39
dicamba + 2,4-D amine	0.5 + 1.0	99	100	10	8	100	100
clopyralid	0.13	95	96	11	10	100	99
clopyralid	0.25	100	100	14	6	100	100
dicamba + clopyralid	0.5 + 0.25	100	100	10	8	100	100
dicamba + clopyralid	1.0 + 0.13	100	100	8	5	100	100
chlorsulfuron	0.38[2]	23	25	6	6	54	28
chlorsulfuron	0.75	30	34	13	9	95	81
metsulfuron	0.14	29	31	13	8	71	50
metsulfuron	0.30	33	38	15	10	84	76
dicamba + chlorsulfuron	0.5 + 0.38	73	84	12	4	100	98
dicamba + chlorsulfuron	0.5 + 0.75	63	60	13	9	93	93
dicamba + chlorsulfuron	1.0 + 0.38	100	97	14	8	100	100
LSD (.05)		11	11	6	5	19	16

[1] First year rosette.

[2] Cholrsulfuron and metsulfuron rates in oz ai/a and X-77 added at 0.25% v/v to cholrsulfuron and metsulfuron treatments.

Dalmatian toadflax control in rangeland, Livermore, CO. Hanson, D.E., K.G. Beck, and J.R. Sebastian. Research was conducted at Livermore, CO to test effects of application timing on efficacy of picloram and fluroxypyr on dalmatian toadflax (LINDA). A randomized complete block design with four replications was used. Plots were 10 ft by 30 ft. Treatments were applied with a CO_2 charged backpack sprayer calibrated to deliver 24 gpa at 15 psi and equipped with 11003LP flat fan nozzles. Herbicides were applied on June 7, July 11, and October 7, 1988. Picloram and fluroxypyr did not tank mix well regardless of mixing order. Application conditions are listed in Table 1. Visual evaluations were made on July 11, August 9, and September 6, 1988.

Vegetative treatments with picloram at 1.0 and 2.0 lb ai/a and fluroxypyr+picloram at 0.5 + 1.0 lb ai/a provided better control than other vegetative treatments (Table 1). All flowering treatments were the same except picloram at 0.5 and 1.0 lb ai/a 30 DAT and picloram at 0.5 lb ai/a 60 DAT. No evaluation of dormant treatments were made. All treatments will be evaluated in 1989. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523)

Table 1. Application data for dalmatian toadflax control in rangeland.

Environmental Data			
Date treated	June 7	July 11	October 7
Time treated	11:00	12:00P	9:00A
Cloud cover, %	Clear	35	Clear
Air temperature, C	34	28	9
Relative humidity, %	29	35	86
Wind speed/direction, mph	5 to 7/S	5 to 6/S	Calm
Soil temperature, (2 in) C	12	20	8
Leaf Surface Moisture	Dry	Dry	Dry

Weed Data

Application Date	Species	Growth Stage	Density (pl/ft^2)
June 7	LINDA	Vegetative	2 to 3
July 11	LINDA	Flowering	"
October 7	LINDA	Dormant	"

Table 2. Dalmatian toadflax control in rangeland.

TREATMENT	RATE (lb ai/a)	TIMING	LINDA	LINDA	LINDA
			(CONTROL)		
			July, 11	August, 9	September, 6
			(% of check)		
PICLORAM	0.5	VEG	16	20	31
PICLORAM	1.0	VEG	23	43	74
PICLORAM	2.0	VEG	30	40	65
FLUROXYPYR	0.5	VEG	0	5	11
FLUROXYPYR	1.0	VEG	0	9	11
FLUROXYPYR + PICLORAM	0.5 + 1.0	VEG	25	43	50
FLUROXYPYR + PICLORAM	1.0 + 0.5	VEG	17	29	31
PICLORAM	0.5	FLR		5	11
PICLORAM	1.0	FLR		10	14
PICLORAM	2.0	FLR		18	30
FLUROXYPYR	0.5	FLR		15	18
FLUROXYPYR	1.0	FLR		19	29
FLUROXYPYR + PICLORAM	0.5 + 1.0	FLR		20	31
FLUROXYPYR + PICLORAM	1.0 + 0.5	FLR		23	31
LSD (.05)			7	9	16

Yellow toadflax control with fluroxypyr and picloram on Colorado rangeland. Sebastian, J.R., Beck, K.G. A rangeland experiment was established near Meeker, CO to evaluate yellow toadflax (LINVU) control with fluroxypyr, picloram, and tank mixes of fluroxypyr plus picloram (Table 2). The design was a randomized complete block with four replications. All treatments were applied on July 2, 1987 with CO_2 pressurized backpack sprayer using 11003LP flat fan nozzles calibrated to deliver 24 gpa at 15 psi. Other information is presented in Table 1. Plot size was 10 ft by 30 ft.

Visual observations were taken on October 7, 1987 and August 3, 1988, approximately 3 and 13 months after treatment application. Picloram alone (2.0 lb ai/acre) and picloram (1.0 lb ai/acre) plus fluroxypyr (1.0 lb ai/acre) provided excellent yellow toadflax control 3 months after application. Picloram and picloram (> 0.25 lb ai/acre) plus fluroxypyr tank mixes maintained fair to good yellow toadflax control one year after treatment application.

Herbicide treatments will be evaluated again in 1989 for control longevity. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

Table 1. Application information for yellow toadflax control with fluroxypyr and picloram on Colorado rangeland.

Environmental data

Application date	July 2, 1987
Application time	12:30 PM
Air temperature, C	22
Cloud cover, %	0
Relative humidity, %	Not taken
Wind speed/direction, mph	0 to 3/W
Soil temperature (2.0 in), C	18

Weed data

Application date	Species	Growth Stage	Height (in)	Density (plt/ft^2)
July 2, 1988	LINVU	Vegetative	3 to 8	2 to 4

Table 2. Yellow toadflax control with fluroxypyr and picloram on Colorado rangeland.

Herbicide	Rate	LINVU Control	
	(lb ai/acre)	--------(% of Check)------	
		Oct 7, 1987	Aug 3, 1988
fluroxypyr	1.0	45	30
picloram	1.0	48	60
picloram	2.0	93	86
fluroxypyr	0.25		
+ picloram	0.25	44	30
fluroxypyr	0.25		
+ picloram	0.50	79	65
fluroxypyr	0.25		
+ picloram	1.0	79	63
fluroxypyr	0.50		
+ picloram	0.25	66	10
fluroxypyr	0.50		
+ picloram	0.50	88	43
fluroxypyr	0.50		
+ picloram	1.0	91	58
fluroxypyr	1.0		
+ picloram	0.25	65	55
fluroxypyr	1.0		
+ picloram	0.50	80	56
fluroxypyr	1.0		
+ picloram	1.0	70	75
LSD (0.05)		12	36

PROJECT 2.

HERBACEOUS WEEDS OF RANGE AND FOREST

Steve Whisenant - Project Chairman

Broom snakeweed (Gutierrezia sarothrae) control in improved pastureland. Whitson, T. D. and M. A. Ferrell. Broom snakeweed is a highly competitive rangeland species and is reported to cause cattle abortions. Two studies were established near McFadden, Wyoming to control broom snakeweed on pastureland established to Fairway crested wheatgrass (Agropyron cristatum). Plots were 9 by 30 ft arranged in a randomized complete block design with four replications on August 1, 1985 and June 17, 1986 when broom snakeweed was in early bloom and early vegetative growth stages 4 to 6 inches in height. Herbacides were broadcast with a CO_2 pressurized six-nozzle knapsack unit delivering 40 gpa at 45 psi. The soil was a sandy loam (75% sand, 18% silt and 7% clay) with 2.4% organic matter and a 7.8 pH. Weather factors on August 1, 1985, temperature: air 78F, soil surface 89F, 1 inch 86F, 2 inches 76F, and 4 inches 72F with a relative humidity of 80% and wind 3 mph, NW; on June 17, 1986, temperature: air 78F, soil surface 109F, 1 inch 106F, 2 inches 90F and 4 inches 78F, with a relative humidity of 55% and wind speeds of 0 to 5 mph, NW. Evaluations were made September 4, 1988. Broom snakeweed controls declined an average of 17% from 1987 to 1988 for those treatments applied August 1, 1985. An average decline of 13% was found from 1987 to 1988 with treatments applied June 17, 1986. Picloram applied at 0.25 lb ai/A on August 1, 1985 and picloram + clopyralid at 0.125 + 0.125, 0.25 + 0.25 lb ai/A and picloram at 0.25 and 0.5 lb ai/A applied June 17, 1986 maintained above 90% control for the two and three year study periods. (WY Agric. Exp. Sta., Laramie, WY 82071 SR 1560.)

Broom snakeweed control in improved pastureland

Herbicide	Rate lbs ai/A	Application date Aug. 1, 1985 % control 1987	1988	June 17, 1986 % control 1987	1988
triclopyr + 2,4-D (LVE)[1]	1.0 + 2.0	99	82[2]	100	84
triclopyr + 2,4-D (LVE)	1.5 + 3.0	99	76	100	83
triclopyr	1.0	68	55	53	40
triclopyr	2.0	96	80	99	79
picloram + clopyralid	0.125 + 0.125	96	53	100	94
picloram + clopyralid	0.25 + 0.25	100	85	100	91
picloram	0.25	96	90	100	94
picloram	0.5	98	88	100	96
fluroxypyr	1.0	89	70	80	61
2,4-D (LVE)	2.0	15	10	82	65
Check)	-	0	0	0	0

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[1] LVE = Low Volitile Ester

[2] Evaluations made September 4, 1988

Broom snakeweed (Gutierrezia sarothrae (Pursh) Britt. and Rusby) control in two rangeland locations. Whitson T. D. and J. W. Freeburn. Broom snakeweed now infests approximately 118 million acres of rangeland in the western U.S. Forage production has been reduced up to 70% because of competition with this species and livestock abortions have been reported. Studies were established near McFadden and Wheatland, WY to evaluate the efficacy of herbicide treatments for broom snakeweed control. Plots were 10 by 27 ft in size with four replications arranged in a randomized complete block design. Herbicides were applied broadcast with a CO_2 pressurized knapsack unit delivering 30 gpa at 45 psi., June 28, 1987 at McFadden temperature: air 70F, surface 65F, 1 inch 70F, 2 inches 70F, 4 inches 80F with 60% relative humidity and 5 mph NW wind, to broom snakeweed 4 to 6 inches high in the vegetative stage, July 28, 1987 at Wheatland, temperature: air 96F, surface 100F, 1 inch 90F, 2 inches 93F, 4 inches 91F with 40% relative humidity and 1 to 2 mph N wind to snakeweed in early bloom. The soil at McFadden was a sandy loam (75% sand, 18% silt and 7% clay with 2.4% organic matter and 7.8 pH and at Wheatland a sandy loam (54% sand, 28% silt and 18% clay with 1.6% organic matter and 7.6 pH. Broom snakeweed control was excellent with all picloram and metsulfuron rates at McFadden. However for similar control at Wheatland 0.25 lb ai/A picloram or 0.038 lb ai/A metsulfuron were preferred. The greater effectiveness of low rates of picloram and metsulfuron at McFadden than Wheatland was probably due to growing conditions and growth stage at time of treatment. Addition of surfactant to the picloram spray mixture did not improve broom snakeweed control at either location. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Broom snakeweed control with various herbicides at two locations with and without grazing.

Herbicide	Rate lbs ai/A	Location McFadden, WY[1] grazed (% cont.)	 McFadden, WY ungrazed (% cont.)	 Wheatland, WY grazed (% cont.)	Ave. % control
picloram	0.125	98	96	90	95
picloram + X-77	0.125 + 0.25% VV	94	98	79	90
picloram	0.25	100	100	100	100
picloram + X-77	0.25 + 0.25% VV	100	100	90	97
picloram	0.5	100	100	100	100
2,4-D (LVE) Esteron 99	2.0	88	83	12	61
triclopyr	0.125	0	28	0	9
triclopyr	0.5	14	30	0	15
fluroxypyr	0.25	3	37	13	18
fluroxypyr	0.5	48	83	0	43
fluroxypyr	0.75	77	78	0	52
dicamba + 2,4-D (A)	0.25 + 0.75	80	75	13	56
triclopyr + 2,4-D (LVE)	0.33 + 0.67	72	65	9	49
2,4-D (Weedone 638)	2.0	54	90	0	48
metsulfuron + X-77	0.013 + 0.25% VV	97	96	19	71
metsulfuron + X-77	0.025 + 0.25% VV	100	100	76	92
metsulfuron + X-77	0.038 + 0.25% VV	100	100	92	97
metsulfuron + X-77	0.05 + 0.25% VV	100	100	97	99
metsulfuron + X-77	0.063 + 0.25% VV	100	100	99	100
Check	-	0	0	0	0

1. Application times: McFadden 6/28/87, Wheatland 7/28/87.

Comparisons of three 2,4-D formulations for control of leafy spurge. Whitson, T. D. and M. A. Ferrell. The preferred treatment for leafy spurge near standing water is 2,4-D. This experiment was established near Sundance, WY on a uniform stand of leafy spurge in early bloom. Treatment areas 10 by 27 ft were arranged in a randomized complete block design with four replications. Soil in the experiment area was a silt loam (22% sand, 58% silt and 20% clay with 1.8% organic matter and a 6.3 pH. Herbicides were applied with a CO_2 pressurized six-nozzle knapsack unit delivering 30 gpa at 45 psi. May 24, 1987 temperature, air 60F, soil surface 60F, 1 inch 55F, relative humidity 75%. Evaluations were taken July 7, 1987 and June 8, 1988. 2,4-D formulations of Vertac (Esteron 99) and Union Carbide (Weedone 638) were not significantly different at the three rates tested. Vertac (Formula 40) provided significantly less control than Esteron 99 or Weedone 638 at the 1.0 ai/A rate and significantly less control than Weedone 638 at the 1.5 lb ai/A rate. Picloram was the only herbicide to provide control one year following treatment. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie WY 82071.)

Comparisons of three 2,4-D formulations for control of leafy spurge

Herbicide	Application rate lbs ai/acre	% Leafy spurge control 7/07/87	6/08/88
2,4-D (Formula 40)	1.0	54[2]	0
2,4-D (LVE)(Esteron 99)	1.0	74	0
2,4-D (Weedone 638)	1.0	80	0
2,4-D (Formula 40)	1.5	69	0
2,4-D (LVE) (Esteron 99)	1.5	78	0
2,4-D (Weedone 638)	1.5	81	0
2,4-D (Formula 40)	2.0	80	0
2,4-D (LVE)(Esterone 99)	2.0	81	0
2,4-D (Weedone 638)	2.0	85	0
picloram	2.0	73	70
Control	-	0	0
LSD (0.05)		11	4

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[1] Herbicides were applied 5/28/87.

[2] Evaluations made 6/8/88.

Control of hoary cress (Cardaria draba) with various herbicides. Whitson, T. D., Allen Mooney and Merv Griswold. Hoary cress, a deep rooted perennial, is increasing in acreage on alkaline sites throughout the Western U.S. This experiment was established on a pasture having a densly populated hoary cress stand near Gillette, WY on a sandy loam soil (38% sand, 24% silt, 38% clay with 1.3% organic matter and a pH of 8.0). Plots, 10 by 27 ft, were arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized knapsack unit delivering 30 gpa at 45 psi., May 4, 1988 (temperature: air 67F, soil surface 72F, 1 inch 72F, 2 inches 62F, 4 inches 60F, with a relative humidity of 62% and winds SW at 2 to 3 mph) to hoary cress in the rosette stage. Evaluations were made September 14, 1988, four months after herbicide application. Applications of chlorsulfuron at 0.03 and 0.06 lbs ai/A and metsulfuron at 0.03 and 0.06 lbs ai/A provided 92, 94, 95 and 98% control of hoary cress, respectively. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Control of hoary cress (*Cardaria draba*) with various herbicides.

Herbicide	Rate lbs ai/A	% Control Ave.
2,4-D (LVE)	1.0	11
2,4-D (LVE)	2.0	24
fluroxypyr	0.25	0
fluroxypyr	0.375	3
fluroxypyr	0.5	14
fluroxypyr	1.0	20
triclopyr	1.0	13
triclopyr	2.0	31
chlorsulfuron + X-77	0.03 + 0.25%	92
chlorsulfuron + X-77	0.06 + 0.25%	94
metsulfuron + X-77	0.03 + 0.25%	95
metsulfuron + X-77	0.06 + 0.25%	98
Check	-	0

[1] Herbicides were applied May 4, 1988.
[2] Evaluations were taken September 14, 1988.

Control of hoary cress (Cardaria draba (L.) Dasv.) on pastures. Drake, K. R. and T. D. Whitson. Hoary cress, a perennial weed, is spreading rapidly in alkaline soils throughout the Western U.S. This experiment was established near Basin, WY on a sandy loam soil (56% sand, 22% silt and 22% clay with 1.8% organic matter and 8.1 pH. Plots, 10 by 27 ft, were arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized knapsack sprayer delivering 20 gpa at 45 psi July 15, 1987 (temperature, air 85F, soil surface 86F, 1 inch 85F, 2 inches 82F, 4 inches 80F with 42% relative humidity and winds calm) to 12 to 16 inch hoary cress in mid-bloom. Evaluations were made August 10, 1988. Applications of chlorsulfuron at 0.031, 0.062 and 0.124 lb ai/A provided 83, 93 and 97% control, respectively. Metsulfuron at 0.031, 0.062 and 0.124 lb ai/A provided 86, 80 and 88% control, respectively. Sulfometuron had no effect on hoary cress but reduced stands of perennial grasses over 85%. Bromoxynil and fluroxypyr did not control hoary cress, however, 2,4-D was partially effective. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Control of hoary cress with various herbicides.

Herbicide[1]	Rate lbs. ai/A	Control[2] %
chlorsulfuron	0.031	83
chlorsulfuron	0.062	93
chlorsulfuron	0.124	97
metsulfuron	0.031	86
metsulfuron	0.062	80
metsulfuron	0.124	88
sulfometuron[3]	0.031	0
sulfometuron	0.062	0
sulfometuron	0.124	13
bromoxynil	0.5	0
bromoxynil	2.0	0
Check	-	0
fluroxypyr	0.5	0
fluroxypyr	1.0	0
2,4-D (LVE)	1.0	66
2,4-D (LVE)	2.0	79

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[1] Applied July 15, 1987.

[2] Evaluation made Aug. 10, 1988.

[3] Sulfometuron reduced grass stands over 85% at 0.031, 0.062 and 0.124 lbs ai/acre.

Control of hoary cress with chlorsulfuron. Ferrell, M.A. and T.D. Whitson. Hoary cress can be a problem on improved pastureland and other disturbed areas. This research was conducted at Rock River, WY, on an improved pasture to evaluate the efficacy of chlorsulfuron on hoary cress.

Plots were 10 by 108 ft. with one replication. The herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 35 psi June 4, 1987 (air temp. 75 F, soil temp. 0 inch 90 F, 2 inch 87 F, 4 inch 85 F, relative humidity 65%, wind calm, sky clear). The soil was classified as a sandy loam (79% sand, 11% silt and 10% clay) with 1.0% organic matter and a 7.6 pH. Hoary cress was in full bloom and 15 to 20 inches high. Infestations were heavy throughout the experimental area. Visual weed control evaluations were made August 3, 1988.

Hoary cress control was 90% or better with chlorsulfuron at rates of 0.75 oz ai/A and above. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1561 .)

Hoary cress control

Treatment[1]	Rate	Control[2]
	(oz ai/A)	(%)
chlorsulfuron	0.25	60
chlorsulfuron	0.5	85
chlorsulfuron	0.75	90
chlorsulfuron	1.0	95
chlorsulfuron	2.25	99
check	0	0

[1] Treatments applied June 4, 1987; surfactant, X-77, added to all treatments at 0.25% v/v

[2] Visual evaluations August 3, 1988

Control of leafy spurge with picloram and 2,4-D LVE. Ferrell, M.A. and T.D. Whitson. This research was conducted near Devil's Tower, WY, on pastureland, to compare the efficacy of treatments 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 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 W at 10 mph, sky 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 high. Infestations were heavy throughout the experimental area. Visual weed control evaluations were made June 8, 1988.

Leafy spurge control was 80% or better with picloram at rates greater than 1.0 lb ai/A. No other treatments effectively controlled leafy spurge. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1565 .)

Leafy spurge control

Treatment[1]	Rate	Control[2]
	(lb ai/A)	(%)
picloram	0.25	5
picloram	0.5	48
picloram	0.75	59
picloram	1.0	75
picloram	1.25	83
picloram	1.5	80
picloram	1.75	83
picloram	2.0	89
picloram + 2,4-D LVE	0.25 + 1.0	25
2,4-D LVE	1.0	0
2,4-D LVE	2.0	18
check	0	0

[1] Treatments applied May 28, 1987
[2] Visual evaluations June 8, 1988

Control of Russian knapweed (Centaura repens L.) with various herbicides. Whitson, T. D. and J. R. Gill. Russian knapweed is a perennial weed widely established in pastures and cultivated fields in the Western U.S. This experiment was established May 10, 1988 on a pasture densily infested with a 6 to 8 inch tall stand of Russian knapweed near Worland, Wyoming. Plots, 10 by 27 ft, were arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized knapasack unit delivering 30 gpa at 45 psi., May 10, 1988 (temperature: air 72F, soil surface 70F, 1 inch 71F, 2 inches 72F, 4 inches 71F, with a relative humidity of 50% with winds S at 2 to 3 mph). The soil was a sandy loam (44% sand, 28% silt and 28% clay) with 1.6% organic matter and a 8.1 pH. Picloram applied at 0.5, 1.0, 2.0 and dicamba at 4.0 lb ai/A controlled 100, 99.5, 100 and 84% of the Russian knapweed four months after treatments were applied. Evaluations were made August 4, 1988. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Control of Russian knapweed (Centaurea repens) with various herbicides

Herbicide	Rate lbs ai/A	% Control Ave.
picloram	0.25[1]	33[2]
picloram	0.5	100
picloram	1.0	99.5
picloram	2.0	100
fluroxypyr	0.25	0
fluroxypyr	0.5	0
fluroxypyr	1.0	0
dicamba	2.0	58
dicamba	4.0	84
dicamba + 2,4-D (Amine)	0.25 + 0.75	0
dicamba + 2,4-D (Amine)	0.5 + 1.5	0
triclopyr	0.5	0
triclopyr	1.0	0
triclopyr	2.0	10
triclopyr + 2,4-D (LVE)	0.33 + 0.67	0
triclopyr + 2,4-D (LVE)	0.66 + 1.34	0
2,4-D (LVE)	1.0	5
2,4-D (LVE)	2.0	0
Check	-	0

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[1] Herbicides applied May 10, 1988.

[2] Evaluations made August 4, 1988.

Control of silky crazyweed (Oxytropis sericea) on rangeland. Freeburn, J. W. and T. D. Whitson. Silky crazyweed is a perennial herbaceous legume, poisonous to livestock, found commonly on western U.S. rangelands. This experiment was established May 19, 1987 on a uniform but lightly populated stand of silky crazyweed in rangeland near Wheatland, Wyoming. Silky crazyweed was in the early bloom stage when treatments were applied May 19, 1988 (temperature, air 70F, soil surface 72F, 1 inch 76F, 2 inches 76F, 4 inches 78F; relative humidity 80%, wind SW 1 to 2 mph). Plots were 20 ft by 54 ft arranged as single blocks. Herbicides were applied with a pressurized knapsack unit delivering 30 gpa at 45 psi. The soil was a sandy loam (54% sand, 28% silt, and 18% clay) with 1.6% organic matter and 7.6 pH. Evaluations were made August 25, 1988. Metsulfuron at 0.034 and 0.104 lb ai/A or picloram at 0.125 and .25 lb ai/A provided 100% control 15 months after treatments. No rangeland grass damage was evident with any treatment. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Silky crazyweed control with various herbicides.

Herbicide	Rate lbs ai/A	No. plants in plot	Control %
Metsulfuron + X-77	0.01 + .25% V/V	5	71
Metsulfuron + X-77	0.034 + .25% V/V	0	100
Metsulfuron + X-77	0.104 + .25% V/V	0	100
triclopyr	0.5	23	0
triclopyr	1.0	9	48
triclopyr + 2,4-D (LVE)	0.17 + .34	10	42
triclopyr + 2,4-D (LVE)	0.33 + .67	17	0
picloram	0.125	37	0
picloram	0.25	0	100
picloram	0.5	0	100
dicamba	0.5	15	12
dicamba	1.0	10	42
dicamba + 2,4-D (A)	0.25 + .75	20	0
2,4-D (LVE)	1.0	15	12
2,4-D (LVE)	2.0	11	36
Check	-	17	0

Control of twogrooved milkvetch (Astragalus bisulcatus Hook.) Gray with various herbicides. Whitson, T. D. Twogrooved milkvetch is a perennial poisonous plant commonly found on high pH soils throughout Wyoming. This experiment was conducted near Laramie, WY, July 10, 1987 to determine the efficacy of various herbicides on the control of this species. Plots, 10 by 27 ft, were arranged in a randomized complete block design with four replications. Herbicides were applied broadcast with a CO_2 pressurized six-nozzle knapsack unit delivering 40 gpa at 45 psi., July 10, 1988 (temperature: air 73F, soil surface 80F, 1 inch 80F, 2 inch 70F, and 4 inch 65F with a relative humidity of 60% and winds at 5-10 mph East). The soil was a sandy loam (65% sand, 20% silt and 15% clay) with 1.8% organic matter and a 7.9 pH. Evaluations were made August 5, 1988. Dicamba at 2.0 lb ai/A, Picloram at 0.25, 0.5, 0.75, 1.0 and 2.0 lb ai/A, 2,4-D (LVE) at 2.0 lb ai/A, triclopyr at 2.0 lb ai/A, clopyralid at 0.25 and 0.5 lb ai/A and metsulfuron at 0.0625 lb ai/A provided 100% control of twogrooved milkvetch. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Control of twogrooved milkvetch (Astragalus bisulcatus (Hook.) Gray) with various herbicides.

Herbicide	Rate lbs. ai/A	Control %
dicamba + 2,4-D (A)	0.25 + 0.75	25
dicamba + 2,4-D (A)	0.5 + 1.5	80
dicamba	0.5	75
dicamba	1.0	80
dicamba	2.0	100
picloram	0.25	100
picloram	0.5	100
picloram	0.75	100
picloram	1.0	100
picloram	2.0	100
2,4-D LVE	1.0	50
2,4-D LVE	2.0	100
triclopyr + 2,4-D (LVE)	0.33 + 0.66	33
triclopyr + 2,4-D (LVE)	0.66 + 1.32	88
triclopyr	1.0	58
triclopyr	2.0	100
clopyralid	0.25	100
clopyralid	0.5	100
fluroxypyr	0.25	0
fluroxypyr	0.5	5
fluroxypyr	1.0	10
metsulfuron + X-77	0.0625 + 0.25%	100
chlorsulfuron + X-77	0.0625 + 0.25%	88
sulfometuron + X-77	0.0625 + 0.25%	19
Check	-	0

Dalmatian toadflax control in rangeland. Ferrell, M.A. and T.D. Whitson. Dalmatian toadflax is native to Europe and was introduced into the U.S. as an ornamental. It has since escaped the flower garden and has become a serious problem along roadsides and rangelands. It is difficult to control due to its extensive and deep root system. This experiment was established to evaluate the effectiveness of various herbicide treatments on Dalmatian toadflax. Plots were established June 17, 1985 to a stand of Dalmatian toadflax in rangeland. The toadflax was 6 to 18 inches tall and in the bud to full bloom stage. Perennial grasses 4 to 6 inches tall were present as an understory. Treatments were applied with a six-nozzle knapsack spray unit delivering 40 gpa (air temp. 68 F, relative humidity 42%, wind northwest at 2 mph, sky partly cloudy, soil temp. - 0 inches 89 F, 1 inch 88 F, 2 inch 75 F, 4 inch 69 F). Soil was a clay loam (52% sand, 17% silt and 31% clay) with 4.5% organic matter and 6.8 pH. Plots were 9 by 30 ft. and arranged in a randomized complete block design with three replications. Visual weed control evaluations were made June 29, 1986, June 17, 1987, and August 3, 1988.

Three years after treatment only picloram at 2.0 lb ai/A is maintaining effective Dalmatian toadflax control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1563.)

Dalmatian toadflax control

Treatment[1]	Rate	Percent control[2]		
		1986	1987	1988
	(lb ai/A)			
triclopyr + 2,4-D amine	1.0 + 2.0	0	0	0
triclopyr + 2,4-D amine	1.5 + 3.0	0	0	0
triclopyr	2.0	0	0	0
triclopyr	3.0	0	0	0
fluroxypyr	2.0	0	0	0
fluroxypyr	3.0	0	0	0
triclopyr + fluroxypyr	1.0 + 1.0	0	0	0
triclopyr + fluroxypyr	1.5 + 1.5	0	0	0
picloram + fluroxypyr	1.0 + 1.0	96	97	65
picloram + fluroxypyr	1.5 + 1.5	99	99	72
picloram	2.0	99	99	90
check	0	0	0	0

[1] Treatments applied June 17, 1985

[2] Visual evaluations June 29, 1986, June 17, 1987 and August 3, 1988

Decision support system for integrated resource management. Stuth, J.W., W.T. Hamilton, J.R. Conner, and D.A. Riegel. The Ranching Systems Group is a team of subject matter specialists, systems analysts, and biological support staff whose goal is to develop a knowledge-based, decision support system for the ranching industry. This computerized planning system is designed to assist ranch managers, owners, and action agency personnel in strategic, tactical, and operational decision-making. The system combines simulation and planning with both external and user-built data bases. The model will facilitate estimating long and short-term effects of alternative technologies on land resources and finances. Emphasis is on developing aids for strategic decisions to improve range forage/habitat and tactical decisions to adjust livestock numbers for weather and market dynamics.

The objectives of the Ranching Systems Group include the following:

1. To develop a system that accommodates specific user inputs and facilitates decisions made at the ranch firm level.
2. To develop system applications that allow greater user control in the planning process and more functions for operational decisions.
3. To determine alternative means of effectively transferring ranching decision-support system technology to resource managers.
4. To provide a means for identifying and prioritizing research needs.

The system consists of three major groups of subsystems. The strategic subsystems include these components:

Goal Analysis-contrasts a hierarchy of needs to projected enterprise budgets.

Resource Inventory-provides an assessment of rangeland, pastureland, grazable woodland, cropland, and hayland.

Enterprise Optimization-analyzes annual costs and returns and resource demand and availability to select optimal mix of livestock and/or wildlife.

Strategic Investment-estimates rate of return based on estimates of future annual cash flows which include added costs and revenues associated with practice implementation.

The tactical subsystems include these components:

Enterprise Budgeting-analyzes monthly costs and revenues and provides cash flow and gross margins for an enterprise mix under specified conditions.

Forage Balance-yields a ranch level analysis of a monthly supply and demand (AU) balance to manage stored forages.

Grazing Plan-furnishes grazing regimes linking herds to pastures by a dynamic scheduler.

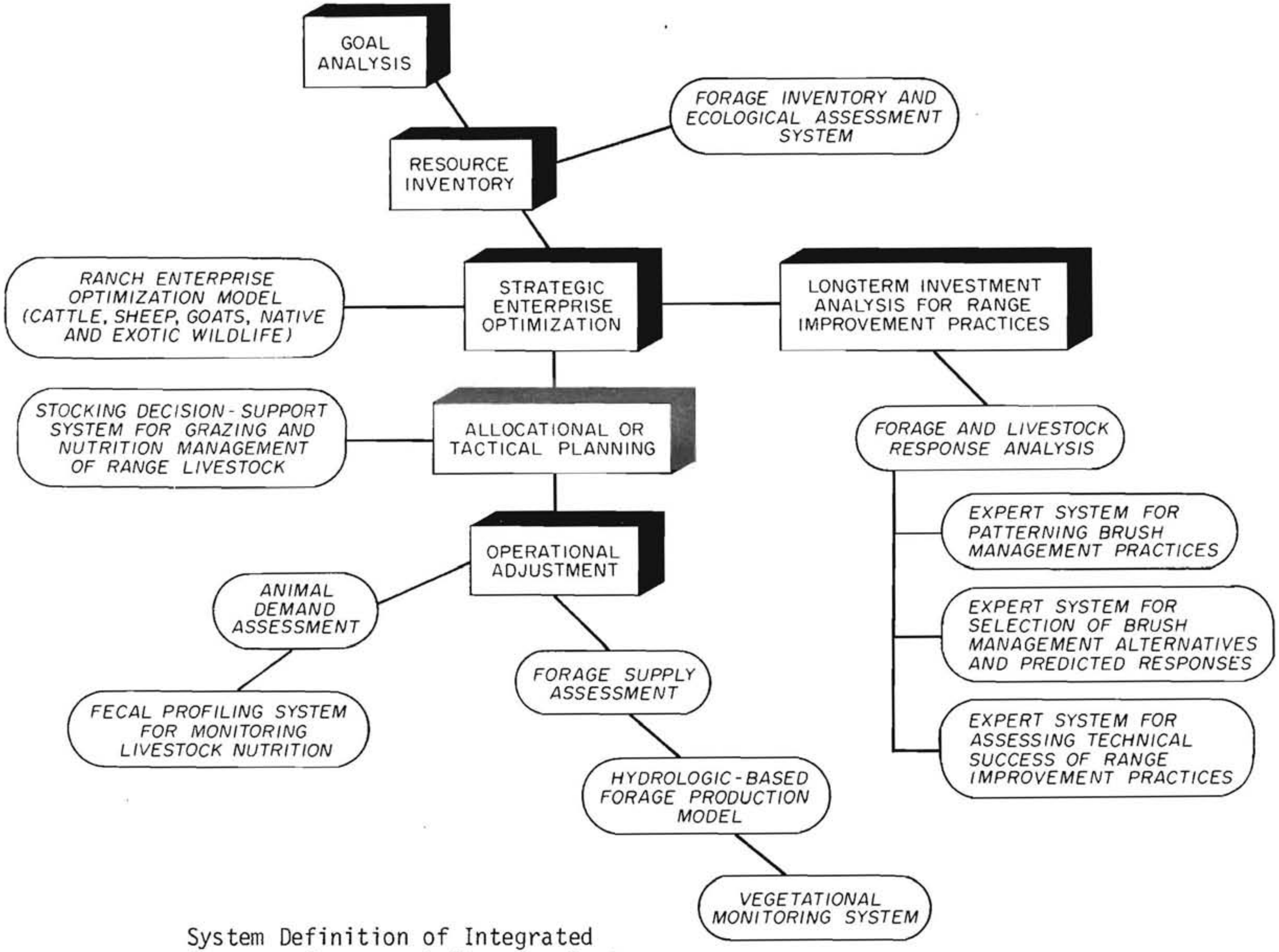
Nutritional Mediation-allows users to define a large number of feedstuff and associated costs to correct nutritional needs.

The operational subsystems include these components:

Plant Monitor-collects information on herbage and browse supply and habitat attributes.

Animal Monitor-estimates protein, forage intake, and digestible organic matter through near infrared spectrophotometry fecal analysis.

This region-neutral system is also designed to include emerging technologies, such as expert systems, geographical information systems, and mass storage CD-ROM. (Department of Range Science, Texas A&M University, College Station TX 77843)



System Definition of Integrated
Resource Management Planning System

Diffuse knapweed (*Centaura diffusa* Lam.) control on rangeland meadows. Whitson, T.D., G.E. Fink and J.P. Buk. Diffuse knapweed, a biennial, is considered an extremely threatening species to western U.S. rangelands. Plots were established on a dense infestation of diffuse knapweed on a creek bottom in Natrona County, WY, to evaluate the efficacy of several herbicides for control of diffuse knapweed. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block design. Herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 45 psi on May 11, 1988 (air temp. 85 F, soil surface 80 F, 1 inch 80 F, 2 inch 75 F, 4 inch 70 F with a 78% relative humidity and calm winds), to diffuse knapweed in the rosette stage 3 to 5 inches in size. The soil was sandy loam (48.5% sand, 30.4% silt and 21.1% clay) with 2.2% organic matter and a pH of 8.1. Evaluations were made July 18, 1988. Controls of diffuse knapweed two months after application were above 97% with applications of picloram at 0.5, 0.75 and 1.0 lb ai/A, 2,4-D (LVE) at 2.0 lb ai/A, dicamba at 1.0 and 2.0 lb ai/A and the combination of dicamba + 2,4-D at 0.5 + 1.5 lb ai/A. Department of Plant, Soil and Insect Sciences, Univ. of Wyoming, Laramie 82071.

Diffuse knapweed control on rangeland meadows

Herbicide[1]	Rate lbs ai/A	% control[2]
picloram	0.125	58
picloram	0.25	78
picloram	0.375	90
picloram	0.5	97
picloram	0.75	99
picloram	1.0	100
2,4-D LVE	2.0	100
glyphosate	0.5	61
dicamba	0.5	79
dicamba	1.0	99
dicamba	2.0	100
dicamba + 2,4DA	0.25 + 0.75	89
dicamba + 2,4DA	0.5 + 1.5	100
triclopyr + 2,4D LVE	0.33 + 0.67	88
metsulfuron + X-77	0.03 + 0.25%	03
metsulfuron + X-77	0.06 + 0.25%	09
fluroxypyr	0.5	46
chlorsulfuron	0.06 + 0.25%	05
chlorsulfuron	0.125 + 0.25%	08
check	-------------	0

[1] Treatments applied May 11, 1988
[2] Evaluations made July 18, 1988

Downy brome (Bromus tectorum) control with various herbicides on rangeland. Whitson, T. D. and D. A. Reynolds. Downy brome, an annual grass invader, has become a common rangeland problem throughout the western U.S. This experiment was established September 14, near Lusk Wyo., on a rangeland site having a dense stand of downy brome. The treatment area was fenced to exclude livestock. Plots 10 by 27 ft were arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized knapsack unit delivering 30 gpa at 45 psi., September 14, 1987 (temperature: air 70F, soil surface 70F, 1 inch 68F, 2 inch 67F, 4 inch 65F, with a relative humidity of 28% and calm winds) and May 26, 1988 (temperature: air 72F, soil surface 72F, 1 inch 71F, 2 inch 65F, 4 inch 64F, with a 47% relative humidity and 3 to 4 mph SW winds). The soil was a silt loam (sand 21%, silt 36% and clay 43%) with 2.47% organic matter and a 8.1 pH. Evaluations were taken August 9, 1988. Treatments providing greater than 92% control included atrazine at 1.0 and 2.0 lb ai/A, metribuzin at 1.0 lb ai/A, terbacil at 0.5 and 1.0 lb ai/A, fluazifop at 0.25 lb ai/A, quizalofop at 0.06, 0.13 and 0.15 lb ai/A. Perennial grasses were damaged over 50% with atrazine at 2.0 lb ai/A, terbacil at 1.0 lb ai/A and quizalofop at 0.25 lb ai/A. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Downy brome (Bromus tectorum) control with various herbicides on rangeland.

Herbicide	Rate lb ai/A	Application time	Control %	% Grass damage
Atrazine	0.25	9/14/87	0	0
Atrazine	0.5	9/14/87	68	0
Atrazine	1.0	9/14/87	92	0
Atrazine	2.0	9/14/87	100	50
Metribuzin	0.25	9/14/87	15	0
Metribuzin	0.5	9/14/87	75	0
Metribuzin	1.0	9/14/87	99	0
Ethiozin	1.0	9/14/87	18	0
Terbacil	0.5	9/14/87	93	0
Terbacil	1.0	9/14/87	100	50
Fluazifop + coc	0.08	5/26/88	37	0
Fluazifop + coc	0.13	5/26/88	37	0
Fluazifop + coc	0.25	5/26/88	94	0
Quizalofop + coc	0.06	5/26/88	98	10
Quizalofop + coc	0.13	5/26/88	95	15
Quizalofop + coc	0.25	5/26/88	100	80
Check	-	-	0	

Effects of burial on the germination of mat-grass. Northam, F.E. and R.H. Callihan. A study was established on 24 August 1987 to monitor the longevity of mat-grass (*Nardus stricta* L.) florets (caryopses enclosed in lemmas and paleas) at 0.2 cm, 2.0 cm, and 20.0 cm below the soil surface. The burial site was a wet meadow in mountain forest land of northern Idaho (Latah Co.). Flat, nylon-organdy packets were constructed with 100 mat-grass florets placed into each packet. A set of three packets (one for each depth) was sewn on a nylon cord, and one set was placed in each hole with one packet at each depth. When samples were retrieved, all three depths for each replication came from the same hole. Samples from six replications were retrieved at each sampling date (3.5 and 8.5 months after burial). Prior to burial the initial germination of the seedlot was evaluted at 18C with a 14 hour light/10 hour dark photoperiod (Table). A gibberellic acid treatment was also evaluated at the same time. These two evaluations gave an initial germination estimate of 67%.

Florets were removed from the packets and surface-sterilized by soaking in a 2.5% sodium hypochlorite solution for 1.5 min and rinsed five times with 50 ml of distilled water. The florets were placed into plastic petri dishes with one layer of Anchor brand germination pads. Plates were maintained in an 18C germinator with a 14 hrs light/10 hrs dark photoperiod. A control treatment consisting of florets from the same seedlot, but stored at room temperatue during the time the buried florets were in the soil was also tested. A floret was considered germinated when both the radicle and plumule had emerged to a length of 1.0 mm. Germinated florets were removed when counted (every seven days).

The maximum germination of mat-grass florets buried 3.5 months averaged 32.8% at 0.2 cm, 32.0% at 2.0 cm, and 29% at 20.0 cm (Table). These averages were attained after 12-14 weeks in the germinator. The control treatment (stored at room temperature during the 3.5 months) had a total germination of 55%. Comparing the 29% to 33% germination of florets buried for 3.5 months to the initial 67% germination of the seedlot (when the experiment began) a reduction of 51% to 57% occurred during 3.5 months of burial.

The maximum germination of mat-grass florets buried for 8.5 months averaged 31.3% at 0.2 cm, 35.3% at 2.0 cm, and 31.2% at 20.0 cm (Table). These maxima were attained after five weeks in the germinator. The control treatment (stored at room temperature during the 8.5 months) had a total germination of 47.0% after 31 weeks in the germinator. Again, comparing the 31% to 35% germination of the buried florets with the initial 67%, germination was reduced by 47.3% to 53.4% during the 8.5 months of burial.

Based on the two sampling periods, it appears that germination of the buried mat-grass florets was reduced to an average of 50% of the initial viability of the seedlot. The buried florets germinated much more rapidly than those maintained in dry storage at room temperature. This suggests that conditions in the meadow soils may have overcome an inhibitor that reduces the speed of mat-grass germination. (Idaho Agriculture Experiment Station, Moscow, ID 83843).

Table. The effects of 3.5 and 8.5 months of burial on the germination of mat-grass florets.

Treatment	Weeks in germinator						
	1	2	5	12	24	31	52
	---------------(% Germination)---------------						
Florets retrieved @ 3.5 mos.							
Buried 0.2 cm	6.0	11.2	30.5	32.5	32.8	32.8	32.8
Buried 2.0 cm	27.5	30.5	31.7	32.0	32.0	32.0	32.0
Buried 20.0 cm	19.7	24.7	28.5	29.0	29.0	29.0	29.0
Dry storage in lab	0.7	4.7	35.7	50.7	55.3	55.7	55.7
Florets retrieved @ 8.5 mos.							
Buried 0.2 cm	30.5	31.3	31.3	31.3	31.3	31.3	--
Buried 2.0 cm	34.1	35.0	35.3	35.3	35.3	35.3	--
Buried 20.0 cm	29.3	31.0	31.2	31.2	31.2	31.2	--
Dry storage in lab	0.3	4.7	28.2	42.2	46.5	46.8	--
Control: Germination tested at zero months of burial	0.0	1.0	27.5	41.3	56.5	61.3	63.0
Gibberellic Acid: Germination tested at zero months of burial	0.0	5.3	46.3	66.8	67.8	67.8	--

Effects of combined herbicides and various seeded grass species on leafy spurge. Whitson, T. D., D. W. Koch, A. E. Gade and M. E. Ferrell. Single herbicide applications do not provide long-term leafy spurge control. This study was conducted near Sundance, WY to determine long-term effects provided by combinations of herbicides and grass species competition. Before seeding perennial grasses, two applications of glyphosate at 0.75 lb ai/A were broadcast applied with a truck mounted sprayer delivering 15 gpa at 35 psi. on June 2, 1986, temperature: air 69F, soil surface 65F, 1 inch 64F, 2 inches 63F, 4 inches 63F with 58% relative humidity and calm wind. A post emergence broadcast application of pendimethalin at 2.0 and 0.5 lb ai/A were applied May 16, 1988, temperature: air 73F, 1 inch 68F, 2 inches 67F, 4 inches 64F with 64% relative humidity and wind 2 to 3 mph NW., with a tractor mounted sprayer applying 20 gpa at 35 psi. Plots were arranged as a split plot, 60 by 9 ft, with four replications, one-half of the plot tilled, the other half left untilled. Tilling was done with a rotatiller on August 11, 1986 and grasses seeded in a silt loam soil ((22% sand, 58% silt, 20% clay with 1.8% organic matter and a 6.3 pH) with a powertill drill August 12, 1986.

All herbicide treatments combined with tillage treatments resulted in greater grass establisment with greater production per acre than the untilled areas. Pubescent wheatgrass and big bluegrass were the only two grasses to establish adequately on areas without tillage. Mountain rye and bluebunch wheatgrass were the only two grasses failing to establish adequately in tilled areas. Leafy spurge control levels above 88% in no-tilled areas were found in plots seeded with pubscent wheatgrass and big bluegrass. Leafy spurge control was less than 83% in tilled areas seeded to mountain rye and bluebunch wheatgrass, the other nine grasses had control greater than 91%. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Leafy spurge grass competition study

Grass Species (Variety)	% Grass established Tilled	% Grass established No-tilled	% Leafy spurge control Tilled	% Leafy spurge control No-tilled	Lbs. grass (D.M./Acre) Tilled	Lbs. grass (D.M./Acre) No-tilled
Pubescent wheatgrass (Luna)[1]	90[2]	70	97	88	572	274
Crested wheatgrass (Ephraim)	83	55	95	79	474	218
Mountain Rye	18	05	79	58	368	224
Big bluegrass (Sherman)	74	79	96	89	594	336
Hybrid wheatgrass (RS1)	74	13	94	60	518	142
Smooth bromegrass (Lincoln)	80	18	92	68	294	152
Intermediate wheatgrass (Oahe)	71	16	97	68	652	152
Bluebunch wheatgrass (Secar)	64	15	83	64	194	128
Western wheatgrass (Rosana)	76	26	91	65	464	174
Russian wildrye (Bozoisky)	83	30	97	63	552	160
Thickspike wheatgrass (Critana)	81	29	94	70	484	210

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[1] Grasses were seeded August 12, 1986.

[2] Evaluated September 14, 1988.

<u>Effects of eleven herbicides on a yellow starthistle community</u>. Northam, F.E. and R.H. Callihan. Eleven herbicides were applied to separate plots in yellow starthistle (*Centaurea solstitialis* L. CENSO)-infested land in northern Nez Perce County, Idaho. No domestic livestock were allowed on the site during the last three years. The soil was a Lickskillet gravelly silt loam with a three to five percent slope; the site was a cultivated field prior to 1979. The soil depth ranged from 12-20 inches over basalt and the annual precipitation was 12-14 inches. Prior to cultivation and improper grazing, the native vegetation in these areas would have normally been bunchgrasses with a 20%-30% perennial forb component.

Atrazine (1.12 kg ai/ha), chlorsulfuron (0.021 kg ai/ha), clopyralid (0.28 kg ai/ha), dicamba (1.12 kg ai/ha), DPX-L5300 (0.056 kg ai/ha), imazapyr (1.12 kg ai/ha), metsulfuron (0.056 kg ai/ha), picloram (0.11 and 0.21 kg ai/ha), pyridate (1.01 kg ai/ha), sulfometuron (0.056 kg ai/ha) and 2,4-D LVE (1.12 kg ai/ha) were evaluated for control of yellow starthistle. These herbicides were applied in April while the starthistle plants were in the cotyledon to three leaf stages. Due to a dry fall (no precipitation from August until mid-November), the yellow starthistle did not emerge until April. The only mechanical preparation for this site was removal of a dense cover of the previous season's yellow starthistle litter by mowing and raking. Table 1 lists the environmental conditions at the time of application.

Table 1. Conditions during application of eleven herbicides to yellow starthistle community.

Factors	14 April 1988*	15 April 1988**
Y. starthistle phenology	cotyledon-3 leaf	cotyledon-3 leaf
Method of application	broadcast spray	broadcast spray
Air temp (C)	37	36
Soil temp (C) @ 2 in	22	21
@ 6 in	15	13
Relative humidity (%)	42	58
Cloud Cover (%)	10	10
Wind speed (km/hr); direction	3.2-4.8 SW	4.8-7.2 S
Dew present	No	No
Time of Day	3:00-4:30 p.m.	9:45-11:25 a.m.
Soil Surface	Dry	Dry
Sprayer speed (km/hr)	3.1	3.1
Carrier volume (l/ha)	374.1	374.1
Nozzle tips	TeeJet 8002VS	TeeJet 8002VS
Nozzle height (cm)	50.8	50.8
Boom pressure (kPa)	275.6	275.6

* Herbicide treatments applied 14 April: picloram @ 0.11 and 0.21 kg ai/ha, clopyralid @ 0.28 kg ai/ha.

** Herbicide treatments applied 15 April: chlorsulfuron @ 0.021 kg ai/ha, DPX-L5300, metsulfuron, and sulfometuron @ 0.056 kg ai/ha, pyridate @ 1.01 kg ai/ha, atrazine, dicamba, imazapyr and 2,4-D LVE @ 1.12 kg ai/ha.

The herbicides were applied through a boom mounted on a small tractor. The plot size was 3 x 9.1 m (10 x 30 ft). Each treatment was replicated four times in a randomized complete block experimental design. Table 2 lists the plant species present in the control plots on 14 June 1988.

Table 2. Predominant plant species in a yellow starthistle community.

Species	Frequency (%)*	Family	Common Name
Alyssum alyssoides (L.)	14	Cruciferae	yellow alyssum
Amsinckia retrorsa Suksd.	47	Boraginaceae	Palouse tarweed
Anthriscus caucalis Bieb.	11	Umbelliferae	bur chervil
Apera interrupta (L.) Beauv.	75	Poaceae	interrupted windgrass
Bromus japonicus Thunb. ex Murr.	17	Poaceae	Japanese brome
Bromus mollis L.	11	Poaceae	soft brome
Bromus tectorum L.	64	Poaceae	downy brome
Centaurea solstitialis L.	94	Asteraceae	yellow starthistle
Convolvulus arvensis L.	11	Convolvulaceae	field bindweed
Galium aparine L.	56	Rubiaceae	catchweed bedstraw
Lactuca serriola L.	22	Asteraceae	prickly lettuce
Lepidium perfoliatum L.	58	Brassicaceae	clasping pepperweed
Montia perfoliata (Donn) Howell	47	Portulacaceae	miner's lettuce
Myosotis micrantha Pall.	47	Boraginaceae	blue scorpion-grass
Sisymbrium altissimum L.	58	Brassicaceae	tumble mustard
Valerianella locusta (L.) Laterrade	31	Valerianaceae	common cornsalad
Veronica hederaefolia (L.)	53	Scrophulariaceae	ivyleaf speedwell
Vicia villosa Roth.	83	Leguminosae	hairy vetch
Vulpia myuros (L.) C. C. Gmelin	28	Poaceae	rattail fescue

* Frequency was determined by recording the presence or absence of each species in 36 quadrats (81.3 cm x 91.4 cm) in the unsprayed control plots.

The above-ground biomass was clipped from two 0.19 m^2 (two-square-foot)-quadrats in each plot on 27 July 1988. Over 90% of the starthistle flower heads had some mature seeds at the time of harvest. After clipping, the samples were dried overnight at 50C. Before weighing, the samples were separated into two components: yellow starthistle plant material and all other plant material. The weights of these two components were added to estimate total production. Table 3 presents the total plant biomass.

The total weight of above-ground vegetation in the unsprayed control plots averaged 474 g/m2 or 4229 lb/ac (Table 3). Yellow starthistle produced 89.5% of this total (3783 lb/ac). The total vegetation weight in the DPX-L5300 and chlorsulfuron plots averaged 30% and 20% more total weight than the control plots. These two herbicides reduced the number of yellow starthistle plants (Table 5) but the remaining plants were benefited by the reduced density and produced 17% to 23% more yellow starthistle biomass (Table 4) than the controls. The total plant biomass in the plots treated with atrazine, chlorsulfuron, dicamba, DPX-L5300, picloram, pyridate and 2,4-D LVE were not significantly different from the control. The total biomass in clopyralid (247 g/m2) and sulfometuron plots (229 g/m2) was significantly less than the biomass in the control plots. The metsulfuron and imazapyr treatments resulted in only 5.0 g/m^2 of plant material.

The untreated check plots produced an average of 424 g/m2 (3783 lb/ac) of oven-dried yellow starthistle (Table 4). This site is typical of the yellow starthistle infestations on previously cultivated land along the rim of the Clearwater and Snake River canyons in Latah and Nez Perce Counties. Plots of four herbicides (clopyralid, metsulfuron, picloram and imazapyr) yielded less than 0.2 g/m2 of yellow starthistle biomass by the end of July 1988 (3.5 months after the treatments were applied). The yellow starthistle biomass yields in the dicamba (73 g/m2) and sulfometuron (27 g/m2) plots were reduced to 17% and 6% of the check plots. Average biomass yields from other herbicide-treated plots were not significantly different from the check.

The yellow starthistle densities were significantly reduced by all herbicide treatments (Table 5). The average number of yellow starthistle plants in the control plots was 1403 plants/m2. The next closest treatment average was pyridate with 525 plants/m2. Five herbicide treatments reduced the starthistle density to less than 0.8 plants/m2 including clopyralid, imazapyr, metsulfuron, sulfometuron and picloram (at both rates).

The biomass of vegetation other than yellow starthistle averaged 50 g/m2 (446 lb/ac) in the check plots (Table 6) or 10.5% of the total oven-dried biomass. The plots of five herbicide treatments (atrazine, dicamba, clopyralid and both rates of picloram) produced significantly (four to seven times) more non-yellow starthistle biomass than the controls; they averaged between 238 to 351 g/m2. The picloram and clopyralid treatments eliminated yellow starthistle and most other broadleaf weeds so that annual grass weeds were predominant in those plots.

In conclusion, metsulfuron and imazapyr removed virtually all plant species, resulting in almost total bare ground in those plots. Picloram and clopyralid eliminated yellow starthistle and allowed the annual grasses to increase. DPX-L5300, chlorosulfuron, pyridate, atrazine and 2,4-D LVE all significantly reduced yellow starthistle density but not total starthistle biomass. Based on the number of seed heads produced in these five treatments, seed production appeared to be at least equivalent to that in the control plots. Dicamba and sulfometuron severely reduced yellow starthistle biomass and density, but did not eliminate seed production. Sulfometuron reduced biomass, density and the number of plant species to less than 50% of that produced in the control plots. (Idaho Agriculture Experiment Station, Moscow, ID 83843).

Table 3. Effects of herbicides on the total standing biomass of a yellow starthistle community.

Chemical	Rate	Total Standing Vegetation
	(kg ai/ha)	(grams/m^2)
DPX-L5300	0.056	616
Chlorsulfuron	0.021	570
Atrazine	1.120	517
CHECK	0.000	474
Pyridate	1.010	439
2,4-D LVE	1.120	430
Picloram	0.210	351
Picloram	0.110	320
Dicamba	1.120	317
Clopyralid	0.280	247
Sulfometuron	0.056	229
LSD(0.05)	---	169
The following data were not included in the analysis of variance.		
Metsulfuron	0.056	4.2
Imazapyr	1.120	0.0

Table 4. Effects of herbicides on yellow starthistle biomass in a yellow starthistle community.

Chemical	Rate	Yellow Starthistle Weight
	(kg ai/ha)	(grams/m2)
DPX-L5300	0.056	546
Chlorsulfuron	0.021	525
CHECK	0.000	424
Pyridate	0.010	318
Atrazine	1.120	278
2,4-D LVE	1.120	187
Dicamba	1.120	73
Sulfometuron	0.056	27
LSD(0.05)	---	241
The following data were not included in the analysis of variance.		
Clopyralid	0.280	0.13
Metsulfuron	0.056	0.13
Picloram	0.110	0.06
Picloram	0.210	0.00
Imazapyr	1.120	0.00

Table 5. Effects of herbicides on yellow starthistle density in a yellow starthistle community.

Chemical	Rate	Yellow Starthistle Density
	(kg ai/ha)	(plants/m^2)
CHECK	0.0	1403
Pyridate	1.01	525
DPX-L5300	0.056	277
Chlorsulfuron	0.021	163
2,4-D LVE	1.120	83
Dicamba	1.120	23
LSD(0.05)	---	249
The following data were not included in the analysis of variance.		
Atrazine	1.120	9.9
Clopyralid	0.280	0.7
Sulfometuron	0.056	0.7
Metsulfuron	0.056	0.3
Picloram	0.110	0.3
Picloram	0.210	0.0
Imazapyr	1.120	0.0

Table 6. Effects of herbicides on the biomass of vegetation other than yellow starthistle.

Chemical	Rate	Non-Starthistle Biomass
	(kg ai/ha)	(grams/m2)
Picloram	0.210	351
Picloram	0.110	320
Clopyralid	0.280	247
Dicamba	1.120	244
2,4-D LVE	1.120	243
Atrazine	1.120	238
Sulfometuron	0.056	202
Pyridate	1.010	121
DPX-L5300	0.056	71
CHECK	0.000	50
Chlorosulfuron	0.021	46
LSD(0.05)	---	180
The following data were not included in the analysis of variance.		
Metsulfuron	0.056	3.9
Imazapyr	1.120	0.0

Effects of three post-emergence grass herbicides on matgrass (Nardus stricta L.). Callihan, R.H. and L.W. Lass. Matgrass, a European perennial weed found in pastures, has been found in an isolated area of northern Idaho. This grass starts as small bunches that eventually mature into a large mats of forage that are low in both quality and productivity. This study examines effects of both spring and summer treatments of fluaziplop-P (0.09, 0.18, 0.37 lbs ai/A), quizalofop (0.06, 0.13, 0.25 lbs ai/A) and sethoxydim (0.19, 0.38, 0.76 lbs ai/A) on matgrass growing in a mountain meadow. Plots were 6 by 30 ft, replicated five times in a split plot design. Five plants within each plot were flagged for evaluating herbicide damage.

The spring treatments were applied on May 17, 1988, at a speed of 2.5 mph and 20 gpa. The air temperature was 71 F, the soil surface 82 F, 2 inches depth 63 F, and 6 inches depth 57 F. The cloud cover was 90%. Relative humidity was 42%. No dew was present at the time of application. During application the winds ranged from 0 to 2 mph from the west. The matgrass and other plants ranged from 2 to 3 inches tall.

The summer application was made on July 26, 1988, when the matgrass seeds were maturing. Treatments were applied at a speed of 1.7 mph and at a of 30 gpa. The air temperature was 75 F, the soil surface of 79 F, and 60 F at the 2 inches and 6 inches soil depths. The cloud cover was 0%, relative humidity was 59%, and wind was calm. Dew was present, but not heavy enough to cause herbicide runoff during application. The matgrass was 2 to 6 inches tall with other plant cover 5 to 12 inches tall. Some matgrass plants may have been partially protected by growth of other species.

Herbicide damage was quantified by determining the percent of shoots with living intercalary meristems within a sample groups of meristems. The spring application of fluazifop-P at 0.37 lbs/A resulted in the lowest number of living intercalary meristems and leaves (6%), when measured on August 19, 1988. The spring treatment of sethoxydim at 0.76 lbs/A resulted in 20% live intercalary meristems and leaves. Lower rates of both fluazifop-P and sethoxydim were less able to kill intercalary meristems and leaves of the matgrass plants. Quizalofop failed to satisfactorily kill 50% of the meristems and leaves of the matgrass.

The matgrass was just beginning to show symptoms from summer applications of the herbicide, when evaluated on August 19, 1988. The evaluation of summer application showed most of the meristems and leaves were still living, due to the slow action of these herbicides. By November, no plants appeared to have been substantially injured by these treatments. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table. The effects of post-emergence herbicides on matgrass intercalary meristems.

Herbicide	Rate	Application Time	Mean Live Intercalary Meristems[1]
	(lb/A ai)		-(%)-
quizalofop	0	Spring	86 B A[2]
quizalofop	0.06	Spring	57 E B D C
quizalofop	0.13	Spring	53 E B D C
quizalofop	0.25	Spring	46 E D C F
fluazifop-P	0	Spring	80 B A C
fluazifop-P	0.09	Spring	36 E F
fluazifop-P	0.18	Spring	43 E D F
fluazifop-P	0.37	Spring	6 G
sethoxydim	0	Spring	98 A
sethoxydim	0.19	Spring	74 B D A C
sethoxydim	0.38	Spring	54 E B D C
sethoxydim	0.76	Spring	20 G F
quizalofop	0	Summer	83 ns
quizalofop	0.06	Summer	97
quizalofop	0.13	Summer	64
quizalofop	0.25	Summer	77
fluazifop-P	0	Summer	92 ns
fluazifop-P	0.09	Summer	76
fluazifop-P	0.18	Summer	65
fluazifop-P	0.37	Summer	69
sethoxydim	0	Summer	93 ns
sethoxydim	0.19	Summer	84
sethoxydim	0.38	Summer	95
sethoxydim	0.76	Summer	78

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[1] Percent living meristem of a sample of 20 to 40 stems.

[2] Any two means having a common letter are not significantly different at the 5% level using protected Duncan's Test.

(ns = Group not statistically different using 5% level of Duncan's Test)

Establishment of various grass species in leafy spurge infested rangeland with and without tillage following eleven glyphosate treatments. Whitson, T. D., D. W. Koch and A. E. Gade. Glyphosate has been tested as single applications for leafy spurge control and found to be ineffective. Areas treated in 1986 near Sundance, Wyoming with split applications of glyphosate provided good control in 1987. This study was conducted to evaluate the influence of grass and glyphosate application on leafy spurge control in tilled and no-tilled establishment systems. Glyphosate treatments were applied broadcase with a CO_2 pressurized six nozzle sprayer delivering 40 gpa at 45 psi. May 14, 1987 temperature: air 70F, soil surface 72F, 1 inch 76F, 2 inches 76F, 4 inches 78F with a relative humidity of 80% and wind 6 to 8 mph, North, to leafy spurge in the bloom stage, June 17, 1987, temperature: air 72F, soil surface 73F, 1 inch 74F, 2 inches 76F, 4 inches 76F, with North wind 2 to 3 mph and a relative humidity of 60% to leafy spurge in late bloom, July 28 temperature: air 70F, 1 inch 70F, 2 inches 72F, 4 inches 70F, wind, SW 5 mph and a relative humidity of 48% to mature leafy spurge. Plots were arranged as a split plot 60 by 30 ft with four replications, one-half of the plot tilled, the other half untilled. Tillage was done with a rotiller on August 13 and the plots rolled and seeded with a Tyedrill August 17, 1987. The soil was a silt loam (22% sand, 58% silt and 20% clay) with 1.8% organic matter and 6.3 pH. Evaluations were made September 14, 1988. In no-tilled areas, leafy spurge control was highest in areas receiving three 0.375 split applications of glyphosate. Leafy spurge was greater than 85% only in tilled areas treated with single glyphosate applications of 1.5 lb ai/A. Two split applications of glyphosate at 1.5 lb in May/July and May/June, and 0.75 lb/A in May/June along with three split applications of 0.375 lb ai/A in May, June and July. Grass species established at satisfactory levels only in those plots receiving tillage treatments. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Establishment of various grass species in leafy spurge infested rangeland with and without tillage in eleven glyphosate applications.

Herbicide	Application date(s)	Rate lb ai/A	Grass species	% Establishment tilled	% Establishment no-till	% Leafy spurge control tilled	% Leafy spurge control no-tilled
1. glyphosate[2]	5-14-87	1.5	1. Ephraim C.W.[1]	65	10	90	45
			2. Rosana W.W.	50	10	90	45
			3. Bozoisky R.W.	60	10	90	45
			4. Secar B.W.	40	10	90	45
			5. Critana T.W.	50	10	90	45
			6. Hybrid W.G.	50	10	90	45
			7. Sherman B.B.	20	10	90	45
			8. Luna P.W.	75	10	90	45
			9. Oahe I.W.	75	10	90	45
2. glyphosate[3]	5-14-87	0.375+	1. Ephraim C.W.	60	10	85	75
	6-17-87	0.375+	2. Rosana W.W.	40	10	85	75
	7-28-87	0.375	3. Bozoisky R.W.	40	10	85	75
			4. Secar B.W.	40	10	85	75
			5. Critana T.W.	60	10	85	75
			6. Hybrid W.G.	40	10	85	75
			7. Sherman B.B.	50	10	85	75
			8. Luna P.W.	70	10	85	75
			9. Oahe I.W.	75	10	85	75
3. glyphosate	5-14-87	1.5+	1. Ephraim C.W.	55	10	90	60
	7-28-87	1.5	2. Rosana W.W.	60	10	90	60
			3. Bozoisky R.W.	60	10	90	60
			4. Secar B.W.	40	10	90	60
			5. Critana T.W.	50	10	90	60
			6. Hybrid W.G.	50	10	90	60
			7. Sherman B.B.	20	10	90	60
			8. Luna P.W.	60	10	90	60
			9. Oahe I.W.	65	10	90	60
4. Check			1. Ephraim C.W.	25	10	20	0
			2. Rosana W.W.	20	10	20	0
			3. Bozoisky R.W.	20	10	20	0
			4. Secar B.W.	10	10	20	0
			5. Critana T.W.	15	10	20	0
			6. Hybrid W.G.	15	10	20	0
			7. Sherman B.B.	20	10	20	0
			8. Luna P.W.	40	10	20	0
			9. Oahe I.W.	40	10	20	0
5. glyphosate	5-14-87	1.5+	1. Ephraim C.W.	90	25	97	60
	6-17-87	1.5	2. Rosana W.W.	70	10	97	60
			3. Bozoisky R.W.	80	15	97	60
			4. Secar B.W.	70	20	97	60
			5. Critana T.W.	70	10	97	60
			6. Hybrid W.G.	70	10	97	60
			7. Sherman B.B.	20	10	97	60
			8. Luna P.W.	70	30	97	60
			9. Oahe I.W.	75	40	97	60
6. glyphosate	5-14-87	0.38+	1. Ephraim C.W.	65	10	70	10
	6-17-87	0.38	2. Rosana W.W.	30	10	70	10
			3. Bozoisky R.W.	55	10	70	10
			4. Secar B.W.	40	10	70	10
			5. Critana T.W.	30	10	70	10
			6. Hybrid W.G.	35	10	70	10
			7. Sherman B.B.	35	10	70	10
			8. Luna P.W.	75	10	70	10
			9. Oahe I.W.	75	10	70	10

Continued

Herbicide	Application date(s)	Rate lb ai/A	Grass species	% Establishment tilled	no-till	% Leafy spurge control tilled	no-tilled
7. glyphosate	5-14-87	0.75+	1. Ephraim C.W.	65	10	80	40
	7-28-87	0.375	2. Rosana W.W.	40	10	80	40
			3. Bozoisky R.W.	70	10	80	40
			4. Secar B.W.	25	10	80	40
			5. Critana T.W.	60	10	80	40
			6. Hybrid W.G.	55	10	80	40
			7. Sherman B.B.	50	10	80	40
			8. Luna P.W.	80	10	80	40
			9. Oahe I.W.	70	10	80	40
8. glyphosate	5-14-87	0.375+	1. Ephraim C.W.	30	10	70	40
	6-17-87	0.75	2. Rosana W.W.	20	10	70	40
			3. Bozoisky R.W.	50	10	70	40
			4. Secar B.W.	25	10	70	40
			5. Critana T.W.	50	10	70	40
			6. Hybrid W.G.	40	10	70	40
			7. Sherman B.B.	30	10	70	40
			8. Luna P.W.	60	10	70	40
			9. Oahe I.W.	35	10	70	40
9. glyphosate	5-14-87	0.75+	1. Ephraim C.W.	40	10	85	50
	6-17-87	0.75	2. Rosana W.W.	30	10	85	50
			3. Bozoisky R.W.	65	10	85	50
			4. Secar B.W.	40	10	85	50
			5. Critana T.W.	80	10	85	50
			6. Hybrid W.G.	75	10	85	50
			7. Sherman B.B.	50	10	85	50
			8. Luna P.W.	90	10	85	50
			9. Oahe I.W.	80	10	85	50
10. glyphosate	5-14-87	0.375	1. Ephraim C.W.	20	10	40	0
			2. Rosana W.W.	15	10	40	0
			3. Bozoisky R.W.	45	10	40	0
			4. Secar B.W.	40	10	40	0
			5. Critana T.W.	40	10	40	0
			6. Hybrid W.G.	60	10	40	0
			7. Sherman B.B.	40	10	40	0
			8. Luna P.W.	60	10	40	0
			9. Oahe I.W.	50	10	40	0
11. glyphosate	5-14-87	0.75	1. Ephraim C.W.	25	10	50	0
			2. Rosana W.W.	20	10	50	0
			3. Bozoisky R.W.	70	10	50	0
			4. Secar B.W.	30	10	50	0
			5. Critana T.W.	60	10	50	0
			6. Hybrid W.G.	35	10	50	0
			7. Sherman B.B.	30	10	50	0
			8. Luna P.W.	50	10	50	0
			9. Oahe I.W.	30	10	50	0

1. Abbreviations:

   C.W. = crested wheatgrass, W.W. = western wheatgrass, R.W. = Russian wildrye, B.W. = bluebunch wheatgrass, T.W. = thickspike wheatgrass, W.G. = wheatgrass, B.B. = big bluegrass, P.W. = pubescent wheatgrass, I.W. = intermediate wheatgrass.

2. One fourth % V/V X-77 surfactant added to each glyphosate treatment.

3. Intermediate wheatgrass and Kentucky bluegrass present before applications were damaged only slightly by the three 1 pint glyphosate applications.

Fluroxypyr in combination with various herbicides for leafy spurge control. Ferrell, M.A. and T.D. Whitson. This research was conducted near Devil's Tower, WY, on pastureland, to compare the efficacy of treatments of fluroxypyr in combination with various herbicides for the control of leafy spurge.

Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. The 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 W at 5 mph, sky 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 high. Infestations were heavy throughout the experimental area. Visual weed control evaluations were made June 8, 1988.

No treatments were effective in controlling leafy spurge. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1558 .)

Leafy spurge control

Treatment[1]	Rate	Control[2]
	(lb ai/A)	(%)
fluroxypyr + picloram	0.5 + 0.25	20
fluroxypyr + picloram	0.5 + 0.5	18
fluroxypyr + dicamba	0.5 + 1.0	0
fluroxypyr + dicamba	0.5 + 2.0	0
fluroxypyr + 2,4-D LVE	0.5 + 2.0	0
fluroxypyr + 2,4-D LVE	0.5 + 4.0	0
picloram	0.25	0
picloram	0.5	13
dicamba	1.0	0
dicamba	2.0	0
2,4-D LVE	2.0	0
2,4-D LVE	4.0	0
fluroxypyr	0.5	0
check	0	0

[1] Treatments applied May 28, 1987

[2] Visual evaluations June 8, 1988

Foliar sprays for the control of two species of the genus Paspalum. Santos, G.L., L.W. Cuddihy, and C.P. Stone. Dallis grass (Paspalum dilatatum Poir.) and vasey grass (P. urvillei Stend.) are two alien grasses that are displacing native understory and suppressing the germination of native tree species in the mesic areas of Hawaii Volcanoes National Park in Hawaii. Both species were introduced to Hawaii for pasture purposes and have since become naturalized.

The tests were set out in a mesic parkland of koa (Acacia koa) and soapberry (Sapindus saponaria). Treatments tested were: glyphosate (3 lb ae/gal) at 5 lb ae/A; fluazifop-butyl (4 lb ai/gal) at 0.5 lb ai/A; sethoxydim (1.5 lb ai/gal) at 0.5 lb ai/A; sulfometuron methyl (75% formulation) at 12 oz product/A; and imazapyr (2 lb ae/gal) at 1.5 lb ae/A. All treatments were diluted in water and applied with a hand-pressurized knapsack sprayer at 80 gal/A and 30 psi. Nozzle was a Teejet 8004E. Sample size was three 5 x 10 m plots per treatment. Plots included mixed stands of both species. Herbicides were applied on Feb. 4, 1988, and results are 9 MAT.

Imazapyr and glyphosate resulted in excellent kill, with glyphosate giving a quick knockdown and imazapyr a long residual activity. The glyphosate plots were characterized by moderate to heavy recolonization by the native bracken fern (Pteridium aquilinum (L.)), while the bracken fern in the imazapyr plots also recovered but its fronds were slightly deformed. Imazapyr also affected nearby naio trees (Myoporum sandwicense), causing deformation of developing leaves and shoots. By 9 months, these native trees seemed to have recovered, although leaves were larger than normal. (Hawaii Field Research Center, Hawaii Volcanoes National Park, P.O. Box 52, Hawaii National Park, HI 96718)

Control of two species of Paspalum in Hawaii Volcanoes National Park*

			control rating**					
Treatment	1 mo	2 mo	3 mo	4 mo	5 mo	6 mo	7 mo	9 mo
imazapyr/water	1.0	2.0	4.0	5.0	5.0	5.0	5.0	4.0
glyphosate/water	4.3	4.0	4.7	4.7	4.7	4.7	5.0	4.0
fluazifop-butyl/water	1.0	2.0	2.7	2.7	2.7	1.3	1.6	0
sethoxydim/oil/water	1.0	1.3	1.0	1.0	0.3	0	0	0
sulfometuron-methyl/water	1.3	2.0	3.3	4.0	4.0	1.6	2.0	1.3
control	0	0	0	0	0	0	0	0

*Scale of effectiveness:

0 = no effect, healthy growth
1 = poor control, chlorosis, < 50% necrosis
2 = inadequate control, moderate symptoms, 50-75% necrosis
3 = good control, severe symptoms, 75-90% necrosis
4 = excellent control, very severe symptoms, 90-99% necrosis
5 = 100% necrosis

**mean of 3 plots

Herbaceous weed control in young conifer plantations. Cole, E.C., M. Newton, and M. Gourley. Herbaceous weeds are a common problem in young conifer plantations, especially in areas with summer droughts. An experiment was established in the Coast Range of western Oregon to determine efficacy of different herbicides for controlling herbaceous weeds in newly planted Douglas-fir on a very productive site. The site selected had been clearcut in 1987 and planted with Douglas-fir seedlings in February 1988. At the time of spraying, vegetation consisted of a variety of grasses and forbs.

Six herbicide treatments were applied at two timings, pre- and post budbreak (April and May, 1988). For the post budbreak applications, seedlings varied from bud swell to 3 cm needle elongation. Treatments included atrazine at 4.5 kg ai/ha, atrazine at 4.5 kg ai/ha plus glyphosate at 0.8 kg ae/ha, atrazine at 4.5 kg ai/ha plus 2,4-D ester at 2.2 kg ai/ha, hexazinone at 1.4 kg ai/ha, and sulfometuron at 0.11 kg ai/ha, and untreated controls. Herbicide treatments were applied using a backpack sprayer equipped with a single adjustable hollow cone nozzle and using the "waving wand" technique. Spray volume was 94 l/ha, and plot size was 9 by 30 meters (0.027 ha, 0.069 a). Plots were evaluated for percent cover in summer 1988. In addition, Douglas-fir injury was rated on a six-point scale--0: no injury, 1: minor injury to foliage, 2: injury to foliage and buds, 3: slight terminal dieback, 4: terminal dieback and loss of over one-third of crown, and 5: dead.

All but one of the herbicide treatments (glyphosate at 0.8 kg in April) had significantly different total cover from the untreated control (Table 1). Control plots averaged 90 percent total cover, the glyphosate at 0.8 kg in April treatment averaged 57 percent, and the remaining treatments had less than 40 percent. The atrazine plus glyphosate treatments had the lowest total covers, 12 percent with the April treatment and 10 percent with the May treatment. Overall, May treatments were significantly better at reducing total cover than the April treatments.

Most of the treatments (including the control plots) exhibited some degree of injury to Douglas-fir seedlings (Table 2). Some of the minor injury, such as chlorosis of foliage and slight stunting may be associated with stress related to planting. However, major injury, including injury to buds, terminal dieback, and mortality, was associated with the herbicide treatments. Severe injury occurred only on those plots treated with 2,4-D (especially in May) or glyphosate (both timings), with the most severe injury occurring on the plots treated with glyphosate. Some mortality occurred on these plots. Atrazine plus 2,4-D in April, sulfometuron, or hexazinone are acceptable choices for conditions of this study. (Department of Forest Science, Oregon State University, Corvallis, OR 97331; and Starker Forests, Inc., PO Box 809, Corvallis, OR 93779)

Table 1 Cover for herbaceous plots

Treatment	Rate/ Hectare	Timing	% Total Cover	% Forb Cover	% Grass Cover
Atrazine	9.0 kg	April	38 bc*	22 abcd	13 ab
		May	26 bc	21 abcd	3 b
Atrazine+ 2,4-D	9.0 kg + 2.2 kg	April	20 c	10 cd	4 b
		May	19 c	6 d	7 ab
Atrazine+ Glyphosate	9.0 kg + 0.8 kg	April	12 c	4 d	1 b
		May	10 c	5 d	1 b
Glyphosate	0.8 kg	April	57 ab	40 abc	14 ab
		May	18 c	14 bcd	1 b
Hexazinone	1.4 kg	April	35 bc	18 bcd	10 ab
		May	22 c	13 bcd	6 b
Sulfometuron	0.11 kg	April	22 c	17 bcd	2 b
		May	28 bc	11 cd	14 ab
Control	0	April	90 a	45 ab	42 a
		May	90 a	52 a	32 ab

Table 2 Injury to Douglas-fir seedlings

Treatment	Rate/ Hectare	Timing	Injury Rating	% Injured	% Severely Injured
Atrazine	9.0 kg	April	0.38 e*	38 b	0 b
		May	0.63 de	63 ab	0 b
Atrazine+ 2,4-D	9.0 kg + 2.2 kg	April	0.48 e	43 b	3 b
		May	1.62 bc	100 a	7 b
Atrazine+ Glyphosate	9.0 kg + 0.8 kg	April	1.33 cd	100 a	5 b
		May	2.17 ab	97 a	39 a
Glyphosate	0.8 kg	April	2.43 a	100 a	39 a
		May	2.43 a	100 a	50 a
Hexazinone	1.4 kg	April	0.25 e	25 b	0 b
		May	0.57 de	57 ab	0 b
Sulfometuron	0.11 kg	April	0.57 de	57 ab	0 b
		May	0.72 de	66 ab	0 b
Control	0	April	0.28 e	28 b	0 b
		May	0.40 e	37 b	0 b

* Means followed by the same letter within columns are not significantly different at α=0.05 using Tukey's

Herbicide tolerance of seedling grasses for erosion control. I. Vegetative response. Callihan R.H. and L.W. Lass. Grass establishment practices on erodible crop land in the U.S.D.A. Conservation Reserve Program often allow weeds to dominate during and after grass establishment. Early application of certain herbicides may cause injury to some seedling grasses. The tolerance of seedlings of 19 grass taxa to picloram (0.0, 0.25, 0.5, 1.0 lb ai/a); clopyralid (0.0, 0.125, 0.25, 0.5, 1.0 lb ai/a); clopyralid plus 2,4-D (0.25 + 1 lb ai/a); DPX-G8311 (0.0, 0.016, 0.023, 0.031 lb ai/A); chlorsulfuron (0.0, 0.017, 0.023, 0.031 lb ai/a), CGA-136872 (0.0, 0.013, 0.027, 0.054 lb ai/a), CGA-131036 (0.0, 0.013, 0.027, 0.054 lb ai/a), and glyphosate (0.0, 0.125, 0.25, 0.5 lb ai /a) was tested in the field. Grass seedlings were: bluebunch x quackgrass (*Agropyron spicatum* (Pursh) Scribn. & Smith x *A. repens* (L.)Beauv.); Canada bluegrass (*Poa compressa* L. cv. Reubens); Kentucky bluegrass (Poa pratensis L. cv. Kenblue); meadow brome (*Bromus biebersteinii* cv. Regar); smooth brome (*Bromus inermis* Leys. cv. Manchar); crested wheatgrass (*Agropyron cristatum* Gaertn. cv. Ephraim); creeping red fescue (*Festuca rubra* L. cv. Logro); hard fescue (*Festuca ovina* L. var. *duriuscula* cv. Durar); sheep fescue (*Festuca ovina* cv. Covar), and (*Festuca ovina* cv. Meckelenburg); tall fescue (*Festuca arundinacea* Schreb. cv. Alta) and (*Festuca arundinacea* cv. Fawn); orchard grass (*Dactylis glomerata* L. cv. Paiute); redtop (*Agrostis alba* L. cv. Alba), (*Agrostis alba* cv. Exerata), and (*Agrostis alba* cv. Streaker), common timothy (*Phleum pratense* L. cv. *Climax*), intermediate wheatgrass (*Agropyron intermedium* (Host)Beauv. cv. Oahe), streambank wheatgrass (*Agropyron riparium* Scribn. & Smith cv. Sodar) and an unplanted check.

The experiment was initiated on a Vassar-Uvi silt loam on April 13, 1988 at Viola, Id. Plots were tilled and packed on April 13, 1988. Plots measured 8 by 10 ft, with a split-plot randomized strip block design with four replications. Grass seed was planted on tilled packed plots April 28, using a 7 ft drill, with drag chains, calibrated to deliver 12.98 lb/A. The row spacing was 7 inches and the depth of planting was 1/2 to 3/4 inches. Rice hulls were used to adjust seed volume to a constant seeding rate to compensate for different grass seed sizes. Plots were treated with 0.5 lb ai/A of glyphosate on May 10 prior to grass emergence to remove seedling weeds.

Treatments were applied in 25 gal/A water carrier, with TeeJet 8002 nozzles at a pressure of 25 psi, from a motorized plot sprayer operated at 1.9 mph. The application date was July 10, 1988. The air temperature was 73F, soil temperature was 93F at surface, 91F at 2 inches, and 73F at depth of 5 inches. The relative humidity was 38% and the sky was clear. The wind was from the west at 0 to 3 mph. Grass seedling size ranged from 2 to 5 inches. Measurements of height and chlorosis production were made the first week of August.

Grass seedlings not showing herbicide injury symptoms were Covar sheep fescue; Meckelenburg sheep fescue; and Durar hard fescue. Tolerance to all herbicides except glyphosate was found in seedlings of: Kenblue Kentucky bluegrass; Reubens Canada bluegrass; Logro creeping red fescue; redtop; Exerata redtop; Streaker redtop; and Oahe intermediate wheatgrass.

Height of bluebunch x quackgrass was reduced 53% by 0.5 lb/A glyphosate, 30% by 0.031 lb/A chlorsulfuron, 44% by 1.0 lb/A picloram, 35% by clopyralid plus 2,4-D, and 46% or more by all rates of CGA-136872 (Table 1). Glyphosate at 0.5 lb/A increased leaf chlorosis by 63%;

however at 0.125 lb/A chlorosis was not present (Table 2).

Regar meadow brome height was reduced 26% by 0.5 lb/A glyphosate, and 27% or more by all rates of CGA-136872 (Table 1). Manchar smooth brome height was reduced 43% by 0.5 lb/A glyphosate, and 22% or more by all rates of CGA-136872 (Table 2).

Height of Ephraim crested wheatgrass was reduced 33% or more by all rates of CGA-136872 and 24% to 36% by all rates of glyphosate (Table 1). Glyphosate at 0.5 lb/A increased chlorosis 69% in Ephraim crested wheatgrass (Table 2).

CGA-131036 at 0.054 lbs/A reduced the height of Fawn tall fescue by 40% and Alta tall fescue by 35% (Table 1). Glyphosate at 0.5 lbs/A reduced the height of Fawn tall fescue by 48% and Alta tall fescue by 32%. DPX-G8311 treatment resulted in chlorosis and necrosis on 17% of the Fawn tall fescue. Glyphosate increased the number of chlorotic and necrotic leaves of Fawn tall fescue by 80% or more and Alta tall fescue leaves by 53% or more (Table 2).

Height of Sodar streambank wheatgrass was reduced 21% or more by all rates of CGA-131036 and 45% by 0.5 lb/A glyphosate.

Common timothy height was reduced 9 to 44% by higher rates of DPX-G8311, 32% or more by all rates of chlorsulfuron and 22% or more at higher rates of CGA-136872.

CGA-131036 and the combination of clopyralid plus 2,4-D reduced the height of Paiute orchard grass by 45% and 20%, respectively (Table 1).

The results of this study suggests seedlings of some taxa are not injured by effective rates of these herbicides, when used for postemergence weed control, however, it is apparent that responses of any given grass taxon to these herbicides may not be accurately assumed. (Idaho Agricultural Experiment Station, Moscow, ID. 83843)

Table 1. Effects of herbicides on grass height.

Herbicide	Rate	Bluebx Quackg.	Kenblue Kent. blueg.	Reubens Canada blueg.	Regar meadow brome	Manch. smooth brome	Ephraim crested wheatg.	Logro creep. red f.	Durar hard fescue	Covar sheep fescue	Meck. sheep fescue	Alta tall fescue	Fawn tall fescue	Paiute orchard	Redtop	Exerata redtop	Streak. redtop	Common timothy	Oahe inter. wheatg.	Sodar streamb. wheatg.
	(lb ai/A)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
CGA-131036	0	36 ns	18 ns	27 ns	40 BC	45 ns	52 ns	16 ns	12 ns	5 ns	9 ns	35 A	43 A	49 AB	28 ns	23 ns	31 ns	55 ns	23 ns	41 A
	0.013	31	18	28	43 AB	41	46	14	10	4	10	27 AB	35 AB	39 AB	27	21	39	56	22	29 BDC
	0.027	26	16	27	42 AB	35	57	18	9	4	9	23 B	29 B	30 C	27	20	27	51	17	32 BAC
	0.054	26	17	26	30 C	35	54	19	11	5	9	22 B	26 B	32 BC	17	22	29	44	22	22 ED
Clopyralid	0	41 A	19 ns	28 AB	42 AB	46 ns	48 ns	18 ns	11 ns	3 ns	12 ns	36 ns	38 ns	46 AB	26 ns	27 ns	28 ns	64 ns	25 ns	31 ns
2,4-D	1	32 AB	22	19 B	52 A	42	44	18	11	4	11	29	39	45 AB	30	25	26	51	24	27
	0.125	36 AB	18	25 AB	48 AB	43	48	14	12	4	10	32	42	50 A	31	26	25	65	24	26
	0.25	42 A	18	32 A	45 AB	48	54	13	12	4	10	35	35	39 ABC	32	24	24	67	23	30
+2,4-D	0.25+1.0	28 B	20	22 B	40 B	42	40	19	12	4	10	32	34	32 C	34	29	29	65	23	27
	0.5	33 AB	18	23 AB	49 AB	39	47	18	12	5	8	33	37	42 ABC	29	26	29	62	23	25
DPX-G8311	0	32 ns	16 ns	27 ns	41 ns	43 ns	51 ns	19 ns	10 ns	5 ns	10 ns	39 A	36 ns	45 ns	26 ns	24 AB	29 ns	53 A	26 ns	30 ns
	0.016	34	15	28	50	40	62	16	9	5	9	25 B	28	39	33	23 AB	28	44 B	26	28
	0.023	31	13	28	40	41	55	15	8	4	10	24 B	33	39	27	30 A	28	49 B	20	23
	0.031	35	14	27	42	38	53	11	11	4	9	31 AB	28	37	26	19 B	27	35 C	28	34
Chlorsulfuron	0	43 ns	20 ns	32 ns	42 ns	50 ns	52 ns	18 ns	10 ns	4 ns	10 ns	29 AB	36 AB	38 ns	27 ns	27 ns	33 ns	59 A	22 ns	32 ns
	0.016	39	14	31	40	40	49	15	10	3	8	18 C	30 ABC	37	32	26	33	41 C	22	25
	0.023	33	16	33	40	43	47	14	10	4	11	25 BC	25 C	32	24	28	24	36 C	23	27
	0.031	35	19	29	39	43	48	13	8	4	9	27 ABC	22 C	37	23	22	22	37 C	21	28
Glyphosate	0	35 AB	15 A	21 ns	40 AB	43 AB	59 A	21 A	11 ns	4 ns	9 ns	33 A	42 A	35 ns	24 ns	26 AB	29 ns	60 A	21 A	34 BA
	0.125	32 AB	18 B	24	44 AB	36 B	45 B	15 B	12	4	9	31 AB	35 AB	36	26	22 AB	36	55 A	20 A	27 BED
	0.25	25 B	15 A	23	39 B	37 B	44 C	17 C	10	5	12	25 B	25 C	30	20	21 AB	32	35 C	17 AB	23 EDC
	0.5	18 C	16 A	18	30 C	25 C	38 C	13 C	11	5	8	23 BC	22 C	30	19	10 C	22	32 C	13 B	19 E
Picloram	0	30 AB	14 ns	25 ns	43 ns	41 ns	54 ns	13 ns	8 ns	4 ns	9 ns	28 ns	35 ns	41 ns	22 ns	24 ns	31 ns	47 ns	21 ns	27 ns
	0.25	31 AB	17	23	39	43	44	9	8	4	8	27	34	38	23	21	23	51	23	30
	0.5	24 B	16	24	37	36	41	12	10	4	10	27	33	36	24	19	24	46	26	24
	1	18 C	14	25	40	39	41	12	8	3	8	26	33	31	22	21	30	53	18	23
CGA-136872	0	38 AB	21 ns	28 ns	47 AB	53 A	56 A	21 ns	13 ns	5 ns	9 ns	30 ns	41 AB	43 ns	27 ns	28 ns	35 ns	51 A	21 ns	30 ns
	0.013	20 C	16	26	32 C	40 B	35 C	16	13	4	11	27	30 C	33	18	22	24	53 ABC	23	23
	0.027	20 C	19	28	34 C	38 B	38 C	14	9	4	8	24	40 AB	36	20	22	31	40 C	20	24
	0.054	25 BC	21	29	30 C	45 B	31 C	20	10	3	8	27	31 BC	32	27	22	34	39 C	23	28

1. Any two means within a column having a common letter are not significantly different at the 5% level using the Protected Duncan's Test. (ns=not significant)

Table 2. Effects of herbicides on leaf chlorosis of 19 grasses.

Percent chlorotic leaves

Herbicide	Rate	Bluebx Quackg.	Kenblue Kent. blueg.	Reubens Canada blueg.	Regar meadow brome	Manchar smooth brome	Ephraim crested wheatg.	Logro creeping red fes.	Durar hard fescue	Covar sheep fescue	Meck. sheep fescue	Alta tall fescue	Fawn tall fescue	Paiute orchard	Redtop	Exerata redtop	Streak. redtop	Common timothy	Oahe inter. wheatg.	Sodar streamb. wheatg.
	(lb ai/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
CGA-131036	0	1 ns	0 ns	4 ns	1 ns	0 ns	1 ns	0 ns	0 ns	0 ns	0 ns	0 ns	0 ns	0 ns	0 ns	4 ns	0 ns	3 ns	1 ns	1 ns
	0.013	0	0	1	1	0	3	0	0	1	1	2	1	1	1	1	0	12	1	0
	0.027	0	1	1	0	1	0	1	2	2	1	1	9	1	0	1	0	3	0	1
	0.054	0	0	2	1	1	1	0	2	2	0	3	11	1	1	0	3	5	1	0
Clopyralid	0	3 ns	0 ns	1 ns	0 ns	1 ns	0 ns	0 ns	0 ns	0 ns	0 ns	0 ns	0 ns	2 ns	0 ns	1 ns	0 ns	1 ns	0 ns	1 ns
2,4-D	1	1	0	5	7	0	5	1	1	0	0	0	0	0	0	0	0	1	1	4
	0.125	0	0	6	0	3	0	0	0	0	0	0	0	3	0	6	0	2	0	0
	0.25	0	0	1	2	0	0	0	0	0	0	0	1	2	0	0	0	1	1	3
+2,4-D	0.25+1.0	1	0	3	6	0	20	0	0	0	0	0	1	2	1	0	0	2	0	0
	0.5	1	0	6	0	4	5	0	0	0	0	0	1	1	0	3	0	1	1	6
DPX-G8311	0	0 ns	0 ns	5 ns	1 ns	0 ns	6 ns	0 ns	1 ns	1 ns	1 ns	1 ns	1 C	0 ns	0 ns	1 ns	3 ns	3 ns	0 ns	3 ns
	0.016	0	0	5	1	3	1	4	3	0	0	3	6 C	2	1	0	0	6	1	4
	0.023	0	0	4	0	3	2	0	1	0	0	3	18 B	1	0	1	3	1	2	0
	0.031	4	0	0	0	0	1	1	2	0	0	5	11 C B	1	1	5	0	2	3	1
Chlorsulfuron	0	0 ns	0 ns	4 ns	2 ns	3 ns	23 ns	0 ns	1 ns	1 ns	1 ns	5 ns	3 ns	0 ns	5 ns	10 B A	0 ns	20 ns	2 ns	1 ns
	0.016	3	1	7	1	4	5	1	0	1	0	1	4	2	0	1 B C	6	18	1	3
	0.023	1	0	7	3	2	3	1	0	1	1	3	5	8	0	6 B A	3	8	2	2
	0.031	1	0	1	1	2	3	8	0	1	1	4	5	0	0	0 C	4	2	2	5
Glyphosate	0	0 D	0 B	2 B	1 C	3 B	0 B	0 ns	0 ns	0 B	1 ns	0 B	0 C	1 C B	0 B	0 C	0 C	4 B	0 B	0 B
	0.125	0 D	1 B	5 B	2 C B	6 B	21 B	0	1	4 B	2	2 B	1 C	1 C B	9 B	5 B A	9 C B	20 B	4 B	5 B
	0.25	23 B	4 B	11 B	14 B	8 B	8 B	3	1	1 B	3	16 B	11 C B	9 B	2 B	6 B A	11 C B	14 B	8 B	9 B
	0.5	63 A	15 A	52 A	25 A	62 A	69 A	5	0	14 A	3	52 A	80 A	34 A	39 A	11 A	51 A	87 A	91 A	55 A
Picloram	0	0 ns	5 ns	1 ns	1 ns	3 ns	0 ns	0 ns	0 B	0 ns	1 ns	1 ns	0 ns	0 ns	1 ns	6 ns	8 C B	18 ns	1 ns	3 ns
	0.25	4	1	2	5	11	1	2	0 B	0	0	1	0	2	1	4	21 B	9	0	3
	0.5	0	0	9	6	5	3	2	1 B	1	0	1	1	1	5	1	4 C B	21	3	3
	1	4	4	23	5	13	3	5	4 A	1	0	1	0	5	2	1	1 C	13	5	0
CGA-136872	0	0 D	0 ns	5 ns	0 ns	3 ns	0 ns	1 ns	0 ns	0 ns	0 ns	1 ns	0 ns	0 ns	0 ns	4 ns	6 ns	11 ns	6 ns	0 ns
	0.013	4 D C	1	8	6	9	7	0	1	2	3	0	0	2	2	3	1	12	2	11
	0.027	13 C	0	7	6	10	23	3	1	0	0	3	1	3	3	4	1	15	5	4
	0.054	8 D C	1	1	4	8	5	4	3	3	0	5	5	5	1	3	13	11	8	1

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1. Any two means within a column having a common letter are not significantly different at the 5% level using the Protected Duncan's Test. (ns=not significant)

Herbicide tolerance of seedling grasses for erosion control. II. Reproductive response. Lass, L.W., and R.H. Callihan. Grass establishment practices on erodible crop land in the U.S.D.A. Conservation Reserve Program often allow weeds to dominate during and after grass establishment. Early application of certain herbicides may cause injury to some seedling grasses. The vegetative responces of seedling grasses to herbicides were reported in part I. Part II examined the reproductive responce of seedling grasses during the first season after herbicide application. The tolerance of seedlings of 19 grass taxa to picloram (0.0, 0.25, 0.5, 1.0 lb ai/a); clopyralid (0.0, 0.125, 0.25, 0.5, 1.0 lb ai/a); clopyralid plus 2,4-D (0.25 + 1 lb ai/a); DPX-G8311 (0.0, 0.016, 0.023, 0.031 lb ai/A); chlorsulfuron (0.0, 0.017, 0.023, 0.031 lb ai/a), CGA-136872 (0.0, 0.013, 0.027, 0.054 lb ai/a), CGA-131036 (0.0, 0.013, 0.027, 0.054 lb ai/a), and glyphosate (0.0, 0.125, 0.25, 0.5 lb ai /a) was tested in the field. Grass seedlings were: bluebunch x quackgrass (*Agropyron spicatum* (Pursh) Scribn. & Smith x *A. repens* (L.)Beauv.); Canada bluegrass (*Poa compressa* L. cv. Reubens); Kentucky bluegrass (Poa pratensis L. cv. Kenblue); meadow brome (*Bromus biebersteinii* cv. Regar); smooth brome (*Bromus inermis* Leys. cv. Manchar); crested wheatgrass (*Agropyron cristatum* Gaertn. cv. Ephraim); creeping red fescue (*Festuca rubra* L. cv. Logro); hard fescue (*Festuca ovina* L. var. *duriuscula* cv. Durar); sheep fescue (*Festuca ovina* cv. Covar), and (*Festuca ovina* cv. Meckelenburg); tall fescue (*Festuca arundinacea* Schreb. cv. Alta) and (*Festuca arundinacea* cv. Fawn); orchard grass (*Dactylis glomerata* L. cv. Paiute); redtop (*Agrostis alba* L. cv. Alba), (*Agrostis alba* cv. Exerata), and (*Agrostis alba* cv. Streaker), common timothy (*Phleum pratense* L. cv. *Climax*), intermediate wheatgrass (*Agropyron intermedium* (Host)Beauv. cv. Oahe), streambank wheatgrass (*Agropyron riparium* Scribn. & Smith cv. Sodar) and an unplanted check.

Information on planting and herbicide application is reported in Part I. Vegetative response. Measurements of seed head production was made the first week of August. Measurements of internode length and seed head length were made the third week of August.

