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FORWARD

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Stephen D. Miller
Editor, Research Progress Report
Western Society of Weed Science;
1994

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PROJECT 1

WEEDS OF RANGE AND FOREST

Keith W. Duncan - Project Chairperson

Control of red alder seed germination using pre-plant broadcast herbicide applications: Fourth-year status report. Figueroa, P.F. Red alder is a major hardwood competitor to conifers in the Pacific Northwest. It is a prolific seeder that seeds in from adjacent natural stands and rapidly develops forming an overtopping canopy that suppresses conifer growth. Current standard control methods allow alder to develop until densities exceed a competition threshold (usually between ages six and ten years).

Most aerial herbicide control methods use a 2,4-D spring-foliar release treatment. The spring-foliar release window is narrow since it is between the time red alder leaves have developed to at least 75% of their previous years full size, and Douglas-fir terminal bud expansion is less than 1.5 inches (on less than 5% of the trees). This is the time Douglas-fir has the lowest risk of herbicide injury and when the alder is most sensitive. This guide can result in having an operational treatment window that ranges from a few days to several weeks depending on climatic and growing conditions from year to year. This leaves the conifers on these untreated acres under more severe competition further reducing conifer growth.

An alternative alder control strategy is to prevent red alder seed from germinating through the use of soil-active herbicides. This would eliminate or reduce future need for conifer release treatments. A research test was established to evaluate several soil active herbicides and their ability to prevent alder seed from germinating and developing into conifer competitors. The study was established in an area where there was a high probability of alder seed germination.

The test was established in Weyerhaeuser Company's Southwest Washington Region on a site that had been burned as a site preparation treatment in the fall of 1988. Red alder seed germination was assessed on 48 0.03 acre treatment plots that were treated with imazapyr, asulam, atrazine, and sulfometuron. Treatments were applied as pre-plant and pre-plant plus repeat broadcast application treatments to prevent alder seed from germinating. Blocks were established to correspond to seeding distances from a mature alder seed stand. These blocks represented zones 50 to 100, 100 to 150, 150 to 200, and 200 to 250 feet from the seed source. Pre-plant herbicide treatments were initially applied three weeks prior to planting 2+0 Douglas-fir seedlings (3/6/89). Follow-up release treatments were done in March 1990 and February 1991. Treatments were as follows:

Check	no herbicide treatment
Asulam (1.7 lb)	year 0 only (Aug 1989)
Imazapyr (0.15 lb)	year 0, year 0+1, year 0+1+2
Atrazine (4.0 lb)	year 0, year 0+1, year 0+1+2
Atrazine (4 lb year 0+1+2 plus asulam (1.7 lb) year 0	year 0,1,2; Aug 1989 for asulam
Sulfometuron (2 oz)	year 0, year 0+1, year 0+1+2

Alder seed germination patterns resulted in highest seed germination beginning closest to the seed source then progressing outward to further distances. After four years, red alder seed germination has progressed into the 200 to 250 feet zone from seed source. As shown in the table below, the non-treated check plots had alder densities averaging 2533 tpa in the closest zone and diminishing at the furthest distances. The same trend was seen for the other treatments as shown in Figure 1.

The following fourth-year results are based on an evaluation of the red alder seeding germination data for the 50 to 100 feet zone only to compare treatment effects. Alder germination ranged between 0 and 6133 seedlings per acre across all treatments. The non-treated check plot averaged 2530 alder per acre while the asulam and imazapyr 0, 0+1, and atrazine 0, treatments had higher levels of alder germination (Figure 2). Predominant height is the average co-dominant level of the stand. Predominant height of red alder ranged between 0 and 9.98 feet after four years amongst treatments (Figure 3).

At this age in the stand, alder seedling density differences could be related to chance, but it appears applications of sulfometuron were effective at preventing alder seed from germinating. Visual observations revealed a generally higher degree of vegetation control, and increase in Douglas-fir growth on sulfometuron treated plots (compared to the non-treated check and the atrazine and imazapyr plots) suggest there are other positive gains from sulfometuron in addition to controlling red alder germination.

In sites where the risk of natural seeding of red alder is high, use of soil-active herbicides, multiple year applications of sulfometuron or atrazine may provide preventative control of red alder. This type of treatment may reduce or eliminate a conifer release treatment at a later date. Future assessments of this site are planned to further evaluate long-term herbicide treatments effects on red alder seedling growth, overall vegetation control, and Douglas-fir growth. (Weyerhaeuser Company, 505 North Pearl Street, Centralia, WA 98531).