The percentage of Fawn tall fescue plants bearing seed heads was reduced 85% or more by all rates of CGA-131036, 95 and 99% by 0.0234 and 0.03125 lbs/A DPX-G8311, 90 to 100% by all rates of chlorsulfuron, 95% by 0.5 lb/A glyphosate and 85% by 0.5 lb/A picloram (Table 1). Both CGA-131036 and DPX-G8311 reduced the percentage of Alta tall fescue plant bearing seed heads by at least 80%. Seed head length of Fawn tall fescue was reduced 40% or more by the highest rates of CGA-131036, chlorsulfuron, DPX-G8311, and glyphosate (Table 2). CGA-131036, DPX-G8311, chlorsulfuron, and glyphosate at highest rate reduced internode length of Fawn tall fescue by 45% or more (Table 2).

Glyphosate, at 0.5 lb ai/A affected Streaker redtop by reducing seed head length 50% and internode length 45% (Table 2).

The results of this study suggests seedlings of some taxa are not injured by effective rates of these herbicides, when used for postemergence weed control, however, it is apparent that responses of any given grass taxon to these herbicides may not be accurately assumed. (Idaho Agricultural Experiment Station, Moscow, ID. 83843)

Table 1. Effects of herbicides on first year seed head production.

Percent of plants bearing seed heads the first year.

Herbicide	Rate	Bluebx Quackg.	Kenblue Kent. blueg.	Reubens Canada blueg.	Regar meadow brome	Manchar smooth brome	Ephraim crested wheatg.	Logro creep. red f.	Durar hard fescue	Covar sheep fescue	Meck. sheep fescue	Alta tall fescue	Fawn tall fescue	Paiute orchard	Redtop	Exerata redtop	Streak. redtop	Common timothy	Oahe inter. wheatg.	Sodar streamb. wheatg.
	(lb ai/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
CGA-131036	0	10 ns	0 ns	53 ns	0 B	13 ns	48 ns	0 ns	0 ns	0 ns	0 ns	33 AB	53 A	0 ns	28 ns	25 ns	51 ns	46 ns	1 ns	6 ns
	0.013	11	0	65	1 A	5	50	0	0	0	0	8 BC	6 C	0	25	14	45	60	1	13
	0.027	13	0	78	0 B	5	63	0	0	0	0	7 BC	9 C	0	25	27	58	60	2	13
	0.054	20	0	70	0 B	1	60	0	0	0	0	2 C	4 C	0	6	20	38	48	2	0
Clopyralid	0	3 ns	0 ns	49 ns	0 ns	5 ns	50 ns	0 ns	0 ns	0 ns	0 ns	16 ns	54 ns	0 ns	10 ns	23 ns	25 ns	49 ns	2 ns	0 ns
2,4-D	1	6	0	45	0	9	44	0	0	0	0	21	43	0	20	17	18	65	0	2
	0.125	21	0	59	0	6	41	0	0	0	0	21	46	0	15	13	18	49	1	2
	0.25	19	0	39	0	5	40	0	0	0	0	30	37	0	24	26	13	63	0	0
+2,4-D	0.25+1.0	3	0	63	0	7	30	0	0	0	0	16	41	0	10	32	14	78	0	2
	0.5	3	0	50	0	8	38	0	0	0	0	19	30	0	6	4	25	63	0	1
DPX-G8311	0	16 ns	0 ns	64 ns	0 ns	16 ns	55 ns	0 ns	0 ns	0 ns	0 ns	42 A	40 AB	0 ns	8 ns	26 ns	39 ns	73 ns	3 ns	2 ns
	0.016	6	0	46	0	5	65	0	0	0	0	2 C	10 BC	0	23	21	36	36	1	11
	0.023	13	0	64	1	15	70	0	0	0	0	3 BC	4 C	0	20	20	26	56	1	4
	0.031	11	0	65	0	7	60	0	0	0	0	11 BC	2 C	0	24	18	18	59	1	3
Chlorsulfuron	0	20 ns	0 ns	80 ns	0 ns	20 ns	34 ns	0 ns	0 ns	0 ns	0 ns	11 ns	37 AB	0 ns	8 ns	24 ns	48 ns	64 ns	1 ns	8 ns
	0.016	3	0	70	0	23	41	0	0	0	0	3	1 C	0	13	34	25	52	2	1
	0.023	11	0	80	0	19	65	0	0	0	0	2	3 C	0	29	26	13	28	2	1
	0.031	26	0	66	0	15	49	0	0	0	0	1	4 C	0	6	15	6	34	1	1
Glyphosate	0	10 ns	0 ns	53 ns	0 ns	16 ns	60 ns	0 ns	0 ns	0 ns	0 ns	23 ns	39 AB	0 B	23 ns	23 ns	41 ns	55 ns	1 ns	7 ns
	0.125	18	0	74	0	13	40	0	0	0	0	13	13 BC	0 B	6	30	39	38	0	0
	0.25	2	0	31	0	14	24	0	0	0	0	9	8 BC	0 B	18	20	13	29	2	13
	0.5	0	0	28	0	13	22	0	0	0	0	1	1 C	1 A	6	3	4	13	0	6
Picloram	0	3 ns	0 ns	59 ns	0 ns	15 ns	48 ns	0 ns	0 ns	0 ns	0 ns	38 ns	50 A	0 ns	13 ns	8 ns	19 ns	34 ns	3 ns	3 ns
	0.25	6	0	51	0	9	38	0	0	0	0	28	25 ABC	0	14	15	17	31	0	4
	0.5	9	0	50	0	1	34	0	0	0	0	29	8 C	0	0	1	10	33	0	1
	1	1	0	36	0	1	41	0	0	0	0	28	36 ABC	0	6	9	15	58	0	2
CGA-136872	0	23 ns	0 ns	80 ns	0 ns	23 ns	68 ns	0 ns	0 ns	0 ns	0 ns	25 ns	33 ns	0 ns	14 ns	33 ns	46 ns	48 ns	1 ns	13 ns
	0.013	0	0	57	0	6	43	0	0	0	0	23	26	0	8	32	33	48	0	1
	0.027	0	0	66	0	2	35	0	0	0	0	13	34	0	14	44	34	29	0	2
	0.054	0	0	76	0	4	47	0	0	0	0	12	28	0	2	33	25	26	0	7

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1. Any two means within a column having a common letter are not significantly different at the 5% level using the Protected Duncan's Test. (ns=not significant)

Table 2. Effect of herbicides on seed head length and length of last internode.

		Length of Seed Head					Length of stem from last node to seed head.				
Herbicide	Rate	Common timothy	Ephraim crested wheatg.	Fawn tall fescue	Reubens Canada blueg.	Streaker redtop	Common timothy	Ephraim crested wheatg.	Fawn tall fescue	Reubens Canada blueg.	Streaker redtop
	(lb ai/A)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
CGA-131036	0	3.1 ns	3.4 ns	14.6 A	2.9 ns	12.1 ns	23.5 ns	21.1 ns	30.7 A B	15.0 ns	23.1 ns
	0.01338	3.3	3.5	11.1 B	3.7	12.5	24.7	19.3	23.4 B	13.9	25.9
	0.02676	3.7	3.8	10.9 B	3.5	13.6	23.0	24.4	23.0 B C	12.3	24.4
	0.05352	3.3	2.6	9.3 B	3.0	12.0	23.3	23.8	18.9 C	11.3	23.3
Clopyralid	0	3.1 ns	3.2 ns	14.6 ns	3.3 ns	11.9 ns	22.3 ns	21.3 ns	38.4 ns	14.8 A	22.9 ns
2,4-D	1	3.5	3.0	16.3	3.3	10.4	23.8	20.1	33.6	10.3 B	23.4
	0.125	3.4	3.3	15.9	3.5	12.6	29.2	22.0	37.3	14.1 A B	22.5
	0.25	3.6	2.9	14.6	3.2	10.5	28.3	24.3	34.2	14.5 A B	22.7
	0.25+1.0	4.0	3.1	14.1	2.9	12.3	28.1	19.9	40.9	13.4 A B	23.3
	0.5	3.2	3.2	13.3	3.5	12.2	26.4	22.2	36.7	15.0 A	22.9
DPX-G8311	0	9.6 A	3.1 ns	14.5 A	3.2 ns	13.8 ns	19.2 B	20.9 ns	38.3 A	12.7 ns	23.9 ns
	0.0156	3.6 B	3.1	11.5 B	3.3	12.1	23.2 B	20.9	23.2 C	13.7	20.8
	0.0234	5.5 B	3.2	9.4 BC	2.7	12.2	49.6 A	22.1	20.7 C	13.0	21.7
	0.03125	3.3 B	3.4	8.6 C	3.4	13.8	18.6 B	22.2	19.6 C	13.6	21.7
Chlorsulfuron	0	3.0 ns	2.7 ns	13.6 AB	2.9 ns	11.8 ns	25.4 ns	21.3 ns	33.2 A B	13.9 ns	19.4 ns
	0.0156	3.9	3.6	7.9 C	3.6	12.2	20.8	22.6	22.7 B C	15.4	24.6
	0.0234	3.6	3.1	6.8 C	3.5	11.5	18.6	21.2	21.7 C	14.1	17.4
	0.03125	3.0	3.6	10.8 BC	3.7	13.3	17.6	23.1	22.9 B C	14.9	23.7
Glyphosate	0	2.9 ns	3.3 ns	14.1 AB	3.5 ns	11.1 A	26.4 ns	19.9 ns	32.6 A B	14.3 ns	23.8 A
	0.125	3.4	3.3	11.9 B	3.4	13.3 A	19.8	20.2	25.0 C	13.4	21.9 A
	0.25	3.7	3.2	9.9 BC	2.8	12.8 A	20.2	19.1	21.3 C D	11.1	16.5 A B
	0.5	3.5	2.7	7.7 C	2.9	6.8 B	15.9	14.1	15.0 D	10.5	13.4 B
Picloram	0	2.6 ns	3.1 ns	14.0 ns	3.0 ns	10.9 ns	19.6 ns	25.6 A	34.6 ns	13.1 ns	21.5 ns
	0.25	3.4	2.6	13.7	3.3	10.4	21.5	20.2 B	31.1	13.4	23.2
	0.5	5.2	2.6	12.6	3.3	8.4	23.5	20.1 B	32.7	12.6	20.3
	1	3.1	3.3	14.1	3.0	9.8	24.1	18.6 B	36.5	10.6	17.3
CGA-136872	0	3.1 ns	3.4 ns	13.1 ns	2.8 ns	11.3 ns	22.7 ns	25.8 A	34.9 ns	11.3 ns	17.7 ns
	0.01338	3.2	2.6	12.2	3.0	11.4	22.1	18.6 B C	26.4	11.4	21.0
	0.02676	2.9	3.0	12.8	3.2	11.8	19.2	12.6 C	30.3	10.2	25.3
	0.05352	3.2	2.9	11.6	3.5	9.8	16.3	13.6 C	33.0	11.6	18.6

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1. Any two means within a column having a common letter are not significantly different at the 5% level using the Protected Duncan's Test. (ns = not significant at 5% level)

The effects of glyphosate on seedling fescues. Lass, L.W. and R.H. Callihan. Establishing a weed-free grass stand is an important step in many management situations. This study examined the tolerance of turf and forage fescue seedlings to glyphosate. The seven grass taxa used for this test were: Covar and Meckelenburg sheep fescue (*Festuca ovina* L. cv. Covar and Meckelenburg); Durar hard fescue (*Festuca ovina* L. var. *duriuscula* cv. Durar); Idaho fescue (*Festuca idahoensis* Elmer); Logro creeping red fescue (Festuca rubra L. cv. Logro); Wilma chewings fescue (*Festuca rubra* L. var. *commutata* cv. Wilma); and Fawn tall fescue (*Festuca arundinacea* Schreb. cv. Fawn). Glyphosate was applied at rates of 0.0, 0.25, 0.38, 0.5, 0.75, and 1.0 lb ai/A.

A seven-row drill with a 7 inch row spacing was used to establish the fescues in a strip-split plot design on May 14. Each row consisted of a single taxon randomized within each replicate. The planting depth was 3/4 inch. The application of glyphosate was delayed until all species had emerged. Seedling size ranged from 1/2 inch to 2 inches. The plant populations ranged from 5 to 10 per ft except for Idaho fescue, which produced fewer than 1 per ft of row. Plots were 5 by 20 ft with three replicates. Treatments were applied in 25 gal/A water carrier, with TeeJet 8002 nozzles at a pressure of 45 psi, from a backpack sprayer operated at 2.2 mph. The application date was June 16, 1988 and the time was 16:49. The air temperature at the time of application was 86F, soil temperature was 113F at surface, 89F at the depth of 2 inches, 77F at the depth of 5 inches. The relative humidity was 34% and the sky was 10% cloudy. The wind was from the east at 1 to 2 mph. A visual estimate of the percentage of the leaves showing necrotic lesions was made on July 14. Plant heights were measured on August 3. An estimate of the weed response was made on August 3.

Glyphosate reduced mid-summer biomass of redroot pigweed (*Amaranthus retroflexus* L.) by 85% (Table 1).

Glyphosate treatments at rates above 0.5 lbs/A produced some leaf necrosis on all of the tested fescues (Table 2). Wilma, Idaho, and Fawn tall fescues showed injury to 50% to 100% of the leaves where treated with 1.0 lb ai/A glyphosate on August 3. However, fescue height on August 3 was not significantly affected by glyphosate. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843).

Table 1. Effects of glyphosate on redroot pigweed in seedling fescue.

Rate	Redroot Pigweed Biomass August 3
(lbs ai/A)	--(%)---
0	100 A[1]
0.25	13.3 B
0.38	10.7 B
0.5	10.0 B
0.75	13.3 B
1	13.3 B
LSD	9.5

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[1] Any two means having a common letter are not significantly different at the 5% level of significance, using the Protected LSD.

Table 2. Effects of glyphosate on seedling fescues.

Taxon	Glyphosate Rate	Necrotic Leaves July 14	Height August 3
	(lb ai/a)	-(%)-[1]	-(cm)-
Covar sheep	0	0 A[2]	4.0 ns[3]
	0.25	3 A	3.7
	0.38	0 A	4.0
	0.5	0 A	3.0
	0.75	13 B A	3.7
	1	43 B A C	2.7
Durar hard	0	0 A	6.3 ns
	0.25	0 A	6.7
	0.38	0 A	5.0
	0.5	20 B A	7.0
	0.75	7 A	6.0
	1	27 B A C	7.0
Logro creeping red	0	0 A	5.3 ns
	0.25	0 A	7.0
	0.38	0 A	5.3
	0.5	0 A	4.7
	0.75	7 A	6.0
	1	43 B A C	4.3
Idaho	0	0 A	1.0 ns
	0.25	33 B A C	1.7
	0.38	0 A	3.7
	0.5	67 D C	1.0
	0.75	33 B A C	0.7
	1	100 D	0.0
Wilma chewings	0	0 A	8.3 ns
	0.25	0 A	6.7
	0.38	0 A	5.3
	0.5	0 A	6.7
	0.75	17 B A	8.0
	1	50 B C	4.7
Fawn tall	0	0 A	11.0 ns
	0.25	0 A	12.0
	0.38	1 A	7.7
	0.5	3 A	12.0
	0.75	33 B A C	10.0
	1	50 B C	9.7
Meckelenburg sheep	0	0 A	5.3 ns
	0.25	0 A	5.7
	0.38	0 A	5.3
	0.5	0 A	6.7
	0.75	10 B A	5.7
	1	30 B A C	5.7

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1. The percentage of the plant leaves showing necrotic lesions.
2. Any two means within a column having a common letter are not significantly different at the 5% level using Protected Duncan's test.
3. ns = not significantly different at the 5% level using Protected Duncan's test.

Highways 12 & 14 1988 weed surveys. Callihan, R.H., R.R. Old, and D.S. Pavek. A two-phase noxious and invading weed survey along rights-of-way of U.S. Highway 12 within the Lochsa wild and scenic river corridor and Idaho Highway 14 was conducted by the University of Idaho for the Clearwater and Nez Perce National Forests (Figure 1). The survey was conducted during 6, 7, and 15 June (Phase 1) and 5 and 6 October 1988 (Phase 2). Spring- and late-season-flowering weed species were identified and located to provide baseline data for the management of significant weed species.

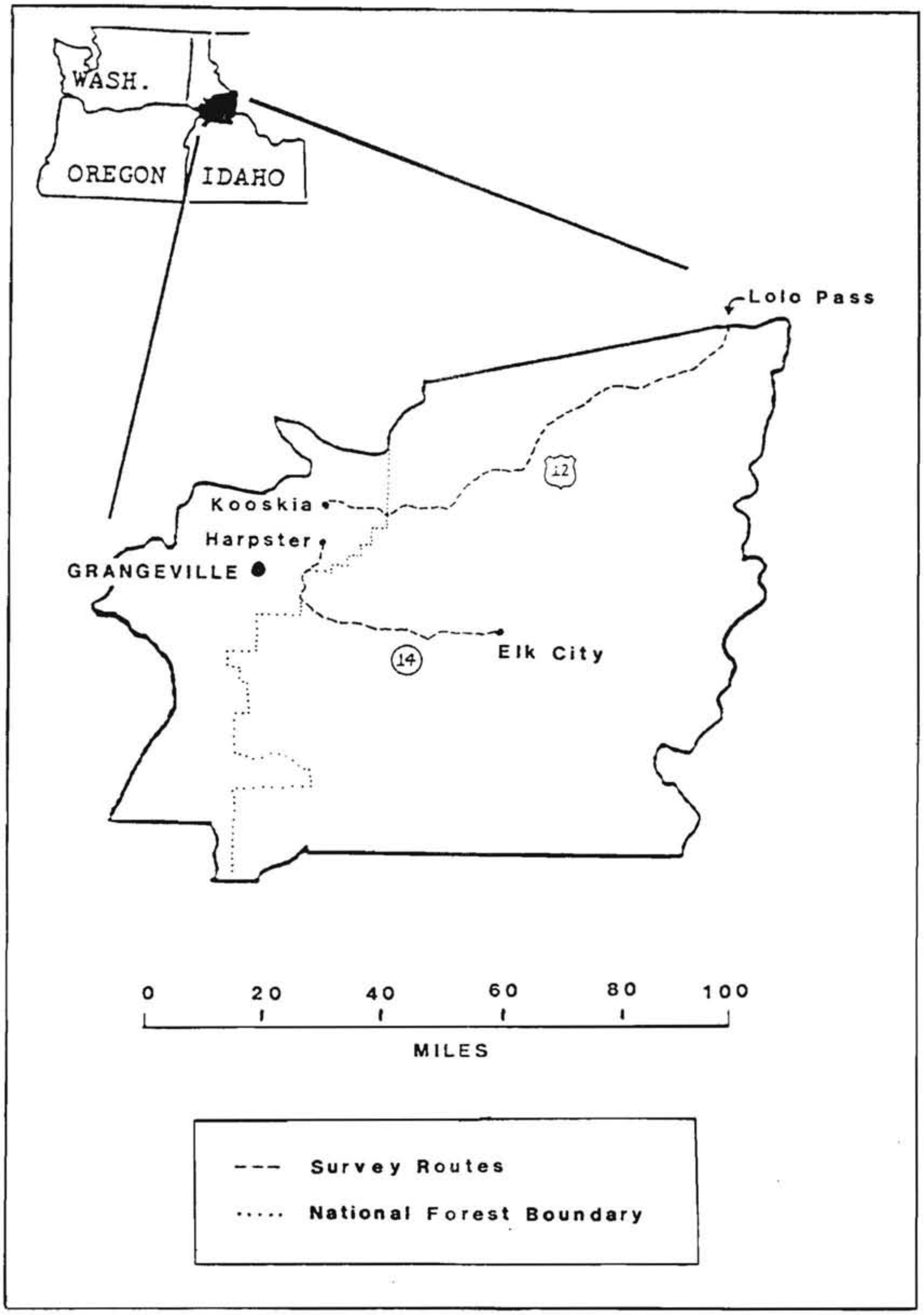
Rights-of-way were surveyed for weeds by two personnel traveling by automobile. Priority weeds recorded were those species listed on the state noxious weed list or as those considered to be introduced invading weed species of such limited extent as to be considered eradicable or containable. Seventy-eight other introduced species were recorded along Highway 12 and 72 along Highway 14. Approximately 10% of these species were of crop or ornamental origin; the remainder were widespread weed species. Weed species, location, plant and site characteristics (abundance, density, situation, distance to water, terrain, and associated species), and comments about significance of this information to management plans were recorded. Locations were marked upon 25 USGS quadrangle maps. Specimens of species not readily identifiable were collected for subsequent laboratory examination.

A total of 35 locations of significant weed infestations along Highway 12 (100 miles) and 22 locations along Highway 14 (43 miles) were recorded during the survey. Eight noxious weed species--Centaurea maculosa Lam., Centaurea solstitialis L., Cirsium arvense (L.) Scop. Convolvulus arvensis L., Crupina vulgaris Cass., Daucus carota L., Linaria dalmatica (L.) Mill., and Onopordum acanthium L.--were located along Highway 12. Seven noxious weed species were found along Idaho Highway 14: Centaurea maculosa, Centaurea solstitialis, Cirsium arvense, Convolvulus arvensis, Crupina vulgaris, Daucus carota, and Linaria dalmatica. Eleven introduced invading species of limited extent were observed along U.S. Highway 12: Anthoxanthum odoratum L., Chrysanthemum leucanthemum L., Cynoglossum officinale L., Cytisus scoparius (L.) Link, Digitalis purpurea L., Eschscholtzia californica Cham., Galium pedamontanum All., Hesperis matronalis L., Hieracium pratense Tausch., Polygonum sachalinense Schmidt, and Potentilla recta L. Along Idaho Highway 14, six introduced invading species of limited extent were found--Chrysanthemum leucanthemum, Cynoglossum officinale, Euphorbia cyparissias L., Hesperis matronalis, Polygonum sachalinense, and Salvia sclarea L.

Two introduced species were first recorded in Idaho during the survey of U.S. Highway 12. Anthoxanthum odoratum L. was found at Split Creek during Phase 1 of the survey. During Phase 2 of the survey, Melissa officinalis L. was identified at two locations: one between milepost 80 and 81 and one near milepost 86.

These results provide an initial database for noxious and invading weed species management plans along two major transportation routes and one wild and scenic river corridor through the Clearwater and Nez Perce National Forests. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Figure 1. Location of Highways 12 and 14 weed survey routes.



Imazapyr: a tool for use in forestry and noxious weed control programs. Beardmore, Richard A.[1] and Thomas E. Nishimura[2]. (2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imadazol-2-yl]-3-pyridinecarboxylic acid) Imazapyr has been recently labeled for site preparation and release of several new conifer species. ARSENAL® has been registered for site preparation of Ponderosa pine (Pinus ponderosa) and Douglas fir (Pseudotsuga menziesii) and tolerance has been demonstrated when applied at 0.4 lb ai/a as a release treatment in the fall.

The translocation properties and broad spectrum herbicidal activity of imazapyr result in the control of numerous difficult to control weeds. Field trials with ARSENAL and CHOPPER® herbicides have shown control of Desert camelthorn (Alhagi pseudalhagi, (Bieb.) Desv.), Russian thistle (Salsola iberica, Sennen & Pau), Kochia (Kochia scoparia, (L.) Schrad.), Russian Olive (Elaeagnus angustifolia, L.), Punctervine (Tribulus terrestris, L.), Grey rabbitbrush (Chrysothamnus nauseosus spp. gaveolens, (Nutt.) Piper), Rush Skeletonweed (Chondrilla juncea, L.), Diffuse knapweed (Centaurea diffusa, Lam.), Russian knapweed (Centaurea repens, L.), Yellow starthistle (Centaurea solstitialis, L.), Broom snakeweed (Gutierrezia sarothrae, (Pursh) Britt. & Rushby), Stinging nettle (Urtica dioica, L.), Common reed (Phragmites australis, (Cav.)Trin. ex Steud.), Purple loosestrife (Lythrum salicaria), and Salt cedar (Tamarix ramosissima, Ledeb.).

The following rates and timings have proven effective weed control of the respective species.

Weed species	Rate(kg ai/ha)	Timing
ALHPS - Desert camelthorn	0.5	Mid - post
SASKR - Russian thistle	0.4	Early post
KCHSC - Kochia	0.4	Early post
ELGAN - Russian olive	0.75	Post
TRBTE - Puncturevine	0.25	Early post
CYTNA - Grey rabbitbrush	1% sol.	Spray to wet
CHOJU - Rush skeletonweed	0.5	Post
CENDI - Diffuse knapweed	0.5	Rosette-E.Post
CENRE - Russian knapweed	1.0	Early post
CENSO - Yellow starthistle	0.75	Early post
GUESA - Broom snakeweed	0.75	Post
URTDI - Stinging nettle	0.5	Post
PHRCO - Common reed	1.0	Post
LYTSA - Purple loosestrife	0.5	Post
TAARA - Salt cedar	1.0	Post

The efficacy of imazapyr on these and other weed species offers plant control managers a valuable new tool for tough weed control problems. ([1]Product Development Manager, American Cyanamid Company, Princeton, NJ 08540. [2]Market Development Representative, American Cyanamid Company, Lake Oswego, OR 97034)

Interactions between a yellow starthistle community and a pubescent wheatgrass community. Prather, T.S. and R.H. Callihan. This study was established to observe community dynamics between adjacent perennial grass dominated communities and yellow starthistle (Centaurea solstitialis) dominated communities. The experiment was established on 5-18-1987 on a southeast facing slope near Juliaetta, Idaho and on 6-9-1987 on a south facing slope on the Central Grade near Lewiston, Idaho. Existing communities dominated by yellow starthistle (both sites), pubescent wheatgrass (Thinopyrum intermedium ssp barbulatum) (Juliaetta), and a perennial fescue (Festuca ovina) (Central Grade) were used in the experiment. Three pubescent wheatgrass communities were selected at Juliaetta. Six eight-meter transects radiating at 60 degree angles from the center of the pubescent wheatgrass community and extending into the yellow starthistle community were established. At Central Grade the fescue was not in discrete colonies but in irregular patterns with definite divisions between the two communities; therefore, four transects were established where four meters of the transect was in the fescue community and extended four meters into an adjacent yellow starthistle community.

To detect shifts in species composition frequencies for seventeen species were collected on 5/18/1987, 5/19/1987, and 7/20/1988 at Juliaetta and on 6/9/1987 and 7/22/1988 at Central Grade (see Table). A nested quadrat procedure using 0.062 m^2 and 0.25 m^2 sampling sizes was used for determining frequency. These quadrat sizes allowed determination of the most prevalent species in each 0.062 m^2 quadrat up through the least prevalent species in the 0.25 m^2 quadrat. Frequencies were calculated as the number of occurrences at a given nested quadrat of the transect, divided by the total number of transects.

Qualitative density changes can be deduced when frequency through time increases in the smaller quadrat. Frequencies of all plant species encountered in the 0.25 m^2 quadrat along the transects were recorded and are listed in the table. The five most common species are discussed below.

Pubescent wheatgrass increased from 1987 to 1988 at the third through the eighth meters of the transect (see Figure 1). Yellow starthistle remained the same except near the border of the two communities. Yellow starthistle decreased at the third meter of the transect (see Figure 1). The increase in pubescent wheatgrass and the decrease in yellow starthistle, suggests the pubescent wheatgrass community expanded at the expense of the surrounding yellow starthistle community.

The three abundant annual grasses, medusahead (Taeniatherum caput-medusae), Ventenata (Ventenata dubia), and Japanese brome (Bromus japonicus), decreased at the second meter of the transect from 1987 to 1988 (see Figure 2). Medusahead decreased as did yellow starthistle at the third meter but Ventenata and Japanese brome increased. These results may indicate that medusahead occurrence was affected by the same conditions as yellow starthistle while Ventenata and Japanese brome occurrence were not affected by these conditions. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table. Frequency of all species encountered.[*]

Species	Distance from Center of Wheatgrass Community							
	1	2	3	4	5	6	7	8
	(% occurrence)							
Thinopyron intermedium	100	100	100	61	17	28	22	11
Centaurea solstitialis	94	83	100	83	94	83	100	94
Taeniatherum caput-medusae	61	67	89	100	100	100	94	100
Ventenata dubia	50	67	78	61	67	61	72	78
Bromus japonicus	11	22	78	56	67	67	83	67
Holostium umbellatum	11	39	39	33	33	44	22	22
Poa bulbosa	22	28	22	50	28	50	61	50
Tragopogon sp.	0	11	11	39	39	33	28	39
Erodium cicutarium	6	0	6	11	6	11	6	6
Veronica hedereafolia	0	6	11	17	17	6	17	6
Convolvulus arvensis	6	17	22	33	28	22	28	33
Vicia villosa	17	11	11	17	28	22	6	28
Lactuca serriola	6	6	0	11	11	22	0	6
Verbascum blattaria	0	0	6	0	6	6	6	0
Amsinkia sp.	0	0	6	11	11	6	6	11
Eremocarpus setigerus	22	17	6	6	11	0	0	6
Vulpia myuros	6	0	6	6	0	0	0	0

[*] Species frequency in 0.25 m^2 quadrats.

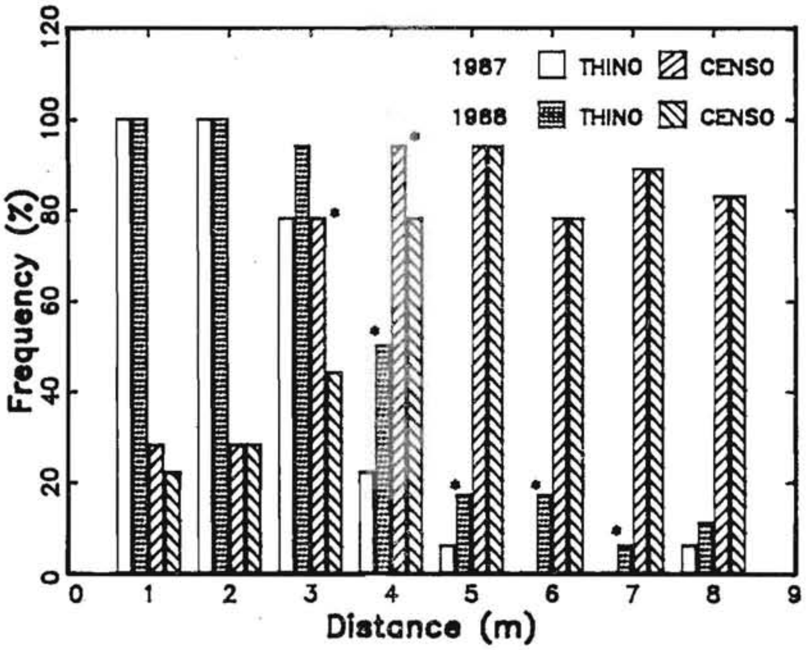


Figure 1. Frequency changes from a pubescent wheatgrass community to a yellow starthistle community in one year. Adjacent bars with an '*' are different (α=0.05).

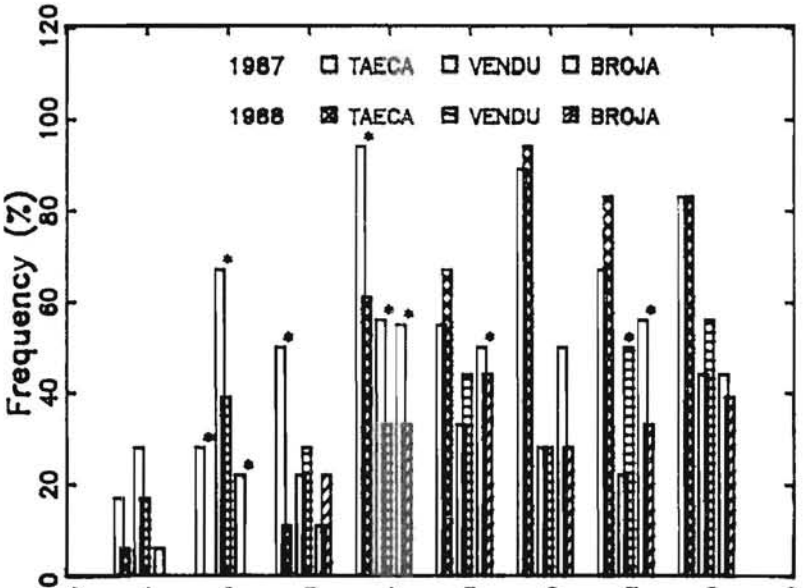


Figure 2. Frequency change for Ventenata, medusahead, and Japanese brome from a pubescent wheatgrass to a yellow starthistle community. Adjacent bars with an '*' are different (α=0.05).

Leafy spurge control with sequential treatment. Ferrell, M.A. and T.D. Whitson. This research was conducted near Devil's Tower, WY, on pastureland to compare the efficacy of sequential herbicide treatments on leafy spurge control.

Three study areas, each 90 ft. by 120 ft., were established with initial applications of fluroxypyr at 3/8, 1/2, and 5/8 lb ai/A. After initial treatments were applied, the study areas were divided into plots 9 by 30 ft. with four replications, to which spring and late summer retreatments were applied. The initial treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 35 psi August 12, 1986 (air temp. 96 F, soil temp. 0 inch 115 F, 1 inch 93 F, 2 inch 83 F, 4 inch 78 F, relative humidity 27%, wind S at 5 mph, sky clear). The leafy spurge was 14 inches tall and most of the seed had been shed four weeks earlier. 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. Spring retreatments were applied May 28, 1987 to a dense stand of leafy spurge 8 to 12 inches tall (air temp. 65 F, soil temp. 0 inch 70 F, 1 inch 60 F, 2 inch 60 F, 4 inch 55 F, relative humidity 63%, wind calm, sky clear). Late summer treatments were applied August 27, 1987 to high density leafy spurge 10 to 14 inches tall (air temp. 57 F, soil temp. 0 inch 75 F, 1 inch 70 F, 2 inch 65 F, 4 inch 60 F, relative humidity 77%, wind calm, sky clear).

Visual weed control evaluations made May 28, 1987, prior to retreatment applications, showed the leafy spurge to be stunted with very little flowering. Visual weed control evaluations were also made June 8, 1988 to evaluate the retreatments. No treatment proved adequate control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1559.)

Leafy spurge control

Retreatment[1]	Rate	Percent shoot control[2] Fluroxypyr initial treatment lb ai/A[3] 3/8	 1/2	 5/8
	(lb ai/A)	- - - - - - - - -	(%)	- - - - - - - -
Spring				
dicamba	2.0	0	0	0
2,4-D LVE	2.0	0	0	0
picloram	0.5	0	0	0
fluroxypyr	0.5	0	0	0
check	0.0	0	0	0
Late summer				
dicamba	2.0	0	0	0
2,4-D LVE	2.0	0	0	0
picloram	0.5	43	40	40
fluroxypyr	0.5	0	0	0
check	0	0	0	0

[1] Spring retreatments applied May 28, 1987; late summer retreatments applied August 27, 1987

[2] Visual evaluation June 8, 1988

[3] Initial treatments applied August 12, 1986

Leafy spurge (Euphorbia esula L.) control with sulfometuron alone and in combination with various herbicides. Whitson, T. D. and M. A. Ferrell. Leafy spurge is a perennial rangeland invader in Wyoming and many other western states. A study was established near Sundance, WY on a leafy spurge infested site on a silt loam soil (22% sand, 58% silt and 20% clay) with 1.8% organic matter and 6.3 pH. Treatment areas 10 by 27 ft were arranged in a randomized complete block design with four replications. Herbicides were applied with a CO_2 pressurized six-nozzle knapsack unit delivering 30 gpa at 45 psi on May 18, 1987 (relative humidity 80%, air temperature 70F, soil surface 72F, 1 inch 76F, 2 inches 76F, 4 inches 78F, wind 2 to 3 mph, SW). Leafy spurge was in the early bloom stage. In July, 1988 leafy spurge control was above 90% in areas treated with sulfometuron + 2,4-D at 0.188 + 1.0 lb ai/A, sulfometuron + picloram at 0.094 + 1.0 lb ai/A, sulfometuron + dicamba at 0.094 + 2.0 lb ai/A and picloram at 1.0 lb ai/A. However, by August, 1988 picloram at 1.0 lb ai/A was the only treatment providing 80% control. Sulfometuron suppressed growth 70% in 1988. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Control of leafy spurge with various herbicides

Herbicide[1]	App. rate lb ai/A	% leafy spurge control		% grass injury
		7/20/88	8/24/88	8/24/88
sulfometuron	0.094	20	10	20
sulfometuron	0.188	17	12	23
sulfometuron + 2,4-D (Amine)	0.094 + 1.0	57	17	20
sulfometuron + 2,4-D (Amine)	0.188 + 1.0	90	13	20
sulfometuron + picloram	0.094 + 1.0	93	33	20
sulfometuron + dicamba	0.094 + 2.0	90	15	20
2,4-D (Amine)	1.0	73	0	0
picloram	0.5	88	33	0
picloram	1.0	95	80	0
dicamba	2.0	82	10	0
Check	-	0	0	0
(LSD 0.05)		14	16	3

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[1] Herbicides were applied 5-18-87.

[2] Evaluations were made 6-8-88.

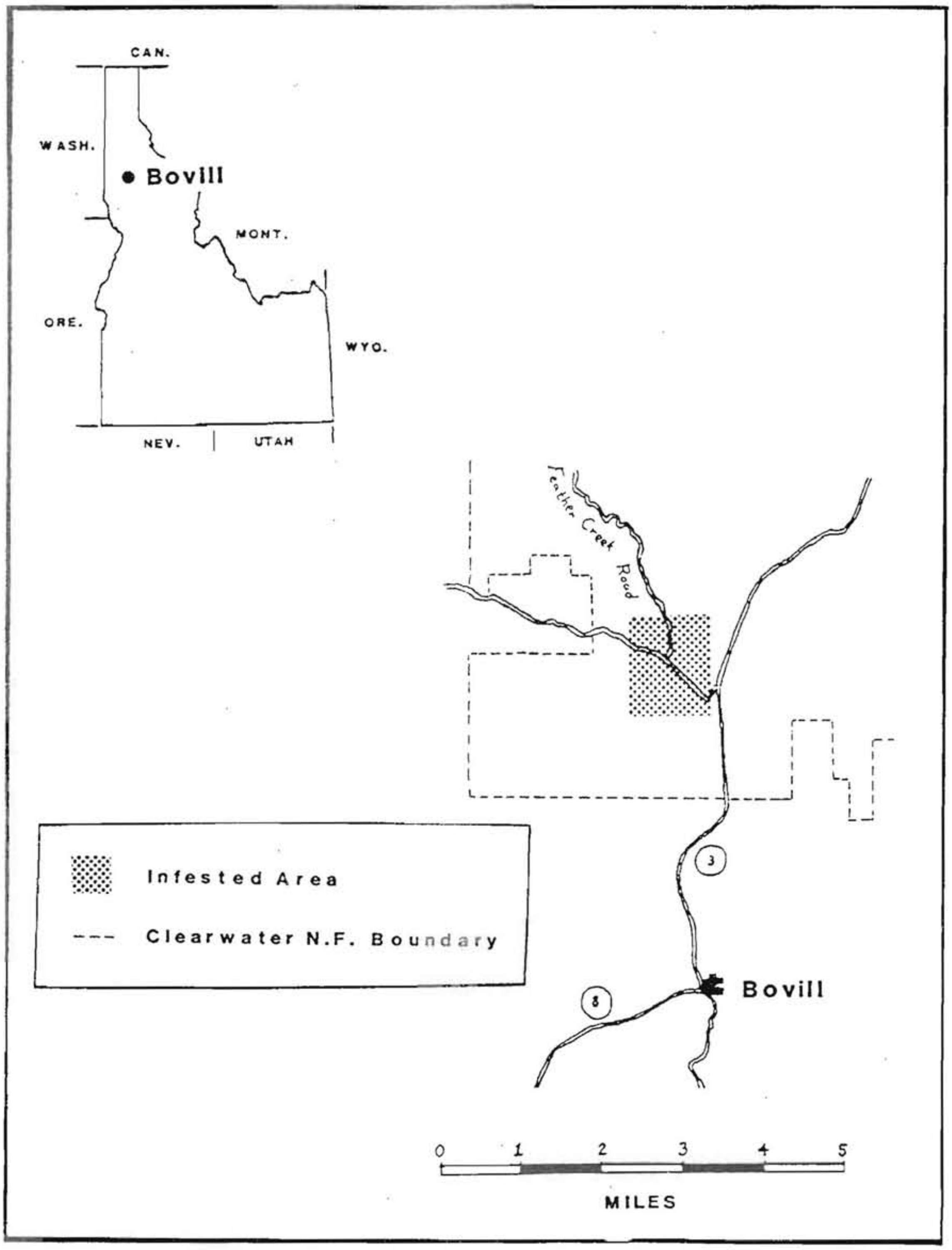
Mat-grass eradication technology. Callihan, R.H., L.W. Lass, F.E. Northam, R.R. Old, and D.S. Pavek. An integrated pest management (IPM) project was begun in 1986 to eradicate mat-grass (Nardus stricta L.). The infestation was within approximately 70 a of meadow and timber in the Feather Creek and west fork of Potlatch Creek drainages within the Clearwater National Forest, north of Bovill, ID. The University of Idaho and USFS developed and implemented this control plan of the only known population of mat-grass in Idaho. Project activities included mechanical and chemical removal and monitoring vegetation responses. Biological evaluations not reported here, were done on seed germination, seed longevity, vegetative reproduction, and efficacy of alternative herbicides.

The main infestation lies in approximately 40 a of wet meadow. Surveys of the surrounding area have located 58 disjunct plants which were dug out and destroyed by autoclaving. The infested meadow was broadcast sprayed with pronamide (2.0 lb ai/a) during Nov. and Dec. 1987 and Nov. 1988. In 1987, mat-grass seedlings appeared to have been controlled by pronamide, but the established plants apparently were not affected by this treatment. Glyphosate spot treatments will be used to eliminate mat-grass plants that are still surviving in the spring of 1989.

Response of vegetation within the meadow to the pronamide treatment was evaluated by transect and paired plot surveys. Twenty vegetation transects within the meadow were examined before and after the fall 1987 application. There was a significant difference ($p=0.05$) between the two years (before treatment versus after treatment) in the frequencies of 15 dominant species among the three meadows. Four grass species (Poa pratensis L., Deschampsia cespitosa (L.) Beauv., Festuca arundinacea Schreb., and Dactylis glomerata L.) were not found in the transects after treatment. Estimations of grass cover in the paired plots (sprayed versus not sprayed) showed an 80% grass cover reduction ($p=0.05$) in the sprayed plots.

Decisions on the management of the entire infested area require more information for the development of the final eradication plan for mat-grass. Administrative studies and surveys will continue to evaluate progress and provide information necessary for improved eradication efficiency. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Figure 1. Location of area infested by *Nardus stricta*.



Matgrass seed germination in pronamide solutions. Callihan R.H. and L.W. Lass.

This study examined the effectiveness of pronamide in preventing germination of matgrass florets and those of a known a susceptible standard, creeping red fescue (*Festuca rubra* L. cv. Logro), in 50 germination dishes. Heavy blotter paper lined the round petri plates (150 mm). The petri plates were randomized in a split block design with 5 replicates. Each petri plate received the pronamide treatment in 15 mls water carrier at the concentrations of 0, 0.25, 0.5, 1.0 and 2.0 ppm. After the addition of the herbicide solutions to the petri plate, 100 seeds of matgrass were sprinkled evenly over each of the 25 plates. Each of the other 25 herbicide-treated plates were evenly sprinkled with 100 seeds of creeping red fescue. The petri plates were incubated at 18 C. Germination was measured 9, 16, 23, 30, 37, and 42 days after planting. Florets that produced seedlings with shoot and root lengths greater than 1.0 cm were considered germinated and tolerant to pronamide.

Pronamide at rates of 0.5, 1.0, and 2.0 ppm effectively blocked germination of creeping red fescue and matgrass. At 0.25 ppm, 5% of the creeping red fescue and about 35% of the matgrass seeds produced shoots longer than 1 cm when compared to the cumulative germination of the check.

These results indicate pronamide at rates greater than 0.5 PPM can prevent germination of matgrass. Matgrass seeds appeared to be approximately seven times more tolerant to 0.25 ppm pronamide than seeds of creeping red fescue. This in-vitro study suggests that the currently registered application rates of 2 lb ai/A would be adequate for preventing germination, if the herbicide is not lost to degradation, adsorption on organic matter or leaching. (Idaho Agricultural Experiment Station, Moscow, ID. 83843)

Table. Effect of pronamide on the germination of matgrass and pronamide-susceptable creeping red fescue florets.

Species	Pronamide Concentration	Days after Planting 9	16	23	30	37	42
	(PPM)	----------(Mean Cumulative % Germ.)*--------					
Creeping Red Fescue	0.00	68 a**	73 a	75 a	75 a	-	-
Creeping Red Fescue	0.25	2 cd	4 d	4 d	4 d	-	-
Creeping Red Fescue	0.50	0 d	0 d	0 d	0 d	-	-
Creeping Red Fescue	1.00	0 d	0 d	0 d	0 d	-	-
Creeping Red Fescue	2.00	0 d	0 d	0 d	0 d	-	-
Matgrass	0.00	8 b	29 b	35 b	40 b	43 a	44 a
Matgrass	0.25	3 c	11 c	12 c	14 c	15 b	17 b
Matgrass	0.50	0 d	0 d	0 d	0 d	0 c	0 c
Matgrass	1.00	0 d	0 d	0 d	0 d	0 c	0 c
Matgrass	2.00	0 d	0 d	0 d	0 d	0 c	0 c

* Florets with shoots and roots longer than 1 cm, expressed as a percentage of total florets in each germination plate.

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

New weed species and potential weed problems in Idaho. Old, R.R., F.E. Northam, R.H. Callihan. Several plant species not previously reported in Idaho were observed during 1988 and possess the potential to become weed problems. Also recorded were extensions of the ranges of several species that have been present in Idaho for several years. The following list separates the species into three groups: (1) those not previously reported for Pacific Northwest; (2) those not previously documented for Idaho, although present in the Pacific Northwest (Hitchcock and Cronquist, Flora of the Pacific Northwest, 1973); (3) those previously reported in Idaho, wherein the known range of the species has been expanded due to 1988 field observations. The following lists cite the scientific name, Weed Science Society of America code (if available), common names, family names and locations.

Group I: Species not previously reported for Idaho, nor listed in Flora of the Pacific Northwest.

1. Anchusa arvensis (L.) Bieb. (LYCAR) small bugloss; Boraginaceae; wheatfields and waste areas southern Kootenai Co. (= Lycopsis arvensis)

2. Bromus squarrosus L. Gramineae; shore of Anderson reservoir, Elmore Co.*; roadside, Central Grade, Nez Perce Co., associated with yellow starthistle.

Group II: Species not previously documented for Idaho, although currently listed in Flora of the Pacific Northwest.

1. Anthoxanthum odoratum L. (AOXOD) sweet vernalgrass; Gramineae; at offloading ramp along the Lochsa River, Idaho Co.

2. Bellis perennis L. (BELPE) English daisy; Asteraceae; in lawn at the Clearwater National Forest headquarters office, Orofino, Clearwater Co.

3. Knautia arvensis (L.) T. Coult. (KNARR) bluebutton; Dipsacaceae; Caribou, Clark, Custer and Owyhee Co.*

4. Kuhnia eupatorioides L. (KUHEU) false boneset; Compositae, Idaho Co.

5. Leonurus cardiaca L. (LECCA) motherwort; Labiatae; around farm buildings, south of Moscow, Latah Co.

Group III: Species previously reported in Idaho; new county records.

1. Abutilon theophrasti Medik (ABUTH) velvetleaf; Malvaceae; home gardens in Payette and Lewis Co.

2. Ambrosia psilostachya DC. (AMBPS) western ragweed; Compositae; Boundary Co.

3. Barbarea vulgaris L. (BARVU) yellow rocket; Cruciferae; in roadside grass plantings; Nez Perce and Canyon Co.

*Includes unreported 1987 collection.

4. Bromus arvensis L. (BROAV) field brome; Gramineae; very common in winter wheat and Conservation Reserve Program fields; Latah Co.

5. Centaurea solstitialis L. (CENSO) yellow starthistle; Compositae; as contaminant in alfalfa seed; Cassia, Elmore and Gooding Co.

6. Eragrostis orcuttiana Vasey, Orcutt's lovegrass; Gramineae; on roadshoulders north of McCall; Valley Co.

7. Eremocarpus setigerus (Hook) Benth. (ERMSE) turkey mullein; Euphorbiaceae; south-facing rangeland near Kendrick, Latah Co.

8. Fumaria officinalis L. (FUMOF) fumitory; Fumariaceae; winter wheat and roadshoulders, northern Nez Perce Co., winter wheat, Idaho Co.

9. Hieracium aurantiacum L. (HIEAU) orange hawkweed, Compositae; in lawns, Gem and Elmore Co.

10. Hieracium pratense Taush (HIECA) yellow hawkweed; Compositae; on Highway 12 right-of-way, Idaho Co.

11. Hypochaeris radicata L. (HRYRA) spotted catsear; Compositae; high school lawn, Bonners Ferry, Boundary Co., Clearwater National Forest headquarters office lawn, Orofino, Clearwater Co.

12. Iva axillaris Pursh (IVAAX) poverty sumpweed; Compositae; along railroad tracks near Culdesac, Nez Perce Co.

13. Mirabalis nyctaginea (Michx.) Macmill. (MIBNY) wild four o'clock; Nyctaginaceae; Nez Perce and Fremont Co.

14. Myriophyllum aquaticum (Vell.) Verde. (MYPBR) parrotfeather; Halagoraceae; between Kendrick and Juliaetta, Latah Co.

15. Poa trivialis L. (POATR) roughstalk bluegrass; Gramineae; wooded areas Nez Perce Co.

16. Potentilla recta L. (PTLRC) sulfur cinquefoil; Rosaceae; open rangeland along the Payette River, Gem Co.

(Idaho Agriculture Experiment Station, Moscow, Idaho 83843).

Perennial grass responses to control of mat forbs in rangeland. Whitson, T. D., A. D. Hulett and M. A. Ferrell. A series of herbicides were applied to a mat forb community to determine the effects of various herbicides on control and forage production. The experiment was located on rangeland at a 7500 ft elevation. Forbs were in early bloom when herbicide treatments were applied. April 7, 1986 temperature, air 50F, soil surface 45F, 1 inch 46F, 2 inches 46F and 4 inches 45F; relative humidity 70% with wind 2 to 3 mph NW. Plots, 9 by 30 ft, were arranged in a randomized block design with three replications. Herbicides were applied broadcast with a CO_2 pressurized knapsack unit delivering 40 gpa at 45 psi. The soil was a sandy loam (75% sand, 18% silt and 7% clay) with 2,4% organic matter and a 7.8 pH. The rangeland mat forb community consisted of tufted cryptantha (Crypthantha caespitosa) CRYCA, northern crypthantha (Crypthanta celosiodes) CRYCE, stemless goldenweed (Haplopappus acaulis) HAPAC, broom snakeweed (Gutierrezia sarothrae) GUESA, fringed sagewort (Artemisia frigida) ARTFR, cushion wild buckwheat (Eriogonum ovolofolium) ERIOV, hooker sandwort (Arenaria hookerii) AREHO, spoonleaf milkvetch (Astragalus spatulatus) ASTSP, Douglas rabbitbrush (Chrysothamnus viscidiflorus) CYTVIA, nuttail goldenweed (Haplopappus nuttalli) HAPNU, Hoods phlox (Phlox hoodii) PHLHO. Perennial grass species consisted of needle-and-thread (Stipa comata) STDCO and Griffiths wheatgrass (Agropyron griffithsi) AGGRI. Control evaluations were made by species August 26, 1986 (reported pp 50-51, Western Society Weed Science 1987) and on September 8, 1987. Perennial grass production was determined by clipping two 5 ft^2 circular quadrats in each treated area on September 8, 1988. Treatment which provided greater than 40% control of the mat forb species were picloram at 0.25, 0.5 or 1.0 lbs ai/A and dicamba + 2,4-D (amine) at 0.5 + 1.5 lb ai/A. Perennial grass yields averaged 459 lb/A on all treated areas in 1987 or 2;7 times that of the untreated control. In 1988 grass yields averaged 451 lbs/acre or 2;5 times that of the untreated check. Two year average grass yields above 500 lbs/A obtained with dicamba at 1.0 lb ai/A, picloram at 0.25 lb ai/A and 2,4-D (LVE) + triclopyr at 0.5 + 0.25 lb ai/A. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Cushion community control and resulting perennial grass production with various herbicide treatments.

Herbicide	Rate lbs ai/A	% control	lbs perennial grass/acre 1987	 1988	2 yr. Ave.
dicamba	1.0[1]	84	457[2]	557	507
2,4-D (LVE)	2.0	75	413	350	381
triclopyr	1.0	84	395	350	373
metsulfuron	0.019	71	466	474	470
metsulfuron	0.038	77	485	473	479
picloram	0.25	91	511	533	522
picloram	0.5	97	500	461	481
picloram	1.0	100	354	400	377
2,4-D (LVE)	0.5				
+ triclopyr	+0.25	81	549	512	530
dicamba	0.5				
+ 2,4-D (Amine)	+1.5	91	462	398	430
Check	-	0	168	180	174

[1] Treatments were made April 7, 1986.

[2] Evaluations made September 8, 1987 and September 2, 1988.

Picloram and fluroxypyr with and without surfactant for leafy spurge control. Ferrell, M.A. and T.D. Whitson. This research was conducted near Devil's Tower, WY, on pastureland, to compare the efficacy of treatments of picloram and fluroxypyr with and without surfactant (X-77) for the control of leafy spurge.

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 35 psi. Picloram treatments were applied May 28, 1987 when leafy spurge was in the full bloom stage and 8 to 12 inches high (air temp. 60 F, soil temp. 0 inch 60 F, 1 inch 55 F, relative humidity 75%, wind W at 5 mph, sky cloudy). Fluroxypyr treatments were applied July 7, 1987 when leafy spurge plants were setting seed and 10 to 14 inches high (air temp. 80 F, soil temp. 0 inch 95 F, 1 inch 80 F, 2 inch 75 F, 4 inch 70 F, relative humidity 75%, wind S at 5 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. Infestations were heavy throughout the experimental area. Visual weed control evaluations were made June 8, 1988. Infestations were heavy throughout the experimental area.

The surfactant, X-77, was not effective in increasing the activity of either picloram or fluroxypyr. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1560.)

Leafy spurge control

Treatment[1]	Rate	Control[2]
	(lb ai/A)	(%)
picloram	0.25	3
picloram + X-77	0.25	6
picloram	0.5	10
picloram + X-77	0.5	8
picloram	0.75	30
picloram + X-77	0.75	38
picloram	1.0	43
picloram + X-77	1.0	28
picloram	1.25	38
picloram + X-77	1.25	43
picloram	1.5	50
picloram + X-77	1.5	58
picloram	1.75	58
picloram + X-77	1.75	51
picloram	2.0	61
picloram + X-77	2.0	56
fluroxypyr	0.125	0
fluroxypyr + X-77	0.125	0
fluroxypyr	0.25	0
fluroxypyr + X-77	0.25	0
fluroxypyr	0.5	0
fluroxypyr + X-77	0.5	0
check	0	0

[1] Picloram treatments applied May 28, 1987; fluroxypyr treatments applied July 7, 1987; X-77 applied at 0.25% v/v

[2] Visual evaluations June 8, 1988

Picloram/fluroxypyr combinations for Dalmatian toadflax control. Ferrell, M.A. and T.D. Whitson. Dalmatian toadflax is a problem on pasturelands and rights-of-way. This research was conducted at the High Plains Research Station near Cheyenne, Wyoming on pasture, to compare the efficacy of picloram/fluroxypyr combinations on the control of Dalmatian toadflax.

Plots were 10 by 20 ft. with three replications. The herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 35 psi June 16, 1987 (air temp. 78 F, soil temp. 0 inch 95 F, 1 inch 90 F, 2 inch 85 F, 4 inch 75 F, relative humidity 47%, wind SW at 8 mph, sky clear). Dalmatian toadflax was in full bloom and 18 to 24 inches high. Infestations were moderate throughout the experimental area.

Visual weed control evaluations were made August 3, 1988. Dalmatian toadflax control was excellent with picloram at all rates. Fluroxypyr was ineffective in controlling Dalmatian toadflax and there was no increase in control when fluroxypyr was combined with picloram. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1562.)

Dalmatian toadflax control

Treatment[1]	Rate	Control[2]
	(lb ai/A)	(%)
picloram	0.5	97
picloram	1.0	99
picloram	2.0	99
fluroxypyr	0.5	0
fluroxypyr	1.0	0
picloram + fluroxypyr	0.5 + 0.5	99
picloram + fluroxypyr	0.5 + 1.0	98
picloram + fluroxypyr	1.0 + 0.5	99
picloram + fluroxypyr	1.0 + 1.0	98
check	0	0

[1] Treatments applied June 16, 1987

[2] Visual evaluations August 3, 1988

Perennial grass production changes in rangeland infested with mat forbs when treated with four herbicides and a roller chopper. Whitson T. D., M. A. Smith and A. D. Hulett. In high elevation rangeland, mat forbs of various species are common. These forbs are very competitive with perennial grasses. An experiment was located near McFadden WY, on rangeland at 7500 ft to compare mechanical treatments to chemical treatments in the control of mat forbs and to determine forage production changes. Plots were 25 by 200 ft arranged in a randomized complete block design with four replications. In March, 1987, a 15 ton roller chopper was used on half of each plot to compare effects of mechanical and herbicide treatments. Herbicides were applied April 10, 1987 (air temperature air 60F, soil surface 58F, 1 inch 56F, 2 inches 54F and 4 inches 53F, with a relative humidity of 62% and wind 2 to 3 mph, SW) with a pressurized knapsack unit delivering 30 gpa at 45 psi. The soil in the experiment area was a sandy loam (75% sand, 18% silt and 7% clay) with 2.4% organic matter and a 7.8 pH. The rangeland mat forb community consisted of tufted cryptantha (*Crypthantha caespitosa*) CRYCA, northern crypthantha (*Crypthanta celosiodes*) CRYCE, stemless goldenweed (*Haplopappus acaulis*) HAPAC, broom snakeweed (*Gutierrezia sarothrae*) GUESA, fringed sagewort (*Artemisia frigida*) ARTFR, cushion wild buckwheat (*Eriogonum ovolofolium*) ERIOV, hooker sandwort (*Arenaria hookerii*) AREHO, spoonleaf milkvetch (*Astragalus spatulatus*) ASTSP, Douglas rabbitbrush (*Chrysothamnus viscidiflorus*) CYTVIA, nuttail goldenweed (*Haplopappus nuttalli*) HAPNU, Hoods phlox (*Phlox hoodii*) PHLHO. Perennial grass species consisted of needle-and-thread (*Stipa comata*) STDCO and Griffiths wheatgrass (*Agropyron griffithsi*) AGGRI. Perennial grass production was determined by clipping two 5 ft^2 circular quadrats in each treated area on September 2, 1988. Areas treated with picloram at 0.25 and 0.5 and metsulfuron at 0.038 lb ai/A had grass yields of 345, 321 and 315 lbs grass/acre or 3,17, 2.95 and 2,89 times the production of the check. The roller alone provided 1.26 times the production of the check. When the roller and herbicides were applied in the same area, no advantage was found for the additional mechanical treatment. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, Wyo. 82071.)

Perennial grass production changes with herbicides and a roller chopper.

Treatment	Rate lbs ai/A	Perennial grass lbs/Acre
roller + picloram	0.25[1]	330
picloram	0.25	345
roller/chopper + picloram	0.5	351
picloram	0.5	321
roller/chopper + metsulfuron	0.038	312
metsulfuron	0.038	315
roller/chopper + 2,4-D (LVE)	2.0	258
2,4-D (LVE)	2.0	209
roller (no herbicide)	-	137
Check	-	109

[1] Treatments were applied April 10, 1987.

[2] Evaluations taken September 2, 1988.

Post- and pre-emergent control of nasturtium with sulfometuron methyl and triclopyr. Santos, G.L., L.W. Cuddihy, and C.P. Stone. Nasturtium (Tropaeolum majus L.), an ornamental vine introduced to Hawaii prior to 1871, is a problem in a mesic forest on the slope of Mauna Loa in Hawaii Volcanoes National Park on the island of Hawaii. It forms a dense ground cover, which inhibits germination of native species. Previous tests had shown triclopyr to be very effective in post-emergent control, with quick knockdown.

Two series of tests were established on populations of nasturtium in the Park. Treatments in the first series were triclopyr ester (4 lb ae/gal) at 0.32 lb ae/A, followed in 22 days by sulfometuron methyl (75% formulation) at 5 oz product/A sprayed onto the newly exposed ground. The second series of tests included: sulfometuron at 1, 5, and 12 oz product/A as foliar/soil sprays. All sprays were applied with a hand-pressurized knapsack sprayer at 20 gal/A spray volume and 30 psi with a Teejet 8004E tip. Plot size was 3 x 3 m for all treatments, with 10 plots per treatment for the first series and 5 plots per treatment for the second series. Mechanical pull controls were included in both series. Herbicides in the first series were applied on Sept. 30 (triclopyr) and Oct. 21, 1987 (sulfometuron methyl), and in the second series on Feb. 24, 1988. Results are 9 MAT for the triclopyr/sulfometuron methyl series, and 7 MAT for the sulfometuron methyl series.

Results indicate that the triclopyr/sulfometuron methyl treatment provided the longest suppression (6-8 months) of nasturtium (see table). Sulfometuron methyl at 5 and 12 oz per acre did provide pre-emergent control, although of a shorter duration (4-5 months). The pretreatment of the test plots with triclopyr, which had 90-100% cover of nasturtium at application time, apparently allowed a greater amount of sulfometuron methyl to be deposited on the soil, and also more uniform coverage. Sulfometuron methyl at 1 oz product and triclopyr at 0.32 lb ae/A resulted in 90-100% post-emergent kill of nasturtium with no pre-emergent activity.

All treatments resulted in the death of most of the native tree seedlings within plots (koa or Acacia koa and papala-kepau or Pisonia brunoniana). However, after 6 to 9 months, koa seedlings had reappeared in numbers greater than before treatment. Mature native trees adjacent to treated plots were also monitored for herbicide effects. One species, mamaki (Pipturus albidus), appeared to be sensitive to sulfometuron methyl and showed drastically reduced vigor. Five other native tree species exhibited slight deformation of young developing leaves. (Hawaii Field Research Center, Hawaii Volcanoes National Park, P.O. Box 52, Hawaii National Park, HI 96718)

Control of nasturtium with sulfometuron and triclopyr

Treatment	mean number of nasturtium plants per plot							
	1 mo	2 mo	3 mo	4 mo	5 mo	6 mo	7 mo	9 mo
sulfometuron methyl 1 oz	--	7.2	9.6	24.4	42.6	70.2		
sulfometuron methyl 5 oz	--	0.4	1.0	10.6	27.2[a,b]	52.4		
sulfometuron methyl 12 oz	--	0	0.8	3.4	11.6	23.0[a,b]		
mechanical pull control	2.6	6.8	10.0[a]	17.5[b]	43.2	68.0[c]		
triclopyr/sulfometuron methyl	4.3	5.8	10.6	13.8	12.5[a]	14.5[b]	17.3	57.5
triclopyr	24.2	39.2	35.3	-plots uncountable -- 100% vine cover-				
mechanical pull control	36.2	39.9	36.3	-plots uncountable -- 100% vine cover-				

a = first flower seen
b = first fruit seen
c = mean of 4 plots -- one plot uncountable

Response of yellow hawkweed to sulfonylurea and pyridine herbicides. Lass, L.W., R.H. Callihan, and T.W. Miller. 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 0.0, 0.5, 1.0, 2.0 oz ai/A), picloram (0.0, 0.1, 0.4 and 0.6 lb ae/a) and clopyralid (0.0, 0.25, 0.5 and 1 lb ae/a). 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. Herbicide treatments 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 years results by estimating percent chlorosis of treated yellow hawkweed on July 17, 1986. The second year's evaluation on July 13 to 15, 1987 consisted of a vegetative sampling within randomly placed 22-cm diameter hoops. The third year's evaluation on July 6 to 13, 1988 consisted of a vegetative sampling within randomly placed 30 by 120 cm metal frame. Vegetative samples were clipped at ground level, and separated into one of four categories: 1. grasses (species were Bromus inermis Leys., Poa pratensis L., and Phleum pratense L.); 2. meadow hawkweed; 3. oxeye daisy (Chrysanthemum leucanthemum L. CHYLE); or 4. other forbs (species were Trifolium pratense L., Trifolium hybridum L., Taraxacum officinale Weber. TAROF, Rumex acetosella L. RUMAA, and Potentilla recta L.). In 1987, the forb samples were further split into clover and non-clover catagories. After clipping, the samples dried for at least 48 hours at 100 F before weighing.

Results of the first year indicated extensive chlorosis in 0.4 and 0.6 lb/a picloram treatments (93 to 100%) and all clopyralid treatments (80 to 100%). Metsulfuron caused moderate chlorosis at 1 to 2 oz ai/a (71 to 66%). Chlorsulfuron, sulfometuron, and DPX-L5300 caused some chlorosis, but the effect was erratic and not pronounced. The vegetative analysis of the second year showed hawkweed dry weights decreased 72 to 100% in the picloram plots, 89 to 100% in the clopyralid plots and 70% in the 2.0 oz/a metsulfuron treatment. Grass dry weights more than doubled in plots treated with all rates of clopyralid, picloram at 0.4 and 0.6 lb/a, chlorsulfuron at 0.5 and 2.0 oz/a, and metsulfuron at 2.0 oz/a WSWS 1988 Progress Report p.11-13.

Three years after herbicide application, the vegetative composition analysis of 1988 indicated that clopyralid at all rates and picloram at 0.4 and 0.6 lb/a were still controlling 95 to 100% of the yellow hawkweed. Picloram at 0.1 lb/a controlled 75% of the hawkweed in the fertilized plots. Metsulfuron at 2.0 lb/a reduced the weight of hawkweed 84% in the fertilized plots. Dry weight of hawkweed from plots treated with chlorsulfuron, sulfometuron, and DPX-L5300 were not different from the check.

Grass regrowth in 1988 more than doubled in all plots treated with clopyralid, picloram at 0.4 and 0.6 lb/a, and metsulfuron at 2.0 oz/a as measured by dry weight and compared to the check. The dry weight of the grass in the chlorsulfuron, sulfometuron, and DPX-L5300 plots were the same as the check. The hawkweed-to-grass ratio showed the greatest decrease in hawkweed and increase in grass occurred in the clopyralid and picloram treatments.

Other forbs decreased in the chlorsulfuron (90%), clopyralid (70%), DPX-L5300 (95%), and picloram (70 to 95%) treatments, when compared to the check. Sulfometuron and metsulfuron treatments also tended to have fewer forbs than the check.

Oxeye daisy dry weight tended to be less in plots treated with chlorsulfuron, DPX-L5300, metsulfuron, picloram and metsulfuron. The random placement of the frame and poor distribution of oxeye daisy in the checks, in the third year of the study, contributed to the generally non-significant differences in dry weights.

The application of nitrogen in the second year did not increase hawkweed or grass dry weighs of the third year when compared to the check. Removal of competition of hawkweed by herbicides appears to be more effective in increasing grass response than additional nitrogen. The limiting factor for maximum grass production after weed removal may not have been fertility.

Results of this project indicate at least three years of control of yellow hawkweed with clopyralid at rates of 0.5 and 1.0 lb/a and picloram at rates of 0.4 and 0.6 lb/a. Both the clopyralid and picloram treatments more than doubled the amount of grass. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table. Response of pasture vegetation to sulfonylurea and pyridine herbicides 37 months after application.

Herbicide	Rate	Nitrogen Rate	Dry Weight				Ratio of Hawkweed to Grass
			Hawkweed	Grass	Other Forbs	Daisy	
	(ai or ae/a)	(lbs/a)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	
chlorsulfuron	0 oz	0	192 ns	97 ns	37 A	8 ns	2.19 ns
		50	169	82	12 C E	2	2.48
	0.5 oz	0	265	88	2 E	0	7.03
		50	173	134	2 E	0	1.52
	1 oz	0	178	110	2 E	0	5.49
		50	202	109	1 E	0	2.45
	2 oz	0	145	133	1 E	0	1.38
		50	166	102	2 E	0	1.93
clopyralid	0 lb	0	188 A B C	70 J I	16 C B	6 B	26.58 A
		50	183 A B C	65 J I	4 C E	4 B	13.41 B A
	0.25 lb	0	19 D	247 B A C	4 C E	12 B	0.09 B
		50	4 D	232 B D A C	1 E	40 A	0.02 B
	0.5 lb	0	0 D	244 B A C	5 C E	2 B	0.00 B
		50	0 D	222 E B D A C	8 C E	0 B	0.00 B
	1 lb	0	0 D	226 E B D A C	1 E	0 B	0.00 B
		50	0 D	256 B A	6 C E	0 B	0.00 B
DPX-L5300	0 oz	0	259 A	73 ns	18 C B	4 ns	4.29 B
		50	177 A B C	70	8 C E	3	3.07 B
	0.5 oz	0	254 A	79	0 E	3	5.47 B
		50	215 A	87	1 E	0	2.92 B
	1 oz	0	229 A	77	0 E	1	26.12 A
		50	195 A B	111	0 E	0	3.20 B
	2 oz	0	135 B C	111	0 E	0	1.56 B
		50	174 A B C	106	1 E	0	2.69 B
metsulfuron	0 oz	0	133 B C	100 J H I G F	12 ns	11 ns	1.67 ns
		50	191 A B	52 J	7	1	4.16
	0.5 oz	0	162 A B C	142 E J D H I	0	0	1.47
		50	139 B C	202 E B D A G	0	0	0.66
	1 oz	0	136 B C	271 B A	0	1	0.92
		50	92 B C D	176 E B D H I	0	0	0.69
	2 oz	0	64 C D	207 E B D A C	0	6	0.33
		50	32 D	267 B A	0	0	0.15
picloram	0 lb	0	114 B C D	132 E J D H I	19 B	15 ns	2.06 ns
		50	195 A B	96 J H I G	10 C E	1	3.26
	0.1 lb	0	59 C D	172 E B D H I	9 C E	7	0.42
		50	52 C D	182 E B D H A	6 C E	0	0.33
	0.4 lb	0	0 D	257 B A	6 C E	0	0.00
		50	0 D	244 B A C	3 E D	0	0.00
	0.6 lb	0	0 D	270 B A	1 E	1	0.00
		50	0 D	285 A	1 E	0	0.00
sulfometuron	0 oz	0	145 ns	113 ns	5 ns	10 ns	2.68 ns
		50	177	89	13	2	2.26
	0.5 oz	0	159	92	2	16	1.88
		50	162	91	0	9	2.22
	1 oz	0	221	41	1	1	8.52
		50	196	120	4	0	4.73
	2 oz	0	207	82	0	0	5.65
		50	180	127	4	2	2.22

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1 Plants clipped from a 30 by 120 cm metal frame randomly placed in the treatment area.

2 Any two means within a column having a common letter are not significantly different at the 5% level using Protected Duncan's test. (ns = No significantly different).

Rhizome spray treatments on kahili ginger. Santos, G.L., L.W. Cuddihy, and C.P. Stone. Kahili ginger (Hedychium gardnerianum Roscoe), a cold-tolerant perennial herb to 2 m in height, is native to the Himalayas. It is a serious threat to the wet and mesic forests of Hawaii Volcanoes National Park on Hawaii Island. Very aggressive and shade-tolerant, kahili ginger can establish itself under dense forest canopies and displace native understory vegetation. It reproduces both vegetatively, with a massive rhizome system, and sexually, through the dispersal of seeds. Tests were located in an 'ohi'a (Metrosideros polymorpha) rain forest of Hawaii Volcanoes National Park. Treatments included: amitrole + ammonium thiocyanate (2 lb ai/gal) 20% v/v in water; metsulfuron methyl (60% dry flowable) at 4.5 gm product/liter of water; imazapyr (2 lb ae/gal) 20% v/v in water; and a commercial mix of 2,4-D and triclopyr esters (2 lb and 1 lb ae/gal water, respectively). All sprays were applied to the above-ground portion of the rhizome subsequent to the removal of all leafy material. Sample size was 20 clumps per treatment. Herbicides were applied on Nov. 19, 1987, with monitoring at 12 MAT. Amitrole has resulted in 95% kill of treated rhizomes, while rhizomes treated with metsulfuron and imazapyr appear to be in decline. Monitoring until at least 18 MAT is required. The production of amitrole has recently been discontinued.

Native plants were monitored for effects of herbicides in circular plots centered on the ginger clumps. Plot size was 3 m in diameter for ginger with a large rhizome mass and 2 m in diameter for smaller treated plants. Results have not been completely analyzed, but it appears that both amitrole and imazapyr treatments caused the death or decline in vigor of young pilo trees (Coprosma sp.), an important component of the forest understory. (Hawaii Field Research Center, Hawaii Volcanoes National Park, P.O. Box 52, Hawaii National Park, HI 96718)

Kahili ginger control in Hawaii Volcanoes National Park

Treatment	% resprouting	% cambium alive
amitrole + ammonium thiocyanate/water	5	5
metsulfuron methyl/water	15	85
imazapyr/water	25	100
2,4-D + triclopyr/water	100	100
water only	100	100

Russian knapweed (Centaurea repens (L.) control in pastureland. Drake, K. R., Carl Cauffman and T. D. Whitson. Russian knapweed, a perennial common on disturbed soils and riverbottom land, is highly competitive with crops and hay production. This experiment was established near Basin, WY on a sandy loam soil (56% sand, 22% silt and 22% clay) with a 1.8% organic matter and 7.5 pH. Plots, 10 x 27 ft, were arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized knapsack sprayer delivering 30 gpa at 45 psi., July 18, 1987 (temperature: air 85F, soil surface 85F, 1 inch 84F, 2 inches 81F, 4 inches 80F with 40% relative humidity and 2-3 mph NW winds, to Russian knapweed in the early bud stage 12 to 16 inches tall. Evaluations were made August 10, 1988. Picloram treatments of 0.5 and above resulted in 100% control while dicamba at 2.0 and 4.0 controlled 76 and 83% of Russian knapweed, respectively. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Russian knapweed control in pastureland

Herbicide	Rate lb ai/A	Average
picloram[1]	0.25	72
picloram	0.5	100
picloram	1.0	100
picloram	2.0	100
2,4-D LVE	1.0	3
2,4-D LVE	2.0	3
triclopyr	0.5	0
triclopyr	1.0	0
triclopyr	2.0	10
dicamba	2.0	76
dicamba	4.0	83
dicamba + 2,4-D (A)	0.25 + 0.75	0
dicamba + 2,4-D (A)	0.5 + 1.5	0
triclopyr + 2,4-D (LVE)	0.3 + 0.7	0
triclopyr + 2,4-D (LVE)	0.6 + 1.4	0
fluroxypyr	0.25	0
fluroxypyr	0.5	0
fluroxypyr	1.0	0
Check	-	0

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[1] Herbicides were applied July 18, 1987.

[2] Evaluations were made August 10, 1988.

Russian knapweed control in rangeland. Ferrell, M.A. and T.D. Whitson. Russian knapweed is a serious problem on Wyoming's rangelands. This research was conducted at Rock River, WY, on rangeland to compare the efficacy of fluroxypyr and tank mixes of dicamba with picloram and 2,4-D LVE on Russian knapweed.

Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. The herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 35 psi June 15, 1987 (air temp. 78 F, soil temp. 0 inch 90 F, 2 inch 90 F, 4 inch 85 F, relative humidity 64%, wind calm, sky clear). The soil was classified as a sandy loam (70% sand, 15% silt and 15% clay) with 1.5% organic matter and a 7.8 pH. Russian knapweed was in the bud stage and 10 to 14 inches high. Infestations were moderate throughout the experimental area. Visual weed control evaluations were made August 3, 1988.

Russian knapweed control was 100% with picloram at 2.0 lb ai/A and 88% with picloram at 0.5 lb ai/A. No other treatments were effective. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1564.)

Russian knapweed control

Treatment[1]	Rate	Control[2]
	(lb ai/A)	(%)
dicamba	0.5	0
dicamba	1.0	0
dicamba	2.0	0
picloram	0.5	88
picloram	2.0	100
dicamba + picloram	0.5 + 0.125	5
dicamba + picloram	0.5 + 0.25	35
dicamba + picloram	1.0 + 0.125	18
dicamba + picloram	1.0 + 0.25	44
dicamba + picloram	2.0 + 0.125	3
dicamba + picloram	2.0 + 0.25	60
dicamba + 2,4-D LVE	1.0 + 1.0	0
dicamba + 2,4-D LVE	1.0 + 3.0	0
fluroxypyr	0.25	0
fluroxypyr	0.5	0
fluroxypyr	0.75	0
fluroxypyr	1.0	0
check	0	0

[1] Treatments applied June 15, 1987; surfactant, X-77, added to all treatments at 0.5 v/v

[2] Visual evaluations August 3, 1988

Spotted knapweed control in pasture. Lass, L.W. and R.H. Callihan The objective of this experiment was to determine the effects of six different herbicides at three rates on established spotted knapweed (*Centaurea maculosa* Lam.) in pasture.

The experiment was established at Farragut State Park, west of Athol, ID. on June 9, 1986. Plots measured 10 by 40 ft with four replications in a split block design. The treatments consisted of single applications of metsulfuron (0.0, 0.5, 1.0, 2.0 oz ai/A), DPX-L5300 (0.0, 0.5, 1.0, 2.0 oz ai/A), clopyralid (0.0, 0.25, 0.5, 1.0 lb ai/A), chlorsulfuron (0.0, 0.5, 1.0, 2.0 oz ai/A), sulfometuron (0.0, 0.5, 1.0, 2.0 oz ai/A), and picloram (0.0, 0.5, 1.0, 2.0 lb ai/A).

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 application date was June 9, 1986. The air temperature at the time of application was 83F, soil temperature at 3 in 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; and July 11, 1988.

Results of the first year (1986) indicated metsulfuron, DPX-L5300, chlorsulfuron, and sulfometuron slightly suppressed the biomass of spotted knapweed following application. However, clopyralid and picloram at all rates reduced the spotted knapweed biomass by 95-100% during growth of the first year after application ($p = 0.0001$). Less than 5% of the plants treated with metsulfuron, DPX-L5300, sulfometuron, clopyralid, and picloram produced seeds the first year.

Results of spring evaluations in the second year supported the previous fall evaluation. By summer, the growth suppression noticed in the plots of metsulfuron, DPX-L5300, chlorsulfuron, and sulfometuron was declining. Successful control (95%) of spotted knapweed was maintained with all rates of clopyralid and picloram. The metsulfuron, DPX-L5300, chlorsulfuron, and sulfometuron did not reduce seed production in the second year. A small amount of seed was produced in clopyralid treatments because of some knapweed regrowth.

Evaluations in the summer of the third year indicated that all clopyralid and picloram treatments continued to control over 95% of the spotted knapweed. The new plants found in the clopyralid- and picloram-treated areas may have been in part from the existing seed bank, but likely were largely from the seed rain from border plants and check plots. The loss of spotted knapweed competition apparently allowed yellow toadflax (*Linaria vulgaris* Hill) to become the dominant plant in the clopyralid treatments. Some suppression of yellow toadflax by picloram apparently prevented its dominance in the picloram treatments.

After three years, results suggest picloram and clopyralid will control spotted knapweed growth and seed production for more than 2 years. Although herbicides provide a method of controlling spotted knapweed, criteria for herbicide selection should in some cases include ability to control potential invading species after the loss of spotted knapweed competition. (Idaho Agricultural Experiment Station, Moscow, ID. 83843)

Spotted Knapweed Control in Pasture.

		Spotted Knapweed							Yellow Toadflax
		Biomass					Seed Production		Cover
Herbicide	Rate	Summer 7/86	Fall 10/86	Spring 4/87	Summer 8/87	Summer 7/88	Fall 10/86	Summer 8/87	Summer 8/87
	(ai/A)	(% of Check)					(% of Check)		(%)
Metsulfuron	0.0 oz	100 a	100 a	100 a	100 a	100 a	100 a	100 a	0 b
	0.5 oz	62 a	90 a	97 ab	100 a	100 a	1 b	100 a	0 b
	1.0 oz	72 a	100 a	100 a	100 a	100 a	3 b	100 a	0 b
	2.0 oz	70 a	77 a	97 ab	100 a	100 a	1 b	100 a	0 b
DPX-L5300	0.0 oz	100 a	100 a	100 a	100 a	100 a	100 a	100 a	0 b
	0.5 oz	67 a	93 a	82 ab	100 a	100 a	3 b	100 a	0 b
	1.0 oz	70 a	95 a	97 ab	100 a	100 a	1 b	100 a	0 b
	2.0 oz	65 a	91 a	77 b	100 a	100 a	1 b	100 a	0 b
Chlorsulfuron	0.0 oz	100 a	100 a	100 a	100 a	100 a	100 a	100 a	0 b
	0.5 oz	88 a	88 a	100 a	100 a	100 a	58 a	100 a	0 b
	1.0 oz	82 a	81 a	100 a	100 a	100 a	65 a	100 a	0 b
	2.0 oz	87 a	74 a	97 a	100 a	100 a	54 a	100 a	0 b
Clopyralid	0.0 lb	100 a	100 a	100 a	100 a	100 a	100 a	100 a	0 b
	0.3 lb	2 b	0 b	0 c	4 b	4 b	0 b	0 b	50 a
	0.5 lb	1 b	0 b	0 c	4 b	1 b	0 b	0 b	50 a
	1.0 lb	0 b	0 b	0 c	4 b	1 b	0 b	1 b	37 ab
Sulfometuron	0.0 oz	100 a	100 a	100 a	100 a	100 a	100 a	100 a	0 b
	0.5 oz	58 a	80 a	81 ab	100 a	100 a	0 b	100 a	0 b
	1.0 oz	53 a	89 a	97 ab	100 a	100 a	1 b	100 a	0 b
	2.0 oz	50 a	74 a	77 b	100 a	100 a	0 b	100 a	0 b
Picloram	0.0 lb	100 a	100 a	100 a	100 a	100 a	100 a	100 a	25 a
	0.5 lb	5 b	0.5 b	0 c	0 b	2 b	0 b	0 b	6 b
	1.0 lb	2 b	0 b	0 c	0 b	1 b	0 b	0 b	2 b
	2.0 lb	1 b	0 b	0 c	0 b	3 b	0 b	0 b	0 b

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[1] The 8/86 fall biomass estimation was based on new seedling growth or regrowth from perennial roots.

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

Survival of mat-grass transplants. Northam, F.E. and R.H. Callihan. Examination of mat-grass (*Nardus stricta* L.) crowns revealed enlarged culm bases that appeared similar to bulbous bluegrass (*Poa bulbosa* L.) bulbs. This suggested that mat-grass may have true bulbs. New mat-grass culms are produced in a linear fashion, arising directly from the lower base of the proceding culm, similar to the vegetative addition of bulbs to chives (*Allium schoenoprasum* L.), garlic (*Allium sativum* L.), and onions (*Allium cepa* L.). So a study was established to observe the ability of mat-grass stems to survive transplanting on the surface of or 2.5-3.0 cm deep in greenhouse potting medium. The experiment was repeated to evaluate survival of uprooted mat-grass culms during two different portions of a growing season.

The first culms were transplanted from mat-grass clumps dug on 23 October 1987 and the second from clumps dug on 7 June 1988. The material was divided into fragments containing four to seven culms. The fragments were clipped to 5-7 cm segments that included the lower enlarged base and roots. Four treatments were evaluated for the October transplants. They included: 1) transplanted 2.5 to 3.0 cm deep in potting medium, 2) laid upon the surface of potting medium, 3) air dried two weeks and transplanted 2.5 to 3.0 cm deep into potting media, and 4) air dried 2 weeks and laid upon the surface of the potting medium. Only the first two treatments were evaluated in the June transplants. Plants were watered frequently to maintain saturated conditions representative of a wet meadow in early spring.

Culms planted with bases below the potting medium surface (within 24 hrs after harvest) had 95% survival of the October transplants, and 75% survival of the June transplants after 30 days (Table). Ninety-five percent of the October transplants that were laid on the potting media surface survived, but only 62.5% of the June surface transplants survived.

The clipped culms subjected to air drying before transplanting never produced growth even after sixty days in the potting medium (Table). Two weeks of air drying apparently killed the stems which indicates that mat-grass does not have a true bulb capable of surviving extended periods of drying.

An ecological implication of mat-grass transplant survival would be the establishment of colonies by animal uprooting and transport during wet autumns (September through November) and springs (March through May). Several uprooted segments of *N. stricta* were observed scattered over the meadow in October of 1987 and 1988. These segments were not able to root due to the dry conditions at the time, but if these fragments had been uprooted when the meadow soil was saturated, the above data indicates that mat-grass culms can easily survived uprooting and established new roots if they did not dry out. (Idaho Agriculture Experiment Station, Moscow, ID 83843)

Table. Survival of mat-grass fragments transplanted into peatmoss potting medium.

Transplant date	Planting depth in potting medium	Length of time from field harvest	No. of days after transplanting	
			30	60
			(% of live plants)	
October 1987	2.5-3.0 cm	24 hrs	95.0	95.0
	surface	24 hrs	95.0	95.0
	2.5-3.0 cm	14 days**	0.0	0.0
	surface	14 days	0.0	0.0
June 1988	2.5-3.0 cm	24 hrs	75.0	80.0
	surface	24 hrs	62.5	62.5

* Each value is the mean of four replications with 10 plants per replication.

** _N. stricta_ fragments were air dried during the two weeks prior to this experiment.

Tall larkspur (Delphinum occidentale) control with various herbicides. Whitson, T. D. and G. E. Fink. Tall larkspur, a poisonous perennial rangeland species, commonly causes death losses in cattle in high elevation range sites. A tall larkspur infested site located near Barnum, Wyoming was treated with various herbicides on a silty clay loam soil (20% sand, 52% silt and 28% clay with 7.5% organic matter and a 7.0 pH. June 12, 1987, temperature, air 70F, soil surface 72F, 1 inch 74F, 2 inches 73F, 4 inches 69F; with a relative humidity of 70% and wind speed 1 to 2 mph S while tall larkspur was 10 to 14 inches high before bloom. July 18, 1987 temperature, air 78F, soil surface 85F, 1 inch 80F, 2 inches 80F, 4 inches 80F; with relative humidity of 42% and wind south 2 to 3 mph, while larkspur was in early seed set. Treatment areas 10 by 27 ft were arranged in a randomized complete block design with four replications. The studies were fenced to prevent grazing. Herbicides were applied broadcast with a CO_2 pressurized six nozzle knapsack unit delivering 30 gpa at 45 psi. Evaluations were taken July 20, 1988 by counting total numbers of larkspur plants in each plot. In treatments made June 12, 1987 applications of picloram at 1.0 and 2.0 lb ai/A and metsulfuron applied at 0.063 lb ai/A provided 78, 98 and 82%, respectively. In treatments applied July 7, 1987 picloram at 0.75, 1.0 and 2.0 lb ai/A provided 79, 89 and 98% control, respectively. July applications of picloram provided greater control than June applications. Metsulfuron applied in June provided 82% larkspur control but declined to 44% control when applied in July. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Tall larkspur control with various herbicides.

Herbicide	Rate lb ai/A	Ave. no. larkspur plants/plot Application date 6/12/87	7/18/87	% Control Application date 6/12/87	7/18/87
Dicamba + 2,4-D (A)	0.25+0.75	48[1]	46	34	27
Dicamba + 2,4-D (A)	0.5+1.5	39	46	47	26
Dicamba	0.5	47	57	36	9
Dicamba	1.0	43	52	42	14
Dicamba	2.0	44	60	41	3
Picloram	0.25	45	38	38	39
Picloram	0.5	29	44	60	29
Picloram	0.75	29	13	61	79
Picloram	1.0	16	7	78	89
Picloram	2.0	2	1	98	98
2,4-D LVE	1.0	53	55	27	12
2,4-D LVE	2.0	42	65	43	0
Triclopyr + 2,4-D (LVE)	0.33+0.67	66	40	10	36
Triclopyr + 2,4-D (LVE)	0.67+1.33	51	66	20	0
Triclopyr	1.0	54	59	27	11
Triclopyr	2.0	36	65	51	0
Clopyralid	0.25	44	54	40	13
Clopyralid	0.5	53	63	27	0
Fluroxypyr	0.25	63	52	14	17
Fluroxypyr	0.5	51	56	31	10
Fluroxypyr	1.0	55	51	25	18
Metsulfuron	.0625+.25% V/V	14	35	82	44
Chlorsulfuron	.0625+.25% V/V	34	45	54	29
Sulfometuron	.0625+.25% V/V	41	38	44	39
Check	-	73	62	0	0

1. Evaluated 7/20/88

The effects of glyphosate on seedling fescues. Lass, L.W. and R.H. Callihan. Establishing a weed-free grass stand is an important step in many management situations. This study examined the tolerance of turf and forage fescue seedlings to glyphosate. The seven grass taxa used for this test were: Covar and Meckelenburg sheep fescue (*Festuca ovina* L. cv. Covar and Meckelenburg); Durar hard fescue (*Festuca ovina* L. var. *duriuscula* cv. Durar); Idaho fescue (*Festuca idahoensis* Elmer); Logro creeping red fescue (Festuca rubra L. cv. Logro); Wilma chewings fescue (*Festuca rubra* L. var. *commutata* cv. Wilma); and Fawn tall fescue (*Festuca arundinacea* Schreb. cv. Fawn). Glyphosate was applied at rates of 0.0, 0.25, 0.38, 0.5, 0.75, and 1.0 lb ai/A.

A seven-row gandy box drill with a 7 inches row spacing was used to establish the fescues in a strip-split plot design on May 14. Each row consisted of a single grass randomized within each replicate. The planting depth was 3/4 inch. The application of glyphosate was delayed until all species had emerged. Seedling size ranged from 1/2 inch to 2 inches. The plant populations ranged from 5 to 10 per ft except for Idaho fescue, which produced fewer than 1 per ft of row. Plots were 5 by 20 ft with three replicates. Treatments were applied in 25 gal/A water carrier, with TeeJet 8002 nozzles at a pressure of 45 psi, from a backpack sprayer operated at 2.2 mph. The application date was June 16, 1988 and the time was 16:49. The air temperature at the time of application was 86F, soil temperature was 113F at surface, 89F at the depth of 2 inches, 77F at the depth of 5 inches. The relative humidity was 34% and the sky was 10% cloudy. The wind was from the east at 1 to 2 mph. A visual estimate of the percentage of the leaves showing necrotic lesions was made on July 14. Plant heights were measured on August 3. An estimate of the removal of weeds was made on August 3.

Glyphosate reduced mid-summer biomass of redroot pigweed (*Amaranthus retroflexus* L.) by 85% (Table 1).

Glyphosate treatments at rates above 0.5 lbs/A produced some leaf necrosis on all of the tested fescues (Table 2). Wilma, Idaho, and Fawn tall fescues showed injury to 50% to 100% of the leaves where treated with 1.0 lb ai/A glyphosate on August 3. However, fescue growth on August 3, was not significantly affected by glyphosate. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843).

Table 1. Effects of glyphosate on redroot pigweed in seedling fescue.

Rate	Redroot Pigweed Biomass August 3
(lbs ai/A)	--(%)---
0	100 A[1]
0.25	13.3 B
0.38	10.7 B
0.5	10.0 B
0.75	13.3 B
1	13.3 B
LSD	9.5

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[1] Any two means having a common letter are not significantly different at the 5% level of significance, using the Protected LSD.

Table 2. Effects of glyphosate on seedling fescues.

Taxon	Glyphosate Rate	Necrotic Leaves July 14		Height August 3	
	(lb ai/a)	-(%)-[1]		-(cm)-	
Covar sheep	0	0	A[2]	4.0	ns[3]
	0.25	3	A	3.7	
	0.38	0	A	4.0	
	0.5	0	A	3.0	
	0.75	13	B A	3.7	
	1	43	B A C	2.7	
Durar hard	0	0	A	6.3	ns
	0.25	0	A	6.7	
	0.38	0	A	5.0	
	0.5	20	B A	7.0	
	0.75	7	A	6.0	
	1	27	B A C	7.0	
Logro creeping red	0	0	A	5.3	ns
	0.25	0	A	7.0	
	0.38	0	A	5.3	
	0.5	0	A	4.7	
	0.75	7	A	6.0	
	1	43	B A C	4.3	
Idaho	0	0	A	1.0	ns
	0.25	33	B A C	1.7	
	0.38	0	A	3.7	
	0.5	67	D C	1.0	
	0.75	33	B A C	0.7	
	1	100	D	0.0	
Wilma chewings	0	0	A	8.3	ns
	0.25	0	A	6.7	
	0.38	0	A	5.3	
	0.5	0	A	6.7	
	0.75	17	B A	8.0	
	1	50	B C	4.7	
Fawn tall	0	0	A	11.0	ns
	0.25	0	A	12.0	
	0.38	1	A	7.7	
	0.5	3	A	12.0	
	0.75	33	B A C	10.0	
	1	50	B C	9.7	
Meckelenburg sheep	0	0	A	5.3	ns
	0.25	0	A	5.7	
	0.38	0	A	5.3	
	0.5	0	A	6.7	
	0.75	10	B A	5.7	
	1	30	B A C	5.7	

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1. The percentage of the plant leaves showing necrotic lesions.
2. Any two means within a column having a common letter are not significantly different at the 5% level using Protected Duncan's test.
3. ns = not significantly different at the 5% level using Protected Duncan's test.

The effects of herbicides on the species composition of an annual weed community. Northam, F.E. and R.H. Callihan. Eleven herbicides were applied to a yellow starthistle (*Centaurea solstitialis* L. CENSO)-dominated plant community on 14 and 15 April 1988. The experiment was established in a severe ungrazed infestation of yellow starthistle on crop ground abandoned prior to 1979. Treatments (Table 2) were applied to yellow starthistle in the cotyledon to 3-leaf stages. This site is typical of many pastures on the canyon rims in north-central Idaho. Such sites have virtually no native vegetation and are dominated by alien annual weeds. The soil at the site was a Lickskillet gravelly silt loam with a three to five percent slope and a soil depth of 30-50 cm over basalt. Annual precipitation ranges from 30-50 cm. Table 1 lists the plant species identified during the frequency sampling.

This report discusses the changes in species numbers and frequencies resulting from the herbicide treatments. The effects of these chemicals on the presence of plant species were evaluated two months after spraying. The frequency of individual species was determined by recording the species presence in a $0.74\ m^2$ quadrat. Three quadrats were sampled per plot. The herbicide treated plots were replicated four times in a randomized complete block experimental design. Three control plots were established in each replicate.

Table 1. Plant species identified in herbicide treated plots of a yellow starthistle community.

Plants with >20% occurrence in one or more treatments:		
Amsinckia retrorsa Suksd.	Palouse tarweed	Boraginaceae
Anthriscus caucalis Bieb.	bur chervil	Apiaceae
Apera interrupta (L.) Beauv.	interrupted windgrass	Poaceae
Bromus japonicus Thunb. ex Murr	Japanese brome	Poaceae
Bromus tectorum L.	downy brome	Poaceae
Centaurea solstitialis L.	yellow starthistle	Asteraceae
Collomia linearis Nutt.	narrow-leaf collomia	Polemoniaceae
Convolvulus arvensis L.	field bindweed	Convolvulaceae
Erodium cicutarium (L.) L'Her. ex Ait.	redstem filaree	Geraniaceae
Galium aparine L.	catchweed bedstraw	Rubiaceae
Hypericum perforatum L.	common St. Johnswort	Hypericaceae
Lactuca serriola L.	prickly lettuce	Asteraceae
Lepidium perfoliatum L.	clasping pepperweed	Brassicaceae
Montia perfoliata (Donn) Howell	miner's lettuce	Portulacaceae
Myosotis micrantha Pall.	blue scorpion-grass	Boraginaceae
Sisymbrium altissimum L.	tumble mustard	Brassicaceae
Valerianella locusta (L.) Betcke	common cornsalad	Valerianaceae
Veronica hederaefolia L.	ivyleaf speedwell	Scrophulariaceae
Vicia villosa Roth	hairy vetch	Fabaceae
Vulpia myuros (L.) K.C. Gmel	rattail fescue	Poaceae
Plants with <20% occurrence in all treatments:		
Alyssum alyssoides L.	yellow alyssum	Brassicaeceae
Amaranthus blitoides S. Wats	prostrate pigweed	Amaranthaceae
Bromus brizaeformis Fisch. & Mey.	rattlesnake brome	Poaceae
Bromus mollis L.	soft brome	Poaceae
Chenopodium album L.	common lambsquarters	Chenopodiaceae

Table 1. (cont.)

Helianthus annuus L.	common sunflower	Asteraceae
Holosteum umbellatum L.	umbrella spurry	Caryophyllaceae
Hordeum leporinum Link	hare barley	Poaceae
Lithospermum arvense L.	corn gromwell	Boraginaceae
Solanum sarrachoides Sendt.	hairy nightshade	Solanaceae
Tragopogon sp.	salsify	Asteraceae
Taraxacum officinale Weber	dandelion	Asteraceae

The number of plant species/m2 was determined by totaling the species identified in the sampling quadrats. The control plots averaged 10.9 species/m2 (Table 2). The clopyralid plots averaged 11.9 species/m2 and the pyridate plots averaged 10.3 species/m2. Neither of these means were significantly different from the control mean, but the average number of species in the remaining herbicide treatments were significantly less than the control mean. Since the imazapyr killed all living plant material, no species were recorded in its plots. An average of only 1.3 and 2.1 species/m2 were present in the sulfometuron and metsulfuron plots, respectively. The remaining herbicide treatments with significantly fewer species than the control plots averaged between 4.9 to 8.2 species/m2.

The plant community composition was markedly different among treatments. Table 2 lists the predominant species (those with >70% occurrence) in each treatment. Even though the untreated control plots were dominated by yellow starthistle (424 g/m2 and 1403 plants/m2), 12 other species had frequencies over 20%. Hairy vetch, interrupted windgrass, downy brome and two mustards (clasping pepperweed and tumble mustard) were the plants most frequently associated with yellow starthistle in untreated areas. The remaining common species in the control plots were cool season dicots that flowered and produced fruits before the dense yellow starthistle population began removing the surface moisture from the soil.

Yellow starthistle and hairy vetch frequencies were reduced to 25% or less in the clopyralid plots. Annual grass frequency increased to the extent that interrupted windgrass, downy brome, rattail fescue and Japanese brome became the dominant vegetation in these plots. Miner's lettuce and redstem filaree became important components of this community, but were minor components in the control plot communities.