Table. Red alder density and mean height for ages 3 and 4 by distance zone from the alder seed source for the non-treated check plots.

Distance from Seed Source	Red Alder Density age 3	Red Alder Density age 4	Red Alder Mean Height age 3	Red Alder Mean Height age 4
(feet)	(tpa)	(tpa)	(feet)	(feet)
50 - 100	2267	2533	6.4	10.0
100 - 150	433	1000	3.2	6.9
150 - 200	67	100	0.5	2.4
200 - 250	0	0	0.0	0.0

Ryderwood, 9100 Road herbicide screening trial. Red alder seeding density and height four years after Douglas-fir plantation establishment. Asulam applied at 1.7 lb, imazapyr at 0.15 lb, atrazine at 4.0 lb, and sulfometuron at 2 oz.

Figure 1. Red alder density by treatment by zone from the seed source.

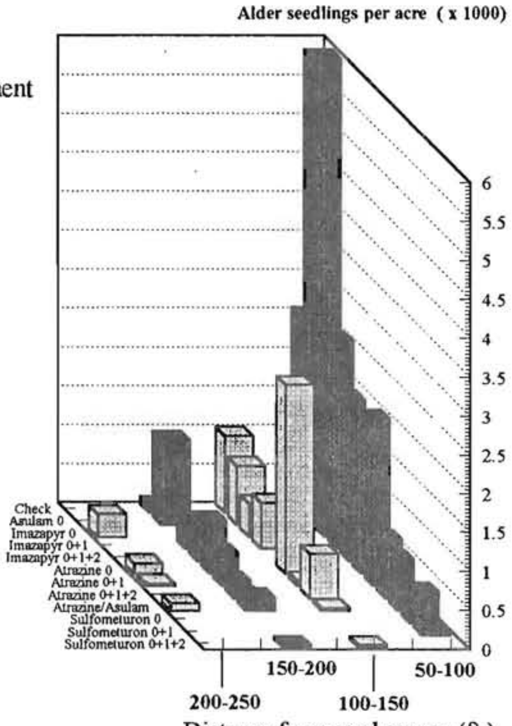


Figure 2. Red alder density in the 50 to 100 ft. zone from the seed source by treatment.

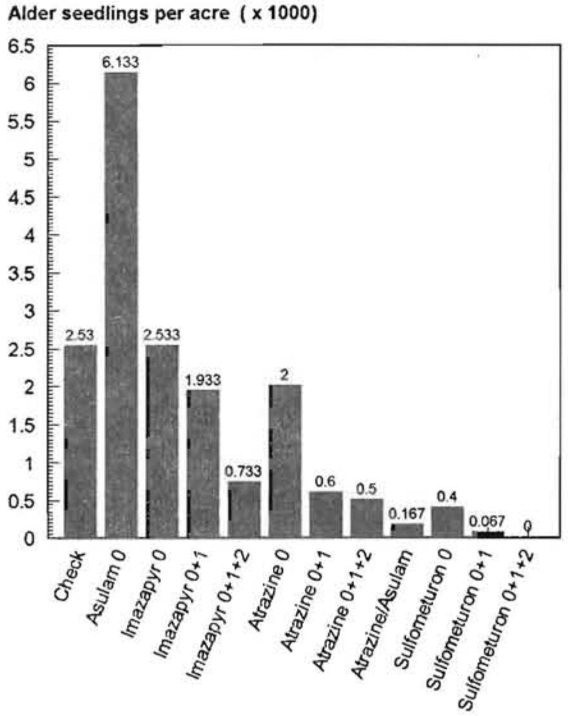
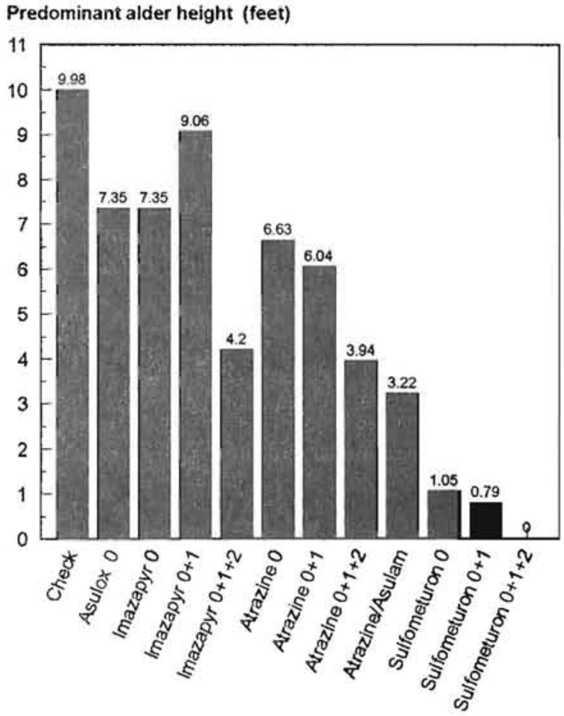


Figure 3. Red alder mean height in the 50 to 100 ft. zone from the seed source by treatment.



Percent live canopy of downy brome infested rangeland following one, two and three annual applications of paraquat and glyphosate (Kaycee, WY). Tom D. Whitson, Gerald E. Fink, R.E. Swearingen, D.C. Meyers. Research was established on rangeland at the Means Old 88 Ranch, Kaycee, WY to evaluate successive annual herbicide treatments for control of downy brome (*Bromus tectorum* L.). The studies were established at two downy brome growth stages, 2 to 8 leaf and early bloom. Treatments were applied to 35 by 660 ft. single blocks with four randomized permanent transects established within each block. Herbicides were applied with a tractor mounted sprayer delivering 13 gpa at 35 psi. Applications were made April 9, 1991 (air temp. 48F, relative humidity 48%, wind N 2-5 mph, sky clear, soil temp. - 0 inch 45F, 2 inch 45F and 4 inch 42F) downy brome was in the 2 to 3 leaf stage 1 inch tall and May 17, 1991 (air temp. 55F, relative humidity 55%, wind calm, sky cloudy, soil temp. - 0 inch 53F, 2 inch 49F and 4 inch 55F) to downy brome in the 2 to 8 leaf stage. April 23, 1992 (air temp. 59F, relative humidity 59%, calm winds, clear sky, soil temp. - 0 inch 67F, 2 inch 63F and 4 inch 63F) Downy brome was in the 2 to 8 leaf stage at the time of treatment. The second growth stage application was made May 6, 1992 (air temp. 80F, relative humidity 32%, calm winds, clear sky, soil temp. - 0 inch 70F, 2 inch 70F and 4 inch 65F) to downy brome with 50% seed head emergence and April 29, 1993 (air temp. 65F, relative humidity 60%, clear sky, wind SW 2-3 mph, soil temp. - 0 inch 60F, 2 inch 62F and 4 inch 62F) downy brome was in the 2 to 3 leaf stage and on June 11, 1993 (air temp. 70F, relative humidity 71%, wind S 1 mph, clear sky, soil temp. - 0 inch 85F, 2 inch 75F and 4 inch 75F). Downy brome was in early bloom. Downy brome was heavy with a uniform distribution.

A single application of either glyphosate or paraquat did not effectively reduce downy brome stands. Two successive applications of paraquat provided excellent stand reductions of downy brome with the application at early bloom consistently reducing downy brome greater than 90% in all treatments. When three successive applications of paraquat were made downy brome control was 98% in all treatments regardless of time of application. Glyphosate was more consistent when applied at the early bloom stage and all treatments averaged 94% control. No blue grama (Bouteloua gracilis H.B.K.) Lag. ex Steud., threadleaf sedge (Carex filifolia Nutt.), needle and thread (Stipa comata Trin. and Rupr.) or perennial forbs were reduced by any treatment. Some Western wheatgrass (Agropyron smithii Rydb.) reduction were found in all treatments which might be attributed to extreme cattle grazing following the removal of downy brome. Bare ground increases were found in almost all treatments especially with applications made when downy brome was in mid-bolt.

Table. Percent live canopy of downy brome infested rangeland following one, two and three annual applications of paraquat and glyphosate. (Kaycee, WY)