The pyridate plots had 10 species in common with the control plots. Catchweed bedstraw, blue scorpion grass and common cornsalad were three control species that were reduced below 20% in the pyridate plots, but the frequency of redstem filaree and rattail fescue increased in the pyridate plots. The frequency of the mustards was not appreciably changed by the pyridate treatment.

The 2,4-D LVE plots had seven species in common with the control plots. They were yellow starthistle, hairy vetch, interrupted windgrass, downy brome, catchweed bedstraw, rattail fescue and ivyleaf speedwell. The mustard species frequencies were reduced below 20% as were the frequencies of Palouse tarweed, blue scorpion-grass, prickly lettuce and common cornsalad. Rattail fescue, miner's lettuce and redstem filaree frequencies increased in the 2,4-D plots.

Seven species were predominant in the dicamba and control plots (interrupted windgrass, yellow starthistle, ivyleaf speedwell, downy brome, rattail fescue, clasping pepperweed and tumble mustard). Hairy vetch, catchweed bedstraw, Palouse tarweed, blue scorpion-grass, common cornsalad and prickly lettuce were severely reduced in the dicamba plots, but bur chervil and redstem filaree increased.

The frequencies of yellow starthistle, hairy vetch, catchweed bedstraw, blue scorpion-grass and common cornsalad were reduced below 10% in the 0.11 kg ai/ha picloram plots. The frequencies of the annual grasses were increased with Japanese brome and rattail fescue becoming part of the predominate species.

The DPX-L5300 plots had only six predominant species in common with the control plots. Downy brome and rattail fescue frequencies increased in this treatment. The mustards, ivyleaf speedwell, Palouse tarweed, blue scorpion-grass, common cornsalad and prickly lettuce frequencies decreased well below 10% in these plots.

The plots with picloram at 0.21 kg ai/ha were also dominated by annual grasses. These annuals filled the space left by the reduction of yellow starthistle, hairy vetch, catchweed bedstraw, Palouse tarweed, blue scorpion-grass, prickly lettuce and common cornsalad. Ivyleaf speedwell and miner's lettuce were broadleaf species that had substantially higher frequencies in the picloram plots than in the control plots.

The atrazine plots had only six species with 20% or higher frequencies. They were yellow starthistle, hairy vetch, downy brome, clasping pepperweed, Japanese brome and field bindweed. Windgrass, tumble mustard, catchweed, bedstraw, ivyleaf speedwell, blue scorpion-grass, common

Table 2. Effects of herbicides on the number of plant species and the frequency of the predominant species in a yellow starthistle community.

Chemical*	Number of species	Predominant taxa	Frequency in 0.74 m^2 quadrats
	-No./m2-	------(species)-------	% occurrence
Clopyralid 0.28 kg ai/ha	11.9	Vulpia myuros	92
		Myosotis micranthra	92
		Apera interrupta	83
		Bromus tectorum	75
		Veronica hederaefolia	75
CHECK	10.9	Centaurea solstitialis	94
		Vicia villosa	83
		Apera interrupta	75
Pyridate 1.01 kg ai/ha	10.3	Centaurea solstitialis	100
		Apera interrupta	92
		Bromus tectorum	83
		Vicia villosa	83
2,4-D LVE 1.12 kg/ai/ha	8.9	Centaurea solstitialis	100
		Apera interrupta	92
		Bromus tectorum	83
Dicamba 01.12 kg ai/ha	8.2	Apera interrupta	100
		Centaurea solstitialis	75
		Veronica hederaefolia	75

Table 2. (cont.)

Picloram	7.5	Apera interrupta	83
0.11 kg ai/ac			
DPX-L5300	6.7	Centaurea solstitialis	100
0.056 kg ai/ha		Bromus tectorum	100
Picloram	6.5	Apera interrupta	83
0.22 kg ai/ha		Veronica hederaefolia	83
Chlorsulfuron	6.1	Centaurea solstitialis	100
0.021 kg ai/ha		Apera interrupta	75
Atrazine	4.9	Centaurea solstitialis	92
1.12 kg ai/ha		Vicia villosa	75
Metsulfuron	2.1	Bromus tectorum	75
0.056 kg ai/ha			
Sulfometuron	1.3	Galium aparine	58
0.056 kg ai/ha			
LSD (0.05)	1.9		

* Imazapyr plots had no species present.

cornsalad, prickly lettuce and rattail fescue were not present in the atrazine plots. Downy brome was the major species present in the metsulfuron plots. A few yellow starthistle plants were present but their frequency was approximately 1/3 of the frequency in the control plots.

The sulfometuron plots had only one species with >10% frequency--catchweed bedstraw. No species survived in the imazapyr plots. (Idaho Agriculture Experiment Station, Moscow, ID 83843)

The effects of temperature, gibberellic acid and light on mat-grass germination. Northam, F.E. and R.H. Callihan. mat-grass (*Nardus stricta* L.), a perennial weed of montane pastures, infests approximately 70 acres of a mountain meadow in northern Idaho. Since no germination results have been published for North American populations of this weed, an experiment was initiated to investigate its germination biology.

Dry mat-grass florets (caryopses enclosed within paleas and lemmas) were harvested from the infested meadow during July and August 1987, which was approximately one month after all green color had disappeared from the florets and rachis. The effects of 8C and 18C on mat-grass germination were compared. Four germination plates were prepared for each temperature by placing 100 florets on germination pads (Anchor brand) in each plate. The pads were saturated with distilled water, and water was added as needed to maintain saturated conditions. The germinator light cycle was 14 hours light/10 hours dark. Germination counts were made every seven days, and all germinated florets were removed when they were counted. A floret was considered germinated when both the radicle and plumule were at least 1.0 mm long. The germination of mat-grass florets at 8C and 18C were as follows:

Effects of temperature on the cumulative germination of mat-grass florets.

Temp.	Number of weeks in germinator*							
C	2	5	8	12	24	31	41	52
	(% Germination)							
8	0.0**	0.0	0.0	0.0	0.0	1.3	2.5	---
18	1.0	27.5	33.3	41.3	56.5	61.3	63.0	63.0

*Germinator light conditions were 14 hrs light/10 hrs dark.
Experiment began on 7 Aug. 1987.
**Each value is the average of four replicates with 100 florets in each plate.

Germination of this seedlot was strongly inhibited at 8C, but not at 18C. No germination occurred at 8C before 22 weeks, and 31 weeks had passed before 1.0% germination was attained. The total germination at 8C was only 2.5% after 287 days. In contrast, germination at 18C was 1.0% at 2 weeks, and 61.3% of the florets had germinated by 31 weeks. Maximum germination (63.0%) was reached after 41 weeks at 18C. The 18C plates were observed for 52 weeks.

Since maximum germination was only 63% at 18C, florets from the above seedlot were examined to determine how many were empty (sterile) or contained a caryopsis (fertile). An examination of 42 samples, each containing 100 florets and treated with a bleach solution (5% hypochlorite), yielded an average of 27.7 sterile florets (95% confidence interval = 16.7 to 38.7 florets). Based upon the average number of fertile florets (72.3) present in a 100-seed sample, the actual germination in 18C was 87.1% at 41 weeks.

The seedlot required more than 12 weeks to reach 50% actual germination. After 5 weeks, there was a steady, gradual increase in the cumulative germination through 41 weeks.

An experiment to determine whether gibberellic acid (GA) would improve the germination of mat-grass was begun on 7 Aug. 1987. The same procedures described in the temperature effects trial were used for this experiment, except that a 0.001 molar GA solution replaced the distilled water initially, but only distilled water was added thereafter to maintain saturated conditions.

Gibberellic acid increased the amount of germination at 8C and increased the rate of germination at 18C. The 8C treatment had 15 times more germinated florets (43 per plate or 59.4% accounting for sterile florets) in the GA plates than in the control plates (2.5 florets per plate) after 41 weeks. The number of germinated florets in the GA-treated plates was higher than the 18C control during the first eight weeks of the experiment. Thirty-three florets/plate had germinated in the control plates at eight weeks, and 58 florets/plate in the GA-treatment germinated during the same time. The control plates required 22 weeks to attain an average of 50 germinated florets/plate and 41 weeks were needed to reach total germination. Plates treated with GA required 23 weeks to reach maximum germination which was 18 weeks sooner than the control. The final total germination of the GA-treated 18C florets (67.8%) was not substantially different from that of the control plate florets (63.0%).

The effects of the presence and absence of light on mat-grass germination were also evaluated. Control treatments at 8C and 18C were maintained in 14 hrs light/10 hrs dark. The dark treatment consisted of florets kept in light-proof boxes within the 8C and 18C germinators (i.e., continuous darkness). These plates were exposed to five minutes of fluorescent room light during counting, once every seven days.

The response of mat-grass florets to the light and dark treatments differed according to temperature. Germination at 8C was almost twice as high in the dark (4.8%) as in the light (2.5%) after 41 weeks. However, at 18C, germination in the light was five times higher than in the dark. After 41 weeks at 18C, 63 florets germinated per plate in the light treatment, and 12.5 florets germinated per plate in the 18C dark treatment. Based upon these results, the conditions for future testing of the germination of mat-grass florets will be 18C with a 14 hrs light/10 hrs dark photoperiod.

The results of these evaluations indicated that mat-grass germinates 25 times better at 18C than at 8C, but even at 18C the germination rate of mat-grass was very slow under these test conditions. Most nondormant, cool-season grass caryopses reach their maximum germination within two weeks at 18C, but the 1987 mat-grass seedlot reached only 1.0% germination by two weeks. mat-grass inflorescences produce a substantial number of empty florets; this fact should be considered when investigating the true viability of a mat-grass seedlot. The dark conditions used in this evaluation strongly inhibited mat-grass germination. This suggests the possibility that field conditions with dense vegetation covering the soil may inhibit mat-grass seedling establishment. Gibberellic acid strongly enhanced germination at 8C and increased germination rate at 18C. A seedlot from the 1988 growing season will be evaluated to confirm these results. (Idaho Agriculture Experiment Station, Moscow, ID 83843).

University of Idaho weed identification. Old, R. R., R. H. Callihan, and F. E. Northam. The occurrence and distribution of weed species is a dynamic phenomenon. It is their nature to disperse into new areas. Therefore one aspect of weed science encompasses 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 includes: (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 and planning programs for extension and regulatory personnel on weed identification, and (7) creating an available historical data base. This report also serves the important function of advising research, extension, and regulatory personnel in other states of problems and weed status in Idaho that may be significant in their states.

Plants submitted for identification or verification in 1988 are listed below. These data are only identification requests submitted to weed identification personnel by county extension agents and county weed superintendents. Over 600 plant species have been identified for these two groups during the past three years (see also WSWS Progress Reports for 1986-1988.

Date	County	Identification
06/28/88	Payette	*Abutilon theophrasti*, Malvaceae
11/01/88	Lewis	*Abutilon theophrasti*, Malvaceae
05/09/88	Ada	*Acer negundo*, Aceraceae
06/13/88	Ada	*Acer negundo*, Aceraceae
06/09/88	Bear Lake	*Achillea millefolium*, Asteraceae
06/29/88	Idaho	*Agropyron cristatum*, Poaceae
07/29/88	Ada	*Agropyron dasystachyum*, Poaceae
11/21/88	Ada	*Agrostis tenuis*, Poaceae
04/21/88	Idaho	*Agrostis tenuis*, Poaceae
11/07/88	Ada	*Ailanthus altissima*, Simaroubaceae
10/27/88	Ada	*Ailanthus altissima*, Simaroubaceae
06/17/88	Kootenai	*Alopecurus carolinianus*, Poaceae
05/10/88	Fremont	*Alyssum desertorum*, Brassicaceae
07/29/88	Ada	*Ambrosia artemisiifolia*, Asteraceae
08/22/88	Ada	*Ambrosia artemisiifolia*, Asteraceae
07/25/88	Washington	*Ambrosia psilostachya*, Asteraceae
08/22/88	Boundary	*Ambrosia psilostachya*. Asteraceae
06/27/88	Latah	*Apocynum androsaemifolium*, Apocynaceae
06/24/88	Power	*Apocynum androsaemifolium*, Apocynaceae
08/08/88	Ada	*Arctium minus*, Asteraceae
06/16/88	Minidoka	*Artemisia abrotanum*, Asteraceae
03/11/88	Clearwater	*Artemisia absinthium*, Asteraceae
04/29/88	Blaine	*Artemisia absinthium*, Asteraceae
09/20/88	Canyon	*Artemisia biennis*, Asteraceae
11/07/88	Fremont	*Artemisia dracunculus*, Asteraceae
09/28/88	Minidoka	*Atriplex rosea*, Chenopodiaceae
05/17/88	Latah	*Barbarea orthoceras*, Brassicaceae
05/10/88	Canyon	*Barbarea vulgaris*, Brassicaceae
06/30/88	Bannock	*Brassica nigra*, Brassicaceae

06/17/88	Kootenai	*Bromus inermis*, Poaceae
06/01/88	Idaho	*Bromus sterilis*, Poaceae
05/11/88	Bingham	*Bryonia alba*, Cucurbitaceae
04/29/88	Kootenai	*Campanula rapunculoides*, Campanulaceae
07/22/88	Bingham	*Campanula rapunculoides*, Campanulaceae
05/16/88	Latah	*Cardaria draba*, Brassicaceae
07/22/88	Lewis	*Carduus acanthoides*, Asteraceae
08/01/88	Latah	*Centaurea diffusa*, Asteraceae
07/22/88	Lewis	*Centaurea maculosa*, Asteraceae
06/16/88	Payette	*Centaurea repens*, Asteraceae
08/15/88	Elmore	*Centaurea solstitialis*, Asteraceae
05/10/88	Ada	*Cerastium dubium*, Caryophyllaceae
03/16/88	Parker	*Cerastium vulgatum*, Caryophyllaceae
10/20/88	Canyon	*Chaenactis douglasii*, Asteraceae
10/17/88	Ada	*Chondrilla juncea*, Asteraceae
06/22/88	Fremont	*Chrysanthemum leucanthemum*, Asteraceae
06/09/88	Payette	*Cirsium canovirens*, Asteraceae
06/16/88	Latah	*Cirsium undulatum*, Asteraceae
08/31/88	Butte	*Clematis ligusticifolia*, Ranunculaceae
08/15/88	Minidoka	*Cleome serrulata*, Capparidaceae
04/18/88	Boundary	*Conium maculatum*, Umbelliferae
05/17/88	Ada	*Conium maculatum*, Umbelliferae
07/29/88	Nez Perce	*Conyza canadensis*, Asteraceae
06/20/88	Ada	*Coriandrum sativum*, Umbelliferae
03/29/88	Ada	*Cornus mas*, Cornaceae
03/18/88	Gem	*Cornus stolonifera*, Cornaceae
08/31/88	Canyon	*Crataegus douglassi* var. *douglassi*, Rosaceae
06/21/88	Canyon	*Crepis acuminata*, Asteraceae
09/20/88	Ada	*Daucus carota*, Umbelliferae
06/30/88	Idaho	*Elymus canadensis*, Poaceae
08/05/88	Bannock	*Epilobium angustifolium*, Onagraceae
06/01/88	Ada	*Epilobium paniculatum*, Onagraceae
07/22/88	Latah	*Epilobium paniculatum*, Onagraceae
06/22/88	Ada	*Equisetum arvense*, Equisitaceae
09/21/88	Fremont	*Eragrostis cilianensis*, Poaceae
10/31/88	Ada	*Eragrostis cilianensis*, Poaceae
10/20/88	Gooding	*Eragrostis pectinacea*, Poaceae
08/22/88	Camas	*Eriogonum baileyi*, Polygonaceae
11/02/88	Twin Falls	*Eriogonum vimineum*, Polygonaceae
08/25/88	Power	*Eupatorium maculatum*, Asteraceae
06/16/88	Butte	*Euphorbia cyparisias*, Euphorbiaceae
05/26/88	Ada	*Euphorbia myrsinites*, Euphorbiaceae
11/07/88	Payette	*Euphorbia myrsinites*, Euphorbiaceae
06/16/88	Latah	*Festuca rubra*, Poaceae
11/21/88	Valley	*Filago arvensis*, Asteraceae
07/22/88	Idaho	*Fumaria officinalis*, Fumariaceae
06/01/88	Ada	*Galium aparine*, Rubiaceae
06/24/88	Power	*Gaura parviflora*, Onagraceae
06/09/88	Bear Lake	*Glechoma hederacea*, Labiatae
06/09/88	Ada	*Grindelia squarrosa*, Asteraceae
09/08/88	Cassia	*Gutierrezia sarothrae*, Asteraceae
08/29/88	Power	*Helenium autumnale*, Asteraceae
09/12/88	Elmore	*Hibiscus trionum*, Malvaceae
08/17/88	Ada	*Hibiscus trionum*, Malvaceae

02/25/88	Twin Falls	Hordeum leporinum, Poaceae
05/04/88	Lewis	Hordeum vulgare, Poaceae
10/10/88	Ada	Humulus lupulus, Moraceae
08/15/88	Gooding	Hypericum perforatum, Hypericaceae
09/12/88	Kootenai	Hypericum perforatum, Hypericaceae
08/03/88	Boundary	Hypochaeris radicata, Asteraceae
07/14/88	Ada	Iva axillaris, Asteraceae
06/16/88	Bannock	Iva axillaris, Asteraceae
08/08/88	Canyon	Iva xanthifolia, Asteraceae
08/17/88	Nez Perce	Iva xanthifolia, Asteraceae
07/18/88	Clark	Knautia arvensis, Dipsacaceae
07/14/88	Bannock	Lactuca pulchella, Asteraceae
06/30/88	Bannock	Lactuca pulchella, Asteraceae
06/13/88	Kootenai	Linaria vulgaris, Scrophulariaceae
03/28/88	Canyon	Linum perenne, Linaceae
06/22/88	Gem	Lolium multiflorum, Poaceae
04/05/88	Latah	Lolium multiflorum, Poaceae
09/14/88	Washington	Lolium multiflorum, Poaceae
04/12/88	Nez Perce	Lolium perenne, Poaceae
07/01/88	Canyon	Lolium perenne, Poaceae
06/12/88	Payette	Lomatium bicolor, Umbelliferae
06/29/88	Idaho	Lonicera involucrata, Caprifoliaceae
10/20/88	Canyon	Lonicera tatarica, Caprifoliaceae
06/02/88	Power	Lycium halimifolium, Solanaceae
08/14/88	Latah	Lythrum salicaria, Lythraceae
10/10/88	Ada	Machaeranthera canescens, Asteraceae
08/22/88	Camas	Machaeranthera canescens, Asteraceae
07/25/88	Washington	Mashaeranthera canescens, Asteraceae
04/25/88	Canyon	Matricaria matricarioides, Asteraceae
05/11/88	Nez Perce	Matricaria perforata, Asteraceae
07/29/88	Minidoka	Medicago lupulina, Fabaceae
08/15/88	Blaine	Mentzelia laevicaulis, Loasaceae
07/29/88	Ada	Mentzelia laevicaulis, Loasaceae
07/25/88	Idaho	Microsteris gracilis, Polemoniaceae
07/22/88	Latah	Mimulus guttatus, Scrophulariaceae
06/30/88	Clearwater	Mimulus guttatus, Scropulariaceae
04/27/88	Boundary	Myosotis micrantha, Boraginaceae
06/16/88	Bonner	Myosotis micrantha, Boraginaceae
08/08/88	Lewis	Navarretia intertexta, Polemoniaceae
07/22/88	Washington	Navarretia intertexta, Polemoniaceae
03/15/88	Idaho	Nepeta cataria, Labiatae
08/08/88	Jerome	Nicotiana attenuata, Solanaceae
07/19/88	Bear Lake	Oenathera strigosa, Onagraceae
10/17/88	Minidoka	Oenathera strigosa, Onagraceae
08/15/88	Oneida	Oenothera strigosa, Onagraceae
07/22/88	Bingham	Onobrychis viceafolia, Fabaceae
10/18/88	Shoshone	Oplopanax horridum, Araliaceae
05/04/88	Power	Ornithogalum umbellatum, Liliaceae
05/16/88	Lewis	Ornithogalum umbellatum, Liliaceae
08/16/88	Kootenai	Orobanche pinorum, Orobanchaceae
01/20/88	Canyon	Oryzopsis hymenoides, Poaceae
03/11/88	Ada	Panicum capillare, Poaceae
08/12/88	Idaho	Panicum miliaceum, Poaceae
10/20/88	Washington	Parthenocissus quinquefolia, Vitaceae

06/22/88	Idaho	*Pentstemon venustus*, Scropulariaceae
07/25/88	Washington	*Phacelia hastata*, Hydrophyllaceae
03/16/88	Parker	*Plantago lanceolata*, Plantaginaceae
03/23/88	Ada	*Poa annua*, Poaceae
05/23/88	Ada	*Polygonum cuspidatum*, Polygonaceae
10/05/88	Washington	*Polygonum lapathifolium*, Polygonaceae
06/21/88	Minidoka	*Potentilla gracilis*, Rosaceae
08/16/88	Ada	*Potentilla norvegica*, Rosaceae
06/16/88	Bonner	*Potentilla recta*, Rosaceae
06/17/88	Bonner	*Prunella vulgaris*, Labiatae
08/22/88	Boundary	*Prunella vulgaris*, Labiatae
08/31/88	Canyon	*Prunus emarginata*, Rosaceae
09/27/88	Ada	*Prunus emarginata*, Rosaceae
07/14/88	Bonner	*Ranunculus repens* var. *repens*, Ranunculaceae
09/19/88	Gem	*Ranunculus repens*, Ranunculaceae
04/21/88	Ada	*Ranunculus testiculatus*, Ranunculaceae
09/27/88	Ada	*Rhamnus alnifolia*, Rhamnaceae
05/23/88	Bonner	*Rhinanthus crista-galli*, Scrophulariaceae
09/08/88	Ada	*Ribes aureum*, Grossulariaceae
06/24/88	Latah	*Rorippa curvisiliqua*, Brassicaceae
06/30/88	Clearwater	*Rorippa nasturtium-aquaticum*, Brassicaceae
03/16/88	Parker	*Rumex occidentalis*, Polyonaceae
09/01/88	Washington	*Saponaria officinalis*, Caryophyllaceae
08/22/88	Adams	*Saponaria officinalis*, Caryophyllaceae
04/25/88	Ada	*Sclerochloa dura*, Poaceae
04/14/88	Gem	*Setaria verticillata*, Poaceae
07/19/88	Bear Lake	*Silene alba*, Caryophyllaceae
07/29/88	Clearwater	*Solanum rostratum*, Solanaceae
07/19/88	Bingham	*Solidago graminifolia*, Asteraceae
03/16/88	Parker	*Sonchus oleraceus*, Asteraceae
08/08/88	Canyon	*Sphaeralcea coccinea*, Malvaceae
04/29/88	Power	*Stellaria media*, Caryophyllaceae
10/31/88	Fremont	*Stellaria media*, Caryophyllaceae
06/17/88	Ada	*Syringa vulgaris*, Oleaceae
08/29/88	Power	*Thelypodium integrifolium*, Brassicaceae
04/29/88	Gem	*Thermopis montana*, Fabaceae
06/09/88	Bear Lake	*Thermopsis montana*, Fabaceae
06/17/88	Ada	*Ulmus glabra*, Ulmaceae
08/22/88	Camas	*Verbena bracteata*, Verbenaceae
09/12/88	Gem	*Verbena bracteata*, Verbenaceae
04/29/88	Ada	*Viburnum curlesii*, Caprifoliaceae
07/29/88	Nez Perce	*Vicia tetrasperma*, Fabaceae
04/18/88	Kootenai	*Vicia villosa*, Fabaceae
06/23/88	Gooding	*Vicia villosa*, Fabaceae
05/19/88	Ada	*Vulpia bromoides*, Poaceae
07/29/88	Ada	*Xanthium spinosum*, Asteraceae

Sixteen specimens which were identified only to genus and 570 specimens from other sources are not included.

(Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Using herbicides to delay vegetation development on burns. Cole, E.C., and M. Newton. Fire is a natural component of many forest ecosystems in the Pacific Northwest and is also used as a silvicultural tool. Revegetation of burned areas by noncrop species can be rapid, even if sites are planted. If vegetation development could be delayed on such sites, then seedlings would have a better environment for growth and survival.

Four soil residual herbicides were applied on March 21, 1988 on a burned area in southwestern Oregon. The site was part of a wildfire that started in August 1987. The fire killed all existing vegetation and was hot enough to remove the duff layer. The area is a dry, windy ridgetop, with slope 0 to 5 percent. Summers are generally hot and dry, although average annual precipitation is approximately 170 cm. Soils are clay loams.

Herbicide treatments included atrazine at 9.0 kg ai/ha, hexazinone at 1.1, 1.7, and 2.2 kg ai/ha, imazapyr at 0.6 and 0.8 kg ai/ha, and sulfometuron at 0.11 and 0.21 kg ai/ha. All treatments were completely randomized among plots with three replications of each treatment and including untreated control plots. Herbicides were applied broadcast using a nitrogen pressurized precision sprayer with 7 teejet (80015) nozzles mounted on a handheld boom. Volume was 120 l/ha, and plot size was 3.2 by 13.3 meters (0.004 ha, 0.01 a). Douglas-fir seedlings had been planted in February 1988. Plots were evaluated in summer 1988 for percent cover of forbs, grasses, and shrubs, and for seedling injury. Injury was rated on a six-point scale--0: no injury, 1: minor injury to foliage, 2: injury to foliage and buds, 3: slight terminal dieback, 4: terminal dieback and loss of over one-third of crown, and 5: dead.

All herbicide treatments differed significantly from the untreated control plots (which averaged 59 percent total cover), but were not significantly different from each other (Table 1). The imazapyr treatments had the lowest cover, 9 percent for the 0.6 kg/ha rate and 7 percent for the 0.8 kg/ha rate. The remaining herbicide treatments had between 23 and 30 percent total cover.

All treatments, including the untreated control, had significant injury to Douglas-fir. In general, injury included bud injury, terminal dieback, and some mortality. Some injury was related to site conditions. The site is hot and dry throughout most of the summer and on an exposed ridge which contributes to both summer and winter dehydration of seedlings. None of the treatments was significantly different from any other in terms of injury (Table 2). However, the best survival and least amount of injury to Douglas-fir was found on the plots with the lowest amount of cover (imazapyr, both rates). (Department of Forest Science, Oregon State University, Corvallis, OR 97331)

Table 1 Percent cover for burn plots

Treatment	Rate/ Hectare	% Total	% Forb	% Grass	% Shrub
Atrazine	9.0 kg	23 b*	18 ab	3 bc	2 a
Hexazinone	1.1 kg	29 b	17 ab	8 b	4 a
	1.7 kg	23 b	15 b	4 bc	4 a
	2.2 kg	30 b	22 ab	1.3 bc	7 a
Imazapyr	0.6 kg	9 b	7 b	1 c	1 a
	0.8 kg	7 b	5 b	0.3 c	1 a
Sulfometuron	0.11 kg	23 b	20 ab	1.3 bc	2 a
	0.21 kg	23 b	20 ab	1 c	2 a
Control	0.0	59 a	38 a	15 a	5 a

Table 2 Injury to Douglas-fir seedlings

Treatment	Rate/ Hectare	Injury Rating	% Severely Injured	% Mortality
Atrazine	9.0 kg	3.5 a*	13 ab	53 a
Hexazinone	1.1 kg	4.3 a	12 ab	68 a
	1.7 kg	3.2 a	0 b	53 a
	2.2 kg	3.4 a	18 ab	41 a
Imazapyr	0.6 kg	2.7 a	27 ab	13 a
	0.8 kg	2.2 a	32 ab	0 a
Sulfometuron	0.11 kg	3.4 a	51 a	23 a
	0.21 kg	3.1 a	12 ab	38 a
Control	0.0	3.7 a	23 ab	55 a

* Means followed by the same letter within columns are not significantly different at $\alpha=0.05$ using Tukey's.

Viability and germination of buried yellow starthistle seed. Northam, F.E., T.S. Prather and R.H. Callihan. Yellow starthistle (*Centaurea solstitialis* L. CENSO) seeds collected in late August, 1981 near Lewiston, Idaho were separated into plumed and non-plumed seed. Four replications of 250 seeds of each type were placed in nylon mesh packets and buried on Oct. 5, 1981. The site was in southeast Whitman County, Washington. The soil was a sandy loam, and the mean annual precipitation was 10-15 in. Seeds were buried at depths of 1, 3, and 6 in. Seed viability will be tested for 14 retrieval dates.

Seeds have been retrieved on Jan. 6, July 20, and Oct. 6, 1982; May 5 and Oct. 29, 1983; Nov. 1, 1984; Jan. 29, 1986; and Sept. 29, 1987 (three, nine, twelve, eighteen, twenty-four, thirty-six, fifty and seventy-two months after burial). Seeds were surface sterilized with a 0.5% sodium hypochlorite solution and placed on filter paper in petri dishes held at 21°C (room temperature) for thirty days. During this time germinated seeds were periodically counted. Seeds which did not germinate were treated with a one percent tetrazolium chloride solution to determine viability. The tetrazolium test was terminated after the 1986 retrieval. The table on the following page summarizes the data for three, nine, twelve, twenty-four, thirty-six, fifty, and seventy-two months after burial.

Three months after burial 23% of the seeds remained viable but only seven percent germinated after 28 days. No differences between burial depth and seed type were found. Seeds retrieved after nine months averaged 33% germination and none dormant. Again there were no differences in germination or viability among depths or between seed types. Seed buried 12 months averaged 30% viability, and less than one percent of viable seed failed to germinate.

Seeds retrieved Oct. 29, 1983 and Nov. 1, 1984, two and three years after burial, exhibited 9% and 10% germination, respectively. None of the seeds were dormant and no differences between seed type or between burial depths were found. Germination of the samples retrieved on Jan. 29, 1986 was significantly different ($p=0.05$) among the three depths. The combined average for both plumed and nonplumed seed at 1 in. was 14.5%, at three in. was six percent, and at six in. was 0.6%. Since numerous viable seed remained after four years, biennial sampling began so that the study can extend well beyond 10 years.

The next sampling date was 72 months after burial (Sept. 29, 1987). Germination at the one-inch depth was nine percent which was three times higher than at the three inch depth and 45 times higher than at the six-inch depth (Table), but these means were not significantly different due to the variation among the samples. Yellow starthistle seeds survived much better in the drier surface layer of the soil than the deeper layers. Six years after burial, nine percent of this 1981 seed population still germinated if located within one inch of the soil surface.

Regression analyses were done on the data through 72 months. There was a semi log relationship between germination percentage and time. Germination decreased rapidly the first year after burial and decreased more slowly in subsequent years (Figure). The equation predicting germination as the seed ages in the soil was:

$$\%GERM = 20.301 - 9.783(l_n \text{ months}) \qquad r^2=0.80$$

where %GERM is the percentage germination and months is the age of the seed when exhumed. In the figure, the regression line shows that the predicted zero germination percentage to be twelve years. However, the variation in the data indicate the range of germination percentages could be as much as 30%. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843).

Table Germination of yellow starthistle seed from burial study begun in October 1981.

Date Retrieved	Months after burial	Burial depth			Mean % of all depths
		1 in.	3 in.	6 in.	
		(%)			(%)
6 Jan. 1982	3				
% Germinated		6.0*	7.8	7.3	7.0
% Dormant		16.8	15.0	16.7	16.2
Tot. % Viable		22.8a**	22.8a	24.0a	23.3a**
7 Jul. 1982	9				
% Germinated		34.4	30.6	33.1	32.6
% Dormant		0.0	0.0	0.0	0.0
Tot. % Viable		34.4a	30.6a	33.1a	32.6b
6 Oct. 1982	12				
% Germinated		32.1	30.8	29.0	30.6
% Dormant		0.0	0.0	0.0	0.0
Tot. % Viable		32.1a	30.8a	29.0a	30.6b
29 Oct. 1983	24				
% Germinated		11.0	5.4	11.6	9.3
% Dormant		0.0	0.0	0.0	0.0
Tot. % Viable		11.0a	5.4a	11.6a	9.3c
1 Nov. 1984	36				
% Germinated		10.8	11.8	6.3	9.6
% Dormant		0.0	0.0	0.0	0.0
Tot. % Viable		10.8a	11.8a	6.3a	9.6c
29 Jan. 1986	50				
% Germinated		17.2	9.0	0.9	9.0
% Dormant		0.0	0.0	0.0	0.0
Tot. % Viable		17.2a	9.0ab	0.9b	9.0c
29 Sept. 1987	72				
% Germinated		9.0	2.8	0.2	4.0
% Dormant		0.0	0.0	0.0	0.0
Tot. % Viable		9.0a	2.8a	0.2a	4.0c

*These percentages are based on 8 packets each containing 250 seeds for each depth and sampling date. Both plumed and nonplumed seed are included.

**Lower case letters in the individual burial depth columns indicate least squares mean separation of burial depths within a retrieval date ($P<0.05$). Lower case letters in the depth means column indicate least squares mean separation of overall mean for all depths at each retrieval date ($P<0.05$).

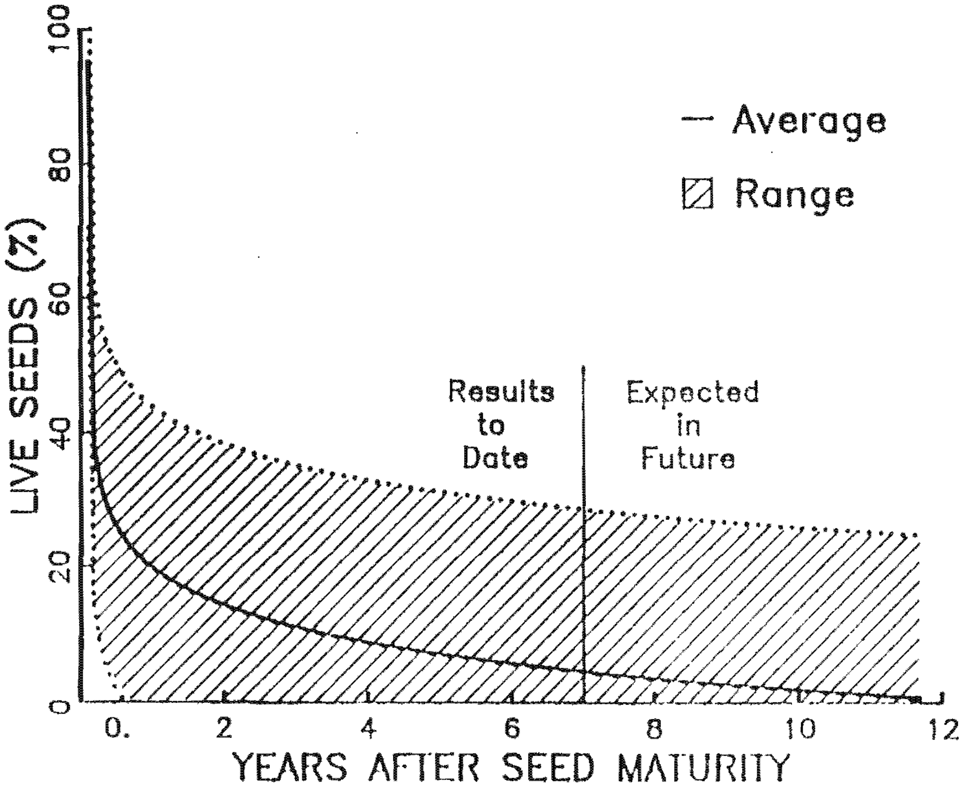

Figure. Longevity of yellow starthistle seed.

Yellow starthistle 1987 survey. Prather, T.S. and R.H. Callihan. The yellow starthistle (Centaurea solstitialis) infestation in north central Idaho was surveyed aerially in May 1987. The aerial survey boundaries extended from Moscow on the north, east to Harpster, south to Lucile, and west to the Snake river. Areas near Potlatch and Riggins were surveyed on the ground. Yellow starthistle was identified by texture and color. The search image was calibrated against known infestations at the beginning of the survey. Yellow starthistle was highly visible from the air because most vegetation was brown, whereas yellow starthistle was blue-green. Dense colonies at least ten feet in diameter could be detected. Areas overflown were not completely examined even though flown over twice. Yellow starthistle locations were marked on USGS topographic maps.

Calculation of area infested was done on a quarter section basis. A quarter section was considered infested if any yellow starthistle was identified. Using this procedure, the 1981 infestation was expressed as 233,920 acres.

The results of the 1987 survey showed 277,440 acres infested which was an increase of 43,520 acres. The total increase from 1981 to 1987 was 19% per year (see Figure 1). The main body of the infestation had occupied nearly all potential sites in the region wherein the greatest area of infestation lay. The rate of increase for some areas peripheral to the main infestation was quite high. Lawyer's Canyon area (T33N R3E, R2E, R1E, and R1W) had the highest rate of increase i.e. 367% since 1981. The rapid increases in these peripheral areas stemmed from small yellow starthistle colonies which were scattered throughout the area in 1981 and which had coalesced into large, contiguous infestations by 1987. Several peripheral areas were observed to have small colonies scattered over a wide area, similar to the 1981 infestation in Lawyer's Canyon. The area surrounding Eagle creek (T31N R3W) and the Whitebird area (T29N R1E and T28N R1E) appeared to be at this stage. The Eagle creek and Whitebird areas were predicted to become infested to the extent of 80% of susceptible acreage by 1993. This projection was based on the rate of infestation which had occurred in Lawyer's canyon where the infestation increased from 18% of the susceptible area in 1981, to 86% of the susceptible area in 1987 (see Figure 2).

A statewide mail survey of county weed superintendents, agricultural agents, and Soil Conservation Service personnel for presence of yellow starthistle was conducted during the summer of 1987. Additional new infestations were recorded by this survey. A total of 29 new yellow starthistle infestations were reported, mostly in south-eastern and south-central Idaho (see Figure 3). These additional reports increased the infestation in Idaho by 4,640 acres. The total infestation is now estimated at 282,080 acres. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

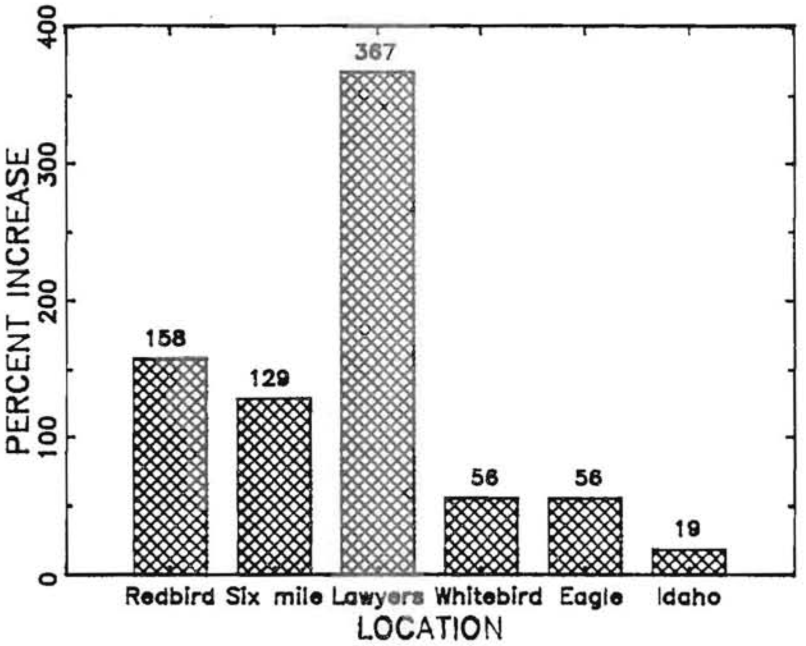

Figure 1. Expansion of yellow starthistle infestations from 1981 to 1987.

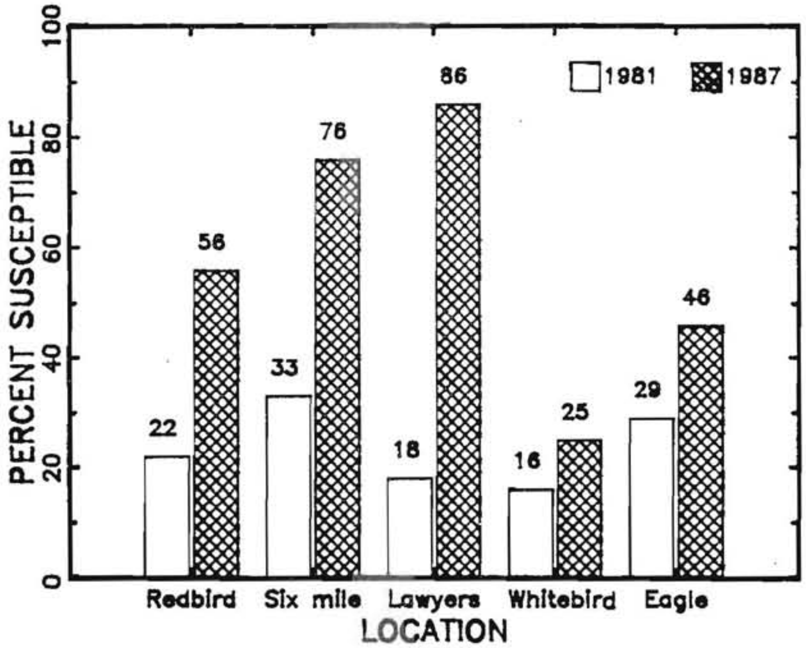

Figure 2. Area infested with yellow starthistle in northern Idaho.

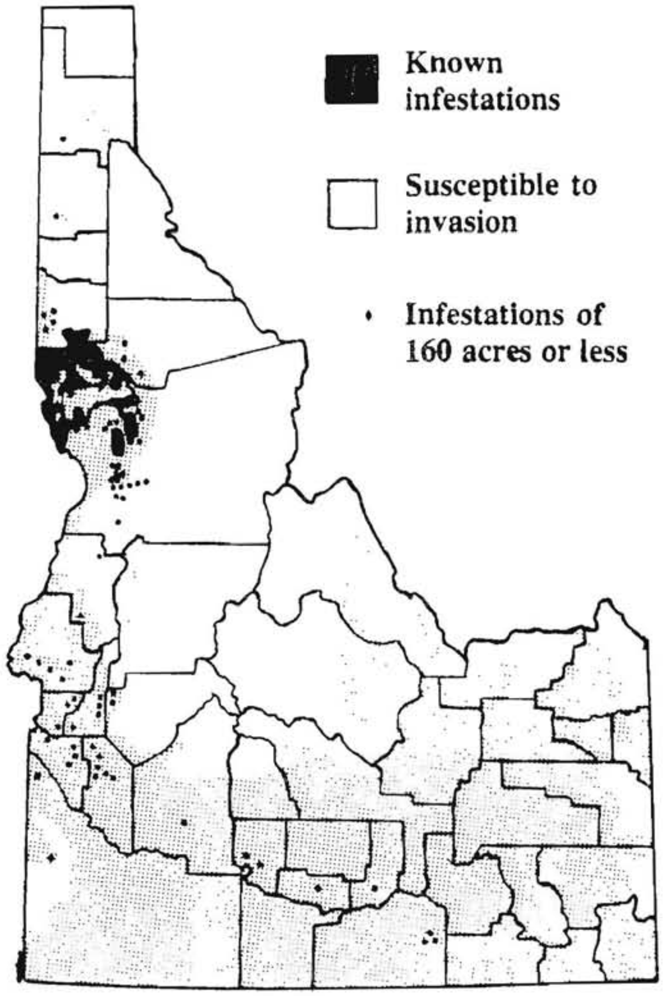

Figure 3. Known yellow starthistle infestations in Idaho.

Yellow starthistle trends in perennial and annual communities. Prather, T.S. and R.H. Callihan. This study was established to monitor yellow starthistle (*Centaurea solstitialis*) survival and mortality in both perennial grass (*Thinopyrum intermedium* ssp. *barbulatum*; *Festuca ovina*) and yellow starthistle communities. Two permanent, 1 m^2 plots were established on 12/03/1987 at each of four sites wherein one perennial grass community was paired with an adjacent yellow starthistle community. Mature yellow starthistle plants and seedlings were counted within each plot. In the perennial grass plots all yellow starthistle plants were counted; in yellow starthistle plots high plant densities precluded counting all plants, therefore, four 0.01 m^2 subsamples were counted in each plot. Data were taken on 12/02/1987.

Large differences in the number of seed-producing yellow starthistle plants were noted between the perennial grass and yellow starthistle communities at each site. At the Juliaetta sites there were nine matured yellow starthistle plants in the pubescent wheatgrass community and 725 matured yellow starthistle plants/m^2 in the yellow starthistle community. There were 26 yellow starthistle seedlings/m^2 in the pubescent wheatgrass community and 1475 yellow starthistle seedlings/m^2 in the yellow starthistle community.

The results from the Central Grade sites were comparable; six yellow starthistle plants/m^2 had set seed in the fescue community and 3200 plants/m^2 in the yellow starthistle community. No seedlings had emerged at the Central Grade site, due to a dry fall.

Most of the matured yellow starthistle plants at both locations had a single seed head and were small in stature (5-25 cm) regardless of which community they were in (data not shown). This indicates there was not good recruitment capacity in either community (e.g. no large individual plants producing thousands of seeds). (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Leafy spurge (Euphorbia esula L.) control with various herbicides. Whitson, T. D., M. A. Ferrell and A. E. Gade. Leafy spurge, a rangealnd invader, occupies considerable rangeland acreages in the Western U.S. A study was established near Sundance, WY to evaluate the efficacy of herbicides on leafy spurge on a silt loam soil (22% sand, 58% silt and 20% clay) with 1.8% organic matter and 6.3 pH. Treatment areas 10 by 27 ft were arranged in a randomized complete block design with four replications. Herbicides were applied with a CO_2 pressurized six-nozzle knapsack unit delivering 30 gpa at 45 psi to leafy spurge inthe early bloom stage. May 28, 1987 temperature, air 60F, soil surface 60F, 1 inch 55F, relative humidity 75%. Evaluations were taken June 8, 1988. Treatments providing 60% control one year after application include sulfometuron + glyphosate at 0.047 + 1.0 lb/A and picloram at 2.0 lb ai/A. Treatments containing glyphosate controlled 100% of the grasses. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Leafy spurge control with various herbicides

Herbicide[1]	App. rate lbs/ ai/acre	% Leafy spurge[2] control	% Grass suppression
sulfometuron + 2,4-D (amine)	0.047 + 1.0	0	0
sulfometuron + 2,4-D (amine)	0.063 + 1.0	0	0
sulfometuron + 2,4-D (amine)	0.094 + 1.0	0	0
sulfometuron + dicamba	0.047 + 0.5	0	0
sulfometuron + dicamba	0.094 + 0.5	0	0
sulfometuron + glyphosate	0.047 + 1.0	0	100
sulfometuron + glyphosate	0.094 + 1.0	0	100
sulfometuron + picloram	0.047 + 0.25	0	0
sulfometuron + picloram	0.063 + 0.25	0	0
sulfometuron + picloram	0.094 + 0.25	0	0
sulfometuron + fluroxypyr	0.047 + 0.5	0	0
sulfometuron + fluroxypyr	0.094 + 0.5	5	0
fosamine	6.0	54	0
fosamine	12.0	61	0
picloram	2.0	83	0
sulfometuron	0.047	0	0
sulfometuron	0.063	0	0
sulfometuron	0.094	0	0
Check	-	0	0
(LSD 0.05)		11	

[1] Herbicides were applied 5/28/87.
[2] Evaluations made 6/08/88.

PROJECT 3.

UNDESIRABLE WOODY PLANTS

Tom Lanini - Project Chairman

Cut-stump treatments on Himalayan yellow raspberry. Santos, G.L., L.W. Cuddihy, and C.P. Stone. Yellow raspberry (Rubus ellipticus Sm.), a native of tropical and subtropical India, is an evergreen shrub 2-4 m tall, densely covered with prickles 6 mm long; it can form impenetrable thickets several meters wide that crowd out native species. It is currently invading wet and mesic forests in and around Hawaii Volcanoes National Park on the island of Hawaii. Tests were established in an 'ohi'a/tree fern (Metrosideros polymorpha/ Cibotium spp.) rain forest in the Park. Treatments tested included: metsulfuron methyl (60% dry flowable), 28 gm product/l of water; triclopyr amine (3 lb ae/gal) 50% v/v in water; triclopyr ester (4 lb ae/gal) 50% v/v in diesel oil; imazapyr (2 lb ae/gal) 50% v/v in water; picloram (2 lb ae/gal) 20% v/v in water; and a commercial mix of 2,4-D and triclopyr esters (2 lb and 1 lb ae/gal respectively). Diesel oil and water were added as controls.

Sample size was 20 plants per treatment. Herbicides were applied in Oct. 1987, and results are 12 MAT. The metsulfuron, triclopyr amine and ester, and imazapyr treatments all gave excellent resprout inhibition and cambium kill. The picloram and 2,4-D/triclopyr treatments gave minimally acceptable control. With R. ellipticus, cambium kill is not a good indicator of effectiveness, as resprouts occur from the roots of dead stumps.

The fate of native plants adjacent to treated raspberry was followed in circular plots with a radius of 1 m, centered on the cut-stump. Only imazapyr and picloram had any noticeable impact on native species. In both treatments, saplings of olomea (Perrottetia sandwicensis) and pilo (Coprosma sp.) adjacent to treated stumps were killed or exhibited a marked decline in vigor. (Hawaii Field Research Center, Hawaii Volcanoes National Park, P.O. Box 52, Hawaii National Park, HI 96718)

Himalayan Yellow raspberry control in Hawaii Volcanoes National Park

Treatment	%resprouting	%cambium alive*
metsulfuron methyl 28 g/a water	5	0
triclopyr amine 50% v/v water	10	0
triclopyr ester 50% v/v diesel	10	5
imazapyr 50% v/v water	0	0
picloram 20% v/v water	35	10
2,4-D + triclopyr 50% v/v diesel oil	35**	10**
diesel oil	70	35
water	90	95

*Cambium checked at base of treated stem. With R. ellipticus, the stem could be dead to ground level; resprouting occurs from roots

**Results after 9 months

Cut-stump, frill, and basal bark treatments of triclopyr on strawberry guava. Santos, G.L., L.W. Cuddihy, and C.P. Stone. Strawberry guava (Psidium cattleianum Sabine), a small tree 2-6 m tall, is thought to have been introduced to Hawaii in 1825 from the Neotropics. It is one of the most serious weeds in Hawaii. It is capable of forming monotypic stands and displacing native plant species due to its dense growth habit and allelopathic properties. Previous research has shown triclopyr to be an effective treatment on strawberry guava in dry areas.

The cut-stump, thin-line basal bark, and continuous frill tests were set out in a koa/'ohi'a (Acacia koa/Metrosideros polymorpha) rainforest within Kipahulu Valley, a remote district of Haleakala National Park on the island of Maui in Hawaii. Rainfall in the Valley is 200-300 inches annually. Ten trees were selected in each of two size classes (1-5 cm and 6-10 cm basal diameter) for each treatment, for a total of 20 trees per treatment. The triclopyr treatments included: the ester (4 lb ae/gal) undiluted and at 5% and 50% v/v in citrus oil, and the amine (3 lb ae/gal) undiluted and at 5% and 50% v/v in water for the cut stumps; undiluted amine on the frill tests; and the ester at 50% v/v in oil for the thin-line basal bark tests. Herbicides were applied in August 1987. Results are 14 MAT.

The undiluted ester gave excellent resprout inhibition and cambium kill on the cut-stump treatments. None of the other cut-stump treatments have given adequate cambium kill. However, the cut slash has produced roots and shoots, which have negated the overall effectiveness of this technique in the test area. The undiluted amine gave excellent defoliation and resprout inhibition, but only minimally acceptable cambium kill in the frill tests. The thin-line basal bark treatment did not prove effective.

Native plant species were monitored in circular plots 2 m in diameter centered on each treated strawberry guava. No significant impacts attributed to the herbicide treatments were noted. (Hawaii Field Research Center, Hawaii Volcanoes National Park, P.O. Box 52, Hawaii National Park, HI 96718)

Strawberry guava control in Kipahulu Valley, Haleakala National Park

Treatment	% resprouting	% cambium alive
CUT STUMP		
triclopyr amine, 5% v/v in water	70	85
triclopyr amine, 50% v/v in water	30	55
triclopyr amine, undiluted	20	55
triclopyr ester, 5% v/v in oil	30	50
triclopyr ester, 50% v/v in oil	10	45
triclopyr ester, undiluted	5	5
citrus oil	85	90
water	100	100
FRILL		
triclopyr amine, undiluted	0	35
BASAL BARK		
triclopyr ester, 50% v/v in oil	35*	100

*Defoliation in the canopy varied from 0-90% at 14 months. Basal sprouts occurring near site of herbicide application

Cut-stump and frill treatments on firetree in Hawaii Volcanoes National Park. Santos, G.L., L.W. Cuddihy, and C.P. Stone. Firetree (*Myrica faya* Ait.), a tree introduced to Hawaii from the Azores, has become a serious threat to the integrity of the wet, mesic, and open dry forests of the submontane and montane regions of Hawaii Volcanoes National Park. In the past 22 years firetree has increased from a single recorded individual to an infestation of over 16,600 ha in and near the Park. Firetree, because it is a nitrogen fixer, may encourage the establishment of other alien plant species which would otherwise be less able to compete with native species in the nitrogen-poor volcanic substrates of the Park.

Research to evaluate the effectiveness of 5 herbicide treatments on firetree was conducted in 2 sites in Hawaii Volcanoes National Park: a closed-canopy wet 'ohi'a (*Metrosideros polymorpha* (Gaud.)) forest (Site A) and an open-canopy dry 'ohi'a forest (Site B). Treatments included: glyphosate (3 lb ae/gal) undiluted; imazapyr (2 lb ae/gal) at 9% v/v in water and in citrus oil; triclopyr amine (3 lb ae/gal) at 10% v/v in water; and metsulfuron methyl (60% dry flowable) at 28 gm product/l of water. Citrus oil and water controls were also added. The experiment included cut-stump applications at both sites, with an additional test of continuous-frill applications at Site A. Two size classes, based on basal diameter, were used for the tests: small (3 to 9 cm) and large ($\geq$9.5 cm). Ten trees per size class were chosen at each site, for a total of 40 trees per treatment in the cut-stump test. Twenty "large" trees per treatment were chosen for the continuous frill test. Herbicides were applied to cover the entire surface of the cut stump, while a thin stream of herbicide was introduced into the frill cut around the entire diameter of each tree in the frill test. A 1-m radius plot was established around each tree to detect possible effects of herbicides on native plant species. Cut-stump treatments were applied on June 16 to 19, 1987, at Site B, and on June 23 to 26 and July 2, 1987, at Site A. Frill applications were applied on July 7 through 13, 1987. Visual evaluations of the cambium, presence of resprouts, and vigor of firetree canopy (frill treatment only) were conducted 12 MAT.

In the site A cut-stump treatments, the metsulfuron, triclopyr, and both imazapyr treatments resulted in excellent resprout inhibition (see table). Cambium kill was excellent with metsulfuron while only acceptable with the triclopyr and imazapyr treatments. At site B, the imazapyr/water treatment gave excellent resprout inhibition and cambium kill, while metsulfuron, triclopyr, and imazapyr/oil were slightly less effective. Glyphosate was not acceptably effective at either site.

In the frill treatments, triclopyr gave complete resprout inhibition, while metsulfuron and glyphosate gave good control. Canopy defoliation was excellent for all the herbicide treatments. However, cambium kill was poor with all frill treatments, indicating the necessity for further monitoring. Monitoring will continue until 18 months post treatment. Effects on native plants have not yet been analyzed. (Hawaii Field Research Center, Hawaii Volcanoes National Park, P.O. Box 52, Hawaii National Park, HI 96718)

Herbicide treatments on firetree in Hawaii Volcanoes National Park

Herbicide	Dilution	Technique	Site**	% stumps without resprouting	% stumps with dead cambium***
glyphosate, isopropylamine salt, 3 lb ae/gal	Undiluted	Cut stump	A	55	40
		Cut stump	B	60	60
		Frill*	A	85	20
imazapyr, isopropylamine salt, 2 lb ae/gal	9% v/v in water	Cut stump	A	95	70
		Cut stump	B	90	90
		Frill*	A	50	10
imazapyr, isopropylamine salt, 2 lb ae/gal	9% v/v in citrus oil	Cut stump	A	95	75
		Cut stump	B	70	70
		Frill*	A	35	10
triclopyr, triethylamine salt, 3 lb ae/gal	10% v/v in water	Cut stump	A	90	65
		Cut stump	B	85	80
		Frill*	A	100	30
metsulfuron methyl 60% dry flowable	28 gm product/l water v/v	Cut stump	A	95	95
		Cut stump	B	75	75
		Frill*	A	80	45
water control		Cut stump	A	15	5
		Cut stump	B	0	0
		Frill*	A	30	0
citrus oil control		Cut stump	A	40	15
		Cut stump	B	5	5
		Frill*	A	0	0

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*Canopy defoliation heavy (>50%): glyphosate - 100%; imazapyr/oil - 95%; imazapyr/water - 95%; triclopyr - 95%; metsulfuron methyl - 100%; water - 5%; citrus oil - 10%

**A = closed canopy wet 'ohi'a,
B = open canopy dry 'ohi'a

***Checked at ground level

Banana poka control in Hawaii Volcanoes National Park. Santos, G.L., L.W. Cuddihy, and C.P. Stone. Banana poka (*Passiflora mollissima* (HBK) Bailey), a woody vine from South America, has become a serious problem in the montane wet and mesic forests of Hawaii. Originally introduced as an ornamental, banana poka currently infests more than 4,000 ha of the wet forests in Hawaii Volcanoes National Park on the island of Hawaii. This research was conducted to evaluate the efficacy of one mechanical (cut-only) and 6 herbicidal treatments.

Ten vines were selected for each treatment. The cut-stem technique was used on all vines. Treatments included: triclopyr amine (3 lb ae/gal) undiluted and at 5 and 50% v/v in water, and glyphosate (3 lb ae/gal) undiluted and at 5 and 50% v/v in water. Herbicides were applied immediately after cutting to the entire cut surface of the stump as well as the cut vine. One-meter radius plots were established around each stump to detect adverse effects on native plant species. Treatments were applied on August 3 to 6, 1987. Visual evaluations were conducted 12 MAT.

All treatments provided complete resprout inhibition and 100% cambium mortality (see table). Adventitious rooting of the cut vine was observed on 4 of the cut-only and 1 of the 5% glyphosate treatments. This rooting caused the reestablishment of the vine despite the death of the cut stump. None of the treatments caused severe injury to native species except individuals abutting the cut stem, which apparently received herbicidal treatment. (Hawaii Field Research Center, Hawaii Volcanoes National Park, P.O. Box 52, Hawaii National Park, HI 96718)

Banana poka control in Hawaii Volcanoes National Park

Treatment	Dilution	Resprouts (%)	Dead cambium (%)	Cut vine rooting (%)
triclopyr, triethylamine salt, 3 lb ae/gal	5% v/v in water	0	100	10
	50% v/v in water	0	100	0
	undiluted	0	100	0
glyphosate, isopropylamine salt, 3 lb ae/gal	5% v/v in water	0	100	0
	50% v/v in water	0	100	0
	Undiluted	0	100	0
cut only		0	100	40

Pacific poison oak control with herbicides in southern Oregon. Burrill, L.C., R. Mobley, and G. Tiger. Poison oak is well known as a pest in wood lots and recreation areas. That it is also a serious invader of rangeland in southern Oregon is not as well known. The land most susceptible to invasion is hill land with shallow soils and annual rainfall of less than 15 inches.

Two tests were established to compare several herbicides for effectiveness on Pacific poison oak growing under these conditions. Individual plants were selected and treated as plots. The treatments were replicated three times. The plants were sprayed on June 12, 1987, with a single adjustable-cone nozzle. Each herbicide was applied as a 2% concentration of the formulated product except picloram which was applied as a 1% mix of the product.

The summer and fall of 1987 were extremely dry which normally would create conditions not conducive to herbicide penetration and translocation. Thirteen months following treatment all of the plants were essentially dead based on visual evaluation (see table). Three plants were given a rating of 98% control because a tip of one branch was still green. We assumed that this was caused by less than complete coverage with the spray.

Perhaps it is more important that only plants treated with glyphosate consistently showed evidence of regrowth from crowns or roots. One or two of the six plants treated with picloram, dicamba plus 2,4-D, and 2,4-D had started to regrow. None of the plants treated with triclopyr had new shoots. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Pacific poison oak control in southern Oregon

Herbicide	% conc.	% control	
		Site I	Site II
glyphosate	2	99	100
triclopyr (ester)	2	100	100
triclopyr + 2,4-D (Crossbow)	2	100	100
picloram	1	99	99
dicamba + 2,4-D (Weedmaster)	2	100	100
2,4-D LVE	2	100	100

Scotch broom herbicide screening trial results testing clopyralid, imazapyr and metsulfuron.

Figueroa, Paul F.

Scotch broom (Cytisus scoparius (L.) Link) is a shrub that can impact the growth and survival of Douglas-fir (Pseudotsuga menziesii (Mirb) Franco). It is an aggressive species that can quickly colonize a site when a seed source is available.

A herbicide screening trial was established to test several new compounds on scotch broom in western Washington. Clopyralid {3,6-dichloro-2-pyridinecarboxylic acid} at four rates, imazapyr {2-[4,5-dihydro-4-methyl-4-(1-methylethyl) -5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid} and metsulfuron {2-[[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] amino]sulfonyl] benzoic acid} were applied as a June foliar treatment to evaluate control on scotch broom.

The study site was located 30 miles east of Seattle in King county at the junction of the Tokul Road and the Weyerhaeuser 4000 main line (sec 20 T24N R 8E). The study site is at 600 feet elevation on a Barneston soil series. The area was part of an old log sorting area that was planted with 2+0 Douglas-fir in spring 1985. Scotch broom on this study site averaged 4.6 feet tall (se 0.3) and covered 52% (se 4.5%) of the ground area.

The treatments tested in this study were as follows:

Treatment	Rate (lb ai/ac)
Check - no treatment	-
Clopyralid	0.125
Clopyralid	0.25
Clopyralid	0.5
Clopyralid	1.0
Imazapyr	0.5
Metsulfuron	3 oz

All treatments were applied at a solution rate of 15 gallons per acre using a multi-tip boom sprayer which sprayed a 4 foot swath. Application date was June 16, 1987. Vegetation measurements were made after one growing season on May 25, 1988. Two 1 meter square sampling plots were established in each plot. These subplots were systematically located on a diagonal across each plot. Percent cover of scotch broom was a visual estimate of ground covered by a vertical projection of live crown. Predominant mean height was recorded as a measure of the average dominant height of the shrubs.

The experimental design for this study was a randomized block design with three replications. Each of the 7 treatments were randomly assigned within a block. Treatment size was 0.005 acres which was chosen to fit within the uniform area of scotch broom cover available at that site. The hypothesis tested was herbicide treatments would not affect scotch broom total height or ground cover. Percent ground cover was transformed using a square root arcsine transformation. Treatment effects were analyzed using analysis of variance procedures described by Steel and Torrie (1980) and hypothesis tested at the 0.05 probability level.

The partitioning of degrees of freedom is shown in the following analysis of variance table:

Source of Variation	Degrees of Freedom
Blocks	2
Treatment	6
Error	12
Total	20

Results/Discussion

There were no significant differences (P=0.05) in percent ground cover between the untreated check plot and any herbicide treatments as shown in the accompanying table. Also, no significant differences in total height of the scotch broom could be detected among the treatments. While there were no significant differences, there was a general trend towards lower percentage ground cover as the rate of clopyralid was increased as shown in accompanying figure.

This herbicide screening trial demonstrated that clopyralid, imazapyr or metsulfuron, at the rates tested, would not control scotch broom when applied with a water carrier in June.
(Weyerhaeuser Company, Weyerhaeuser Research Center, 505 North Pearl street, Centralia, Wa. 98531)

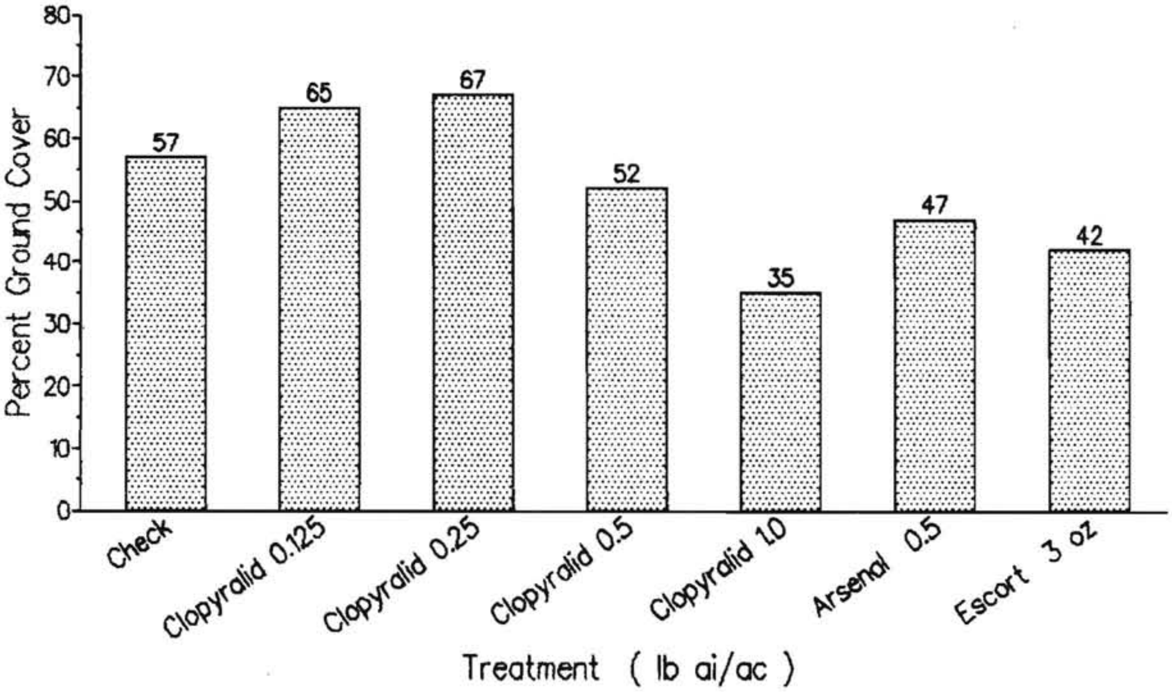
Literature Cited

Steel, R.G.D., J.H. Torrie, 1980. Principles and Procedures of Statistics. McGraw-Hill Book Company.

Scotch broom herbicide screening trial, effect of treatments one year after application

Treatment	(lbs ai/ac)	Ground Cover %	(se)	Total Height ft	(se)
Check - no treatment		57[1]	(10)	4.9[1]	(0.3)
Clopyralid	0.125	65	(9)	3.9	(0.3)
Clopyralid	0.25	67	(16)	4.9	(0.9)
Clopyralid	0.5	52	(12)	4.9	(0.3)
Clopyralid	1.0	35	(10)	4.3	(0.3)
Imazapyr	0.5	47	(13)	4.3	(0.3)
Metsulfuron	3 oz	42	(14)	4.3	(0.3)

[1] Treatment means were not significantly different using an analysis of variance at P = 0.05.



Scotch broom herbicide screening trial: percent ground covered by scotch broom one year after treatment application

Big sagebrush (Artemisia tridentata) control with fluroxypyr and 2,4-D at various application rates and dates. Whitson, T. D. and K. J. Nix. Big sagebrush, a prennial woody species, occupies over 34 million acres in Wyoming and limits forage production to 1/3 of its potential. This experiment was located on a uniform big sagebrush infestation on rangeland near Saratoga, Wyoming. Treatments were applied to 10 by 27 ft plots arranged in a randomized complete block design. Herbicides were applied with a pressurized knapsack unit delivering 30 gpa at 45 psi. June 2, 1987 temperature: air 70F, soil surface 70F, 1 inch 73F, 2 inches 79F, 4 inches 79F, with 50% relative humidity and west winds 5 to 6 mph. July 1, 1987 temperature: air 70F, soil surface 70F, 1 inch 72F, 2 inches 74F, 4 inches 80F, with 80% relative humidigy and wind 2 mph north. May 26, 1988 temperature: air 64F, soil surface 65F, 1 inch 66F, 2 inches 70F, 4 inches 77F, with 38% relative humidity and calm winds. The soil was a sandy loam (73% sand, 10% silt and 17% clay) with 1.2% organic matter and a 7.1 pH. Evaluations were taken August 30, 1988. Fluroxypyr applications made June 2, 1987 did not provide satisfactory sagebrush control. The hightest fluroxypyr rate of 0.7 lb ai/A controlled only 64% of the sagebrush, compared to 79% with 2,4-D at 2 lbs. Fluroxypyr treatments applied July 1, 1987 controlled from 4 to 31% of the big sagebrush with only 11% control with 2,4-D. Fluroxypyr treatments applied on May 26, 1988 at 0.6 and 0.7 lbs ai/A provided 90% sagebrush control which was comparable to 89% with 2,4-D. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, Wyo. 82071.)

Big sagebrush (Artemisia tridentata) control with fluroxypyr and 2,4-D (LVE) at various application rates and dates.

Herbicide	Rate lbs ai/A	Application date	Control %
fluroxypyr	0.1	6/2/87	4
fluroxypyr	0.2	6/2/87	11
fluroxypyr	0.3	6/2/87	16
2,4-D (LVE)	2.0	6/2/87	79
fluroxypyr	0.4	6/2/87	31
fluroxypyr	0.5	6/2/87	41
fluroxypyr	0.6	6/2/87	36
fluroxypyr	0.7	6/2/87	64
Check	-	6/2/87	0
fluroxypyr	0.1	7/1/87	4
fluroxypyr	0.2	7/1/87	6
fluroxypyr	0.3	7/1/87	6
fluroxypyr	0.4	7/1/87	11
2,4-D (LVE)	2.0	7/1/87	11
fluroxypyr	0.5	7/1/87	13
fluroxypyr	0.6	7/1/87	13
fluroxypyr	0.7	7/1/87	31
Check	-	7/1/87	0
fluroxypyr	0.1	5/26/88	10
fluroxypyr	0.2	5/26/88	24
fluroxypyr	0.3	5/26/88	55
fluroxypyr	0.4	5/26/88	64
fluroxypyr	0.5	5/26/88	79
fluroxypyr	0.6	5/26/88	90
fluroxypyr	0.7	5/26/88	90
2,4-D	2.0	5/26/88	89
Check	-	5/26/88	0

Control of silver sagebrush (Artemisia cana) in rangeland. Whitson, T. D., K. J. Nix and Roger Cox. Silver sagebrush, a woody perennial, has increased in many areas in the Western U.S. because of grazing with cattle. This study was established to determine if control of this resprouting shrub could be accomplished with single herbicide applications or if retreatments would be required for control. This experiment was established on a rangeland site near Sundance, WY on a sandy loam soil ((87.4% sand, 7.8% silt and 4.8% clay with a 1.1% organic matter and a pH of 7.2) which was burned in September 1987 and was densily populated with 6 to 18 inch silver sagebrush resprouts. Plots 10 by 27 ft were arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized knapsack unit delivering 30 gpa at 45 psi or a centrifugal granular spreader July 24, 1988 (temperature: air 85F, soil surface 90F, 1 inch 100F, 2 inches 103F, 4 inches 85F with a 35% relative humidity and winds S at 1 mph). Evaluations were made September 5, 1988. Applications of fluroxypyr at 2.0 lb ai/A, triclopyr + 2,4-D (LVE) at 1.0 + 2.0 lb ai/A, 2,4-D (LVE) + tebuthiuron, at 2.0 + 0.5 lb ai/A and chlorsulfuron + 2,4-D at 0.063 + 2.0 lb ai/A provided 89, 88, 85 and 91% control, respectively, one month following herbicide application. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Control of silver sagebrush in rangeland

Herbicide[1]	Rate lbs ai/A	Control[2] %
fluroxypyr	0.5	29
fluroxypyr	1.0	48
fluroxypyr	2.0	89
triclopyr	0.5	25
triclopyr	1.0	43
triclopyr	2.0	83
triclopyr + 2,4-D (LVE)	0.5 + 1.0	65
triclopyr + 2,4-D (LVE)	1.0 + 2.0	88
metsulfuron + LI700	0.06 + 0.25%	8
chlorsulfuron + LI700	0.06 + 0.25%	1
2,4-D (LVE)	2.0	80
tebuthiuron	0.5	9
tebuthiuron	0.75	18
PPG 1259	0.5	44
fluroxypyr + triclopyr	0.5 + 1.0	73
2,4-D (LVE) + tebuthiuron	2.0 + 0.5	85
chlorsulfuron + 2,4-D (LVE)	0.06 + 2.0	91
Check	-	0

[1] Treatments applied July 24, 1988.
[2] Evaluations made September 5, 1988.

<u>Imazapyr stem injection trials</u>. Cole, E.C., M. Newton, and D. Newton. Fast-growing hardwood species have the capacity to quickly dominate a forest plantation. When hardwoods reach tree size, they are often large, scattered, and difficult to control. Stem injection offers the possibility to selectively control these hardwoods. Efficacy of different formulations and concentrations of imazapyr for stem injection on four hardwood species in Oregon was evaluated. Species included bigleaf maple, red alder, Pacific madrone, and white oak, and each species was located on a different site.

Treatments were applied using the "hack and squirt" stem injection technique. Two formulations of imazapyr were used--Chopper® and Arsenal® . Chopper® was used at concentrations of 0.02, 0.06, 0.12, 0.24 kg/l, and Arsenal® was used at 0.06 kg/l. Each formulation and concentration was applied during two seasons--winter 1986 and late spring 1987. Hacking was done at three spacings of cuts around the stems--7.6, 15.2, and 22.9 cm. In addition, during the June 1987 injections, control trees were established. These trees were hacked, but had no chemical injected. Percent crown reduction was ocularly estimated for all trees in June 1988.

Stem injections with imazapyr were highly effective in reducing crown cover and vigor for all four species. With bigleaf maple, Arsenal® was more effective, June applications were better, and the higher concentrations and closest spacings had the greatest control. With red alder, spacing was more important than season, but even the widest spacings at low concentrations were effective. To obtain mortality, concentrations as low as 0.02 kg/l could be used if spacings were 7.6 cm, and perhaps even wider spacings could be used during the summer. With madrone, December applications resulted in greater crown reduction and mortality than June applications. Low concentrations could be used if applications are in winter. For white oak, a concentration of 0.06 kg/l is effective at all spacings, regardless of season. (Department of Forest Science, Oregon State University, Corvallis, OR 97331; and Lone Rock Timber Co., 2635 Old Highway 99 S, Roseburg, OR 97470)

Percent crown reduction for hardwood species

Bigleaf Maple

		June			December		
	Conc.	Spacing (cm)			Spacing (cm)		
Treatment	kg/l	7.6	15	23	7.6	15	23
Arsenal®	0.06	93	92	68	89	73	32
Chopper®	0.02	82	52	60	50	38	35
	0.06	92	74	69	58	52	25
	0.12	100	94	99	95	50	50
	0.24	100	92	94	92	98	99
Control	0	2	13	5			

Red Alder

		June			December		
	Conc.	Spacing (cm)			Spacing (cm)		
Treatment	kg/l	7.6	15	23	7.6	15	23
Arsenal®	0.06	99	99	88	100	95	92
Chopper®	0.02	94	96	99	100	73	98
	0.06	100	95	98	100	92	98
	0.12	100	99	100	100	100	83
	0.24	100	100	100	100	100	100
Control	0	2	10	0			

Pacific Madrone

		June			December		
	Conc.	Spacing (cm)			Spacing (cm)		
Treatment	kg/l	7.6	15	23	7.6	15	23
Arsenal®	0.06	100	98	77	100	98	100
Chopper®	0.02	92	80	79	100	99	97
	0.06	97	93	94	100	100	93
	0.12	100	92	100	100	100	100
	0.24	93	100	75	100	100	100
Control	0	0	3	7			

White Oak

		June			December		
	Conc.	Spacing (cm)			Spacing (cm)		
Treatment	kg/l	7.6	15	23	7.6	15	23
Arsenal®	0.06	100	100	100	100	100	100
Chopper®	0.02	86	98	70	98	90	65
	0.06	100	88	100	100	100	90
	0.12	100	100	95	100	100	100
	0.24	100	100	98	100	100	100
Control	0	15	22	28			

PROJECT 4.

WEEDS IN HORTICULTURAL CROPS

Stott Howard - Project Chairman

Competitive effects of living mulch and no-till management systems on vegetable productivity. Neilsen, J.C. and J.L. Anderson. In September 1987, a seedbed approximately 76 x 30.5 m was prepared in an area previously planted to red clover and seeded to 'Elka' perennial ryegrass. In March 1988, the sod was fertilized with a nitrogen fertilizer and 1/3 of the sodded area plowed and prepared as a seedbed. The remaining sod was mowed to 6 cm height and half of it (the no-till plots) sprayed with a tank mixture of glyphosate (1.1 kg ai/ha) and oryzalin (0.6 kg ai/ha). The sod-free seedbed was also treated with oryzalin (0.6 kg ai/ha). On May 9, 1988, plots .9 x 11 m for beans and tomatoes and 1.8 x 11 m for watermelon were laid out and .28 m strips were sprayed with glyphosate in each living mulch plot. Two days later these strips were tilled for seedbeds and similar strips prepared in the no-till plots. On May 24, 1988, 6 replicated plots in each of the cultivated, no-till and living mulch areas were seeded to 'Shamrock' snap beans and 'VF-145' tomatoes. On June 6, 'Crimson Sweet' watermelon seedlings were transplanted into each of 6 replicated plots in the 3 areas. Sod between the vegetable rows was mowed with a rotary lawn mower to 4 cm height in the living mulch plots as needed until the vine growth of the watermelons made mowing impractical. Plots were sprinkler irrigated as needed throughout the summer, generally 2-4 hrs every 5-7 days.

Bean plots were harvested 4 times during August. Comparative total yields are shown in the table. The ryegrass sod had a high water demand and suppressed vegetable growth in the living mulch plots. When plots were watered heavily to meet the sod requirements, beans in the cultivated plots receiving the same amount of water developed root rot. Consequently, bean yields in the cultivated plots were reduced to a comparable level of the living mulch plots. 1988 was a bad year for curly top virus infection in Utah, and reduced yields of infected bean and tomato plants occurred in all plots.

Tomato plots were harvested September 6 and 16. Yields in the no-till and clean cultivated plots were similar and significantly higher than those from the living mulch plots. Watermelons were harvested 7 times during August and September. No differences in watermelon earliness, number of melons or melon size between no-till and clean cultivated plots was observed. No melons had reached marketable size nor maturity in the living mulch plots when the study was terminated in late September.

Similar results were obtained in a preliminary study during 1986-87. It appears that 'Elka' perennial ryegrass is too competitive a crop to be considered as a living mulch in vegetables under the hot, arid conditions experienced in Utah during 1987 and 1988. No-till culture produced yields of three crops at least comparable to conventional clean-cultivated practices. (Utah State University, Logan, UT 84322)

Effects of living mulch and no-till culture on vegetable yields

Management Practices	Beans (kg/plot)	Tomatoes (kg/plot)	Watermelons		
			number/plot	av. wt. (kg/plot)	total yield
Living mulch	4.3 a	0.7 a	0 a	0 a	0 a
No-till	10.3 b	9.7 b	13 b	10.2 b	132.6 b
Clean cultivation	3.6 a	11.2 b	15.5 b	9.9 b	153.2 b

Values in a column followed by a common letter are not significantly different (.01 level) according to the Student-Newman-Keuls test.

Nitrogen fertilizer sprays for weed control in broccoli. Crabtree, G. D., N. S. Mansour, and S. Eskelsen. A field study was established in 1988 to further assess selective weed control in broccoli with nitrogen (N) fertilizer sprays and to evaluate the N contribution to the nutrition of the crop. Based on the program developed by Agamalian (California Agriculture Nov./Dec. 1988, p. 16-17), ammonium nitrate (AN-20), ammonium thiosulfate (am-thio) and monourea sulfuric acid (Enquik) were applied as topical sprays to various ages of broccoli. Broccoli cv. 'Gem' was seeded on April 13, April 26, and May 12 and sprayed on June 14, while a June 21 planting was sprayed on July 19. Following the foliar sprays, plots were side-dressed with varying amounts of ammonium sulfate to provide a total supply of N of 300 lb/a.

An extended period of rainy weather delayed applications to plots in the first three planting dates. The consequences of spraying large weeds and broccoli plants were poor weed control, and injury to broccoli. Wet weather also may have contributed to crop injury by causing a reduction in cuticular and epicuticular waxes by the broccoli leaves. Yield data are not reported for the April 13 planting since heads were visible at the time of spraying thereby greatly reducing yields. Less, but significant, yield reductions resulted from most of the treatments applied to broccoli seeded on the other three planting dates. Among the three fertilizer materials minimal differences were observed between AN-20 and am-thio, and the combinations of half rates of each improved selective weed control. Enquik performance was inferior in terms of crop tolerance and weed control. Low yields from treated plots resulted from injury to the crop from applied sprays and marginal weed control with surviving weeds interfering or competing with the broccoli crop. Under these conditions, soil-applied N fertilizer was a more efficient source of N compared with topical sprays. (Department of Horticulture, Oregon State University, Corvallis, OR 97331)

Weed control and broccoli yields from topical sprays of nitrogen fertilizers

Treatment	Application G/A[1]	lbs N supplied	Apr 13 planting		Apr 26 planting			May 12 planting			June 21 planting			
			AMARE[2] control	SENVU control	AMARE control	SENVU control	T/A[3]	AMARE control	SENVU control	T/A	AMARE control	SOLSA control	RAPRA control	T/A
AN-20	60	127	11	5	78	70	3.7	74	73	3.1	59	81	83	1.2
AN-20	90	190	15	9	93	73	2.9	81	73	3.3	66	80	85	1.6
am-thio	60	67	13	9	80	73	2.7	85	80	3.0	71	93	98	1.9
am-thio	90	101	9	8	80	68	2.9	81	75	2.8	80	98	98	1.2
AN-20 + am-thio	30+30	97	18	10	85	75	3.2	84	84	3.3	68	93	96	1.6
AN-20 + am-thio	45+45	145	14	16	80	75	3.0	75	88	3.6	81	95	98	2.1
Enquik	60	38-21	48	31	65	68	2.7	63	76	1.5	64	88	91	1.2
Enquik	90	57-30	63	46	70	73	1.9	79	89	0.8	68	90	88	1.0
Check (weeded)	---	---	100	100	99	100	4.0	98	98	4.0	100	91	95	3.2
LSD (0.05)			21	19	13	9	0.6	13	9	0.6	20	8	8	0.7

1) AN-20 and am-thio sprays were undiluted; Enquik sprays contained 20 and 30 gallons of the commercial product, respectively, in the 60 and 90 G/A rates for the first three plantings, and 11 and 16 gallons in the fourth planting.

2) Visual ratings of weed control (average of four replications); AMARE - redroot pigweed, SENVU - common groundsel, SOLSA - hairy nightshade, RAPRA - wild radish; 0 - no effect, 100 - complete control.

3) Yield (tons/acre) calculated from total weight of marketable heads from two harvests.

Control of annual weeds in cole crops with oxyfluorfen under plastic mulch. Draper, E.A. and J.L. Anderson. Oxyfluorfen was compared with other preemergent herbicides for weed control and safety in cole crops on a Kidman fine sandy loam at the Kaysville farm of the Farmington (Utah) Field Station. Trifluralin was applied with a carbon dioxide backpack sprayer and incorporated to a 2-inch depth with a roto-tiller May 27, 1988; other treatments were applied June 1, 1988. Eight seedlings each of 'Green Duke' broccoli, 'Market Prize' cabbage and 'Snowball' cauliflower were transplanted to a series of plots, with and without a clear plastic mulch cover June 6. Plots, measuring .9 x 12.1 m, were replicated four times and furrow irrigated as required.

Temperatures during June were so high that weeds in all plastic covered plots were controlled by solarization. Some early stunting of crop seedlings was observed, but no injury due to herbicide treatment could be measured. Differences in crop yields from clear plastic covered plots were not significantly different.

Yield differences from the plots without plastic mulch could be correlated to chemical weed control (see table). (Utah State University, Logan, UT 84322-4820)

Effects of herbicide treatment without plastic mulch on cole crop weed control

Herbicide	Rate (kg/ha)	Method	Weed Control	Yield (g/plant) Broccoli	Yield (g/plant) Cabbage	Weeds Present
DCPA	9.0	Preplant surface	3.5 b	344 ab	2338 ab	PANCA, SOLSA, ECHCG, CHEAL, AMARE
oryzalin	0.8	preplant surface	3.5 b	356 b	2372 ab	PANCA, SOLSA, CHEAL, AMARE, SETVI, ECHCG
oryzalin	1.1	preplant surface	4.3 b	322 ab	2338 ab	PANCA, SOLSA, POROL, SETVI, CHEAL
oxyfluorfen	0.6	preplant surface	8.5 c	338 ab	2792 b	ECHCG, SOLSA, PANCA, SETVI, ERACN, POROL
oxyfluorfen	1.1	preplant surface	9.8 c	361 b	2679 b	ECHCG, PANCA, SETVI
trifluralin	0.6	preplant incorp	9.8 c	378 b	3144 b	SOLSA
untreated	---	--------	0 a	293 a	1793 a	PANCA, ECHCG, SOLSA, CHEAL, ERACN, SETVI, AMARE, MALNE

Weed control rated 0-10, 10 = 100% weed control

Values within a column followed by a common letter are not significantly different (0.05) according to Student-Newman-Keuls test.

The effects of three increments of water on the mobility of dazomet in soil. Agamalian, H.S. and W. Pestemer. The biocide dazomet is a 98% active granular formulation. The application procedure requires soil incorporation to a depth of 15 to 20 cm. This experiment was conducted to study the effects of sprinkler irrigation on the efficacy of surface applied granules without soil incorporation.

Soil collected from the Biological Research Institute research areas was sifted through a 2.5 mm sieve. The soil had 10% moisture content. The soil was placed into 10 x 10 cm plastic containers. Cabbage seed (90% germination) was sown at 2, 5, 7.5, and 12 cm depths. A plastic screen was placed above the seed in order to relocate the seed. This was followed by the soil which was compressed to minimize settling. The seed was allowed to imbibe for 24 hours. The herbicide dazomet (50 g/m^2) was mixed with washed quartz sand and spread as a covering of 0.5 cm depth.

Three increments were utilized. These were 12.5, 25, and 50 mm. The water was applied with a perforated shaker device for a uniform application. Two days later, additional uniform watering was applied to maintain a water seal for 7 days.

The pots were then left to dry for 7 additional days. At the 14th day, the soils were removed to seed depth. Seed germination was evaluated for all treatments. After soil removal, an additional 7 days were used to observe subsequent cabbage seed germination, using additional overhead moisture. Final percent germination was taken at that time.

Germination of cabbage from controls were as follows (14 day) 2.5 cm depth (75%); 7.5 cm depth (62%); and 12 cm depth (50%). No germination was evident with the dazoment treatments at the 2.5 and 7.5 cm depth. One seed germinated at the 12 cm depth. Twenty-one days after treatment, the controls resulted in 83% germination at 2.5 cm, 68% at 7.5 cm and 63% at 12 cm depth. No seed germination was observed at the dazoment treatments for the 3 depths of seeding.

The results from this experiment demonstrated that a miniumum of 12 mm of water applied to surface applied dazoment, moved to a depth of 12 cm and effectively killed cabbage seed placed at that depth. (University of California Cooperative Extension, 118 Wilgart Way, Salinas, CA 93901, and Biological Research Center, Weed Research Institute, D-3300 Braunschweig, Germany)

Tolerance of four sweet corn cultivars to herbicides. Brewster, B.D., R.L. Spinney, and A.P. Appleby. DPX M6316 controls certain atrazine-resistant broadleaf weeds and DPX V9360 controls grasses when applied postemergence. A trial was conducted at Corvallis, Oregon to evaluate the tolerance of four sweet corn cultivars to these herbicides.

The trial design was a randomized complete block with five replications and 2.5 m by 7.5 m plots. Each cultivar was tested in a separate trial. Carrier volume was 234 L/ha delivered at 138 kPa through 8002 flat fan tips set in a double-overlap spray pattern. Herbicides were applied on June 7, 1988 when the corn had four leaves. Several broadleaf weed species infested the site.

None of the herbicide treatments reduced corn ear yield. Increases in ear yield in several treatments resulted from control of weeds, primarily Powell amaranth. Some slight yellowing of the corn occurred within a week after the application of the two experimental herbicides, but normal color soon returned. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Ear yield of four sweet corn cultivars following herbicide treatment

Herbicide[1]	Rate	Early Sunglow	Jubilee Supersweet	Crisp and Sweet	Jubilee
	(kg a.i./ha)	(kg/ha)			
atrazine + DPX M6316	0.5 + 0.008	18,500	23,200	29,700	25,800
atrazine + DPX M6316	1.0 + 0.016	19,300	21,300	27,900	25,200
atrazine + DPX M6316	1.5 + 0.024	20,300	19,300	27,400	24,400
DPX V9360	0.017	15,000	20,900	24,000	17,300
DPX V9360	0.035	15,900	19,900	25,400	25,800
DPX V9360	0.07	19,500	19,200	27,200	23,200
atrazine	1.1	20,100	24,600	28,500	27,400
check	0	13,800	18,100	23,600	20,500
	$LSD_{.05}$	2,800	n.s.	3,400	6,000

[1] Surfactant X-77 added to herbicide treatments at 0.25% v/v.

Cucumber herbicide evaluation. Howard, S.W., C.R. Libbey and E.R. Hall. The Environmental Protection Agency's action to prevent further use of dinoseb has caused much concern to western Washington cucumber growers. This is because the currently registered alternatives have not adequately satisfied the requirements for an effective cucumber herbicide. A trial was conducted at Mount Vernon, Washington to evaluate the tolerance of 'Pioneer' cucumbers to various herbicides.

Cucumbers were planted on June 22, 1988. Plots were 3 rows wide (spaced 50 cm apart) and 3.1 m long. The trial was a randomized complete block with four replications.

The herbicides that were most injurious to cucumbers were FMC 57020 and ethalfluralin. Injury caused by FMC 57020 was primarily related to initial transient stunting of the cucumbers during emergence. Ethalfluralin stunted and thinned the cucumbers, a condition from which they did not recover. The remaining treatments caused no significant injury to the cucumbers.

Weed control highlights were exclusively limited to plots treated with FMC 57020, cinmethylin, and DPX-M6316. Chloramben and a combination of bensulide plus naptalam did control a limited number of weeds. (Washington State University, 1468 Memorial Hwy, Mount Vernon, WA 98273)

Cucumber herbicide evaluation

				Phytotoxicity[1]			Weed Control[2]				
TREATMENT	TIME	RATE[3]	YIELD	STUNT	THIN	CIR	GWR	CAPBP	LAMAM	POLPE	CHEAL
		(kg/ha)	-(g)-								
FMC 57020	PPI	0.28	643	2.0	0.0	1.8	8.8	10.0	9.8	8.0	10.0
FMC 57020	PPI	0.56	562	2.3	0.0	2.3	9.8	10.0	10.0	9.8	10.0
FMC 57020	PPI	1.12	421	5.8	5.0	6.5	10.0	10.0	10.0	10.0	10.0
ethalfluralin	PPI	0.56	267	3.3	2.8	3.0	6.0	4.8	7.5	7.3	9.8
ethalfluralin	PPI	0.84	198	7.0	5.0	5.5	6.5	4.5	9.3	8.0	8.0
bensulide + naptalam	PPI	4.48 2.24	387	0.8	0.0	0.3	5.8	6.0	6.3	6.8	7.5
bensulide + naptalam	PPI	4.48 4.48	365	1.5	0.3	0.5	6.3	6.8	5.5	4.8	7.5
bensulide + naptalam	PPI	6.72 2.24	350	1.5	0.0	0.8	6.8	8.3	5.8	6.5	9.0
DPX-M6316	Pre	0.018	448	1.0	0.3	0.3	7.5	6.8	5.5	6.3	9.3
DPX-M6316	Pre	0.035	549	1.0	0.0	0.3	8.5	9.3	7.8	8.8	9.5
DPX-M6316	Pre	0.053	435	0.5	0.5	0.3	5.8	7.0	3.8	7.0	9.5
cinmethylin	Pre	0.28	404	2.3	0.0	0.0	6.3	7.5	4.3	7.5	10.0
cinmethylin	Pre	0.56	492	0.5	0.0	0.0	7.3	8.5	3.5	7.8	9.8
cinmethylin	Pre	0.84	435	0.5	0.0	0.0	7.5	9.3	3.3	9.3	9.8
chloramben	Pre	2.24	407	0.8	0.0	0.3	4.8	6.3	4.5	3.0	4.8
chloramben	Pre	3.36	457	1.0	0.0	0.3	6.0	6.5	4.0	4.8	9.5
bensulide	Post	2.24	316	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
bensulide	Post	4.48	296	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
bensulide	Post	6.72	273	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WEEDY CHECK			293	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSD (0.05)			208								

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[1] Phytotoxicity ratings were based on the following scale: 0 = no injury, 10 = dead crop. STUNT = stunting, THIN = thining, CIR = crop injury rating

[2] Weed contol ratings were based on the following scale: 0 = no control, 10 = complete control. GWR = general weed control rating, CAPBP = *Capsella bursa-pastoris*, LAMAM = *Lamium amplexicaule*, POLPE = *Polygonum persicaria*, CHEAL = *Chenopodium album*.

[3] Rates expressed in kg ai/ha.

Broadleaf weed control in onions. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established on April 18, 1988 to evaluate the efficacy of herbicide treatments for control of annual broadleaf weeds in spring planted onions (var. X-62). Soil type was a Kinnear very fine sandy loam with a pH of 7.8 and an organic matter content of less than 1%. Individual plots were 6 by 30 ft in size with four replications arranged in a randomized complete block design. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi. Preemergence surface (PES) applied treatments were applied April 19, 1988 and immediately incorporated with 0.75 in of sprinkler applied water. Postemergence (POST) treatments were applied May 5, 1988 when onions were in the first true leaf stage. Prostrate pigweed, kochia, and Russian thistle infestations were heavy and kochia infestations were moderate throughout the experimental area.

Visual weed control and crop injury evaluations were assessed on June 23, 1988. Prostrate and redroot pigweed control was good to excellent with all treatments. Kochia control was excellent with all treatments except oxyfluorfen applied PES at 0.2 lb ai/A and DCPA applied PES at 10 lb ai/A. Russian thistle control was good to excellent with all treatments except pendimethalin applied PES at 2.0 and 1.0 lb ai/A and DCPA applied PES at 10 lb ai/A. Pendimethalin applied PES at 1.0 lb ai/A and DCPA applied PES at 10 lb ai/A were the only treatments that did not injure onions. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Broadleaf weed control in onions

Treatment	Timing[1]	Rate lb ai/A	Crop[2] Injury	Weed Control[2] AMABL	AMARE	KCHSC	SASKR	Yield cwt/A
			%					
pendimethalin	PES	2.0	5	100	100	100	68	439
oxyfluorfen	PES	0.4	85	100	100	97	98	19
pendimethalin + oxyfluorfen	PES	1.0 + 0.2	72	100	100	100	92	182
metolachlor + bromoxynil	POST	1.0 + 0.5	45	100	100	100	99	122
oxyfluorfen + bromoxynil	POST	0.5 + 1.0	75	100	100	100	100	153
oxyfluorfen + bromoxynil	POST	0.3 + 0.5	15	100	100	100	100	593
pendimethalin + bromoxynil	PES + POST	2.0 + 1.0	75	100	100	100	100	182
oxyfluorfen	PES	0.2	74	93	100	79	96	29
pendimethalin	PES	1.0	0	92	100	98	62	388
DCPA	PES	10.0	0	91	100	53	25	185
handweeded check			0	100	100	100	100	664
check			0	0	0	0	0	8

1. PES = preemergence surface, POST = postemergence
2. Based on a visual scale from 0-100 where 0 = no control or crop injury and 100 = dead plants

Tree phytotoxicity symptoms with metolachlor in two central valley soils. Lange, A. H. and E. K. Stillwell. Nutritional condition of trees and vines have been shown to affect foliar condition and subsequent responses of trees and vines to herbicides. Metolachlor caused unexpected symptoms and injury in a small area of light soils near Balico, California with known deficiencies in calcium, magnesium, and potassium. The objective of this study was to measure the effect of soil, nutritional balance, variety and rootstock on peach tree growth and metolachlor symptom expression. Metolachlor had not shown phytotoxicity to deciduous fruit trees in early herbicide screening work, and in a large number of field tests. In the spring of 1987 after a period of heavy rainfall and in orchards utilizing more than one acre inch of flood irrigation (symptoms and injury occurred in the Balico area). Since tree injury was observed in an isolated case, this study was developed to study the low Ca - Mg - K conditions of the Balico soil. Since injury had not occurred at UC Kearney, we chose this soil as a comparison. Small 1/4 - 3/8 inch grafted trees from a commercial nursery were planted in the two soils in eighteen inch cement tile pots. One soil was from a Balico orchard where metolachlor has affected both small and large peach and nectarine trees, and small walnut trees. The tree symptoms were extremely severe from this site. The second soil was from UC Kearney, field no. 62, Fresno California where as much as sixteen pounds of metolachlor on newly planted peach trees had caused no visible effect. On March 3, 1988 three ton of dolemite plus five hundred pounds of potassium sulfate per acre rate was added (rates used by orchardists). On April 8, 1988 the metolachlor was applied suspended in four acre inches of water calculated on the basis of the pot surface area.

In about a month metolachlor symptoms were observable. The total vigor was reduced where the nutrition was lowest in the Balico soil. There was a trend for the effect of metolachlor to be less when nutrients were added. This did not appear to happen in the UC Kearney soil. By 1 1/2 months after treatment the phytotoxicity symptoms were more apparent approaching severe at the 32 pound per acre rate of metolachlor (Table 1). Varietal differences were apparent but the nutritional effects were not consistent. The Halford variety's susceptibility was even more easily observed in the 2 1/2 month evaluation. The nemagard rootstock appeared to be a little more susceptible grafted to Halford. This did not follow with Carson. Therefore, the top appeared much more affected than the rootstock. These findings suggest that Carson and other "resistant" varieties may have physiological characteristics worth studying. In the 2 1/2 month phytotoxicity evaluation the addition of increased nutrition showed less symptoms. This did not follow in the UC Kearney soil with any consistency. The 32 pound per acre rate may have overloaded the "protection" of better nutrition. By 5 months the trees in the UC Kearney soil lost significant foliage at all rates as well as the untreated check. A soil analysis indicated less calcium and potassium in the UC Kearney soil which may again suggest an interaction between herbicide phytotoxicity and nutritional deficiency (Table 2) as expressed by the response of peach trees treated with metolachlor.