Treatment[1]	Rate	Year	BROTE[2] 2-8 lf	BROTE EB	STICO 2-8 lf	STICO EB	BOUGR 2-8 lf	BOUGR EB	CARFI 2-8 lf	CARFI EB	AGRSM 2-8 lf	AGRSM EB	Misc forb 2-8 lf	Misc forb EB	Bare G 2-8 lf	Bare G EB
			Percent live canopy cover[3]													
Paraquat	0.5	1991	11	18	37	31	18	20	3	1	2	2	7	7	22	18
Paraquat	0.5	1991,1992	3	3	31	36	28	25	4	1	1	1	8	6	25	28
Paraquat	0.5	1991,1992,1993	1	1	20	37	36	31	6	0	1	0	7	3	29	28
Paraquat	0.7	1991	13	5	27	38	37	23	2	1	0	2	4	3	16	28
Paraquat	0.7	1991,1992	4	8	24	24	38	20	4	2	2	2	9	12	20	30
Paraquat	0.7	1991,1992,1993	1	0	26	40	24	26	4	0	1	1	10	5	32	29
Paraquat	0.9	1991	15	8	41	28	10	29	2	1	2	1	5	3	24	30
Paraquat	0.9	1991,1992	2	1	34	40	11	17	6	2	1	2	14	8	31	30
Paraquat	0.9	1991,1992,1993	0	0	16	37	26	22	13	1	0	0	9	3	35	37
Paraquat	1.1	1991	36	7	19	29	16	26	3	2	2	1	6	2	18	32
Paraquat	1.1	1991,1992	17	1	33	39	16	21	4	1	1	0	16	5	13	33
Paraquat	1.1	1991,1992,1993	1	0	10	28	31	30	9	0	1	0	7	4	40	38
Glyphosate	0.38	1991	44	30	20	16	7	15	0	0	12	10	4	3	13	25
Glyphosate	0.38	1991,1992	19	17	29	31	14	0	0	0	9	1	5	4	24	26
Glyphosate	0.38	1991,1992,1993	22	3	30	22	23	28	0	0	3	1	4	2	19	44
Glyphosate	0.5	1991	21	13	26	30	21	26	0	0	8	1	6	2	18	26
Glyphosate	0.5	1991,1992	9	12	33	29	27	22	0	0	0	4	9	5	18	28
Glyphosate	0.5	1991,1992,1993	1	4	33	24	36	26	0	0	1	7	7	1	18	38
Glyphosate	0.63	1991	10	38	27	12	34	15	0	0	3	11	9	4	17	19
Glyphosate	0.63	1991,1992	9	19	35	21	25	16	0	0	0	9	11	8	20	26
Glyphosate	0.63	1991,1992,1993	10	2	35	26	9	14	0	0	1	6	16	2	29	48
Glyphosate	0.75	1991	38	23	26	25	7	21	0	0	3	3	15	3	11	21
Glyphosate	0.75	1991,1992	31	14	13	35	9	17	0	0	2	5	22	2	20	21
Glyphosate	0.75	1991,1992,1993	8	0	23	27	13	20	0	0	1	1	16	2	34	49
Check	--	-------	33	33	18	18	14	14	0	0	18	19	2	1	15	15

1Treatments applied April 9, 1991, April 23, 1992 and April 29, 1993 downy brome 2 to 8 leaf stage, May 17, 1991, May 6, 1992 and June 11, 1993 downy brome early bloom.
[2]BROTE - Bromus tectorum, STICO - Stipa comata, BOUGR - Bouteloua gracilis, CARFI - Carex filifolia, AGRSM - Agropyron smithii, Misc. forb - miscellaneous forbs, Bare G. - Bare ground, 2-8 lf - 2 to 8 leaf, EB - Early Bloom.
3Weed control live canopy based on 400 pint frame counts/treatment, July 28-30, 1993.

Percent live canopy of downy brome infested rangeland following one, two and three annual applications of paraquat and glyphosate (Lusk, WY). Tom D. Whitson, R.J. Swearingen, D.C. Meyer and A. Lauer. Research was established on rangeland at the Brown Ranch, Lusk, WY to evaluate successive annual herbicide treatments for control of downy brome. The study was established to compare treatments applied at two growth stages of downy brome (*Bromus tectorum* L.). Treatments were applied to 35 by 660 ft. single blocks with four randomized permanent transects established within each block. Herbicides were applied with a tractor mounted sprayer delivering 13 gpa at 35 psi. Application information: April 25, 1993 (air temp. 70F, relative humidity 70%, wind S 3-4 mph, sky clear and soil temp. - 0 inch 60F, 2 inch 60F and 4 inch 56F). Downy brome was in the 6 to 8 leaf stage, May 29, 1991 (air temp. 75F, relative humidity 65%, wind SE 2-5 mph, sky clear and soil temp. - 0 inch 84F, 2 inch 74F and 4 inch 74F). Downy brome was in early bloom. April 21, 1992 (air temp. 40F, relative humidity 68%, wind W 4-5 mph, sky clear and soil temp. - 0 inch 67F, 2 inch 62F and 4 inch 60F) downy brome was in the 1 to 2 leaf growth stage. May 8, 1992 (air temp. 90F, relative humidity 50%, wind calm, sky clear and soil temp. - 0 inch 90F, 2 inch 90F and 4 inch 85F) when downy brome was in the early bloom stage and on May 13, 1993 (air temp. 69F, relative humidity 60%, wind SE at 3-6 mph, sky clear and soil temp. - 0 inch 69F, 2 inch 75F and 4 inch 70F) when downy brome was in the 3 to 4 leaf stage. June 9, 1993 (air temp. 75F, relative humidity 71%, wind S 2-3 mph, sky cloudy and soil temp. 0 inch 85F, 2 inch 77F and 4 Inch 78F) when downy brome was in the early seed head stage. Soils: clay loam (41% sand, 35% silt, 24% clay with 1.7% organic matter and a 7.6 pH). Downy brome was moderate to heavy in the study area with a uniform distribution.

Downy brome live canopy cover reductions were found with all treatments applied in the 2 to 8 leaf stage and greater control was found in areas treated 3 times. When treated in the early bloom stage all paraquat treatments repeated three times had over 99% downy brome population reductions. All glyphosate treatments applied two or three times in the 2 to 8 leaf stage had 98% downy brome control. No perennial grasses growing in association with downy brome were reduced with any herbicide application.

Percent live canopy of downy brome infested rangeland following one, two and three annual applications of paraquat and glyphosate. (Lusk, WY)

			Percent live canopy cover[3]											
			BROTE[2]		AGRSM		BOUGR		OPUPO		Misc forb		Bare G	
Treatment[1]	Rate	Year	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB
Paraquat	0.5	1991	4	40	2	1	75	43	2	1	3	2	14	1
Paraquat	0.5	1991,1992	3	22	3	0	75	61	1	0	2	11	16	3
Paraquat	0.5	1991,1992,1993	4	0	2	1	69	82	1	1	1	7	22	7
Paraquat	0.7	1991	4	42	9	2	61	43	0	1	2	4	23	5
Paraquat	0.7	1991,1992	3	17	2	0	73	55	1	0	3	21	12	5
Paraquat	0.7	1991,1992,1993	1	0	2	1	75	76	1	1	1	10	19	11
Paraquat	0.9	1991	5	27	4	0	70	57	1	3	4	6	15	5
Paraquat	0.9	1991,1992	1	20	1	0	68	58	1	0	3	15	22	2
Paraquat	0.9	1991,1992,1993	0	0	0	0	82	74	0	0	2	8	14	17
Paraquat	1.1	1991	2	4	5	9	76	60	1	4	1	2	14	17
Paraquat	1.1	1991,1992	4	2	4	0	76	77	2	2	3	5	11	15
Paraquat	1.1	1991,1992,1993	1	1	3	1	75	67	1	0	2	5	0	22
Glyphosate	0.38	1991	4	1	8	7	61	71	4	5	1	3	18	13
Glyphosate	0.38	1991,1992	6	0	4	6	73	81	4	2	2	2	11	8
Glyphosate	0.38	1991,1992,1993	0	0	4	11	70	71	1	5	1	0	22	13
Glyphosate	0.5	1991	9	5	6	10	67	71	3	4	5	1	9	10
Glyphosate	0.5	1991,1992	4	1	2	4	78	70	4	11	1	4	10	10
Glyphosate	0.5	1991,1992,1993	1	1	0	4	78	69	5	7	1	4	13	14
Glyphosate	0.63	1991	5	11	5	6	71	58	5	6	1	2	13	9
Glyphosate	0.63	1991,1992	2	2	2	9	81	53	2	2	1	9	12	18
Glyphosate	0.63	1991,1992,1993	0	0	7	11	67	50	2	2	1	6	20	28
Glyphosate	0.75	1991	1	3	1	15	78	56	7	4	0	2	11	16
Glyphosate	0.75	1991,1992	2	1	1	7	82	47	7	1	0	8	6	26
Glyphosate	0.75	1991,1992,1993	0	0	0	3	78	43	8	0	1	4	13	37
Check	--	-----	21	49	2	1	49	42	2	0	5	1	21	3

[1]Treatments applied April 25, 1991, April 21, 1992, May 13, 1993 to downy brome in the 2 to 8 leaf stage, May 29,1991, May 8, 1992, June 9, 1993 to downy brome in the mid-bolting to early bloom stage.
[2]BROTE -Bromus tectorum, AGRSM - Agropyron smithii, BOUGR - Bouteloua gracilis, OPUPO - Opuntia polyacantha, Misc forb - miscellaneous forbs, Bare G - Bare ground, 2 to 8 lf - 2 to 8 leaf stage, EB - early bloom stage for downy brome
[3]Weed control live canopy based on 400 point frame counts/treatment, July 16-17, 1993.