The effect on tree trunk diameters was not as great as the visual symptoms and foliage condition, but did emphasize the effect of 32 pound per acre of metolachlor on some varieties in some soil nutrition situations. Averages across varieties only pointed out the effect of the excessive rate, but did not show anything consistent relative to the soil or the mineral nutrition. (Herbicide Research Institute, Reedley, CA 93654.)

Table 1. The effect of two soils, soil nutrient amendments and herbicide rates on the activity of metolachlor on young peach tree foliage.

Treatment	Lb/A	Soil	Soil Amend	Average Phytotoxicity (1 1/2 months)[1] Carson Lovell	 Carson Nemagard	 Halford Lovell	 Halford Nemagard	 Average
Metolachlor	2	UCK	-	1.0	1.0	0.2	0.8	0.75
Metolachlor	4	UCK	-	1.5	1.5	0.5	1.0	1.12
Metolachlor	8	UCK	-	2.5	2.5	2.2	2.2	2.35
Metolachlor	32	UCK	-	3.8	4.5	4.0	3.8	4.02
Check	-	UCK	-	1.5	1.0	0.5	1.0	1.00
Metolachlor	2	Balico	-	0.2	0.5	0.2	0.2	0.28
Metolachlor	4	Balico	-	1.0	0.8	0.8	1.0	0.90
Metolachlor	8	Balico	-	1.5	0.8	1.0	0.8	1.02
Metolachlor	32	Balico	-	2.2	3.5	4.0	4.2	3.48
Check	-	Balico	-	1.5	1.0	0.0	0.2	0.68
Metolachlor	2	UCK	+	1.8	1.2	0.2	0.2	0.85
Metolachlor	4	UCK	+	1.8	2.2	0.8	1.2	1.50
Metolachlor	8	UCK	+	2.2	3.0	2.5	0.0	1.92
Metolachlor	32	UCK	+	4.8	4.8	3.8	4.2	4.40
Check	-	UCK	+	1.2	1.0	0.5	0.8	0.88
Metolachlor	2	Balico	+	1.2	1.8	0.8	0.5	1.08
Metolachlor	4	Balico	+	1.8	1.8	1.8	1.2	1.65
Metolachlor	8	Balico	+	1.8	2.0	1.5	1.2	1.62
Metolachlor	32	Balico	+	3.5	4.5	2.5	2.0	3.12
Check	-	Balico	+	1.0	1.2	0.8	1.0	1.00

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[1] Average of four replications where 0 = no effect, 3 = unacceptable symptoms, 5 = terminal die back, 10 = complete top kill.

Table 2. The effect of two soils, soil nutrient amendments, and herbicidal rates on the activity of metolachlor on peach varieties.

				Average Vigor (5 months)[1]				
Treatment	Lb/A	Soil	Soil Amend	Carson Lovell	Carson Nemagard	Halford Lovell	Halford Nemagard	Average
Metolachlor	2	UCK	-	4.5	5.0	4.2	2.8	4.12
Metolachlor	4	UCK	-	5.5	4.0	3.2	2.8	3.88
Metolachlor	8	UCK	-	6.2	4.2	2.5	1.5	3.60
Metolachlor	32	UCK	-	3.2	2.8	3.8	3.5	3.32
Check	-	UCK	-	5.8	6.5	5.2	5.8	5.82
Metolachlor	2	Balico	-	9.0	7.8	8.0	5.8	7.65
Metolachlor	4	Balico	-	8.2	7.8	4.5	4.0	6.12
Metolachlor	8	Balico	-	8.0	8.8	5.8	4.8	6.85
Metolachlor	32	Balico	-	7.0	5.8	4.8	3.5	5.28
Check	-	Balico	-	8.8	7.5	8.8	8.2	8.32
Metolachlor	2	UCK	+	6.2	5.0	4.2	3.0	4.60
Metolachlor	4	UCK	+	4.8	4.2	2.8	2.8	3.65
Metolachlor	8	UCK	+	4.5	4.2	2.0	2.5	3.30
Metolachlor	32	UCK	+	4.2	2.8	3.2	3.5	3.42
Check	-	UCK	+	4.8	5.2	2.5	4.0	4.12
Metolachlor	2	Balico	+	7.5	7.0	9.0	7.2	7.68
Metolachlor	4	Balico	+	8.8	9.2	7.2	5.5	7.68
Metolachlor	8	Balico	+	7.8	8.2	7.8	5.5	7.32
Metolachlor	32	Balico	+	7.0	4.2	4.2	3.5	4.72
Check	-	Balico	+	8.2	8.0	8.2	9.0	8.35

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[1] Average of four replications where 0 = no growth and no foliage left and 10 = largest trees with the most healthy foliage.

The influences of irrigation on the activity of metolachlor when used on the soil in trees. Lange, A. H. and E. K. Stilwell. Metolachlor is an effective nutsedge control herbicide. It has been particularly useful in orchards and vineyards where nutsedge is an increasing problem, i.e. with drip irrigation. In early experiments no phytotoxicity on young trees were observed with metolachlor. Early widespread use also showed no phytotoxicity to all ages of trees except in 1987 in the Balico area in a coarse soil with low organic matter. Most of the tree injury occurred when four to six acre inches of flood irrigation water were used for incorporation, followed by heavy rainfall. Although the amount of initial irrigation influences the activity of herbicides and metolachlor has been shown to be fairly mobile in soil the amount of initial irrigation was not expected to reduce the safety of metolachlor in orchards. The objective of this study was to evaluate three levels of initial irrigation water used for incorporation on the activity of metolachlor. This affect was measured by the growth of two varieties of peaches on two rootstocks growing in a Delhi loamy sand. The two varieties, Carson and Halford grafted on Lovell and Nemagard rootstock were planted February 13, 1988 in five by five foot plots. The irrigation plots (main plots) were five by twenty feet replicated six times. The herbicides were applied on May 11, 1988 to May 14, 1988 and the water applied immediately after application. The effect of different irrigation amounts showed within a month as measured by symptoms. The symptoms were slight where one acre inch was used, even at 8 pounds per acre, but severe where four acre inches of water were used. By the middle of summer (4 months) considerable dieback was observed in the treated trees but there was regrowth from laterals. Most of the trees had recovered at 4 months in the lower rates of metolachlor in both the one acre inch and four acre inch plots. In the eight pound per acre rate and at the four acre inch irrigation trees were still smaller at 4 months. Even at these levels of herbicide and water, stunting of the trees were similar between the summer grass competition in the untreated checks and the high herbicide and irrigation rate. Little effect on total tree growth was observed when measured in October. The lower amounts of water seemed to cause the treated trees to be bigger than the weedy untreated check trees. The results suggested some of the trees that were slightly smaller were due to the eight pound per acre rate of metolachlor with one and four acre inch of water. This was somewhat more apparent in the Halford on Nemagard (H/N) trees at one and four acre inches. The averages of all varieties suggested little or no differences in one seasons growth (diameter) due to metolachlor. The excellent weed control at the end of the season coupled with minimal injury at the lower herbicide rates at the one fourth and one acre inch of water suggests that metolachlor was selective on young newly planted peach trees. Greater amounts of initial water, however were detrimental to the selectivity of metolachlor. (Herbicide Research Institute, Reedley, CA 93654.)

Table 1. The phytotoxicity response of four combinations of scion-rootstocks of young grafted peach trees to three rates of water used for incorporation of metolachlor.

		Acre	Average Phytotoxicity (1 month)[1]				
Treatment	Lb/A	Inch Water	Carson Lovell	Carson Nemagard	Halford Lovell	Halford Nemagard	Average
Metolachlor	2	1/4	1.0	1.0	0.2	0.8	0.75
Metolachlor	4	1/4	0.5	0.7	0.5	0.3	0.50
Metolachlor	8	1/4	0.2	0.2	0.3	0.2	0.21
Check	-	1/4	0.3	0.0	0.3	0.3	0.25
Metolachlor	2	1	0.2	0.2	0.5	0.2	0.25
Metolachlor	4	1	0.5	0.8	0.3	0.8	0.62
Metolachlor	8	1	1.0	0.7	2.2	1.8	1.42
Check	-	1	0.2	0.0	0.3	0.0	0.12
Metolachlor	2	4	0.3	0.5	0.5	0.5	0.46
Metolachlor	4	4	0.8	1.8	1.0	1.8	1.37
Metolachlor	8	4	3.0	3.2	2.5	3.2	2.96
Check	-	4	0.3	0.2	0.8	0.2	0.40

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[1] Average of six replications where 0 = no effect, 3 = unacceptable curvature, stem lesions and necrosis, 5 = half of the new foliage burned, 10 = all foliage burned.

Table 2. The vigor response of four combinations of scion-rootstocks of young grafted peach trees to three rates of water used for incorporation of metolachlor.

			Average Vigor (4 months)[1]				
Treatment	Lb/A	Acre Inch Water	Carson Lovell	Carson Nemagard	Halford Lovell	Halford Nemagard	Average
Metolachlor	2	1/4	7.2	7.0	7.8	8.3	7.6
Metolachlor	4	1/4	8.0	7.2	8.0	7.5	7.7
Metolachlor	8	1/4	7.8	7.8	8.0	8.7	8.1
Check	-	1/4	6.0	6.0	6.7	6.7	6.3
Metolachlor	2	1	7.8	7.8	6.5	7.2	7.3
Metolachlor	4	1	7.2	8.0	6.5	7.2	7.2
Metolachlor	8	1	7.8	7.2	7.0	6.2	7.0
Check	-	1	6.5	6.3	6.0	6.8	6.4
Metolachlor	2	4	7.2	7.3	6.7	7.3	7.1
Metolachlor	4	4	7.0	7.3	5.5	4.5	6.1
Metolachlor	8	4	6.0	6.7	6.5	6.0	6.3
Check	-	4	7.0	6.3	6.2	6.5	6.5

[1] Average of six replications where 0 = no growth and 10 - most vigorous.

Table 3. The trunk diameter response of four combinations of scion-rootstocks of young grafted peach trees to three rates of water used for incorporation of metolachlor.

Treatment	Lb/A	Acre Inch Water	Average Diameter (4 months)[1] Carson Lovell	Carson Nemagard	Halford Lovell	Halford Nemagard	Average
Metolachlor	2	1/4	14.2	14.2	15.8	15.0	14.8
Metolachlor	4	1/4	17.5	13.3	18.3	16.7	16.4
Metolachlor	8	1/4	17.5	16.7	17.5	16.7	17.1
Check	-	1/4	15.1	11.7	15.0	15.8	14.4
Metolachlor	2	1	17.5	15.0	16.7	14.2	15.8
Metolachlor	4	1	16.7	15.0	15.8	15.8	15.8
Metolachlor	8	1	16.7	12.5	16.7	14.2	15.0
Check	-	1	15.8	12.5	16.7	15.8	15.2
Metolachlor	2	4	15.8	15.0	15.8	16.7	15.8
Metolachlor	4	4	16.7	14.2	16.7	14.2	15.4
Metolachlor	8	4	17.0	14.2	16.7	14.2	15.5
Check	-	4	15.8	13.3	14.2	16.7	15.0

[1] Average diameters in millimeters taken just above the graft from six trees of each variety.

Broadleaf weed control in pumpkins. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established on May 26, 1988 at the Agricultural Science Center to evaluate efficacy of individual and/or herbicide combinations applied preemergence surface (PES) for annual broadleaf weed control in pumpkins (var. Connecticut Field). Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. Individual plots were 6 by 30 ft long in size with four replications arranged in a randomized complete block design. Pumpkins were planted in each plot on 3 ft centers. Herbicides were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi. All treatments were applied May 27, 1988 and immediately incorporated with 0.75 in of sprinkler applied water. Russian thistle, prostrate and redroot pigweed infestations were heavy and kochia infestations were moderate throughout the experimental area.

Visual weed control and crop injury evaluations were assessed July 17, 1988. All treatments gave 85 percent or better control of annual broadleaf weeds. The three way combination of trifluralin plus metolachlor plus pendimethalin applied PES at 0.5 + 1.0 + 0.5 lb ai/A caused slight pumpkin injury of 10 percent. Pumpkin yields were 22 to 36 T/A higher in herbicide treated plots compared to the check. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Broadleaf weed control in pumpkins

Treatment	Rate lb ai/A	Crop Injury[1]	Weed Control[1] AMABL	AMARE	KCHSC	SASKR	Yield T/A
		%	%	%	%	%	
pendimethalin	1.0	0	100	100	98	95	88
trifluralin	1.0	0	100	100	100	93	88
pendimethalin + metolachlor	0.5 + 1.0	0	100	100	96	87	90
bensulide	5.0	0	100	100	97	85	95
ethalfluralin	1.0	0	100	100	98	93	83
trifluralin + metolachlor + pendimethalin	0.5 + 1.0 + 0.5	10	100	100	100	97	86
trifluralin + ethalfluralin	0.5 + 0.5	0	100	100	99	84	93
ethalfluralin + metolachlor	0.5 + 1.0	0	100	100	97	93	96
trifluralin + metolachlor + pendimethalin	0.25 + 0.5 + 0.25	0	99	100	99	88	94
trifluralin + metolachlor	0.75 + 1.0	0	99	99	100	90	82
handweeded check		0	100	100	100	100	92
check		0	0	0	0	0	60

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[1] Based on a visual scale from 0–100 where 0 = no control or crop injury and 100 = dead plants

Hairy nightshade control in radish seed production. Boydston, R. A. Hairy nightshade is a serious weed problem in radish grown for seed. Currently trifluralin and DCPA are the only herbicides registered for use in radish seed production and both fail to control nightshade species. This work was conducted to evaluate herbicides for selective control of nightshade species in radish grown for seed.

Experiments were conducted on a furrow irrigated silt loam soil near Connell, Washington. The experiment was a randomized complete block design with four replications. Plots were 3.3 m wide by 6.4 m long. Spray volume was 280 L/ha delivered at 276 kPa pressure through 8002 flat fan nozzles. Herbicides were applied on March 22, May 10, May 27, and June 9, 1988. Radish was planted on March 22, 1988. Herbicides applied preplant on March 22, 1988, were incorporated 7.5 cm deep with a power driven rotovator or 6 cm deep with a tine tooth power harrow. Herbicides applied May 10 and May 27, 1988, were incorporated only in the inter-row area using either a rolling cultivator or a harrow. 2,4-DB was applied postemergence on May 10, May 27, and June 9, 1988, when the radish was 6.5 cm, 15 cm, and 50 cm tall, respectively, and was not mechanically incorporated. Cycloate was also applied through injector shoes 10 cm deep. All plots were cultivated with a rotary hoe in May and again in mid-June, so final nightshade counts reflect only intra-row populations. Nightshade populations were sparse, less than 1 per m^2 and variable.

Alachlor injured radish slightly at 3.4 and 5.0 kg ai/ha, but did not reduce radish stand counts significantly (Table 1). Alachlor tended to injure radish more when incorporated with a power harrow than when incorporated with a rotovator. Cycloate at 2.2 and 3.4 kg ai/ha incorporated with a rotovator caused visual injury to the radish and at 3.4 kg ai/ha reduced the radish stand (Table 1). Neither cycloate injected 10 cm deep on both sides of the seed row nor EPTC injured radish at the rates tested. Radish seed yield and hairy nightshade density were not significantly different between treatments.

Postemergence applications of 2,4-DB injured radish temporarily, but radish seed yield was not reduced (Table 2). Chloramben and EPTC applied broadcast in May and incorporated in the inter-row area with a harrow did not affect radish seed yield compared to a cultivated check. Plots treated with 2,4-DB tended to have lower intra-row hairy nightshade populations than other postemergence treatments and the cultivated check, but differences were not statistically significant. (USDA-ARS in affiliation with Washington State University, IAREC, Prosser, WA 99350)

Table 1. Radish seed yield and hairy nightshade control with herbicides

Application date	Herbicide	Rate	Incorporation	Radish stand counts 4 WAT[1]	Seed yield	SOLSA density 7/14/88
		(kg/ha)		(no./m)	(kg/ha)	(plants/plot)
3/22/88	alachlor	1.7	rotovator	5.1 bc	607	3.8
		3.4		4.6 bc	728	1.8
		5.0		4.3 bc	846	1.0
		1.7	power harrow	4.3 bc	754	1.4
		3.4		3.7 c	725	0.0
		5.0		4.3 bc	721	11.5
3/22/88	cycloate	1.1	rotovator	5.0 bc	850	2.0
		2.2		4.1 bc	730	0.0
		3.4		3.3 c	706	0.0
		1.1	injector shoes	7.6 a	735	4.3
		2.2		5.7 b	530	14.3
		3.4		5.6 b	775	3.8
5/10/88	alachlor	1.7	rolling cultivator	-	700	4.5
		3.4		-	493	3.8
		5.0		-	484	3.8
		1.7	harrow	-	560	9.0
		3.4		-	559	4.5
		5.0		-	597	14.0
5/10/88	EPTC	2.2	rolling cultivator	-	707	11.5
		3.4		-	699	9.0
		2.2	harrow	-	536	4.5
		3.4		-	881	10.0
	Cultivated check			5.7 b	678	7.1
					N.S.	N.S.

[1] Means within a column followed by the same letter are not significantly different using protected LSD at the 5% level.

Table 2. Radish seed yield and hairy nightshade control with herbicides applied postemergence to the crop

Application date	Herbicide	Rate	Incorporation	Seed yield	SOLSA density 7/14/88
		(kg ai/ha)		(kg/ha)	(plants/plot)
5/10/88	2,4-DB amine	0.6	None	594	0.3
		1.1		865	2.8
5/27/88	2,4-DB amine	0.6	None	772	0.5
		1.1		964	0.5
6/9/88	2,4-DB amine	0.6	None	1000	0.8
		1.1		670	0.0
5/10/88	chloramben	2.8	harrow	522	2.3
		4.5		848	3.0
5/27/88	chloramben	2.8	harrow	691	3.0
		4.5		610	0.3
5/27/88	EPTC	2.2	harrow	536	14.0
		3.4		690	7.0
	cultivated check			678	7.1
				N.S.	N.S.

Weed control in baby Scotch spearmint. Boydston, R. A. Mint production is an important industry to the Pacific Northwest states. Weed control in mint continues to be a major problem for the industry. Weeds can reduce both the yield and quality of mint oil. This work was conducted to compare the efficacy and selectivity of several herbicide treatments in first year mint.

Experiments were conducted on a silt loam near Prosser, Washington. The experiment was a randomized complete block design with four replications. Plots were 3.2 m wide by 9.1 m long. Spray volume was 280 L/ha delivered at 276 kPa pressure through 8002 flat fan nozzles. Preemergence herbicides were applied March 30, 1987, and April 14, 1988, without mechanical incorporation. Postemergence herbicides were applied May 5, 1987, and May 17, 1988. Mint was planted in mid-March and was just beginning to emerge when herbicides were applied preemergence and averaged 10 cm tall when they were applied postemergence. Plots were furrow irrigated beginning in mid-April. Mint injury and weed control were estimated visually on June 10, 1987, and on June 8, 1988.

Clomazone and norflurazon injured baby mint in 1987. Injury was not excessive and did not appear to reduce mint growth by midsummer. Barnyardgrass, redroot pigweed, and common lambsquarters control was good to excellent with all herbicides applied preemergence except trifluralin (Table 1). Weed control was equally poor with trifluralin formulated as Treflan TR10 granules or as 5% starch xanthate. The lack of rain for 3 weeks following the application of trifluralin granules in 1987 probably contributed to the lack of trifluralin performance.

In 1988, 1.3 cm rain fell 3 days after preemergence herbicide applications. Cinmethylin controlled redroot pigweed and common lambsquarters less than terbacil, pendimethalin, and prodiamine in 1988.

Postemergence herbicides tended to injure mint more than preemergence herbicides. In 1987, AC222-293 injured mint excessively and did not control weeds well (Table 2).

Clopyralid caused terminal leaf cupping in baby mint, but overall growth of the mint appeared normal in both years. In 1988, terbacil, bromoxynil, and combinations of pyridate or bromoxynil with terbacil injured mint slightly. However, mint growth appeared equal to untreated checks later in the summer. In 1988, bromoxynil and terbacil combinations injured mint more than other treatments.

Of the herbicide combinations applied postemergence, only those containing terbacil controlled barnyardgrass (Table 2). Pyridate partially controlled barnyardgrass that was emerged at the time of application.

All herbicides with the exception of clopyralid and AC222-293 controlled redroot pigweed and common lambsquarters. In 1987, bromoxynil, bentazon, and pyridate controlled redroot pigweed initially (data not presented), but subsequent flushes of redroot pigweed germination were unaffected as reflected in the poorer control ratings. (USDA/ARS in affiliation with Washington State University, IAREC, Prosser, WA 99350).

Table 1. Mint injury and weed control with herbicides applied preemergence

Herbicide	Rate	Mint injury		ECHCG[1] control		AMARE control		CHEAL control	
		1987	1988	1987	1988	1987	1988	1987	1988
	(kg ai/ha)	(%)							
terbacil	0.9	0 c	0	98 a	98 a	91 a	100 a	99 a	100 a
pendimethalin	1.1	0 c	0	88 abc	98 a	80 a	92 b	86 a	98 a
cinmethylin	1.1	0 c	0	99 a	100 a	78 a	75 c	84 a	77 b
prodiamine	2.2	0 c	0	92 ab	99 a	93 a	98 ab	85 a	98 a
clomazone	1.1	12.5	-	99 a	-	77 a	-	99 a	-
norflurazon	2.2	15.0 a	-	99 a	-	90 a	-	53 b	-
trifluralin[2]	0.6	0 c	-	68 bc	-	40 b	-	13 cd	-
trifluralin[2]	1.1	0 c	-	65 c	-	35 b	-	28 bcd	-
trifluralin[3]	0.6	0 c	-	38 d	-	35 b	-	30 bc	-
trifluralin[3]	1.1	0 c	-	72 bc	-	46 b	-	29 bcd	-
check	-	0	-	0	-	0	-	0	-

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[1] Means within a column followed by the same letter are not significantly different using Fischer's protected LSD at the 5% level.

[2] Formulated as Treflan TR-10 granules.

Table 2. Mint injury and weed control with herbicides applied postemergence

Herbicide	Adjuvant[1]	Rate	Mint injury[2]		ECHCG control		AMARE control		CHEAL control	
			1987	1988	1987	1988	1987	1988	1987	1988
		(kg ai/ha)	(%)							
AC 222-293	X77	0.5	95 a	-	20 c	-	24 d	-	36 c	-
bentazon	COC	1.0	0 c	-	10 cd	-	65 bc	-	99 a	-
bentazon + terbacil	COC	0.75 + 0.25	0 c	-	99 a	-	97 a	-	99 a	-
bentazon + terbacil	COC	0.5 + 0.5	0 c	-	99 a	-	100 a	-	100 a	-
bromoxynil	X77	0.25	-	8 bc	-	0 c	-	98 a	-	100 a
bromoxynil	X77	0.38	0 c	8 bc	14 cd	0 c	65 bc	98 a	100 a	100 a
bromoxynil + terbacil	X77	0.25 + 0.25	-	9 ab	-	92 a	-	100 a	-	100 a
bromoxynil + terbacil	X77	0.25 + 0.5	-	13 a	-	98 a	-	100 a	-	100 a
clopyralid +	X77	0.13	13 b	5 bcd	0 d	0 c	35 d	0 b	80 b	0 c
clopyralid	X77	0.25	14 b	8 bc	0 d	0 c	60 c	0 b	55 c	67 b
clopyralid + terbacil	X77	0.13 + 0.25	-	8 bc	-	78 b	-	97 a	-	100 a
pyridate	None	0.9	0 c	0 d	78 b	10 c	81 ab	98 a	99 a	98 a
pyridate + terbacil	COC	0.9 + 0.25	0 c	3 cd	100 a	90 a	99 a	98 a	100 a	97 a
terbacil	COC	0.8	0 c	8 bc	100 a	97 a	99 a	99 a	100 a	100 a

[1] COC added at 1% v/v spray solution, X77 nonionic surfactant added at 0.25% v/v solution.
[2] Means within a column followed by the same letter are not significantly different using Fischer's protected LSD at the 5% level.

Influence of field bindweed competition on processing tomatoes. Lanini, W.T. and E.M. Miyao. Studies were conducted near Woodland, CA to evaluate two factors in field bindweed competition with processing tomatoes; (1) length of field bindweed exclusion, and (2) cultivation frequency. Treatments were replicated four times in a randomized complete block design with each plot containing a single row of tomatoes and measuring 1.5 m x 30 m. Tomatoes were planted April 24, 1988 and emerged May 8, 1988. Field bindweed exclusion periods represented time after tomato emergence.

Excluding field bindweed for periods of 4 weeks or longer reduced field bindweed cover significantly compared to shorter periods of exclusion (Table 1). Field bindweed exclusion period of just two weeks was enough to significantly increase yields of red tomatoes (Table 2), however, 6 weeks or longer was required to improve brix.

Cultivation frequency compared cultivation at two week intervals to plots cultivated twice at various timing intervals. It appears two cultivations can effectively suppress field bindweed (Table 3) and increase yields and brix (Table 4) compared to untreated check plots. (Botany Department, University of California, Davis, CA 95616 and Cooperative Extension, Woodland, CA 95695)

Table 1.

Field bindweed cover and proportion of tomato plant shading as influenced by field bindweed exclusion period

Field bindweed exclusion period (wks)*	Field bindweed cover (%)**			% of tomato plant shaded by field bindweed leaves
	5/27	6/20	7/19	7/19
0	16 a	56 a	56 a	77 a
2	2 b	20 b	28 b	43 b
4	2 b	4 c	6 c	13 c
6	0 b	0 c	4 cd	8 cd
8	1 b	1 c	0 d	2 de
10	0 b	0 c	0 d	0 e
Full Season	2 b	1 c	0 d	0 c

* Field bindweed exclusion period began on May 8, 1988. Plots were cultivated at two week intervals as needed.

** Values in a column followed by the same letter are not significantly different as determined by a LSD test at the 5% level.

Table 2.

Tomato fruit yield and quality as affected by field bindweed exclusion period

Field bindweed exclusion period (wks)*	Yield (tons/a)**			
	Reds	Greens	Rots	Brix (%)
0	10.0 b	2.9 a	0 a	4.78 b
2	14.4 a	3.1 a	0.1 a	4.80 b
4	15.2 a	3.1 a	0.2 a	4.82 b
6	17.7 a	1.7 a	0.3 a	4.92 a
8	15.4 a	2.5 a	0.5 a	5.00 a
10	14.5 a	3.5 a	0.5 a	4.98 a
Full Season	15.2 a	2.2 a	0.5 a	4.98 a

* Field bindweed exclusion period began on May 8, 1988. Plots were cultivated at two week intervals as needed.

** Values in a column followed by the same letter are not significantly different as determined by a LSD test at the 5% level.

Table 3.

Field bindweed cover and proportion of tomato plant shading as influenced by field bindweed exclusion timing

Cultivation timing (wks)*	Field bindweed cover (%)** 5/27	6/20	7/19	% of tomato plant shaded by field bindweed leaves 7/19
2,4,6,8	1.4 b	1.4 c	.3 b	1.7 b
4,8	19.3 a	7.1 bc	1.4 b	5.0 b
2,8	1.4 b	12.0 b	1.6 b	5.0 b
Weedy check	15.9 a	56.2 a	56.4 a	76.6 a
Weed free check	1.7 b	.8 c	.2 b	0 b

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* Field bindweed exclusion period began on May 8, 1988. Plots were cultivated at two week intervals as needed.

** Values in a column followed by the same letter are not significantly different as determined by a LSD test at the 5% level.

Table 4.

Tomato fruit yield and quality as affected by field bindweed exclusion timing

Cultivation timing (wks)*	Yield (tons/a)** Reds	Greens	Rots	Brix (%)
2,4,6,8	15.4 a	2.5 a	.5 a	5.00 a
4,8	13.9 a	3.3 a	.1 a	4.95 a
2,8	15.3 a	4.0 a	.4 a	5.08 a
Weedy check	10.0 b	2.9 a	0 a	4.78 b
Weed free check	15.2 a	2.2 a	0.5 a	4.98 a

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* Field bindweed exclusion period began on May 8, 1988. Plots were cultivated at two week intervals as needed.

** Values in a column followed by the same letter are not significantly different as determined by a LSD test at the 5% level.

Black nightshade control with soil solarization. Elmore, C.L. and J.A. Roncoroni. Black nightshade, *Solanum nigrum* (SOLNI), has not been controlled selectively in processing tomatoes with current methods. To evaluate a non-pesticide method of nightshade control, black nightshade seeds were planted at a rate of 25 seeds/ft of bed. The seeds were scattered onto moist soil and incorporated with a power tiller to a depth of 3 inches on June 26, 1987. Polyethylene mulch (1.5 mil thickness) was mechanically applied on June 26, 1987, to a wet soil, and remained intact for a period of six weeks (removed August 10, 1987). Processing tomatoes var. 'U.C. 204C' were planted with a John Deere percision planter in two rows (1 seed/3 inches of bed) on a 60 inch bed on April 12, 1988. Napropamide was applied at 2 lbs ai/a on April 16, 1988 and sprinkler irrigated on April 18, 1988. Sprinkler irrigation was applied as needed until the tomatoes were established, furrow irrigation was then used until harvest.

This trial was designed with paired beds (two beds solarized and two beds unsolarized) and replicated 6 times. Within each of the 6 replications one solarized plot and one unsolarized plot were treated with napropamide, while one plot each was left untreated.

Black nightshade counts and fresh weights were taken on July 8, 1988 by removing all weeds from the 20 ft. by 5 ft. plots. Tomatoes were harvested on September 8, 1988 by hand from the center 15 ft. then counted and weighed.

RESULTS: The number and total weight of black nightshade plants were significantly reduced with the use of soil solarization. There was an increase in the number of nightshade plants in the napropamide treated plots of both the solarized and unsolarized plots. This was due to the reduced competition on the nightshade by other weeds mostly barnyardgrass (ECHCG) because of the napropamide treatment.

The number and weight of red tomatoes in the solarized plots was significantly increased over that of the unsolarized plots and was unaffected by the herbicide treatment due to the low numbers of nightshade and other weeds. There was no significant difference in the number and weights of the pink and green tomatoes. The higher number of rots in the solarized plots could be due to an earlier ripening of the tomatoes due to reduced weed competition. (University of California, Cooperative Extension, Department of Botany, Davis, CA 95616)

Black nightshade control and the effect on tomato fruits with or without soil solarization and napropamide

	Black nightshade		Red tomatoes		Pink tomatoes		Green tomatoes		Rot tomato
	Number	Grams	Number	lbs.	Number	lbs.	Number	lbs.	lbs.
SOLARIZED									
napropamide	7.5 A	508 A	220 A	28 A	36	3.2	166	10	8.6 A
untreated	3.7 A	434 A	203 AB	27 A	36	4	215	14	6.2 B
UNSOLARIZED									
napropamide	102.8 B	6511 B	99 BC	11 B	32	2.4	224	11.5	4.6 B
untreated	88.5 B	1959 A	56 C	6 B	32	2.3	211	12.5	1.8 C
significant					NS	NS	NS	NS	

All means with the same letter are not sig. dif. at 0.5% level using Duncan's Multiple Range Test

Response of hairy nightshade and canning tomato variety Castle Rock 489G to postemergence applications of metribuzin. Orr, J. P. Hairy nightshade is a major broadleaf weed problem in tomatoes grown throughout California. This research was conducted in Sacramento to compare various rates of metribuzin applied to tomatoes in the 2-3 and 3-4 leaf stage. On May 3 and May 11, 1988, at Takemori Farms, metribuzin was applied postemergence to tomatoes in the 2 to 3 leaf stage and hairy nightshade in the cotyledon to three true leaf stage (Table 1). Tomatoes were grown in a sandy loam soil and furrow irrigated. A second application was made one week later to tomatoes and nightshade in the 3 to 4 leaf stage. Application was with a CO_2 backpack sprayer, 30 gal/a water, and replicated four times.

The experiment was a randomized complete block and split plot design with four replications. Plots were one row by 30 feet with subplots 10 feet in length. Metribuzin was applied May 3 and May 11 with a CO_2 back pack sprayer in 30 and 90 gal/a. Visual evaluations were made on May 11 and May 17.

Metribuzin at 0.20 lb ai/a gave 85% control of hairy nightshade with a 15% tomato vigor reduction and a phytotoxic necrosis rating of 2. Rates above 0.20 resulted in increased weed control but unacceptable tomato stand and vigor reduction and phytotoxicity ratings.

An application one week later to tomatoes in the 3 to 4 leaf stage and nightshade in the 3 leaf stage (Table 2) at 0.50 and 0.75 lb ai/a gave 45% and 78% control, respectively, with no stand or vigor reduction with slight phytotoxicity, and a 1.8 phytotoxic rating at the 0.75 lb ai/a rate.

On May 11, 1968, plots were divided into three sections (Table 3). Section A was treated a second time at 0.125 lb ai/a, Section B at 0.20 lb ai/a a second time, and Section C at the single original treatment.

In general, the second application of metribuzin at 0.125 lb ai/a did not increase the nightshade control. The second application at 0.20 lb ai/a significantly increased hairy nightshade control. Rates of 0.225 + 0.20 lb ai/a gave 88% control, no stand reduction, and phytotoxicity rating of 2. A rate of 0.15 + 0.20 lb ai/a gave 83% control, no stand reduction, 28% vigor reduction, and a phytotoxicity rating of 2. A single application at 0.5 lb ai/a applied to tomatoes in the 3 to 4 leaf stage and nightshade in the 3 leaf stage in 30 gal/a water gave 85% control with minimal vigor reduction and phytotoxicity. A 0.75 lb ai/a treatment in 90 gal/a water gave 80% control with minimal vigor reduction and phytotoxicity. (University of California Cooperative Extension, Sacramento County, 4145 Branch Center Road, Sacramento, CA 995827)

TABLE 1

Tomatoes 2-3 leaf, nightshade 1-3 true leaf

Chemical	Rate[2]	Weed Control	Stand	Vigor	Phytotoxicity[3]
		Ratings[1]			
		(05/11)			
metribuzin	0.09	0.0	0.0	0.0	0.4
metribuzin	0.12	4.5	0.0	1.3	1.3
metribuzin	0.15	5.0	0.0	1.1	1.1
metribuzin	0.175	5.6	0.0	1.3	1.1
metribuzin	0.20	8.5	0.0	1.5	2.0
metribuzin	0.225	8.0	0.0	1.5	1.8
metribuzin	0.25	7.9	1.0	2.4	4.0
metribuzin	0.50	9.4	2.8	3.8	4.0
metribuzin	0.75	9.3	6.0	6.5	7.3
control	----	0.0	0.0	0.0	0.0

[1] 0 = no weed control; no crop damage
10 = 100% weed control; crop dead

[2] Rate is expressed as lb ai/a

[3] Necrosis: 0 = none
3-5 = moderate
>5 = severe

TABLE 2

Tomatoes 3-4 leaf; nightshade 1-3 true leaf

Chemical	Rate[2]	Weed Control	Stand	Vigor	Phytotoxicity[3]
		Ratings[1]			
		(05/17)			
metribuzin	0.50	4.5	0.0	0.0	0.0
metribuzin	0.75	7.8	0.0	0.5	1.8
control	----	0.0	0.0	0.0	0.0

[1] 0 = no weed control; no crop damage
10 = 100% weed control; crop dead

[2] Rate is expressed as lb ai/a

[3] Necrosis: 0 = none
3-5 = moderate
>5 = severe

TABLE 3

Plots divided into three sections

		Ratings[1]			
Chemical[2]	Rate[3]	Weed Control	Stand	Vigor	Phyto-toxicity
		(05/17)			
A metribuzin	0.09+0.125	2.3	0.0	0.8	0.3
B metribuzin	0.09+0.20	6.5	0.0	2.3	1.7
C metribuzin	0.09	3.8	0.0	1.3	0.8
A metribuzin	0.12+0.125	6.0	0.0	2.3	1.3
B metribuzin	0.12+0.20	8.1	0.0	3.0	1.8
C metribuzin	0.12	5.3	0.0	2.3	1.3
A metribuzin	0.15+0.125	5.8	0.0	2.0	1.3
B metribuzin	0.15+0.20	8.3	0.0	2.8	2.0
C metribuzin	0.15	5.8	0.0	1.8	0.5
A metribuzin	0.175+0.125	4.5	0.0	2.5	1.5
B metribuzin	0.175+0.20	7.5	0.0	3.0	2.0
C metribuzin	0.175	6.8	0.0	2.0	2.0
A metribuzin	0.20+0.125	8.5	0.0	2.3	1.5
B metribuzin	0.20+0.20	9.4	3.3	1.8	---
C metribuzin	0.20	7.0	0.0	2.3	1.3
A metribuzin	0.225+0.125	6.8	0.0	2.3	1.8
B metribuzin	0.225+0.20	8.8	0.0	3.3	2.0
C metribuzin	0.225	6.3	0.0	2.0	1.5
A metribuzin	0.25+0.125	5.3	0.0	3.3	2.0
B metribuzin	0.25+0.20	8.9	1.8	4.3	2.8
C metribuzin	0.25	7.3	0.0	2.5	1.8
metribuzin	0.50	8.5	0.5	2.8	1.5
metribuzin	0.75	8.5	4.3	4.8	3.3
A metribuzin	0.5*	5.3	0.0	1.5	1.5
B control	----	0.0	0.0	0.5	0.0
C metribuzin	0.75*	8.0	0.0	2.5	2.0

[1] 0 = no weed control; no crop damage
10 = 100% weed control; crop dead

[2] A and B were applied 05/11/88
C was applied on 05/03/88

[3] Rate is expressed as lb ai/a

* 90 GPA

Multiple postemergence herbicide applications for kikuyugrass control. D. W. Cudney , J. S. Reints, C. E. Engle and and C. L. Elmore. Kikuyugrass(Penisitum clandestinum) is a serious weed problem for turf managers. Kikyugrass is well adapted to the Mediterranean climate of California's coastal and intercoastal moutain valleys. It is extremely aggressive in these regions, often crowding out both cool- and warm-season turf species. The following trial was established in a hybrid bermuda (Cynadon dactylon var. Santa Ana) sward which was undergoing invasion from kikuyugrass. Both herbicides used in this test are registered for use in bermuda. It was postulated that a combination of the two or sequential applications of these herbicides might be more effective than single applications.

The first application was made on July 15, 1988. Three more applications followed for the sequential treatments at two week intervals. All applications were made using a constant pressure CO_2 backpack sprayer with a spray volume of 50 gal/A. All treatments with MSMA were applied at 2.0 lbs ai/A. Metribuzin was used at 0.25 and 0.5 lbs ai/A alone and in combination with MSMA for the single applications. Both 0.25 and 0.5 lbs ai/A were tested in combination with MSMA for the sequential combination treatments. MSMA and 0.5 lbs ai/A metribuzin were tested singlely for both types of application. In addition, a low rate of metribuzon was tested (0.25 lbs ai/A) for the single application. All treatments were replicated four times in a completely randomized block design.

Bermuda injury after treatment was similar for all application dates with the combination high rate of metribuzin plus MSMA showing the most bermuda injury followed by the lower rate of metribuzin plus MSMA and MSMA alone. Metribuzin applied alone did not cause excessive phytotoxicity. Bermuda tended to recover within the two week period prior to the next sequential application. By the third treatment, kikuyugrass density was most reduced by the MSMA and sequential application treatments containing MSMA and metribuzin. After the fourth application, kikuyugrass ratings suggested best control achieved by the sequential treatment of metribuzin plus MSMA and MSMA alone. Metribuzin applied alone did not control kikuyugrass. These encouraging results support continued testing of sequential treatments with the use of MSMA and MSMA plus metribuzin. (University of California, Riverside, Botany and Plant Sci. Dept., Riverside, CA 92521.)

Multiple postemergence herbicide applications for kikuyugrass control

Treatment	lb ai/A	bermudagrass[1] Phytotoxicity 7/29/88	kikuyugrass[2] Density 8/26/88	kikuyugrass[3] Control 9/23/88
MSMA	2.00	3.00	1.67	6.00
metribuzin	0.25	2.20	4.30	1.80
metribuzin	0.50	2.40	8.80	0.60
metribuzin +MSMA	0.25 2.00	5.00	9.17	4.40
metribuzin +MSMA	0.50 2.00	6.40	5.73	4.20
metribuzin +MSMA(4x)	0.25 2.00	5.00	1.50	8.70
metribuzin +MSMA	0.50 2.00	6.20	2.87	8.40
MSMA(4x)	2.00	3.20	1.30	7.00
metribuzin(4x)	0.50	2.00	7.73	3.80
control		0.40	16.83	0.60
LSD(5%)		2.15	8.16	3.00

[1] bermudagrass phytotoxicity: 0 = no effect; 10 = all Bermudagrass dead.

[2] kikuyugrass density: plants/500 cm^2.

[3] kikuyugrass control: 0 = no control; 10 = all kikuyugrass dead.

Tolerance of 'el toro' zoysiagrass to selected postemergence herbicides. Cudney, D.W., C. Elmore, V.A. Gibeault and S. Cockerham. A new, superior variety of zoysia, 'El Toro,' has been released by the University of California. 'El Toro' zoysia has not been commonly grown in southern California. Therefore, it is important to evaluate the tolerance of the new 'El Toro' zoysia variety to the commonly used postemergence turf herbicides.

Postemergence herbicides similar to those reported in the 1987 Progress Report were established on August 4, 1988 to a sward of 'El Toro' zoysia which had been established for approximately three years. The postemergence herbicides were applied using a CO_2 constant pressure backpack sprayer with a spray volume of 50 gal/A. The postemergence herbicides compared included: 2,4-D (1.0 and 2.0 lb ai/A), dicamba (Banvel) (1.0 and 2.0), MSMA (Bueno, Dal-E-Rad) (2.0 and 4.0), 2,4-D plus MCPP plus dicamba (1.34 + 0.65 + 0.11) and (2.67 + 1.30 + 0.22), triclopyr (Turflon, Garlon) (0.50 and 1.0), bromoxynil (Brominal, Buctril) (1.0 and 2.0), bentazon (Basagran) (1.0 and 2.0), triclopyr plus 2,4-D (0.50 plus 1.0 and 1.0 plus 2.0), chlorflurenol (maintain CF-125) plus dicamba (0.50 plus 0.50), chlorflurenol plus triclopyr (0.50 plus 0.50), imazaquin (Image) (0.38), and metribuzin (0.25 and 0.50). All treatments were replicated four times in a randomized compelte block design.

The treatments were applied on August 4 and evaluated for 'El Toro' zoysia phytotoxicity on August 9 and 16. The plots were left unmowed for three weeks after treatment so that regrowth measurements (height) and seadhead suppression could be made (August 23). Some zoysia cultivars, including 'El Toro,' produce an extensive array of seedheads if left unmowed for more than two weeks during the growing season. It had been noted that some postemergence herbicides could suppress this seedhead production. Seedhead counts were made by randomly placing ten centimeter rings within the plots and counting the number of seedheads within each ring. Averages of four counts per plot were taken.

'El Toro' zoysia phytotoxicity ratings taken five days after treatment showed that the high rates of dicamba, MSMA, bromoxynil, triclopyr plus 2,4-D, triclopyr plus dicamba, triclopyr plus chlorflurenol, and both rates of metribuzin were causing significant phytotoxicity. Twelve days after treatment, the second phytotoxicity evaluation showed that recovery had taken place and only plots which had received the high rate of MSMA and metribuzin were showing discoloration. No phytotoxicity symptoms were evident in the zoysia three weeks after treatment.

Height measurements taken nineteen days after treatment showed that only MSMA caused slight reductions.

Seedhead counts were reduced by some herbicide applications. The high rates of dicamba, bromoxynil, and triclopyr and the combinations of 2,4-D plus triclopyr, triclopyr plus chlorflurenol,and dicamba plus chlorflurenol had the lowest seedhead counts. Although some significant seedhead suppression was evident, it was not enough to be aesthetically effective. (University of California, Riverside Botany and Plant Sic. Dept., Riverside, CA 92521)

'El Toro' Zoysiagrass postemergence tolerance, UC Riverside

Treatment	lb ai/A	Phyto- toxicity* 8/9/88	Phyto- toxicity* 8/16/88	Seed- Heads 8/23/88	Height (cm) 8/23/88
2,4-D	1.00	0.75	0.75	6.20	6.38
2,4-D	2.00	0.75	0.50	7.15	6.50
dicamba	1.00	1.00	0.75	5.30	6.38
dicamba	2.00	2.75	1.25	4.75	5.75
MSMA	2.00	1.25	1.75	7.45	5.63
MSMA	4.00	5.50	3.00	6.25	5.63
^{1}1.34 + 0.65	+ 0.11	0.50	0.75	6.30	5.75
^{2}2.67 + 1.30	+ 0.22	0.50	0.75	6.95	5.88
triclopyr	0.50	1.25	0.50	5.00	6.00
triclopyr	1.00	2.00	0.50	2.25	5.50
bromoxynil	1.00	1.75	0.75	5.50	6.75
bromoxynil	2.00	4.50	1.50	4.10	7.00
bentazon	1.00	0.75	0.75	7.20	6.63
bentazon	2.00	0.50	1.00	5.95	6.00
triclopyr +2,4-D	0.50 +1.00	0.25	0.50	5.90	5.63
triclopyr +2,4-D	1.00 +2.00	1.50	0.50	3.95	6.00
chlorflurenol +triclopyr	0.50 +0.50	1.25	0.50	4.85	6.63
chlorflurenol +dicamba	0.50 +0.50	1.25	1.00	3.80	6.25
imazaquin	0.38	0.50	0.75	7.00	5.75
metribuzin	0.25	0.0	1.50	7.15	6.00
metribuzin	0.50	0.0	2.50	5.50	6.50
check		1.00	1.00	6.40	6.25
LSD(5%)		1.12	0.96	1.36	0.67

Application date: 8/4/88

*Phytotoxicity = 0 = no effect; 10 = all Zoysia dead.
^{1}2,4-D + MCPP + dicamba
^{2}2,4-D + MCPP + dicamba

Evaluation of several herbicides for the preemergent control of smooth crabgrass. Elmore, C. L., G. Vogel, and John A. Roncoroni. Several herbicides were tested to determine their effectiveness for the preemergent control of smooth crabgrass (*Digitaria ischaemum*) (DIGIS). Due to the number of chemicals tested, the test was split into two adjoining trials, each with a check plot and DCPA at 10 lbs/A as a standard treatment. These tests were conducted at Mather Air Force Base Golf Course, Rancho Cordova, Sacramento County, California. The compounds evaluated in the first trial were MON 15151 at 0.25, 0.50, and 1.0 lb/A, MON 15172 at 0.25, 0.50, and 1.0 lbs/A, pendimethalin at 1.5 and 3.0 lbs/A, oxadiazon at 2 and 4 lbs/A, and oxadiazon at 2 lbs/A in combination with prodiamine at 0.5 and 1.0 lbs/A and benefin 1.0 lb/A.

The compounds evaluated in the second test were quinclorac at 0.5, 1.0, and 2.0 lbs/A, and benefin at 3 lbs/A, and the combination of quinclorac at 1.0 lb/A and benefin at 3.0 lb/A.

Treatments were applied on February 2, 1988 using a CO_2 backpack handsprayer, (3) 8002 nozzles calibrated to deliver 30 gpa, or a hand granular applicator. Applications were made to 10 ft. by 10 ft. plots with four replications. Weather conditions at the time of application were clear skies, no wind, and temperatures as follows: Ambient air, 68° F; thatch soil at 0.5 inch 64° F, and moderately thick turf at 0.5 inch 60° F. Clay is a major constituant of all the foothill soils in this area with a characteristic red color.

The turf was composed of a mixture of perennial ryegrass and annual bluegrass with an understory of bermudagrass. The turf area was aerated prior to the application of the herbicides. No crabgrass had emerged at the time of application. Irrigation was applied three hours after treatment continuing on an every other day cycle of 0.2 inch per irrigation.

Smooth crabgrass was controlled with all preemergence herbicides and rates of herbicides for 5 months, except quinclorac at 0.5, 1.0, or 2.0 lbs/A and its combination with 3 lbs/A of benefin. This was shown with either visual evaluations or a quadrat method of evaluation. After almost 7 months only MON 15151 at 0.5 and 1.0 lbs/A, MON 15172 at 0.25, 0.50 and 1.0 lbs/A, pendimethalin at 3 lbs/A, oxadiazon at 4 lbs/A, combinations of oxadiazon and prodiamine, and oxadiazon and benefin gave acceptable (7 evaluation) control. All other experimental plots contained excessive smooth crabgrass. (University of California, Davis 95616 and Cooperative Extension, Sacramento, CA 95827)

Trial 1.

Evaluation of several herbicides for the preemergent control of smooth crabgrass

			Crabgrass[a]	Crabgrass control[b]	
Herbicide	Formulation	Rate lb/a ai	count 7/11/88	7/11/88	8/29/88
DCPA	75 WP	10.0	0 A	10.0 A	6.0 BC
MON 15151	1 EC	0.25	0.2 A	9.4 A	5.8 BC
MON 15151	-	0.0	0 A	10.0 A	9.5 A
MON 15172	0.5G	0.25	0 A	10.0 A	8.3 AB
MON 15172	-	0.50	0 A	10.0 A	9.5 A
MON 15172	-	1.0	0 A	10.0 A	0.0 A
pendimethalin	60 WDG	3.0	0.5 A	9.4 A	3.8 CD
pendimethalin	-	3.0	0.5 A	9.1 A	8.5 AB
oxadiazon	2G	2.0	0 A	9.6 A	5.8 BC
oxadiazon	-	4.0	0 A	10.0 A	9.5 A
oxadiazon + prodiamine	50 WP 65 WDG	2.0 0.5	0 A	10.0 A	7.8 AB
oxadiazon + prodiamine	- -	2.0 1.0	0 A	10.0 A	9.3 A
oxadiazon + benefin	1+0.5 G	2.0 1.0	0 A	9.8	7.8 AB
Control	-	-	3.2 B	4.3 B	2.0 D

[a] Counts are measurements of 3 meter diagonal transect through plot.

[b] 1=no control; 10=complete control

All values are averages of four replications.

All means with same letter are not significantly different at 0.50% using Duncan's Multiple Range Test.

Trial 2.

		Rate	Crabgrass[a] count	Crabgrass control[b]	
Herbicide	Formulation	lb/a ai	7/11/88	7/11/88	8/29/88
DCPA	75 WP	10.0	0.3 A	9.8 A	4.3 A
quinclorac	50 WP	0.5	6.3 B	4.5 CD	2.5 BC
quinclorac		0	7.2 B	3.8 D	1.5 C
quinclorac		2.0	5.2 AB	4.5 CD	1.5 C
quinclorac + benefin	50 WP 60 WDG	1.0 3.0	3.0 AB	6.4 BC	2.5 BC
benefin	60 WDG	3.0	0.3 A	8.4 AB	3.0 AB
Control	-	-	2.5 AB	5.5 CD	1.8 BC

[a] Counts are measurements of 3 meter diagonal transect through plot.

[b] 1=no control; 10=complete control

All values are averages of four replications.

All means with same letter are not significantly different at 0.5% using Duncan's Multiple Range Test.

Effect of herbicides on ornamental bulb yield. Howard, S.W., C.R. Libbey, and E.R. Hall. Narcissus var. King Alfred (1500 g/plot), bulbous iris var. Wedgewood (650 g/plot), and tulips var. Apeldoorn (650 g/plot) were planted on October 2, 1987 in Puget silt loam soil. Treatments were applied on December 12, 1987, 17 days after the final hilling operation. Adjacent to each treated bulb plot was an untreated, unplanted, hilled area that was used for comparative weed control evaluations. Oryzalin was used as the industry standard. Bulbs were harvested on August 17-19, 1988 allowed to dry, cleaned and weighed. The experiment was an RCB with four replications.

Only tulips showed significant decrease in yield from any of the treatments when compared to the yield of oryzalin. Isoxaben and isoxaben plus oryzalin significantly reduced tulip yield. This injury is substantiated by the 33 percent visual phytotoxicity rating for tulips treated with isoxaben or isoxaben plus oryzalin. Isoxaben and isoxaben plus oryzalin also caused substantial injury to narcissus as indicated by the visual phytotoxicity ratings, however, without a corresponding reduction in yield. Cinmethylin at 0.56, 1.12, or 2.24 kg/ha did not injure any of the bulb types. In addition, cinmethylin at 1.12 and 2.24 kg/ha provided weed control equal to or better than oryzalin on shepherdspurse, pineappleweed, annual bluegrass and hedgemustard. Cinmethylin did not adequately control common chickweed. (Washington State University, 1468 Memorial Hwy, Mount Vernon, WA 98273)

Effect of herbicides on ornamental bulbs

		YIELD			PHYTOTOXICITY[2]			WEED CONTROL[3]					
TREATMENT	RATE[1]	NARC	IRIS	TULIPS	NARC	IRIS	TULIPS	GWR	CAPBP	STEME	MATMT	POAAN	SSYOF
	(kg/ha)	-----(grams)------			-----(4-18-88)----			-------------(6-29-88)-------------					
weedy check		2043	1003	1814	0	0	0	0	0	0	0	0	0
cinmethylin	0.56	2414	1227	2163	0	0	0	40	83	43	90	68	48
cinmethylin	1.12	2419	1260	2350	0	0	0	73	100	80	98	98	98
cinmethylin	2.24	2603	1424	2361	0	0	0	78	100	75	100	100	100
lactofen + chlorpropham	0.56 1.68	2283	961	2376	15	13	15	53	100	100	0	93	100
isoxaben	1.12	2392	1261	1793	30	8	33	98	100	100	100	100	100
isoxaben + oryzalin	0.25 0.75	2437	1226	1906	25	5	33	100	100	100	100	100	100
oryzalin	2.24	2528	1131	2258	5	8	8	85	93	93	100	95	93
LSD (0.05)		439	398	294									

[1] Treatments applied December 12, 1987

[2] 0 = no injury, 100 = all plants killed

[3] 0 = no control, 100 = complete control
GWR = General Weed Rating
CAPBP = <u>Capsella bursa-pastoris</u>, shepherdspurse
STEME = <u>Stellaria media</u>, common chickweed
MATMT = <u>Matricaria matricarioides</u>, pineappleweed
POAAN = <u>Poa annua</u>, annual bluegrass
SSYOF = <u>Sisymbrium officinale</u>, hedge mustard

PROJECT 5.

WEEDS IN AGRONOMIC CROPS

Rod Warner - Project Chairman

Evaluation of herbicide treatments in dormant alfalfa. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established on February 9, 1988 to evaluate the efficacy of selected herbicides for weed control in dormant alfalfa (var. Lahonton). Soil type was a Persayo-Farb silty clay loam with a pH of 7.7 and an organic matter content of less than 1%. Individual plots were 12 by 25 ft in size with four replications arranged in a randomized complete block design. Treatments were applied with CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi.

Visual weed control and crop injury evaluations were made on April 9, and plots harvested for yield June 15, 1988. Downy brome infestations were heavy throughout the experimental area. Downy brome control was good to excellent with all treatments except oxyfluorfen at 0.2, prodiamine plus paraquat at 0.5 + 0.5, and paraquat at 0.5 lb ai/A. All treatments resulted in a higher protein content than the untreated check. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Downy brome control in dormant alfalfa, 1988

Treatment	Rate lb ai/A	Crop Injury	Weed Control[1] BROTE	Yield[2]	Protein
		----------------	---------------%	--------------------	----------
hexazinone	0.5	0	98.8	2582.2	17.9
norflurazon + paraquat	3.0 + 0.5	0	97.0	2509.1	17.7
oxyfluorfen + paraquat	0.6 + 0.5	0	96.5	2604.9	17.3
norflurazon + paraquat	1.5 + 0.5	0	96.0	2310.4	17.5
prodiamine + norflurazon + paraquat	1.0 + 0.75 + 0.5	0	94.3	2476.0	17.6
oxyfluorfen + paraquat	0.3 + 0.5	0	94.0	2442.8	17.6
prodiamine + paraquat	2.0 + 0.5	0	93.8	2484.7	17.4
prodiamine + paraquat	1.0 + 0.5	0	93.5	2559.6	17.5
prodiamine + norflurazon + paraquat	0.5 + 1.5 + 0.5	0	91.8	2578.8	17.2
prodiamine + norflurazon + paraquat	0.5 + 0.75 + 0.5	0	92.3	2608.4	16.5
hexazinone	0.25	0	88.5	2306.9	17.2
oxyfluorfen	0.5	0	87.0	2361.0	15.4
oxyfluorfen	0.2	0	76.3	2632.8	15.6
prodiamine + paraquat	0.5 + 0.5	0	74.3	2577.0	16.6
paraquat	0.5	0	46.0	2484.7	15.1
check		0	0	2338.3	13.6
LSD 0.05			6.4	570.4	0.7

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1. Based on a visual scale from 0-100 where 0 = no control or crop injury and 100 = dead plants.
2. Forage yields are expressed on a 20% moisture basis.

Warm season broadleaf and grassy weed control in seedling alfalfa in Colorado. Beck, K.G. and J.R. Sebastian. An experiment was conducted near Kersey, CO in seedling alfalfa to evaluate phytotoxicity and control of redroot pigweed (AMARE), common lambsquarters (CHEAL), puncturevine (TRBTE), and stinkgrass (ERACN) with herbicides. Bromoxynil was applied at two rates with and without crop oil concentrate or sethoxydim and paraquat at two rates with surfactant (Table 1). The design was a randomized complete block with four replications. All treatments were applied on Jun 16, 1987 when alfalfa was in the three trifoliate leaf stage with a CO_2 pressurized backpack sprayer through 11002LP flat fan nozzles calibrated to deliver 13 gpa at 30 psi. Other application information is provided in Table 1. Plot size was 10 by 30 ft.

Visual evaluations were taken one, two, and three weeks after treatments were applied. Paraquat caused unacceptable phytotoxicity at both rates at all evaluation dates (Table 2). Bromoxynil alone and mixed with sethoxydim caused 65 to 83% less phytotoxicity to seedling alfalfa than paraquat; 0.38 lb ai/a of bromoxynil tended to cause greater phytotoxicity than 0.25 lb ai/a. Bromoxynil at both rates in combination with sethoxydim and crop oil concentrate caused 15 to 18% more phytotoxicity than 0.25 lb ai/a bromoxynil applied alone. Common lambsquarters was effectively controlled with all bromoxynil treatments but not with paraquat. All treatments provided excellent puncturevine control. Paraquat and bromoxynil at 0.38 lb ai/a with and without crop oil concentrate provided greatest redroot pigweed control. Lower rates of bromoxynil or when mixed with sethoxydim caused reduced redroot pigweed control. Paraquat at both rates provided best stinkgrass control and bromoxynil the least. (Weed Research Laboratory, Colorado State University, Ft. Collins, CO 80523).

Table 1. Application data for broadleaf and grassy weed control in seedling alfalfa in Colorado.

Environmental data	
Application date	Jun 16, 1987
Application time	10:00 A
Air temperature, C	7
Cloud cover, %	0
Wind speed/direction, mph	0-2/W
Soil temperature (2 in), C	6

Weed data

Application date	Species	Growth Stage	Ht/diam (in)	Density
Jun 16, 1987	AMARE	seedling	1-3 ht	1-4/ft^2
	CHEAL	seedling	1-2 ht	< 10/plot
	TRBTE	vegetative	4-6 di	10-30/plot
	ERACN	3-5 leaf	-	4-8/ft^2

Table 2. Warm season broadleaf and grassy weed control in seedling alfalfa in Colorado.

Herbicide	Rate	Phyto			AMARE			CHEAL			TRBTE			ERACN		
	(lb ai/A)	6-23	6-29	7-14	6-23	6-29	7-14	6-23	2-29	7-14	6-23	6-29	7-14	6-23	6-29	7-14
bromoxynil	0.25	15	15	16	85	90	92	100	100	100	100	100	100	0	0	0
bromoxynil	0.38	26	26	31	93	92	94	100	100	100	100	100	100	0	0	0
bromoxynil + COC[1]	0.25	13	15	8	84	81	84	100	100	100	100	100	100	0	5	0
bromoxynil + COC	0.38	25	24	23	94	94	94	100	100	100	100	100	100	0	8	0
bromoxynil + sethoxydim + COC	0.25 0.20	30	29	23	85	79	63	100	100	100	100	100	96	60	84	81
bromoxynil + sethoxydim + COC	0.38 0.20	31	31	20	89	85	79	100	100	100	100	100	100	61	84	70
paraquat[2]	0.25	95	96	89	100	100	100	33	25	0	100	93	94	97	97	90
paraquat	0.50	98	98	98	100	100	100	5	5	0	100	97	91	100	99	98
LSD (0.05)		14	18	23	8	8	14	26	25	0	0.3	6	7	8	7	7

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[1] Crop oil concentrate applied at 1 qt/A.

[2] Non-ionic surfactant (X-77) added at 0.5% v/v to all paraquat treatments.

Broadleaf weed control in established, dormant alfalfa at Sterling, Colorado. Beck, K.G., J.R. Sebastian, and D.E. Hanson. Flixweed (DESSO) is a major winter annual weed problem for Colorado alfalfa producers. A herbicide efficacy experiment was conducted to control flixweed in dormant, established alfalfa. All herbicides were applied on March 23, 1988 with a CO_2 backpack sprayer equipped with 11003LP nozzles and calibrated to deliver 225 L/ha at 104 kPa. All other application and weed data are in Table 2. Plot size was 3.1 m by 9.1 m. Control was evaluated on April 25 and May 24, 1988.

Excellent flixweed (both dates) and lambsquarters (CHEAL; May 24 evaluation) control was provided by all imazethapyr, imazethapyr+pendimethalin, hexazinone, and paraquat+metribuzin treatments (Table 1). Bromoxynil at 0.42 and bromoxynil+sethoxydim at 0.42+0.22 kg ai/ha provided good flixweed control. Lower rates of bromoxynil alone or in combination with sethoxydim caused fair flixweed control. No lambsquarters control occurred with any bromoxynil treatments. Sethoxydim did not control either weed. Alfalfa injury was less than 10% at both evaluation dates with all treatments. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

Table 1. Broadleaf weed control in established, dormant alfalfa, Sterling, Colorado.

Treatment	Rate	Alfalfa Injury	DESSO Control	Alfalfa Injury	DESSO Control	CHEAL Control
	(kg ai/ha)	--Apr 25, 1988--		-----May 24, 1988-----		
		-------------(% of Check)---------------				
imazethapyr	0.07	7	91	5	100	100
imazethapyr	0.11	8	98	5	100	100
imazethapyr	0.14	5	99	6	100	100
imazethapyr	0.07					
+ pendimethalin	1.12	6	98	4	100	100
imazethapyr	0.11					
+ pendimethalin	1.12	4	99	6	100	100
hexazinone	0.56	2	91	8	100	100
paraquat[1]	0.56					
+ metribuzin	0.56	3	99	1	100	100
bromoxynil	0.28	3	71	0	69	0
bromoxynil	0.42	1	86	0	85	0
bromoxynil[2]	0.28					
+ sethoxydim	0.22	4	75	0	74	0
bromoxynil	0.42					
+ sethoxydim	0.22	2	84	1	85	0
sethoxydim	0.22	0	0	0	0	0
LSD (0.05)		4	7	4	5	0

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[1] X-77 added at 0.5% v/v.

[2] COC (Herbimax) added to all bromoxynil + sethoxydim and sethoxydim treatments at 2.3 L/ha.

Table 2. Application and weed data for broadleaf weed control in dormant, established alfalfa, Sterling, Colorado.

Environmental data	
Application date	March 23, 1988
Application time	6:30 am
Cloud cover, %	0
Air temperature, C	0
Relative humidity, %	60
Wind speed/direction, kph	0 to 6/SW
Soil temperature, C	2

Weed data

Species	Growth Stage	Diameter	Density
		(cm)	(plants/0.093 m^2)
DESSO	rosette	1 to 3	2 to 3

Efficacy of granular herbicides in established alfalfa. Brewster, B.D., R.L. Spinney, and A.P. Appleby. The preemergence control of annual grasses in established alfalfa with granular formulations of EPTC and trifluralin was investigated. Immediately following the first cutting, oats, Italian ryegrass, and barnyardgrass were seeded into the stand with a John Deere power drill. The herbicides were applied with a shaker can on May 5, 1988, and were followed within an hour with 0.5 inch of sprinkler irrigation. The trial was a randomized complete block design with four replications and 2.5 m by 7.5 m plots.

Visual evaluations on May 31 indicated that EPTC provided excellent control of Italian ryegrass and oats, but the addition of trifluralin improved barnyardgrass control. Trifluralin by itself did not provide adequate control of any species. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Alfalfa injury and grass control following applications of granular herbicides

Herbicide	Rate	Alfalfa	Barnyardgrass	Oats	Italian ryegrass
	(kg a.i./ha)	(% injury or control)			
EPTC + trifluralin	3 + 0.8	0	95	100	90
trifluralin	0.84	0	53	33	23
trifluralin	2.2	0	40	56	65
EPTC	3.4	0	83	100	99
Check	0	0	0	0	0

Broadleaf weed control in seedling alfalfa. Brewster, B.D., R.L. Spinney, and A.P. Appleby. A field trial was conducted to evaluate herbicides in seedling alfalfa for postemergence broadleaf weed control. Herbicides that are currently registered do not provide adequate control of some species in western Oregon.

The trial was a randomized complete block design with four replications and 2.5 m by 10 m plots. Carrier volume was 234 L/ha delivered at 138 kPa through 8002 flat fan nozzle tips set in a double-overlap spray pattern. One LX 101-01 treatment was applied on May 9, 1988 when the alfalfa had one trifoliolate leaf. The remaining treatments were applied on May 17, 1988 when the alfalfa had three trifoliolate leaves. The weeds ranged from cotyledon stage to two-leaf stage on May 9 and were 1 to 3 inches in diameter on May 17. The visual evaluations reported here were conducted on June 8, 1988.

Treatments that contained 2,4-DB amine caused the greatest crop stunting, while LX 101-01 caused the least crop injury. The 2,4-DB treatment was also least effective on most of the weed species. Bromoxynil plus imazethapyr and LX 101-01 plus imazethapyr provided the best overall control. The apparent reduction in mayweed chamomile and henbit control with bromoxynil plus 2,4-DB compared to bromoxynil alone was probably a result of less competition from the crop because of injury from the combination of herbicides. (Crop Science Department, Oregon State University, Corvallis, OR 97331).

Alfalfa injury and broadleaf weed control

Herbicide	Rate	Alfalfa	BRSNA[1]	ANTCO	SENVU	AMARE	LAMAM	CAPBP
	(kg a.i./ha)	(% injury or control)						
One trifoliolate; May 9, 1988								
LX 101-01	1.0	5	85	93	98	85	100	96
Three trifoliolate; May 17, 1988								
bromoxynil	0.28	9	89	73	100	73	75	95
bromoxynil	0.42	16	94	88	100	76	83	96
bromoxynil + 2,4-DB	0.28 + 0.42	25	95	46	100	98	34	83
2,4-DB	0.56	24	80	15	28	38	0	55
bromoxynil + imazethapyr	0.28 + 0.07	9	97	94	98	100	100	96
imazethapyr	0.07	10	94	28	50	95	85	88
LX 101-01 + bromoxynil	1.0 + 0.07	14	85	97	100	99	100	96
LX 101-01 + imazethapyr	1.0 + 0.07	11	95	96	95	100	100	98
LX 101-01	1.0	0	69	98	100	99	99	88
check	0	0	0	0	0	0	0	0

[1] BRSNA = *Brassica napus*

Quackgrass (Agropyron repens) control in established alfalfa. Drake, K. R. and T. D. Whitson. Quackgrass, a perennial grass adapting well to moist soils in cool climates, has adapted to much of North America. This experiment was established on a dense quackgrass stand in established alfalfa near Emblem, WY. Plots, 10 by 27 ft, were arranged in a randomized complete block design with four replications. Herbicides were applied with a pressurized knapsack unit delivering 20 gpa at 45 psi, May 15, 1988 (temperature air 65F, soil surface 73F, 1 inch 72F, 4 inches 71F with a relative humidity of 45% with winds south 2 to 3 mph). Soil at the experimental site was a sandy loam (44% sand, 35% silt and 21% clay) with 1.1% organic matter and a 7.6 pH. Evaluations were taken August 10, 1988. Quizalofop at 0.5 lb ai/A provided 78% control with no alfalfa damage observed. Glyphosate at 1.5 lb ai/A provided 58% control but caused 78% reduction in alfalfa height. Amitrol at 2.0 and 4.0 lb ai/A caused 48 and 88% reduction in the alfalfa height with little quackgrass control. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Quackgrass control with various herbicides in established alfalfa.

Herbicide	Rate lbs ai/A	Quackgrass control %	Alfalfa damage %
sethoxydim	0.25[1] + coc[3]	6[2]	0
sethoxydim	0.5 + coc	0	0
fluazifop-P	0.25 + coc	14	0
fluazifop-P	0.5 + coc	20	0
quizalofop	0.25 + coc	34	0
quizalofop	0.5 + coc	78	0
glyphosate	0.5	11	5
glyphosate	1.0	50	55
glyphosate	1.5	58	78
amitrol	2.0	0	48
amitrol	4.0	8	88
MAA	2.0	0	0
MAA	4.0	30	0
Check	-	0	0

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[1] Herbicides were applied May 15, 1988.

[2] Evaluations were taken August 10, 1988.

[3] Coc = 1 qt crop oil concentrate/acre.

Broadleaf and grassy weed control in seedling alfalfa, Brighton, CO. Hanson, D.E., K.G. Beck, and J.R. Sebastian. Research was conducted at Brighton, CO to test the efficacy of three herbicides on various weed species in seedling alfalfa. A randomized complete block design with four replications was used. Plots were 3 m by 9 m in size. Treatments were applied with a CO_2 charged backpack sprayer calibrated at 224 l/ha at 103 kPa equipped with 11003LP flat fan nozzles. Herbicides were applied on June 28, and July 1, 1988 (for split application treatment) to alfalfa with 5 to 7 trifoliate leaves. Application conditions are listed in Table 1. Weed species present at time of treatment were redroot pigweed (AMARE), purslane (POROL), and barnyardgrass (ECHCG). Visual evaluations were made on July 6, July 13, and July 22, 1988.

The bromoxynil+sethoxydim tank mix provided excellent barnyardgrass control (Table 2). Bromoxynil and sethoxydim in a split application also controlled barnyardgrass and improved pigweed control but was still below acceptable levels. Sethoxydim alone gave excellent barnyardgrass control. Bromoxynil provided some pigweed control but was not as effective as the split application with sethoxydim except at the third evaluation. Imazethapyr provided excellent pigweed and barnyardgrass control. None of the treatments controlled purslane or injured alfalfa. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523)

Table 1. Application data for broadleaf and grassy weed control in seedling alfalfa

Environmental Data		
Date treated	6/28/88	7/1/88
Time treated	10:30A	4:30P
Cloud cover	Clear	Clear
Air temperature, C	26	19
Relative humidity, %	68	75
Wind speed/direction, kph	6/NE	Calm
Soil temperature, (5 cm) C	22	18
Leaf Surface Moisture	Moist	Moist

Weed Data

Application Date	Species	Growth Stage	Height (cm)	Density (pl/0.09 m^2)
June 28, 1988 and	AMARE	Tight bud	30 to 40	3 to 7
July 1, 1988	POROL	Flowering	18 to 20	3 to 7
	POROL	Seedling	3 to 6	5 to 20
	ECHCG	Vegetative	40 to 60	3 to 5

Table 2. Broadleaf and grassy weed control data in seedling alfalfa, Brighton CO

Treatment	Rate	AMARE	ECHCG	AMARE	ECHCG	AMARE	ECHCG
	(kg ai/ha)	July 6, 1988		July 13, 1988		July 22, 1988	
		(% Control)					
bromoxynil[1] + sethoxydim[2]	0.28 + 0.17	20	20	34	71	35	95
bromoxynil + sethoxydim	0.28 + 0.17	4	79	9	98	5	99
sethoxydim	0.17	0	65	0	91	1	99
bromoxynil	0.28	6	10	16	0	28	0
imazethapyr[3]	0.11	74	41	84	65	97	85
LSD (.05)		11	21	12	15	18	11

[1] Split application.

[2] Dash (COC) and 28% N solution (AMS) added at 2.3 l/ha and 9.4 l/ha respectively to all treatments with sethoxydim.

[3] X-77 added at 0.25% v/v.

<u>Foxtail barley control in established alfalfa, Monte Vista, CO.</u> Hanson, D.E., K.G. Beck, and J.R. Sebastian. Research was conducted in the San Luis Valley of Colorado to evaluate several herbicides for foxtail barley (HORJU) control in alfalfa. A randomized complete block design with four replications was used. Plots were 3 m by 9 m in size. Treatments were delivered with a CO_2 charged backpack sprayer calibrated to deliver 224 l/ha at 103 kPa and equipped with 11003LP flat fan nozzles. Herbicides were applied on April 15, 1988 to established alfalfa 60 to 90 cm tall. Seedling alfalfa with 2 to 3 trifoliate leaves were also present. Foxtail barley was in a vegetative growth stage, 8 to 16 cm in diameter, and there were 3 to 6 plants per 0.09 m^2. Application conditions are listed in Table 1. Visual evaluations were made on May 17, June 14, and July 15, 1988.

At 30 DAT, all treatments provided foxtail barley control but not at agronomically acceptable levels (Table 2). Paraquat injured alfalfa at both rates, with the 0.84 kg ai/ha rate having the greater effect. Seedling alfalfa was more seriously injured than established alfalfa.

All treatments provided some foxtail barley control 60 and 90 DAT; however only fluazifop-P at 0.28 kg ai/ha caused acceptable control (Table 2). Although alfalfa injury occurred with both paraquat treatments, sethoxydim at 0.22 kg ai/ha, fluazifop-P at 0.14 kg ai/ha, and clethodim at 0.084 kg ai/ha at 60 DAT, all were below 10 percent. By 90 DAT, no alfalfa injury was observed.

Fall pronamide treatments will be applied and evaluations continued in 1989. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523)

Table 1. Application data for foxtail barley control in alfalfa

<u>Environmental Data</u>	
Date treated	4/15/88
Time treated	11:00A
Cloud cover, %	60
Air temperature, C	18
Relative humidity, %	82
Wind speed/direction, kph	0 to 5/SE
Soil temperature, (5 cm) C	6
Leaf Surface Moisture	Dry

Table 2. Foxtail barley control and alfalfa injury in established alfalfa, Monte Vista, CO

Treatment	Rate	HORJU Control	Seed Alfalfa Injury	Est Alfalfa Injury	HORJU Control	Est Alfalfa Injury	HORJU Control
	(kg ai/ha)	May 17, 88			June 14,88		July 15, 88
		(% of check)					
paraquat[1]	0.56	16	26	16	20	8	16
paraquat	0.84	23	48	20	46	8	14
sethoxydim[2]	0.22	20	0	0	16	5	14
sethoxydim	0.34	15	0	0	21	4	18
fluazifop-P	0.14	26	8	0	53	5	51
fluazifop-P	0.28	30	5	0	83	3	80
clethodim	0.07	16	0	0	34	3	38
clethodim	0.084	20	0	0	39	5	29
clethodim	0.11	30	6	0	55	3	46
LSD (.05)		10	12	3	21	4	26

[1] X-77 added at 0.5% v/v to all paraquat treatments.

[2] Herbimax (COC) added at 2.3 l/ha to all sethoxydim, fluazifop-P, and clethodim treatments.

Evaluation of postemergence herbicide applications in seedling alfalfa. Kidder, D.W. and D.P. Drummond. Five herbicides, alone and in tank mix combinations, were evaluated for control of common lambsquarters (*Chenopodium album* L., CHEAL), hairy nightshade (*Solanum sarrachoides* Sendtner, SOLSA), redroot pigweed (*Amaranthus retroflexus* L., AMARE) and green foxtail (*Setaria viridis* (L.) Beauv., SETVI) at the University of Idaho Research and Extension Center, Kimberly, Idaho. Fifteen treatments, including the control, were applied in a randomized complete block design with four replications. Alfalfa (var. Baker) was seeded on April 27, 1988 at a rate of 10 lb/A on furrow irrigated cropland.

Herbicides were applied on June 7, 1988 with a CO_2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa at a pressure of 30 psi. Treatment plots were 10 feet by 30 feet. Alfalfa was in the 1 to 2 trifoliolate stage of growth at the time of application. Weed density for common lambsquarters, hairy nightshade, redroot pigweed and green foxtail were 344, 500, 216 and 219 plants/square meter respectively at the time of application. Visual evaluation of weed control and crop injury were made on June 14 and July 14.

Results are given in Table 2. No visual symptoms of injury were evident on the July 14 evaluation date. The 2,4-DB controlled green foxtail better than bromoxynil, bromoxynil + 2,4-DB, or the untreated check. This appeared to be due to reduced crop injury and slower broadleaf weed control (shading) during the period of green foxtail emergence. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in alfalfa

Date of application	6/7/88
Air temperature (F)	64
Soil temperature @ surface (F)	65
Soil temperature @ 3 in (F)	67
Relative humidity (%)	45
Dew present	none
Wind (mph)	5-9
Cloud cover (%)	100
Soil	
organic matter (%)	1.4
pH	7.7
texture	silt loam

Table 2. Postemergence herbicides in seedling alfalfa

			Weed Control							
			6/14				7/14			
Treatment[1]	Rate	Crop inj. 6/14	CHEAL[2]	SOLSA	AMARE	SETVI	CHEAL	SOLSA	AMARE	SETVI
	(lb a.i./a)	(%)								
Untreated		0	0	0	0	0	0	0	0	0
2,4-DB	0.50	1	20	25	18	0	91	92	95	33
Bromoxynil	0.25	8	87	93	80	13	96	97	79	4
Bromoxynil	0.375	25	99	100	96	2	100	99	83	0
Sethoxydim + COC[3]	0.20 + 1 qt/a	0	0	0	0	45	0	0	0	99
Imazethapyr + surf.[4]	0.063 + 0.25% v/v	2	13	19	26	35	1	94	98	78
Bromoxynil + 2,4-DB	0.25 + 0.50	18	96	96	94	4	99	96	95	0
Bromoxynil + imazethapyr	0.25 + 0.063	11	93	96	93	10	92	92	96	26
Bromoxynil + sethoxydim + COC	0.25 + 0.20 + 0.25% v/v	14	96	99	86	84	94	96	57	99
Bromoxynil + sethoxydim + COC	0.375 + 0.20 + 0.25% v/v	16	98	99	87	88	99	98	54	73
2,4-DB + sethoxydim + COC	0.50 + 0.20 + 0.25% v/v	4	37	45	36	57	99	99	87	99
Imazethapyr + sethoxydim + COC	0.063 + 0.20 + 0.25% v/v	2	14	21	43	53	15	93	93	92
Pyridate	0.90	3	63	79	88	48	80	87	91	6
Pyridate	1.35	2	62	77	82	23	84	92	95	0
Pyridate + sethoxydim + COC	1.35 + 0.20 + 0.25% v/v	5	94	97	96	90	92	84	82	85
LSD(0.05)		5	10	8	13	14	3	NS	22	25

1 Treatments were applied on June 7, 1988.
2 CHEAL = common lambsquarters
SOLSA = hairy nightshade
AMARE = redroot pigweed
SETVI = green foxtail
3 COC = Crop oil concentrate (Moract)
4 Surf = Surfactant (R-11)

Pyridate for weed control in spring-seeded alfalfa. Lass, L.W. and R.H. Callihan. Precipitation patterns in northern Idaho do not consistently permit successful establishment of good alfalfa stands by underseeding in small grains. Weeds have a competitive edge until the alfalfa becomes established, and result in open alfalfa stands that are continually weedy. The purpose of this experiment was to determine the effects of single applications of two formulations of pyridate and of pyridate EC formulation alone in combination with two graminicides and in comparison with 2,4-DB as a commercial standard.

Alfalfa (Medicago sativa L. c.v. Vernal) was planted on May 12, 1988, at a seeding rate of 20 lb/A in a nonirrigated Palouse-Latahco silt loam. EPTC was rototiller-incorporated preplant over all treatments at the rate of 3 lb ai/A to remove grass weeds and to limit dicot weeds to a few object species. The plots were 10x30 ft, replicated four times in a split block design. The herbicides were applied with a CO2 sprayer using 8002 nozzles calibrated to deliver 23 gpa at a speed of 2.2 mph. The alfalfa plants, at the time of application on June 16, were at the 2-to-3 leaf stage.

All sethoxydim and fluazifop-P treatments were applied with 1 qt/A crop oil concentrate (COC). The air temperature was 82 F. Soil temperatures were 80 F at the surface and 77 F at depths of 2 and 6 inches. The relative humidity was 34% with a 10% cloud cover. No dew was present. The wind was 3 to 4 mph from the East. Alfalfa and weed injury were evaluated on June 30 and July 15.

Treatments were pyridate EC (0.0, 0.67, 0.9, 1.35 lb ai/A) and pyridate WP (0.9 lb ai/A), 2,4-DB (0.0, 0.5, 0.75, 1.0 lb ai /A), sethoxydim (0.0, 0.25 lb ai/A), sethoxydim+pyridate (0.25+0.9, 0.25+1.35 lb ai/A), fluazifop-P (0.0, 0.25 lb ai/A), and fluazifop-P+pyridate (0.25+0.9, 0.25+1.35 lb ai/A).

Alfalfa

On June 30, alfalfa plants treated with pyridate + fluazifop-P + COC at the rates of 0.9+0.25 and 1.35+0.25 lb ai/A showed chlorotic spots covering greater than 25% total leaf area on 26% and 32% of the alfalfa leaves, respectively. Alfalfa treated with pyridate EC and pyridate EC in combination with sethoxydim plus COC had more chlorotic spots, than Pyridate WP. Although the pyridate treated plants measured on June 30 tended to be 15 to 30% shorter than the check, this was not a statistically significant difference. Heights of alfalfa treated with 2,4-DB were not reduced when compared to the check.

On July 15, the pyridate-induced chlorotic symptoms on alfalfa noted June 30 were not visible. August 3 observations indicated none of the herbicide treatments delayed alfalfa bloom.

Weed Control

The pyridate EC at 1.35 lb ai/A effectively controlled more than 90% of the redroot pigweed (Amaranthus retroflexus L.), mayweed chamomile (Anthemis cotula L.), and common lambsquarter (Chenopodium album L.); and field pennycress (Thlaspi arvense L.) was satisfactorily suppressed. At the rate of 0.9 lb ai/A, pyridate EC controlled more than 80% of the redroot pigweed, mayweed chamomile, and common lambsquarter. At 0.67 lb ai/A, pyridate was not as effective on field pennycress or common lambsquarter. Pyridate WP at 0.9 lb ai/A tended to be less effective than the EC formulation in controlling redroot pigweed, field pennycress, and mayweed chamomile. The level of weed control by pyridate EC + fluazifop-P or pyridate EC + sethoxydim was the same as that from pyridate EC alone, but tended to be better than that resulting from pyridate WP.

Control with 1.35 lb ai/A pyridate persisted through July 15. Control with 0.9 lb ai/A pyridate persisted on all species; however, redroot pigweed appeared to recover slightly by July 15.

2,4-DB at 1.0 lb ai/A had controlled 97% of the redroot pigweed and 100% of the common lambsquarter on July 15 (29 days after application). Lower rates of 2,4-DB controlled only 80% of the redroot pigweed and 75% of the lambsquarter. Field pennycress and mayweed chamomile were suppressed by the 2,4-DB treatments. Pyridate treatments were substantially better than 2,4-DB for control of field pennycress and mayweed chamomile, regardless of evaluation date. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table 1.
Effects of pyridate herbicides on seedling alfalfa.

			Height		Injury		Bloom
No.	Herbicide	Rate	June 30	July 15	June 30	July 15	August 3
		(lb ai/A)	(cm)	(cm)	(%)[1]	(%)	(%)
1	Check	0	21 ns	39 ns	0 C[2]	0 ns	2 ns
2	Pyridate EC	0.67	18	39	6 B C	0	1
3	Pyridate EC	0.9	21	34	6 B C	0	1
4	Pyridate WP	0.9	18	38	0 C	0	2
5	Pyridate EC	1.35	14	32	11 B A C	0	0
6	Check	0	20	38	0 C	0	1
7	Fluazifop-P	0.25	18	37	0 C	0	2
8	Pyridate + fluazifop-P	0.9+0.25	18	34	26 B A	0	0
9	Pyridate + fluazifop-P	1.35+0.25	17	34	32 A	0	1
10	Check	0	19	40	0 C	0	3
11	Sethoxydim	0.25	18	39	0 C	0	2
12	Pyridate + sethoxydim	0.9+0.25	16	34	15 B A C	0	1
13	Pyridate + sethoxydim	1.35+0.25	15	32	22 B A C	0	0
14	Check	0	17	37	0 C	0	0
15	2,4-DB	0.5	18	34	0 C	0	3
16	2,4-DB	0.75	17	34	0 C	0	1
17	2,4-DB	1	18	35	0 C	0	1

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[1] Percent injury is the percentage of leaves with more than 25% chlorosis.

[2] Any two means having a common letter are not significantly different at the 5% level of significance, using protected Duncan's Test. Columns without letters following have no statistically different interval comparisons. (ns = Not statistically different).

Table 2.
Effects of herbicides on weeds in seedling alfalfa.

			Redroot Pigweed		Field Pennycress		Mayweed Chamomile		Common Lambsquarter
No.	Herbicide	Rate	June 30	July 15	June 30	July 15	June 30	July 15	July 15
		(lb ai/A)	(% control)						
1	Check	0	0 B	0 C	0 C	0 E	0 C	0 D	0 B
2	Pyridate EC	0.67	91 A	80 B A	70 B A	75 B A	86 B A	86 A	65 A
3	Pyridate EC	0.9	96 A	90 B A	68 B A	88 A	90 B A	87 A	88 A
4	Pyridate WP	0.9	70 A	75 B	50 B	61 B D A C	63 B	70 A	92 A
5	Pyridate EC	1.35	97 A	93 B A	86 A	85 A	94 B A	87 A	100 A
6	Check	0	0 B	0 C	0 C	0 E	0 C	0 D	0 B
7	Fluazifop-P	0.25	0 B	0 C	0 C	0 E	0 C	0 D	0 B
8	Pyridate + fluazifop-P	0.9+0.25	95 A	82 B A	56 B A	81 B A	93 B A	91 A	100 A
9	Pyridate + fluazifop-P	1.35+0.25	96 A	97 A	65 B A	85 A	85 B A	94 A	100 A
10	Check	0	0 B	0 C	0 C	0 E	0 C	0 D	0 B
11	Sethoxydim	0.25	0 B	0 C	0 C	0 E	0 C	0 D	0 B
12	Pyridate + sethoxydim	0.9+0.25	96 A	78 B A	64 B A	63 B A C	98 A	90 A	88 A
13	Pyridate + sethoxydim	1.35+0.25	98 A	95 B A	83 A	88 A	98 A	94 A	100 A
14	Check	0	0 B	0 C	0 C	0 E	0 C	0 D	0 B
15	2,4-DB	0.5	0 B	81 B A	0 C	56 B D C	0 C	33 C B	75 A
16	2,4-DB	0.75	23 B	84 B A	19 C	36 D	25 C	10 C D	75 A
17	2,4-DB	1	25 B	97 A	20 C	44 D C	25 C	43 B	100 A

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[1] Control is expressed as estimated % reduction in biomass of the weed species.

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

Weed control in dormant alfalfa. Miller, S.D., D.A. Ball and A.W. Dalrymple. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of herbicide treatments for weed control in dormant alfalfa (var. Apollo II). Plots were established under irrigation and were 9 by 30 ft. with three replications arranged in a randomized complete block. The herbicides were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi March 23, 1988 (air temp. 62 F, relative humidity 20%, wind SE at 6 mph, sky cloudy and soil temp. - 0 inch 64 F, 2 inch 52 F and 4 inch 49 F). The soil was classified as a sandy loam (76% sand, 14% silt and 10% clay) with 1.2% organic matter and pH 7.6. Visual weed control and crop damage evaluations were made May 17 and plots harvested for yield June 6, July 11 and August 7, 1988. Tansymustard (DESPI) and shepherdspurse (CAPBP) infestations were moderate and downy brome (BROTE) infestations light throughout the experimental area.

No treatment reduced alfalfa stand; however, hexazinone at rates above 0.5 lb/A, A-1237 at rates above 0.063 lb/A and imazethapyr combinations with metribuzin or terbacil caused 5 to 12% injury. Total alfalfa yields were 418 to 1709 lb/A higher in herbicide treated plots compared to weedy check plots. Broad-spectrum weed control was excellent with all treatments except A-1237 at 0.063 and 0.125 lb/A, imazethapyr at 0.063 to 0.125 lb/A, bromoxynil at 0.38 lb/A, 2,4-DB at 0.5 lb/A or bromoxynil combinations with imazethapyr and 2,4-DB. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1525 .)

Weed control in dormant alfalfa

		Alfalfa[2]						Control[3]		
			stand	yield						
Treatment[1]	Rate lb ai/A	injury %	red %	1st lb/A	2nd lb/A	3rd lb/A	total lb/A	DESPI %	CAPBP %	BROTE %
hexazinone	0.5	0	0	5146	2323	2554	10023	100	100	100
hexazinone	0.75	5	0	4992	2361	2592	9945	100	100	100
hexazinone	1.0	7	0	4954	2477	2534	9965	100	100	100
terbacil	0.5	0	0	4915	2419	2650	9984	100	100	100
metribuzin	0.5	0	0	4800	2342	2746	9888	93	97	95
A-1237	0.063	0	0	4416	2400	2707	9523	60	63	80
A-1237	0.125	5	0	4992	2362	2688	10042	87	83	88
A-1237	0.25	12	0	5030	2342	2669	10041	97	93	97
imazethapyr	0.063	0	0	5184	2458	2700	10342	97	97	50
imazethapyr	0.094	0	0	5165	2458	2899	10522	100	100	67
imazethapyr	0.125	0	0	4954	2419	2880	10253	100	100	80
bromoxynil	0.38	0	0	4263	2438	2726	9427	47	67	0
bromoxynil + 2,4-DB	0.38 + 0.5	0	0	4550	2458	2720	9728	60	65	0
bromoxynil + imazethapyr	0.38 + 0.063	0	0	5203	2477	2554	10234	100	97	50
2,4-DB	0.5	0	0	4109	2342	2880	9331	40	60	0
metribuzin + imazethapyr	0.5 + 0.063	5	0	5050	2496	2740	10286	100	100	100
terbacil + imazethapyr	0.5 + 0.063	7	0	5126	2400	2630	10156	100	100	100
weedy check	-----------	0	0	3955	2285	2573	8813	0	0	0

[1] Treatments applied March 23, 1988

[2] Alfalfa injury and stand reduction visually evaluated May 17 and plots harvested June 6, July 11 and August 7, 1988

[3] Weed control visually evaluated May 17, 1988

Evaluation of preplant or complementary preplant/postemergence treatments in new seeding alfalfa. Miller, S.D., D.A. Ball and A.W. Dalrymple. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of preplant incorporated or complementary preplant incorporated/postemergence herbicide treatments for weed control in new seeding alfalfa. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Preplant herbicides were applied April 4, 1988 (air temp. 62 F, relative humidity 25%, wind W at 10 mph, sky cloudy and soil temp. - 0 inch 64 F, 2 inch 58 F and 4 inch 52 F) and incorporated twice immediately after application with a roller harrow operating at a 1.5 inch depth. Alfalfa (var. DeKalb-Pfizer 1102) was planted April 7, 1988 in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2% organic matter and 7.4 pH. Postemergence treatments were applied May 17, 1988 (air temp. 79 F, relative humidity 40%, sky clear, wind calm and soil temp. - 0 inch 107 F, 2 inch 74 F and 4 inch 69 F) to 2 to 3 trifoliolate leaf alfalfa and 1 to 2 inch weeds. Visual weed control and crop damage evaluations were made May 25 and plots harvested for yield July 5, 1988. Common lambsquarters (CHEAL), kochia (KCHSC), Russian thistle (SASKR) and wild buckwheat (POLCO) infestations were light, and common sunflower (HELAN) infestations heavy throughout the experimental area.

Alfalfa was injured 2 to 18% by postemergence treatments and stand reduced 2 to 13% by preplant incorporated treatments. All herbicide treatments increased alfalfa yield and reduced weed yield compared to the weedy check. Complementary preplant incorporated/postemergence treatments provided 72 to 100% control of common sunflower and the highest alfalfa yield. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1526.)

Evaluation of preplant or complementary preplant/postemergence treatments in new seeding alfalfa

		Alfalfa[2]			Weed control[3]					Weed[3]
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield lb/A	CHEAL %	KCHSC %	SASKR %	POLCO %	HELAN %	yield lb/A
Preplant incorporated										
EPTC	2.0	0	2	1566	63	93	80	77	0	1106
EPTC + pendimethalin	2.0 + 0.75	0	8	1693	95	100	98	97	0	766
EPTC + pendimethalin	2.0 + 1.0	0	10	1861	100	100	97	97	0	743
EPTC + benefin	2.0 + 1.0	0	5	2003	87	93	87	93	0	808
pendimethalin	0.75	0	3	1956	87	93	83	88	0	781
pendimethalin	1.0	0	7	1620	90	97	90	93	0	810
benefin	1.0	0	2	1848	85	90	88	90	0	863
benefin	1.5	0	7	1626	90	92	90	90	0	785
Preplant incorporated/postemergence										
EPTC/imazethapyr + s	2.0/0.063	2	2	2957	92	100	93	90	88	0
EPTC/imazethapyr + s	2.0/0.094	3	2	2802	93	100	93	93	92	0
EPTC/bromoxynil	2.0/0.25	18	7	3037	100	100	100	100	100	0
EPTC/2,4-DB	2.0/0.5	8	5	2695	88	95	82	87	77	150
pendimethalin/imazethapyr + s	1.0/0.063	2	3	2775	97	100	95	98	92	0
pendimethalin/imazethapyr + s	1.0/0.094	2	7	2882	97	100	97	98	92	0
pendimethalin/bromoxynil	1.0/0.25	13	13	2849	100	100	100	100	100	0
pendimethalin/2,4-DB	1.0/0.5	5	5	2782	100	100	88	93	72	63
weedy check	-------	0	0	1233	0	0	0	0	0	1782

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[1] Treatments applied April 4 and May 17, 1988; s = X-77 at 0.25% v/v

[2] Alfalfa injury and stand reduction visually evaluated May 25 and plots harvested July 5, 1988

[3] Weed control visually evaluated May 25 and weeds harvested July 5, 1988

Evaluation of postemergence treatments in new seeding alfalfa. Miller, S.D., D.A. Ball and A.W. Dalrymple. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate weed control and alfalfa tolerance with postemergence herbicide applications. Plots were established under irrigation and were 9 by 30 ft. with three replications arranged in a randomized complete block. Alfalfa (var. DeKalb-Pfizer 1102) was planted in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2 organic matter and 7.4 pH April 7, 1988. Herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 10 gpa at 40 psi May 10 (air temp. 63 F, relative humidity 42%, wind NW at 5 mph, sky cloudy and soil temp. - 0 inch 68 F, 2 inch 54 F and 4 inch 52 F) to cotyledonary alfalfa and 0.5 inch weeds or May 17, 1988 (air temp. 66 F, relative humidity 57%, sky clear, wind calm and soil temp. - 0 inch 83 F, 2 inch 66 F and 4 inch 64 F) to 1 to 2 trifoliolate alfalfa and 1 to 2 inch weeds. Visual weed control and crop damage evaluations were made June 6 and plots harvested for yield July 5, 1988. Common lambsquarters (CHEAL), kochia (KCHSC), hairy nightshade (SOLSA), Russian thistle (SASKR) and wild buckwheat (POLCO) infestations were light and common sunflower (HELAN) and green foxtail (SETVI) infestations heavy throughout the experimental area.

Alfalfa was injured 2 to 23% and stand reduced 0 to 15% with treatments containing imazethapyr or bromoxynil. Imazethapyr applications at the cotyledon stage were more injurious to alfalfa than applications at the trifoliolate stage. Oil concentrate increased alfalfa injury with both bromoxynil and imazethapyr. All herbicide treatments increased alfalfa yield and reduced weed yield compared to the weedy check. Alfalfa yield related closely to weed control and/or crop injury. Broad-spectrum weed control was good with treatments containing imazethapyr or bromoxynil combinations with sethoxydim. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1527.)

Evaluation of postemergence treatments in new seeding alfalfa

		Alfalfa[2]			Weed control[3]							Weed[3]
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield lb/A	CHEAL %	KCHSC %	HELAN %	SOLSA %	SASKR %	POLCO %	SETVI %	yield lb/A
Cotyledon												
imazethapyr + s	0.063	5	0	2334	90	100	95	100	100	100	92	0
imazethapyr + s	0.094	15	3	1897	100	100	100	100	100	100	100	0
imazethapyr + s	0.125	18	5	1754	100	100	100	100	100	100	100	0
1st trifoliolate												
imazethapyr + s	0.063	2	0	2334	85	98	85	97	93	92	88	0
imazethapyr + s	0.094	5	0	2132	92	100	93	100	100	100	97	0
imazethapyr + s	0.125	8	3	1956	95	100	93	100	100	100	100	0
imazethapyr + oc	0.094	17	7	1682	97	100	98	100	100	100	98	0
imazethapyr + AMS	0.094	3	0	2008	85	97	90	97	90	93	87	82
imazethapyr + sethoxydim + oc	0.063 + 0.2	3	2	2243	93	98	97	100	100	100	98	0
imazethapyr + sethoxydim + oc	0.094 + 0.2	20	7	1754	98	100	98	100	100	100	100	0
sethoxydim + carbaryl + BCH-815	0.2 + 1.5	0	0	1578	20	13	27	23	20	20	100	1021
sethoxydim + dimethoate + BCH-815	0.2 + 0.5	3	0	1708	40	30	45	30	30	27	100	985
sethoxydim + malathion + BCH-815	0.2 + 1.25	0	0	1441	0	0	0	0	0	0	98	1101
sethoxydim + methoxychlor + BCH-815	0.2 + 1.5	0	0	1200	0	0	0	0	0	0	98	1287
sethoxydim + chlorpyrifos + BCH-815	0.2 + 0.5	0	0	1291	0	0	0	0	0	0	98	1287
sethoxydim + carbofuran + BCH-815	0.2 + 0.5	0	0	1278	0	0	0	0	0	0	98	1344
sethoxydim + oc	0.2	0	0	1141	0	0	0	0	0	0	98	1361
sethoxydim + BCH-815	0.2	0	0	1389	100	100	100	100	100	100	98	1279
bromoxynil	0.25	7	2	2132	100	100	100	100	100	100	0	137
bromoxynil + oc	0.25	13	2	1969	100	100	100	100	100	100	20	118
bromoxynil	0.375	13	2	1916	100	100	100	100	100	100	13	131
bromoxynil + oc	0.375	23	10	1878	100	100	100	100	100	100	27	122
bromoxynil + sethoxydim + oc	0.25 + 0.2	13	2	2015	100	100	100	100	100	100	100	72
bromoxynil + sethoxydim + oc	0.375 + 0.2	23	13	1871	100	100	100	100	100	100	100	78
bromoxynil + 2,4-DB	0.25 + 0.5	23	15	1813	100	100	100	100	100	100	0	99
bromoxynil + imazethapyr	0.25 + 0.032	8	2	2289	100	100	100	100	100	100	90	11
bromoxynil + imazethapyr	0.25 + 0.063	18	3	1969	100	100	100	100	100	100	97	0
2,4-DB	0.75	3	0	2126	90	100	87	100	83	0	0	272
weedy check	----	0	0	711	0	0	0	0	0	0	0	1836

[1] Treatments applied May 10 and 17, 1988; s = X-77 at 0.25% v/v, oc = At Plus 411 F at 1 qt/A, BCH-815 = Dash at 1 qt/A and AMS = ammonium sulfate at 3.4 lb/A

[2] Alfalfa injury and stand reduction visually evaluated June 6 and plots harvested July 5, 1988

[3] Weed control visually evaluated June 6 and weeds harvested July 5, 1988

Evaluation of herbicide treatments in new seeding alfalfa. Miller, S.D., D.A. Ball and A.W. Dalrymple. Research plots were established at the Research and Extension Center, Archer, WY, to evaluate the efficacy of preplant incorporated, postemergence or complementary preplant incorporated /postemergence herbicide treatments for weed control in new seeding alfalfa. Plots were established under dryland conditions 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Preplant herbicides were applied May 9, 1988 (air temp. 65 F, relative humidity 25%, wind NW at 10 mph, sky cloudy and soil temp. - 0 inch 64 F, 2 inch 58 F and 4 inch 55 F) and incorporated twice immediately after application with a disc operating at a 3 inch depth. Alfalfa (var. Apollo II) was planted May 11, 1988 in a loam soil (46% sand, 28% silt and 26% clay) with 1.3% organic matter and pH 7.3. Postemergence treatments were applied June 29, 1988 (air temp. 65 F, relative humidity 90%, wind calm, sky cloudy and soil temp. - 0 inch 68 F, 2 inch 70 F and 4 inch 66 F) to 8 inch alfalfa and 2 to 4 inch weeds. Visual weed control and crop damage evaluations were made July 30 and plots harvested August 2, 1988. Cutleaf nightshade (SOLTR) and green foxtail (SETVI) infestations were heavy, kochia (KCHSC) and Russian thistle (SASKR) infestations moderate and skeletonleaf bursage (FRSTO) and common lambsquarters (CHEAL) infestations light but uniform throughout the experimental area.

No treatment injured alfalfa; however, several preplant incorporated treatments caused slight stand reductions (2 to 5%). All herbicide treatments increased alfalfa yield compared to the weedy check. Imazethapyr was the only treatment which provided 70% control of skeletonleaf bursage. Cutleaf nightshade control was good with treatments containing EPTC, imazethapyr, bromoxynil and 2,4-DB. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1528.)

Evaluation of preplant, postemergence and complementary preplant/postemergence treatments in new seeding alfalfa

		Alfalfa[2]			Weed control[3]					
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield lb/A	FRSTO %	KCHSC %	CHEAL %	SETVI %	SASKR %	SOLTR %
Preplant incorporated										
EPTC	2.0	0	0	1372	23	87	80	90	77	97
pendimethalin	0.75	0	0	1343	0	100	100	97	83	0
pendimethalin	1.0	0	0	1168	0	100	100	97	87	0
pendimethalin	1.5	0	0	1110	0	100	100	97	100	0
benefin	1.0	0	0	1285	0	93	97	83	83	0
benefin	1.5	0	0	1314	0	100	100	97	90	0
trifluralin	0.5	0	2	1256	0	100	100	97	83	0
trifluralin	1.0	0	5	1314	0	100	100	97	100	0
EPTC + pendimethalin	2.0 + 0.75	0	0	1460	37	100	100	100	93	100
EPTC + pendimethalin	2.0 + 1.0	0	3	1256	40	100	97	100	93	100
EPTC + benefin	2.0 + 1.0	0	0	1226	33	92	100	100	93	100
EPTC + benefin	2.0 + 1.5	0	3	1198	30	100	100	100	97	100
EPTC + trifluralin	2.0 + 0.5	0	0	1226	33	100	100	100	90	100
EPTC + trifluralin	2.0 + 1.0	0	3	1198	38	100	100	100	100	100
Preplant incorporated/postemergence										
pendimethalin/imazethapyr + s	1.0/0.094	0	0	1285	72	100	100	100	100	90
pendimethalin/bromoxynil	1.0/0.375	0	0	1198	30	100	100	100	100	100
pendimethalin/2,4-DB	1.0/0.5	0	0	1226	0	100	100	97	93	97
Postemergence										
sethoxydim + imazethapyr + oc	0.2/0.094	0	0	1139	70	97	77	87	100	90
weedy check	---------	0	0	496	0	0	0	0	0	0

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[1] Treatments applied May 9 and June 29, 1988; s = X-77 at 0.25% v/v and oc = At Plus 411 F at 1 qt/A

[2] Alfalfa injury and stand reduction visually evaluated July 30 and plots harvested August 2, 1988

[3] Weed control visually evaluated July 30, 1988

A Comparison of post-attachment dodder control methods. Orloff, S. B., and David Cudney. Post-attachment dodder control measures must be employed to curtail the spread of dodder after it has become attached to the alfalfa. The most common treatment for attached dodder was the nonselective herbicide dinoseb. However, its use was discontinued in 1986. Burning was the only remaining method commonly used for post-attachment dodder control. While effective, burning is time consuming, costly, and injurious to the alfalfa.

A trial was conducted to compare burning with flail mowing as an alternative method of controlling attached dodder. The trial was established in the high desert region of Southern California in August of 1988. Treatments were made four days after the fourth cutting when alfalfa regrowth was approximately eight cm. in height. Treatments were made to alfalfa with and without attached dodder. Plots were either mowed using a flail mower, burned with a propane-fueled weed burner, or received no treatment. The flail mower was adjusted so that the flails removed the alfalfa at the soil surface. A minimum of two mowing passes, made in opposite directions, were made per plot to permit close mowing under uneven soil surface conditions. The experimental design was completely randomized with five replications and treatments arranged factorially.

The flail mowing treatments required less than a third the time to accomplish than did the burning treatments. One week after treatment, mowed plots had slightly less alfalfa regrowth than untreated plots, while regrowth was just being initiated in burned plots. Burning and flailing completely controlled the dodder, as no attached dodder was observed at the time of the next alfalfa harvest in any of the plots.

The dodder control methods had significant effects on alfalfa yield and stand, which was measured at the subsequent harvest (table 1). In all cases dodder reduced yield significantly. Yield was significantly reduced by burning whether dodder was present or absent. Flail mowing did not reduce yield significantly. Likewise, burning reduced alfalfa stand where no dodder was present. Alflafa stand was also reduced by dodder prasitization. Mowing dodder infested areas resulted in less stand reduction than did burning.

Flail mowing was shown to have several advantages over burning for the control of attached dodder. Flail mowing was effective, required less time, and caused less deleterious effects on yield and stand. (University of California Cooperative Extension, Los Angeles County, 1110 W. Ave. J, Lancaster, CA 93534.)

Table 1. The effect of flail mowing and burning on alfalfa yield and stand where dodder is present and absent.

Treatment	Yield (tons/A) No Dodder	Dodder Present	Stand (plants/ft^2) No Dodder	Dodder Present
Untreated	1.23	0.77	5.7	2.5
Flail Mowing	1.08	0.85	5.1	4.4
Burning	0.90	0.50	4.0	2.7
LSD .05	0.20		1.0	

Postemergence herbicide treatments for broadleaf and grass weed control in seedling alfalfa. Orloff, S. B. and D. W. Cudney. Weed control during alfalfa stand establishment is important to reduce early weed competition which can reduce alfalfa stand, vigor, and first cutting quality. The herbicides which are currently available for use in seedling alfalfa do not control the spectrum of weeds encountered in the high desert valleys of Southern California.

The following trial was initiated to compare the efficacy of commonly used postemergence broadleaf and grass herbicides (2,4-DB and sethoxydim) with promising unregistered herbicides (bromoxynil and imazethapyr). All herbicides were compared alone and in combination. The combinations included 2,4-DB + sethoxydim, bromoxynil + sethoxydim, imazethapyr + sethoxydim, and imazethapyr + 2,4-DB. The treatments were applied using a CO^2 constant pressure backpack sprayer at a spray volume of 30 gallons per acre and a pressure of 30 psi. The plots measured 6.5 by 25 feet and were arranged in a randomized complete block design.

Alfalfa injury was greatest with treatments containing bromoxynil. Initial phytotoxicity symptoms decreased rapidly, with no alfalfa injury evident six weeks after application. With the exception of sethoxydim, which does not control broadleaf species, all herbicides controlled the mustard spp. (London rocket and tansy mustard). Imazethapyr and 2,4-DB controlled filaree as shown in the April evaluation. Both sethoxydim and bromoxynil were not effective in controlling filaree. Sethoxydim, and combinations containing sethoxydim, gave excellent control of volunteer barley. The high rate of imazethapyr (0.125 lb ai/A) alone , and in combination with 2,4-DB (0.25 lb ai/A), provided approximately 85 percent control of volunteer barley. Sethoxydim, and combinations containing sethoxydium, controlled foxtail barley.

The best overall weed control was obtained where 2,4-DB or imazethapyr were combined with sethoxydim. This illustrates the value of combining herbicides to achieve full-spectrum weed control in seedling alfalfa. (University of California Cooperative Extension, Los Angeles County, 1110 W. Ave. J, Lancaster, CA 93534).

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

Herbicide	Rate lb ai/A	Alfalfa Injury[1]		Weed Control[2]			Filaree		Volunteer Barley		Foxtail Barley
		12/4	1/14	London Rocket 12/21	Tansy Mustard 12/21	Mustard[3] 4/25	12/21	4/25	12/21	5/13	5/13
sethoxydim[4]	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	8.8	10.0	10.0
2,4-DB	0.75	0.8	0.0	10.0	9.0	9.9	7.8	10.0	0.0	1.0	5.8
bromoxynil	0.5	2.1	0.1	10.0	10.0	9.3	0.0	0.0	0.0	3.3	3.5
imazethapyr[5]	0.063	0.5	0.1	9.6	10.0	10.0	9.4	10.0	4.8	6.5	5.3
imazethapyr	0.125	0.8	0.8	9.9	10.0	10.0	7.0	10.0	5.1	8.9	8.3
2,4-DB	0.75	1.1	0.6	10.0	10.0	10.0	8.4	10.0	8.5	9.9	9.9
+sethoxydim	0.4										
bromoxynil	0.5	2.0	0.4	10.0	9.5	8.8	0.3	1.0	8.5	10.0	9.5
+sethoxydim	0.42										
imazethapyr	0.063	0.9	0.1	10.0	10.0	10.0	9.5	10.0	8.5	10.0	9.4
+sethoxydim	0.4										
imazethapyr	0.125	1.3	0.5	10.0	10.0	10.0	9.5	10.0	9.0	9.8	8.7
+sethoxydim	0.4										
imazethapyr	0.063	1.3	0.1	10.0	10.0	9.8	9.8	10.0	4.3	6.0	8.5
+2,4-DB	0.5										
imazethapyr	0.125	1.5	1.1	10.0	9.9	10.0	10.0	10.0	5.3	8.5	7.0
+2,4-DB	0.25										
check		0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
LSD (0.05)		0.6	0.5	0.2	0.6	0.5	2.1	0.8	0.7	1.9	2.4

[1] Alfalfa injury: 0 = no injury; 10 = all alfalfa dead

[2] Weed control: 0 = no control; 10 = 100% weed control

[3] Mustard - both London rocket and tansy mustard

[4] plus 2 pts/A surfel

[5] plus .25% X-77

Timing of dinitroaniline herbicide applications for the control of yellow foxtail in alfalfa. Orloff, S. B., M. Sybouts and D. W. Cudney. Yellow Foxtail (Setaria glauca) has been a serious weed problem for alfalfa producers in the high desert valleys of Southern California. Dinitroaniline herbicides have been shown to control Yellow Foxtail when applied in late February to early March as preemergence treatments. The following trial was established to determine if earlier application timing would influence control. An herbicide timing trial was established in the Willow Springs area of the Antelope Valley in an established stand of alfalfa. Prodiamine, pendimethalin and trifluralin were applied on January 7, February 5, and March 18. Prodiamine and pendimethalin were applied at a spray volume of 20 gallons per acre using a constant pressure CO_2 backpack sprayer. Prodiamine was applied at one and two lbs. ai/A. Pendimethalin was applied at two lbs ai/A in January and three lbs in February and March. Trifluralin was applied as a granular formulation at two lbs ai/A. The plots were 10 by 20 feet in size and were replicated four times in a randomized complete block design. Plots were evaluated for Yellow Foxtail control on July 8, August 11, and September 23.

Yellow Foxtail control diminished for each successive application date (i.e. January applications were the most effective and March applications the least effective). This pattern was observed at each of the three evaluation dates. Pendimethalin, trifluralin, and prodiamine at the high rate performed similarly for each date of application for the three evaluations. Prodiamine at the low application rate provided effective weed control when applied in January, however, control was poor with February and March applications.

These results showed that dinitroaniline herbicides could be applied earlier and be as effective or more effective than normal late-February and March applications. (University of California Cooperative Extension, Los Angeles County, 1110 W. Ave. J, Lancaster, CA 93534.)

Timing of dinitroaniline herbicide applications for Yellow Foxtail control in alfalf

Herbicide	Rate lb ai/A	Timing	Yellow Foxtail Control (%) 7/8	8/11	9/23
prodiamine	1	Jan	95	93	95
prodiamine	2	Jan	98	98	97
pendimethalin	2	Jan	93	89	88
trifluralin	2	Jan	98	95	96
prodiamine	1	Feb	81	83	81
prodiamine	2	Feb	94	95	91
pendimethalin	3	Feb	94	93	92
trifluralin	2	Feb	90	93	93
prodiamine	1	Mar	63	69	70
prodiamine	2	Mar	90	88	88
pendimethalin	3	Mar	87	84	83
trifluralin	2	Mar	89	87	92
LSD .05			10	10	13

Post and preemergence weed control in established alfalfa. Orr, J. P. and D. Colbert. This research was conducted in Sacramento, California, on established alfalfa for the control of yellow foxtail, common chickweed, shepherdspurse, and sowthistle.

This experiment was a randomized, complete block design with four replications. Plots were 10 feet by 20 feet. Herbicides were applied December 30, 1987, with a CO_2 backpack sprayer, 10 gal/a, and an 8001 flat fan nozzle. The alfalfa was semi-dormant with 0.5 to 2.0 inches regrowth. Common chickweed was 2 to 3 inches in height, flowering; shepherd's purse, 3-7 inches in height, flowering; and sowthistle, 6 leaf stage.

Pendimethalin plus paraquat at 3.0 + 0.5 lb ai/a and 4.0 + 0.5 lb ai/a applied sequentially or as a tank-mix gave excellent postemergence control of malva, chickweed, henbit, and sowthistle.

Trifluralin as the standard gave the best overall yellow foxtail control throughout the season. Pendimethalin and prodiamine gave good control along with good alfalfa tolerance. (University of California Cooperative Extension, Sacramento County, 4145 Branch Center Road, Sacramento, CA 95827)

TABLE 1

Postemergence weed control in established alfalfa

Rated 02/22/88	Rate	Weed Control[1]					Alfalfa[1]		
Chemical	lb ai/a	Malva	Chick weed	Henbit	Sow-Thistle	Shepherds-purse	Stand Red.	Vigor Red.	Phyto-toxicity
pendimethalin +paraquat (sequential)	3.0 0.5	9.7	10.0	10.0	10.0	6.7	0.0	0.0	0.0
pendimethalin +paraquat (sequential)	4.0 0.5	9.3	10.0	10.0	10.0	6.7	0.0	0.7	0.0
pendimethalin +paraquat (tank-mix)	3.0 0.5	9.7	9.7	10.0	10.0	10.0	0.0	0.7	0.0
pendimethalin +paraquat (tank-mix)	4.0 0.5	10.0	9.8	9.0	10.0	6.7	0.0	2.0	0.0
pendimethalin	3.0	0.0	5.0	0.0	0.0	6.7	0.0	0.0	0.0
pendimethalin	4.0	0.0	5.0	0.0	3.3	6.7	0.0	0.7	0.0
pendimethalin (sequential) (2.0 Jan + 2.0 after first cutting)	2.0 +2.0	9.7	10.0	10.0	10.0	10.0	0.0	2.0	0.0
trifluralin	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
prodiamine	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
prodiamine	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
prodiamine +norflurazon (tank-mix)	1.0 1.0	5.0	5.0	5.0	10.0	5.0	0.0	0.0	0.0
prodiamine +norflurazon (tank-mix)	1.5 1.0	5.0	5.0	5.0	10.0	3.3	0.0	0.0	0.0
oxadiazon	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
oxadiazon	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control	---	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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[1] 0 = no weed control, no crop damage
10 = complete weed control, crop dead

TABLE 2

Pre-emergence weed control in established alfalfa

	Rate	Weed Control[1]				Alfalfa[1] [2]
	lb	Yellow Foxtail				Vigor Reduction
Chemical	ai/a	06/14/88	07/18/88	08/08/88	09/21/88	04/10/88
pendimethalin	3.0					
+paraquat	0.5	9.7	9.2	8.3	7.1	0.0
(sequential)						
pendimethalin	4.0					
+paraquat	0.5	9.7	9.1	8.7	7.8	0.0
(sequential)						
pendimethalin	3.0					
+paraquat	0.5	9.5	8.9	8.1	7.3	0.0
(tank-mix)						
pendimethalin	4.0					
+paraquat	0.5	9.1	8.6	8.1	6.8	0.0
(tank-mix)						
pendimethalin	3.0	9.5	8.6	7.8	4.4	0.0
pendimethalin	4.0	9.8	9.1	8.6	6.0	0.0
pendimethalin	2.0					
(sequential)	+2.0	9.1	8.8	8.4	6.6	0.0
(2.0 Jan + 2.0 after first cutting)						
trifluralin	2.0	9.5	9.5	9.1	8.5	0.0
prodiamine	1.0	9.8	8.5	7.7	6.8	0.0
prodiamine	1.5	9.5	8.8	8.4	5.5	0.0
prodiamine	1.0					
+norflurazon	1.0	9.2	8.8	8.3	5.4	0.0
(tank-mix)						
prodiamine	1.5					
+norflurazon	1.0	9.2	8.8	8.3	5.6	0.0
(tank-mix)						
oxadiazon	2.0					
+paraquat	0.5	1.3	0.0	0.0	0.0	10.0
oxadiazon	3.0					
+paraquat	0.5	0.0	0.0	0.0	0.0	10.0
Control	---	0.0	0.0	0.0	0.0	0.0
oxadiazon	2.0					
+paraquat	0.5					
+X-77	0.25%	6.3	5.6	2.3	0.0	0.0
oxadiazon	3.0					
+paraquat	0.5					
+X-77	0.25%	7.3	5.4	1.3	0.0	0.0

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[1] 0 = no weed control, no crop damage
10 = complete weed control, no crop growth

[2] On 06/14/88, 07/18/88, 08/08/88, and 09/21/88, there was no alfalfa stand or vigor reduction, or phytotoxicity

Effect of imazethapyr as a post-emergence herbicide in seedling alfalfa. Orr, J. P. and D. Colbert. Control of broadleaf weeds in seedling alfalfa is a major problem in California. This research was conducted in Sacramento County to study herbicide treatments in relation to weed control and alfalfa yield.

The experiment was a randomized complete block design with four replications. Plots were 10 feet by 20 feet. Carrier volume was 10 gal/a delivered through an 8001 flat fan nozzle. Herbicides were applied January 21, 1988, to seedling alfalfa in the 4 to 6 trifoliate leaf stage, 1.5 to 4 inches in height. Visual evaluations and yield were taken on March 29, May 4, and June 14, 1988.

Imazethapyr at rates of 0.063, 0.078, 0.094, and 0.125 gave good to excellent control of malva, shepherd's purse, and filaree. This was reflected in excellent alfalfa yields.

TABLE 1

Imazethapyr weed control and vigor reduction in seedling alfalfa

	Rate	Weed Control[1]				Alfalfa[1]	
	lb	Malva	Shepherds-purse	Redstem Filaree	Whitestem Filaree	Vigor Reduction	
Chemical	ai/a	3/4	3/4	3/4	3/4	2/4	3/4
imazethapyr	0.063						
+X-77	0.25%	9.1	8.6	9.0	8.9	0.9	0.3
imazethapyr	0.078						
+X-77	0.25%	9.1	8.6	8.9	8.9	1.0	1.1
imazethapyr	0.094						
+X-77	0.25%	9.6	9.3	9.0	9.0	1.3	2.0
imazethapyr	0.125						
+X-77	0.25%	9.8	9.6	9.0	9.0	1.3	2.3
2,4-DB	1.0	6.6	3.5	4.3	4.9	0.8	0.0
paraquat	0.125	4.8	2.0	6.1	6.0	4.3	0.0
imazethapyr	0.063						
+NV190	0.25%	9.1	8.5	8.5	8.6	1.1	1.0
imazethapyr	0.078						
+NV190	0.25%	9.3	8.9	9.0	9.0	1.1	1.3
imazethapyr	0.094						
+NV190	0.25%	9.8	9.3	8.9	8.9	1.3	1.1
imazethapyr	0.125						
+NV190	0.25%	9.8	9.7	9.3	9.3	1.3	2.1
Control	-----	0.0	0.0	0.0	0.0	0.0	0.0

[1] 0 = no weed control, no crop damage
10 = complete weed control, crop dead

Weed Stages at Applicaton: Malva - 8-10 leaf
Shepherdspurse - 16 leaf to flower
Filaree - 8-12 leaf

TABLE 2

Stand Loss, growth reduction, and yield of alfalfa
and yield of broadleaf weeds

Chemical	Rate lb ai/a	Percent Stand Loss 3/29	Alfalfa Growth Red. 3/29	Broadleaf Weeds Yield t/a 3/29	Broadleaf Weeds Yield t/a 5/05	Alfalfa[1] Yield t/a 3/29	Alfalfa[1] Yield t/a 5/05	Alfalfa[1] Yield t/a 6/14
imazethapyr	0.063							
+X-77	0.25%	0	0	0.008	0.07	0.54 a	1.8 a	2.2 ab
imazethapyr	0.078							
+X-77	0.25%	0	5	0.005	0.04	0.43 a	1.6 a	2.2 ab
imazethapyr	0.094							
+X-77	0.25%	0	8	0.008	0.01	0.53 a	1.7 a	2.3 ab
imazethapyr	0.125							
+X-77	0.25%	0	13	0.003	0.008	0.43 a	1.6 bc	2.4 a
2,4-DB	1.0	33	65	1.6	0.62	0.12 bc	0.5 b	1.6 bc
paraquat	0.125	30	50	1.4	0.41	0.19 b	0.8 b	1.9 ab
imazethapyr	0.063							
+NV190	0.25%	0	6	0.02	0.03	0.52 a	1.7 a	2.6 a
imazethapyr	0.078							
+NV190	0.25%	0	3	0.01	0.01	0.51 a	1.8 a	2.5 a
imazethapyr	0.094							
+NV190	0.25%	0	6	0.003	0.03	0.53 a	1.7 a	2.5 a
imazethapyr	0.125							
+NV190	0.25%	0	10	0.003	0.02	0.50 a	1.6 a	2.4 a
Control	-----	86	70	2.6	0.6	0.01 c	0.3 c	1.3 c

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[1] Duncan's multiple range

C.V. 21.5 - 03/29/88
11.5 - 05/05/88
15.0 - 06/14/88

Broadleaf and grassy weed control with preplant and postemergence herbicides in seedling alfalfa, Antonito, Colorado. Sebastian, J.R., K.G. Beck, and D.E. Hanson. Preplant incorporated (PPI) and postemergence herbicide treatments were applied near Antonito, CO to evaluate redroot pigweed (AMARE) and green foxtail (SETVI) control in seedling alfalfa. The design was a randomized complete block with four replications. PPI treatments included pendimethalin, EPTC, and pendimethalin plus EPTC. Split applications of pendimethalin (Jul 14) and imazethapyr (Aug 11) also were made. Postemergence treatments included imazethapyr, bromoxynil, sethoxydim, 2,4-DB, bromoxynil plus sethoxydim, and bromoxynil plus 2,4-DB. All treatments with imazethapyr and sethoxydim were applied with X-77 at 0.25% v/v.

All treatments were applied with a CO_2 pressurized backpack sprayer using 11003LP flat fan nozzles and calibrated to deliver 224 L/ha at 103 kPa. Alfalfa was 5 cm to 8 cm tall and had 3 to 5 trifoliate leaves at application (Jul 14). Other application and weed data are presented in Table 1. Plot size was 3.1 m by 9.1 m.

Visual evaluations were taken on Aug 11, Aug 16, Aug 16, and Sep 14, 1988. Alfalfa injury ranged from 5% with sethoxydim to over 70% with pendimethalin and pendimethalin plus EPTC tank mixes (Table 2). Alfalfa injury caused by the PPI treatments decreased over time. Soil at the study site was very, rocky, gravelly and had low organic matter (2.1%); stones one to two inches in diameter were quite common.

Pendimethalin, EPTC, and pendimethalin plus EPTC tank mixes provided the greatest green foxtail and redroot pigweed control in the first two evaluations (Table 2). Imazethapyr (0.11 and 0.14 kg ai/ha) provided excellent redroot pigweed control and fair to excellent green foxtail control in the third and fourth evaluations. Sethoxydim did not effectively control green foxtail and bromoxynil (0.42 kg ai/ha) provided fair redroot pigweed control. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

Table 1. Application information and weed data for broadleaf and grassy weed control with preplant and postemergence herbicides in seedling alfalfa, Antonito, Colorado.

Environmental data		
Application date	Jul 14, 1988	Aug 11, 1988
Application time	4:00 pm	12:00 pm
Air temperature, C	30	29
Cloud cover, %	10	85
Relative humidity, %	30	56
Wind speed/direction, kmh	5 to 11/W	8/E
Soil temperature (5 cm), C	24	-

Weed data

Application date	Species	Growth Stage	Height (cm)	Density (plt/m^2)
Jul 14, 1988	AMARE	seedling	-	1 to 4
Aug 11, 1988	AMARE	vegetative	1 to 3	1 to 4
	SETVI	seedling	-	1 to 4

Table 2. Broadleaf and grassy weed control with preplant and postemergence herbicides in seedling alfalfa.

Herbicide	Rate	Timing	AMARE	SETVI	ALFALFA INJURY	AMARE	SETVI	ALFALFA INJURY	AMARE	SETVI	ALFALFA INJURY	AMARE	SETVI	ALFALFA INJURY
	(kg ai/ha)		(% of check)											
			Aug 11			Aug 16			Aug 26			Sep 15		
pendimethalin	0.84	PPI[1]	96	90	67	91	89	60	93	83	34	86	83	29
pendimethalin	1.12	PPI	90	84	74	80	81	65	83	66	55	68	63	46
pendimethalin	1.68	PPI	97	90	83	97	90	80	97	88	73	89	84	69
pendimethalin	1.12	PPI												
+imazethapyr[3]	0.07	POST[2]	98	89	77	98	86	74	99	91	63	100	91	63
pendimethalin	1.12	PPI												
+ imazethapyr	0.11	POST	95	85	76	95	88	73	99	91	65	100	96	70
imazethapyr	0.07	POST				14	5	6	68	49	0	67	40	13
imazethapyr	0.11	POST				18	8	8	94	75	6	100	68	26
imazethapyr	0.14	POST				17	7	9	95	82	0	100	92	19
pendimethalin	1.12	PPI												
+ EPTC	2.24	PPI	100	100	78	100	100	75	100	100	70	96	100	70
EPTC	3.92	PPI	96	100	53	96	100	48	91	99	28	80	97	27
bromoxynil	0.28	POST				38	6	26	36	1	19	75	25	31
bromoxynil	0.42	POST				49	14	29	73	1	20	75	10	41
bromoxynil	0.28	POST												
+ sethoxydim[4]	0.22	POST				38	23	29	44	24	18	58	43	24
bromoxynil	0.28	POST												
+ 2,4-DB	0.56	POST				35	6	33	51	0	31	73	11	44
bromoxynil	0.42	POST												
+ sethoxydim	0.22	POST				45	26	30	59	26	25	73	39	41
2,4-DB	0.56	POST				9	3	6	48	21	4	83	31	19
sethoxydim	0.20	POST				4	4	5	0	20	0	10	45	5
LSD (0.50)			9	6	8	14	7	8	24	20	11	20	28	18

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[1] All PPI herbicides applied July, 14, 1988.

[2] All POST herbicides applied August, 11,1988.

[3] X-77 added at 0.25% v/v to all imazethapyr treatments.

[4] Herbimax (COC) added at 2.0 L/ha to all sethoxydim treatments.

Johnsongrass control in seedling alfalfa, Lamar, CO.

Sebastian, J.R., Beck, K.G., and Hanson, D.E. An experiment was established in seedling alfalfa near Lamar, CO to evaluate johnsongrass (SORHA) control with clethodim, primisulfuron, norflurazon, and fluazifop-P in combination with different adjuvants. The design was a randomized complete block with four replications. Each clethodim treatment was applied with one of two surfactants, Herbimax (Loveland Industries, Greely, CO) at 2.3 l/ha or Volck Oil (Ortho Chemical) at 1.0% v/v. Clethodim plus adjuvants also were applied as split application treatments on Aug 16 and Sep 12, 1988. All treatments were applied with a CO_2 pressurized backpack sprayer using LP11003 flat fan nozzles calibrated to deliver 225 L/ha at 104 kPa. Other application data is presented in Table 1. Plot size was 3.1 m by 9.1 m.

Visual evaluations were taken on October 12, 1988, approximately two months after the first treatments were applied. Clethodim plus Herbimax (0.28 kg ai/a + 2.3 L/ha) and clethodim plus Volck Oil (0.28 kg ai/ha + 1.0% v/v) provided fair control; these treatments were more effective than primisulfuron, clethodim split application treatments, and clethodim at 0.07 and 0.08 kg ai/ha. Norflurazon (2.24 kg ai/ha) provided the lowest control. Alfalfa was injured 8 to 11% with all clethodim, norflurazon, and fluazifop-P treatments. Primisulfuron caused greatest alfalfa injury (58%).

Herbicide treatments will be evaluated again in 1989. (Weed Research Laboratory, Fort Collins, CO 80523).

Table 1. Application information for johnsongrass control in seedling alfalfa.

Environmental data		
Application date	Aug 16,1988	Sep 12,1988
Application time	8:00 A	12:30 A
Air temperature, C	30	13
Cloud cover, %	0	100
Relative humidity, %	50	90
Wind speed/direction, kph	11 to 14/S	0
Soil temperature (5 cm), C	23	16

Weed data

Application date	Species	Growth Stage	Height (cm)	Density (plt/m^2)
Aug 16, 1988	SORHA	Veg. to Boot	20 to 30	0 to 8
Sep 12, 1988	SORHA	Boot	-	0 to 8

Table 2. Johnsongrass control in seedling alfalfa, Lamar, CO.

Herbicide	Rate	Adjuvants[1]	Alfalfa Injury	SORHA Control
	(kg ai/ha)		---(% of check)--	
clethodim	0.07	Volck Oil	9	45
clethodim	0.07	Herbimax	10	55
clethodim	0.08	Volck Oil	8	49
clethodim	0.08	Herbimax	10	55
clethodim	0.11	Volck Oil	9	64
clethodim	0.11	Herbimax	10	63
clethodim	0.14	Volck Oil	11	66
clethodim	0.14	Herbimax	10	60
clethodim	0.28	Volck Oil	10	74
clethodim	0.28	Herbimax	9	75
primisulfuron	0.10	X-77	58	39
fluazifop-P	0.21	Herbimax	9	63
clethodim[2]	0.07	Volck Oil		
+ clethodim	0.07	Volck Oil	10	46
clethodim	0.07	Herbimax		
+ clethodim	0.07	Herbimax	10	56
LSD (0.05)			4	13

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[1] Herbimax, Volck Oil, and X-77 were applied at 2.24 kg ai/ha, 1.0% v/v, and 1.0% v/v, respectively.

[2] Clethodim applied as a split application; first and second treatments were applied on Aug 16 and Sep 12, 1988, respectively.

Common lambsquarters control in spring barley with urea ammonium nitrate, nonionic surfactant, and DPXR9674 combinations. Dial, M.J. and D.C. Thill. A four (surfactant rate) by three (urea ammonium nitrate percent of spray solution) factorial, randomized complete block design was used to evaluate percent herbicide control of common lambsquarters (CHEAL) in spring barley (var. Andre) at Moscow, Idaho. DPXR9674 was applied at 0.0188 lb ai/a when the spring barley crop was in the 3 to 5 leaves stage of growth. R-11, a nonionic surfactant, was added to the spray solution at 0, 0.063, 0.13, and 0.25 % v/v, along with urea ammonium nitrate (UAN) applied at 0, 25, and 50 percent of the total spray solution. The herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 41 psi and 3 mph. Plots were 10 by 30 ft, and treatments were replicated four times. Treatments were evaluated for percent common lambsquarters control on July 19. Grain yield was not measured. Application data are listed in Table 1.

Table 1. Application data

Application date	May 27, 1988
CHEAL growth stage	3 to 6 leaves
Air temperature (F)	63
Soil temperature at 2 in. (F)	65
Relative humidity (%)	60
Wind (mph) - direction	4-E
Soil pH	4.6
OM (%)	5.0
CEC (meq/1 00g soil)	34.0
Texture	silt loam

No differences were observed for rate of surfactant or percent UAN in the spray solution (Table 2). The rate of surfactant by percent UAN interaction was not significant. As rate of surfactant was increased, percent control of common lambsquarters was increased. However, when percent UAN in the spray solution was increased, percent control of common lambsquarters was decreased. DPXR9674 applied at 0.0188 lb ai/a with 0.25 %v/v nonionic surfactant did not control common lambsquarters adequately. The 0.0188 lb ai/a rate may not be high enough to be effective on common lambsquarters. (Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Common lambsquarters control with 0.0188 lb ai/a DPXR9674, nonionic surfactant and urea ammoniun nitrate in spring barley

Rate of nonionic surfactant	Control CHEAL
(% v/v)	(% of check)
0	40
0.063	48
0.13	58
0.25	64
LSD (0.05)	ns
weed density (no./ft^2)	48

Percent urea ammonium nitrate	Control CHEAL
(% of spray solution)	(% of check)
0	61
25	48
50	49
LSD (0.05)	ns
weed density (no./ft^2)	48

Russian knapweed control in spring barley in Fremont County. Dial, M.J. and D.C. Thill. 2,4-D and clopyralid/2,4-D were applied to spring barley (var. Klages) to evaluate Russian knapweed (CENRE) control near Ashton, Idaho. The herbicide treatments were applied to fully tillered barley and 3 to 8 in. tall Russian knapweed with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 40 psi and 3 mph. The plots were 20 by 30 ft, and the treatments were arranged in a randomized complete block design replicated four times. Treatments were evaluated visually for percent control of Russian knapweed on July 25. Grain yield was not determined. Application data are listed in Table 1.

Table 1. Application data

Date of application	June 6, 1988
Air temperature (F)	45
Soil temperature at 2 in. (F)	75
Relative humidity (%)	46
Soil pH	5.5
OM	2.4
CEC (meq/100g soil)	13.1
Texture	silt loam

2,4-D and clopyralid/2,4-D applied at 1.00 and 0.6 lb ai/a respectively, effectively controlled Russian knapweed (Table 2). When the rate of clopyralid/2,4-D was reduced to 0.4 lb ai/a, the Russian knapweed control was reduced. (Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Russian knapweed control in spring barley.

Treatment	Rate	Control CENRE
	(lb ai/a)	(% of check)
2,4-D amine	1.0	90
clopyralid/2,4-D	0.6	91
clopyralid/2,4-D	0.4	63
LSD (0.05)		7
weed density (no./ft^2)		8

Evaluation of wild oat herbicides in spring barley. Evans, J.O. and B.M. Jenks. Postemergence wild oat herbicides were applied May 21, 1988 to spring barley (var. Russell) at Cove, Utah. Barley plants were approximately in the 3-leaf stage, and the wild oat (AVEFA) varied from 3-4 leaves. The treatments were applied with a bicycle sprayer calibrated to deliver 16 gpa at 40 psi. The plots were 12 by 30 ft and arranged in a randomized complete block design, replicated four times. The treatments were evaluated visually June 30 and harvested July 7 by cutting random square yard samples. The experiment was established under dryland conditions and the nearest weather station (2 miles) recorded 3.45 inches of precipitation from planting to harvest. Table 1 contains the application data.

AC-222,293 controlled more than 90% of the wild oat in each treatment (Table 2). Difenzoquat was the only other treatment with more than 50% control. However, there appears to be a rate response to HOE-7113. The high rate of HOE-7113 controlled three times as many wild oat as the low rate. (Utah Agricultural Experiment Station, Logan, UT 84322-4820)

Table 1. Application data for wild oat control in spring barley

Planting date	4/08/88
Application date	5/21/88
Air temperature (F)	74
Soil temperature (F)	68
Relative humidity (%)	30
Wind (mph)	3
Sky/Soil conditions	clear/dry
Soil texture	silt loam
Sand/silt/clay (%)	02/73/25
pH	7.7
OM (%)	4.6

Table 2. Wild oat control and barley yield from herbicide treatments in Cove, Utah. 1988

Treatment	Rate	AVEFA control	Yield
	(lb ai/A)	(% of check)	(bu/A)
check	----	--	27
diclofop	1.00	40	30
diclofop + bromoxynil	0.75 0.375	33	28
AC-222,293	0.67	95	36
AC-222,293 + bromoxynil	0.67 0.375	95	36
AC-222,293	1.00	93	31
AC-222,293 + bromoxynil	1.00 0.375	95	37
difenzoquat + bromoxynil	0.50 0.375	72	35
difenzoquat	0.75	70	34
HOE-7125	0.66	20	22
HOE-7125	0.78	29	25
HOE-7113	0.20	16	27
HOE-7113	0.24	50	31
LSD (0.05)		29	15
CV		37	34

Injury and grain yield of spring barley treated with diclofop and DPXM6316. Evans, R.M. and D.C. Thill. Diclofop and DPXM6316 tank mixes were applied to spring barley (var. Andre) at the 1 to 3 leaf stage to determine herbicide induced crop injury and grain yield reduction. The study was designed as a four (diclofop rates) by four (DPXM6316 rates) factorial, randomized complete block replicated four times. The plots were 10 by 30 ft. All herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 42 psi and 3 mph. All DPXM6316 treatments included 0.13% v/v R11 nonionic surfactant. The checks and diclofop alone treatments were sprayed with bromoxynil/MCPA at 0.375 lb ai/a on June 15. The study was located in a wild oat free area and broadleaf weed control was 95 to 100% over all treatments. Crop injury was evaluated June 18. The grain was harvested August 22 with a Hege plot combine. Application data are listed in Table 1.

Table 1. Application data

Location	U of I Plant Science Farm Moscow, ID
Date of application	May 20, 1988
Barley growth stage	1 to 3 leaf
Air temperature (F)	68
Soil temperature (F) 2 in.	75
Relative humidity (%)	58
Wind (mph) direction	1 to 2 -- NW
Soil type	Silt loam
Organic matter (%)	3.56
pH	5.54
CEC (meq/100 g soil)	18.2

Diclofop applied alone decreased barley height and caused chlorosis (Table 2). Barley injury increased as diclofop rate increased in the diclofop alone treatments. The addition of DPXM6316 to diclofop reduced barley injury. Barley treated with diclofop alone did not lodge. Barley treated with diclofop plus DPXM6316 lodged to some extent and barley treated with DPXM6316 alone was lodged severely. Barley grain yield tended to decrease as lodging increased. However, diclofop applied alone at 1.25 ai/a decreased barley grain yield even though the barley did not lodge (Table 3). (Idaho Agricultural Experimental Station, Moscow, ID 83843)

Table 2. Diclofop and DPXM6316 injury to spring barley on June 18, 1988

DPXM6316	Diclofop (lb ai/a)				
	0	0.75	1.0	1.25	Mean[a]
(lb ai/a)	%				
0	0[b]	36	48	85	42
0.0156	0	5	10	9	6
0.0234	0	5	5	5	4
0.0313	0	4	5	5	3
Mean[c]	0	12	17	26	

[a] LSD (0.05) = 4 for DPXM6316
[b] LSD (0.05) = 7 for diclofop by DPXM6316
[c] LSD (0.05) = 4 for diclofop

Table 3. Grain yield of spring barley treated with diclofop and DPXM6316

DPXM6316	Diclofop (lb ai/a)				
	0	0.75	1.0	1.25	Mean[a]
(lb ai/a)	(lb/a)				
0	2610[b]	2898	2760	1932	2550
0.0156	2311	2541	2392	2564	2452
0.0234	2461	2553	2564	2553	2533
0.0313	2300	2323	2438	2817	2470
Mean[c]	2421	2579	2539	2467	

[a] LSD (0.05) = ns for DPXM6316
[b] LSD (0.05) = 555 for diclofop by DPXM6316
[c] LSD (0.05) = ns for diclofop

Wild oats control in spring barley. Kidder, D.W., G.W. Gibson and D.P. Drummond. Five herbicides were evaluated for control of wild oats (*Avena Fatua* L., AVEFA) and crop injury in spring barley located in Camas county, Idaho. Eighteen treatments, including the control, were applied in a randomized complete block design with four replications. Spring barley (var. Piroline) was seeded on May 6, 1988 at a rate of 90 lb/A on irrigated cropland.

Herbicides were applied on June 8, to the wild oats in the 1 to 3 leaf stage and on June 21 to the wild oats in the 3 to 5 leaf stage. Herbicides were applied with a CO_2 pressurized backpack sprayer using 8002 nozzles calibrated to deliver 20 gpa at a pressure of 30 psi. Plots were 10 feet by 30 feet. Spring barley was in the 3 leaf stage and starting to tiller at the time of the early application and in the 4 to 6 leaf stage and had 4 to 5 tillers at the time of the later application. Control was evaluated visually on July 6 and on July 28. Grain was harvested on August 22 using a small plot combine.

Results are shown in table 2. (Univ. of Idaho Coperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in spring barley

Date of application	6/8/88	6/21/88
Air temperature (F)	65	88
Soil temperature @ surface (F)	56	80
Soil temperature @ 3 in (F)	62	49
Relative humidity (%)	27	36
Dew present	none	none
Wind (mph)	2-8	0-6
Cloud cover (%)	50	0

Table 2. Wild oats control in spring barley

Treatment	Rate	Timing[1] (AVEFA)	7/6	7/28	8/22	
			Crop inj	AVEFA[2] control	Grain yield	AVEFA yield
	(lb a.i./a)	(leaves)	-----(%)-----		--(g/plot)[3]--	
Untreated			0	0	2058	23.0
Diclofop	0.75	1-3	1	98	2484	2.0
Diclofop + COC[4]	0.75 + 1 pt.	1-3	16	97	2484	0.5
Diclofop	1.00	1-3	4	97	2687	0.1
Diclofop + COC	1.00 + 1 pt.	1-3	8	98	2491	1.6
Diclofop	1.25	1-3	5	97	2373	0.6
Diclofop + bromoxynil	0.80 + 0.40	1-3	8	80	2480	4.4
Diclofop + DPX-M6316 + surf.[5]	1.00 + 0.016 + 0.25%	1-3	14	83	1911	2.5
Hoe 7113	0.20	1-3	70	100	2063	1.2
RH-0898 + COC	0.05 + 1 pt.	1-3	1	75	2333	17.9
RH-0898 + COC	0.10 + 1 pt.	1-3	6	90	2816	1.9
Hoe 7125	0.66	3-5	0	82	2667	18.0
Hoe 7125	0.78	3-5	7	70	1910	18.6
Hoe 7125 + bromoxynil	0.66 + 0.25	3-5	24	72	2054	27.1
Hoe 7125 + DPX-M6316	0.66 + 0.012	3-5	6	80	2338	14.9
Hoe 7125 + DPX-R9674	0.66 + 0.012	3-5	0	80	2248	6.9
Hoe 7113	0.20	3-5	16	95	1894	1.4
Hoe 7121	0.66	3-5	1	93	2511	22.2
LSD (0.05)			19	22	N.S.	N.S.

1 Treatments were applied on June 8 for the 1 to 3 leaf stage and June 21 for the 3 to 5 leaf stage.
2 AVEFA= wild oats
3 Harvested area measured 4 feet wide and 30 feet long.
4 COC= Crop oil concentrate (Atplus 411F)
5 Surf.= Surfactant (R-11)

Evaluation of imazamethabenz tank mixes in spring barley. Kidder, D.W., G.W. Gibson and D.P. Drummond Imazamethabenz, alone and in tank mix combination with difenzoquat and diclofop, was evaluated for control of wild oats (*Avena Fatua* L., AVEFA) and crop injury in spring barley located in Camas county, Idaho. Seventeen treatments, including the control, were applied in a randomized complete block design with four replications. Spring barley (var. Piroline) was seeded on May 6, 1988 at a rate of 90 lb/A on irrigated cropland.

Herbicides were applied on June 8 to wild oats in the 1 to 3 leaf growth stage and on June 21 to wild oats in the 3 to 5 leaf growth stage. Herbicides were applied using a CO^2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa at a pressure of 30 psi. Treatment plots were 10 feet and 30 feet. Spring barley had three leaves and was starting to tiller at the time of the early application and in the 4 to 6 leaf growth stage and had 4 to 5 tillers at the time of the later application. Control was evaluated visually on July 6 and on July 28. Grain was harvested on August 22 using a small plot combine.

Results are shown in table 2. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in spring barley

Date of application	6/8/88	6/21/88
Air temperature (F)	65	88
Soil temperature @ surface (F)	56	80
Soil temperature @ 3 in (F)	62	49
Relative humidity (%)	27	36
Dew present	none	none
Wind (mph)	2-8	0-6
Cloud cover (%)	50	0

Table 2. Imazamethabenz tank mixes in spring barley

			7/28	8/22	
Treatment	Rate	Timing[1] (AVEFA)	AVEFA[2] control	Grain yield	AVEFA yield
	(lb a.i./a)	(leaves)	(%)	----(g/plot)[3]---	
Untreated			0	2687	4.91
Imazamethabenz	0.47	1-3	100	2566	0.08
Difenzoquat	1.00	1-3	100	2966	0.57
Diclofop	1.00	1-3	96	3025	0.00
Imazamethabenz + difenzoquat	0.125 + 0.50	1-3	100	3208	0.08
Imazamethabenz + difenzoquat	0.25 + 0.50	1-3	100	2491	0.12
Imazamethabenz + difenzoquat	0.31 + 0.25	1-3	100	2279	0.00
Imazamethabenz + diclofop	0.125 + 0.50	1-3	93	2711	2.47
Imazamethabenz + diclofop	0.25 + 0.50	1-3	96	2814	3.55
Imazamethabenz	0.47	3-5	97	2005	0.63
Difenzoquat	1.00	3-5	95	2328	0.33
Diclofop	1.00	3-5	95	2609	0.00
Imazamethabenz + difenzoquat	0.125 + 0.50	3-5	91	2535	0.12
Imazamethabenz + difenzoquat	0.25 + 0.50	3-5	90	2460	0.06
Imazamethabenz + difenzoquat	0.31 + 0.50	3-5	91	2535	0.26
Imazamethabenz + diclofop	0.125 + 0.50	3-5	83	3104	2.42
Imazamethabenz + diclofop	0.25 + 0.50	3-5	86	2443	1.39
LSD (0.05)			14	N.S.	N.S.

[1] Treatments were applied on June 8 for the 1 to 3 leaf stage and June 21 for the 3 to 5 leaf stage.

[2] AVEFA= wild oats

[3] Harvested area measured 4 feet wide and 30 feet long.

Wild oats control in barley. Miller, S.D. and J. Lauer. Research plots were established at the Research and Extension Center, Powell, WY, to evaluate wild oats control with postemergence herbicides applied at several stages. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 10 gpa at 40 psi. Barley (var. Klages) was seeded in a clay loam soil (40% sand, 27% silt and 33% clay) with 1.6% organic matter and pH 7.9 March 29, 1988. Treatments were applied June 1 (air temp. 72 F, relative humidity 25%, wind S at 5 mph, sky clear and soil temp. - 0 inch 116 F, 2 inch 70 F and 4 inch 68 F) to 5-leaf barley, 2 to 3-leaf wild oats and 3 inch rape or June 8, 1988 (air temp. 82 F, relative humidity 19%, wind calm, sky clear and soil temp. - 0 inch 100 F, 2 inch 85 F and 4 inch 77 F) to fully tillered barley, 4 to 5-leaf wild oats and 5 inch rape. Visual weed control and crop damage evaluations were made August 9 and plots harvested August 10, 1988. Wild oats (AVEFA) and volunteer rape (BRACA) infestations were heavy and uniform throughout the experimental area.

No treatment reduced barley stand; however, several treatments injured barley 3 to 13%. Barley yields were 3 to 32 bu/A higher in herbicide treated plots than in the weedy check and generally reflected weed control and/or crop injury. Wild oats control was 90% or greater with imazamethabenz at 0.47 lb/A, HOE-7125 at 0.78 lb/A or treatments containing difenzoquat and volunteer rape control 90% or greater with HOE-7125 at 0.78 lb/A, difenzoquat combinations with 2,4-D or treatments containing imazamethabenz. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1552.)

Wild oats control in barley

		Barley[2]			Control[3]	
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield bu/A	AVEFA %	BRACA %
2 to 3-leaf						
diclofop	0.75	0	0	58	37	0
diclofop + oc	0.75	3	0	65	52	0
diclofop + bromoxynil	0.75 + 0.375	3	0	75	45	73
diclofop + thiameturon	1.0 + 0.018	0	0	76	40	80
diclofop + thiameturon + oc	1.0 + 0.018	3	0	78	47	87
imazamethabenz + s	0.38	0	0	81	75	83
imazamethabenz + s	0.47	0	0	83	90	93
imazamethabenz + bromoxynil + s	0.38 + 0.25	0	0	85	73	90
imazamethabenz + bromoxynil + s	0.38 + 0.375	0	0	86	73	92
imazamethabenz + bromoxynil + MCPA + s	0.38 + 0.25 + 0.25	0	0	87	77	96
imazamethabenz + bromoxynil + MCPA + s	0.38 + 0.375 + 0.375	0	0	83	70	92
HOE-7113	0.12	0	0	68	47	0
HOE-7113	0.16	0	0	68	57	0
4 to 5-leaf						
difenzoquat	0.25	0	0	72	95	0
difenzoquat	1.0	0	0	73	96	0
difenzoquat + 2,4-D	1.0 + 0.375	0	0	82	92	93
difenzoquat + bromoxynil	1.0 + 0.375	0	0	81	92	73
HOE-7125	0.44	3	0	77	82	87
HOE-7125	0.66	10	0	82	83	88
HOE-7125	0.78	13	0	80	90	90
weedy check	----	0	0	55	0	0

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[1] Treatments applied June 1 and 8, 1988; oc = At Plus 411 F at 1 qt/A and s = X-77 at 0.25% v/v

[2] Barley injury and stand reduction visually evaluated August 9 and plots harvested August 10, 1988

[3] Weed control visually evaluated August 9, 1988

Imazamethabenz herbicide combinations for wild oat control in spring barley. Lish, J.M. and D.C. Thill. Imazamethabenz was tank mixed with diclofop and difenzoquat to evaluate low rate herbicide combinations for wild oat (AVEFA) control in spring barley. The experiment was established at Bonners Ferry and Moscow, Idaho. Herbicides were applied at two wild oat growth stages with a CO_2 backpack sprayer calibrated to deliver 10 gal/a at 42 psi (Table 1). Wild oat control was evaluated visually on August 24 at Bonners Ferry and July 18 at Moscow. Barley grain was harvested August 18 and 24 at Moscow and Bonners Ferry, respectively.

Table 1. Application data.

	Bonners Ferry		Moscow	
Application date	May 24	June 10	May 26	June 9
Wild oat leaf stage	1 to 3	5	1 to 3	5
Barley leaf stage	1	3	1	3
Air temperature (F)	50	60	62	70
Soil temperature at 2 in. (F)	55	66	70	74
Relative humidity (%)	88	90	59	64
Wind (mph)/direction	0	0	3 to 5/N	0
Soil pH	7		4.9	
OM (%)	7		2.8	
CEC (meq/100 g)	20		34.1	
texture	clay loam		loam	

Wild oat control was 85 to 100% with most treatments (Table 2). However, imazamethabenz (0.47 lb ai/a) applied at the wild oat 5 leaf stage at Bonners Ferry and imazamethabenz + difenzoquat (0.125 + 0.5 lb ai/a) applied at the wild oat 1 to 3 leaf stage at Moscow controlled only 64 and 60% of the wild oat, respectively. Wild oat control at Bonners Ferry was poor with diclofop alone and in combination with imazamethabenz applied at the wild oat 5 leaf stage. Wild oat control was better with herbicides applied at the wild oat 3 leaf stage (96%) than the wild oat 5 leaf stage (64%) at Bonners Ferry (orthogonal contrast $P = 0.0001$).

Grain yield at Bonners Ferry was better than the check with all applications at the 3 leaf stage except with diclofop (1 lb ai/a). Grain yield was better than the check only with difenzoquat (1 lb ai/a), imazamethabenz + diclofop (0.125 + 0.5 lb ai/a), and imazamethabenz + difenzoquat (0.31 + 0.25 lb ai/a) when herbicides were applied at the wild oat 5 leaf stage. Grain yield at Moscow did not differ statistically ($P = 0.05$) among treatments. Overall, it appears that imazamethabenz and difenzoquat rates can be reduced by one half without sacrificing wild oat control or grain yield. (Idaho Agricultural Experiment Station, Moscow, Id 83843)

Table 2. Wild oat control and barley grain yield

			Moscow		Bonners Ferry	
Treatment	Rate	AVEFA stage	AVEFA control	Grain yield	AVEFA control	Grain yield
	(lb ai/a)	(leaves)	(%)	(lb/a)	(%)	(lb/a)
check	--	--	-	2877	-	4879
imazamethabenz	0.47	1 to 3	95	3191	100	5734
difenzoquat	1.00	1 to 3	88	3155	95	5658
diclofop	1.00	1 to 3	93	3104	86	5497
imazamethabenz + difenzoquat	0.25 + 0.50	1 to 3	96	3242	99	5779
imazamethabenz + difenzoquat	0.125 + 0.50	1 to 3	60	3639	96	5865
imazamethabenz + diclofop	0.25 + 0.50	1 to 3	91	2841	97	5963
imazamethabenz + diclofop	0.125 + 0.50	1 to 3	92	3169	94	5708
imazamethabenz + difenzoquat	0.31 + 0.25	1 to 3	94	3572	100	6065
imazamethabenz	0.47	5	85	3294	64	5426
difenzoquat	1.00	5	100	3125	94	5787
diclofop	1.00	5	96	3078	10	5324
imazamethabenz + difenzoquat	0.25 + 0.50	5	96	3179	92	5504
imazamethabenz + difenzoquat	0.125 + 0.50	5	89	2927	86	5275
imazamethabenz + diclofop	0.25 + 0.50	5	92	2974	51	5450
imazamethabenz + diclofop	0.125 + 0.50	5	97	3357	27	5735
imazamethabenz + difenzoquat	0.31 + 0.25	5	97	3388	86	5886
LSD (0.05)			17	NS	26	699
Wild oat density (plant/ft^2)			*6*	--	*1*	--

Broadleaf weed control in barley. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate weed control and barley tolerance with several postemergence herbicide treatments. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 10 gpa at 40 psi. Barley (var. Steptoe) was seeded in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2% organic matter and pH 7.6 March 29, 1988. Treatments were applied May 11, 1988 (air temp. 70 F, relative humidity 44%, wind SW at 3 mph, sky clear and soil temp. - 0 inch 97 F, 2 inch 55 F and 4 inch 50 F) to 5-leaf barley and 1 to 2 inch weeds. Visual crop damage evaluations were made May 17 and May 25, visual weed control ratings May 25, barley height measured June 28 and plots harvested July 21, 1988. Common lambsquarters (CHEAL) infestations were moderate and hairy nightshade (SOLSA) infestations light throughout the experimental area.

No treatment reduced barley stand; however, barley was injured 30 to 50% and 7 to 25% by A-1237 or C-4243 one and two weeks after application. Barley yields related closely to weed control and/or crop injury and were 3 to 8 bu/A higher in herbicide treated plots, except A-1237 and C-4243, than in the weedy check. Barley yields in plots treated with A-1237 or C-4243 were 1 to 11 bu/A lower than in the weedy check. Common lambsquarters control was excellent with all treatments and hairy nightshade control excellent with all treatments except DPX-R9674, DPX-L5300 or thiameturon alone. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1547.)

Broadleaf weed control in barley

		Barley[2]					Weed control[3]	
		injury		stand	stand			
Treatment[1]	Rate lb ai/A	1 wk %	2 wk %	reduction %	height inches	yield bu/A	CHEAL %	SOLSA %
clopyralid + bromoxynil	0.094 + 0.25	0	0	0	26	72	100	100
clopyralid + bromoxynil	0.094 + 0.375	0	0	0	25	72	100	100
CGA-131036 + s	0.009	0	0	0	25	71	100	0
CGA-131036 + s	0.018	0	0	0	25	71	100	0
metsulfuron + 2,4-D + s	0.004 + 0.25	0	0	0	26	72	95	93
DPX-R9674 + s	0.008	0	0	0	27	74	98	43
DPX-R9674 + s	0.016	0	0	0	27	72	100	47
DPX-L5300 + s	0.008	0	0	0	27	72	91	50
DPX-L5300 + s	0.016	0	2	0	24	71	98	60
thiameturon + s	0.008	0	0	0	26	70	100	0
thiameturon + s	0.016	0	0	0	26	73	100	0
clopyralid + 2,4-D	0.063 + 0.38	0	0	0	27	75	98	97
clopyralid + 2,4-D	0.094 + 0.5	0	0	0	25	71	100	100
clopyralid + 2,4-D + DPX-R9674 + s	0.063 + 0.38 + 0.004	0	0	0	27	72	98	95
clopyralid + 2,4-D + metsulfuron + s	0.063 + 0.38 + 0.004	0	0	0	26	72	100	100
clopyralid + 2,4-D + dicamba	0.063 + 0.38 + 0.063	0	4	0	26	73	100	100
clopyralid + 2,4-D + fluroxypyr	0.063 + 0.38 + 0.063	0	0	0	27	74	100	98
dicamba + MCPA	0.063 + 0.38	0	4	0	25	71	97	98
dicamba + MCPA	0.063 + 0.5	0	4	0	26	71	99	99
bromoxynil	0.375	0	0	0	26	71	97	100
bromoxynil + MCPA	0.375 + 0.375	0	0	0	27	74	100	100
bromoxynil + DPX-R9674 + s	0.187 + 0.008	0	0	0	26	71	100	100
bromoxynil + DPX-R9674 + s	0.187 + 0.016	0	0	0	25	71	100	100
bromoxynil + thiameturon + s	0.187 + 0.008	0	0	0	27	74	100	100
bromoxynil + thiameturon + s	0.187 + 0.016	0	0	0	26	71	100	100
A-1237	0.015	40	10	0	23	56	100	100
A-1237	0.03	50	18	0	23	59	100	100
C-4243	0.03	30	7	0	27	66	100	100
C-4243	0.06	40	25	0	24	59	100	100
2,4-D	0.5	0	0	0	26	73	93	93
weedy check	---	0	0	0	26	67	0	0

[1] Treatments applied May 11, 1988; s = X-77 at 0.25% v/v

[2] Barley injury visually evaluated May 17 and 25; stand reduction visually evaluated May 25, plant height measured June 28 and plots harvested July 21, 1988

[3] Weed control visually evaluated May 25, 1988

Weed control in barley with fluroxypyr. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of fluroxypyr alone or in combination with other herbicides for broadleaf weed control in barley. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 10 gpa at 40 psi. Barley (var. Steptoe) was seeded in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2% organic matter and pH 7.6 March 29, 1988. Treatments were applied May 10, 1988 (air temp. 70 F, relative humidity 33%, wind W at 2 mph, sky clear and soil temp. - 0 inch 79 F, 2 inch 64 F and 4 inch 60 F) to 5-leaf barley and 1 to 2 inch weeds. Visual weed control and crop damage evaluations were made May 25, barley height measured June 28 and plots harvested July 21, 1988. Common lambsquarters (CHEAL) infestations were moderate and hairy nightshade (SOLSA) infestations light throughout the experimental area.

No herbicide treatment reduced barley stand; however, dicamba combinations with 2,4-D or MCPA injured barley slightly (4 to 5%). Barley yields related closely to weed control and were 3 to 8 bu/A higher in herbicide treated plots, except fluroxypyr alone, than in the weedy check. Weed control was excellent with all treatments except fluroxypyr alone or fluroxypyr in combination with XRM-5114. (Wyoming Agric. Exp. Sta. Laramie, WY 82071 SR 1548.)

Weed control in barley with fluroxypyr

		Barley[2]				Weed control[3]	
Treatment[1]	Rate lb ai/A	injury %	stand red %	height inches	yield bu/A	CHEAL %	SOLSA %
fluroxypyr	0.063	0	0	26	78	7	10
fluroxypyr	0.094	0	0	26	79	17	20
fluroxypyr	0.125	0	0	27	79	30	33
clopyralid + 2,4-D + fluroxypyr	0.063 + 0.375 + 0.063	0	0	26	83	98	97
clopyralid + 2,4-D + fluroxypyr	0.063 + 0.375 + 0.094	0	0	26	84	100	98
XRM-5114 + fluroxypyr	0.094 + 0.063	0	0	25	81	70	75
XRM-5114 + fluroxypyr	0.094 + 0.094	0	0	26	81	77	70
picloram + 2,4-D + fluroxypyr	0.02 + 0.375 + 0.063	0	0	26	85	99	99
picloram + 2,4-D + fluroxypyr	0.02 + 0.375 + 0.094	0	0	27	85	97	99
2,4-D + fluroxypyr	0.375 + 0.063	0	0	25	83	98	99
2,4-D + fluroxypyr	0.375 + 0.094	0	0	27	83	99	99
MCPA + fluroxypyr	0.375 + 0.063	0	0	27	85	94	97
MCPA + fluroxypyr	0.375 + 0.094	0	0	26	83	96	98
bromoxynil + fluroxypyr	0.375 + 0.063	0	0	25	85	100	100
bromoxynil + fluroxypyr	0.375 + 0.094	0	0	25	84	100	100
bromoxynil + MCPA	0.375 + 0.375	0	0	26	86	100	100
dicamba + 2,4-D	0.063 + 0.375	4	0	25	84	100	99
dicamba + MCPA	0.063 + 0.375	5	0	24	82	99	99
weedy check	-------------	0	0	26	78	0	0

[1] Treatments applied May 10, 1988

[2] Barley injury and stand reduction visually evaluated May 25, plant height measured June 28 and plots harvested July 21, 1988

[3] Weed control visually evaluated May 25, 1988

Influence of nitrogen on weed control with sulfonyl urea herbicides in barley. Miller, S.D. and J.M. Krall. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate weed control and crop tolerance with DPX-R9674 and DPX-L5300 alone or in combination with nitrogen. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 10 gpa at 40 psi. Barley (var. Steptoe) was seeded in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2% organic matter and pH 7.6 March 29, 1988. Treatments were applied May 10, 1988 (air temp. 60 F, relative humidity 53%, wind N at 6 mph, sky overcast and soil temp. - 0 inch 71 F, 2 inch 66 F and 4 inch 62 F) to 5-leaf barley and 1 to 2 inch weeds. Visual weed control and crop damage evaluations were made May 25, barley height measured June 28 and plots harvested July 21, 1988. Common lambsquarters (CHEAL) infestations were heavy and hairy nightshade (SOLSA) infestations light throughout the experimental area.

No herbicide treatment reduced barley stand and only slight injury (5%) was observed with DPX-R9674 at the high application rate. Barley yields were closely related to common lambsquarters control and were 4 to 8 bu/A higher in herbicide treated plots than in the weedy check. Weed control with DPX-R9674 or DPX-L5300 was not influenced by nitrogen. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1549.)

Weed control with DPX-R9674 and DPX-L5300 in barley

		Barley[2]				Weed control[3]	
Treatment[1]	Rate lb ai/A	injury %	stand red %	height %	yield bu/A	CHEAL %	SOLSA %
DPX-R9674 + s	0.014	0	0	25	86	93	27
DPX-R9674 + s	0.018	0	0	25	85	98	33
DPX-R9674 + s	0.023	0	0	24	83	100	40
DPX-R9674 + s	0.028	5	0	24	86	100	43
DPX-R9674 + AMS + s	0.014	0	0	25	86	94	30
DPX-R9674 + AMS + s	0.018	0	0	24	85	99	35
DPX-R9674 + AMS + s	0.023	0	0	24	86	100	37
DPX-R9674 + AMS + s	0.028	5	0	24	83	100	47
DPX-R9674 + 28% N + s	0.014	0	0	23	86	99	33
DPX-R9674 + 28% N + s	0.018	0	0	25	87	100	40
DPX-R9674 + 28% N + s	0.023	0	0	23	86	100	37
DPX-R9674 + 28% N + s	0.028	0	0	23	83	100	47
DPX-L5300 + s	0.008	0	0	24	84	92	40
DPX-L5300 + s	0.012	0	0	25	87	97	43
DPX-L5300 + AMS + s	0.008	0	0	24	83	95	43
DPX-L5300 + AMS + s	0.012	0	0	24	88	99	43
DPX-L5300 + 28% N + s	0.008	0	0	25	84	97	40
DPX-L5300 + 28% N + s	0.012	0	0	23	86	99	40
bromoxynil + MCPA	0.25 + 0.25	0	0	25	87	100	100
weedy check	-----------	0	0	25	79	0	0

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[1] Treatments applied May 10, 1988; s = X-77 at 0.25% v/v, AMS = ammonium sulfate at 3.4 lb/A and 28% N = 28% w/w nitrogen

[2] Barley injury and stand reduction visually evaluated May 25, plant height measured June 28 and plots harvested July 21, 1988

[3] Weed control visually evaluated May 25, 1988

Sulfonyl urea herbicide-insecticide combinations in barley. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate weed control and barley tolerance with sulfonyl urea herbicides alone or in combination with insecticides. Plots were established under irrigation and were 9 by 30 ft. with three replications arranged in a randomized complete block. Herbicide and/or insecticide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Barley (var. Steptoe) was seeded in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2% organic matter and pH 7.6 March 29, 1988. Treatments were applied May 11, 1988 (air temp. 77, relative humidity 24%, wind W at 7 mph, sky clear and soil temp. - 0 inch 110 F, 2 inch 66 F, and 4 inch 58 F) to 5-leaf barley and 1 to 2 inch common lambsquarters. Visual weed control and crop damage evaluations were made May 24, barley height measured June 28 and plots harvested July 22, 1988. Common lambsquarters (CHEAL) infestations were light and variable throughout the experimental area.

No treatment reduced barley stand; however, several sulfonyl urea herbicide-insecticide combinations caused 2 to 10% injury. Disulfoton combinations with chlorsulfuron or DPX-R9674 tended to be the most injurious. Barley yields were 3 to 10 bu/A lower in disulfoton combinations with chlorsulfuron and 5 to 7 bu/A lower in disulfoton combinations with DPX-R9674 than in the weedy check. Common lambsquarters control with sulfonyl urea herbicides was excellent and not influenced by insecticide. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1550.)

Sulfonyl urea herbicide-insecticide combinations in barley

Treatment[1]	Rate lb ai/A	Barley[2] injury %	 stand red %	 height inches	 yield bu/A	Control[3] CHEAL %
chlorsulfuron + s	0.032	0	0	30	103	100
chlorsulfuron + disulfoton + s	0.015 + 0.75	2	0	29	101	99
chlorsulfuron + disulfoton + s	0.032 + 1.5	10	0	28	94	100
chlorsulfuron + dimethoate + s	0.015 + 0.375	0	0	29	100	100
chlorsulfuron + dimethoate + s	0.032 + 0.75	3	0	28	101	100
chlorsulfuron + esfenvalerate + s	0.015 + 0.025	0	0	29	104	100
chlorsulfuron + esfenvalerate + s	0.032 + 0.05	2	0	27	104	100
metsulfuron + 2,4-D + s	0.008 + 0.25	0	0	30	101	100
metsulfuron + 2,4-D + disulfoton + s	0.004 + 0.019 + 0.75	0	0	29	104	100
metsulfuron + 2,4-D + disulfoton + s	0.008 + 0.25 + 1.5	5	0	27	103	100
metsulfuron + 2,4-D + dimethoate + s	0.004 + 0.19 + 0.375	2	0	28	104	100
metsulfuron + 2,4-D + dimethoate + s	0.008 + 0.25 + 0.75	3	0	27	101	100
metsulfuron + 2,4-D + esfenvalerate + s	0.004 + 0.19 + 0.025	2	0	28	102	99
metsulfuron + 2,4-D + esfenvalerate + s	0.008 + 0.25 + 0.05	2	0	27	101	100
DPX-R9674 + s	0.0375	0	0	27	104	100
DPX-R9674 + disulfoton + s	0.019 + 0.75	3	0	28	99	99
DPX-R9674 + disulfoton + s	0.0375 + 1.5	7	0	27	97	100
DPX-R9674 + dimethoate + s	0.019 + 0.375	0	0	28	104	100
DPX-R9674 + dimethoate + s	0.0375 + 0.75	3	0	29	102	99
DPX-R9674 + esfenvalerate + s	0.019 + 0.025	2	0	28	103	99
DPX-R9674 + esfenvalerate + s	0.0375 + 0.05	3	0	27	105	100
disulfoton	1.5	0	0	29	104	0
dimethoate	0.75	0	0	29	104	0
esfenvalerate	0.05	0	0	29	103	0
weedy check	----	0	0	29	104	0

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[1] Treatments applied May 11, 1988; s = X-77 at 0.25% v/v

[2] Barley injury and stand reduction visually evaluated May 24, plant height measured June 28 and plots harvested July 22, 1988

[3] Weed control visually evaluated May 24, 1988

Evaluation of herbicide treatments for alfalfa control or suppression in barley. Krall, J.M. and S.D. Miller. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of herbicide treatments for control or suppression of established alfalfa plants in barley. Plots were established under irrigation and were 9 by 30 ft. with four 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. Barley (var. Steptoe) was seeded in a sandy loam soil (81% sand, 10% silt and 9% clay) with 1.1% organic matter and pH 7.8 March 29, 1988. Treatments were applied May 6, 1988 (air temp. 65 F, relative humidity 25%, wind W at 5 mph, sky clear and soil temp. 0 inch 85 F, 2 inch 66 F and 4 inch 62 F) to 3-leaf barley and 4 to 6 inch alfalfa. Visual alfalfa control and crop damage evaluations were made May 17 and alfalfa and barley yields determined July 22, 1988. Alfalfa infestations were moderate and uniform throughout the experimental area.

No treatment reduced barley stand; however, slight injury (5%) was observed with clopyralid and picloram combinations with 2,4-D at the high rate. Alfalfa yields were reduced 18 to 79% in herbicide treated compared to untreated plots. Barley yields were related to alfalfa control and were 13 to 25 bu/A lower in untreated than herbicide treated plots. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1551.)

Alfalfa control in barley

		Alfalfa[2]		Barley[2]		
Treatment[1]	Rate lb ai/A	control %	yield lb/A	injury %	stand red %	yield bu/A
clopyralid	0.063	63	179	0	0	79
clopyralid	0.125	75	103	0	0	74
clopyralid + 2,4-D	0.063 + 0.375	80	184	0	0	74
clopyralid + 2,4-D	0.125 + 0.75	88	28	5	0	72
metsulfuron + 2,4-D + s	0.008 + 0.5	76	220	0	0	70
bromoxynil + MCPA	0.375 + 0.375	79	283	0	0	67
picloram + 2,4-D	0.012 + 0.375	79	67	0	0	78
picloram + 2,4-D	0.024 + 0.375	75	14	5	0	75
2,4-D	0.5	61	69	0	0	78
MCPA	0.5	60	206	0	0	78
bromoxynil	0.375	14	1130	0	0	68
untreated check	-----	0	1384	0	0	54

[1] Treatments applied May 6, 1988; s= X-77 at 0.25% v/v

[2] Alfalfa control and barley damage evaluations were made May 17 and yields determined July 22, 1988

Canada thistle and volunteer alfalfa control in barley. Miller, S.D., J. Lauer and A.W. Dalrymple. A series of postemergence herbicide treatments were applied near Powell, WY, June 15, 1988 (air temp. 75 F, relative humidity 20%, wind NW at 5 mph, sky clear and soil temp. - 0 inch 85 F, 2 inch 75 F and 4 inch 72 F) to 1 to 6 inch Canada thistle rosettes, 6 to 12 inch alfalfa and 4 leaf barley to evaluate weed control and crop tolerance. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 10 gpa at 40 psi. The soil was classified as a sandy loam (67% sand, 17% silt and 16% clay) with 2.1% organic matter and pH 8.1. Visual weed control evaluations were made July 13 and August 22, visual crop damage evaluations July 13 and plots harvested September 28, 1988. Canada thistle (CIRAR) infestations were light and volunteer alfalfa (MEDSA) infestations moderate throughout the experimental area.

No treatment reduced crop stand; however, treatments containing dicamba injured barley 10 to 12%. Barley yields were closely related to weed control and/or crop injury. Canada thistle and volunteer alfalfa control was good (85% or greater) with all clopyralid plus 2,4-D treatments. Dicamba or bromoxynil combinations with 2,4-D were more effective than combinations with MCPA. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1555.)

Canada thistle and volunteer alfalfa control in barley

						Weed control[3]		
		Barley[2]				CIRAR		MEDSA
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield bu/A	200 kernel wt g	July %	August %	July %
clopyralid + 2,4-D	0.063 + 0.38	0	0	75	10.5	80	92	85
clopyralid + 2,4-D	0.094 + 0.5	0	0	73	10.3	87	95	93
clopyralid + 2,4-D	0.125 + 0.625	0	0	75	10.5	95	87	96
DPX-R9674 + s	0.008	0	0	69	10.3	23	43	7
bromoxynil	0.25	0	0	64	10.4	13	0	7
bromoxynil + MCPA	0.25 + 0.25	0	0	67	10.5	30	8	37
bromoxynil + 2,4-D	0.25 + 0.25	2	0	69	10.4	50	47	62
bromoxynil + DPX-R9674 + s	0.25 + 0.008	0	0	66	10.2	23	10	13
clopyralid + 2,4-D + DPX-R9674 + s	0.094 + 0.5 + 0.008	0	0	73	10.6	90	83	87
clopyralid + 2,4-D + DPX-L5300 + s	0.094 + 0.5 + 0.008	0	0	73	10.6	88	99	92
clopyralid + 2,4-D + bromoxynil	0.094 + 0.5 + 0.25	0	0	73	10.2	85	99	93
clopyralid + 2,4-D + dicamba	0.094 + 0.5 + 0.125	10	0	76	10.6	92	93	93
clopyralid + 2,4-D + picloram	0.094 + 0.5 + 0.023	0	0	73	10.3	92	98	92
clopyralid + 2,4-D + thiameturon + s	0.094 + 0.5 + 0.008	0	0	73	10.5	85	90	90
clopyralid + 2,4-D + thiameturon + s	0.094 + 0.5 + 0.016	0	0	72	10.3	87	93	93
dicamba + MCPA	0.125 + 0.5	10	0	68	10.5	67	37	82
dicamba + 2,4-D	0.125 + 0.5	12	0	63	10.1	72	92	90
weedy check	-----------	0	0	61	10.3	0	0	0

[1] Treatments applied June 15, 1988; s = X-77 at 0.25% v/v

[2] Barley injury and stand reduction visually evaluated July 13 and plots harvested September 28, 1988

[3] Canada thistle control visually evaluated July 13 and August 22 and alfalfa control July 13, 1988

Preplant incorporated herbicide evaluations in pinto beans. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established on May 24, 1988 at the Agricultural Science Center to evaluate efficacy of individual and/or herbicide combinations applied preplant incorporated in pinto beans (var. UI-126). Soil type was a Kinnear very fine sandy loam with a pH of 7.9 and an organic matter content of less than 1%. Individual plots were 12 by 30 ft in size with four replications arranged in a randomized complete block design. Herbicides were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi. Treatments were immediately incorporated using a power driven rototiller to a depth of 2 to 4 in. Pinto beans were planted on 34 in beds at a rate of 60 lb/A on May 24, 1988. Russian thistle and prostrate pigweed infestations were heavy and redroot pigweed and kochia infestations were moderate throughout the experimental area.

Visual evaluations of crop injury and weed control were made July 25, 1988. All treatments provided excellent to good control of all weed species. Trifluralin applied at 2.0 lb ai/A was the only treatment to cause substantial crop injury. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Broadleaf evaluations in pinto beans, 1988

Treatment	Rate lb ai/A	Crop[1] Injury	Weed Control[1]				Yield lb/A
			AMABL	AMARE	KCHSC	SASKR	
		%					
ethalfluralin	2.0	10	100	100	100	100	2341
ethalfluralin + EPTC R-33865	1.5 + 3.0	0	100	100	100	99	2543
trifluralin + EPTC R-33865	0.75 + 3.0	0	100	100	94	88	2401
trifluralin + EPTC R-33865	1.5 + 3.0	5	100	100	100	100	2543
alachlor + trifluralin	2.5 + 0.5	0	100	100	100	96	2519
trifluralin + metolachlor	1.5 + 2.0	4	100	100	100	100	2283
trifluralin	2.0	40	100	100	100	100	1573
ethalfluralin + EPTC R-33865	0.75 + 3.0	0	100	100	100	98	2661
trifluralin	1.0	0	99	100	98	93	2460
ethalfluralin	0.75	0	99	100	99	96	2720
handweeded check			100	100	100	100	2602
check			0	0	0	0	686
LSD 0.05			ns	ns	1.2	3.5	661

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1. Based on a visual scale from 0-100, where 0 = no control or crop injury and 100 = dead plants

Evaluation of preplant incorporated and complementary preplant incorporated/preemergence or postemergence treatments in pinto beans. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of preplant incorporated herbicide treatments alone or in combination with preemergence and postemergence treatments for weed control in pinto beans. Plots were established under irrigation and were 10 by 40 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. Preplant herbicides were applied May 26, 1988 (air temp. 67 F, relative humidity 48%, wind calm, sky clear and soil temp. - 0 inch 81 F, 2 inch 60 F and 4 inch 59 F) and incorporated twice with a roller harrow operating at 2.5 to 3 inches immediately after application. Pinto beans (var. UI-114) were planted May 26, 1988 in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.3% organic matter and pH 7.4 and preemergence treatments applied (air temp. 84 F, relative humidity 20%, wind W at 5 mph, sky cloudy and soil temp. - 0 inch 88 F, 2 inch 78 F and 4 inch 70 F). Postemergence treatments were applied to 2 trifoliolate beans and 0.5 to 1 inch weeds June 14, 1988 (air temp. 62 F, relative humidity 64%, sky clear, wind N at 5 mph and soil temp. - 0 inch 70 F, 2 inch 64 F and 4 inch 60 F). Weed counts, crop stand counts and visual crop injury ratings were made June 28, visual weed control ratings August 5 and plots harvested August 26, 1988. Hairy nightshade (SOLSA), common lambsquarters (CHEAL), redroot pigweed (AMARE) and yellow foxtail (SETLU) infestations were moderate and kochia (KCHSC) infestations light throughout the experimental area.

Herbicide treatments had little effect on pinto bean stand; however, treatments containing imazethapyr caused 7 to 10% injury. Pinto bean yields generally reflected weed control and were 613 to 835 lb/A higher in herbicide treated plots compared to weedy check plots. Broad-spectrum season long weed control was excellent with imazethapyr alone or in combination with other herbicides. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1535.)

Weed control in pinto beans with preplant incorporated and complementary preplant incorporated/preemergence or postemergence herbicide treatments

					Weed control[3]								
		Pinto beans[2]			June					August			
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield lb/A	SOLSA %	CHEAL %	KCHSC %	AMARE %	SETLU %	SOLSA %	CHEAL %	AMARE %	SETLU %
Preplant incorporated													
pendimethalin	1.5	0	4	2401	0	100	100	100	96	0	97	100	97
EPTC	3.0	0	0	2383	0	89	75	80	70	70	80	77	73
imazethapyr	0.047	8	0	2321	100	100	100	100	72	100	87	100	92
imazethapyr	0.063	10	0	2324	100	100	100	100	77	100	93	100	92
EPTC + trifluralin	2.0 + 0.75	0	0	2340	100	100	100	100	100	75	95	96	96
EPTC + ethafluralin	2.0 + 0.75	0	0	2453	0	93	100	100	100	73	100	100	97
EPTC + pendimethalin	2.0 + 1.0	0	0	2371	70	100	100	100	96	73	93	97	95
EPTC + imazethapyr	2.0 + 0.047	7	0	2307	100	100	100	100	89	100	98	100	98
EPTC + imazethapyr	2.0 + 0.063	10	0	2313	100	100	100	100	89	100	100	100	98
EPTC + chloramben	2.0 + 2.25	0	0	2375	25	89	100	100	68	80	90	97	89
pendimethalin + imazethapyr	1.0 + 0.047	8	0	2335	100	100	100	100	100	100	100	100	99
pendimethalin + imazethapyr	1.0 + 0.063	10	0	2364	100	100	100	100	100	100	100	100	100
pendimethalin + chloramben	1.0 + 2.25	0	0	2355	50	100	100	100	95	80	97	97	98
Preplant incorporated/preemergence													
pendimethalin/imazethapyr	1.0/0.047	7	0	2381	100	100	100	100	100	100	98	100	100
pendimethalin/imazethapyr	1.0/0.063	12	0	2465	100	100	100	100	100	100	100	100	100
pendimethalin/chloramben	1.0/2.25	0	0	2400	0	100	100	100	100	80	97	95	98
EPTC/imazethapyr	2.0/0.047	8	0	2481	100	100	100	100	89	100	98	100	97
EPTC/imazethapyr	2.0/0.063	10	0	2358	100	100	100	100	95	100	97	100	97
EPTC/chloramben	2.0/2.25	0	0	2362	75	82	100	100	91	87	85	90	90
Preplant incorporated/postemergence													
pendimethalin/bentazon	1.0/0.75	2	0	2481	0	100	100	100	96	70	100	100	97
pendimethalin/imazethapyr + s	1.0/0.047	7	0	2535	100	100	100	100	100	100	98	100	99
pendimethalin/imazethapyr + s	1.0/0.063	10	0	2460	100	100	100	100	100	100	98	100	100
EPTC/bentazon	2.0/0.75	0	0	2532	0	89	100	100	57	87	100	93	80
EPTC/imazethapyr + s	2.0/0.047	7	0	2359	100	100	100	100	82	100	97	100	99
EPTC/imazethapyr + s	2.0/0.063	8	0	2488	100	100	100	100	96	100	98	100	98
weedy check	---------	0	0	1700	0	0	0	0	0	0	0	0	0
plants/ft. row 6 inch band		---	5.0	----	0.4	0.7	0.2	0.4	1.5	---	---	---	---

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[1] Treatments applied May 26 and June 14, 1988; s = X-77 at 0.25% v/v

[2] Crop stand counts and visual crop injury evaluated June 28 and plots harvested August 26, 1988

Evaluation of preemergence and complementary preemergence/postemergence treatments in pinto beans. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of preemergence herbicide treatments alone or in combination with postemergence treatments for weed control in pinto beans. Plots were established under irrigation and were 10 by 40 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. Pinto beans (var. UI-114) were planted May 26, 1988 in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.3% organic matter and pH 7.7 and preemergence treatments applied (air temp. 75 F, relative humidity 25%, wind W at 5 mph, sky partly cloudy and soil temp. - 0 inch 95 F, 2 inch 80 F and 4 inch 78 F). Postemergence treatments were applied to 2 trifoliolate beans and 0.5 to 1 inch weeds June 14, 1988 (air temp. 64 F, relative humidity 64%, wind calm, sky clear and soil temp. - 0 inch 70 F, 2 inch 60 F and 4 inch 60 F). Weed counts, crop stand counts and visual crop injury ratings were made June 28, visual weed control ratings August 5 and plots harvested August 26, 1988. Hairy nightshade (SOLSA), common lambsquarters (CHEAL), redroot pigweed (AMARE) and yellow foxtail (SETLU) infestations were moderate and kochia (KCHSC) and witchgrass (PANCA) infestations light throughout the experimental area.

Herbicide treatments had little effect on pinto bean stands; however, treatments containing imazethapyr caused 10 to 20% injury. Pinto bean yields generally reflected weed control and were 478 to 771 lb/A higher in herbicide treated plots compared to weedy check plots. Broad-spectrum season long weed control was excellent with imazethapyr alone or in combination with other herbicides. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1536.)

Weed control in pinto beans with preemergence and complementary preemergence/postemergence herbicide treatments

		Pinto beans[2]			Weed control[3]									
					June					August				
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield lb/A	SOLSA %	CHEAL %	KCHSC %	AMARE %	SETLU %	SOLSA %	CHEAL %	AMARE %	SETLU %	PANCA %
Preemergence														
metolachlor	2.5	0	0	2251	0	100	100	100	93	65	43	47	93	97
alachlor	2.5	0	0	2296	47	92	100	60	89	70	53	47	88	97
imazethapyr	0.063	13	4	2470	100	100	100	100	60	100	92	100	96	93
imazethapyr	0.094	20	0	2351	100	100	100	100	86	100	97	100	92	97
metolachlor + chloramben	2.0 + 2.25	0	0	2335	60	100	100	100	100	77	73	80	90	97
metolachlor + imazethapyr	2.0 + 0.063	15	0	2423	100	100	100	100	97	100	97	100	98	100
metolachlor + imazethapyr	2.0 + 0.094	20	0	2428	100	100	100	100	97	100	95	100	100	100
cinmethylin + chloramben	0.75 + 2.25	0	0	2431	20	92	60	100	86	70	65	73	90	93
cinmethylin + imazethapyr	0.75 + 0.063	10	0	2424	100	100	100	100	97	98	93	100	97	100
cinmethylin + imazethapyr	0.75 + 0.094	17	4	2492	100	100	100	100	96	100	97	100	98	100
Preemergence/postemergence														
metolachlor/bentazon	2.0/0.75	0	0	2456	33	100	100	100	91	85	70	73	90	92
metolachlor/imazethapyr + s	2.0/0.063	10	0	2512	100	100	100	100	97	100	93	100	100	100
metolachlor/imazethapyr + s	2.0/0.094	18	0	2354	100	100	100	100	91	100	97	100	100	100
cinmethylin/bentazon	0.75/0.75	0	0	2461	33	100	100	60	86	75	77	73	89	90
cinmethylin/imazethapyr + s	0.75/0.063	8	0	2493	100	100	100	100	91	100	93	100	100	100
cinmethylin/imazethapyr + s	0.75/0.094	13	0	2524	100	100	100	100	93	100	98	100	98	100
weedy check	----------	0	0	1723	0	0	0	0	0	0	0	0	0	0
plants/ft. row 6 inch band		---	5.0	----	0.4	0.7	0.1	0.4	1.4	---	---	---	---	---

[1] Treatments applied May 26 and June 14, 1988; s = X-77 at 0.25% v/v

[2] Crop stand counts and visual crop injury evaluated June 28 and plots harvested August 26, 1988

[3] Weed stand counts June 28 and visual weed control ratings August 5, 1988

Evaluation of postemergence herbicide treatments in pinto beans. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of postemergence applications of imazethapyr, alone or in combination with grass herbicides, for weed control in pinto beans. Plots were established under irrigation and were 10 by 40 ft. with three replications arranged in a randomized complete block. Pinto beans (var. UI-114) were planted in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.3% organic matter and pH 7.4 May 26, 1988. The herbicides were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 10 gpa at 40 psi June 14, 1988 (air temp. 67 F, relative humidity 43%, wind N at 5 mph, sky cloudy and soil temp. - 0 inch 82 F, 2 inch 75 F and 4 inch 62 F) to 2 trifoliolate beans and 1 to 2 inch weeds. Weed counts, crop stand counts and visual injury ratings were made June 28, visual weed control ratings August 5 and plots harvested August 26, 1988. Hairy nightshade (SOLSA), common lambsquarters (CHEAL), redroot pigweed (AMARE) and yellow foxtail (SETLU) infestations were moderate and kochia(KCHSC) infestations light throughout the experimental area.

Herbicide treatments had little effect on pinto bean stands; however, treatments containing imazethapyr caused 8 to 18% injury. Pinto bean yields generally reflected weed control and were 500 to 669 lb/A higher in herbicide treated plots compared to weedy check plots. Weed control with imazethapyr was excellent whether applied alone or in combination with grass herbicides. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1537.)

Weed control with postemergence herbicide treatments in pinto beans

		Pinto beans[2]			Weed control[3]								
					June					August			
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield lb/A	SOLSA %	CHEAL %	KCHSC %	AMARE %	SETLU %	SOLSA %	CHEAL %	AMARE %	SETLU %
imazethapyr + oc	0.063	8	0	2546	100	86	100	100	41	100	85	97	96
imazethapyr + oc	0.094	15	4	2446	100	91	100	100	45	100	90	97	98
sethoxydim + imazethapyr + oc	0.2 + 0.063	10	4	2531	100	86	100	100	60	100	90	99	100
sethoxydim + imazethapyr + oc	0.2 + 0.094	15	0	2386	100	91	100	100	65	100	93	98	100
sethoxydim + bentazon + BCH-815	0.2 + 0.75	0	0	2377	73	86	60	100	55	77	83	80	83
haloxyfop + imazethapyr + oc	0.1 + 0.094	18	0	2507	100	100	100	100	97	100	93	100	100
quizalofop + imazethapyr + oc	0.1 + 0.094	15	0	2460	100	91	100	100	77	100	92	98	100
fluazifop + imazethapyr + oc	0.37 + 0.094	17	0	2504	100	100	100	100	55	100	90	100	98
weedy check	------------	0	0	1877	0	0	0	0	0	0	0	0	0
plants/ft. row 6 inch band		---	5.2	----	0.9	0.5	0.1	0.3	3.1	---	---	---	---

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[1] Treatments applied June 14, 1988; oc = At Plus 411 F at 1 qt/A and BCH-815 = Dash at 1 qt/A

[2] Crop stand counts and visual crop injury evaluated June 28 and plots harvested August 26, 1988

[3] Weed stand counts June 28 and visual weed control ratings August 5, 1988

Evaluation of preplant incorporated herbicides in kidney beans. Mitich, L.W., N.L. Smith, and G.B. Kyser. Six herbicides in 16 preplant incorporated treatments were evaluated for weed control and crop tolerance in 'California Dark Red' kidney beans in Yolo clay loam at the UC Davis farm, on furrow irrigated 30-in. beds. Plots were 10 ft by 20 ft (four 20-ft rows) and arranged in complete randomized blocks. Treatments were applied June 13, 1988, broadcast with a CO_2 backpack sprayer delivering 20 gpa through 8002 nozzles; weather at application was clear, 90 F to 95 F. Glyphosate (1.3 lb/a) was included with all treatments to control existing weeds. On the same day, treatments were incorporated to 2 in., on bed tops only, with a power tiller. Kidney beans were planted June 15 at 45 lb/a; they emerged June 20.

Visual evaluations for weed control and crop phytotoxicity were performed July 26. No treatments appeared to injure bean plants. Weeds present at evaluation included barnyardgrass (# ECHCG), redroot pigweed (# AMARE), common purslane (# POROL), and Solanums (hairy nightshade # SOLSA and tomatillo groundcherry # PHYIX). AC-263,499 at 0.047 and 0.063 lb/a failed to control barnyardgrass; metolachlor at 2.5 lb/a failed to control common purslane adequately; and pendimethalin (1.0 lb/a) and trifluralin (1.0 lb/a) failed to control solanids adequately. With these exceptions, all treatments provided good to excellent control (80% to 100%) of all weeds.

Beans were last irrigated August 30; they were cut September 9, and a 5 ft by 18 ft swath in the center of each plot was harvested September 23. Bean yields ranged from 1852 to 2334 lb/a and they were not significantly different at the 5% level. (Department of Botany, University of California, Davis, CA 95616)

Evaluation of preplant incorporated herbicides in kidney beans, UC Davis

Treatment	Rate (lb/a)	Percent weed control[1]				Yield[1,3] (lb/a)
		ECHCG	AMARE	POROL	solanids[2]	
AC-263,499 (Pursuit)	0.047	18	100	100	100	1966 A
AC-263,499	0.063	23	100	100	100	1852 A
metolachlor (Dual)	2.5	100	98	73	100	1990 A
AC-263,499 + metolachlor	0.047 + 2.5	98	100	100	100	2258 A
pendimethalin (Prowl)	1.0	93	100	100	67	2100 A
AC-263,499 + pendimethalin	0.047 + 1.0	98	95	95	100	1950 A
pendimethalin + metolachlor	1.0 + 2.5	100	100	100	100	2040 A
alachlor + trifluralin (Cannon)	3.0	83	100	100	100	1890 A
alachlor + trifluralin	3.75	96	98	100	100	2247 A
alachlor (Lasso MT)	3.0	95	100	100	100	2187 A
alachlor + trifluralin	3.0 + 0.5	100	100	100	100	2101 A
trifluralin (Treflan)	1.0	98	100	100	65	2234 A
metolachlor + trifluralin	2.5 + 0.5	98	98	100	88	2334 A
ethalfluralin (Sonalan)	1.0	100	98	98	98	2257 A
alachlor + ethalfluralin	3.0 + 1.0	100	100	98	100	2055 A
metolachlor + ethalfluralin	2.5 + 1.0	100	100	100	95	1977 A
control	---	0	0	0	0	1895 A

[1] Average of four replications.

[2] Solanids include tomatillo groundcherry (# PHYIX) and hairy nightshade (# SOLSA).

[3] Yields followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Greenhouse study of kidney been competition with barnyardgrass and hairy nightshade in the presence of various levels of soil phosphorus. Mitich, L.W., and G.B. Kyser. Kidney beans (B), barnyardgrass (G), and hairy nightshade (N) were planted in 6 competitive arrangements (BBB, BBG, BBN, BGG, BNN, BGN) in 6 soil types [3 levels of soil phosphorus (P) vs. lime (L) or no lime (U)]. Species interaction was evaluated under various levels of available P; addition of hydrated lime [$Ca(OH)_2$] increased soil pH, thereby decreasing availability of P. The basic soil was a low P (8.8 ppm) loamy sand, pH 7.9, from Tulare County. P was added at 0, 50, or 100 ppm by weight in the form of 0-25-0 fertilizer mortared to pass through a size 50 screen; lime was added to half the soil at 0.3% by weight. Soil characteristics are summarized in Table 1.

Table 1. Summary of soil characters

	Added P (ppm)	pH	Available P (ppm)
Unlimed	0	7.9	8.8
	50	7.4	40.0
	100	7.0	71.0
Limed	0	9.6	10.1
	50	8.7	29.0
	100	8.3	64.0

The experiment was established in split blocks as follows:
- The 6 soil types were randomized within each of 4 replication blocks.
- Within each soil type, competitive arrangements were randomized.

Plants were seeded in 6-in. pots in a 'warm' greenhouse on the UC Davis campus on July 6, 1988. Before planting, pots were watered for 1 week to allow pH in limed soils to stabilize. Each pot was fertilized weekly with 120 ml of 10x normal strength Hoagland's solution without P. On August 31 all plants were cut at the soil level, dried, and later weighed. Dry plant weights were used for all analyses; average weight per pot was used for pots with more than one plant of a species.

In analysis it was found that bean plant weight increased greatly between 0 and 50 ppm added P; a slight but significant increase also appeared between 50 and 100 ppm added P. Bean plant weight also varied significantly with competitive arrangement: beans competed best against nightshade and worst against other beans. Added P and competitive arrangement interacted significantly as follows: a great increase in bean plant size owing to added P was found in pots where beans were not competing against other beans. In other words, P increased the interspecific competitive strength of bean plants. Neither barnyardgrass nor nightshade increased significantly in weight with added P, but both species showed the effects of competition. Barnyardgrass competed against itself just as well as it did against bean plants, and outcompeted nightshade. Nightshade obviously competed well only with other nightshade; it also showed significant variation between replication blocks. (Department of Botany, University of California, Davis, CA 95616)

Table 2. Factors significantly affecting growth of kidney beans, barnyardgrass, and nightshade in the greenhouse, UC Davis

Plant	Factor	Unit	Average dry wt[1] (grams)	LSD (5%)
Kidney beans (B)	Phosphorus	0 ppm	6.8 C	2.85
		50 ppm	19.0 B	
		100 ppm	21.9 A	
	Competition	BBB	10.5 E	2.79
		BBG	12.6 DE	
		BBN	14.5 CD	
		BGG	15.5 C	
		BNN	23.4 A	
		BGN	19.1 B	
	P X competition	0 ppm X BBB	5.0 H	4.83
		X BBG	5.1 H	
		X BBN	6.8 H	
		X BGG	7.6 GH	
		X BNN	9.7 FGH	
		X BGN	6.6 H	
		50 ppm X BBB	12.1 EFG	
		X BBG	15.6 DE	
		X BBN	17.9 CD	
		X BGG	15.3 DE	
		X BNN	31.1 A	
		X BGN	22.2 BC	
		100 ppm X BBB	14.4 DEF	
		X BBG	17.1 D	
		X BBN	18.8 BCD	
		X BGG	23.6 B	
		X BNN	29.4 A	
		X BGN	28.4 A	
Barnyardgrass	Competition	BBG	14.7 B	3.01
		BGG	14.5 B	
		BGN	19.3 A	
Nightshade	Competition	BBN	1.48 AB	1.11
		BNN	2.49 A	
		BGN	1.27 B	

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[1] Values followed by the same letter are not significantly different according to Duncan's Multiple Range Test. Average dry weight per pot.

<u>Weed control in dry beans with imazethapyr</u>. Westra, P. and T. D'Amato. Seven field studies were conducted with imazethapyr and Cannon (trifluralin and alachlor)in dry beans. Each consisted of 3 replications of 10 x 30 ft. plots in a RCB design. Herbicides were applied with a CO_2 pressurized backpack sprayer using 11002LP SS nozzles spraying 24 GPA at 18 psi boom pressure. The field experiments evaluated herbicides applied: 1.) preplant incorporated (PPI); 2.) preemergent (PRE); 3.) postemergent (POST). PPI treatments of imazethapyr and imazethapyr/pendimethalin tank mixes provided excellent control (90-100%) of redroot pigweed (AMARE), but caused unacceptable pinto bean injury. PPI treatments of Cannon provided excellent control of redroot pigweed (90-100% control) with minimal bean injury. PRE treatments of imazethapyr/alachlor and imazethapyr/metolachlor tank mixes provided excellent control of redroot pigweed with no objectionable bean injury. POST treatments of imazethapyr provided a range of redroot pigweed control from poor to good (50-90% control) and did not harm beans significantly. These studies show that preemergent applications of imazethapyr,alone or in various tank mixes, and preplant incorporated applications of Cannon provide excellent redroot pigweed control with minimal dry bean injury. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523)

Barnyardgrass control in dry beans. Westra, P. and T. D'Amato. A field study was conducted on postemergence control of barnyardgrass (ECHCG) in dry beans. The study consisted of 3 replications of 10 x 30 ft. plots in a RCB design. Applications were made with 11002LP SS tips spraying 24 GPA at 18 psi boom pressure. The barnyardgrass was 6-10 in. tall and the bean canopy was 6-8 in. high at the time of treatment applications (August 16). Barnyardgrass density was high (1 plant/in^2) and uniform throughout the study site. Bean yields were taken September 16.

Fluazifop provided poor to fair control (68-73%) of barnyardgrass. Sethoxydim was rated fair for controlling barnyardgrass at the 0.15 lb ai/a rate and excellent (91% control) at the 0.30 lb ai/a rate. Select provided excellent barnyardgrass control (91%, 97%, 98%) at all three rates applied (0.075, 0.10, 0.125 lb ai/a). Bean injury ratings on August 31 were based on discoloration and canopy reduction relative to check plots. Based on this study barnyardgrass in dry beans can be satisfactorily controlled with postemergent applications of fluazifop, sethoxydim, or Select. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523)

Grass Control in Dry Beans

Herbicide	Rate (lb ai/a)	Growth Stage	ECHCG %Control	Bean Yield (Cwt/a)
Check			0.0c	20b
Fusilade	0.18	POST	73.3b	23ab
Fusilade	0.25	POST	68.3b	25ab
Poast	0.15	POST	73.3b	23ab
Poast	0.30	POST	91.3a	25ab
Select	0.075	POST	90.7a	23ab
Select	0.10	POST	97.0a	28a
Select	0.125	POST	97.7a	27ab

Weed control in field corn with complimentary preemergence/postemergence herbicides. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established at the Agricultural Science Center to evaluate the efficacy of complementary preemergence/postemergence herbicide treatments for weed control in field corn (var. Super Crost 5460). 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 25 psi. Preemergence surface (PES) treatments were appplied May 20, 1988 and immediately incorporated with 0.75 in of sprinkler applied water. Postemergence (POST) treatments were applied June 7, 1988 when corn was in the 3 to 4 leaf stage and weeds were small. Russian thistle, prostrate and redroot pigweed infestations were heavy and barnyardgrass and field sandbur infestations were light throughout the experimental area.

Visual weed control and crop injury evaluations were assessed July 6, 1988. All treatments gave excellent control of all five weed species. No crop injury was apparent in any of the treatments. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Weed control in field corn with complimentary preemergence/postemergence herbicides

Treatment[1]	Rate lb ai/A	Crop[2] Injury	Weed Control[2] AMABL	AMARE	ECHCG	CCHIN	SASKR
		%					
Preeemergence/Postemergence							
cyanazine/atrazine + tridiphane	1.0/1.5 + 0.75	0	100	100	100	100	100
atrazine/atrazine + tridiphane	1.0/1.5 + 0.75	0	100	100	100	100	100
atrazine + tridiphane[3]	1.5 + 0.75	0	100	100	99	100	100
cyanazine/atrazine	1.0/1.5	0	100	100	100	97	100
atrazine/atrazine	1.0/1.5	0	100	100	100	98	100
atrazine[3]	1.5	0	100	100	100	99	100
atrazine/cyanazine + tridiphane	1.0/1.0 + 0.75	0	100	100	100	100	100
cyanazine + tridiphane[3]	1.0 + 0.75	0	100	100	100	100	100
handweeded check		0	100	100	100	100	100
check		0	0	0	0	0	0

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1. All postemergence treatments were applied with a COC at 0.25 v/v
2. Based on a visual scale from 1-100, where 0 = no control or crop injury and 100 = dead plants
3. Treatments were applied postemergence only

Broadleaf weed control in field corn with postemergence herbicides. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established on May 12, 1988 at the Agricultural Science Center to evaluate the response of field corn (var. Super Crost 5460) and annual broadleaf weeds to herbicides. The experimental design was a randomized complete block with four replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi. Herbicides were all applied postemergence on June 7, 1988 when corn was in the 3 to 4 leaf stage and weeds were small. Russian thistle, prostrate and redroot pigweed infestations were heavy and kochia infestations were moderate throughout the experimental area.

Visual evaluations of crop injury and weed control were assessed July 6, 1988. All treatments gave good to excellent control of all four weed species. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Broadleaf weed control in field corn with postemergence herbicides

Treatment	Rate lb ai/A	Crop[1] Injury	Weed Control[1] AMABL	 AMARE	 KCHSC	 SASKR
			%			
dicamba + atrazine (pm)	0.28 + 0.53	0	100	100	100	100
dicamba + atrazine + (pm) cyanazine	0.28 + 0.53 + 1.0	0	100	100	100	100
dicamba + atrazine + (pm) pendimethalin	0.28 + 0.53 + 1.0	0	100	100	100	100
dicamba + atrazine + (pm) DPX-9360	0.28 + 0.53 + 0.063	0	100	100	100	100
DPX-9360[2]	0.063	0	100	100	99	88
dicamba + pendimethalin + cyanazine	0.25 + 1.0 + 1.0	0	97	100	100	100
dicamba + pendimethalin	0.25 + 1.0	0	93	100	100	100
pendimethalin	1.0	0	83	100	88	100
dicamba + cyanazine	0.25 + 1.0	0	80	100	100	100
handweeded check		0	100	100	100	100
check		0	0	0	0	0

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1. Based on a visual scale from 0-100, where 0 = no control or crop injury and 100 = dead plants
2. A COC was added at 0.25 v/v
3. pm = packaged mix

Broadleaf and green foxtail control with DPX-M6316 and primisulfuron in corn. Evans, J.O. and B.M. Jenks. Postemergence herbicides were evaluated for control of lambsquarters (CHEAL), redroot pigweed (AMARE), and green foxtail (SETVI) in field corn (var. Grand Valley 134L). The plots were 10 by 50 ft and applied in a randomized complete block design with four replications. Herbicides were applied with a bicycle sprayer at 16 gpa and 40 psi. Broadleaf weeds ranged from 1-3 inches and corn was about in the 6-leaf stage.

Visual evaluations were made on July 12. All treatments had good-excellent control of broadleaf weeds while the primisulfuron + atrazine treatment was considerably better on green foxtail. Table 2 contains percent weed control for herbicide treatments. No treatment caused noticable crop injury. (Utah Agricultural Experiment Station, Logan, UT 84322-4820)

Table 1. Application data for weed control in field corn

Planting date	5/06/88
Application date	6/21/88
Air/Soil temp. (F)	85/78
Relative humidity (%)	17
Wind (mph)	3
Sky/Soil conditions	clear/dry
Soil texture	silt loam
Sand/silt/clay (%)	17/62/21
pH	8.3
OM (%)	2.6

Table 2. Weed control with postemergence herbicides in field corn

Treatment	Rate	CHEAL	AMARE	SETVI
	(lb ai/A)	-------% Control-------		
check		0	0	0
DPX-M6316	0.0078	98	96	30
DPX-M6316	0.0156	98	99	49
DPX-M6316 +	0.0078	100	100	69
atrazine	0.5			
primisulfuron	0.018	86	86	29
primisulfuron	0.0359	91	91	59
primisulfuron +	0.027	88	89	56
primisulfuron	0.009 (1 week later)			
primisulfuron +	0.0359	100	99	93
atrazine	1.0			
2,4-D	0.5	94	94	10
LSD (0.05)		10	10	30
CV		9	8	43

Corn production in alfalfa sod following no-till and plow based field preparation. Krall, J.M., D.M. Smith and S.D. Miller. Research plots were established under sprinkler irrigation in a six year old alfalfa field at the Research and Extension Center, Torrington, WY. Soil type was a sandy loam (80% sand, 11% silt and 9% clay) with 1.1% organic matter and ph 7.6. No-till treatments of cyanazine plus atrazine plus dicamba (2.0 + 1.0 + 0.5 lb ai/A), and metolachlor plus atrazine plus dicamba (1.5 + 1.2 + 0.5 lb ai/A) were applied 20 days prior to planting. Seedbed preparation on the plowed treatment consisted of moldboard plowing and two packing operations with a roller harrow. Plow based treatments of cyanazine plus atrazine (1.4 + 0.7 lb ai/A), and metolachlor plus atrazine (1.2 + 1.0 lb ai/A) were applied preplant May 4, 1988 prior to seeding corn (var. DeKalb-Pfizer Genetics Hybrid 464). All herbicide treatments were broadcast using a tractor mounted sprayer delivering 20 gpa. All plots were fertilized, according to a soil test, with 120 lb N and 35 lb P_2O_5/A on April 27, 1988. Each main plot consisted of eight 30 inch rows 88 ft. long. A split-plot in a randomized complete block design was used with four replications. The split was cultivation across all treatments using an Eversman minimum-till cultivator on June 16 when the corn was 18 to 20 inches tall. Alfalfa escapes were treated with dicamba (0.25 lb ai/A) on June 8, 1988 when corn and alfalfa were 8 and 6 to 12 inches tall, respectively. The plots were hand-harvested, using 10 ft. of row, for silage August 25, 1988 and for grain September 25, 1988. Alfalfa and corn stand counts were made following harvest and population per acre calculated.

Alfalfa counts were higher in the no-till but did not adversely influence yields compared to the plow treatments. There were no differences in silage yields due to any treatment. There were differences in grain yields due to tillage treatments with interactions non significant. No-till yields were 22 bu/A greater than for the plowed treatments. Herbicide combinations provided season long weed control, and no yield differences were observed between herbicide treatments or cultivation. Corn populations for the plow treatments were significantly lower than no-till treatments but within recommended irrigated corn population limits. The extra weight added to the planter may have caused deeper seed placement, resulting in reduced stand in the plow treatments. The results indicate potential for no-till corn production into alfalfa sod using herbicides to control weeds and alfalfa. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1568.)

Plant populations, corn silage and grain yields from primary tillage and herbicide treatments for corn following alfalfa

Treatment	Corn			Alfalfa
	(plant/A)	silage (tons/A)	grain (bu/A)	(plant/A)
Primary tillage				
plow	27,500**	26.4 NS	194**	1,770**
no-till	29,950	26.6	217	64,000
Primary herbicides[1]				
cyanazine + atrazine	29,780*	27.1 NS	211 NS	25,810*
metolachlor + atrazine	27,660	25.8	200	39,980
Cultivation				
cultivated	27,880 NS	26.4 NS	209 NS	26,570 NS
non-cultivated	29,560	26.6	202	39,220
CV (%)	9	7	11	56

[1] Combined data of no-till and plow application of each herbicide combination

*, **significant at $P = 0.05$ and 0.01, respectively; NS = not significant at $P = 0.05$

Early preplant herbicide applications in corn. Miller, S.D., D.A. Ball and A.W. Dalrymple. Several soil persistent herbicides and/or combinations were applied at the Research and Extension Center, Torrington, WY, 30 and 0 days prior to corn planting to assess weed control and crop tolerance. Plots were established under irrigation and were 10 by 40 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 on March 29 (air temp. 52 F, relative humidity 20%, wind W at 15 mph, sky cloudy and soil temp. - 0 inch 60 F, 2 inch 40 F and 4 inch 40 F) and April 28, 1988 (air temp. 55 F, relative humidity 28%, wind E at 8 mph, sky partly cloudy and soil temp. - 0 inch 72 F, 2 inch 60 F and 4 inch 50 F). Corn (var. Pioneer 3902) was seeded on April 28 immediately prior to the 0-day herbicide applications. The soil was classified as a sandy loam (71% sand, 23% silt and 6% clay) with 1.4% organic matter and pH 7.6. Weed counts, crop stand counts and visual crop injury ratings wre made June 7, 1988. Yellow foxtail (SETLU) and redroot pigweed (AMARE) infestations were moderate and kochia (KCHSC), Russian thistle (SASKR), common lambsquarters (CHEAL) and common purslane (POROL) infestations light but uniform throughout the experimental area.

No corn injury or stand reduction was observed with any treatment. Treatments applied 30 days prior to corn planting were equally as effective as those applied at planting. Kochia control was weak with a number of herbicide treatments. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1529 .)

Weed control in corn with herbicide treatments applied 30 and 0 days prior to corn planting

Treatment[1]	Rate	Corn[2]		Weed control[3]					
	lb ai/A	injury %	stand red %	KCHSC %	SASKR %	AMARE %	CHEAL %	POROL %	SETLU %
30-day									
metolachlor + atrazine	1.2 + 1.0	0	0	75	100	100	100	100	92
metolachlor + atrazine	1.5 + 1.2	0	0	75	100	100	100	100	92
cyanazine + atrazine	1.4 + 0.7	0	0	90	100	100	100	100	83
cyanazine + atrazine	2.0 + 1.0	0	0	100	100	100	100	100	95
pendimethalin + atrazine	1.0 + 1.0	0	0	75	100	100	100	100	85
pendimethalin + atrazine	1.5 + 1.5	0	0	90	100	100	100	100	89
cyanazine + metolachlor	1.2 + 1.2	0	0	70	100	95	100	100	80
cyanazine + metolachlor	1.5 + 1.5	0	0	70	100	92	100	100	97
cyanazine	2.0	0	0	70	97	74	100	100	85
cyanazine	3.0	0	0	70	100	84	100	100	85
0-day									
paraquat + metolachlor + atrazine + s	0.75 + 1.2 + 1.0	0	0	70	100	100	100	100	100
paraquat + cyanazine + atrazine + s	0.75 + 1.4 + 0.7	0	0	90	100	100	100	100	97
paraquat + pendimethalin + atrazine + s	0.75 + 1.0 + 1.0	0	0	90	100	100	100	100	92
paraquat + cyanazine + metolachlor + s	0.75 + 1.2 + 1.2	0	0	100	100	95	100	100	97
paraquat + cyanazine + s	0.75 + 2.0	0	0	85	100	85	100	100	92
glyphosate + alachlor + atrazine	0.75 + 2.1 + 1.0	0	0	90	100	100	100	100	97
glyphosate + alachlor + cyanazine	0.75 + 2.1 + 1.5	0	0	70	93	100	100	100	100
paraquat + atrazine	0.3 + 1.5	0	0	75	100	100	100	100	95
paraquat + atrazine	0.4 + 2.0	0	0	85	100	100	100	100	97
weedy check	---------	0	0	0	0	0	0	0	0
plants/ft. row 6 inch band		---	1.6	0.4	0.6	1.0	0.2	0.1	1.3

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[1] Treatments applied March 29 and April 28, 1988; s = X-77 at 0.25% v/v

[2] Crop stand counts and visual crop injury evaluated June 7, 1988

[3] Weed stand counts June 7, 1988

Wild proso millet control in corn with preplant incorporated, preemergence, postemergence or complementary treatments. Miller, S.D., D.A. Ball and A.W. Dalrymple. Research plots were established near Cassa, WY, to evaluate the efficacy of preplant incorporated, preemergence, postemergence and complementary preplant incorporated/preemergence or postemergence herbicide treatments for wild proso millet control in corn. Plots were established under furrow irrigation and were 10 by 30 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. Preplant herbicides were applied April 28, 1988 (air temp. 74 F, relative humidity 26%, wind NW at 10 mph, sky cloudy and soil temp. - 0 inch 84 F, 2 inch 70 F and 4 inch 60 F) and incorporated twice with a roller harrow operating at 2.5 to 3 inches immediately after application. Corn (var. Golden Harvest 2235) was planted May 7 in a silt loam soil (52% sand, 34% silt and 14% clay) with 2.1% organic matter and pH 7.7 and preemergence treatments applied May 9, 1988 (air temp. 64 F, relative humidity 30%, wind N at 6 mph, sky cloudy and soil temp. - 0 inch 80 F, 2 inch 60 F and 4 inch 55 F). Postemergence treatments were applied to 0.5 to 1 inch wild proso millet and 2-leaf corn May 31, 1988 (air temp. 70 F, relative humidity 29%, wind calm, sky clear and soil temp. - 0 inch 108 F, 2 inch 78 F and 4 inch 71 F). Weed counts, crop stand counts and visual crop injury ratings were made June 15 and visual weed control ratings July 11 and August 4, 1988. Wild proso millet (PANMI) infestations were heavy (>50 plants/linear ft. of row) and uniform throughout the experimental area.

No treatment injured corn; however, corn stands were reduced slightly (1 to 6%) by several treatments. Season long wild proso millet control was good (80% or greater) with alachlor plus triallate at 4.0 plus 4.0 lb/A alone or 3.0 plus 3.0 lb/A in combination with cyanazine, pendimethalin or cyanazine plus pendimethalin. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1530.)

Wild proso millet control in corn with preplant incorporated, preemergence, postemergence or complementary treatments

		Corn[2]		PANMI control[3]		
Treatment[1]	Rate lb ai/A	injury %	stand red %	June %	July %	August %
Preplant incorporated						
EPTC + dichlormid	6.0	0	6	34	20	17
EPTC + dichlormid + metolachlor	4.0 + 2.0	0	0	76	67	65
alachlor + triallate	3.0 + 3.0	0	0	82	75	73
alachlor + triallate	4.0 + 4.0	0	0	83	85	85
PPG-4000 + metolachlor	0.6 + 2.0	0	0	85	73	73
Preemergence						
cyanazine	2.0	0	1	72	57	40
pendimethalin	2.0	0	0	69	63	50
cyanazine + pendimethalin	1.5 + 1.5	0	0	88	70	67
cyanazine + metolachlor	1.5 + 2.0	0	0	80	67	57
Preplant incorporated/preemergence						
EPTC + dichlormid/cyanazine	4.0/1.5	0	0	70	63	58
EPTC + dichlormid/pendimethalin	4.0/1.5	0	0	70	67	60
EPTC + dichlormid/metolachlor	4.0/2.0	0	0	83	72	70
EPTC + dichlormid/cyanazine + pendimethalin	4.0/1.5 + 1.5	0	6	86	70	63
alachlor + triallate/cyanazine	3.0 + 3.0/1.5	0	6	78	85	80
alachlor + triallate/pendimethalin	3.0 + 3.0/1.5	0	0	89	92	87
alachlor + triallate/ cyanazine + pendimethalin	3.0 + 3.0/1.5 + 1.5	0	0	92	90	88
Preplant incorporated/postemergence						
EPTC + dichlormid/cyanazine	4.0/1.0	0	0	68	47	47
EPTC + dichlormid/cyanazine + pendimethalin	4.0/1.0 + 1.5	0	1	79	57	57
EPTC + dichlormid/cyanazine + tridiphane	4.0/1.0 + 0.75	0	1	70	68	62
weedy check	--------------	0	0	0	0	0
plants/ft. row 6 inch band		---	1.8	58.5	---	---

[1] Preplant incorporated treatments applied April 28, preemergence treatments May 9 and postemergence treatments May 31, 1988

[2] Crop stand counts and visual crop injury evaluated June 15, 1988

[3] Weed stand counts June 15 and visual weed control ratings July 11 and August 4, 1988

Wild proso millet control in corn with postemergence herbicide treatments. Miller, S.D., D.A. Ball and A.W. Dalrymple. Research plots were established near Cassa, WY, to evaluate the efficacy of postemergence herbicide treatments for wild proso millet control in corn. Plots were established under furrow irrigation and were 10 by 30 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. Corn (var. Golden Harvest 2235) was planted in a silt loam soil May 7, 1988. Treatments were applied May 31 (air temp. 70 F, relative humidity 29%, wind calm, sky clear, and soil temp. - 0 inch 108 F, 2 inch 78 F, 4 inch 71 F) to 2-leaf corn and 0.5 to 1 inch wild proso millet, June 6 (air temp. 90 F, relative humidity 22%, wind SW at 5 mph, sky clear and soil temp. - 0 inch 120 F, 2 inch 84 F and 4 inch 75 F to 5-leaf corn and 2 inch wild proso millet and June 13, 1988 (air temp. 64, relative humidity 70%, wind W at 3 mph, sky cloudy and soil temp. - 0 inch 65 F, 2 inch 68 F and 4 inch 67 F) to 7-leaf corn and 4 inch wild proso millet. Weed counts, crop stand counts and visual crop injury ratings were made June 29 and visual weed control ratings July 11 and August 9, 1988. Wild proso millet (PANMI) infestations were heavy (>70 plants/linear ft. of row) and uniform throughout the experimental area.

No injury or stand reduction was observed with any treatment. Season long wild proso millet control was excellent (95%) with 2-leaf applications and good (>90%) with 5-leaf applications of DPX-V9360 at 0.063 lb/A. Split applications of CGA-136872 were only slightly more effective than single treatments. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1531.)

Wild proso millet control in corn with postemergence treatments

		Corn[2]		PANMI control[3]		
Treatment[1]	Rate lb ai/A	injury %	stand red %	June %	July %	August %
2-leaf						
DPX-V9360 + s	0.032	0	0	53	73	78
DPX-V9360 + s	0.0475	0	0	67	77	80
DPX-V9360 + s	0.063	0	0	94	97	98
CGA-136872 + s	0.018	0	0	45	53	55
CGA-136872 + s	0.027	0	0	46	55	57
CGA-136872 + s	0.036	0	0	55	65	65
cyanazine + oc	1.0	0	0	53	50	33
cyanazine + tridiphane	1.0 + 0.75	0	0	63	62	60
cyanazine + pendimethalin	1.0 + 1.5	0	0	66	69	55
2-leaf and 5-leaf split						
CGA-136872 + s/CGA-136872 + s	0.009/0.009	0	0	45	50	53
CGA-136872 + s/CGA-136872 + s	0.018/0.009	0	0	56	63	67
CGA-136872 + s/CGA-136872 + s	0.018/0.018	0	0	62	67	67
CGA-136872 + s/CGA-136872 + s	0.009/0.018	0	0	45	60	38
5-leaf						
DPX-V9360 + s	0.032	0	0	49	75	78
DPX-V9360 + s	0.0475	0	0	66	73	80
DPX-V9360 + s	0.063	0	0	86	86	91
7-leaf						
DPX-V9360 + s	0.032	0	0	43	43	53
DPX-V9360 + s	0.0475	0	0	50	48	60
DPX-V9360 + s	0.063	0	0	56	52	57
weedy check	-----	0	0	0	0	0
plants/ft. row 6 inch band		---	1.8	75.8	---	---

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[1] Treatments applied May 31, June 6 and 13, 1988; s = X-77 at 0.25% v/v and oc = At Plus 411 F at 1 qt/A

[2] Crop stand counts and visual crop injury evaluated June 29, 1988

[3] Weed stand counts June 29 and visual weed control ratings July 11 and August 4, 1988

Evaluation of preemergence or complementary preemergence/postemergence treatments in corn. Miller, S.D., A.W. Dalrymple and J.M. Krall. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of preemergence or complementary preemergence/postemergence herbicide treatments for weed control in corn. Plots were established under irrigation and were 10 by 40 ft. with three replications arranged in a randomized complete block. Corn (var. Pioneer 3902) was planted in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2% organic matter and pH 7.4 April 28, 1988. Herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Preemergence treatments were applied April 29 (air temp. 68 F, relative humidity 25%, wind SE at 10 mph, sky partly cloudy and soil temp. - 0 inch 85 F, 2 inch 75 F and 4 inch 65 F), 2-leaf treatments May 17 (air temp. 89 F, relative humidity 20%, wind calm, sky clear and soil temp. - 0 inch 130 F, 2 inch 82 F and 4 inch 70 F) to emerging to 0.5 inch weeds, 5-leaf treatments May 25 (air temp. 77 F, relative humidity 42%, wind NW at 3 mph, sky cloudy and soil temp. - 0 inch 88 F, 2 inch 78 F and 4 inch 70 F) to 0.5 to 2 inch weeds and 8-leaf treatments June 9, 1988 (air temp. 88 F, relative humidity 33%, wind calm, sky partly cloudy and soil temp. - 0 inch 96 F, 2 inch 82 F and 4 inch 77 F) to 3 to 5 inch weeds. Weed counts, crop stand counts and visual crop injury ratings were made June 23 and grain yields determined October 13, 1988. Common lambsquarters (CHEAL) and yellow foxtail (SETLU) infestations were heavy, redroot pigweed (AMARE) infestations moderate and kochia (KCHSC) and Russian thistle (SASKR) infestations light but uniform throughout the experimental area.

No corn injury or stand reduction was observed with any treatment. Corn yields related closely to weed control and were 12 to 67 bu/A higher in herbicide treated plots than in weedy check plots. Weed control was excellent with all treatments except alachlor or metolachlor alone or complementary metolachlor/DPX-M6316 treatments. Common lambsquarters control was less than 90% with all complementary treatments of metolachlor and DPX-M6316. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1532.)

Weed control with preemergence or complementary preemergence/postemergence treatments in corn

		Corn[2]			Weed control[3]				
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield bu/A	CHEAL %	KCHSC %	SASKR %	AMARE %	SETLU %
Preemergence									
cyanazine	2.0	0	0	201	98	92	97	80	99
pendimethalin	1.5	0	0	198	95	92	83	90	93
alachlor	2.0	0	0	190	73	68	67	80	92
metolachlor	2.0	0	0	173	72	68	65	78	93
cyanazine + atrazine	1.4 + 0.7	0	0	198	100	98	100	100	100
metolachlor + atrazine	1.2 + 1.0	0	0	198	100	97	100	100	100
pendimethalin + atrazine	1.0 + 1.0	0	0	199	100	100	100	100	99
pendimethalin + atrazine	1.5 + 1.5	0	0	204	100	100	100	100	100
pendimethalin + cyanazine	1.5 + 1.5	0	0	206	100	100	100	100	100
metolachlor + cyanazine	1.5 + 1.5	0	0	201	100	97	97	95	100
pendimethalin + PPG-4000	1.5 + 0.6	0	0	198	100	99	100	100	100
metolachlor + PPG-4000	2.0 + 0.6	0	0	201	100	100	100	100	100
Preemergence/2-leaf									
metolachlor/DPX-M6316	1.5/0.0062	0	0	165	78	77	77	83	90
metolachlor/DPX-M6316	1.5/0.008	0	0	164	77	80	77	88	90
metolachlor/DPX-M6316	1.5/0.012	0	0	173	80	75	77	90	92
metolachlor/DPX-M6316	1.5/0.016	0	0	176	85	82	80	90	92
metolachlor/atrazine + oc	1.5/0.75	0	0	207	100	97	100	98	100
metolachlor/dicamba	1.5/0.25	0	0	204	97	92	95	97	90
Preemergence/5-leaf									
metolachlor/DPX-M6316	1.5/0.0062	0	0	154	85	82	87	87	90
metolachlor/DPX-M6316	1.5/0.008	0	0	165	87	88	85	87	90
metolachlor/DPX-M6316	1.5/0.012	0	0	187	85	92	90	92	90
metolachlor/DPX-M6316	1.5/0.016	0	0	181	88	92	95	93	90
metolachlor/atrazine + oc	1.5/0.75	0	0	201	100	95	100	100	100
metolachlor/dicamba	1.5/0.25	0	0	204	100	100	100	100	92
Preemergence/8-leaf									
metolachlor/DPX-M6316	1.5/0.0062	0	0	167	73	78	78	83	90
metolachlor/DPX-M6316	1.5/0.008	0	0	173	73	78	78	82	90
metolachlor/DPX-M6316	1.5/0.012	0	0	173	78	75	85	85	88
metolachlor/DPX-M6316	1.5/0.016	0	0	176	83	87	85	88	92
metolachlor/atrazine + oc	1.5/0.75	0	0	209	99	98	100	100	97
metolachlor/dicamba	1.5/0.25	0	0	201	93	93	92	97	90
weedy check	--------	0	0	142	0	0	0	0	0
plants/ft. row 6 inch band		---	1.8	---	1.8	0.1	0.1	0.4	2.2

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[1] Treatments applied April 29, May 17, May 25 and June 9, 1988; oc = At Plus 411 F at 1 qt/A

[2] Crop stand counts and visual crop injury evaluated June 23 and plots harvested October 13, 1988

[3] Weed stand counts June 23, 1988

Evaluation of postemergence herbicide treatments in corn. Miller, S.D., A.W. Dalrymple and J.M. Krall. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of individual and/or herbicide combinations applied postemergence for weed control in corn. Plots were established under irrigation and were 10 by 40 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. Corn (var. Pioneer 3902) was planted in a sandy loam soil (78% sand, 13% silt and 9% clay) with 1.2% organic matter and pH 7.4 April 28, 1988. Postemergence treatments were applied May 23, 1988 (air temp. 70 F, relative humidity 56%, wind SE at 5 mph, sky partly cloudy and soil temp. - 0 inch 84 F, 2 inch 70 F and 4 inch 68 F) to 3-leaf corn and 1 to 2 inch weeds. Weed counts, crop stand counts and visual crop injury ratings were made June 15 and plots harvested October 13, 1988. Common lambsquarters (CHEAL) and yellow foxtail (SETLU) infestations were heavy, hairy nightshade (SOLSA) and wild buckwheat (POLCO) infestations moderate, and kochia (KCHSC) and Russian thistle (SASKR) infestations light but uniform throughout the experimental area.

No treatment injured corn; however, several treatments reduced stand slightly (2 to 5%). Corn yields related closely to weed control and were 22 to 92 bu/A higher in herbicide treated plots than in weedy check plots. Broad-spectrum weed control was good with treatments containing atrazine or cyanazine and broadleaf weed control good with treatments containing bromoxynil or dicamba. Yellow foxtail control was less than 80% with DPX-V9360 or CGA-136872 at all rates. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1533.)

Weed control in corn with postemergence herbicide treatments

		Corn[2]			Weed control[3]					
Treatment[1]	Rate lb ai/A	injury %	stand red %	yield bu/A	CHEAL %	KCHSC %	SOLSA %	SASKR %	POLCO %	SETLU %
DPX-V9360 + s	0.016	0	0	142	5	0	29	0	13	48
DPX-V9360 + s	0.032	0	0	156	3	0	6	0	22	73
DPX-V9360 + s	0.063	0	0	156	13	33	54	33	26	73
CGA-136872 + s	0.018	0	0	173	13	33	44	33	26	71
CGA-136872 + s	0.036	0	0	175	17	33	59	33	57	76
DPX-V9360 + dicamba	0.032 + 0.25	0	2	187	100	100	100	100	100	65
DPX-V9360 + dicamba + atrazine	0.032 + 0.28 + 0.52	0	0	207	100	100	100	100	100	86
DPX-V9360 + 2,4-D	0.032 + 0.375	0	0	190	74	100	95	100	44	68
DPX-V9360 + bromoxynil	0.032 + 0.25	0	0	198	94	100	89	100	100	71
DPX-V9360 + dicamba	0.032 + 0.125 + 0.25	0	0	187	100	100	100	100	100	68
DPX-V9360 + atrazine + oc	0.032 + 0.75	0	0	198	100	100	100	100	100	97
DPX-V9360 + cyanazine + s	0.032 + 1.25	0	0	209	100	100	100	100	100	97
DPX-V9360 + DPX-67114 + oc	0.032 + 0.45	0	0	209	100	100	100	100	100	86
cyanazine + oc	1.25	0	0	212	96	100	100	100	100	98
bromoxynil	0.25	0	0	184	78	100	88	100	100	0
bromoxynil	0.375	0	0	193	88	100	95	100	100	0
bromoxynil + clopyralid	0.25 + 0.094	0	0	193	96	100	97	100	100	0
bromoxynil + DPX-M6316	0.25 + 0.008	0	0	190	98	100	92	100	100	0
bromoxynil + cyanazine	0.25 + 1.0	0	0	207	100	100	100	100	100	93
bromoxynil + atrazine	0.25 + 0.5	0	0	201	100	100	97	100	100	80
pendimethalin + PPG-4000	1.5 + 0.6	0	3	207	100	100	100	100	100	93
dicamba + atrazine	0.28 + 0.52	0	0	204	100	100	100	100	100	72
dicamba + atrazine + pendimethalin	0.28 + 0.52 + 1.0	0	2	201	100	100	100	100	100	94
dicamba + atrazine + cyanazine	0.28 + 0.52 + 1.0	0	0	204	100	100	100	100	100	97
dicamba + atrazine + CGA-136872	0.28 + 0.52 + 0.018	0	0	201	100	100	100	100	100	90
dicamba + cyanazine	0.25 + 1.0	0	0	204	100	100	100	100	100	93
dicamba + pendimethalin	0.25 + 1.0	0	5	206	100	100	100	100	100	76
dicamba + cyanazine + pendimethalin	0.25 + 1.0 + 1.0	0	0	204	100	100	100	100	100	99
dicamba + CGA-136872	0.25 + 0.018	0	0	201	100	100	100	100	100	79
weedy check	------------	0	0	120	0	0	0	0	0	0
plants/ft. row 6 inch band		---	1.8	---	1.6	0.1	0.6	0.1	0.5	3.6

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[1] Treatments applied May 23, 1988; oc = At Plus 411 F at 1 qt/A and s = X-77 at 0.25% v/v

[2] Crop stand counts and visual crop injury evaluated June 15 and plots harvested October 13, 1988

[3] Weed stand counts June 15, 1988

Corn tolerance to postemergence applications of DPX-V9360 and CGA-136872. Miller, S.D., A.W. Dalrymple and J.M. Krall. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate corn tolerance to postemergence applications of DPX-V9360 and CGA-136872. Plots were established under irrigation and were 10 by 40 ft. with three replications arranged in a randomized complete block. The experimental area was treated with cyanazine plus alachlor (2.0 + 2.0 lb/A) prior to planting and cultivated twice during the growing season to maintain the crop under weed-free conditions. Corn (var. Pioneer 3902) was seeded April 28, 1988 in a sandy loam soil (74% sand, 16% silt and 10% clay) with 1.3% organic matter and pH 7.4. DPX-V9360 and CGA-136872 treatments were applied with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi May 17 (air temp. 89 F, relative humidity 20%, wind calm, sky clear and soil temp. - 0 inch 130 F, 2 inch 82 F and 4 inch 70 F) to 2-leaf corn, May 25 (air temp. 77 F, relative humidity 42%, wind NW at 3 mph, sky cloudy and soil temp. - 0 inch 88 F, 2 inch 78 F and 4 inch 70 F) to 5-leaf corn and June 9, 1988 (air temp. 88 F, relative humidity 33%, wind calm, sky partly cloudy and soil temp. - 0 inch 96 F, 2 inch 82 F and 4 inch 77 F) to 8-leaf corn. Crop stand counts and visual crop injury ratings were made June 20 and grain yields determined October 12, 1988.

Corn stands were reduced slightly (2 to 5%) by several treatments. CGA-136872 applications at the 2-leaf stage injured corn 50 to 65% and reduced yields 83 to 126 bu/A compared to the untreated check. Corn tolerance to DPX-V9360 at rates of 0.047 to 0.094 lb/A was good at all stages of application; however, rates above 0.094 lb/A reduced yields 26 and 17 bu/A at the 2 and 8-leaf stage of application, respectively. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1534.)

Corn response to postemergence applications of DPX-V9360 and CGA-136872

Treatment[1]	Rate lb ai/A	Corn[2] injury %	 stand red %	 yield bu/A
2-leaf				
DPX-V9360 + s	0.047	0	2	206
DPX-V9360 + s	0.063	0	2	207
DPX-V9360 + s	0.094	3	0	212
DPX-V9360 + s	0.125	8	2	181
DPX-V9360 + s	0.25	10	0	181
CGA-136872 + s	0.032	50	2	126
CGA-136872 + s	0.063	65	2	81
5-leaf				
DPX-V9360 + s	0.047	0	6	215
DPX-V9360 + s	0.063	0	0	204
DPX-V9360 + s	0.094	0	0	204
DPX-V9360 + s	0.125	0	0	212
DPX-V9360 + s	0.25	0	0	207
CGA-136872 + s	0.032	2	2	198
CGA-136872 + s	0.063	7	2	195
cyanazine + atrazine + s	0.75 + 0.75	0	2	209
8-leaf				
DPX-V9360 + s	0.047	0	2	201
DPX-V9360 + s	0.063	0	5	198
DPX-V9360 + s	0.094	0	0	198
DPX-V9360 + s	0.125	0	0	190
DPX-V9360 + s	0.25	7	2	190
CGA-136872 + s	0.032	0	2	204
CGA-136872 + s	0.063	3	0	209
untreated check	-----	0	0	207

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[1] Treatments applied May 17, May 25 and June 9, 1988; s = X-77 at 0.25% v/v

[2] Crop stand counts and visual crop injury evaluated June 20 and plots harvested October 12, 1988

Evaluation of preplant incorporated, postemergence, and sequential herbicide treatments in field corn. Mitich, L.W., and N.L. Smith. Ten herbicides in 17 treatments were evaluated for crop tolerance and weed control in 'Pioneer 3181' field corn in Yolo clay loam on the UC Davis campus. Preplant incorporated treatments were applied May 24, 1988, and incorporated to 2 in. (bed top only) with a power tiller. Postemergence treatments were applied June 25 and June 26 in temperatures of 70 F to 90 F. At this time, corn plants were 18 to 20 in. tall; weeds including redroot pigweed (# AMARE), common purslane (# POROL), barnyardgrass (# ECHCG), velvetleaf (# ABUTH), and tomatillo groundcherry (# PHYIX) were 4 to 12 in. tall. A third application (0.09 lb/a of primisulfuron for a split application comparison) was made July 6, when the temperature was 90 F and corn was 24 to 36 in. tall. All treatments were applied broadcast, in 20 gpa, with a CO_2 backpack sprayer.

Evaluations for weed control and crop phytotoxicity were performed July 26. Ten ft out of the two center rows was harvested October 18. Both formulations of metolachlor provided similar control of barnyardgrass, however, metolachlor II did not control the other weed species as well. The postemergence application of primisulfuron gave better weed control than the PPI treatment of metolachlor II. The tridiphane + atrazine combination gave 100% control of the broadleaf weeds. DPX-V9360 at 0.75 oz/a and higher provided good barnyardgrass control in addition to acceptable control of the broadleaf species. Applications of primisulfuron resulted in some crop injury. (Department of Botany, University of California, Davis, CA 95616)

Evaluation of preplant incorporated, postemergence, and sequential herbicide treatments in field corn, UC Davis

Treatment		Rate (lb/a except noted)		Crop Injury[3] (percent)	Weed control[3,4]				Yield[3,5] (lb/a)
Preplant incorporated	Postemergence	PPI	Post		ECHCG	POROL	AMARE	Solan	
metolachlor I		2.5		0	90	63	80	80	7539 abcd
metolachlor II		2.5		0	93	48	58	65	6634 abcde
metolachlor II	primisulfuron	2.5	0.27	25	88	65	98	98	6123 de
metolachlor II	primisulfuron	2.5	0.36	39	80	85	93	100	5905 de
metolachlor II	primisulfuron	2.5	0.18/0.09[2]	0	100	70	100	100	7596 abcd
metolachlor II	bromoxynil	2.5	0.5	0	88	75	100	100	8442 a
	primisulfuron		0.36	30	15	55	80	78	6410 cde
	DPX-V9360		0.25 oz	0	43	18	88	95	8297 ab
	DPX-V9360		0.5 oz	0	53	33	80	63	7098 abcd
	DPX-V9360		0.75 oz	0	90	43	93	83	7535 abcd
	DPX-V9360		1.0 oz	3	78	65	93	88	5188 e
	DPX-V9360		1.5 oz	0	85	55	80	100	8054 abc
	tridiphane + atrazine		0.75 + 1.0	0	28	100	100	100	6651 abcde
	bentazon[1]		1.0	0	23	65	65	58	7384 abcd
	2,4-D amine		0.5	0	0	28	80	85	7267 abcd
	2,4-D ester		0.38	3	8	45	83	98	6777 abcde
	bromoxynil + atrazine[1]		0.38 + 0.5	13	0	100	100	100	6764 abcde
control				0	0	0	0	0	6611 bcde

[1] With oil at 1 qt/a.
[2] Second application of primisulfuron (0.09 lb/a) made 1 week after initial application.
[3] Average of four replications.
[4] "Solan" includes tomatillo groundcherry (# PHYIX) and hairy nightshade (# SOLSA).
[5] Yields followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Johnsongrass control in field corn. Orr, J. P. Johnsongrass is a major problem of the Sacramento Delta, causing considerable economic loss. This research was conducted on Tyler Island to compare the efficacy of primisulfuron and DPX V9360 in Pioneer 3377 field corn.

The experiment was randomized, complete block design with four replicatons. Plots were 8 rows, 30 inch centers, by 10 feet. Herbicides were applied postemergence on May 18, 1988, with a CO_2 backpack sprayer, water carrier of 30 gal/a, to field corn in the 2 to 3 leaf stage. Johnsongrass size ranged from seedling to rhizome, multi-leaf, 5 to 6 inches in height.

In regard to overall johnsongrass control, split applications of primisulfuron, primisulfuron plus atrazine, and DPX V9360 gave comparable control. DPX V9360 was most effective on seedling johnsongrass, giving 90% control at 0.75 oz/a rate. The control with all treatments was shortlived, since johnsongrass germinates throughout the growing season. Field corn tolerance was excellent with all treatments of primisulfuron and DPX V9360. (University of California Cooperative Extension, Sacramento County, 4145 Branch Center Road, Sacramento, CA 95827.)

Johnsongrass control in field corn

	Rate	Johnsongrass Control[1]			Stand[1]	Vigor[1]	Phyto-[1]
	lb	Seedling	Rhizone	Overall	Reduction	Reduction	toxicity
Chemical	ai/a	5/18	5/18	5/18	5/18	5/18	5/18
[3]primisulfuron	0.027	3.3	4.5	6.3	0.0	0.0	0.0
[3]primisulfuron	0.036	3.3	6.0	6.3	0.0	1.5	0.0
[3]primisulfuron	0.018						
	+0.009	6.8	7.8	7.8	0.0	0.0	0.0
(Split application 1 week)							
primisulfuron	0.027						
+ atrazine	1.0						
+ oil	1 gal	4.8	7.0	7.5	0.0	0.0	0.0
primisulfuron	0.036						
+ atrazine	1.0						
+ oil	1 gal	4.3	6.8	6.8	0.0	0.0	0.0
primisulfuron	0.018						
	+0.009						
+ atrazine	1.0						
+ oil	1gal	7.5	7.5	7.5	0.0	0.0	0.0
(Split application 1 week)							
[3]DPX V9360	0.25[2]	5.5	6.5	6.8	0.0	0.0	0.0
[3]DPX V9360	0.50[2]	6.0	6.5	6.3	0.0	0.0	0.0
[3]DPX V9360	0.75[2]	9.0	8.3	7.5	0.0	0.0	0.0
[3]DPX V9360	1.00[2]	7.3	7.5	7.5	0.0	0.0	0.0
[3]DPX V9360	1.50[2]	7.5	8.0	8.0	0.0	0.8	0.0
Primisulfuron	0.37						
+ surphtac	0.5%	0.0	2.0	1.3	0.0	0.0	0.0
primisulfuron	0.495						
+ surphtac	0.5%	0.0	1.0	1.0	0.0	0.0	0.0
primisulfuron	0.25						
	+0.12						
+ surphtac	0.5%	8.0	8.5	8.0	0.0	0.0	0.0
(Split application 1 week)							
Control	----	0.0	0.0	0.0	0.0	0.0	0.0

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[1] 0 = no weed control, no crop damage
10 = complete weed control, crop dead

[2] oz/a

[3] Surfactant X-77 added at 0.25%

[4] On June 18, 1988, all treatments rated a 0.0 for overall johnsongrass control. There was no corn vigor or stand reduction or phytotoxicity.

Grass Control in Corn with Several New Herbicides. Westra, P. and T. D'Amato. Four new herbicides were evaluated for grass control in corn in the summer of 1988. Ten field experiments were conducted evaluating acetochlor, DPX-V9360, Beacon (primisulfuron) and S-63596 for control of wild proso millet, foxtail sp., sandbur and shattercane in corn. Each study contained 3 replications in a RCB design. Herbicides were applied with a CO_2 backpack sprayerin 20 GPA of water through 11002LP SS nozzles. Acetochlor was applied preemergent at rates of 3 and 4 lb/A. DPX-V9360, Beacon and S-63596 were applied postemergent at various crop and weed stages. DPX-V9360 was applied at rates of 0.25, 0.5, 0.75, and 1.0 oz/A, Beacon at 0.009, 0.018, 0.027, and 0.036 lb/A, and S-63596 at 0.045, 0.067, and 0.09 lb/A. S-63596 and Beacon required additional herbicides to be effective. S-63596 was combined with Aatrex (atrazine) preemergent at several rates and Beacon with Bicep metolachlor + atrazine)preemergent at several rates.

Wild proso millet control was evaluated in 6 of the 10 studies. Acetochlor and DPX-V9360 treatments resulted in variable control between studies with ranges of 30-100 and 10-90% control respectively. DPX-V9360 efficacy was increased when applied to wild proso millet that was less than 1 inch tall. S-63596 and Beacon treatments gave more consistent performance with 60-90 and 70-100% control respectively. Wild proso millet control was better at higher rates of S-63596, Beacon was not as rate dependent.

Foxtail control was excellent for the 4 herbicides with 94-100% control.

Best sandbur control was with S-63596 and DPX-V9360 with 82-98% early season control and 70% late season control. Beacon treatments had 63-73% control early but none later in the season. Acetochlor was poorest on sandbur with only 20% early control and 0% late in the season.

All herbicides except S-63956, gave similar shattercane control ranging between 78-90% for the higher rates. Control with S-63956 was poor with ratings of 0-48%. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523)

Grass Control in Corn

Herbicide	%Control			
	W. p. millet	Foxtail	Sandbur	Shattercane
Acetochlor	30-100	100	20	75
S-63956	60-90	98	82-98	25
Beacon	70-100	98	63-73	65
DPX-V9360	10-90	96	65-95	80

Time of day, rate, and surfactant effects of imazethapyr in cowpea. Eckard, A., and D. W. Cudney. Imadazolinone herbicides (imazaquin and imazethapyr) have shown potential as postemergence cowpea (Vigna unguiculata [L] Walp) herbicides in California. However, some temporary phytotoxic effects (yellowing and stunting) have been noted in cowpea particularly under high temperature conditions. In an effort to study these phytotoxic effects under contrasting temperature conditions, imazethapyr was applied in the late morning and early evening hours (10:00 am and 6:30 pm). The cowpea plants were thus subjected to an increasing or decreasing temperature regime.

Imazethapyr was applied at .07 and .14 kg ai/ha (.06 and .125 lbs ai/A) with a constant pressure CO_2 backpack sprayer with a spray volume of 280 l/ha (30 gal/A) on August 25, 1988. Temperatures at the time of application were 33^o and 29^o C(92^o and 84^oF) for the late morning and evening applications respectively. Maximum temperature that day rose to 39^o C (102^o F). All treatments were compared with and without the use of a nonionic surfactant (X-77 at .05%). The trial was located at the University of California, Riverside Agricultural Experiment Station. Cowpea plants averaged 35 cm (14 inches) in height on the day of application. The cultivar used was California Blackeye #5. A randomized complete block design was used with six replications. Evaluations for phytotoxicity were made on August 29, 1988, 4 days days after application, and height was scored on September 6, 1988, 12 days after application.

Phytotoxic effects were minimal throughout the experiment. There was little difference for time of application, herbicide rate, or use of surfactant.

Height effects (stunting) were minimal with little difference due to time of day, rate, or surfactant use. However, the interaction of time of day and surfactant was significant where the evening application with surfactant showed a reduction in height. Six weeks after application no height differences were apparent.

Under the conditions of this experiment where phytotoxicity and height reduction effects were minimal, no strong correlations could be made for time of day, rate or use of a surfactant. (University of California, Riverside, Botany and Plant Sci. Dept., Riverside, CA 92521.)

Time of day, rate and adjuvant effects of imazethapyr in cowpea

Treatment	Rate[1]	Phyto-Toxicity[2]	Height[3]
Control	0.00	0.00	50.09
Imazethapyr			
Morning			
Surfactant			
Rate 1	0.07	1.25	49.17
Rate 2	0.14	1.25	48.33
No Surfactant			
Rate 1	0.07	0.92	47.83
Rate 2	0.14	1.58	47.18
Evening			
Surfactant			
Rate 1	0.07	1.08	45.33
Rate 2	0.14	0.83	46.00
No Surfactant			
Rate 1	0.07	1.25	48.17
Rate 2	0.14	1.42	49.17
LSD(0.05)		0.37	3.46

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[1] herbicide rate in kg ai/ha.
[2] cowpea phytotoxicity: 0 = no symptoms; 10 = all cowpeas dead.
[3] canopy height in cm.

Preplant and postemergence herbicide treatments in cowpea. Eckard, A. and D. W. Cudney. Weed management options in cowpea (Vigna unguiculata [L] Walp) in California are limited. Several broad-leaved species have not been controlled by existing preplant herbicides and management practices, especially black nightshade (Solanum nodiflorum) which reduces yield as well as seed quality. Both preplant and postemergence herbicides were evaluated for weed control and phyto-toxicity to cowpea at the University of California, Riverside Agricultural Experiment Station. Plot size was 3.2 x 10 m (10 x 30 ft.). A randomized complete block design with 4 replications was used. The experiment was established May 24, 1988 on an Arlington fine sandy-loam soil with a pH of 6.9-7.2 and less than 1% organic content.

All treatments were applied with a constant pressure CO_2 backpack sprayer at a rate of 280 l/ha (30 gal/A). Preplant treatments were applied to the soil surface and incorporated with a Lilliston rolling cultivator to a depth of 1-2" within 30 minutes of application. Air temperature during the postemergence applications was 22° C (72° F). Preplant herbicides tested included: trifluralin, pendimethalin, imazethapyr, and imazaquin. Postemergence herbicides included: imazethapyr and imazaquin. The cowpea cultivar used was California Blackeye #5. A 4 row plate planter was used with 30" rows and a 4" seed spacing. Plots were furrow irrigated weekly.

Red root pigweed (Amaranthus retroflexus) was chosen as the indicator weed because of its uniform distribution. Preplant treatments were scored when the cowpeas were at the third trifoliate leaf stage (1 month after planting). Postemergence treatment scoring for phytotoxicity was done 1 week after application.

Preplant treatments showed no phytotoxic effects to cowpea. Both trifluralin and pendimethalin showed good control of pigweed. Imazaquin did not control pigweed at 0.14 and 0.28 kg ai/ha (0.125 and 0.25 lbs ai/A) but gave marginal control at 0.56 kg ai/ha (0.5 lbs ai/A). Imazethapyr showed marginal pigweed control at 0.14 kg ai/ha (0.125 lbs ai/A), but gave excellent control at 0.28 and 0.55 kg ai/ha (0.25 and 0.5 lbs ai/A).

Both imazethapyr and imazaquin postemergence treatments caused yellowing of cowpea leaves and a subsequent slowing of growth. Yellowing persisted only a few days at 0.14 kg ai/ha (0.125 lbs ai/A) and up to 3 weeks for 0.28 and 0.56 kg ai/ha (0.25 and 0.5 lbs ai/A). Growth retardation was evident for the highest rate for up to 5 weeks. Additional testing revealed no phytotoxic effects by either product at rates of 0.04 or 0.07 kg ai/ha (0.03, or 0.06 lbs ai/A), but with reduced weed control.

Based on yields, preplant treatments were uniformly more effective than postemergence treatments and controls. The reduced effectiveness of postemergence applications may have been due to weed competition effects prior to the herbicide application. (University of California, Riverside Botany and Plant Sci. Dept., Riverside, CA 92521)

Preplant and postemergence herbicide treatments in cowpea

Treatment	Application	Rate[1]	Mean[2] Yield	Mean Weed[3] Control	Phyto-[4] toxicity
untreated			2540	0.00	0
pendimethalin	ppi	0.84	3012	8.00	0
trifluralin	ppi	0.84	3017	8.75	0
imazaquin	ppi	0.14	2456	3.00	0
imazaquin	ppi	0.28	2949	3.00	0
imazaquin	ppi	0.56	3241	6.50	0
imazethapyr	ppi	0.14	3140	6.00	0
imazethapyr	ppi	0.28	3220	9.00	0
imazethapyr	ppi	0.56	3889	9.00	0
imazaquin	post	0.14	2792	5.00	0.60
imazaquin	post	0.28	2552	7.00	2.31
imazaquin	post	0.56	2779	7.50	3.00
imazethapyr	post	0.14	2860	5.00	0.50
imazethapyr	post	0.28	2990	6.75	2.23
imazethapyr	post	0.56	2521	7.50	3.00
LSD(0.05)			592	.84	.26

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[1] Herbicide application rate, kg ai/ha.
[2] Yield expressed as kg/ha.
[3] Weed control: 0 = no control; 10 = all weeds dead.
[4] Cowpea phytotoxicity: 0 = no symptoms; 10 = all cowpeas dead.

Weed control with spring applied chemical fallow herbicides. Dial, M.J. and D.C. Thill. Clomazone, atrazine, and glyphosate/2,4-D (1.70 lb ae/gal formulation) were applied alone and in tank mix combination to standing winter barley stubble (HORVU) near Lewiston, Idaho. Adjacent to this experiment, A1237 was evaluated alone and in tank mix combinations with glyphosate and chlorsulfuron for broadleaf weed control. In both experiments, herbicide treatments were applied with a CO_2 backpack sprayer calibrated to deliver 10 gal/a at 40 psi and 3 mph. Plots were 10 by 30 ft, and the treatments were arranged in a randomized complete block design replicated four times. The plots were evaluated visually for percent weed control on May 19. The plot areas were tilled by the cooperator before additional evaluations could be made. Application data are listed in Table 1.

Table 1. Application data

Date of application		April 19
Air temperature (F)		70
Soil temperature at 2 in. (F)		68
Relative humidity (%)		58
Wind (mph) - direction		6-N
Soil	pH	5.2
	OM (%)	3.0
	CEC (meq/100g soil)	19.1
	Texture	silt clay loam

The clomazone experiment was evaluated for downy brome (BROTE) and prickly lettuce (LACSE) control. Clomazone applied alone controlled downy brome less than 80 % (Table 2). Atrazine alone did not control either downy brome or prickly lettuce adequately, because little or no precipitation followed the application and thus limited soil activity of the atrazine. Glyphosate/2,4-D alone controlled downy brome and prickly lettuce as effectively as any of the clomazone tank mix treatments. A1237 did not control downy brome. The plots were evaluated visually for percent control of field pennycress (THLAR), coast fiddleneck (AMSIN), and prickly lettuce (LACSE). All treatments controlled all broadleaf weeds 90 % or greater (Table 3). (Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Downy brome and prickly lettuce control with clomazone in chemical fallow

Treatment[1]	Rate	Control	
		BROTE	LACSE
	(lb ai/a)	(-% of check-)	
clomazone	0.25	76	87
clomazone	0.5	44	68
atrazine	0.2	20	0
clomazone + atrazine	0.25 0.2	92	97
clomazone + atrazine	0.5 0.2	93	97
clomazone + glyphosate/2,4-D	0.25 0.53	98	95
clomazone + glyphosate/2,4-D	0.5 0.53	98	96
atrazine + glyphosate/2,4-D	0.2 0.53	97	88
clomazone + atrazine + glyphosate/2,4-D	0.25 0.2 0.53	99	93
clomazone + atrazine + glyphosate/2,4-D	0.5 0.2 0.53	99	98
glyphosate/2,4-D	0.53	99	95
LSD (0.05)		28	20

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[1] Glyphosate/2,4-D is the 1.70 lb ae/gal formulation.

Table 3. Broadleaf weed control in chemical fallow with A1237

Treatment	Rate	Control		
		THLAR	AMSIN	LACSE
	(lb ai/a)	(-----% of check-----)		
A1237	0.06	93	95	96
A1237	0.12	90	93	94
A1237 +	0.06	95	94	94
glyphosate +	0.37			
R-11[1]	0.5%			
A1237 +	0.12	95	94	97
glyphosate +	0.37			
R-11	0.5%			
glyphosate +	0.37	98	98	94
chlorsulfuron +	0.0156			
R-11	0.5%			
LSD (0.05)		ns	ns	ns

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[1] R-11 is a nonionic surfactant, the rate is expressed as % v/v.

Weed control in fallow with clomazone. Miller, S.D. and J.M. Krall. Research plots were established at the Research and Extension Center, Archer, WY, to evaluate weed control with clomazone or clomazone-atrazine combinations in fallow. 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Treatments were applied August 13, 1987 (air temp. 82 F, relative humidity 21%, wind NW at 4 mph, sky partly cloudy and soil temp. - 0 inch 101 F, 2 inch 84 F and 4 inch 78 F) to emerging downy brome, September 21, 1987 (air temp. 68 F, relative humidity 29%, wind SW at 5 mph, sky clear and soil temp. - 0 inch 90 F, 2 inch 72 F and 4 inch 63 F) to 2-leaf downy brome, October 13, 1987 (air temp. 56 F, relative humidity 100%, wind NE at 10 mph, sky cloudy and soil temp. 0 inch 58 F, 2 inch 56 F and 4 inch 51 F) to 3-leaf downy brome and March 29, 1988 (air temp. 42 F, relative humidity 30%, wind E at 5 mph, sky cloudy and soil temp. - 0 inch 42 F, 2 inch 39 F and 4 inch 38 F) to 3-tiller downy brome. The soil was classified as a loam (54% sand, 23% silt and 23% clay) with 1.4% organic matter and pH 7.2. Visual weed control evaluations were made July 8, 1988. Downy brome (BROTE) infestations were heavy and common lambsquarters (CHEAL), kochia (KCHSC) and Russian thistle (SASKR) infestations moderate throughout the experimental area.

Weed control was better with treatments applied in October or March than August or September. Combination treatments were more effective than individual treatments at all dates of application. Clomazone-atrazine mixtures at 0.5 plus 0.5 lb/A were as effective as mixtures at 0.75 plus 0.5 lb/A. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1556.)

Weed control in fallow with clomazone or clomazone-atrazine combinations

Treatment[1]	Rate lb ai/A	Weed control[2] CHEAL %	 SASKR %	 KCHSC %	 BROTE %
August					
clomazone	0.5	0	37	18	20
clomazone	0.75	25	37	20	83
clomazone + atrazine	0.5 + 0.3	87	60	40	91
clomazone + atrazine	0.75 + 0.3	97	57	57	98
clomazone + atrazine	0.5 + 0.5	100	66	70	97
clomazone + atrazine	0.75 + 0.5	99	67	70	97
atrazine	0.3	90	45	30	53
atrazine	0.5	97	58	57	73
September					
clomazone	0.5	33	15	10	87
clomazone	0.75	33	20	23	97
clomazone + atrazine	0.5 + 0.3	100	75	67	100
clomazone + atrazine	0.75 + 0.3	100	73	67	100
clomazone + atrazine	0.5 + 0.5	98	73	90	100
clomazone + atrazine	0.75 + 0.5	100	73	87	97
atrazine	0.3	97	30	42	85
atrazine	0.5	100	55	67	93
October					
clomazone	0.5	33	33	32	93
clomazone	0.75	40	27	33	98
clomazone + atrazine	0.5 + 0.3	100	77	77	100
clomazone + atrazine	0.75 + 0.3	100	73	77	100
clomazone + atrazine	0.5 + 0.5	100	83	100	100
clomazone + atrazine	0.75 + 0.5	100	83	98	100
atrazine	0.3	97	35	55	90
atrazine	0.5	97	65	95	100
March					
clomazone	0.5	83	23	72	80
clomazone	0.75	93	33	72	82
clomazone + atrazine	0.5 + 0.3	100	87	97	100
clomazone + atrazine	0.75 + 0.3	100	90	100	100
clomazone + atrazine	0.5 + 0.5	100	100	100	100
clomazone + atrazine	0.75 + 0.5	100	100	100	100
atrazine	0.3	97	78	87	83
atrazine	0.5	97	90	90	90

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[1] Treatments applied August 13, 1987; September 21, 1987; October 13, 1987; and March 29, 1988

[2] Plots visually evaluated July 8, 1988

Weed control in fallow with fall herbicide treatments. Miller, S.D. and J.M. Krall. Research plots were established near Chugwater, WY, to evaluate the efficacy of individual and/or herbicide combinations for weed control in fallow when applied at several dates in the fall. 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Treatments were applied August 11 (air temp. 86 F, relative humidity 20%, wind NW at 9 mph, sky partly cloudy and soil temp. - 0 inch 103 F, 2 inch 82 F, and 4 inch 75 F) to emerging downy brome and October 22, 1987 (air temp. 48 F, relative humidity 60%, wind SE at 3 mph, sky clear and soil temp. - 0 inch 60 F, 2 inch 39 F and 4 inch 37 F) to 3-leaf downy brome. The soil was classified as a sandy loam (69% sand, 18% silt and 13% clay) with 1.4% organic matter and pH 7.8. Visual weed control evaluations were made July 7, 1988. Downy brome (BROTE) infestations were heavy and Russian thistle (SASKR) and kochia (KCHSC) infestations light throughout the experimental area.

Weed control was better with treatments applied in October than August. Clomazone was more effective at 0.5 lb/A in combination with other herbicides than at 0.75 lb/A alone at both dates of application. Clomazone-atrazine mixtures at 0.5 plus 0.5 lb/A were as effective as atrazine alone at 0.75 lb/A. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1557.)

Weed control in fallow with fall herbicide treatments

Treatment[1]	Rate lb ai/A	Weed control[2] SASKR %	KCHSC %	BROTE %
August				
clomazone	0.5	18	24	54
clomazone	0.75	54	60	58
clomazone + atrazine	0.5 + 0.3	57	71	94
clomazone + atrazine	0.5 + 0.4	67	80	98
clomazone + atrazine	0.5 + 0.5	78	97	99
clomazone + metribuzin	0.5 + 0.625	53	70	88
clomazone + cyanazine	0.5 + 2.0	47	47	90
clomazone + chlorsulfuron	0.5 + 0.03	100	99	65
clomazone + metsulfuron	0.5 + 0.023	83	62	62
clomazone + CGA-131036	0.5 + 0.03	99	100	65
clomazone + imazethapyr	0.5 + 0.094	45	56	90
cyanazine + atrazine	2.0 + 0.5	77	88	96
cyanazine + metribuzin	2.0 + 0.625	32	42	82
cyanazine + imazethapyr	2.0 + 0.094	35	40	85
atrazine	0.75	82	90	97
metribuzin	1.0	40	60	98
October				
clomazone	0.5	47	48	70
clomazone	0.75	52	58	80
clomazone + atrazine	0.5 + 0.3	77	98	99
clomazone + atrazine	0.5 + 0.4	88	100	100
clomazone + atrazine	0.5 + 0.5	92	99	100
clomazone + metribuzin	0.5 + 0.625	53	75	92
clomazone + chlorsulfuron	0.5 + 0.03	100	99	75
clomazone + imazethapyr	0.5 + 0.094	60	67	98
cyanazine + atrazine	2.0 + 0.5	87	98	100
atrazine	0.75	94	100	100

[1] Treatments applied August 11 and October 22, 1987

[2] Plots visually evaluated July 7, 1988

Control of winter annual grass in fallow. Whitson, T. D., A. E. Gade and J. M. Krall. Control of volunteer wheat and downy brome should be considered by farmers, following wheat harvest, to conserve moisture. A study was established near Aladdin, WY. on silty clay loam soil (21% sand, 58% silt and 21% clay) with 7.9 pH and organic matter of 2.0%. Weather information: air temperature 73F, soil surface 70F, 1 inch 70F, 2 inches 72F and 4 inches 70F; relative humidity 48%, wind speed 5 mph SW. Plots, 10 by 27 ft, were arranged in a randomized complete block desigh with four replications. Herbicides were applied broadcast with a CO_2 pressurized six nozzle knapsack unit delivering 30 gpa at 45 psi. Evaluations were taken April 15, 1988. Metribuzin + glyphosate at 1.25 and 0.38 lb ai/A, atrazine + terbutryn at 0.5 and 2.0 lb ai/A and atrazine + paraquat at 0.5 + 0.25 lb ai/A provided 99, 91 and 83% grass control respectively. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Control of downy brome and volunteer wheat in wheat fallow land

Herbicide	Rate lbs ai/A	Grass control %
atrazine + paraquat + X-77	0.5 + 0.25 + 1 pt	83
atrazine + terbutryn + X-77	0.5 + 2.0 + 1 pt	91
metribuzin + glyphosate	1.25 + 0.38	99
chlorsulfuron + atrazine + X-77	0.013 + 0.25 + 1 pt	38
chlorsulfuron + glyphosate	0.03 + 0.38	48
dicamba + glyphosate	0.25 + 0.38	35
paraquat + 2,4-D (LVE)	0.25 + 0.25	40
paraquat	0.25	15
Check		0

[1] Evaluated April 15, 1988.

Evaluation of herbicides at three times of application in grain lupine. Mitich, L.W., K. Cassman, and N.L. Smith. Ten herbicides, in 26 applications, were evaluated for weed control and crop tolerance in 'Minnesota Ultra' grain lupine at the UC Davis farm. Plots were 10 ft by 40 ft (two 5-ft by 40-ft rows). All treatments were applied broadcast with a CO_2 backpack sprayer at a spray volume of 20 gpa. Preplant incorporated herbicides were applied November 1, 1987, and incorporated to 2 to 3 in. with a Marvin 60-in. power tiller. Seed was coated with an inoculant for lupine and planted November 2, using a grain drill with 7 in. row spacings. Preemergence surface treatments were applied November 3 and sprinkle irrigated with approximately 1.5 in. water. Temperatures for these applications was 60 F. Postemergence treatments were applied February 17, 1988, when lupine was 8 to 12 in. tall; weeds present included desert rockpurslane (# CLNCM), known locally as redmaids, minerslettuce (# MONPE), and common chickweed (# STEME), all 2 to 4 in. tall, and annual bluegrass (# POAAN), which was flowering. Temperature at this application was 70 F.

Crop tolerance and weed control evaluations were made March 14, 1988; weeds present in numbers great enough to evaluate included shepherdspurse (# CAPBP), common groundsel (# SENVU), minerslettuce, and desert rockpurslane. It was found that 8 treatments produced unacceptable crop injury (greater than 25%) which was later reflected in lupine seed yields. Applied postplant preemergence, pendimethalin (1.5 lb/a and 2.5 lb/a) resulted in acceptable crop tolerance and excellent control (90%-100%) of shepherdspurse, minerslettuce, and desert rockpurslane. Preplant incorporated application of pendimethalin reduced weed control. Poor weed control was achieved with metolachlor; addition of metolachlor to pendimethalin did not improve weed control in this crop situation. Postplant preemergence application of pendimethalin + chloramben (1.5 + 3.0 lb/a) produced results similar to pendimethalin alone; in crop situations with other weeds, this could be a useful mixture. Prometryn provided acceptable tolerance and fair to good (greater than 70%) weed control at 1.0 and 2.0 lb/a.

Lupine seed was harvested July 15, from a 5 ft by 35 ft swath in the center of each plot. Yields appeared to reflect primarily degree of herbicide injury; the unweeded control produced seed weights not significantly different from those obtained from the best-ranked herbicide treatments. Professional lupine growers in California must obtain yields of approximately 3500 kg/ha or better for economic success; top-ranked treatments, including the control, exceeded this amount. (Department of Botany and Department of Agronomy and Range Science, University of California, Davis, CA 95616)

Evaluation of herbicides at three times of application in grain lupine, UC Davis

Herbicide	(lb/a)	Percent crop vigor[1]	Percent weed control[1]				Yield[1,3] (kg/ha)	
			CAPBP	SENVU	MONPE	CLNCM		
PREPLANT INCORPORATED								
pendimethalin	1.5	83	23	23	20	20	3842	A
metolachlor	2.0	73	0	0	0	43	2904	ABCD
pendimethalin + metolachlor	1.5 + 2.0	71	18	25	30	50	3015	ABC
prometryn	1.0	83	28	28	13	75	3189	ABC
prometryn	2.0	81	40	40	30	60	3119	ABC
trifluralin	0.75	85	3	23	28	70	3158	ABC
dimethazone	0.75	50	48	48	75	85	2019	DE
dimethazone	1.5	33	70	70	75	85	561	F
dimethazone + pendimethalin	0.75 + 1.5	50	53	53	65	83	1824	E
POSTPLANT PREEMERGENCE								
pendimethalin	0.75	80	70	30	63	85	3159	ABC
pendimethalin	1.5	90	90	35	98	100	3602	AB
pendimethalin	2.5	90	100	40	100	98	3732	A
metolachlor	2.0	78	13	13	13	23	2957	ABC
pendimethalin + metolachlor	1.5 + 2.0	91	95	28	93	98	3840	A
prometryn	1.0	83	70	70	55	85	3751	A
prometryn	2.0	83	86	86	73	98	3597	AB
chloramben	3.0	78	15	23	13	75	3341	ABC
chloramben	6.0	70	28	25	28	93	2693	BCDE
chloramben + metolachlor	3.0 + 2.0	79	30	35	43	63	3228	ABC
chloramben + pendimethalin	3.0 + 1.5	90	94	45	100	100	3525	ABC
POSTEMERGENCE								
AC 263,499 + X-77	0.063	53	60	60	63	75	2563	CDE
AC 263,499	0.094	48	65	65	68	75	1780	E
sethoxydim + oil	0.4	83	5	5	3	23	3662	AB
fluazifop-butyl + X-77	0.24	76	0	3	0	45	3374	ABC
fluazifop-butyl	0.6	83	0	0	0	53	3828	A
cloproxydim + X-77	0.125	88	13	13	13	23	3577	AB
control	---	85	5	5	5	5	3739	A

[1] Average of four replications.

[2] Values followed by the same letter are not statistically different at the 5% level of significance according to Duncan's Multiple Range Test. The least standard difference determined was 838 kg/ha.

Herbicide control of spring milletgrass. Dial, M.J. and D.C. Thill. Herbicide control of spring milletgrass (Milium vernale M. Biede., MILVE) was evaluated on a fallow test site near Grangeville, Idaho. The herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 20 gal/a at 42 psi and 3 mph to spring milletgrass 1 to 3 in. tall with 3 to 6 fully expanded leaves. Herbicide treatments were arranged in a randomized complete block design, replicated two times. The treatments were evaluated for percent control of spring milletgrass on May 11, 1988 and May 25, 1988. Application data are in Table 1.

Table 1. Application data

Application date	April 17, 1988
Air temperature (F)	66
Soil temperature at 2 in. (F)	58
Relative humidity (%)	63
Soil pH	5.6
OM (%)	7.2
Texture	silt loam
CEC (meq/100 g soil)	33.8

Ethiozin + metribuzin, diclofop, and diclofop + chlorsulfuron or DPXM6316 controlled spring milletgrass 85% or greater (Table 2). Ethiozin alone or cyanazine alone and tank mixed with metribuzin, imazamethabenz, difenzoquat, chlorsulfuron, or DPXM6316 did not control spring milletgrass effectively. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Spring milletgrass control

Treatment	Rate[1]	MILVE control	
	(lb ai/a)	(% of check)	
		May 11	May 25
ethiozin	1.5	63	77
ethiozin +	1.5	95	100
metribuzin	0.1875		
cyanazine	0.8	68	70
cyanazine +	0.8	68	70
metribuzin	0.1875		
imazamethabenz +	0.47	0	18
surfactant	0.25%		
difenzoquat +	1.00	0	10
surfactant	0.25%		
diclofop	1.00	94	95
chlorsulfuron +	0.0156	40	30
surfactant	0.25%		
DPXM6316 +	0.0313	0	5
surfactant	0.25%		
diclofop +	1.00	85	95
chlorsulfuron +	0.0156		
surfactant	0.25%		
diclofop +	1.00	90	97
DPXM6316 +	0.0313		
surfactant	0.25%		
LSD (0.05)		18	20
spring milletgrass density (no./ft^2)		10	

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[1] R-11 is a nonionic surfactant; concentration is expressed as % v/v.

Avena sativa L. bioassay to determine imazamethabenz antagonism with broadleaf herbicides. Lish, J.M. and D.C. Thill. *Avena fatua* L. control is reduced occasionally when some broadleaf herbicides are tank mixed with imazamethabenz. This antagonism was investigated near Moscow, Idaho in 1988. *A. sativa* L. was selected as the bioassay species to ensure a uniform plant stand and to avoid spreading *A. fatua*. 'Otana' *A. sativa* was planted on May 11, and herbicides were applied June 7 with a CO_2 pressurized backpack sprayer at 94 L/ha and 290 kPa (Table 1). Herbage biomass (1 m^2) was collected July 6 and dried 48 h at 60 C.

Table 1. Environmental conditions at application

A. sativa growth stage	1 to 3 lf
Air temperature (C)	9
Soil temperature at 5 cm (C)	12
Relative humidity (%)	78
Soil moisture	high
Wind (kmph)/direction	0 to 8/SE
Soil pH	5.7
CEC (meq/100 g)	18.1
OM (%)	2.5
texture	silt loam

A. sativa growth was stunted with all treatments (data not shown). Biomass from the imazamethabenz + MCPA LVE (0.263 + 0.280 kg ai/ha) treatment was not different from the control according to least significance difference (LSD) mean separation (P = 0.05) (Table 2). Addition of broadleaf herbicides reduced imazamethabenz effectiveness on *A. sativa* from 192 to 286 g/m^2 (orthogonal contrast analysis, P = 0.04). This antagonism was avoided by applying difenzoquat (0.56 kg ai/ha) with imazamethabenz (0.263 kg ai/ha). (Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. *A. sativa* biomass with imazamethabenz, difenzoquat, and broadleaf herbicide tank mixes.

Treatment	Rate (kg ai/ha)	Biomass (g/m^2)
control	--	531
imazamethabenz	0.263	265
imazamethabenz	0.526	120
difenzoquat	0.560	114
difenzoquat	1.120	122
imazamethabenz + bromoxynil	0.263 + 0.280	318
imazamethabenz + MCPA LVE	0.263 + 0.280	395
imazamethabenz + bromoxynil/MCPA	0.263 + 0.280	304
imazamethabenz + bromoxynil	0.526 + 0.280	278
imazamethabenz + MCPA LVE	0.526 + 0.280	208
imazamethabenz + bromoxynil/MCPA	0.526 + 0.280	210
imazamethabenz + difenzoquat	0.263 + 0.560	182
imazamethabenz + difenzoquat + bromoxynil	0.263 + 0.560 + 0.280	138
imazamethabenz + difenzoquat + MCPA LVE	0.263 + 0.560 + 0.280	145
imazamethabenz + difenzoquat + bromoxynil/MCPA	0.263 + 0.560 + 0.280	231
LSD (0.05)		*152*

Broadleaf weed control in field potatoes. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established on April 19, 1988 at the Agricultural Science Center to evaluate the response of Centennial potatoes and annual broadleaf weeds to herbicides. The experimental design was a randomized complete block with four replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi. Preemergence surface (PES) applied treatments were applied April 22, 1988 and immediately incorporated with 0.75 in of sprinkler applied water. Preplant incorporated (PPI) treatments were applied April 19, 1988 and immediately incorporated with a power driven rototiller to a depth of 2 to 3 in. Russian thistle and prostrate pigweed infestations were heavy and kochia and redroot pigweed infestations were moderate throughout the experimental area.

Visual weed control and crop injury evaluations were assessed June 23, 1988. All treatments provided good to excellent control of prostrate pigweed, redroot pigweed and kochia. Russian thistle control was good to excellent with all treatments except pendimethalin applied PES at 1.0 lb ai/A and pendimethalin plus EPTC R-33865 applied PES at 1.0 plus 3.0 lb ai/A. Fluorochloridone applied (PES) at 0.25 and 0.5 lb ai/A did cause a slight yellowing effect of the uppermost leaves, but did not cause a substantial loss in potato yield. Potato yields were 182 to 317 cwt/A higher in herbicide treated plots compared to the check. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Broadleaf weed control evaluations in field potatoes, 1988

Treatment	Timing[1]	Rate lb ai/A	Crop[2] Injury	-------Weed Control[2]---------- AMABL	AMARE	KCHSC	SASKR	Yield cwt/A
			---------------------	----------- %	-----------	-----------	-----------	
fluorochloridone	PES	0.25	10	100	100	100	91	440
fluorochloridone	PES	0.50	14	100	100	100	99	398
trifluralin + metolachlor	PPI	0.75 + 1.5	0	100	100	88	93	479
trifluralin + EPTC R-33865	PPI	0.75 + 3.0	0	100	100	89	95	478
trifluralin + EPTC R-33865 + metribuzin	PPI	0.75 + 3.0 + 0.25	0	100	100	100	100	465
metolachlor + metribuzin	PES	2.0 + 0.25	0	100	100	100	93	463
pendimethalin	PES	1.0	0	100	100	100	69	346
pendimethalin + EPTC R-33865	PES	1.0 + 3.0	0	100	100	100	70	344
pendimethalin + metribuzin	PES	1.0 + 0.25	0	97	100	100	100	444
handweeded check			0	100	100	100	100	469
check			0	0	0	0	0	162

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1. PES = preemergence surface and PPI = preplant incorporated
2. Based on a visual scale from 0-100, where 0 = no control or crop injury and 100 = dead plants

Weed control in quinoa (Chenopodium quinoa). Westra, P. and T. D'Amato. Three replicated field experiments were conducted to evaluate the use of 1. preplant incorporated (PPI) or preemerge herbicides, 2. postemergence (POST) herbicides, and 3. post-emergence grass herbicides in quinoa (a South American grain producing relative of Chenopodium album). Herbicides were applied with a CO_2 backpack sprayer in 20 gpa of water through 11002LP SS nozzles. Each study contained 3 replications in a RCB design. In study 1, alachlor, metolachlor, propachlor, trifluralin, EPTC, and lactofen caused unacceptable quinoa injury. Only metolachlor from this group will be further evaluated at lower rates. Diethatyl ethyl, butylate, endothall, and chlorpropham showed good crop safety and potential for weed control in quinoa. The untreated check yielded 728 lb/a, while effective herbicide treatment plots yielded from 1000 to 1578 lb/a. Primary weeds present were redroot pigweed (AMARE) and kochia (KCHSC). In study 2, clopyralid severely injured quinoa at all rates tested. Pyridate at lower rates (.30 lb ai/a) caused only moderate crop injury. Fluroxypyr and methazole showed excellent crop selectivity at all rates tested. The untreated check plot yielded 1309 lb/a while effective herbicide treatment plots yielded as much as 1504 lb/a. Weed pressure was very light in study 2. In study 3, sethoxydim, fluazifop-butyl, fenoxaprop-ethyl, haloxyfop methyl, clethodim, BAS 517, and DPX-Y6202, showed excellent crop selectivity. The primary weed present, wild oat (AVEFA) was well controlled (95 - 100 %) by all herbicides except haloxyfop methyl (15 %). The untreated check yielded 1532 lb/a while herbicide treatment plots yielded as much as 2233 lb/a. These studies show that several herbicides have good potential for selective weed control in quinoa. (Weed Research Laboratory, Colorado State University, Ft. Collins, CO 80523)

Effect of postemergence grass herbicides on diclofop-resistant Italian ryegrass. Brewster, B.D., R.L. Spinney, and A.P. Appleby. Italian ryegrass that had developed resistance to diclofop-methyl at two sites in western Oregon following repeated annual applications was tested for cross-resistance to other grass herbicides.

The experimental design was a randomized complete block with four replications and 2.5 m by 6 m plots. Carrier volume was 234 L/ha delivered at 138 kPa through 8002 flat fan nozzle tips set in a double-overlap spray pattern. Herbicides were applied in mid-December, 1987 when the ryegrass had one to three leaves; visual evaluations were conducted 6 weeks later.

Clethodim was the most effective herbicide, but all of the chemicals were less effective than expected. Fluazifop-P-butyl and haloxyfop-methyl, the two herbicides structurally most similar to diclofop, were equally ineffective. Subsequent research on diclofop-sensitive and diclofop-resistant Italian ryegrass selections has confirmed the development of cross-resistance to other grass herbicides. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Italian ryegrass control with postemergence grass herbicides
at two sites in western Oregon

Herbicide[1]	Rate	Washington County	Marion County
	(kg a.i./ha)	(%)	
diclofop	1.0	0	8
sethoxydim	0.2	43	45
fluazifop-P	0.2	0	0
clethodim	0.2	78	80
haloxyfop	0.2	20	8
quizalofop	0.2	60	53
check	0	0	0

[1] Crop oil concentrate Agridex was added to each treatment at 1% v/v.

Preemergence weed control in sugarbeet. Kidder, D.W. and D.P. Drummond. Six currently registered herbicides were evaluated for control of common lambsquarters (*Chenopodium album* L., CHEAL), redroot pigweed (*Amaranthus retroflexus* L., AMARE), hairy nightshade (*Solanum sarrachoides* Sendtner, SOLSA), kochia (*Kochia scoparia* (L.) Schrad., KCHSC), green foxtail (*Setaria viridis* (L.) Beauv., SETVI) and barnyardgrass (*Echinochloa crus-galli* (L.) Beauv., ECHCG) in sugarbeet at the University of Idaho Research and Extension Center, Kimberly, Idaho. Nineteen treatments, including the control, were applied in a randomized complete block design with four replications. Sugarbeets (cv. WS88) were planted on April 21, 1988 in 22 inch rows. The sugarbeets were cultivated on June 6, June 13 and June 22 and thinned on June 13 to a nine inch spacing between plants. Sugarbeets were sprinkler irrigated as needed.

Herbicides were applied on April 21 (PPI), April 26 (PRE) and May 31 (POST) using a CO_2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa and at a pressure of 30 psi. Treatment plots were 10 feet by 30 feet. Treatments were evaluated on June 9 and July 14.

Results are shown in table 2. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in sugarbeet

Date of application	4/21/88	4/26/88	5/31/88
Air temperature (F)	86	48	60
Soil temperature @ surface (F)	65	47	61
Soil temperature @ 3 in (F)	56	59	52
Relative humidity (%)	68	31	68
Dew present	none	none	slight
Wind (mph)	0-15	4-6	0-4
Cloud cover (%)	50	0	10
Soil			
organic matter (%)	1.4		
pH	7.8		
texture	silt loam		

Table 2. Preemergence weed control in sugarbeet

					Control										
			Crop inj.		6/9					7/14					
Treatment[1]	Rate	Timing	6/9	7/14	CHEAL[1]	AMARE	SOLSA	KCHSC	SETVI	CHEAL	AMARE	SOLSA	KCHSC	SETVI	ECHCG
	(lb ai/a)		(%)												
Untreated			0	0	0	0	0	0	0	0	0	0	0	0	0
Cycloate	3.00	PPI	7	0	90	92	99	47	94	63	70	100	49	96	92
Diethatyl-ethyl	4.00	PPI	8	0	79	95	95	60	96	30	85	89	70	97	94
Cycloate + diethatyl-ethyl	1.50 + 1.50	PPI	7	0	94	99	97	76	98	82	96	100	38	100	100
Cycloate + diethatyl-ethyl	1.70 + 1.80	PPI	13	0	92	93	93	66	92	91	100	100	38	97	94
Cycloate + diethatyl-ethyl	2.00 + 2.00	PPI	13	0	86	81	91	76	88	93	100	99	36	99	98
Cycloate + diethatyl-ethyl pyrazon	1.50 + 1.50 + 1.60	PPI	15	0	94	100	85	94	91	98	100	100	84	99	100
Cycloate + diethatyl-ethyl dyfonate	1.50 + 1.50 + 1.50	PPI	9	0	83	96	89	75	90	90	100	100	28	98	100
Cycloate + diethatyl-ethyl dyfonate	1.70 + 1.80 + 1.50	PPI	23	0	93	95	96	91	91	87	100	100	65	100	100
Diethatyl-ethyl	4.00	PRE	6	0	61	88	69	54	93	23	85	85	36	99	96
Ethofumesate	2.10	PRE	8	0	94	99	99	95	95	82	100	75	90	90	95
Pyrazon	3.20	PRE	4	0	82	91	94	83	52	88	96	100	51	71	63
Endothall	3.00	PRE	1	0	8	15	85	79	66	10	38	100	90	74	8
Phenmedipham + desmedipham	0.49 + 0.49	POST	8	0	98	84	89	68	64	94	73	61	86	25	15
Diethatyl-ethyl + ethofumesate	2.00 + 1.00	PRE	13	0	87	90	91	86	94	88	100	100	85	99	100
Diethatyl-ethyl + ethofumesate	2.00 + 1.50	PRE	17	0	75	87	90	93	91	67	98	99	89	100	100
Diethatyl-ethyl + pyrazon	2.80 + 2.90	PRE	4	0	69	83	90	81	86	81	91	100	87	93	100
Ethofumesate + pyrazon	1.70 + 1.40	PRE	4	0	55	93	73	82	80	48	99	99	92	93	50
Diethatyl-ethyl + ethofumesate + pyrazon	2.00 1.00 + 1.60	PRE	18	0	93	99	95	91	97	87	100	98	95	100	100
LSD (0.05)			9	NS	16	3	11	15	NS	19	21	16	34	6	19

1 Treatments were applied 4/21 for PPI, 4/26 for PRE and 5/31 for POST.

2 CHEAL = common lambsquarters
AMARE = redroot pigweed
SOLSA = hairy nightshade
KCHSC = kochia
SETVI = green foxtail
ECHCG = barnyardgrass

Postemergence weed control with clopyralid in sugarbeet. Kidder, D.W. and D.P. Drummond. Clopyralid, alone and in tank mix combination with Betamix (phenmedipham + desmedipham, 1:1 w/w), ethofumesate and sethoxydim, was evaluated for control of common lambsquarters (*Chenopodium album* L., CHEAL), redroot pigweed (*Amaranthus retroflexus* L., AMARE), hairy nightshade (*Solanum sarrachoides* Sendtner, SOLSA), and volunteer wheat in sugarbeets at the University of Idaho Research and Extension Center, Kimberly, Idaho. Fifteen treatments, including the control, were applied in a randomized complete block design with four replications. Sugarbeets (cv. WS88) were planted on April 21, 1988 in 22 inch rows. The sugarbeets were cultivated on June 6 and July 20 and thinned on June 13 to a nine inch spacing between plants.

Herbicides were applied on May 27 and June 4 using a CO_2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa and at a pressure of 30 psi. Treatment plots were 11 feet by 30 feet. Sugarbeets were in the 2 to 4 leaf stage at the time of the early application and in the 4 to 6 leaf stage at the later application. Broadleaf weeds were 2 to 3 inches tall at the first application and 3 to 5 inches tall at the later application. Grass weeds were 3 to 5 inches tall at the first application and 5 to 6 inches tall at the later application. Treatments were evaluated on June 8 and July 15. Harvest data were recorded on October 17, 1988.

Results are shown in table 2. Crop injury was generally greater when clopyralid and Betamix were tank mixed than when each herbicide was applied alone. This may be due to the presence of surfactants in the clopyralid formulation. Volunteer grain control was not affected when sethoxydim was applied with clopyralid. Clopyralid was particularly effective on hairy nightshade. With further development clopyralid may become a useful tool for control of this major weed problem in Idaho sugarbeet crops. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in sugarbeet

Date of application	5/27/88	6/4/88
Air temperature (F)	64	70
Soil temperature @ surface (F)	65	68
Soil temperature @ 3 in (F)	61	60
Relative humidity (%)	65	58
Dew present	none	none
Wind (mph)	8-10	0
Cloud cover (%)	100	0
Soil		
organic matter (%)	1.4	
pH	8.0	
texture	silt loam	

Table 2. Postemergence weed control with clopyralid in sugarbeet

			Crop Inj.		Control								Yield			
					6/8				7/15				10/17			
Treatment[1]	Rate	Timing (crop)	6/8	7/15	CHEAL[2]	AMARE	SOLSA	VOGR	CHEAL	AMARE	SOLSA	VOGR	Yield	Sugar	Recoverable sugar	
	(lb a.i./a)	(leaves)			(%)								(tons/a)	(%)	(lbs/a)	(lbs/T)
Untreated			0	0	0	0	0	0	0	0	0	0	12.08	15.81	3184.4	266.1
Betamix	0.73	2-4	9	2	94	92	72	31	94	84	79	9	22.97	16.17	6255.7	272.7
Clopyralid	0.06	2-4	1	2	5	5	10	0	38	26	50	3	13.77	15.63	3616.6	261.2
Clopyralid	0.13	2-4	2	1	6	5	31	0	72	34	94	0	14.45	15.30	3563.1	251.0
Clopyralid	0.25	2-4	3	7	13	5	50	0	92	76	100	0	14.73	15.25	3736.6	252.6
Betamix + clopyralid	0.73 + 0.06	2-4	14	2	88	83	77	55	82	70	55	24	25.39	15.43	6541.9	258.3
Betamix + clopyralid	0.73 + 0.13	2-4	16	2	94	87	92	36	98	90	99	58	29.12	15.29	7384.9	253.7
Betamix + clopyralid	0.73 + 0.25	2-4	23	7	98	94	98	53	99	91	100	32	23.53	14.78	5658.1	241.3
Betamix	0.98	4-6	18	4	85	91	43	11	76	66	56	30	18.34	16.25	5061.4	276.4
Betamix + clopyralid	0.98 + 0.06	4-6	18	3	88	88	54	9	86	80	58	6	20.37	15.94	5419.2	266.3
Betamix + clopyralid	0.98 + 0.13	4-6	30	4	87	89	68	40	85	68	66	30	20.09	16.17	5458.0	271.7
Betamix + clopyralid	0.98 + 0.25	4-6	23	5	93	93	69	33	93	71	98	45	22.97	16.01	6132.3	267.4
Betamix + ethofumesate	0.73 + 0.28	4-6	23	3	80	81	51	18	73	42	20	36	15.41	15.64	4032.3	263.1
Sethoxydim + COC[3]	0.28 + 1 qt.	4-6	0	0	0	0	0	10	0	0	0	98	8.41	15.31	2169.0	257.3
Clopyralid + sethoxydim + COC	0.25 + 0.28 + 1 qt	4-6	2	1	11	10	40	15	88	20	88	97	13.04	15.77	3385.8	261.3
LSD(0.05)			8	5	8	15	21	22	19	37	31	24	7.27	0.76	1803.5	16.6

1. Treatments were applied on May 27 and June 4, 1988.
2. CHEAL = common lambsquarters
   AMARE = redroot pigweed
   SOLSA = hairy nightshade
   VOGR = volunteer wheat
3. Crop oil concentrate (Atplus 411F)

Postemergence grass control in sugarbeet. Kidder, D.W. and D.P. Drummond. Sethoxydim and fluazifop-P,alone and in tank mix combination with betamix (phenmedipham + desmedipham, 1:1 w/w), crop oil concentrate (Atplus 411) and Dash (BCH-081515S) were evaluated for crop injury and control of barnyardgrass (*Echinochloa crus-galli* (L.) Beauv., ECHCG) at the University of Idaho Southwest Idaho Research and Extension Center, Parma, Idaho. Eleven treatments, including the control, were applied in a randomized complete block design with four replications. Sugarbeets (cv. WS88) were planted on April 19, 1988 in 22 inch rows. The sugarbeets were cultivated on June 5, 13, 27 and July 9 and thinned on June 9 to a nine inch spacing between plants.

Herbicides were applied on June 2, 1988 using a CO_2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa and at a pressure of 30 psi. Treatment plots were 11 feet by 30 feet. Sugarbeets were in the 6 leaf stage of growth and barnyardgrass was 2 to 4 inches tall at the time of application. Treatments were evaluated on June 22, 1988. Barnyardgrass samples were harvested from subplots measuring 40 cm by 80 cm on July 20, 1988.

Results are shown in table 2. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in sugarbeet

Date of application	6/2/88
Air temperature (F)	81
Soil temperature @ surface (F)	73
Soil temperature @ 3 in (F)	75
Relative humidity (%)	35
Dew present	none
Wind (mph)	4-8
Cloud cover (%)	25
Soil	
organic matter (%)	1.6
pH	7.8
texture	silt Loam

Table 2. Postemergence grass control in sugarbeet

		June 22		July 20	
				ECHCG wt[3]	
Treatment[1]	Rate	Crop Inj.	ECHCG[2] Control	Fresh	Dry
	(lb a.i./a)	---(%)---		-(g/plot[4])-	
Sethoxydim + COC[5]	0.30 + 1 qt/a	0	98	13	3
Sethoxydim + Betamix + COC	0.30 + 0.49 + 1 qt/a	4	94	48	9
Sethoxydim + Betamix	0.30 + 0.49	2	78	200	40
Sethoxydim + Dash	0.30 + 1 qt/a	0	99	2	0
Sethoxydim + Betamix + Dash	0.30 + 0.49 + 1 qt/a	3	94	57	9
Fluazifop-P + COC	0.27 + 1 qt/a	1	93	5	2
Fluazifop-P + Betamix + COC	0.27 + 0.49 + 1 qt/a	5	88	43	8
Fluazifop-P + Betamix	0.27 + 0.49	2	96	97	19
Fluazifop-P + Dash	0.27 + 1 qt/a	0	95	10	2
Fluazifop-P + Betamix + Dash	0.27 + 0.49 + 1 qt/a	3	89	25	7
LSD (0.05)		2	8	110	22

[1] Treatments were applied on June 2, 1988.

[2] ECHCG = Barnyardgrass

[3] Untreated check yielded 4640 g/plot fresh wt and 868 g/plot dry wt. All herbicide treatments yielded significantly less barnyardgrass fresh and dry wt than the check.

[4] Plots measured 40 cm by 80 cm.

[5] COC = Crop oil contentrate (Atplus 411)

Split application timing of sethoxydim and Betamix. Kidder, D.W. and D.P. Drummond. Betamix (phenmedipham + desmedipham, 1:1 w/w) was applied from three days before to three days following sethoxydim application to evaluate antagonism of volunteer grain control at the University of Idaho Research and Extension Center, Kimberly, Idaho. Thirteen treatments, including the control, were applied in a randomized complete block design with four replications. Sugarbeets (cv. WS88) were planted on April 21, 1988 in 22 inch rows. The sugarbeets were cultivated on June 6 and July 20 and thinned on June 13 to a nine inch spacing between plants.

Herbicides were applied on June 7 through June 13 using a CO_2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa at a pressure of 30 psi. Treatment plots were 11 feet by 30 feet. Sugarbeets were in the 6 to 8 leaf stage of growth and the volunteer grain was in the early boot stage at the time of sethoxydim application. Treatments were evaluated on July 13.

Results are shown in table 2. None of the treatments caused significant sugarbeet injury. Volunteer wheat control was reduced when Betamix was applied 2 or 3 days prior to sethoxydim application. Volunteer wheat control was greater when Betamix was applied 2 to 3 days after sethoxydim than when Betamix was applied from 3 days before to 2 hours after sethoxydim or when sethoxydim was applied alone. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in sugarbeet

Date of application	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Air temperature (F)	64	69	75	68	78	63	76
Soil temperature @ surface (F)	65	80	62	52	--	68	84
Soil temperature @ 3 in (F)	67	72	65	62	--	43	57
Relative humidity (%)	45	31	39	38	32	41	30
Dew present	none	none	none	none	none	none	none
Wind (mph)	5-9	2-6	0-10	8-10	8-10	8-10	0-8
Cloud cover (%)	100	10	10	10	5	20	0
Soil							
organic matter (%)				1.4			
pH				7.7			
texture				silt loam			

Table 2. Split application timing of sethoxydim and Betamix

Betamix timing relative to sethoxydim application[1]	Volunteer wheat control 7/13/88
	-(%)-
3 days before	51
2 days before	59
1 day before	75
2 hours before	75
Split application	83
Tank mix	80
2 hours after	85
1 day after	91
2 days after	94
3 days after	92
Sethoxydim alone	76
Betamix alone	6
Untreated check	0
LSD (0.05)	14

1. Betamix was applied at 0.98 lb a.i./A, sethoxydim was applied at 0.19 lb a.i./A with 1 qt. COC/A.

Split applications of Betamix in sugarbeet. Kidder, D.W. and D.P. Drummond. Betamix (phenmedipham + desmedipham, 1:1 w/w), applied at varying times and rates, was evaluated for control of common lambsquarters (*Chenopodium album* L., CHEAL), redroot pigweed (*Amaranthus retroflexus* L., AMARE) and green foxtail (*Setaria viridis* (L.) Beauv., SETVI) in sugarbeets at the University of Idaho Research and Extension Center, Kimberly, Idaho. Fifteen treatments, including an untreated control and a hand weeded control, were applied in a randomized complete block design with four replications. Sugarbeets (cv. WS88) were planted on April 21, 1988 in 22 inch wide rows. The sugarbeets were cultivated on June 6, 13 and 25 and thinned on June 13 to a nine inch spacing between plants.

Herbicides were applied on May 10, 17, 24 and 31 using a CO_2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa at a pressure of 30 psi. Treatment plots were 10 feet by 30 feet. Sugarbeets were in the cotyledon, first leaf, 2nd leaf, and 4th leaf growth stage at the time of the four applications, respectively. Weeds were in the emerging, cotyledon, 2 to 4 leaf and 1 to 2 inch stage at the four applications, respectively. Treatments were evaluated on June 9 and July 14. Harvest data were recorded on October 17, 1988.

Results are shown in table 2. None of the herbicide treatments in this experiment produced acceptable season-long control. Late emerging weeds were not effected by these treatments. Late-season weed control could be enhanced with a lay-by treatment of EPTC or trifluralin. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in sugarbeet

Date of application	5/10	5/17	5/24	5/31
Air temperature (F)	64	60	81	60
Soil temperature @ surface (F)	63	60	92	61
Soil temperature @ 3 in (F)	59	63	77	52
Relative humidity (%)	52	58	25	68
Dew present	none	none	none	slight
Wind (mph)	0-2	10-12	5-6	0-4
Cloud cover (%)	0	40	60	10
Soil				
organic matter (%)				1.4
pH				7.9
texture				silt loam

Table 2. Postemergence weed control with Betamix (desmedipham + phenmedipham 1:1 w/w)

			Crop Inj.		Control						Yield			
					6/9			7/14			10/17			
Treatment	Rate	Timing[1]	6/9	7/14	CHEAL[2]	AMARE	SETVI	CHEAL	AMARE	SETVI	Yield	Sugar	Recov. sugar	
	(lb a.i./A)		(%)								(tons/a)	(%)	(lbs/a)	(lbs/T)
Untreated			0	0	0	0	0	0	0	0	5.3	15.3	1978	250.3
Hand weeded			0	0	0	0	0	100	100	100	33.6	15.1	8201	242.8
Betamix	0.33	1,2	30	0	94	89	86	82	47	65	23.3	15.5	5926	254.8
Betamix	0.33	1,2,3	24	2	100	96	95	97	87	81	30.3	16.1	8166	268.7
Betamix	0.33	1,2,3,4	63	2	100	100	99	98	90	95	27.2	15.8	7079	259.9
Betamix	0.49	1,2	12	0	92	81	79	76	38	49	15.8	15.8	4139	259.0
Betamix	0.49	1,2,3	45	3	100	99	95	96	88	80	24.0	15.4	6210	254.3
Betamix	0.49	1,2,3,4	43	1	100	100	100	87	70	82	23.1	15.6	5958	256.4
Betamix +	0.33 +	1,2												
Betamix	0.49	3,4	50	9	100	100	100	95	90	78	24.7	15.5	6209	251.3
Betamix +	0.33 +	1												
Betamix	0.73	2	41	4	76	71	60	58	23	39	10.6	15.7	3690	261.6
Betamix +	0.33 +	1												
Betamix +	0.49 +	2												
Betamix	0.73	3	56	2	100	100	98	88	54	86	21.1	15.6	5464	259.7
Betamix +	0.33 +	1												
Betamix +	0.49 +	2												
Betamix	0.73	3,4	58	3	100	100	100	90	50	82	17.7	15.4	4572	255.8
Betamix +	0.49 +	1												
Betamix	0.73	3	39	2	98	98	94	93	87	75	23.9	15.9	6389	266.1
Betamix	0.73	2,4	60	13	100	100	99	94	74	66	27.0	14.7	6335	235.5
Betamix	0.98	4	14	1	97	98	73	89	67	60	24.6	15.8	6451	261.0
LSD(0.05)			30	8	8	6	13	NS	21	23	11.4	0.8	3192	15.3

[1] Timing: 1 = earliest emerging weeds (May 10) 2 = 7 days after 1 (May 17)
3 = 14 days after 1 (May 24) 4 = 21 days after 1 (May 31)

[2] CHEAL = common lambsquarters
AMARE = redroot pigweed
SETVI = green foxtail

Comparison of preplant incorporated and postemergence herbicides in sugarbeets. Norris, R.F., R.A. Lardelli. A field study designed to evaluate the efficacy of preplant incorporated herbicide treatments for weed control in sugarbeets was established at Davis, California.

A randomized complete block design with 4 replications and plots 2 beds on 30-inch centers by 20 feet long. Sugarbeets were planted on May 26; the natural weed infestation consisted of barnyardgrass, redroot pigweed and common purslane. All herbicide treatments (see table) were applied with a CO_2 backpack handsprayer delivering 40 gpa for the preplant treatments and 20 gpa for the postemergence treatments; pressure used was 30 and 20 psi through 80015 E and 8003 E flat fan nozzles, respectively. The PPI treatments were incorporated with a 2-row bedshaper/incorporator to a depth of 2 to 3 inches. The postemergence treatment was applied when the weeds were 1 to 3 inches tall and the crop was at the 2 to 4 true leaf growth stage. Phenmedipham plus desmedipham was applied as two split treatments 7 days apart, with the first treatment applied one day after sethoxydim was applied. Plots were cultivated 2 times during the growing season, but the bed-tops received no weed management other than the herbicide treatments. The center 3 m of each row of each plot was hand dug and sugarbeet root fresh weights obtained on October 17.

Crop tolerance and weed control were evaluated visually on 6/28/88. No herbicides affected the sugarbeet stand or vigor. Excellent barnyardgrass control was achieved with all treatments. Combination treatments of diethatyl plus ethofumesate possibly offered broader spectrum weed control than any single herbicide.

Split treatment of sethoxydim and phenmedipham plus desmedipham provided good grass control but showed weakness in control of the broadleaf weeds. Sugarbeet root yield at harvest was the highest from the plots treated with diethatyl at 6.0 lb/A. (Department of Botany, University of California, Davis, 95616.)

Pre-plant/postemergence weed control in spring planted sugarbeets[1]

		Visual evaluations 6/28[2,3]					
Herbicide	Rate	Sugar-beets 6/28	ECHCG 6/28	AMARE 6/28	POROL 6/28	Sugarbeet harvest roots/6m 10/17	
	(lb ai/A)	% (vigor)	---- (% control) ----			(kg)	(no.)
<u>Preplant incorporated 5/26</u>							
ethofumesate	3.00	98 a	89 b	96 ab	100 a	14.3 ab	77 a
diethatyl	6.00	100 a	100 a	96 ab	98 ab	16.4 a	65 ab
cycloate	6.00	96 a	99 a	88 b	95 ab	12.6 bc	64 ab
ethofumesate + diethatyl	2.0 + 4.0	98 a	100 a	100 a	100 a	15.4 ab	77 a
cycloate + diethatyl	3.0 + 3.0	95 a	100 a	99 a	96 ab	15.4 ab	56 ab
cycloate + diethatyl	3.75 + 4.0	95 a	100 a	100 a	100 a	14.7 ab	61 ab
<u>Post-emergence 6/22</u>[4]							
sethoxydim	0.375						
+ phenm./desm.	0.5						
+ phenm./desm.	0.5	76 c	100 a	58 c	88 b	9.5 c	57 ab
Untreated check		85 b	0 c	0 d	0 c	2.4 d	55 b

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[1] Means within a column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[2] Vigor: 100 = full vigor, 0 = dead.

[3] Abbreviations are WSSA code numbers from composite list of weeds, Weed Science 32, Suppl. 2.

[4] Oil = No Foam herbicide activator; used at volume of 1 qt./A.

Tolerance of four triticale varieties to seven wild oat herbicides. Mallory, C.A., M.J. Dial, R.M. Evans, and D.C. Thill. Triticale tolerance to seven wild oat herbicides was evaluated. Four varieties of triticale, Juan, Nutrical, Grace, and Whitman, were planted on May 13, 1988 at the University of Idaho Plant Science Farm near Moscow, Idaho. Experimental design was a split block with four replications. Plots were 10 by 20 ft. Treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 40 psi and 3 mph. Triallate was applied 24 hours after seeding and was incorporated once with a harrow immediately after application. Other wild oat herbicides were applied on June 3, when the triticale was in the 3 to 5 leaf stage. On June 15, clopyralid/2,4-D (0.5 lb ai/a) was applied for broadleaf weed control. Application and edaphic data are presented in Table 1.

Table 1. Application and edaphic data

	Triallate		Other herbicides
Treatment date	5/14/88		6/3/88
Air temperature (F)	60		60
Soil temperature at 2 in. (F)	65		56
Relative humidity (%)	59		76
Soil moisture	dry		wet
Soil type		silt loam	
Organic matter (%)		2.7	
pH		6.0	

On June 6, crop injury, which included shortening and thinning of the crop, was evaluated visually (Table 2). Triticale was harvested on September 9. Barban, HOE7113, and HOE7125 injured the crop 27, 44, and 81%, respectively. There was no variety by herbicide interaction. Triticale yield with all treatments except triallate was lower than the untreated check. HOE7125 had the greatest affect on yield, 33 bu/a compared to 72 bu/a in the untreated check. HOE7125 also delayed maturity of all varieties. Whitman was the slowest maturing variety. There was a difference in yield among the varieties (Table 3). (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Crop injury and grain yield across triticale varieties

Treatment	Rate	Crop injury	Grain yield
	(lb ai/a)	(% of check)	(bu/a)
check			72
triallate	1.25	3	68
barban	0.38	27	54
imazamethabenz	0.47	2	64
difenzoquat	1.00	3	65
diclofop	1.00	3	64
HOE7125	0.66	81	33
HOE7113	0.20	44	59
LSD (0.05)		5	6

Table 3. Crop injury and grain yield averaged across herbicide treatments

Variety	Grain Yield (bu/a)
Juan	73
Grace	64
Whitman	57
Nutrical	46
LSD (0.05)	4

Broadleaf weed control in spring wheat. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established on April 5, 1988 at the Agricultural Science Center to evaluate the response of Westbred 906R and annual broadleaf weeds to selected postemergence herbicides. The experimental design was a randomized complete block with four replications. Individual plots were 20 by 30 ft in size. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi. Treatments were applied with a COC at 0.25% v/v on April 16, 1988. Prostrate and redroot pigweed infestations were heavy with Russian thistle and kochia infestations moderate throughout the experimental area.

Broadleaf weed control was excellent with all treatments. Spring wheat yields were 8 to 28 bu/A higher in herbicide treated plots than in the checks. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Herbicide evaluations for broadleaf weed control in spring wheat

Treatment	Rate oz ai/A	Crop Injury[1]	Weed Control[1] AMABL	AMARE	KCHSC	SASKR	Yield bu/A
			%				
DPX-R9674	0.225	0	100	100	100	100	97.7
DPX-T6376	0.06	0	100	100	100	100	89.6
DPX-R9674	1.35	0	100	100	100	100	86.0
DPX-R9674	0.90	0	100	100	100	100	83.7
DPX-R9674	0.45	0	100	100	100	100	77.6
check		0	0	0	0	0	68.9
LSD 0.05			ns	ns	ns	ns	10.0

1. Based on a visual scale from 0-100, where 0 = no control or crop injury and 100 = dead plants.

Broadleaf weed control in spring wheat. Arnold, R.N., E.J. Gregory and D. Smeal. Research plots were established on April 5, 1988 at the Agricultural Science Center to evaluate the efficacy of sulfonyl urea herbicides for control of annual broadleaf weeds in spring wheat (var. Westbred 906R). Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. Individual plots were 10 by 30 ft in size with four replications arranged in a randomized complete block design. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 30 gal/A at 25 psi. Plots were harvested for yield July 28, 1988 with a self-propelled plot combine. Weed infestations were moderate throughout the experimental area.

Visual weed control and crop injury evaluations were assessed on June 23, 1988. All treatments provided excellent control of broadleaf weeds. DPX-R9674 at 0.3 oz ai/A plus Uran 32 at 5 gal/A plus COC was the only treatment to significantly reduce yield. Spring wheat yields were 14 to 30 bu/A higher in herbicide treated plots than in the check. (Agricultural Science Center, New Mexico State University, Farmington, N.M. 87499)

Broadleaf weed control in spring wheat

Treatment[1]	Rate oz ai/A	Crop[2] Injury	Control[2] AMABL	AMARE	KCHSC	SASKR	Yield bu/A
		%	%	%	%	%	
DPX-R9674	0.15	0	100	100	100	100	101.4
DPX-L5300	0.25	0	100	100	100	100	100.8
DPX-L5300 + Uran 32[4]	0.187 + 5[3]	4	100	100	100	100	98.8
DPX-T6376	0.06	0	100	100	100	100	97.5
DPX-R9674	0.45	0	100	100	100	100	96.9
DPX-L5300	0.125	0	100	100	100	100	96.8
DPX-R9674 + Uran 32[4]	0.30 + 5[3]	5	100	100	100	100	96.7
DPX-R9674	0.30	0	100	100	100	100	96.6
DPX-L5300 + Uran 32	0.187 + 5[3]	2	100	100	100	100	94.3
DPX-R9674 + Uran 32	0.30 + 5[3]	10	100	100	100	100	84.6
Handweeded check			100	100	100	100	97.8
check			0	0	0	0	70.5
LSD 0.05			ns	ns	ns	ns	12.6

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1. Surfel a COC was applied at 0.25% v/v
2. Based on a visual scale from 0 to 100 where 0 = no control or crop injury and 100 = dead plants
3. Uran 32, a nitrogen solution was applied at 5 gal/A
4. A COC was not added

Wild oat control in spring wheat with diclofop and HOE 7125 tank mixed with broadleaf herbicides. Dial M.J., C.A. Mallory, J.M. Lish, and D.C. Thill. Diclofop was applied to wild oat (AVEFA) in the 2 to 4 leaves stage in spring wheat (var. 906R) at 0.75 and 1.00 lb ai/a alone and in tank mix combinations with DPXR9674, DPXL5300 and triasulfuron near Bonner's Ferry Idaho. Adjacent to this experiment, HOE7125 was applied at 0.66 and 0.78 lb ai/a alone and in tank mix combination with bromoxynil, DPXM6316, DPXR9674, DPXL5300, and triasulfuron to wild oat in the 4 leaf stage of growth. Two experimental herbicides HOE7113 and HOE7121 were included in this experiment. Herbicide treatments in both experiments were applied with a CO_2 backpack sprayer calibrated to deliver 10 gal/a at 40 psi and 3 mph. Plots were 10 by 30 ft and treatments were arranged in a randomized complete block design replicated four times. Treatments were evaluated visually for wild oat control on August 23. The grain from the HOE7125 experiment was harvested on August 23 with a small plot combine. Application and edaphic data are listed in Table 1.

Table 1. Application data

Wild oat growth stage	2 to 3 leaves	4 leaves
Spring wheat growth stage	2 to 3 tillers	4 tillers
Date of application	May 18, 1988	June 10, 1988
Air temperature (F)	58	52
Soil temperature at 2 in. (F)	54	58
Relative humidity (%)	60	90
Wind (mph) - direction	2-S	2-S
Soil pH	7.5	
OM (%)	6.8	
CEC (meq/100g soil)	21.3	
Texture	silty clay loam	

Wild oat control was not different when diclofop was applied with or with out broadleaf herbicides (Table 2). Wild oat control was not commercially acceptable for any treatment.

Differences among treatments were observed when HOE7125 was applied alone and in tank mix combination (Table 3). When bromoxynil was included in the spray solution, percent control of wild oat was not reduced. However, when DPXR9674, DPXL5300, or triasulfuron were added to HOE7125, percent wild oat control usually was reduced.

HOE7121 did not control wild oat as effectivley as HOE7113. Some crop injury (5 to 10 %) was observed in the plots treated with HOE7113. Differences in grain yield tended to reflect the level of wild oat control (Table 3). (Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Wild oat control with diclofop tank mix combinations in spring wheat at Bonners's Ferry

Treatment	Rate	Control AVEFA
	(lb ai/a)	(% of check)
diclofop	0.75	59
diclofop	1.00	72
diclofop +	0.75	44
DPXR9674 +	0.0234	
R-11[1]	0.13%	
diclofop +	1.00	52
DPXR9674 +	0.0234	
R-11	0.13%	
diclofop +	0.75	41
DPXL5300 +	0.0117	
R-11	0.13%	
diclofop +	1.00	43
DPXL5300 +	0.0117	
R-11	0.13%	
diclofop +	0.75	59
triasulfuron	0.0156	
R-11	0.13%	
diclofop +	1.00	69
triasulfuron	0.0156	
R-11	0.13%	
LSD (0.05)		ns
wild oat density (no./ft^2)		45

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[1] R-11 is a nonionic surfactant, rate is expressed as % v/v.

Table 3. Wild oat control and grain yield in spring wheat at Bonner's Ferry

Treatment	Rate	Control AVEFA	Grain yield
	(lb ai/a)	(% of check)	(bu/a)
check	----	---	21
HOE7125	0.66	92	37
HOE7125	0.78	97	36
HOE7125 +	0.66	91	34
bromoxynil	0.25		
HOE7125 +	0.78	90	35
bromoxynil	0.25		
HOE7125 +	0.66	84	35
DPXM6316 +	0.0156		
R-11[1] +	0.13%		
HOE7125 +	0.78	81	31
DPXM6316 +	0.0156		
R-11	0.13%		
HOE7125 +	0.66	78	33
DPXR9674 +	0.0156		
R-11	0.13%		
HOE7125 +	0.78	81	31
DPXR9674 +	0.0156		
R-11	0.13%		
HOE7125 +	0.66	78	29
DPXL5300 +	0.0117		
R-11	0.13%		
HOE7125 +	0.78	75	29
DPXL5300	0.0117		
R-11	0.13%		
HOE7125 +	0.66	65	26
triasulfuron +	0.0156		
R-11	0.13%		
HOE7125 +	0.78	73	33
triasulfuron +	0.0156		
R-11	0.13%		
HOE7121	0.66	81	33
HOE7113	0.2	93	36
LSD (0.05)		10	7
wild oat density (no/ft^2)		50	

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[1] R-11 is a nonionic surfactant, rate is expressed as % v/v.

Evaluation of postemergence herbicides in chemical fallow. Evans, J.O. and B.M. Jenks. Several postemergence herbicides were tested in fallow for control of volunteer wheat (TRIAE), jointed goatgrass (AEGCY), tumble mustard (SSYAL)), and prickly lettuce (LACSE). Herbicides were applied to stubble with a bicycle sprayer at 16 gpa and 40 psi. The broadleaf weeds were 1-3 inches tall, volunteer wheat was approximately in the 2-3 leaf stage, and jointed goatgrass in the 1-leaf stage. The plots were 12 by 50 ft and arranged in a randomized complete block design with four replications.

Visual evaluations were made on June 10, 1988. All treatments controlled broadleaf weeds. Several treatments provided excellent control of volunteer wheat and jointed goatgrass. Dicamba antagonized dimethazone activity on volunteer wheat and jointed goatgrass noticeably. The dimethazone rates are high and will provide an opportunity to evaluate its residual activity. (Utah Agricultural Experiment Station, Logan, UT 84322-4820)

Table 1. Application data for herbicide treatments in chemical fallow. Lehi, UT 1987-88.

Application date	12/02/87	Soil texture	loam
Air/soil temp. (F)	46/37	Sand/silt/clay (%)	43/44/13
Relative humidity (%)	30	pH	8.0
Wind (mph)	0	OM (%)	1.5
Sky/soil conditions	clear/dry		

Table 2. Evaluation of postemergence herbicides in chemical fallow

Treatment	Rate	TRIAE	AEGCY	SSYAL	LACSE
	(lb ai/A)	-------------	control	-------------	
check	---	0	0	0	0
cyanazine + dicamba	2.0 0.25	10	24	100	100
metribuzin + dicamba	0.75 0.25	96	100	100	100
chlorsulfuron + dicamba	0.0313 0.25	3	25	100	100
pronamide + chlorsulfuron	2.0 0.0313	100	100	100	100
pronamide + metsulfuron	2.0 0.02	100	100	100	100
dimethazone	1.0	97	92	100	100
dimethazone	1.5	100	92	100	100
dimethazone + chlorsulfuron	1.0 0.0313	81	65	100	100
dimethazone + dicamba	1.0 0.25	25	62	100	100
diuron + chlorsulfuron	2.0 0.00313	39	79	100	100
glyphosate + metsulfuron	2.5 0.0063	100	100	100	100

<u>Evaluation of wild oat herbicides in spring wheat</u>. Evans, J.O. and B.M. Jenks. Postemergence wild oat herbicides were applied May 21, 1988 to spring wheat (var. Rick) at Richmond, Utah. Wheat plants were approximately in the 3-leaf stage as were the wild oats (AVEFA). A bicycle sprayer, calibrated to deliver 16 gpa at 40 psi, was used to apply the treatments. The plots were 12 by 30 ft and arranged in a randomized complete block design, replicated four times. Visual evaluations were made July 1 and yield was determined from square yard samples cut August 4. Table 1 contains the application data.

The experiment was established under dryland conditions. The Richmond weather station recorded only 3.45 inches of precipitation from April-August which may have contributed to the reduction in wild oat control. Bromoxynil and DPX-R9674 did not reduce wild oat activity when mixed with wild oat herbicides. Only HOE7113 reduced the wild oat population by 50%. (Table 2) (Utah Agricultural Experiment Station, Logan, UT 84322-4820)

Table 1. Application data for wild oat control in spring wheat

Planting date	4/15/88
Application date	5/21/88
Air temperature (F)	70
Soil temperature (F)	68
Relative humidity (%)	20
Wind (mph)	0
Sky/Soil conditions	clear/dry
Soil texture	silt loam
Sand/silt/clay (%)	11/63/26
pH	7.8
OM (%)	4.9

Table 2. Wild oat control and wheat yield from herbicide treatments in Richmond, Utah. 1988

Treatment	Rate	AVEFA control	Yield
	(lb ai/A)	(% of check)	(bu/A)
check	----	--	13
diclofop +	0.75	10	18
bromoxynil	0.375		
diclofop +	0.75	19	28
crop oil	0.25% v/v		
diclofop	1.0	8	16
diclofop +	1.0	24	22
crop oil	0.25% v/v		
HOE7125	0.66	24	16
HOE7125 +	0.66	36	24
bromoxynil	0.25		
HOE7125 +	0.66	25	25
DPXR9674 +	0.018		
surfactant	0.25% v/v		
HOE7113	0.20	51	29
HOE7121	0.66	24	23
LSD (0.05)		18	9
CV		55	29

Evaluation of metribuzin tank mixes in spring wheat. Kidder, D.W., D.P. Drummond. Metribuzin, alone and in tank mix combination with 2,4-D, bromoxynil and DPX-M6316, was evaluated for control of hairy nightshade (*Solanum sarrachoides* Sendtner, SOLSA) and common lambsquarters (*Chenopodium album* L., CHEAL) at the University of Idaho Research and Extension Center, Kimberly, Idaho. Eleven treatments, including the control, were applied in a randomized complete block design with four replications. Spring wheat (var. Bliss) was seeded on April 22, 1988 at a rate of 100 lb/A on irrigated cropland.

Herbicides were applied on June 10 using a CO_2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa at a pressure of 30 psi. Plots were 10 feet by 30 feet. Spring wheat was 8 to 10 inches tall and had 3 to 4 tillers at the time of application. Treatments were evaluated on July 20 and grain yield was determined on August 17.

Results are shown in Table 2. Wheat treated with metribuzin exhibited 10 to 20% chlorosis for approximately 2 weeks following treatment and then recovered. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in spring wheat

Date of application	6/10/88
Air temperature (F)	75
Soil temperature @ surface (F)	57
Soil temperature @ 3 in (F)	74
Relative humidity (%)	33
Dew present	none
Wind (mph)	8-10
Cloud cover (%)	40
Soil	
organic matter (%)	1.4
pH	7.7
texture	silt loam

Table 2. Metribuzin tank mixes in spring wheat

Treatment[1]	Rate	Control 7/20 CHEAL[2]	Control 7/20 SOLSA	Yield 8/17 Wheat
	(lb a.i./a)	---(%)---		(g/plot)[3]
Untreated		0	0	4483
2,4-D	0.75	100	99	4265
Bromoxynil	0.50	99	99	5233
Metribuzin	0.0938	77	21	4905
Metribuzin	0.1406	92	9	4178
DPX-M6316 + surf.[4]	0.0156 + 0.25% v/v	94	19	4008
DPX-M6316 + surf.	0.0234 + 0.25% v/v	95	11	5025
2,4-D + metribuzin	0.50 + 0.1406	100	86	3953
Bromoxynil + metribuzin	0.375 + 0.1406	100	97	3249
DPX-M6316 + metribuzin + surf.	0.0156 + 0.0938 + 0.25% v/v	100	11	2936
DPX-M6316 + metribuzin + surf.	0.0156 + 0.1406 + 0.25% v/v	100	14	2802
LSD(0.05)		10	11	793

[1] Treatments were applied on June 10, 1988.

[2] CHEAL = common lambsquarters
SOLSA = hairy nightshade

[3] Harvested area measured 4 feet wide and 30 feet long.

[4] Surf = Surfactant (R-11)

Evaluation of Sulfonyl urea tank mixes in spring wheat. Kidder, D.W. and D.P. Drummond. Two Sulfonyl urea compounds, DPX-R9674 and DPX-L5300, alone and in tank mix combination with 2,4-D, bromoxynil and dicamba were evaluated for broadleaf weed control. The experiment was conducted in two locations, near Blackfoot in Bingham county and near Kimberly in Twin Falls county, Idaho. Broadleaf weed species included common lambsquarters (*Chenopodium album* L., CHEAL), kochia (*Kochia scoparia* (L.) Schrad., KCHSC) and hairy nightshade (*Solanum sarrachoides* Sendtner, SOLSA). Twenty two treatments, including the control, were applied in a randomized complete block design with four replications. Spring wheat (var. Wallace) was seeded at Blackfoot on March 28,1988 at the rate of 120 lb/A. Spring wheat (var. Bliss) was planted at Kimberly on April 22,1988 at the rate of 100 lb/A.

Herbicides were applied on June 6 at Blackfoot and on June 9 at Kimberly. Applications were made using a CO_2 pressurized backpack sprayer with 8002 nozzles calibrated to deliver 20 gpa at a pressure of 30 psi. Plots were 10 feet by 30 feet. Spring grain was 8 to 10 inches tall with 3 to 4 tillers at the time of application. Treatments were evaluated on June 10, June 17 and July 13 at Blackfoot, and on June 13, June 18 and July 20 at Kimberly.

Results are shown in Table 2. Bromoxynil and bromoxynil combinations generally induced more rapid weed death than other treatments. Both sulfonyl urea compounds controlled hairy nightshade poorly when applied alone. (Univ. of Idaho Cooperative Extension Service, Twin Falls, ID 83301)

Table 1. Application data for weed control in spring wheat

Application location	Blackfoot	Kimberly
Date of application	6/6/88	6/9/88
Air temperature (F)	79	75
Soil temperature @ surface (F)	75	63
Soil temperature @ 3 in (F)	70	65
Relative humidity (%)	42	39
Dew present	none	none
Wind (mph)	8-9	0-8
Cloud cover (%)	75	10
Soil		
organic matter (%)		1.4
pH		7.7
texture		silt loam

Table 2. Sulfonyl urea tank mixes in spring wheat

		Blackfoot						Kimberly					
		6/10		6/17		7/13		6/13		6/18		7/20	
Treatment[1]	Rate	CHEAL[2]	KOCSO	CHEAL	KOCSO	CHEAL	KOCSO	CHEAL	SOLSA	CHEAL	SOLSA	CHEAL	SOLSA
	(lb a.i./a)	---(% Control)---											
Untreated		0	0	0	0	0	0	0	0	0	0	0	0
2,4-D	0.750	28	18	73	38	100	48	33	49	58	56	100	98
Bromoxynil	0.375	89	81	100	100	99	100	56	80	95	99	99	99
Bromoxynil + MCPA	0.375 + 0.375	69	65	100	100	100	100	75	83	99	99	100	100
DPX-R9674[3]	0.024	14	11	66	71	100	100	12	4	30	7	100	77
DPX-L5300	0.016	10	10	71	75	100	99	7	2	32	6	100	81
DPX-R9674 + 2,4-D	0.024 + 0.063	14	14	72	68	98	88	8	5	38	16	100	80
DPX-R9674 + 2,4-D	0.024 + 0.125	11	13	76	75	100	99	14	21	53	28	100	87
DPX-R9674 + 2,4-D	0.008 + 0.375	15	15	71	76	100	100	26	44	49	43	100	94
DPX-R9674 + bromoxynil	0.024 + 0.063	21	21	95	87	100	100	8	20	38	69	100	96
DPX-R9674 + bromoxynil	0.024 + 0.125	43	38	99	96	100	100	25	58	87	97	99	98
DPX-R9674 + bromoxynil	0.008 + 0.188	51	53	99	100	99	100	38	59	79	94	98	98
DPX-R9674 + bromoxynil	0.016 + 0.188	66	59	97	98	100	100	39	68	88	95	100	97
DPX-R9674 + dicamba	0.024 + 0.063	16	16	65	73	100	100	19	28	38	22	100	90
DPX-L5300 + 2,4-D	0.016 + 0.063	20	20	75	79	100	100	9	6	25	7	80	66
DPX-L5300 + 2,4-D	0.016 + 0.125	19	19	80	82	100	100	22	31	49	30	100	89
DPX-L5300 + 2,4-D	0.008 + 0.375	20	18	75	76	100	99	27	40	63	50	100	97
DPX-L5300 + bromoxynil	0.016 + 0.063	31	31	96	96	100	100	18	38	67	82	100	95
DPX-L5300 + bromoxynil	0.016 + 0.125	64	65	100	100	100	100	24	51	80	90	100	99
DPX-L5300 + bromoxynil	0.016 + 0.188	63	60	100	100	100	100	58	79	78	97	100	97
DPX-L5300 + bromoxynil	0.008 + 0.188	86	80	99	100	100	100	50	74	82	98	100	99
DPX-L5300 + dicamba	0.024 + 0.063	18	15	78	83	100	100	14	23	33	16	100	90
LSD (0.05)		24	22	15	17	2	15	18	21	25	15	11	14

[1] Treatments were applied on June 6 at Blackfoot and June 9 at Kimberly.

[2] CHEAL = common lambsquarters
KOCSO = kochia
SOLSA = hairy nightshade

[3] All DPX treatments included 0.25% v/v surfactant (R-11).

Wild oats control in spring wheat. Miller, S.D., J.M. Krall and R. Hybner. Research plots were established at the Research and Extension Center, Sheridan, WY, to evaluate wild oats control with postemergence herbicides applied at several stages. Plots were established on non-irrigated land 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Spring wheat (var. Olaf) was seeded in a loam soil (49% sand, 27% silt and 24% clay) with 1.6% organic matter and pH 6.3 March 29, 1988. Treatments were applied May 15 (air temp. 60 F, relative humidity 38%, wind SW at 10 mph, sky clear and soil temp. - 0 inch 75 F, 2 inch 52 F and 4 inch 49 F) to 3-leaf wheat and 2 to 2.5-leaf wild oats or May 17, 1988 (air temp. 75 F, relative humidity 24%, wind SE at 6 mph, sky cloudy and soil temp. - 0 inch 87 F, 2 inch 65 F, and 4 inch 63 F) to 5-leaf wheat and 4 to 4.5-leaf wild oats. Visual weed control, crop damage and plant height measurements were made July 13, and plots harvested July 15, 1988. Wild oats (AVEFA) infestations were light but uniform throughout the experimental area.

No treatment reduced crop stand; however, HOE-7113 alone or in combination with DPX-R9674 injured wheat slightly at the 4-leaf stage (less than 10%). Wheat yield in herbicide treated plots was not different from wheat yield in the weedy check. Wild oats control was 90% or greater with all herbicide treatments except difenzoquat. Wild oats control with 0.75 lb/A diclofop was increased 8% by the addition of 1 pt/A oil concentrate. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1554.)

Wild oats control in spring wheat

Treatment[1]	Rate lb ai/A	Spring wheat[2] injury %	 stand red %	 height inches	 yield bu/A	Control[3] AVEFA %
<u>2-leaf</u>						
diclofop	0.75	0	0	20	19	92
diclofop + oc	0.75	0	0	20	19	100
diclofop + thiameturon	1.0 + 0.018	0	0	20	18	92
diclofop + thiameturon + oc	1.0 + 0.018	0	0	21	19	95
diclofop + DPX-R9674 + s	0.75 + 0.018	0	0	20	20	93
diclofop + DPX-R9674 + s	0.75 + 0.0375	0	0	20	19	90
diclofop + bromoxynil + MCPA	0.8 + 0.25 + 0.045	0	0	20	18	95
HOE-7113	0.16	0	0	19	19	98
HOE-7113 + DPX-R9674 + s	0.16 + 0.018	0	0	19	20	100
HOE-7113 + DPX-R9674 + s	0.16 + 0.0375	0	0	20	20	100
imazamethabenz + s	0.38	0	0	20	19	100
<u>4-leaf</u>						
HOE-7125	0.66	0	0	21	19	98
HOE-7125	0.78	0	0	19	18	100
HOE-7125 + DPX-R9674 + s	0.66 + 0.018	0	0	20	19	100
HOE-7125 + DPX-R9674 + s	0.78 + 0.018	0	0	20	18	100
HOE-7125 + DPX-R9674 + s	0.66 + 0.0375	0	0	19	19	100
HOE-7125 + DPX-R9674 + s	0.78 + 0.0375	0	0	19	18	100
HOE-7113	0.16	3	0	19	19	100
HOE-7113 + DPX-R9674 + s	0.16 + 0.018	5	0	19	20	100
HOE-7113 + DPX-R9674 + s	0.16 + 0.0375	7	0	20	19	100
difenzoquat	1.0	0	0	19	20	85
weedy check	---	0	0	21	19	0

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[1] Treatments applied May 5 and 17, 1988; s = X-77 at 0.25% v/v and oc = At Plus 411 F at 1 pt/A

[2] Wheat injury, stand reduction and plant height measurments July 13 and plots harvested July 15, 1988

[3] Weed control visually evaluated July 13, 1988

Wild oats control in spring wheat with imazamethabenz. Miller, S.D., J.M. Krall and R. Hybner. Research plots were established at the Research and Extension Center, Sheridan, WY, to evaluate wild oats control with imazamethabenz alone or in combination with broadleaf herbicides. Plots were established on non-irrigated land 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 six-nozzle knapsack sprayer delivering 10 gpa at 40 psi. Spring wheat (var. Olaf) was seeded in a loam soil (49% sand, 27% silt and 24% clay) with 1.6% organic matter and pH 6.3 March 29, 1988. Treatments were applied May 5, 1988 (air temp. 60 F, relative humidity 42%, wind SW at 10 mph, sky clear and soil temp. - 0 inch 75 F, 2 inch 52 F and 4 inch 49 F) to 3-leaf wheat and 2 to 2.5-leaf wild oats. Visual weed control, crop damage and plant height measurements were made July 13, and plots harvested July 15, 1988. Wild oats (AVEFA) and common sunflower (HELAN) infestations were light but uniform throughout the experimental area.

No treatment reduced crop stand; however, imazamethabenz combinations with 2,4-D or metsulfuron plus 2,4-D caused slight wheat injury (less than 10%). Wheat yield in herbicide treated plots was not different from wheat yield in the weedy check. Wild oats control was excellent with imazamethabenz alone or in combination with broadleaf herbicides. Common sunflower control was excellent with all treatments except imazamethabenz or diclofop alone. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1553.)

Wild oats control in spring wheat with imazamethabenz

Treatment[1]	Rate lb ai/A	Spring wheat[2] injury %	 stand red %	 height inches	 yield bu/A	Weed control[3] AVEFA %	 HELAN %
imazamethabenz + s	0.38	0	0	20	20	100	0
imazamethabenz + s	0.47	0	0	20	19	100	0
imazamethabenz + s	0.38 + 0.25	0	0	20	20	100	100
imazamethabenz + bromoxynil + s	0.38 + 0.38	0	0	21	20	100	100
imazamethabenz + bromoxynil + MCPA + s	0.38 + 0.25 + 0.25	0	0	20	20	100	100
imazamethabenz + bromoxynil + MCPA + s	0.38 + 0.38 + 0.38	0	0	20	20	100	100
imazamethabenz + MCPA + s	0.38 + 0.25	0	0	20	21	100	100
imazamethabenz + MCPA + s	0.38 + 0.38	0	0	21	20	100	100
imazamethabenz + 2,4-D + s	0.38 + 0.5	7	0	20	19	100	100
imazamethabenz + metsulfuron + 2,4-D + s	0.38 + 0.004 + 0.25	3	0	20	19	100	100
imazamethabenz + metsulfuron + 2,4-D + s	0.38 + 0.008 + 0.25	3	0	19	19	100	100
imazamethabenz + CGA-131036 + s	0.38 + 0.009	0	0	19	20	100	100
imazamethabenz + CGA-131036 + s	0.38 + 0.018	0	0	20	19	100	100
imazamethabenz + thiameturon + s	0.38 + 0.009	0	0	20	21	100	100
imazamethabenz + thiameturon + s	0.38 + 0.018	0	0	21	20	100	100
imazamethabenz + DPX-R9674 + s	0.38 + 0.018	0	0	21	20	100	100
imazamethabenz + DPX-R9674 + s	0.38 + 0.0375	0	0	20	20	100	100
imazamethabenz + DPX-L5300 + s	0.38 + 0.009	0	0	21	21	100	100
imazamethabenz + DPX-L5300 + s	0.38 + 0.018	0	0	20	21	100	100
diclofop	0.75	0	0	21	19	88	0
weedy check	----	0	0	21	18	0	0

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[1] Treatments applied May 5, 1988; s = X-77 at 0.25% v/v

[2] Wheat injury, stand reduction and plant height measurements July 13 and plots harvested July 15, 1988

[3] Weed control visually evaluated July 13, 1988

Broadleaf weed control in spring wheat with ethiozin alone and with other herbicides. Tapia, L.S., M.J. Dial, and D.C. Thill. A field experiment was established on May 4, 1988 near Genesee, Idaho. The control of several broadleaf weeds with ethiozin alone and tank mixed with other broadleaf herbicides was evaluated. All treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 3 mph and 40 psi. The study was designed as a randomized complete block with four replications. Plot size was 10 by 30 ft. Application and climatic information are in Table 1. Weed suppression was evaluated on May 16 and July 7. Wheat grain samples were harvested with a small plot combine on August 24.

Table 1. Application and climatic data

Application date	5/4/88
Air temperature at 2 in. (F)	57
Soil temperature (F)	57
Relative humidity (%)	58
Soil pH	5.58
OM	4.23
CEC	22.9
texture	silt loam

Ethiozin tank mixed with other herbicides controlled broadleaf weeds better than ethiozin alone. Weed control was good to excellent with 0.5 and 0.75 lb ai/a ethiozin when tank mixed with other broadleaf herbicides. Control improved through the growing season for all treatments. By the second evaluation date, ethiozin alone at 1.0 lb ai/a controlled all broadleaf weeds (greater than 90%) except mayweed chamomile.

Grain yields generally were higher when ethiozin was tank mixed with other broadleaf herbicides compared to the untreated checks. Grain yield was greater than the check when ethiozin was tank mixed with DPXM6316 (0.75 + 0.0156 lb ai/a) and DPXR9674 (0.5 + 0.0156 lb ai/a) and also when bromoxynil was tank mixed with DPXR9674 (0.25 + 0.0156 lb ai/a). (Idaho Agricultural Experiment Station, Moscow, Idaho 83843).

Table 2. Broadleaf weed control at two observation dates, and grain yield of spring wheat 1988.

		Weed Control								
		May 16				July 7				
Treatment[1]	Rate	ANTCO	THLAR	DESSO	LACSE	ANTCO	THLAR	DESSO	LACSE	Grain Yield
	(lb ai/a)				%					(bu/a)
Check		-	-	-	-	-	-	-	-	63
ethiozin	1.0	63	86	71	75	83	99	91	98	67
ethiozin	0.75	58	84	60	91	73	100	76	96	68
ethiozin	0.5	58	74	60	78	91	98	70	91	71
ethiozin + bromoxynil	0.75 + 0.25	76	90	83	93	100	98	81	94	63
ethiozin + DPXM6316	0.75 + 0.0156	70	89	88	88	98	100	96	96	76
ethiozin + DPXR9674	0.75 + 0.0156	65	90	91	86	100	100	96	100	71
ethiozin + DPXG8311	0.75 + 0.0156	83	80	85	88	75	100	98	99	72
ethiozin + bromoxynil	0.5 + 0.25	73	86	85	91	78	99	93	99	68
ethiozin + DPXM6316	0.5 + 0.0156	61	83	90	79	100	100	100	100	71
ethiozin + DPXR9674	0.5 + 0.0156	55	85	86	81	100	100	85	100	76
ethiozin + DPXG8311	0.5 + 0.0156	76	86	83	78	99	100	90	100	69
bromoxynil + DPXR9674	0.25 + 0.0156	79	91	88	90	99	100	98	100	75
LSD (0.05)		25	9	19	10	25	NS	22	NS	11
Weed density (plants/ft^2)		4	2	7	7	4	2	7	7	

[1] The nonionic surfactant, R11, at 0.25 % v/v was applied to all DPX treatments.

Control of broadleaf weeds in winter wheat with dicamba - sulfonyl-urea combinations Belles, W.S. Combinations of dicamba with six sulfonyl-urea herbicides were evaluated for broadleaf weed control and wheat yield in a study conducted near Colfax, Washington. Treatments were applied with a CO2 backpack sprayer delivering 20 gpa at 40 psi through 8002 flat fan nozzles. Applications were made April 14, 1988 when wheat had four leaves, catchweed bedstraw, the dominant specie, had two to three whorls, flixweed had six to eight leaves and prickly lettuce had two leaves. The experiment was conducted using a randomized complete block design with four replications. Evaluations were made June 13 when weeds were in bud to bloom growth stages.

Addition of 0.094 lb ai/a of dicamba to the tank-mix with the low rate of the sulfonyl-urea afforded control of catchweed bedstraw that was equal to or greater than that with the corresponding sulfonyl-urea alone. Control of flixweed and prickly lettuce was 95 to 100% with all treatments except dicamba alone. There was no visual crop injury with any treatment. (Sandoz Crop Protection, 1240 Joyce Road, Moscow, ID 83843).

Broadleaf weed control and winter wheat yields

Herbicide*	Rate	GALAP	DESSO	LACSE	Wheat Injury
	(lb ai/a)		(%)		
Control	0	0	0	0	0
2,4-D amine	0.38	3	100	100	0
dicamba	0.094	61	74	73	0
chlorsulfuron	0.0078	89	100	100	0
chlorsulfuron	0.0156	88	100	100	0
chlorsulfuron + dicamba	0.0078 + 0.094	89	100	100	0
DPX R9674	0.0156	61	100	100	0
DPX R9674	0.024	74	100	100	0
DPX R9674 + dicamba	0.0156 + 0.094	85	100	100	0
DPX L5300	0.0156	48	100	100	0
DPX L5300	0.024	75	100	100	0
DPX L5300 + dicamba	0.0156 + 0.094	78	100	100	0
DPX G8311	0.0156	79	100	100	0
DPX G8311	0.024	86	100	100	0
DPX G8311 + dicamba	0.0156 + 0.094	91	100	100	0
thiameturon	0.0156	56	100	100	0
thiameturon	0.024	64	100	96	0
thiameturon + dicamba	0.0156 + 0.094	86	98	100	0
trisulfuron	0.0089	59	100	100	0
trisulfuron	0.0178	85	100	100	0
trisulfuron dicamba	0.0089 + 0.094	78	95	100	0

*Surfactant X-77 added at 0.25% v/v to all herbicide treatments except dicamba and 2,4-D amine applied alone.

Catchweed bedstraw control in winter wheat. Brewster, B.D., R.L. Spinney, and A.P. Appleby. Fourteen herbicide treatments were evaluated for crop safety and catchweed bedstraw control in winter wheat in Linn County, Oregon. The trial design was a randomized complete block with four replications and 2.5 m by 7.5 m plots. The soil was a Chehalis silty clay loam with 2.1% organic matter and a pH of 4.8.

Carrier volume was 234 L/ha delivered at 138 kPa through 8002 flat fan nozzle tips set in a double-overlap spray pattern. The treatments were applied on February 18, 1988 and were evaluated on April 14.

LX 101-01 was the most effective single herbicide on bedstraw, but several herbicide combinations provided nearly total control. Most treatments produced substantial increases in grain yield. (Crop Science Department, Oregon State University, Corvallis, Oregon 97331)

Catchweed bedstraw control and wheat injury
and grain yield following herbicide applications

Herbicide[1]	Rate	Wheat injury	Wheat grain yield	Bedstraw control
	(kg a.i./ha)	(%)	(kg/ha)	(%)
DPX R9674	0.026	0	5630	8
chlorsulfuron + metsulfuron	0.022 + 0.004	0	6050	79
CGA-131-36	0.026	0	5780	65
LX 101-01	1.1	0	6320	88
dicamba + DPX R9674	0.07 + 0.026	0	6250	83
dicamba + chlorsulfuron + metsulfuron	0.07 + 0.022 + 0.004	3	6180	81
dicamba + CGA-131036	0.07 + 0.026	0	5850	90
dicamba + LX 101-01	0.07 + 1.1	0	5980	99
bromoxynil + DPX R9674	0.42 + 0.026	3	6180	78
bromoxynil + chlorsulfuron + metsulfuron	0.42 + 0.022 + 0.004	5	6590	99
bromoxynil + CGA-131-36	0.42 + 0.026	0	6050	98
bromoxynil + LX 101-01	0.42 + 1.1	0	6380	98
DPX R9674 + LX 101-01	0.026 + 1.1	0	6250	91
SMY 1500 + LX 101-01	1.1 + 1.1	0	6380	98
Check	0	0	5310	0
		$LSD_{.05}$=	450	

[1] Surfactant X-77 added to all sulfonylurea treatments at 0.25% v/v.

Wild oat control in winter wheat. Brewster, B.D., R.L. Spinney, and A.P. Appleby. Six herbicide treatments were applied on two dates to investigate the control of wild oats in fall-sown wheat. The trial site was in Polk County, Oregon on an Amity silty clay loam. The herbicides were applied on January 19 and February 19, 1988. The trial was a randomized complete block design with four replications and 2.5 m by 7.5 m plots.

Carrier volume was 234 L/ha delivered at 138 kPa through 8002 flat fan nozzle tips set in a double-overlap spray pattern. On January 19 the wheat had one tiller and the wild oats had one to four leaves, while on February 19 the wheat had three tillers and the wild oats had four leaves to two tillers.

Visual evaluations of crop injury and wild oat control were conducted on June 1, 1988. There was a trend toward better wild oat control with the later application--probably because more oats had emerged.

The early application of HOE 7125-01H injured the wheat, but all other treatments resulted in significant increases in wheat grain yield. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Wild oat control and wheat injury and grain yield following six herbicide treatments at two timings in western Oregon

Herbicide	Rate	Wheat injury	Wheat grain yield	Wild oat control
	(kg a.i./ha)	(%)	(kg/ha)	(%)
January 19, 1988				
FOE 3440A	0.14	0	8200	88
diclofop-methyl	1.1	0	8130	99
difenzoquat	1.1	4	7800	74
AC 222,293	0.52	0	8270	96
HOE 7125-OH	0.18	30	6050	89
HOE 7113-OH	0.18	0	8400	85
February 19, 1988				
FOE 3440A	0.14	0	8060	83
diclofop-methyl	1.1	0	8400	97
difenzoquat	1.1	11	8130	89
AC 222,293	0.52	0	8330	100
HOE 7125-OH	0.18	0	8060	98
HOE 7113-OH	0.18	0	8470	96
Check	0	0	5310	0
		LSD.05 =	880	

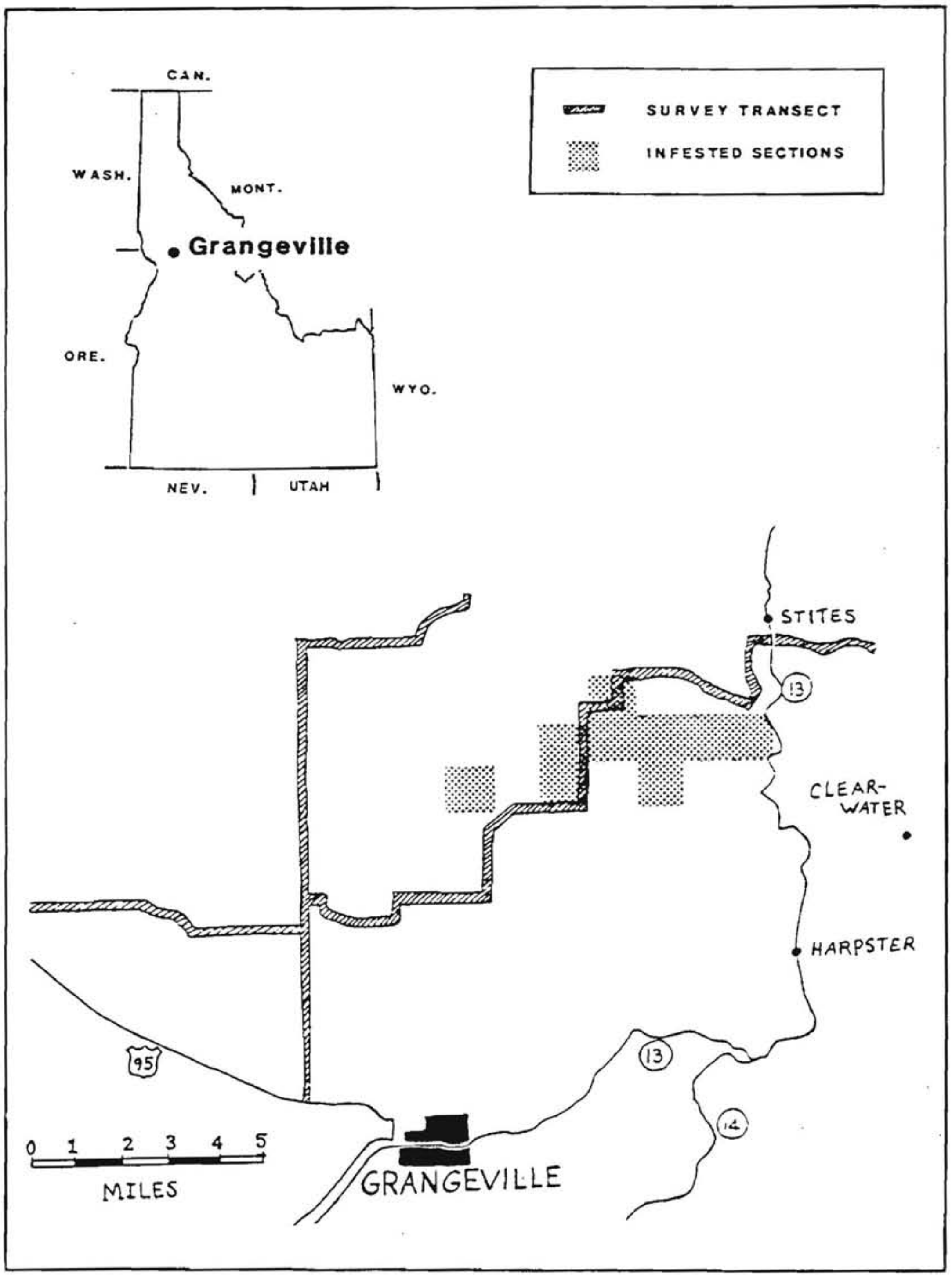
Milium vernale survey in Idaho County, Idaho.

Callihan, R.H. and D.S. Pavek. A survey for new infestations of *Milium vernale* M. Bieb. (spring milletgrass) was conducted 19-20 and 25-27 May 1988 by University of Idaho personnel in cooperation with Idaho County. This survey was a follow-up a preliminary survey subsequent to the first (1987) reported North American occurrence of *M. vernale* near Grangeville, ID (Figure 1). No other reports of this species in North America have come to our attention. As an aggressive competitor in small grain crops in the Mediterranean area, *M. vernale* has the potential to become a significant weed problem in North America.

All sites where *M. vernale* had been found in 1987 were reexamined. Areas adjacent to these sites were also surveyed. The roadside edges of winter wheat (*Triticum aestivum* L.), winter peas (*Pisum sativum* L.), and fall fallow fields along an 80-mile transect were examined to find the leading edge of the infestation (Figure 1).

The 1988 survey revealed a larger infestation in Idaho County than did the 1987 survey: a total of nine quarter-sections (1440 a) are now known to be infested to some degree (Figure 1). The actual ground covered by *M. vernale* was not determined. *Milium vernale* was not found in fields that had been infested in 1987 and were planted with spring crops in 1988. However, it was found in some areas adjacent to the previously infested fields. No additional *M. vernale* populations were observed along the 80-mile transect. Lack of new *M. vernale* along the transect demonstrates that the infestation is not ubiquitous in this area of Idaho County. Since this survey only represents a sample in the vicinity of the original 1987 discovery it is likely that a thorough examination would reveal more *M. vernale* in this part of Idaho County. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Figure 1. Location of areas infested by and survey transect for *Milium vernale*.



<u>Effect of imazamethabenz rate, spray volume, and spray additive on wild oat control in winter wheat</u>. Dial, M.J. and D.C. Thill. A three (herbicide rate) by three (spray additive) by two (spray volume) randomized complete block factorial design was used to evaluate the effect of herbicide rate, spray volume, and spray additive on wild oat (AVEFA) control in winter wheat. Imazamethabenz was applied at 0.235, 0.352, and 0.470 lb ai/a without spray additive, or with 0.5 % v/v nonionic surfactant (R-11), or 2.00 % v/v vegetable oil base crop oil concentrate (Land-O-Lakes) at 10 and 20 gal/a. The experiment was conducted at two locations on conventionally seeded winter wheat near Culdesac, Idaho and Palouse, Washington. The winter wheat variety at each location was Stephens. All treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 or 20 gal/a at 40 or 43 psi, respectively, and 3 mph. Plots were 10 by 30 ft and the treatments were replicated four times. Treatments were visually evaluated at Culdesac on July 10, and August 1, and at Palouse on June 16 and July 27. Application data are listed in Table 1.

Table 1. Application data

Location	Culdesac	Palouse
Application date	April 27, 1988	April 27, 1988
Crop growth stage	2 to 3 tillers	2 to 3 tillers
Wild oat growth stage	2 to 3 leaves	2 to 3 leaves
Wild oat density (no./ft^2)	20	80
Air temperature (F)	72	60
Soil temperature at 2 in. (F)	62	62
Relative humidity (%)	41	75
Wind (mph)-direction	4-E	4-E
Soil pH	5.7	5.5
OM (%)	5.4	4.2
CEC (meq/100 g soil)	25.9	20.1
Texture	clay loam	silt loam

At Culdesac, the main effects herbicide rate, spray additive, and spray volume were significant for wild oat control (Table 2). The main effect, spray volume, was not significant for grain yield. Wild oat control increased with increasing herbicide rate. Grain yield was highest when imazamethabenz was applied at the highest rate. Grain yield was always greater in herbicide treated plots than in the check. Both spray additives improved wild oat control equally. Wild oat control was better when spray volume was 10 gal/a.

At Palouse, only herbicide rate and spray additive were significant (Table 3). The trends were similar to those observed at Culdesac. (Agricultural Experiment Station, Moscow, Idaho 83843).

Table 2. Effect of herbicide rate, spray additive, and spray volume, on wild oat control and grain yield at Culdesac

Imazamethabenz rate		Control AVEFA		Grain yield
(lb ai/a)		(----% of check----)		(bu/a)
		July 10	August 01	
check		---	---	53
0.235		66	70	77
0.353		78	80	79
0.470		79	81	85
LSD (0.05)		7	8	6
Spray additive[1]	Rate			
no additive	---	65	69	76
nonionic surfactant	0.5 %	78	79	81
crop oil concentrate	2.0 %	82	83	84
LSD (0.05)		8	8	6
Spray Volume				
(gal/a)				
10		79	81	83
20		70	73	77
LSD (0.05)		6	6	ns

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[1] Nonionic surfactant used was R-11. Vegetable oil based crop oil concentrate was Land-O-Lakes.

Table 3. Effect of herbicide rate, spray additive, and spray volume on wild oat control and grain yield at Palouse

Imazamethabanz rate		Control AVEFA		Grain yield
(lb ai/a)		(-----% of check-----)		(bu/a)
		June 16	July 07	
check		---	---	23
0.235		73	68	26
0.353		80	72	26
0.470		80	79	29
LSD (0.05)		6	6	ns
Spray additive[1]	Rate			
no additive	---	67	59	23
nonionic surfactant	0.5	79	80	29
crop oil concentrate	2.0	87	82	29
LSD (0.05)		6	6	5
Spray volume				
(gal/a)				
10		76	72	26
20		79	74	27
LSD (0.05)		ns	ns	ns

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[1] Nonionic surfactant used was R-11. Vegetable oil based crop oil concentrate was Land-O-Lakes.

Winter wheat yield following chemical fallow treatments with clomazone. Dial, M.J. and D.C. Thill. Chemical fallow herbicide treatments were applied in the fall of 1986 and spring of 1987 for weed control on no-till fallow ground near Lewiston, Idaho. Winter wheat (var. Hawk) was seeded in October 1987 with a Yielder no-till drill. Herbicide application data and weed control efficacy are reported in the 1988 WSWS Research Progress Report pp. 251-252 and the 1987 Idaho Weed Control Report pp. 58-59. In the early spring, slight crop chlorosis was observed in all clomazone treatments greater than 0.75 lb ai/a (data not shown). Grain yield was determined on August 8 by harvesting a sample from each plot with a small plot combine. No differences were observed between treatments or the check for grain yield (Table 1).

Table 1. Grain yield in no-till winter wheat following chemical fallow treatments with clomazone

Treatment	Rate	Date of application	Grain yield
	(lb ai/a)		(bu/a)
clomazone	0.25	10/86	37
clomazone	0.5	10/86	37
clomazone	0.75	10/86	39
clomazone	1.00	10/86	39
clomazone	2.00	10/86	40
clomazone	0.25	12/86	33
clomazone	0.5	12/86	32
clomazone	1.00	12/86	38
glyphosate/2,4-D + pronamide	0.78 0.25	10/86	42
glyphosate/2,4-D	0.78	3/87	40
clomazone + chlorsulfuron	0.25 0.0078	10/86	38
clomazone + chlorsulfuron	0.5 0.0078	10/86	32
clomazone + chlorsulfuron	0.25 0.0156	10/86	37
clomazone + chlorsulfuron	0.5 0.0156	10/86	35
glyphosate/2,4-D + chlorsulfuron + R-11[1]	0.78 0.0156 0.25%	3/87	34
check	----	----	38
LSD (0.05)			ns

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[1] R-11 is a nonionic surfactant, the rate is expressed as %v/v.

Postplant preemergence weed control, in winter wheat. Dial, M.J. and D.C. Thill. PPG-2365, PPG-2473, chlorsulfuron, and DPXG8311 were applied postplant preemergence to winter wheat (var. Stephens) near Potlatch, Idaho. The winter wheat crop did not emerge until early-March because of drought conditions during the fall. The treatment applications were delayed until February 2, when soil moisture was sufficient to ensure germination and emergence of the winter wheat crop. Treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 20 gal/a at 42 psi and 3 mph. The plots were 10 by 25 ft, and the treatments were arranged in a randomized complete block design replicated three times. Application data are listed in Table 1.

Table 1. Application data

Air temperature (F)	39
Soil temperature at 2 in. (F)	45
Relative humidity (%)	51
Wind (mph)- direction	5-S
Soil pH	5.3
OM (%)	4.4
CEC (meq/100g soil)	21.0
Texture	silt loam

Treatments were evaluated for percent control of coast fiddleneck (AMSIN), mayweed chamomile (ANTCO), and interrupted windgrass (APEIN) on June 16. PPG-2365 did not control coast fiddleneck or mayweed chamomile at either of the three treatment rates (Table 2). As the application rate increased, percent control improved slightly. PPG-2473 controlled broadleaf weeds effectively at all application rates.

Both chlorsulfuron and DPXG8311 controlled coast fiddleneck and mayweed chamomile. All herbicide treatments controlled interrupted windgrass 95 % or greater (Table 2). Crop injury was not observed throughout the coarse of the experiment (data not shown). The plots were not harvested for grain yield. (Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Postplant preemergence control of coast fiddleneck, mayweed chamomile and interrupted windgrass in winter wheat

Treatment	Rate	Control AMSIN	 ANTCO	 APEIN
	(lb ai/a)	(-----%	of check	-----)
PPG-2365	0.05	30	33	95
PPG-2365	0.10	38	58	98
PPG-2365	0.20	66	60	99
PPG-2473	0.025	100	100	100
PPG-2473	0.05	100	100	100
PPG-2473	0.10	100	98	100
chlorsulfuron	0.0156	100	95	100
DPXG8311	0.0188	100	100	100
LSD (0.05)		18	29	ns
weed density (no./ft^2)		12	10	30

Winter annual grass control in winter wheat. Dial, M.J. and D.C. Thill. Two experiments were established to evaluate herbicide control of interrupted windgrass (APEIN), ventenata (VENDO), and field brome (BROAV) near Plummer and Potlatch, Idaho in conventionally seeded winter wheat (var. Stephens and Hill-81, respectively). At the Plummer site, imazamethabenz, ethiozin, cinmethylin, diclofop, terbutryn, PP604, and metribuzin were applied alone and in combination with DPXM6316, DPXR9674, and bromoxynil to determine percent control of mayweed chamomile (ANTCO), interrupted windgrass, and ventenata. Herbicides tested at Potlatch were ethiozin, cyanazine, metribuzin, terbutryn, diuron, and DPXM6316 for percent field brome control. Herbicide treatments at both locations were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 42 psi and 3 mph. Plots were 10 by 30 ft, and the treatments were arranged in a randomized complete block design replicated four times. Application data are listed in Table 1.

Table 1. Application data

Location	Plummer		Potlatch	
Date of treatment	April 16[1]	May 04[2]	April 14[1]	May 03[2]
Air temperature (F)	75	59	70	57
Soil temperature (F)[3]	68	58	59	51
Relative humidity (%)	68	58	59	66
Wind (mph)-direction	3-W	2-E	2-E	2-E
Soil pH		5.3	5.7	
OM (%)		2.5	3.0	
CEC (meq/100g soil)		11.1	18.6	
Texture		silt loam	silt loam	

[1] 1 to 3 leaf stage of wheat.
[2] 2 in. adventious (adv) roots on wheat.
[3] Soil temperature is determined at 2 in. beneath soil surface.

DPXM6316, ethiozin, metribuzin, bromoxynil, and terbutryn treatments controlled mayweed chamomile 90 % or greater when applied alone or in tank mix combinations (Table 2). All treatments except diclofop and diclofop + DPXM6316 controlled interrupted windgrass 90 % or greater. All herbicides, except DPXM6316 alone controlled ventenata equally. Grain yield was not determined.

Only terbutryn + metribuzin, controlled field brome effectively at Potlatch (Table 3). Harvest residue from the previous winter barley crop may have intercepted the spray solution and reduced the activity of the herbicide. Grain yield was not determined. (Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Mayweed chamomile, interrupted windgrass, and ventenata control in winter wheat

			Control		
Treatment	Rate	Time of application	ANTCO	APEIN	VENDO
	(lb ai/a)		(-----	% of check	-----)
imazamethabenz +	0.47	1-3 lf	15	99	88
R-11[1]	0.25%				
imazamethabenz +	0.47	1-3 lf	99	99	99
DPXR9674 +	0.0156				
R-11	0.25%				
imazamethabenz +	0.47	1-3 lf	95	99	90
DPXM6316 +	0.0156				
R-11	0.25%				
DPXM6316 +	0.0313	1-3 lf	97	97	67
R-11	0.25%				
ethiozin	0.75	1-3 lf	98	99	97
ethiozin	1.00	1-3 lf	98	99	97
ethiozin +	0.75	1-3 lf	99	99	96
DPXM6316 +	0.0156				
R-11	0.25%				
cinmethylin	0.5	1-3 lf	79	95	89
diclofop	1.00	1-3 lf	38	0	87
diclofop +	1.00	1-3 lf	98	80	86
DPXM6316	0.0156				
ethiozin +	1.00	1-3 lf	98	100	100
metribuzin	0.125				
PP604 +	0.25	1-3 lf	46	90	98
coc[2]	2.00%				
PP604 +	0.375	1-3 lf	13	98	98
coc	2.00%				
PP604 +	0.5	1-3 lf	10	99	99
coc	2.00%				
PP604 +	0.375	1-3 lf	95	95	96
DPXM6316 +	0.0156				
coc	2.00%				
metribuzin	0.38	2 in.adv	99	99	99
metribuzin +	0.38	2 in.adv	99	99	96
bromoxynil	0.38				
terbutryn +	0.25	2 in.adv	99	99	99
metribuzin	0.6				
LSD (0.05)			15	5	17
weed density (no./ft^2)			10	20	9

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[1] R-11 is a nonionic surfactant, the rate is expressed as % v/v.

[2] Moract is a petroleum base crop oil concentrate, the rate is expressed as %v/v.

Table 3. Annual brome control in winter wheat

Treatment	Rate	Time of application	Control BROAV
	(lb ai/a)		(% of check)
ethiozin +	0.75	1-3 lf	43
R-11[1]	0.25%		
ethiozin +	1.00	1-3 lf	20
R-11	0.25%		
ethiozin +	1.50	1-3 lf	64
R-11	0.25%		
DPXM6316 +	0.0234	1-3 lf	35
R-11	0.25%		
ethiozin +	0.75	1-3 lf	74
DPXM6316 +	0.0234		
R-11	0.25%		
ethiozin +	1.00	1-3 lf	56
DPXM6316 +	0.0234		
R-11	0.25%		
cyanazine	0.4	1-3 lf	0
cyanazine	0.8	1-3 lf	28
cyanazine +	0.4	1-3 lf	20
metribuzin	0.0625		
cyanazine +	0.4	1-3 lf	16
metribuzin	0.0938		
cyanizine +	0.8	1-3 lf	31
metribuzin	0.1875		
cyanizine +	0.4	1-3 lf	25
R-11	0.25%		
cyanazine +	0.4	1-3 lf	15
dicamba	0.125		
cyanazine +	0.4	1-3 lf	14
metribuzin +	0.0938		
dicamba	0.125		
duiron +	0.6	1-3 lf	15
MCPA amine	0.36		
terbutryn +	0.6	2 in. adv	89
metribuzin	0.25		
LSD (0.05)			41
weed density (no./ft^2)			40

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[1] R-11 is a nonionic surfactant, the rate is expressed as % v/v.

<u>Mayweed chamomile control in winter wheat</u>. Evans, R.M. and D.C. Thill. Two studies were established to evaluate mayweed chamomile (ANTCO) control in winter wheat (var. Stevens). The objective of the first study was to compare bromoxynil and three sulfonylurea herbicides (triasulfuron, DPXM6316, and DPXR9674), alone and in tank mixes, to determine if low rate tank mixes would effectively control mayeed chamomile. The second study was initiated to determine the effects of tank mixing dicamba with DPXM6316, DPXR9674, and clopyralid/2,4-D. The herbicides were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 42 psi and 3 mph. The studies were randomized complete block designs with four replications. The plots were 10 by 30 ft. Mayweed chamomile control was evaluated visually May 16, June 20, and July 8. The grain was harvested August 25 with a Hege plot combine. Application data are listed in Table 1.

Table 1. Application data

Location	Near Moscow, ID
Date of application	April 26, 1988
Wheat growth stage	2 tiller
ANTCO growth stage	3 in. rosette
ANTCO density	6 to 8 per ft^2
Air temperature (F)	40
Soil temperature (F) 2 in.	47
Relative humidity (%)	71
Wind (mph) direction	0
Soil type	Silt loam

In the first study, mayweed chamomile control was 88 to 100% on the last evaluation date for all treatments, except triasulfuron (Table 2). Triasulfuron and bromoxynil (0.1875 lb ai/a) controlled only 43 to 59% of the mayeed chamomile on the first two evaluation dates. Wheat grain yield was not affected.

In the second study, DPXM6316 and DPXR9674 controlled mayweed chamomile 79 to 100% (Table 3). Mayweed chamomile control with clopyralid/2,4-D improved over the growing season and was 96% on the last evaluation date. Dicamba alone did not control mayweed chamomile effectively. The addition of dicamba to DPXR9674, DPXM6316 or clopyralid/2,4-D did not affect control of mayweed chamomile. Grain yield from all treated wheat was higher than the untreated check.

The first replication of both studies was infested with interrupted windgrass (APEIN). All herbicide treatments containing DPXM6316, DPXR9674, or triasulfuron controlled interrupted windgrass 85 to 95%. Herbicides were applied preemergence to interrupted windgrass. (Idaho Agricultural Experimental Station, Moscow, ID 83843)

Table 2. Mayweed chamomile control and wheat grain yield of study #1

		ANTCO control			Grain yield
Treatment	Rate	May 16	June 20	July 8	
	(lb ai/a)	-----(% of check)-----			(bu/a)
bromoxynil	0.1875	59	53	88	89
bromoxynil	0.375	86	85	96	92
bromoxynil/MCPA	0.375	65	75	98	89
triasulfuron[1]	0.0156	43	46	78	90
DPXM6316[1]	0.0313	79	96	99	92
DPXR9674[1]	0.0234	90	98	100	93
bromoxynil + triasulfuron[1]	0.1875 + 0.0078	88	88	98	97
bromoxynil + DPXM6316[1]	0.1875 + 0.0078	93	91	100	93
bromoxynil + DPXR9674[1]	0.1875 + 0.0078	95	96	99	93
bromoxynil + triasulfuron[1]	0.1875 + 0.0156	93	94	99	97
bromoxynil + DPXM6316[1]	0.1875 + 0.0156	98	100	100	96
bromoxynil + DPXR9674[1]	0.1875 + 0.0156	98	98	100	92
check	- - -	-	-	-	88
	LSD (0.05)	20	9	6	ns

[1] R11 nonionic surfactant included at 0.13% v/v.

Table 3. Mayweed chamomile control and wheat grain yield of study #2

		ANTCO control			Grain yield
Treatment	Rate	May 16	June 20	July 8	
	(lb ai/a)	-----(% of check)-----			(bu/a)
dicamba	0.125	20	30	73	93
DPXR9674[1]	0.0156	90	95	100	102
dicamba + DPXR9674[1]	0.125 + 0.0156	88	94	99	102
DPXM6316[1]	0.0156	79	90	95	98
dicamba + DPXM6316[1]	0.125 + 0.0156	81	89	99	95
clopyralid/2,4-D	0.4	60	75	96	91
dicamba + clopyralid/2,4-D	0.125 + 0.4	48	70	96	94
check	- - -	-	-	-	79
	LSD (0.05)	14	9	7	10

[1] R11 nonionic surfactant included at 0.13% v/v.

Winter wheat cultivar response to chlorsulfuron and DPX-G8311. Krall, J.M. and S.D. Miller. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate winter wheat cultivar response to spring applications of chlorsulfuron and DPX-G8311. Winter wheat cultivars were seeded in a sandy loam soil (70% sand, 17% silt and 13% clay) with 1.3% organic matter and pH 7.7 October 12, 1987. Herbicide treatments were applied broadcast with a tractor mounted sprayer delivering 20 gpa at 30 psi April 15, 1988 (air temp. 45 F, relative humidity 40%, sky clear and wind W at 2 mph) to 4 to 5-tiller winter wheat. Plots were 8 by 20 ft. with four replications arranged in a split block. Winter wheat stand was visually evaluated May 11, plant height measured June 20, heading date evaluated daily after the appearance of the first head and plots harvested July 22, 1988.

No treatment reduced winter wheat stand compared to the untreated check when averaged over cultivars (table 1). Average wheat yields were 6 bu/A higher in chlorsulfuron treated plots and 2 bu/A lower in DPX-G8311 treated plots than in the untreated check (table 1). Yield of Vona, Buckskin and Archer were 33, 17 and 16% lower; respectively, in DPX-G8311 treated plots than in the untreated check. Herbicide treatments had little effect on plant height or heading date (table 2). (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1542.)

Table 1. Winter wheat stand and yield with spring applications of chlorsulfuron and DPX-G8311

Cultivar		Treatment[1]		
	chlorsulfuron 0.031	DPX-G8311 0.031	untreated check	Mean
	% stand[2]			
Quantum 524	59	58	56	58
Hawk	64	54	58	59
Buckskin	51	49	50	50
Archer	40	40	43	41
Cheyenne	40	45	40	42
Tam 108	61	50	54	55
Vona	39	39	38	39
Centurk 78	16	14	12	14
Agate	46	44	36	42
Thunderbird	61	59	54	58
mean	48	45	44	
	yield bu/A[2]			
Quantum 524	47	43	43	44
Hawk	48	40	43	44
Buckskin	41	30	36	36
Archer	36	27	32	32
Cheyenne	30	30	27	29
Tam 108	54	44	46	48
Vona	35	20	30	28
Centurk 78	14	5	2	7
Agate	32	31	29	31
Thunderbird	49	43	41	44
mean	39	31	33	

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[1] Treatments applied April 15, 1988 and included X-77 at 0.25% v/v

[2] Winter wheat stand evaluated May 11 and plots harvested July 22, 1988

Table 2. Winter wheat height and heading date with spring applications of chlorsulfuron and DPX-G8311

	Treatment[1]			
Cultivar	chlorsulfuron 0.031	DPX-G8311 0.031	untreated check	Mean
	- - - - - - - - - - - - height inches[2] - - - - - - - - - - - -			
Quantum 524	32	31	31	31
Hawk	28	27	29	28
Buckskin	31	29	33	31
Archer	26	24	26	25
Cheyenne	35	31	34	33
Tam 108	30	25	28	28
Vona	29	25	29	28
Centurk 78	25	24	26	25
Agate	32	28	31	30
Thunderbird	28	28	28	28
mean	30	27	30	
	- - - - - - heading date days after January 1[2] - - - - - -			
Quantum 524	156	155	156	156
Hawk	156	154	154	155
Buckskin	155	155	155	155
Archer	156	156	156	156
Cheyenne	158	158	157	158
Tam 108	154	155	154	154
Vona	154	154	154	154
Centurk 78	156	157	157	157
Agate	156	156	157	156
Thunderbird	154	154	154	154
mean	156	155	155	

[1] Treatments applied April 15, 1988 and included X-77 at 0.25% v/v

[2] Height measurements made June 20, 1988 and heading date evaluated daily after the appearance of the first head

Winter wheat cultivar response to SMY-1500 and metribuzin. Krall, J.M. and S.D. Miller. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate winter wheat cultivar response to fall SMY-1500 and/or metribuzin applications. Winter wheat cultivars were seeded in a sandy loam soil (70% sand, 17% silt and 13% clay) with 1.3% organic matter and pH 7.7 October 12, 1987. Herbicide treatments were applied broadcast with a tractor mounted sprayer delivering 20 gpa at 30 psi November 12, 1987 (air temp. 60 F, relative humidity 35%, sky clear and wind calm) to 1.5 to 2-leaf winter wheat. All plots were sprayed with bromoxynil for broadleaf weed control. Plots were 8 by 20 ft. with four replications arranged in a split block. Winter wheat stand was visually evaluated May 11, plant height measured June 20, heading date evaluated daily after the appearance of the first head and plots harvested July 22, 1988.

Winter wheat stands were 5 to 14% and yields 30 to 49% lower in herbicide treated plots than in the untreated check when averaged over cultivars (table 1). Vona was more susceptible to SMY-1500 and/or metribuzin than the other cultivars tested. Herbicide treatments reduced plant height and delayed heading date slightly compared to the untreated check (table 2). (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1541.)

Table 1. Winter wheat stand and yield with fall applications of SMY-1500 and metribuzin

Cultivar	Treatment[1] SMY-1500 + metribuzin 1.0 + 0.125	 SMY-1500 1.5	 metribuzin 0.25	 untreated check	Mean
	% stand[2]				
Quantum 524	65	58	49	56	57
Hawk	61	54	48	58	55
Buckskin	48	48	33	50	45
Archer	34	34	20	43	33
Cheyenne	34	40	28	40	36
Tam 108	45	53	38	54	48
Vona	4	3	7	38	13
Centurk 78	6	12	7	12	9
Agate	33	36	29	36	34
Thunderbird	43	48	41	54	47
mean	37	39	30	44	
	yield bu/A[2]				
Quantum 524	30	38	39	43	38
Hawk	34	32	29	43	35
Buckskin	27	25	23	36	28
Archer	18	18	8	32	19
Cheyenne	16	20	14	27	19
Tam 108	27	40	21	46	34
Vona	0	0	0	30	8
Centurk 78	0	0	0	2	0.5
Agate	14	19	13	29	19
Thunderbird	21	34	24	41	30
mean	19	23	17	33	

[1] Treatments applied November 12, 1987

[2] Winter wheat stand evaluated May 11 and plots harvested July 22, 1988

Table 2. Winter wheat height and heading date with fall applications of SMY-1500 and metribuzin

Cultivar	Treatment[1] SMY-1500 + metribuzin 1.0 + 0.125	 SMY-1500 1.5	 metribuzin 0.25	 untreated check	Mean
	---------- height inches[2] ----------				
Quantum 524	32	31	28	31	31
Hawk	28	27	26	29	28
Buckskin	31	30	30	33	31
Archer	25	24	23	26	25
Cheyenne	33	32	31	34	33
Tam 108	26	28	24	28	26
Vona	28	28	28	29	28
Centurk 78	25	25	25	26	25
Agate	31	30	29	31	30
Thunderbird	27	28	27	28	28
mean	29	28	27	30	
	---------- heading date days after January 1[2] ----------				
Quantum 524	156	156	156	156	156
Hawk	154	155	155	154	155
Buckskin	156	156	157	155	156
Archer	156	157	157	156	157
Cheyenne	158	158	158	157	158
Tam 108	155	155	156	154	155
Vona	157	158	156	154	156
Centurk 78	157	157	157	157	157
Agate	156	157	157	157	157
Thunderbird	154	155	155	154	155
mean	156	156	156	155	

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[1] Treatments applied November 12, 1987

[2] Height measurements made June 20, 1988 and heading date evaluated daily after the appearance of the first head

Wild oat control with postemergence herbicides in winter wheat near Potlatch, Idaho. Lish, J.M. and D.C. Thill. Several herbicides were tested for wild oat control in winter wheat (variety Hill 81) near Potlatch, Idaho. Herbicides were applied on either April 27 or May 8, 1988 with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 42 psi (Table 1). Broadleaf weeds were treated on May 4 with bromoxynil + DPXM6316 at 0.25 + 0.234 lb ai/a. Wild oat control was evaluated visually on June 20 and grain was harvested August 9.

Table 1. Application data

	April 27	May 8
Wild oat growth stage	2 to 4 leaf	3 to 5 leaf
Wheat growth stage	4 to 5 leaf	2 to 4 tiller
Air temperature (F)	69	65
Soil temperature at 2 in. (F)	87	71
Relative humidity (%)	58	69
Wind (mph)/direction	0 to 3/east	0
Soil pH	5.3	
CEC (meq/100 g)	16.7	
OM (%)	3.7	
texture	silt loam	

Wild oat control was excellent (≥ 94%) with HOE-7113, HOE-7121, and HOE-7125 (Table 2). Wild oat control was inadequate (74%) with diclofop at 0.75 and 1.0 lb ai/a applied at the wild oat 2 to 4 and 3 to 5 leaf stage, respectively, and imazamethabenz. Grain yield from all treatments exceeded grain yield from the control by at least 1889 lb/a. Grain yield was lower with diclofop at 0.75 lb ai/a applied with crop oil concentrate at 1.25% v/v compared to diclofop applied alone at the wild oat 2 to 4 leaf stage and HOE-7113. This wheat injury was not apparent visually. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Wild oat control and winter wheat grain yield

Treatment	Rate	Wild oat growth stage	Wild oat control	Grain yield
	(lb ai/a)[1]	(leaves)	(%)	(lb/a)
check	-	-	-	2063
diclofop	0.75	2 to 4	74	5260
diclofop + COC	0.75 + 1.25	2 to 4	87	4891
diclofop	1.00	2 to 4	82	5168
HOE-7113	0.20	2 to 4	98	5679
diclofop	0.75	3 to 5	87	4266
diclofop	1.00	3 to 5	74	4317
diclofop + COC	0.75 + 1.25	3 to 5	85	3952
diclofop + COC	1.00 + 1.25	3 to 5	86	4860
HOE-7113	0.20	3 to 5	100	5183
HOE-7125	0.66	3 to 5	94	4804
HOE-7121	0.66	3 to 5	97	4714
imazamethabenz + surfactant	0.47 + 0.25	2 to 4	74	4153
difenzoquat + surfactant	1.00 + 0.25	3 to 5	91	4875
LSD (0.05)			19	1189
Wild oat plants/ft^2			*11*	--

[1] Surfactant and crop oil concentrate (COC) rate expressed as % v/v.

Wild oat control in winter wheat and triticale in Boundary County, Idaho. Mallory, C.A., M.J. Dial, and D.C. Thill. Wild oat (AVEFA) control studies in winter wheat and triticale were established in adjacent fields in Boundary County, Idaho. Both crop species were planted on October 24, 1987 at 80 lb/a. Experimental design for both experiments was a randomized complete block with four replications. Plot size was 10 by 30 ft. Herbicides were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 40 psi and 3 mph. Application and edaphic data are presented in Table 1. All herbicides except difenzoquat were applied on April 28, 1988. Difenzoquat was applied May 17, 1988.

Table 1. Application and edaphic data

Treatment date	April 28	May 17
Wheat growth stage	5 lf	early tiller
Triticale growth stage	1-2 tiller	fully tillered
Wild oat growth stage	1-3 lf	3-5 lf
Wild oat/ft2	30	30
Air temperature (F)	70	70
Soil temperature at 2 in. (F)	60	60
Relative humidity (%)	70	66
Soil type	silt loam	
Organic matter (%)	3.4	
pH	7.8	
CEC (meq/100 g soil)	15	

Crop injury and wild oat control were evaluated visually on May 17 and July 17, 1988. Difenzoquat injured winter wheat 40% and triticale 50%. Triticale was injured 87% by barban. Both crops were shortened and thinned by the difenzoquat and barban applications. HOE7113 controlled 91% of the wild oat in both studies (Table 2). No other treatment in the winter wheat controlled more than 65% of the wild oat. Diclofop and HOE7125 controlled wild oat 84% and 83%, respectively, in the triticale study. No other treatment controlled wild oat adequately. Plots were not harvested for grain yield. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Wild oat control

Treatment	Rate	Winter wheat AVEFA control	Triticale AVEFA control
	(lb ai/a)	-----------(% of check)	----------
diclofop	1.0	43	84
difenzoquat[1]	1.0	50	43
barban	0.38	15	18
imazamethabenz[1]	0.38	3	64
imazamethabenz[1]	0.47	3	38
HOE7125	0.66	65	83
HOE7113	0.2	91	91
PP604[2]	0.5	5	
LSD(0.05)		27	28

[1] R-11 nonionic surfactant at 0.25% v/v included in tank mix.

[2] Cenex Land O'Lakes crop oil concentrate at 2.0% v/v included in tank mix. PP604 was included in winter wheat only.

Alternative herbicide control of sulfonylurea resistant prickly lettuce. Mallory, C.A., M.J. Dial, and D.C. Thill. A sulfonylurea resistant prickly lettuce (*Lactuca serriola* L.) biotype was identified near Lewiston, Idaho. Three field studies were established to evaluate sulfonylurea effect on the biotype and to evaluate other herbicides for control of the weed. One study was established in 1987 and two studies were established in 1988. All three studies were in winter wheat in the same field. Experimental design was a randomized complete block with four replications. All 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 30 ft. Application and edaphic data are presented in Table 1.

Table 1. Application and edaphic data

	1987	1988	
	Study 1	Study 2	Study 3
Application date	4/14/87	4/20/88	4/26/88
Air temperature (F)	63	60	85
Soil temperature at 2 in. (F)	63	58	65
Relative humidity (%)	66	70	38
Soil texture	silt loam		
pH	4.9		
organic matter (%)	3.9		
CEC (meq/100 g soil)	21		

In Study 1, five visual evaluations were made during the growing season, only data for the final evaluation on August 3, 1987, is reported (Table 2). Results from the other evaluations were similar. Prickly lettuce biomass (dry weight) per plant and density were determined on July 6, 1987 (Table 2). Only visual evaluations were made in 1988 (Tables 3 and 4). None of the sulfonylurea herbicide alone treatments controlled prickly lettuce in either year. All other herbicide treatments controlled the prickly lettuce. Prickly lettuce control with the alternate broadleaf herbicides did not increase with the addition of sulfonylurea herbicides. (Idaho Agricultural Experiment Station, Moscow, Idaho 83843)

Table 2. Prickly lettuce control in Study 1

			Prickly lettuce	
Treatment	Rate	Control	Density	Biomass
	(lb ai/a)	(% of check)	(plants/ft^2)	(g/plant)
check		---	28	1.6
DPX-G8311[1]	0.0017	10	23	1.4
DPX-G8311	0.0234	5	16	1.8
DPX-G8311	0.0469	13	16	2.3
DPX-R9674	0.0017	5	22	1.4
DPX-R9674	0.0234	8	21	1.7
DPX-R9674	0.0469	13	29	1.5
2,4-D LVE	0.75	100	0	0
bromoxynil	0.38	100	0	0
LSD (0.05)		18	27	1

[1] R-11 nonionic surfactant added to all DPX treatments at 0.5% v/v.

Table 3. Prickly lettuce control in Study 2

Treatment	Rate	Control
	(lb ai/a)	(% of check)
DPX-G8311	0.014	0
DPX-R9674	0.0234	0
CGA-131036	0.0234	30
diuron	0.6	91
bromoxynil[1]	0.375	100
2,4-D LVE[1]	0.75	100
DPX-G8311 + diuron	0.014 + 0.3	86
DPX-G8311 + diuron	0.014 + 0.6	94
DPX-G8311 + bromoxynil	0.014 + 0.1875	95
DPX-G8311 + bromoxynil	0.014 + 0.375	94
DPX-G8311 + 2,4-D LVE	0.014 + 0.375	96
DPX-G8311 + 2,4-D LVE	0.014 + 0.75	99
DPX-R9674 + diuron	0.0234 + 0.3	95
DPX-R9674 + diuron	0.0234 + 0.6	95
DPX-R9674 + bromoxynil	0.0234 + 0.1875	96
DPX-R9674 + bromoxynil	0.0234 + 0.375	93
DPX-R9674 + 2,4-D LVE	0.0234 + 0.375	99
DPX-R9674 + 2,4-D LVE	0.0234 + 0.75	98
LSD (0.05)		17

[1] All treatments except these included R-11 a nonionic surfactant at 0.25% v/v.

Table 4. Prickly lettuce control in Study 3

Treatment	Rate	Control
	(lb ai/a)	(% of check)
DPX-G8311[1]	0.0156	0
2,4-D	0.75	100
MCPA	0.75	100
clopyralid/2,4-D	0.4	100
clopyralid/2,4-D	0.6	100
clopyralid/2,4-D + MCPA	0.4 + 0.25	100
picloram + DPX-G8311[1]	0.0156 + 0.014	100
picloram + 2,4-D	0.0156 + 0.25	100
picloram + 2,4-D	0.0234 + 0.375	100
picloram + MCPA	0.0156 + 0.25	100
picloram + MCPA	0.0234 + 0.375	100
picloram + dicamba	0.0156 + 0.0625	100
picloram + dicamba	0.0234 + 0.125	100

[1] R-11 nonionic surfactant added at 0.25% v/v.

Weed control in winter wheat with fall or spring herbicide treatments. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate weed control and winter wheat tolerance with several sulfonyl urea herbicides applied in the fall or spring. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Winter wheat (var. Archer) was seeded in a sandy loam soil (81% sand, 7% silt and 12% clay) with 1.1% organic matter and pH 7.9 September 10, 1987. Treatments were applied October 16, 1987 (air temp. 54 F, relative humidity 19%, wind NW at 10 mph, sky clear and soil temp. - 0 inch 60 F, 2 inch 49 F and 4 inch 44 F) to 3-leaf wheat and 1 inch tansymustard on March 29, 1988 (air temp. 50 F, relative humidity 21%, wind calm, sky clear and soil temp. - 0 inch 60 F, 2 inch 45 and 4 inch 40 F) to 3-tiller wheat and 1 to 3 inch weeds. Visual weed control and crop damage evaluations were made May 5, winter wheat height measured June 20 and plots harvested July 12, 1988. Tansymustard (DESPI) and field pennycress (THLAR) infestations were light but uniform throughout the experimental area.

No wheat injury or stand reduction was observed with any herbicide treatment. Wheat yield in herbicide treated plots was similar to wheat yield in the weedy check. Tansymustard and field pennycress control was good with all treatments. Fall applied herbicides were equally as effective as herbicides applied in the spring. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1540.)

Weed control in winter wheat with fall or spring herbicide treatments

Treatment[1]	Rate lb ai/A	Winter wheat[2] injury %	 stand red %	 height inches	 yield bu/A	Weed control[3] DESPI %	 THLAR %
Fall							
DPX-G8311 + s	0.012	0	0	24	66	95	100
DPX-G8311 + s	0.015	0	0	23	64	95	100
DPX-G8311 + s	0.031	0	0	23	64	100	100
chlorsulfuron + s	0.008	0	0	23	64	90	100
chlorsulfuron + s	0.015	0	0	24	65	98	100
CGA-131036 + s	0.008	0	0	23	67	88	98
CGA-131036 + s	0.015	0	0	23	64	98	100
Spring							
DPX-G8311 + s	0.008	0	0	23	63	95	98
DPX-G8311 + s	0.012	0	0	23	66	98	100
DPX-G8311 + s	0.015	0	0	24	66	99	100
DPX-G8311 + s	0.031	0	0	24	64	100	100
chlorsulfuron + s	0.008	0	0	24	68	91	97
chlorsulfuron + s	0.015	0	0	23	65	98	100
CGA-131036 + s	0.008	0	0	24	67	85	98
CGA-131036 + s	0.015	0	0	24	67	88	95
metsulfuron + 2,4-D + s	0.004 + 0.25	0	0	23	68	85	97
weedy check	------------	0	0	23	64	0	0

[1] Treatments applied October 16, 1987 and March 29, 1988; s = X-77 at 0.25% v/v

[2] Wheat injury and stand reduction visually evaluated May 5, plant height measured June 20 and plots harvested July 12, 1988

[3] Weed control visually evaluated May 5, 1988

Downy brome control in winter wheat. Miller, S.D. and J.M. Krall. Research plots were established at the Research and Extension Center, Archer, WY, to evaluate the efficacy of herbicide treatments for downy brome control in winter wheat when applied at several stages. Plots were established on non-irrigated land 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Winter wheat (var. Buckskin) was planted in a loam soil (46% sand, 28% silt and 26% clay) with 1.3% organic matter and 7.3 pH September 4, 1987 and preemergence treatments applied (air temp. 67 F, relative humidity 37%, wind W at 5 mph, sky partly cloudy and soil temp. - 0 inch 100 F, 2 inch 71 F and 4 inch 64 F). Postemergence treatments were applied September 21 (air temp. 55 F, relative humidity 30%, wind SW at 3 mph, sky clear and soil temp. - 0 inch 88 F, 2 inch 60 F and 4 inch 58 F) to 1-leaf wheat and 1 to 2-leaf downy brome or October 13, 1987 (air temp. 56, relative humidity 90%, wind calm, sky cloudy and soil temp. - 0 inch 56 F, 2 inch 58 F and 4 inch 52 F) to 3-leaf wheat and 2 to 3-leaf downy brome. Visual weed control and crop damage evaluations were made May 6 and wheat height measured June 21, 1988. Downy brome (BROTE) infestations were heavy and uniform throughout the experimental area. Wheat yields were not determined because of variable crop stand.

No treatment caused visible winter wheat injury; however, winter wheat stands were reduced 7 to 14% by preemergence applications of A-1237 and C-4243 and 3 to 5% by postemergence applications of SMY-1500 plus metribuzin. Downy brome control with A-1237 or C-4243 did not exceed 80% at either rate or stage of application. Downy brome control with SMY-1500 decreased as plant maturity increased. Downy brome control with 1.0 lb/A SMY-1500 was 96, 80 and 73% when applied preemergence, at the 1 to 2-leaf or 2 to 3-leaf stage; respectively. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1539 .)

Downy brome control in winter wheat

Treatment[1]	Rate lb ai/A	Winter wheat[2] injury %	 stand red %	 height inches	Control[3] BROTE %
Preemergence					
A-1237	0.032	0	7	28	60
A-1237	0.063	0	14	28	77
C-4243	0.063	0	7	29	63
C-4243	0.125	0	11	26	72
SMY-1500	0.75	0	0	27	88
SMY-1500	1.0	0	0	27	96
SMY-1500	1.25	0	0	28	98
1 to 2-leaf					
A-1237	0.032	0	0	28	47
A-1237	0.063	0	0	27	60
C-4243	0.063	0	0	26	53
C-4243	0.125	0	0	27	60
SMY-1500	0.75	0	0	27	73
SMY-1500	1.0	0	0	27	80
SMY-1500	1.25	0	0	27	90
SMY-1500 + metribuzin	0.75 + 0.063	0	5	28	90
2 to 3-leaf					
SMY-1500	1.0	0	0	27	73
SMY-1500	1.25	0	0	27	90
SMY-1500 + metribuzin	1.0 + 0.063	0	3	28	93
weedy check	-----------	0	0	24	0

[1] Treatments applied September 4, 21 and October 13, 1987

[2] Wheat injury and stand reduction visually evaluated May 6 and plant height measured June 21, 1988

[3] Weed control visually evaluated May 6, 1988

Evaluation of winter wheat tolerance to simulated clomazone drift. Miller, S.D. and J.M. Krall. Research plots were established at the Research and Extension Center, Archer, WY, to evaluate winter wheat response to low rates of clomazone (simulated drift) applied at several stages. Plots were established under dryland conditions 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Winter wheat (var. Buckskin) was seeded in a loam soil (46% sand, 28% silt and 26% clay) with 1.3% organic matter and 7.3 pH, September 4, 1987. Treatments were applied September 21 (air temp. 68 F, relative humidity 30%, wind SW at 5 to 7 mph, sky clear and soil temp. - 0 inch 90 F, 2 inch 72 F and 4 inch 63 F) to 1-leaf winter wheat or October 13, 1987 (air temp. 56 F, relative humidity 100%, wind NW at 5 mph, sky cloudy and soil temp. - 0 inch 58 F, 2 inch, 56 F and 4 inch 52 F) to 3-leaf winter wheat. Visual crop damage evaluations were made April 26, plant height measured June 21 and plots harvested July 26, 1988.

Clomazone did not injure winter wheat at the 1 or 3-leaf stage of application when applied at rates as high as 0.125 lb/A. Winter wheat yields ranged from 37 to 40 bu/A and were similar in clomazone treated or untreated plots. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1538.)

Winter wheat response to low rates of clomazone

		Winter wheat[2]			
Treatment[1]	Rate lb ai/A	injury %	stand red %	height inches	yield bu/A
1-leaf					
clomazone	0.008	0	0	29	38
clomazone	0.015	0	0	29	39
clomazone	0.031	0	0	30	38
clomazone	0.063	0	0	31	40
clomazone	0.125	0	0	30	37
3-leaf					
clomazone	0.008	0	0	30	38
clomazone	0.015	0	0	29	37
clomazone	0.031	0	0	30	38
clomazone	0.063	0	0	29	38
clomazone	0.125	0	0	30	38
untreated check	-----	0	0	30	38

[1] Treatments applied September 21 and October 13, 1987

[2] Wheat injury and stand reduction visually evaluated April 26, plant height measured June 21 and plots harvested July 26, 1988

Evaluation of herbicide treatments for control of large tansymustard in winter wheat. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of herbicide treatments for control of large tansymustard in winter wheat. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Winter wheat (var. Archer) was seeded in a sandy loam soil (78% sand, 12% silt and 10% clay) with 1.2% organic matter and pH 7.6 September 10, 1987. Treatments were applied April 27, 1988 (air temp. 61 F, relative humidity 32%, wind SW at 5 mph, sky clear and soil temp. - 0 inch 82 F, 2 inch 66 F and 4 inch 60 F) to fully tillered winter wheat and flowering tansymustard. Visual weed control and crop damage evaluations were made May 25, winter wheat height measured June 20 and plots harvested July 13, 1988. Tansymustard (DESPI) infestations were light and variable throughout the experimental area.

No treatment reduced winter wheat stand; however, herbicide treatments containing cyanazine or metribuzin injured wheat 8 to 13%. Wheat yields generally reflected injury and were 3 to 6 bu/A lower in cyanazine or metribuzin treatments than in the weedy check. Tansymustard control was excellent (92% or greater) with all treatments. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1546.)

Control of large tansymustard in winter wheat

Treatment[1]	Rate lb ai/A	Winter wheat[2]				Control[3]
		injury %	stand red %	height inches	yield bu/A	DESPI %
clopyralid + 2,4-D	0.063 + 0.38	0	0	26	68	92
clopyralid + 2,4-D	0.094 + 0.5	0	0	26	70	97
chlorsulfuron + s	0.008	0	0	26	68	100
chlorsulfuron + s	0.016	0	0	26	68	100
chlorsulfuron + cyanazine + s	0.016 + 0.45	12	0	25	62	98
chlorsulfuron + metribuzin + s	0.016 + 0.125	10	0	27	65	98
chlorsulfuron + metribuzin + s	0.016 + 0.187	12	0	26	62	100
chlorsulfuron + metribuzin + s	0.016 + 0.25	13	0	26	62	100
CGA-131036 + s	0.008	0	0	27	69	100
CGA-131036 + s	0.016	0	0	26	69	100
CGA-131036 + metribuzin + s	0.016 + 0.125	8	0	27	64	100
metsulfuron + 2,4-D + s	0.004 + 0.25	0	0	26	69	100
metsulfuron + 2,4-D + s	0.008 + 0.25	0	0	26	70	100
DPX-R9674 + s	0.008	0	0	27	71	95
DPX-R9674 + s	0.016	0	0	26	70	95
2,4-D	0.75	0	0	26	70	98
MCPA	0.75	0	0	27	69	92
bromoxynil + MCPA	0.375 + 0.375	0	0	27	71	97
weedy check	-------------	0	0	27	68	0

[1] Treatments applied April 27, 1988; s = X-77 at 0.25% v/v

[2] Wheat injury and stand reduction visually evaluated May 25, plant height measured June 20 and plots harvested July 13, 1988

[3] Weed control visually evaluated May 25, 1988

Weed control in winter wheat with dicamba. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate the efficacy of dicamba alone or in combination with other herbicides for broadleaf weed control in winter wheat. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Winter wheat (var. Archer) was seeded in a sandy loam soil (81% sand, 7% silt and 12% clay) with 1.1% organic matter and pH 7.9 September 10, 1987. Treatments were applied April 13, 1988 (air temp. 52, relative humidity 60%, wind NE at 10 mph, sky partly cloudy and soil temp. - 0 inch 60 F, 2 inch 44 F and 4 inch 40 F) to 6-tiller wheat and 2 to 5 inch tansymustard. Visual weed control and crop damage evaluations were made May 5, winter wheat height measured June 20 and plots harvested July 12, 1988. Tansymustard (DESPI) infestations were light but uniform throughout the experimental area.

No treatment reduced winter wheat stand; however, dicamba-clopyralid-2,4-D treatments caused moderate wheat injury (13 to 15%). Wheat injury was only slight (2 to 3%) with dicamba-sulfonyl urea herbicide treatments and no greater than with dicamba alone. Wheat yield in herbicide treated plots was similar to wheat yield in the weedy check. Tansymustard control was greater with all combination treatments than with dicamba alone. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1545.)

Weed control in winter wheat with dicamba

		Winter wheat[2]				Control[3]
Treatment[1]	Rate lb ai/A	injury %	stand red %	height inches	yield bu/A	DESPI %
dicamba	0.094	2	0	24	73	37
dicamba + chlorsulfuron + s	0.094 + 0.016	2	0	24	69	100
dicamba + metsulfuron + s	0.094 + 0.004	0	0	24	70	92
dicamba + CGA-131036 + s	0.094 + 0.016	2	0	24	69	100
dicamba + DPX-R9674	0.094 + 0.016	3	0	23	69	97
dicamba + DPX-L5300 + s	0.094 + 0.016	3	0	23	72	98
dicamba + thiameturon + s	0.094 + 0.016	3	0	23	70	97
dicamba + clopyralid + 2,4-D	0.094 + 0.063 + 0.375	15	0	23	70	80
dicamba + clopyralid + 2,4-D	0.094 + 0.094 + 0.5	13	0	24	68	87
dicamba + 2,4-D	0.094 + 0.375	3	0	24	70	80
dicamba + MCPA	0.094 + 0.375	2	0	24	71	77
dicamba + bromoxynil	0.094 + 0.375	2	0	23	70	88
weedy check	-------------	0	0	24	71	0

[1] Treatments applied April 13, 1988; s = X-77 at 0.25% v/v

[2] Wheat injury and stand reduction visually evaluated May 5, plant height measured June 20 and plots harvested July 12, 1988

[3] Weed control visually evaluated May 5, 1988

Sulfonyl urea herbicide-insecticide combinations in winter wheat. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate weed control and winter wheat tolerance with sulfonyl urea herbicides alone or in combination with insecticides. Plots were established under irrigation and were 9 by 30 ft. with three replications arranged in a randomized complete block. Herbicide and/or insecticide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa t 40 psi. Winter wheat (var. Archer) was seeded in a sandy loam soil (80% sand, 9% silt and 11% clay) with 1.1% organic matter and pH 7.8. September 10, 1987. Treatments were applied April 14, 1988 (air temp. 60 F, relative humidity 30%, wind NE at 5 mph, sky clear and soil temp. - 0 inch 75 F, 2 inch 58 F and 4 inch 54 F) to 6-tiller wheat and 2 to 5 inch tansymustard. Visual crop damage evaluations were made April 21, 28 and May 5, visual weed control ratings May 5, winter wheat height measured June 20 and plots harvested July 13, 1988. Tansymustard infestations were light but uniform throughout the experimental area.

No treatment reduced winter wheat stand; however, several sulfonyl urea herbicide-insecticide combinations caused 1 to 8% injury. Disulfoton combinations with chlorsulfuron or DPX-R9674 tended to be the most injurious. Wheat yields were 3 to 5 bu/A lower in disulfoton combinations with chlorsulfuron or DPX-R9674 than in the weedy check. Tansymustard control with sulfonyl urea herbicides was excellent and not influenced by insecticide. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1544.)

Sulfonyl urea herbicide-insecticide combinations in winter wheat

Treatment[1]	Rate lb ai/A	Winter wheat[2]						Control[3] DESPI %
		injury			stand reduction %	plant height inches	yield bu/A	
		1 wk %	2 wk %	3 wk %				
chlorsulfuron + s	0.032	0	0	0	0	25	70	100
chlorsulfuron + disulfoton + s	0.015 + 0.75	4	6	2	0	25	68	100
chlorsulfuron + disulfoton + s	0.032 + 1.5	8	7	8	0	24	66	100
chlorsulfuron + dimethoate + s	0.015 + 0.375	1	0	0	0	26	70	100
chlorsulfuron + dimethoate + s	0.032 + 0.75	3	3	2	0	25	67	100
chlorsulfuron + esfenvalerate + s	0.015 + 0.025	0	0	0	0	26	70	99
chlorsulfuron + esfenvalerate + s	0.032 + 0.05	4	3	0	0	26	70	100
metsulfuron + 2,4-D + s	0.008 + 0.25	0	0	0	0	26	69	93
metsulfuron + 2,4-D + disulfoton + s	0.004 + 0.19 + 0.75	1	0	0	0	26	70	95
metsulfuron + 2,4-D + disulfoton + s	0.008 + 0.25 + 1.5	4	3	1	0	26	69	95
metsulfuron + 2,4-D + dimethoate + s	0.004 + 0.19 + 0.375	0	0	0	0	26	70	95
metsulfuron + 2,4-D + dimethoate + s	0.008 + 0.25 + 0.75	3	1	0	0	26	69	93
metsulfuron + 2,4-D + esfenvalerate + s	0.004 + 0.12 + 0.025	0	0	0	0	26	73	95
metsulfuron + 2,4-D + esfenvalerate + s	0.008 + 0.25 + 0.05	1	0	0	0	26	73	95
DPX-R9674 + s	0.0375	0	0	0	0	27	71	95
DPX-R9674 + disulfoton + s	0.019 + 0.75	5	7	3	0	26	66	97
DPX-R9674 + disulfoton + s	0.0375 + 1.5	7	7	8	0	27	67	100
DPX-R9674 + dimethoate + s	0.019 + 0.375	1	1	2	0	26	69	97
DPX-R9674 + dimethoate + s	0.0375 + 0.75	4	3	3	0	26	70	97
DPX-R9674 + esfenvalerate + s	0.019 + 0.025	2	2	0	0	26	72	98
DPX-R9674 + esfenvalerate + s	0.0375 + 0.05	5	5	5	0	26	70	97
disulfoton	1.5	1	0	0	0	26	72	27
dimethoate	0.75	0	0	0	0	28	74	10
esfenvalerate	0.05	0	0	0	0	26	71	0
weedy check	----	0	0	0	0	26	71	0

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[1] Treatments applied April 14, 1988; s = X-77 at 0.25% v/v

[2] Wheat injury visually evaluated April 21, 28 and May 5; stand reduction visually evaluated May 5; plant height measured June 20 and plots harvested July 13, 1988

[3] Weed control visually evaluated May 5, 1988

Tansymustard control in winter wheat. Miller, S.D., A.W. Dalrymple and D.A. Ball. Research plots were established at the Research and Extension Center, Torrington, WY, to evaluate tansymustard control and winter wheat tolerance with several postemergence herbicide treatments. Plots were established under irrigation 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 six-nozzle knapsack sprayer delivering 20 gpa at 40 psi. Winter wheat (var. Archer) was seeded in a sandy loam soil (81% sand, 7% silt and 12% clay) with 1.1% organic matter and pH 7.9 September 10, 1987. Treatments were applied April 14, 1988 (air temp. 64 F, relative humidity 35%, wind NE at 10 mph, sky clear and soil temp. - 0 inch 76 F, 2 inch 60 F and 4 inch 54 F) to 6-tiller wheat and 2 to 5 inch tansymustard. Visual weed control and crop damage evaluations were made May 5, winter wheat height measured June 20 and plots harvested July 13, 1988. Tansymustard (DESPI) infestations were light but uniform throughout the experimental area.

No treatment reduced winter wheat stand; however, slight injury (3 to 5%) was observed with dicamba-2,4-D combinations. Wheat yield in herbicide treated plots was similar to wheat yield in the weedy check. Tansymustard control was 85% or greater with CGA-131036 at all rates, chlorsulfuron at the only rate tested, and metsulfuron at 0.008 lb/A alone or at 0.004 lb/A in combination with 2,4-D. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1543.)

Tansymustard control in winter wheat

Treatment[1]	Rate lb ai/A	Winter wheat[2] injury %	 stand red %	 height inches	 yield bu/A	Control[3] DESPI %
clopyralid + bromoxynil	0.063 + 0.375	0	0	24	72	47
clopyralid + bromoxynil	0.094 + 0.375	0	0	25	74	53
CGA-131036 + s	0.0045	0	0	24	73	85
CGA-131036 + s	0.009	0	0	25	73	93
CGA-131036 + s	0.018	0	0	24	74	95
CGA-131036 + s	0.027	0	0	24	72	98
chlorsulfuron + s	0.018	0	0	24	73	98
metsulfuron + s	0.004	0	0	25	73	73
metsulfuron + s	0.008	0	0	25	72	93
metsulfuron + 2,4-D + s	0.004 + 0.25	0	0	24	71	87
metsulfuron + 2,4-D + s	0.008 + 0.25	0	0	25	73	95
clopyralid + 2,4-D	0.063 + 0.375	0	0	24	74	62
clopyralid + 2,4-D	0.094 + 0.5	0	0	24	73	70
dicamba + 2,4-D	0.063 + 0.375	3	0	23	71	67
dicamba + 2,4-D	0.094 + 0.5	5	0	24	70	70
bromoxynil	0.375	0	0	25	72	47
bromoxynil + MCPA	0.375 + 0.375	0	0	25	74	83
2,4-D	0.5	0	0	24	74	67
weedy check	---	0	0	24	72	0

[1] Treatments applied April 14, 1988; s = X-77 at 0.25% v/v

[2] Wheat injury and stand reduction visually evaluated May 5, plant height measured June 20 and plots harvested July 13, 1988

[3] Weed control visually evaluated May 5, 1988

Jointed goatgrass control with ethyl-metribuzin. Westra, P., and T. D'Amato. Experiments conducted in Fall, 1987 at two Colorado sites assessed the efficacy of ethyl-metribuzin (4-amino-6-(1,1-dimethylethyl)-3-(ethylthio)-1,2,4-triazin-5-(4H)-one) applied either pre- or postemergent for control of jointed goatgrass (*Aegilops cylindrica*). Preemergent applied ethyl-metribuzin rates were 1.75 and 2.00 lb ai/A and postemergent ethyl-metribuzin rates varied between 1.25 and 3.00 lb ai/A. Site 1 treatments were applied 9/9/87 and 9/28/87 and site 2 treatments were applied postemergent only on 10/16/87. Plots 10 x 30 feet were arranged in a RCB design with 3 replications and were sprayed using a CO_2 pressurized backpack sprayer equipped with either 11002LP or 11001LP nozzles and calibrated to deliver 15-20 GPA. Hawk variety wheat was planted at sites 1 and 2 on 9/8/87 and 9/10/87, respectively.

Preemergent ethyl-metribuzin applications provided 80% control of goatgrass but did not significantly affect wheat yield. Site 1 postemergent ethyl-metribuzin applications greater than 1.50 lb ai/A provided 75-80% goatgrass control and significantly increased wheat yield. Rates as low as 1.25 lb ai/A provided good weed control also but did not significantly affect wheat yield. Site 2 postemergent ethyl-metribuzin applications greater than 2.00 lb ai/A provided 84-93% control of goatgrass but only applications of 3.00 lb ai/A significantly increased wheat yield. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523)

Jointed goatgrass control with ethyl-metribuzin [a]

Herbicide	Rate (lb ai/A)	Growth Stage	AEGCY % Control		Wheat % Yield	
			Site 1	Site 2	Site 1	Site 2
Check			0.0b	0.0f	21.0b	38.0b
ethyl-metr	1.75	PRE	80.0a	-	24.7ab	-
ethyl-metr	2.00	PRE	80.0a	-	26.0ab	-
ethyl-metr	1.00	POST	-	8.3ef	-	44.0ab
ethyl-metr	1.25	POST	73.3a	18.3e	24.0ab	41.3ab
ethyl-metr	1.50	POST	76.7a	30.0d	24.0ab	44.0ab
ethyl-metr	1.75	POST	75.0a	51.7c	28.3a	44.0ab
ethyl-metr	2.00	POST	80.0a	65.0b	28.3a	46.3ab
ethyl-metr	2.50	POST	-	84.0a	-	50.7ab
ethyl-metr	3.00	POST	-	93.3a	-	54.3a

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[a] Means in a column followed by different letters are signficantly different based on D.M.R.T. at 0.05.

Blue mustard and flixweed control in winter wheat. Westra, P. and T. D'Amato. Two field studies were conducted on postemergence control of blue mustard (COBTE) and flixweed (DESSO) in winter wheat. Each consisted of 3 replications of 10 X 30 ft plots in a RCB design. Applications were made with a CO_2 backpack sprayer using a 10 ft boom with 11002LP SS tips spraying 20 gpa at 20 psi boom pressure. Visual ratings (scale of 0-100) were made just prior to harvest (June 24). Site 2 weeds were 1-2" tall at application in very early spring; site 1 weeds were 3-6" tall and constituted a late time of application when the wheat was tillered and 6-8" tall. Blue mustard stands were very dense, averaging 30 plants/ft^2 at both sites. Flixweed density averaged 3 plants/yd^2 at both sites. These were excellent tests of herbicide performance on both weed species. No significant crop injury was noted for any treatment.

Dicamba, 2,4-D, bromoxynil/MCPA, MCPA, curtail, and AC 222 293 applied alone provided poor to fair control (10 - 80 %) of both weeds. Dicamba + 2,4-D provided good control if applied when the weeds were small. Metsulfuron, chlorsulfuron, trisulfuron, or DPX-R9674 alone or in combination with surfactant + low rates of 2,4-D gave excellent control of blue mustard and flixweed. Adding 2,4-D gave more rapid kill of larger weeds, but ultimate weed control at harvest was similar whether or not 2,4-D had been used with the sulfonylureas. Rapid kill should minimize moisture utilization by these weeds. Site 2 gave more desirable results than site 1 and little weed tissue was apparent at harvest where treatments provided excellent control. Blue mustard and flixweed are easily controlled in winter wheat, especially when treated at early growth stages. (Weed Research Laboratory, Colorado State University, Ft. Collins, CO 80523)

Blue mustard and flixweed control in winter wheat.

Herbicide	Rate (lb/a)	Blue mustard		Flixweed	
		site 1	site 2	site 1	site 2
		(% control)			
untreated check		0 h	0 g	0 i	0 g
metsulfuron + X-77	.006	95 a	100 a	100 a	100 a
chlorsulfuron+X-77	.016	99 a	100 a	100 a	100 a
DPX-R9674 + X-77	.024	100 a	100 a	100 a	100 a
trisulfuron + X-77	.018	100 a	100 a	100 a	100 a
metsulfuron 2,4-D LVE + X-77	.004 .25	98 a	100 a	99 a	100 a
DPX-R9674 2,4-D LVE + X-77	.024 .25	100 a	100 a	100 a	100 a
trisulfuron 2,4-D LVE + X-77	.018 .25	100 a	100 a	100 a	100 a
dicamba bromoxynil	.10 .25	75 b	83 c	83 de	87 cd
dicamba 2,4-D LVE	.10 .25	67 c	100 a	97 ab	100 a
2,4-D LVE	.50	72 bc	92 b	92 bc	97 a
bromoxynil/MCPA	.75	68 c	72 e	83 de	100 a
bromoxynil	.375	95 a	77 de	88 cd	76 f
dicamba	.125	68 c	75 de	72 f	82 e
AC 222 293	.38	60 d	80 cd	82 e	85 de
AC 222 293	.47	67 c	90 b	96 ab	91 b
MCPA	.50	10 g	65 f	10 h	90 bc
curtail (clopyralid + 2,4-D)	.094	40 e	--	62 g	--
dicamba MCPA	.09 .25	30 f	--	70 f	--
dicamba metsulfuron	.09 .004	100 a	--	100 a	--

Downy brome control with diclofop methyl in winter wheat. Westra, P. and T. D'Amato. Two field studies were conducted on preplant incorporated control of downy brome (BROTE) with diclofop methyl in winter wheat. Each consisted of 3 replications of 10 X 25 ft plots in a RCB design. Applications were made with a CO_2 backpack sprayer using a 10' boom with 11002LP SS tips spraying 20 gpa at 24 psi boom pressure. Granular material was applied with a hand seeder. Visual ratings were made in June (data not presented) and just prior to harvest (scale of 0-100). Downy brome density was moderate but uniform at both locations (200 - 250 plants/yd^2). Wheat yields were taken at site 2.

Diclofop methyl alone at 0.75 lb ai/a provided marginal downy brome control (70-83%). Addition of .016 lb ai/a chlorsulfuron to 0.75 lb ai/a diclofop methyl generally provided 10-15 % additional control. The mechanism for this increased control is not understood, but this phenomenon has been observed by other researchers. When applied alone, diclofop methyl at 1.0 lb ai/a provided very good suppression of downy brome (92-97%); control was not significantly better at 1.25 lb ai/a. Some downy brome escaped control in all treatments. Downy brome control ratings made in June were 10-15 % lower than those at harvest; by harvest much downy brome had shattered, and plots looked cleaner. Use of the lower rate of diclofop methyl in combination with chlorsulfuron is a viable option for downy brome suppression in winter wheat. (Weed Research Laboratory, Colorado State University, Ft. Collins, CO 80523)

Downy brome control with diclofop methyl in winter wheat

Herbicide	Rate (lb/a)	Downy brome site 1	Downy brome site 2	Yield
		----(% control)----		--(bu/a)--
untreated check		0 g	0 d	17 c
diclofop EC	.75	70 f	82 c	21 abc
diclofop EW	.75	72 f	82 c	22 abc
diclofop MC	.75	73 f	82 c	28 a
diclofop EC	1.0	95 ab	92 b	27 a
diclofop EW	1.0	94 bc	93 b	26 a
diclofop MC	1.0	97 ab	93 b	26 a
diclofop EC chlorsulfuron	.75 .016	82 e	98 a	24 ab
diclofop EW chlorsulfuron	.75 .016	84 e	97 a	24 ab
diclofop MC chlorsulfuron	.75 .	86 de	97 a	24 ab
diclofop clay impreg.	1.0	99 a	97 a	25 ab
diclofop sand impreg.	1.0	90 cd	92 b	19 bc
diclofop EC	1.25	97 ab	92 b	23 abc

all diclofop = diclofop methyl; all treatments were applied PPI

means in a column followed by the same letters are not significantly different based on D.M.R.T. at the .05 level.

Effects of herbicides on grasses grown for seed production. Whitson, T. D. and J. G. Lauer. The effects of herbicides during the second year of establishment is important because that is the first year for seed production. This study was established near Powell, WY to determine the effects of vaious herbicides applied at different grass growth stages on weed control and grass growth. Herbicides were applied with a four-nozzle knapsack spray unit delivering 40 gpa at 45 psi. Herbicide plots were 7 by 55 ft arranged in a randomized complete block design with three replications. The soil was a sandy clay loam (47% sand, 27% silt, and 26% clay) with 1.6% organic matter and a 7.9 pH. Grass varieties were seeded April 15, 1987. Herbicides were applied preplant and postemergence on April 15, 1987 (relative humidity 20%, wind 5 to 10 mph NE, air temperature 70G, soil surface 60F, 1 inch 55F, 2 inches 50F, 4 inches 50F), April 19, 1988 (relative humidity 60%, wind 3 to 4 mph W, air temperature 69F, soil surface 68F, 1 inch 69F, 2 inches 70F, 4 inches 70F), and May 24, 1988 (relative humidity 40%, wind 5 to 6 mph W, air temperature 85F, soil surface 85F, 1 inch 85F, 2 inch 80F, 4 inches 80F). Grass species were not tolerant to preplant applications of propazine and simazine. Grasses were injured by postemergence applications of triclopyr + 2,4-D, paraquat and metribuzin. Kochia control was above 90% with postemergence applications of fluroxypyr, pendimethalin, triclopyr + 2,4-D, paraquat, dicamba and chlorsulfuron. Redroot pigweed control was above 80% with applications of picloram, bromoxynil, pendimethalin, triclopyr + 2,4-D, metribuzin, dicamba and chlorsulfuron. No herbicide provided satisfactory annual grass control. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071.)

Herbicide evaluation on grasses grown for seed.

Herbicide	lb ai/A rate	App. time	% Control[1]			% Injury									
			KO	PW	A.G.	1 HC	2 RW	3 SS	4 CT	5 PS	6 BR	7 MB	8 AR	9 BM	10 RM
Propazine	1.0	preplant	20	43.3	0	66.7	66.7	50	66.7	53.3	36.7	66.7	60	60	53.3
Simazine	1.0	preplant	0	6.7	0	66.7	86.7	100	100	100	86.7	100	83.3	100	83.3
Picloram	0.25	preplant	0	80	0	11.7	0	10	0	6.7	10	0	0	0	0
Picloram	0.5	5/24/88	0	83.3	0	0	0	0	0	0	13.3	0	0	0	0
XRM 3972	0.25	5/24/88	0	50	0	0	0	0	0	0	16.7	0	0	0	0
XRM 3972	0.5	preplant	0	13.3	0	0	10	0	0	0	16.7	0	0	0	0
Fluroxypyr	0.25	5/24/88	100	0	0	0	0	0	0	0	16.7	0	0	0	0
Fluroxypyr	0.5	5/24/88	100	0	0	0	0	0	0	0	16.7	0	0	0	0
Fluroxypyr	1.0	5/24/88	100	0	0	0	0	0	0	0	0	0	0	0	0
Bromoxynil	0.5	5/24/88	100	80	0	0	0	0	0	0	0	0	0	0	0
Check	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
Pendimethalin	1.0	4/19/88	90	93.3	60	0	0	0	0	0	0	0	0	0	0
Ethylfluralin	2.0	4/19/88	73.3	60	46.7	0	0	0	0	0	0	0	0	0	0
Triclopyr + 2,4-D LVE	1.0 + 2.0	4/19/88	100	83.3	0	31.7	11.7	25	20	6.7	18.3	10	35	6.7	16.7
Paraquat + X-77	0.38 + 0.25	4/19/88	100	26.7	43.3	50	66.7	46.7	53.3	63.3	53.3	46.7	35	20	53.3
Metribuzin	0.5	4/19/88	80	83.3	26.7	26.7	60	16.7	56.7	25	10	71.7	30	56.7	16.7
Diclofop	0.3	5/24/88	0	0	6.7	0	0	0	0	0	0	0	0	0	0
Dicamba	0.5	5/24/88	100	93.3	0	6.7	10	6.7	0	0	0	0	16.7	0	0
Chlorsulfuron + X-77	0.038	4/19/88	100	100	0	0	0	0	0	0	0	0	6.7	0	0

1. Abbreviations - Weeds: KO = Kochia, PW = Pigweed, A.G. = Annual grasses (downy brome, green foxtail and barnyardgrass). Abbreviations - Grasses: HC = Hycrest crested wheatgrass, RW = Rosana western wheatgrass, SS = Sodar streambank wheatgrass, CT = Critana thickspike wheatgrass, PS = Prior slender wheatgrass, BR = Bozoisky Russian wildrye, MB = Magnar basin wildrye, AR = Synthetic A Russian wildrye, BM = Bromar mountain bromegrass, RM = Regar meadow bromegrass.

2. Grasses were seeded April 15, 1987. Seedbeds were corregated dry seeded then irrigated.

Herbicide tolerance and efficacy on six grass species grown for seed production. Whitson, T. D. and J. G. Lauer. Grass seed growers are unsure of which herbicides to use in the grass industry. This study was established near Powell, WY to determine grass species tolerance to herbicides applied at various growth stages and the resulting weed control. Herbicides were applied with a four nozzle knapsack spray unit delivering 40 gpa at 45 psi. Herbicide plots were 7 by 34.5 ft arranged in a randomized complete block design with four replications. The soil was a sandy clay loam (47% sand, 27% silt and 26% clay with 1.6% organic matter and a 7.9 pH. April 19 weather information: relative humidity 60%, wind 3 to 4 mph W, air temperature 69F, soil surface 68F, 1 inch 69F, 2 inches 70F, 4 inches 70F. May 24 weather information: relative humidity 40%, wind 6 to 6 mph W, air temperature 85F, soil surface 85F, 1 inch 85F, 2 inches 80F, 4 inches 80F. Grass varieties were seeded in three 22 inch rows with herbicides applied across rows. Grass seeding was done August 28, 1987 following barley. Herbicides were applied post emergence on April 19 while grasses were in early boot stages, and May 24, 1988 while grasses were in early head formation. Grasses treated with herbicides on April 19 and May 24th were not selectively tolerant to applications of propazine, metribuzin, chlorsulfuron, simazine, triclopyr + 2,4-D and paraquat. Kochia control was excellent with applications of fluroxypyr, pendimethalin, triclopyr + 2,4-D, paraquat, bromoxynil, dicamba and chlorsulfuron. Wild buckwheat control was excellent with applications of fluroxypyr, clopyralid, propazine, triclopyr + 2,4-D, bromoxynil, picloram, dicamba and chlorsulfuron. Common lambsquarters control was excellent with applications of fluroxypyr at 1.2 lb ai/A, pendimethalin, clopyralid at 0.6 lb ai/A, propazine, triclopyr + 2,4-D, paraquat, metribuzin, bromoxynil, picloram, dicamba and chlorsulfuron. Wild mustard control above 90% was attained with applications of fluroxypyr at 0.6 lb ai/A, propazine, triclopyr + 2,4-D, metribuzin and chlorsulfuron. Green foxtail control above 90% was attained with paraquat, metribuzin and diclofop. (Department of Plant, Soil and Insect Sciences, University of Wyoming, Laramie, WY 82071).

Herbicide evaluation on grasses grown for seed.

			% control					% damage					
Herbicide	lbs/ai/A	App. time	KO[1]	BW	LQ	MU	GF	HC[2,3]	RW	CT	PS	BR	RM
Simazine	1.0	5/24/88	17.5	42.5	77.5	86.3	83.8	11.3	35.0	52.5	32.5	25.0	20
Check	-	-	0	0	0	0	0	0	0	0	0	0	0
Fluroxypyr	0.3	5/24/88	100	100	55	62.5	0	0	0	0	0	0	0
Fluroxypyr	0.6	5/24/88	98.8	100	80	90	0	0	0	0	0	0	0
Fluroxypyr	1.2	5/24/88	100	100	100	76.3	0	0	0	0	0	0	0
Pendimethalin	1.0	4/19/88	100	42.5	100	0	65	0	0	2.5	0	2.5	0
Clopyralid	0.3	5/24/88	40	97.5	72.5	2.5	0	0	0	0	0	0	0
Clopyralid	0.6	5/24/88	27.5	100	100	0	0	0	0	0	0	0	0
Ethalfluralin	2.0	4/19/88	62.5	12.5	77.5	20.0	58.8	0	0	5.0	0	5.0	0
Propazine	0.5	4/19/88	27.5	100	100	90	57.5	32.5	60.0	36.3	35.0	15.0	35.0
Propazine	1.0	4/19/88	90	100	100	100	76.5	82.5	96.3	70.0	85.0	62.5	72.5
Triclopyr + 2,4-D LVE	1.2 + 2.2	5/24/88	100	100	100	97.5	77.5	20.0	26.3	22.5	15.0	17.5	15.0
Paraquat + X-77	0.45 0.25%	5/24/88	100	60	100	82.5	90	40	45	52.5	17.5	37.5	10
Metribuzin	0.5	4/19/88	62.5	80.0	100	90.0	95.0	90.0	100	92.5	97.5	100	80
Bromoxynil	0.6	5/24/88	95	100	100	82.5	0	0	0	0	0	0	0
Picloram	0.3	5/24/88	0	100	100	23.8	0	0	0	0	0	0	0
Picloram	0.6	5/24/88	0	100	100	42.5	2.5	0	2.5	5.0	2.5	0	2.5
Diclofop	0.35	5/24/88	0	0	0	6.3	95.0	0	2.5	0	0	0	0
Dicamba	0.6	5/24/88	97.5	100	97.5	77.5	0	0	0	0	0	0	2.5
Chlorsulfuron + X-77	0.38 + 0.25	4/19/88	98.8	100	100	100	0	32.5	8.8	2.5	12.5	5.0	32.5

1. Abbreviations, weeds: KO = Kochia, BW = buckwheat, LQ = lambsquarter, MU = wild mustard, GF = green foxtail.
2. Abbreviations, grasses: HC = Hycrest crested wheatgrass, RW = Rosana western wheatgrass, CT = critana thickspike wheatgrass, PS = Prior slender wheatgrass, BR = Bozoisky Russian wildrye, RM = Regar meadow bromegrass.
3. Grasses were seeded with double disc opener planter in barley stubble on 8-28-87.

Effect of Plant size on DPX-V9360 bioactivity on field sandbur and redroot pigweed. Anderson, R. L.

Field sandbur (*Cenchrus incertus*) is a prevalent weed infesting corn grown on sandy soils. Present field sandbur management systems usually achieve only marginal control levels (70%). DPX-V9360 is a postemergence sulfonylurea herbicide which selectively controls grasses in corn. This study was conducted to determine whether the sensitivity of field sandbur to DPX-V9360 is affected by rate and plant growth size.

DPX-V9360 was applied on two dates to irrigated corn infested with field sandbur and redroot pigweed (*Amaranthus retroflexus*). A few scattered smooth pigweed (*Amaranthus hybridus*), buffalobur (*Solanum rostratum*), and common sunflower (*Helianthus annuus*) plants were also present. The corn had 4-6 leaves exposed on the first spray date, June 10, 1988 and 8-10 leaves on the second date, June 22, 1988. The plant sizes for the field sandbur and redroot pigweed are described on the Table. The experiment was irrigated twice weekly during the duration of the experiment. Spray volume was 187 L/ha delivered at 1.8 kg/cm^2 with 8001 nozzles. The trial was a randomized complete block with 3 replications and a plot size of 2 m by 5 m. Fresh weight measurements of the above ground plant material from 1 m^2 was collected 28 days after herbicide application.

DPX-9360 exhibited bioactivity on field sandbur and redroot pigweed, but did not affect smooth pigweed, buffalobur, or common sunflower. Redroot pigweed was more sensitive to DPX-V9360 than field sandbur, with growth inhibition (GI) exceeding 90% at both plant sizes when treated with 53 and 70 g/ha (see Table). Comparing the oil additive treatments indicated that DPX-V9360 bioactivity was not altered by type of surfactant used. A possible interaction between light levels and DPX-V9360 bioactivity on field sandbur may exist. Field sandbur response to DPX-V9360 appeared to be enhanced by reduced light penetration due to corn canopy development, as DPX-V9360 reduced field sandbur growth more on the second date. After the second application, corn entered the tasseling growth stage, the period of maximum canopy closure, and this resulted in greater % GI, especially at the lower rates when compared to the first application results. However, the growth of the control plants did not appear to be stunted by canopy development. Since it appears that plant size of field sandbur exerts a minimal influence on its sensitivity to DPX-V9360, delaying application may be advantageous by utilizing the corn canopy development to aid DPX-V9360 bioactivity on sandbur growth.
(USDA-ARS, Akron, CO 80720).

Response of field sandbur and redroot pigweed to DPX-V9360.

	Field sandbur plant size			
	1-3 leaves, 1 tiller		3-6 leaves, 1-5 tillers	
Rate	Plant height	Biomass	Plant height	Biomass
g/ha	cm (% GI[3])	kg/m^2(% GI)	cm (% GI)	kg/m^2 (% GI)
18 [1]	28.7 (2)	1.53 (13)	44.0 (34)	1.70 (47)
35 [1]	21.0 (28)	1.21 (32)	38.3 (43)	1.12 (65)
53 [1]	14.7 (50)	0.42 (77)	23.3 (65)	0.51 (84)
70 [1]	15.3 (48)	0.64 (64)	23.3 (65)	0.55 (83)
35+COC[2]	22.3 (24)	1.19 (33)	40.0 (40)	1.41 (56)
Control	29.3	1.76	66.7	3.21
LSD(0.05)	3.8	0.33	5.0	1.02
Mean (%GI Biomass within plant size)		(44)		(67)

LSD(0.05) Plant size by rate interaction: 19%

	Redroot pigweed plant height			
	3-12 cm		25-35 cm	
Rate	Plant height	Biomass	Plant height	Biomass
g/ha	cm (% GI)	kg/m^2(% GI)	cm (% GI)	kg/m^2 (%GI)
18 [1]	33.0 (12)	0.26 (58)	42.5 (62)	1.37 (65)
35 [1]	16.7 (55)	0.16 (74)	22.7 (80)	0.30 (92)
53 [1]	11.3 (70)	0.01 (98)	18.3 (84)	0.17 (96)
70 [1]	13.0 (65)	0.02 (97)	18.3 (84)	0.32 (92)
35+COC[2]	19.0 (49)	0.09 (85)	35.0 (69)	0.83 (79)
Control	37.3	0.62	113.3	3.88
LSD(0.05)	10.0	0.16	7.4	0.85
Mean (%GI Biomass within plant size)		(83)		(85)

LSD(0.05) Plant size by rate interaction: NS

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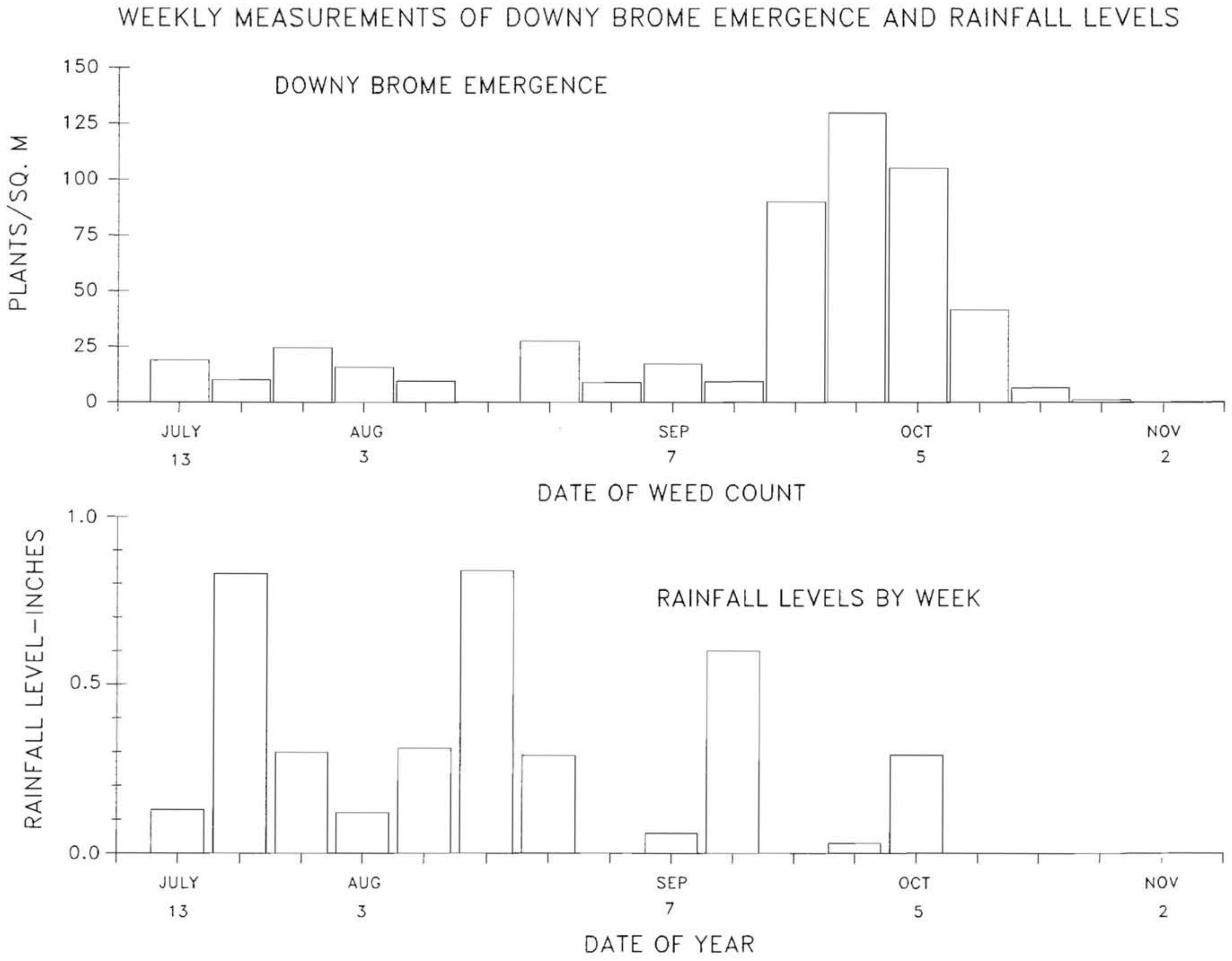
[1] Surfactant Activator 90 added at 0.25% v/v.

[2] Crop oil concentrate added at 0.25% v/v.

[3] Percent growth inhibition when compared to the non-treated control.

Emergence pattern of downy brome and its correlation with precipitation. Anderson, R. L.

Downy brome (Bromus tectorum) seedling emergence was recorded on a weekly basis in 1988 from six plots established in a no-till winter wheat production system. The site had been heavily infested with downy brome for several years. Each week after downy brome plant populations were recorded, the seedlings were removed. The upper figure shows the emergence pattern from July 13 to Nov. 2, 1988. Peak emergence occurred between Sept. 21 and Oct. 5, near the optimal wheat planting time for this region. Precipitation was recorded within 100 m of the site and is shown in the lower figure. Regression analysis was used to correlate precipitation with downy brome emergence. Rainfall totals 0-7, 0-10, 0-14, and 7-14 days before the date seedlings were counted were regressed with seedling numbers. For July and August, the highest correlation occurred between emergence and rainfall received 7-14 days before the date of emergence. The regression line, Y(downy brome seedlings)=6.13 + 16.7X (rainfall level) (r=0.72) indicates that a given unit of rain (0.10 inch) would result in 8 downy brome seedlings/m^2. Linear regression analysis of the September and October emergence date indicated that the highest correlation of downy brome emergence and rainfall occurred when seedling emergence over a 2-week period was regressed with total precipitation 7-14 days before the initial emergence count. The regression equation Y=10.4 + 364.7X (r=0.99) indicated that 0.10 inches of precipitation in September or October stimulated 46 seedlings to emerge, which was almost six times the rate of emergence for the same unit of precipitation in July and August. This increase in downy brome emergence during the fall may be related to a temperature effect on downy brome germination, as the average air temperature during July and August was 23C, but only 14C in September and October. (USDA-ARS, Akron, CO 80720).



WEEKLY MEASUREMENTS OF DOWNY BROME EMERGENCE AND RAINFALL LEVELS

Evaluation of several herbicides for postemergence split applications on control of velvetleaf. Norris, R.F., R.A. Lardelli. Velvetleaf (ABUTH), also known by the common names of Indian mallow and butter print, is becoming an increasingly serious weed in several crops in California. This research was conducted at Davis, California in late summer to evaluate efficacy of several sugarbeet herbicides for control of velvetleaf.

The experiment used a randomized complete block design with 3 replications. Plots were 2 beds on 30 inch center by 12 feet long. Velvetleaf was drill seeded as a single row in each bed. The herbicides were applied broadcast with a CO_2 backpack handsprayer on day 0 (September 6) followed by day 4 and 8 for the split treatments. Carrier volume was 30 gal/A delivered at 30 psi pressure through 8002 flat fan nozzles.

The plots were visually evaluated on September 20 and a destructive harvest made on September 26. Endothal as a single treatment, and the combination of ethofumesate plus the full rate phenmedipham/desmedipham as an eight-day split treatment provided greatest control and the lowest yields at harvest. Phenmedipham/desmedipham as a single or split treatment failed to show any control. (Botany Department, University of California, Davis. 95616)

	Treatment date			ABUTH	
Herbicide[1]	9/6	9/10	9/14	9/20	9/26
	--------- Rate	--------		Control[2]	Yield[3,4]
	------ (lb ai/A)	------		- (%) -	(DW g/4 m)
Phenmedipham/desmedipham	1.30			0 f	100 b
Phenmedipham/desmedipham	0.65		0.65	0 f	124 a
Phenmedipham/desmedipham	0.50	0.40	0.40	3 f	105 ab
ethofumesate	1.50			65 b	47 cd
ethof. + phenm./desm.	1.50 + 1.30			58 bc	50 cd
ethof. + phenm./desm.	1.50 + 0.65		0.65	75 a	23 e
pyrazon	3.00			37 e	52 c
pyrazon + phenm./desm.	3.00 + 0.65		0.65	37 e	51 cd
endothall	2.00			49 cd	28 de
endothall + ethofumesate	2.00 + 1.50			53 cd	34 cde
endothall + phenm./desm.	2.00 + 1.30			45 de	37 cde
endothall + phenm./desm.	2.00 + 0.65		0.65	48 cd	48 cd
Untreated check				0 f	120 ab

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[1] Surfactant X77 added at 0.50% to pyrazon and endothall.
[2] Control, 0 = no control, 10 = dead.
[3] Harvest: 2 rows x 2 meters.
[4] Means within a column followed by the same letter do not differ significantly (5% level) according to Duncan's multiple range test.

Germination of Milium vernale Bieb. Northam, F.E. and R.H. Callihan. The annual grass *M. vernale*, a weed in European winter wheat, was first found in Idaho in May 1987. Subsequent literature research indicates this was the first report for North America. A 1988 survey found several hundred acres infested in north-central Idaho (Idaho County).

The germination response of a 1987 seed lot to temperature, light and age was tested by subjecting florets (caryopses enclosed with tightly adhering paleas and lemmas) to three temperatures and two light treatments. The temperatures were: 8C, 18C and 28C; the two light treatments were a 14 hour light/10 hour dark photoperiod and a continuous dark treatment. Floret ages were zero, two, four and eight months after May 15, 1987 harvest. The florets were in the hard dough to dry grain stage and were disarticulating from the glumes when harvested. Florets were harvested by shaking the panicles into a bag. Each petri dish contained 30 florets and the treatments were replicated three times. A floret was considered germinated when both a radical and plumule were visible. Germinated florets were removed when counted (every seven days).

Table 1 lists the maximum germination in each treatment after 24 weeks in the germination chamber. *Milium vernale* germinated at 8C and 18C, but not at 28C. Even though the florets which were placed in the 18C-light/dark treatment immediately after harvest reached a maximum of 97.7% germination, it took them 14 weeks to begin germinating and 20 weeks to reach maximum germination. The florets placed at 8C and at 18C-dark immediately after harvest did not germinate within 24 weeks. These data indicate the *M. vernale* caryopses have some mechanism that prevents germination when they are first dispersed from the parent plant.

Table 2 shows the results from the first 16 weeks of the 8C and 18C germination tests begun two, four and eight months after harvest. The two-

Table 1. Influence of light, temperature and floret age upon maximum germination of a 1987 *Milium vernale* seedlot after 24 weeks in the germinator.

Germination Conditions	Floret Age months of dry storage after harvest on 15 May 1987 0	 2	 4	 8
	(% Germination after 24 weeks)			
8C Light/dark	0.0*	88.8	30.0	96.6
8C Dark	0.0	84.4	97.7	100.00
18C Light/dark	97.7**	85.5	94.4	92.3
18C Dark	0.0	3.3	92.2	73.3
28C Light/dark	0.0***	0.0***	0.0	0.0
28C Dark	0.0***	0.0***	0.0	0.0

* Each mean is calculated from three replicates with 30 florets each.

** This treatment required 14 weeks to begin germinating and took 20 weeks to reach its maximum.

*** Due to germinator failure, the zero and two months floret ages were subjected to 28C for only 11 and 3 weeks, respectively.

month-old florets germinated faster at 8C. Florets in both the light/dark and dark at 8C reached their maximum germination after two weeks (89% and 84%, respectively). The two-month-old florets in 18C/light reached only 38% after 8 weeks and the 18C/dark resulted in only 3% germination after 16 weeks. In other words florets aged for two months were still not capable of maximum germination after eight weeks at 18C, and florets aged for two months and subjected to 18C/dark conditions did not reach 4.0% germination.

The florets aged for four months and germinated at 18C in the dark had over 90% germination at two weeks in the germinator (Table 2). Florets in the 18C light/dark had 78% germination at two weeks but required over eight weeks to reach 90% germination. Florets in the 8C/dark attained their maximum germination (96.7%) within two weeks. Florets stored for four months and germinated in the 8C-light/dark produced only 30% germination, and based on the 89% germination of the florets stored for two months and germinated in 8C-light/dark, the four-month results are considered errant data.

Florets stored at room temperature for eight months after harvest attained maximum germination within two weeks at both 8C and 18C (Table 2). The 8C-light/dark, 8C-dark and 18C-light/dark treatments resulted in over 92% germination by 14 days. Germination in the 18C/dark treatment was 73%. Results of the 16-month germination test will be necessary to determine whether the lower germination with the 18C-dark treatment was an anomaly.

These results indicate that this M. vernale population is well adapted to germinating in the cool temperature conditions of northern Idaho fields during November and February. Germination at 18C may be inhibited after dispersal from the parent plant for at least 12 weeks. This would prevent emergence during the hot, dry summer months when soil temperatures are usually above 18C. This seedlot did not germinate at 28C, which suggests this species will not germinate during the time warm season weeds emerge. (Idaho Agriculture Experiment Station, Moscow, ID 83843).

Table 2. The effects of temperature, light and floret age on the germination of Milium vernale.

Germination Conditions	Floret age (harvested 15 May 1987)	Germination Time				
		Number of weeks in germinator				
		1	2	4	8	16
	-(months after-- harvest)	(% Germination)				
8C Light/dark	2	0.0*	88.9	88.9	88.9	88.9
8C Dark		1.3	84.4	84.4	84.4	84.4
18C Light/dark		0.0	0.0	0.0	37.8	82.2
18C Dark		0.0	0.0	0.0	0.0	3.3
8C Light/dark	4	0.0	0.0	28.9	28.9	30.0
8C Dark		0.0	96.7	96.7	96.7	96.7
18C Light/dark		6.6	77.8	86.7	87.8	92.2
18C Dark		88.8	91.1	92.2	92.2	92.2
8C Light/dark	8	2.2	96.7	96.7	96.7	96.7
8C Dark		77.8	98.9	100.0	100.0	100.0
18C Light/dark		87.8	92.2	92.2	92.2	92.2
18C Dark		50.0	73.3	73.3	73.3	73.3

* Each mean is calculated from three replicates with 30 florets each.

PROJECT 6.

AQUATIC, DITCHBANK AND NON-CROP WEEDS

Lars Anderson - Project Chairman

Eradication of hydrilla from ponds in Northern California. Dechoretz, N. Hydrilla currently infests seven ponds adjacent to the Sacramento River near Redding, California. Fluridone was applied at a rate of 4.48 Kg ai/ha in May to prevent the growth of hydrilla and production of vegetative propagules during the following growing season. Duplicate water samples were collected from each pond pre, 1, 7, 14, 21, 30, 60, 90, 120, 150, and 180 days after treatment and analyzed for fluridone and N-methylformamide, a photodegredation metabolite produced under laboratory conditions.

Fluridone provided season long control in six of the infested ponds. Hydrilla was controlled in the seventh pond through August. Regrowth was observed in September and subsequently treated with Komeen at 150 L/ha to remove top growth and prevent tuberization.

Maximum concentration (47ppbw) of fluridone in pond water was attained seven days after treatment and remained relatively constant for two months. Fluridone was still detectable (7.2 ppbw) in the pond water 180 days after treatment. N-methylformamide was not detected in any of the water samples. (Department of Food and Agriculture, Sacramento, CA 94271-0001).

Sedimentation velocity of hydrilla propagules. Anderson, L.W.J. Past observations on the large numbers of hydrilla propagules produced on plant shoots above the sediment in the Potomac River populations of monoecious hydrilla suggest that these turions may serve as very effective dispersal agents. The ability to disperse depends in large part of the buoyancy and settling rate of the turions, yet no information is apparently available in the literature. The objective of this study was to determine and compare settling rates of a variety of turion sizes from monoecious and dioecious hydrilla.

Turions and tubers from monoecious and dioecious plants were obtained from outdoor cultures maintained at the USDA/ARS Aquatic Weed facility, and harvested in December and January, 1987 after spring planting. Another set of 158 above-ground propagules was analyzed from a September 1988 collection at Belle Haven marina in the Potomac River. The fresh weight, length and width (diameter) of each propagule was determined and settling velocity was obtained by noting the time required for each to fall 44 cm in an settling column of tap water maintained at 24.5 +/- .5 C. (See Fig. 1). The tap water density was: 0.9962 +/- .0007 g/ml. The mean of three "drops" was determined for each propagule. Between 70 and 100 propagules of each type were assayed (monoecious tubers, monoecious turions, dioecious tubers, dioecious turions) and their settling rate was regressed against their fresh weight. The mean settling velocities of the propagule types were compared using a Fisher PLSD (Duncans-type) separation of means.

Dioecious tubers settled faster than either dioecious turions of monoecious turions (Fig. 2a), but not at a different rate than that of monoecious tubers. When size classes were intentionally segregated in monoecious propagules, the small (50-80 mg) ones settled at ca. 4 cm/sec compared to a higher rate of 6.2 cm/sec for large (>100 mg) ones (Fig. 2b). The importance of size is clearly revealed in regression plots and shows that relatively low settling rates between 2.5 and 4 cm/sec were common among turions but rare in tubers (Fig. 3a, b). By plotting the dispersal potential for a propagule (e.g. turion) dislodged from a 2 meter high plant, one can see that at tidal flow rates in the Potomac (0.25 m/sec) or moderate "runoff" conditions (ca. 1 m/sec), the importance of low settling velocities is apparent (Fig. 4). The mean settling rate of the September Belle Haven samples was similar to the turions from the Davis-produced turions, 3.96 cm/sec, but there were several with rates as low as 1 to 2 cm/sec (Fig. 5), and 7 of the 165 propagules tested floated. (These were not included in the computation of the mean rate.)

Though these measurments are from limited sample sizes, there are some important implications: Allocation of reproductive effort to small, above-group propagules should result in better dispersal and better opportunity to invade new areas. Dispersal of a few hundred to several hundred meters should be feasible under moderate flow conditions. Even with only tidal velocities, propagules attached to floating stems would be capable of long-distance (km) dispersal.

The rapid spread of monoecious hydrilla in the Potomac River since 1983 may be due to high proportion of above-ground propagule production. Previous samples from the Potomac indicate that perhaps one third of total propagules are formed in the water column; whereas, in dioecious hydrilla populations above-sediment propagules are generally rare. (USDA Aquatic Weed Laboratory, Department of Botany, University of California, Davis, CA 95616).

FIGURE 1.
APPARATUS USED FOR DETERMINING PROPAGULE SETTLING VELOCITY

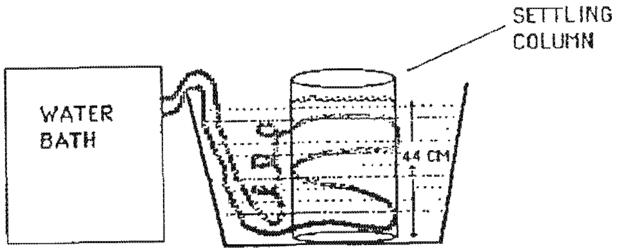
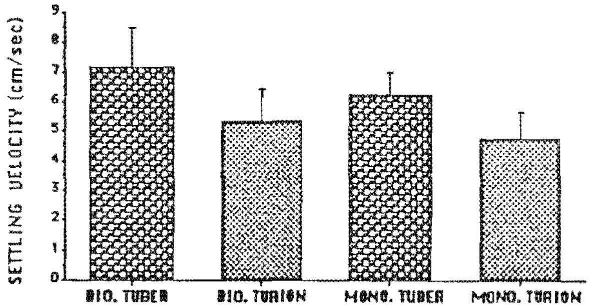
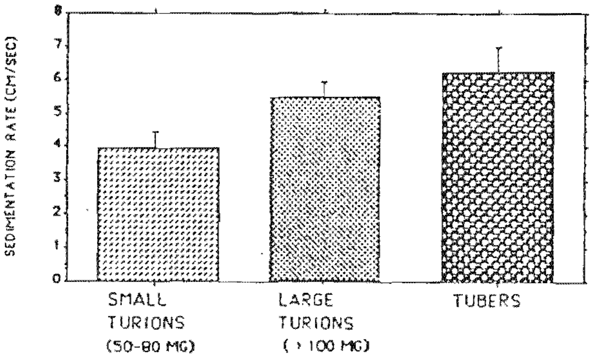


FIGURE 2a
COMPARISON OF *Hydrilla* PROPAGULE SETTLING VELOCITIES



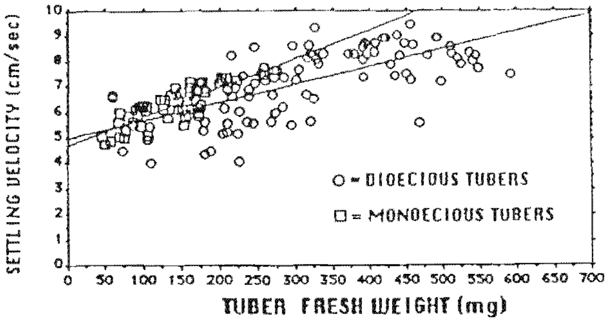
PROPAGULE SEDIMENATION RATES:
MONOECIOUS *Hydrilla verticillata*

FIGURE 2b



COMPARISON OF SETTLING VELOCITIES OF MONOECIOUS AND DIOECIOUS HYDRILLA TUBERS

FIGURE 3a



COMPARISON OF SETTLING VELOCITIES AND WEIGHTS OF MONOECIOUS AND DIOECIOUS *Hydrilla* TURIONS

FIGURE 3b

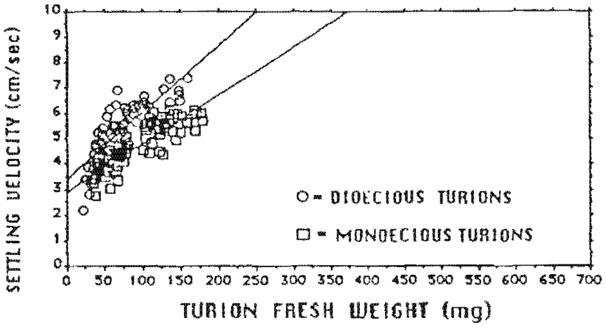
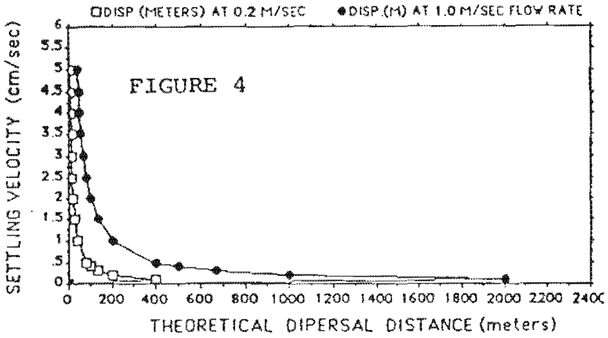
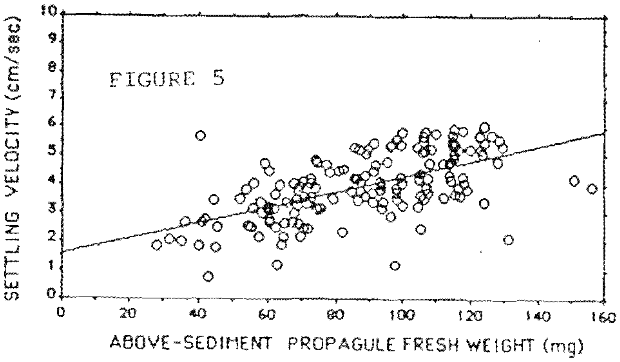


FIGURE 4



SETTLING VELOCITY OF HYDRILLA PROPAGULES: BELLE HAVEN- 9/8/88

FIGURE 5



Inhibition of winter bud formation in Potamogeton nodosus by bensulfuron herbicide: optimal timing of exposure. Anderson, L.W.J. Previous studies at this laboratory have shown that bensulfuron (Mariner^{tm}) can inhibit the formation of propagules in P. nodosus, P. pectinatus, and H. verticillata. The purpose of these experiments was to determine how long after plants are shifted from long-day photoperiods to short day photoperiod they are still susceptible to Mariner's action in preventing winter bud formation in P. nodosus.

Two planting times were used: January 13, 1988 and August 1988. Winter buds from outdoor cultures harvested in fall 1987 were sprouted in tap water in a growth chamber (25 C, LD: 10:14; 150 uE m^2/sec) for three weeks and then planted individually in 1 L plastic containers filled with U.C. mix. Three potted plants (=1 replicate) were immersed in well-water in 24 l pails (41cm height, 29cm dia.) in a glasshouse under natural light supplemented with cool-white fluorescent lamps maintained with a 16:8 photoperiod (long day). Light levels during mid-day were 400 to 600 uE m^2/sec at the surface of the water. Temperature was maintained 22-27 C by glasshouse heaters. After two weeks, the supplementary light was removed leaving only the naturally short-day photoperiod. On the day the short photoperiod started, 1 plant from each of 5 pails was removed and separated into shoots, roots, rhizomes and winter buds and dry weights (except winter buds) were determined. Also, 5 other pails were treated with Mariner at 50 ppbw, and at 2 week intervals thereafter, 5 more pails were treated similarly for a total 4 such treatments. Two weeks after each treatment, one plant from each of the 5 pails was harvested as above. 10 weeks after the start of short photoperiods, all plants were harvested, including 5 pails that had not received any Mariner exposure. Fig. 1 summarizes the treatment and sampling schedule. For the August planting, growth chamber- sprouted winter buds were planted as before, but placed in pails outdoors under natural photoperiod for mid-August (13 hr day). Three weeks later, exposures to 50 ppbw Mariner began on the same schedule as the winter-to-spring treated plants, and sampling was as before.

By the 10 week sampling point, untreated (control) plants produced numerous winter buds in both the spring and fall experiments. Within 4 weeks of the onset of short-day conditions, winter buds had begun to form. However, those plants exposed to Mariner at the onset of short-day conditions, or 2 or 4 weeks thereafter had few if any winter buds (Figure 2a,b). Exposures after 4 weeks did not significantly reduce winter bud production, and in the fall experiments, even the 4 week exposure was apparently too late for significant effect. A comparison of the frequency distributions of winter bud weights at the final harvest of the winter-spring grown plants showed that the exposure at 4 weeks caused a shift in mode from 125-145 mg in the controls to 165-185 mg in the treated plants, which may indicate that Mariner prevented further formation of new (i.e. smaller) winter buds after that the treatment (Figure 3a,b,c). The mode of winter bud size for the 6 week exposures was also 125-145, the same as untreated plants. These results suggest that for optimum inhibition of propagule formation in established P. nodosus, Mariner should be applied no later than 2 to 3 weeks after the onset of short-day (ca. 13hr day) conditions. (USDA Aquatic Weed Laboratory, Department of Botany, University of California, Davis, CA 95616).

FIGURE 1.

Diagram of treatment and sampling schedule for Mariner exposures.

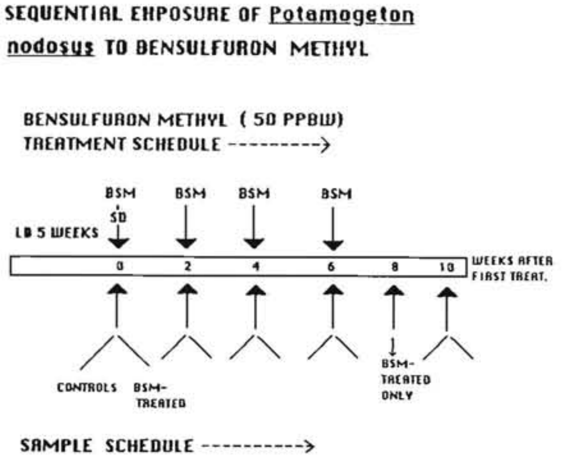
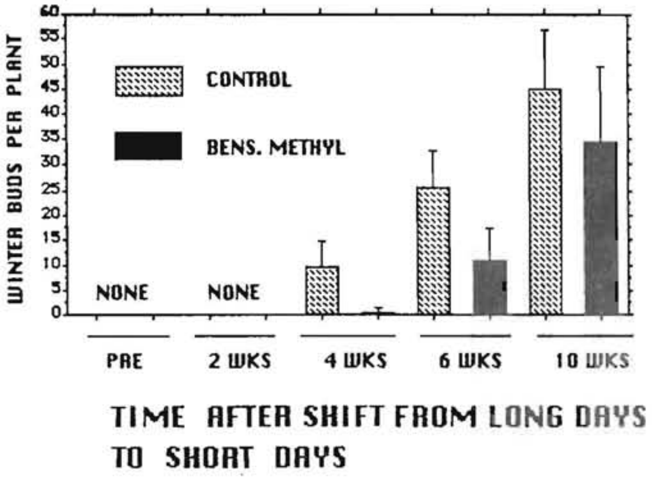


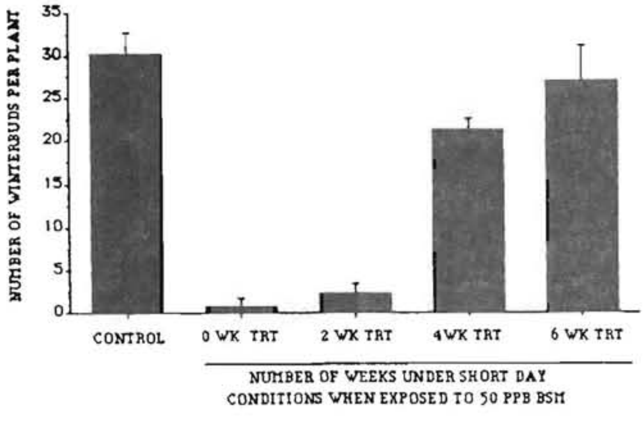
FIGURE 2.

EFFECT OF TIMING OF BENSULFURON METHYL EXPOSURE ON WINTER BUD PRODUCTION IN Potamogeton nodosus.

(a) EARLY SPRING EXPERIMENT



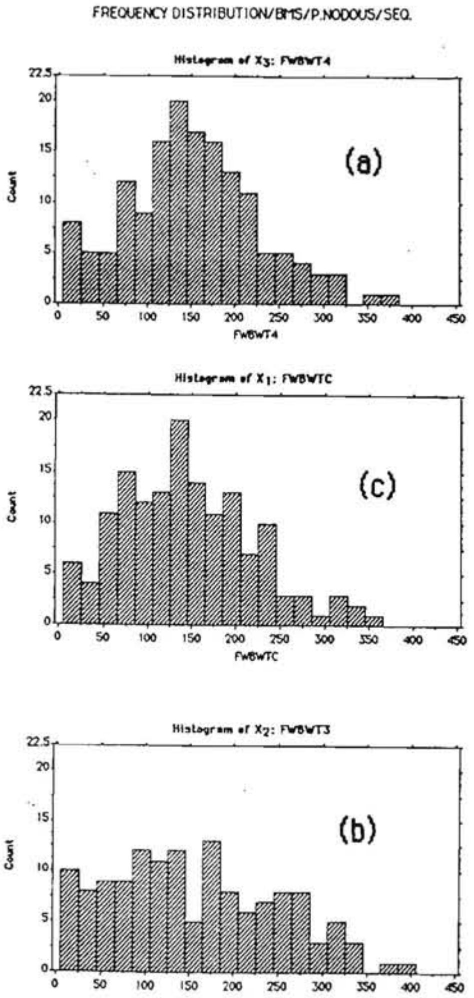
(b) MID-SUMMER/FALL EXPERIMENT



NOTE: ALL PLANTS WERE HARVESTED AFTER 10 WEEKS UNDER SHORT DAY CONDITIONS.

FIGURE 3.

Frequency distribution of winter buds from plants treated with Mariner 6 wk (a) or 4 wk(b) following shift to short-day conditions. Treatments and controls (c) were harvested 10 wk after shift to short days.



Control droplet application effects on malva control in Southern California. D. W. Cudney, N. E. Jackson, and J. S. Reints. Malva (Malva parviflora) is a serious weed pest in both cropped and non cropped sites in Southern California. In noncrop sites malva germinates with the first winter rainfall and has a growth cycle that is perfectly adapted to the Mediterranean climate of the region. A convenient, easy to use herbicide application method might make malva control easier, particularly for managers of small acreages who need to control this pest.

A low spray volume, control droplet applicator was tested for efficacy by comparison with a standard 30 gallon per acre application which used 8003 TeeJet flat fan nuzzles. The control droplet applicator (Nomix system) used a prepackaged formulation of glyphosate and a formulation containing a combination of MCPP and 2,4-D. The control droplet applicator utilized these two formulations directly without mixing. This simplified application greatly over the standard method which involves mixing the herbicide(s) with water and calibration and cleanup of the sprayer.

Two rates of MCPP + 2,4-D (1.1 + 0.5 and 2.2 + 1.0 lbs ai/A) and two rates of glyphosate (1.6 and 3.2 lbs ai/A were applied with the control droplet system at spray volumes of 1 and 2 gal/A respectively. These low volume applications were compared with 1.6 and 3.2 lbs ai/A of glyphosate applied with the flat fan sprayer at the 30 gallon/A application. Applications were made on February 11, 1988. Plots were arranged in a completely randomized block design. Malva height and malva control ratings were made on February 29. Percent control (based on one m^2 malva counts), malva height and 10 plant malva fresh weight was recorded on March 14.

Applications of glyphosate with the control droplet applicator were more effective in controlling malva than were applications of MCPP + 2,4-D. When comparing the applications of glyphosate with the control droplet and the flat fan sprayer, the control droplet application provided better malva control. Control droplet application, when compared at the same rate of active ingredient of glyphosate, showed greater effects on reducing malva height and malva control for both evaluation dates than did the flat fan application. Thus, under the conditions of this test the premixed control droplet applicator, which offered ease of use also provided better malva control with glyphosate. (University of California, Riverside, Botany and Plant Sci. Dept., Riverside, CA 92521.)

Control droplet application
Riverside, 1988 (Malva)

Treatment	lb ai/A	gal/A	Height (cm) 2/29/88	Weed[1] Control 2/29/88	Percent[2] Control 3/14/88	Height (cm) 3/14/88	10 Plants Fresh Weight (gm) 3/14/88
2,4-D, MCPP	1.6	1	14.6	4.0	73.8	13.6	44.4
2,4-D, MCPP	3.2	2	15.6	5.0	83.8	11.0	34.6
glyphosate	1.6	1	17.6	4.8	99.6	0.0	16.0
glyphosate	3.2	2	17.8	5.8	100.0	0.0	13.7
glyphosate	1.6	30	23.0	2.3	88.3	15.0	25.9
glyphosate	3.2	30	19.8	4.0	98.0	5.6	20.4
control	-	-	28.3	0.0	0.0	37.3	97.3
LSD(5%)			2.8	1.2	6.2	5.1	13.6

[1] Weed control rating: 0 = no control; 10 = all weeds dead.
[2] Percent weed control based on malva counts of weeds per m^2.

Spreading dogbane control on roadsides. Burrill, L.C. Spreading dogbane is a common weed of roadsides in the Willamette Valley of Oregon. Because this perennial weed is not controlled by most commonly used roadside herbicides, it is often seen growing alone in large clumps or strips on roadsides. Several herbicides and combinations of herbicides were tested on spreading dogbane when it was found that the Oregon Extension Service had no information on chemical control of the weed.

On July 13, 1987, plots 6 by 20 feet were treated along a section of paved road where a uniform population of spreading dogbane was growing. Treatments were replicated three times. Herbicides were applied with a hand-held plot sprayer fitted with four 8002 flat fan nozzles. Water was used as the carrier at 31 gal/a.

Triclopyr, alone or with 2,4-D, was the only herbicide to give more than 80% control two months after treatment (see table) but one year after treatment control by glyphosate was complete. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Spreading dogbane control
Polk County Oregon

Herbicide	Rate	Percent Control	
	lb ae/a	Sept. 7, 1987	July 7, 1988
2,4-D LVE	2.0	40	17
picloram	0.5	17	13
picloram	1.0	10	43
dicamba	0.5	7	0
dicamba	1.0	13	10
dicamba + 2,4-D (Weedmaster)	0.5 + 1.5	27	13
dicamba + 2,4-D (Weedmaster)	1.0 + 3.0	47	13
triclopyr (ester)	1.0	84	57
triclopyr (ester)	2.0	92	85
triclopyr + 2,4-D (Crossbow)	0.5 + 1.0	48	45
triclopyr + 2,4-D (Crossbow)	1.0 + 2.0	78	13
glyphosate + X-77	1.0 + 0.5%	23	98
glyphosate + X-77	2.0 + 0.5%	73	100
bromacil	4.0	33	20
bromacil	8.0	30	7
metsulfuron + X-77	1 oz ai/a + 0.5%	28	7
metsulfuron + X-77	2 oz. ai/a + 0.5%	20	23

Simulated drawdown applications to assess lateral mobility of bensulfuron herbicide. Anderson, L.W.J. Field applications of Mariner under drawdown conditions have resulted in reductions of plant height and biomass. Since this approach to weed control may have potential for movement of herbicide off site when canals are refilled, a preliminary study was conducted to simulate drawdown applications and to assess lateral movement to sediments immediately adjacent to treated areas.

Canal sediment was obtained from Richvale I.D., sieved to remove propagules, dried and broken into small particle size. Twenty-four plastic troughs, 75 cm long by 13 cm wide by 9 cm deep were filled with the canal sediment. Mean dry weight of trough plus sediment was 7.9 kg. Well water was added to completely saturate sediments and the wet weight of each trough was determined. Troughs were allowed to dry in a glasshouse until moisture (based on dry weights) in 6 troughs each reached 0, 25%, 50% and 100%. Twenty-seven Potamogeton pectinatus tubers in 9 sections (rows) of three each were planted 1.5 to 2 cm deep by carefully lifting the upper sediment surface. The middle three sections were masked off from the adjacent sections with a vertical plastic shield and this area (=treated zone) was sprayed with Mariner at 0.1 or 0.25 kg/ha with a carrier volume of 935 1/ha or 1870 1/ha. The center sections of two troughs from each moisture regime were sprayed with either 935 1/ha or 1970 1/ha well water and served as controls (Figure 1). Forty-eight hours after applications, troughs were immersed in outdoor cement vaults and flushed continuously with well water for 1 week and weekly thereafter. At 28 to 30 DAT, length of each plant was measured and troughs were photographed. At 65 DAT, troughs were removed from the vaults, photographed, and a surface sediment sample (ca. 0.5 cm deep) from each treated zone (and control center zone) was placed in four plastic petri dishes (6 cm dia by 2 cm deep) for bioassay with Lemna gibba (duckweed). Each of the nine sections was separated by slicing the trough with a knife. Plants in each section were washed from the sediment and the following recorded: longest shoot length (from sediment); dry weight of shoots, roots and rhizomes and numbers and individual fresh weights of tubers.

The Mariner treatments inhibited elongation of plants in all center sections (Figure 2a-d); whereas no differences in lengths of plants occured between any of the sections of the control troughs, nor those in the non-treated sections adjacent to the Mariner treatments. Mariner had no apparent effect on germination since germination at 30 DAT was ca. 98% for the treated and untreated zones. At final harvest, 65 DAT, tubers were produced abundantly in the control troughs and in the non-treated areas adjacent to the Mariner-treated sections (Figure 2). However, tuber production was reduced by ca. 80% in the middle sections that received the bensulfuron applications at 0.25 kg/ha compared to the non-treated middle sections of the control troughs. The moisture content of the sediments at the time of Mariner application did not produce a discernable difference on tuber production or plant length except for the zero % troughs, which had fewer tubers and shorter plants in all troughs. (Figure 2 is a composite of the other soil moisture treatments.) When the tuber production within a treated zone or non-treated zone is compared (after compositing all the 25, 50 and 100 % moistures and the two carrier volumes, n=6), it is clear that the presence of 0.25 kg/ha Mariner in the treated zone reduced tuber production in the non-treated sections (Figure 3). It appeared that the 0.1 kg/ha Mariner treatment affected the size distribution in the 50% moisture troughs (Data are not yet complete on the other treatments). There was a greater proportion of larger tubers (i.e. >200 mg) and smaller percentage of those <70 mg. This may be due in part to inhibition of tuber initiation which might therefore result in fewer small tubers; however, the reason for the greater number of larger tubers is unclear. Since the 0.1 kg/ha rate suppressed growth only partially, acting to "thin" the plant density, perhaps there was less intraspecies competition and more allocation to the individual tubers that formed. Futher analysis of the other moisture regimes and a repeat of this experiment may shed more light on this.

Results of the bioassays indicated that 65 DAT, Mariner was still active in the surface sediments, though actual levels were not determined. Since Mariner was apparently present throughout the two month duration of the experiment, the significant reduction in the growth and propagule production in non-treated sections may be due to (1) diffusion and movement within the water column (though vaults were flushed weekly); (2) later mobility within the sediment and (3) encroachment of adjacent plants (via rhizomes) into the treated sections. Few rhizomes were seen growing along the length of the troughs; most appeared to move toward the sides of the trough. P. pectinatus is extremely sensitive to Mariner so it is possible that very low concentrations close to the sediment/water interface over the two months may have affected all plants within the troughs. To resolve this, followup experiments will include bioassays of all sections and an indicator planting will be included adjacent to the troughs. However, even the high rate permitted relatively good growth and tuber production in the untreated section of the treated troughs. The rather sharp demarcation between the sections resembles the effects seen in the field drawdown trials and shows that if there is some lateral movement, it probably is at a very low rate. (USDA Aquatic Weed Laboratory, Department of Botany, University of California, Davis, CA 95616).

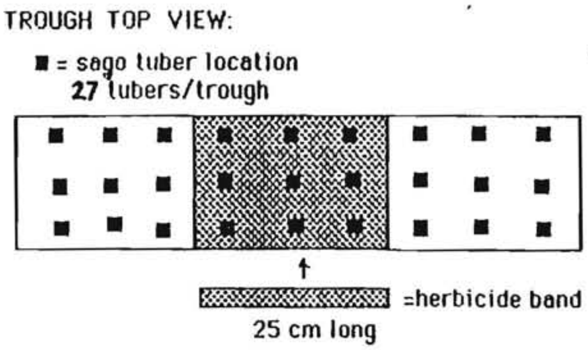
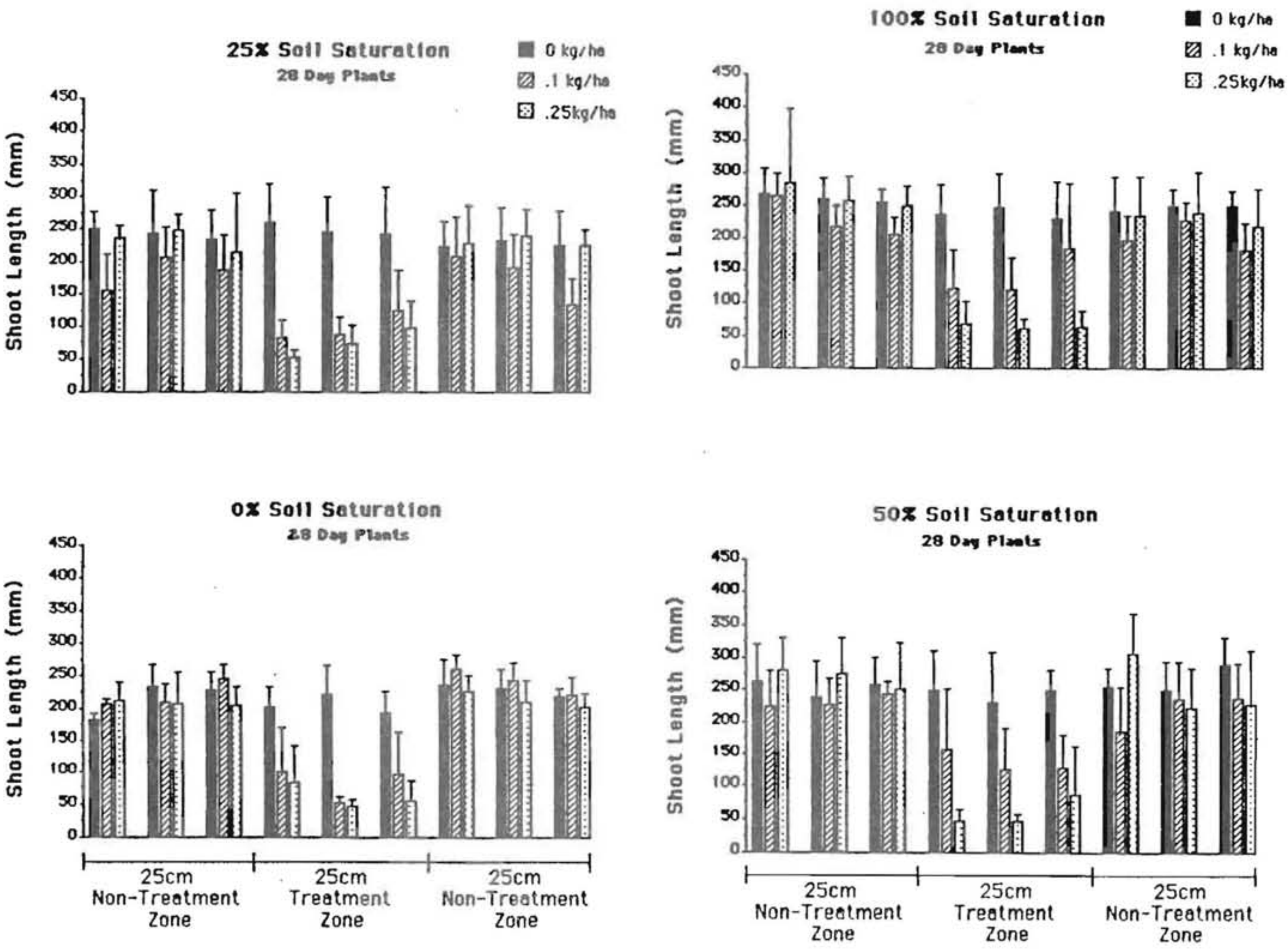


Figure 1. Diagram of trough and planting arrangement for simulated drawdown application of Mariner.

Figure 2. Effect of Mariner on elogation of P. pectinatus 28 days after simulated drawdown application.



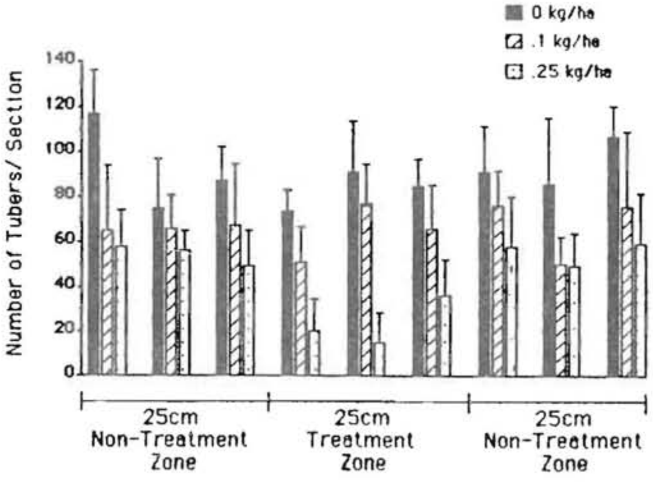


Figure 3. Effect of Mariner on tuber production in P. pectinatus 65 day after simulated drawdown application (n= 6 for each section).

On the potential for flooding canals during the winter to disrupt aquatic weed life cycles Spencer, D.F. and Ksander, G.G. Variable pondweed (Potamogeton gramineus) is a weed in irrigation canals. Plants survive periods of drawdown as winter buds which sprout in the spring when water begins flowing in the canal. Timing of winter bud sprouting is critical to the plant's survival in this environment. Our purpose was to determine if winter buds of P. gramineus are capable of sprouting during the normal drawdown period. If they are, it might be possible to disrupt the life cycle by flooding the canal earlier than normal. Since only standing water would be present, plants could be treated with herbicides not normally used in flowing water.

Two experiments were performed. P. gramineus winter buds were collected from the Byrnes canal (Solano Irrigation District, CA) during the drawdown period of 1987-88 (November 4; November 16; December 11, 1987; and January 5, 1988). They were washed in tap water, placed in aluminum foil-covered flasks containing tap water and incubated at 24 C. Sprouting was monitored at 2 to 3 day intervals. In the second experiment, 20 cores (each core was approximately 15 cm diameter and 15 to 25 cm tall) were collected from the Byrnes canal on January 12, 1988. The cores were placed in plastic containers. Ten cores were placed in a 1000 L tank filled with water. The other 10 cores were covered with loosely fitting lids and put in a dry tank. The cores were exposed to outdoor conditions to simulate conditions in a canal flooded at this time of year. Core temperatures were recorded at 2 to 3 day intervals. Emergence of plants from the cores was monitored weekly. After 8 weeks, the submerged containers were harvested to determine the total number of winter buds per core versus the number that had emerged. The containers in the dry vault were place in the vault containing well water. These were monitored as described above. A second set of cores was collected from the Weyend canal (Solano Irrigation District, CA) in February. Two groups of 5 cores each were treated as above.

For 3 of the 4 collection dates more than 80 % of the winter buds sprouted by the end of the incubation period. For the fourth collection date just under 60 % of the winter buds sprouted. This implies that most winter buds were not innately dormant. Winter buds sprouted and plants emerged from the first set of cores within 27 days of their being flooded. Within an additional 21 days, plants from all the winter buds (31) had emerged. No plants emerged from the dry cores. The dry cores were flooded on March 8, and the first plants emerged 6 days later. Temperatures for the initially dry cores were warmer during the dry period and this probably accounted for the rapid sprouting following flooding. Winter bud sprouting and emergence in cores from the Weyend canal displayed a similar pattern. The results of these experiments demonstrate that flooding a canal during the normal drawdown period would result in sprouting of the majority of winter buds. This suggests that disrupting the life cycle by early flooding of a canal may be a useful method for managing growth of aquatic weeds in irrigation canals. (USDA Aquatic Weed Laboratory, Department of Botany, University of California, Davis, CA 95616)

PROJECT 7.

CHEMICAL AND PHYSIOLOGICAL STUDIES

Rick A. Boydston - Project Chairman

Inhibition of acetyl-CoA carboxylase from tall fescue chloroplast extracts by haloxyfop applied alone and in combination with dicamba.

Aguero, R., D.J. Armstrong and A.P. Appleby. Haloxyfop and several related herbicides have been shown to inhibit acetyl-CoA carboxylase (ACCASE) from several grass species while not affecting the same enzyme from broadleaf plants. This is thought to be the main mechanism by which these herbicides exert their action.

Dicamba has been found to antagonize haloxyfop action. The present studies were conducted to test if such antagonism was expressed through a reversal in the inhibition of haloxyfop on ACCASE activity.

Acetyl-CoA carboxylase was extracted from 18 to 20 day-old tall fescue shoots by macerating 15 g of fresh tissue in a pre-chilled mortar to which 50 ml of the following buffer were added: 100 mM tricine-KOH, pH 8.3; 10% v/v glycerol; 10 mM B-mercaptoethanol; 1 mM Na_2EDTA; and 1 mM phenylmethyl sulfonyl fluoride. All extract manipulations were conducted at 4 C. The crude extract was purified through a series of centrifugation steps followed by protein precipitation with the addition of solid polyethylene glycol (M.W.= 8000) up to 14% w/v.

Acetyl-CoA carboxylase activity was assayed in reaction volumes of 250 µl containing: 50.8 mM tricine-KOH, pH 8.3; 2 mM DTT; 2 mM ATP; 10 mM $NaH^{14}CO_3$ (0.26 µCi/µmol); approximately 0.2 µg protein/µl; 0.32 mM acetyl-CoA; and appropriate concentrations of the acid form of the herbicides (technical grade).

To overcome solubility limitations in aqueous solutions, haloxyfop stock was prepared using ethanol 95% v/v. The final ethanol concentration in the reaction mixture was 1.9% v/v which did not significantly inhibit the enzyme activity in preliminary experiments. The enzyme activity was linear for the first 20 minutes. A 15 minutes reaction time was used for all herbicide experiments.

The results obtained to date indicate that dicamba does not reverse the inhibitory effect of haloxyfop on acetyl-CoA carboxylase activity in cell-free systems. A 20 µM concentration of haloxyfop inhibited the activity of the enzyme by 50%. Dicamba at concentrations as high as 1000 µM did not have a significant effect on the enzyme activity, a result that contrasts with 2,4-D for which a similar concentration was reported to cause a 50% inhibition.

Additional experiments with other forms of the herbicides as well as with bentazon are currently being conducted. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Tolerance of soybean, red fescue, and tall fescue to root-absorbed haloxyfop. Aguero, R., and A.P. Appleby. Haloxyfop-methyl is a relatively new herbicide developed for selective postemergence grass control in a wide range of broadleaf species. Red fescue is one of the few grass species with tolerance far above commercial rates of this herbicide. Haloxyfop has been reported to have soil activity for up to 13 weeks.

Differences in susceptibility between these species have recently been explained in terms of differential inhibition of haloxyfop on the activity of the enzyme acetyl-CoA carboxylase. This study was conducted to quantify and compare the tolerance of the three species to root-absorbed haloxyfop.

Single experiments for each species were conducted using randomized complete block designs with four replications in growth chambers set at 27/22 C (day/night) and 400 µE.m-2.s-1 for soybean, and 18/12 C (day/night) and 300 µE.m-2.s-1 for the two grass species. Photoperiod for all species was 15 h.

Appropriate haloxyfop concentrations were provided through the nutrient solution consisting of Hoagland #2 (pH adjusted to 6.5) to 2-week old soybean plants (2nd trifoliolate leaf starting to expand) and 3-week old grasses (2-3 leaf stage).

GR50 values were obtained 12 days after treatment by linear regression on the average of plant dry weight values.

Soybean plants were 17 times more tolerant to haloxyfop than red fescue which was 9 times more tolerant than tall fescue. The order of tolerance coincides with field and laboratory results with foliar sprays of haloxyfop and sethoxydim reported by other authors. However, haloxyfop appears to be much more phytotoxic than sethoxydim.

When root and foliage GR_{50} values from root-absorbed haloxyfop were compared, the organs had a similar response in soybean, but roots of the grass species were more susceptible than their respective foliage.

Additional experiments with tall fescue (data not included) showed that when root-absorbed, a nearly 35 times lower concentration of haloxyfop was needed to reduce foliage weight by 50% as compared to the foliar application. This suggests that preemergence activity of this herbicide may have a significant impact on the potential selectivity to be expected. (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Haloxyfop concentrations producing 50% weight reduction in three species

Plant organ	Haloxyfop concentration (µM)		
	tall fescue	red fescue	soybean
foliage	0.630	4.20	67
roots	< 0.075*	1.25	65
foliage + roots	0.440	3.90	67

*lowest rate used (sensitivity of roots for the range of concentrations used did not allow the determination of a GR_{50} value through regression)

Absorption and translocation of root-absorbed haloxyfop in soybean, red fescue, and tall fescue. Aguero, R., and A.P. Appleby. Experiments were conducted to characterize and quantify the root absorption of haloxyfop and its distribution into roots and shoots.

The three species were grown at the same time in a single growth chamber set at 27/22 C day/night temperature with a photoperiod of 15 h and a light intensity of 400 $\mu E.m^{-2}.s^{-1}$ from a mixture of fluorescent and incandescent tubes.

An experiment was conducted for each species using randomized complete block designs with three replications and five timings of exposure (48, 96, 144, 192, and 240 h after treatment).

Soybean plants were grown in 250-ml Erlenmeyer flasks and the grasses in 50-ml test tubes. Half-strength Hoagland #2 nutrient solution (pH adjusted to 6.5) was used as the nutrient media and as the herbicide solvent.

For all species, ^{14}C-haloxyfop concentration was 30 nM which provided approximately 600 dpm/ml of nutrient solution.

At each harvest time, shoots and roots were separated, oven-dried at 75 C for 48 h, and ground to achieve homogenization. Representative samples were then solubilized and counts were recorded with a liquid scintillation counter.

Absorption and distribution patterns between roots and shoots were determined by forced linear regression (intercepts forced thru zero) using percentage absorption of total activity originally added to the nutrient solution as the dependent variable and time of exposure to the "hot solution" as the independent variable. Absorption and translocation of ^{14}C-haloxyfop in these species were compared by the slopes of the fitted models.

In soybean and tall fescue, radioactivity increased at the same rate in roots and shoots ($P \leq 0.01$); thus a single regression model was fitted for roots + shoots in these species. Red fescue translocated ^{14}C-haloxyfop to shoots at nearly half the rate of root absorption ($P \leq 0.01$).

Absorption and translocation of ^{14}C-haloxyfop in soybean was higher than either grass species ($P \leq 0.01$). (Crop Science Department, Oregon State University, Corvallis, OR 97331)

Regression models for root-absorbed ^{14}C-haloxyfop in three species

Species/organ	Regression model	R^2
soybean	Y = 0.097 X	0.94
tall fescue	Y = 0.044 X	0.98
red fescue:		
roots	Y = 0.068 X	0.99
shoots	Y = 0.034 X	0.97

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(by common name or code designation)

This table was compiled from approved nomenclature adopted by the Weed Science Society of America (Weed Science 35(5):1986) and the herbicide handbook of the WSSA (5th 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
A-1237	not available	211, 250, 305, 388
AC-222,293	(+)methyl-6-(4-isopropyl-4-methyl- 5-oxo-2-imidazolin-2-yl)-m-toluate	172, 238, 359, 400
AC-263,499	see imazethapyr	269, 313
acetochlor	2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide	300
alachlor	2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl)acetamide	169, 261, 265, 269, 273, 284, 286, 290
amitrole	1H-1,2,4-triazol-3-amine	100, 201
ammonium nitrate	same	150
ammonium thiosulfate	same	150
atrazine	6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine	50, 112, 155, 276 278, 280, 282, 284, 290, 292, 294, 296, 298, 300, 308, 310, 312, 365
barban		335, 381
BAS-517	2-[1-(ethoxyimino)butyl]-3-hydroxy-5-(2H-tetrahydrothiopyran-3-yl)-2-cyclohexen-1-one	321

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ABBREVIATIONS USED IN THIS REPORT

a or ac	acre(s)
A	amine
ae or a.e.	acid equivalent
ae/a or a.e./a	acid equivalent per acre
ai or a.i.	active ingredient
ai/a or a.i./a	active ingredient per acre
ai/ha	active ingredient per hectare
AGGRI	*Agropyron griffithsi*
AGRSM	*Agropyron smithii*
AMABL or Prpw	prostrate pigweed (*Amaranthus blitoides*)
AMARE	redroot pigweed (*Amaranthus retroflexus*)
AMS	ammonium sulfate
am-thio	ammonium thiosulfate (12-0-0-26)
A.G.	annual grasses (downy brome, green foxtail and barnyardgrass)
ANTCO	mayweed chamomile (*Anthemis cotula*)
AN-20	ammonium nitrate (20-0-0)
appl	application
Apr	April
AR	synthetic A Russian wildrye
AREHO	*Arenaria hookerii*
ARTER	fringed sagewort (*Artemisis frigida*)
ASTSP	spoonleaf milkvetch (*Astragalus spatulatus*)
Aug	August
AVEFA	wild oats (*Avena fatua*)
bian	biannually
BM	Bromar mountain bromegrass
BR	Bozoisky Russian wildrye
BRACA	volunteer rape
BROMG	brome, mountain
BROTE or Dobr	downy brome (*Bromus tectorum*)
BRSNI or SOLNI	black nightshade (*Solanum nigrum*)
bu	bushels per acre
bu/a	bushel/a
BYGR or ECHCG	barnyardgrass (*Echinochloa crus-galli*)
C	degree(s) Celsius
CAPBP	shepherdspurse (*Capsella bursa-pastoris*)
CDA	controlled droplet applicator
CEC	cation exchange capacity
CEC/meq	cation exchange capacity/milliequivalent
CENSO	yellow starthistle (*Centaurea solstitialis*)
CHEAL	common lambsquarters (*Chenopodium album*)
CIRAR	Canada thistle (*Cirsium arvense*)
cm	centimeter
CO	Colorado
CO_2 or CO	carbon dioxide

ABBREVIATIONS USED IN THIS REPORT (Cont'd.)

COC, C.O.C. or c.o.c.	crop oil concentrate
CONAR	field bindweed (Convolvulus arvensis)
CRP	Conservation Reserve Program
CRUAC	thistle, plumeless
CRYCA	Crypthantha caespitosa
CRYCE	Crypthantha celosiodes
CT	Critana thickspike wheatgrass
CV or cv	coefficient of variation
cwt/A	hundred weight per acre
DAT	days after treatment
DESPI	pinnate tansymustard (Descurainia pinnata)
DF or df	dry flowable
diam, di	diameter
DMRT	Duncan's multiple range test
dpm	desintegrations per minute
DW	dry weight
E	emulsifiable
EC	emulsifiable concentrate
ECHOG	barnyardgrass
ES	emulsifiable solution
EDA-Cu	ethylene diamine copper complex
encap.	encapsulated
Enquik	monourea sulfuric acid
EPHES	leafy spurge (Euphorbia esula)
EPOE	early postemergence
ERACN	stinkgrass (Eragrostis cilianensis)
ERION	Eriogonum ovolofolium
ES or es	ester
F	degrees Fahrenheit
f	fall
FL or F	flowable
FLR	flowering
FRSTO	skeletonleaf bursage (Ambrosia tomentosa)
ft	foot or feet
ft^2 or sq ft	square feet
g or gm	gram
G	granule
GA	gibberellic acid
GL	granular lignin
GALAP	catchweed bedstraw (Galium aparine)
gal/A, gal/a, G/A GPA or gpa	gallon(s) per acre
g/plot	grams/plot
Grft or SETVI	green foxtail (Setaria viridis)

ABBREVIATIONS USED IN THIS REPORT (Cont'd.)

GR_{50}	rate required to reduce growth by 50%
GUESA	broom snakeweed (*Gutierrezia sarathrae*)
h	hour
ha	hectare
HAPAC	*Haplopappus acaulis*
HAPNU	*Haplopappus nuttalli*
HC	Hycrest crested wheatgrass
HELAN	common sunflower (Helianthus annuus)
HORJU	foxtail barley
HORVL	volunteer barley
ht	height
in	inch(es)
Jul	July
Jun	June
KCHSC or KOC4P	kochia (*Kochia scoparia*)
kg	kilogram
kg/ha	kilogram(s) per hectare
km	kilometer
km/hr or kph	kilometer(s) per hour
KO	Kochia
kPa	kilopascal
2K	2% active
L	liter
L/ha or l/ha	liter(s) per hectare
lb	pound
lb/a, LB/A or lb/A	pound(s) per acre
lb ai/A, lbs ai/A, lb a.i./A or lb ai/a	pound(s) active ingredient per acre
lb/bu	pound(s) per bushel
lf	leaf
LINDA	toadflax, Celsium
LP	low pressure
LSD	least significant difference
LVE	low volatile ester
m	meter
m^2	square meter
Mar	March
MAT	months after treatment
MB	Magnar basin wildrye
MEDSA	volunteer alfalfa
mil	1 thousandth of an inch

ABBREVIATIONS USED IN THIS REPORT (Cont'd.)

min	minute
µCi	microcurie
µE	microeinsteins
µl	microliter
mm	millimeter
µmol	micromol
mM	milimolar
mph	miles per hour
M.W.	molecular weight
N	nitrogen
N	north
nM	nanomolar
n.s., ns or NS	nonsignificant
No. or no.	number
Nov	November
NW	northwest
OC or oc	oil concentrate
Oct	October
OM	organic matter
o/o v/v	percent volume per volume feet
oz	ounce
oz/A or oz/a	ounce(s) per acre
oz ai/A or oz ai/a	ounce(s) active ingredient per acre
p or %	percent
P	phosphorus
P	probability
PANCA	witchgrass
PANMI	proso millet (*Panicum miliaceum* L.)
PE	preemergence
PES	preemergence surface
pH	-log hydrogen ion concentration
pl or plt	plant(s)
plt/ft^2	plant(s) per square foot
PHLHO	Hoods phlox (*Phlox hoodii*)
PM or pm	package mix
POASE	bluegrass
POLCO	wild buckwheat (*Polygonum convolvulus*)
POROL	common purslane (*Portulaca oleracea*)
POST, Post, or post	postemergence
PPI or ppi	preplant incorporated
ppb	parts per billion
ppm	parts per million
ppbw	parts per billion by weight
ppmw	parts per million by weight

ABBREVIATIONS USED IN THIS REPORT (Cont'd.)

Pre	preemergence
PROLO	unicorn-plant (*Proboscidea louisianica*)
PS	prior slender wheatgrass
psi	pounds per square inch
ptly cloudy	partly cloudy
PW	pigweed
qt	quart
qt/A	quart(s) per acre
r	correlation coefficient
RAPRA	*Raphanus raphanistrum*
RCB	randomized complete block
Rdwt	root dry weight
red.	reduction
RM	Regar meadow bromegrass
RN	Renex 36
R^2	coefficient of determination
RW	Rosana western wheatgrass
s	second/seconds
S	surfactant
S	south
SASKR, SALIB or Ruth	Russian thistle (*Salsola iberica*)
SASAL	tumble mustard (*Sisymbrium altissimum*)
Sdwt	shoot dry weight
SECCE	volunteer rye (*Secale cereale*)
SENVU	*Senecio vulgaris*
Sep	September
SETLU	yellow foxtail (*Setaria clauca*)
SETVI	green foxtail
SINAR	wild mustard (*Sinapis arvensis*)
SOLCU	buffalobur (*Solanum sarrachoides*)
SOLSA	hairy nightshade (*Solanum sarrachoides*)
SOLTR	cutleaf nightshade (*Solanum triflorum*)
sp	spring
SORHA	johnsongrass
ss	stainless steel
SS	Sodar streambank wheatgrass
stand red	stand reduction
STEME	common chickweed (*Stellaria media*)
STICO	*Stipa comata*
surf or s	surfactant
SW	southwest
SSW	south southwest

ABBREVIATIONS USED IN THIS REPORT (Cont'd.)

t	metric ton
temp	temperature
THLAR	field pennycress
THIIN	*Taeniatherum caput-medusae*
T/A	ton(s) per acre
t/ha	ton(s) per hectare
til	tiller
TRAZX	volunteer wheat
TRBTE	puncturevine (*Tribulus terrestris*)
UCCGC	yucca (*Yucca glauca*)
V/V or v/v	volume per volume
var.	variety
VEG	vegetative
veg coc	vegetable crop oil concentrate
W	west
WDG	water dispersable granule
wks	weeks
WP or wp	wettable powder
wt	weight
w/v	weight to volume
w/w	weight per weight
yd	yard
yr	year