Percent live canopy cover of rangeland infested with downy brome following glyphosate and paraquat applications made in 2 to 8 leaf and early bloom stages. (Kaycee, WY) Tom D. Whitson, G.E. Fink, D.C. Meyers, and R. J. Swearingen. Plots were established on rangeland near Kaycee, WY infested with downy brome (Bromus tectorum L.) (BROTE) to evaluate the efficacy of various application rates of glyphosate and paraquat. 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 knapsack sprayer delivering 10 gpa at 30 psi April 29, 1993 when downy brome was in the 2 to 8 leaf stage (air temp. 65F, relative humidity 60%, wind SW 0-3 mph, sky clear and soil temp. - 0 inch 60F, 2 inch 62F and 4 inch 62F) and on June 10, 1993 when downy brome was 50% headed and in the early bloom stage (air temp. 70F, relative humidity 70%, wind N 3 -5 mph, sky clear and soil temp. - 0 inch 70F, 2 inch 75F and 4 inch 70F). The soil was a silt loam (21% sand, 40% silt, 39% clay with 2.6% organic matter and pH 6.6). Live canopy counts were made July 28-30, 1993. Downy brome infestations were moderate but uniform throughout the experimental site.

Downy brome control was better with treatments made when downy brome was in early bloom than during the 2 to 8 leaf stage of growth. Applications of glyphosate with non-ionic surfactant made at the early bloom stage gave greater control at lower application rates. Paraquat at application rates greater than 0.5 lb/A provided excellent downy brome control at the early bloom stage. No western wheatgrass (Agropyron smithii Rydb. (AGRSM) thinning occurred when treatments were applied in the 2 to 8 leaf stage but paraquat applications greater than 0.4 lb/A and glyphosate applied with a non-ionic surfactant at rates of 0.39 lb/A or above resulted in 50 to 60% thinning. The warm season grass blue grama (Bouteloua gracilis (H.B.K.) Lag. ex. Steud) was not reduced with any treatment. The amount of bare ground was higher when treatments were applied in the early bloom stage.

Table. Percent live canopy cover of rangeland infested with downy brome following glyphosate and paraquat applications made in the 2 to 8 leaf and early bloom stages. Kaycee, WY.

Treatment[1]	Rate	BROTE[2]		AGRSM		BOUGR		Misc. forb		Bare G.	
		2-8 lf	EB	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB
		Percent live canopy cover[3]									
Glyphosate	0.13	29	12	55	38	8	20	2	7	6	23
Glyphosate	0.26	19	8	59	50	7	20	2	4	13	18
Glyphosate	0.39	34	8	44	28	5	33	3	6	13	25
Glyphosate	0.52	16	1	47	30	18	38	2	3	17	28
Glyphosate+NIS	0.13	29	3	51	43	8	26	2	3	10	25
Glyphosate+NIS	0.26	23	3	50	23	14	36	4	9	9	29
Glyphosate+NIS	0.39	45	0	39	16	5	39	4	5	7	40
Glyphosate+NIS	0.52	21	1	53	12	9	37	3	12	14	38
Paraquat+NIS	0.3	16	1	60	21	9	50	2	8	13	20
Paraquat+NIS	0.4	17	8	51	15	18	38	2	4	12	35
Paraquat+NIS	0.5	16	0	56	15	14	39	4	9	10	37
Paraquat+NIS	0.6	26	1	51	10	10	44	3	10	10	35
Paraquat+NIS	0.7	20	0	47	13	15	41	4	16	14	30
Check		30	31	49	29	6	23	7	9	8	8

[1]Treatments applied April 29, 1993 2 to 8 leaf stage, and June 10, 1993 early bloom stage.
[2]BROTE - Bromus tectorum, AGRSM - Agropyron smithii, BOUGR - Bouteloua gracilis, Misc. forb - miscellaneous forbs, Bare G. - bare ground, 2-8 lf - 2 to 8 leaf, EB - early bloom, NIS - non-ionic surfactant.
[3]Weed control based on 200 point frame counts/treatment, percent live canopy July 28-30, 1993.

Percent live canopy cover of rangeland infested with downy brome following glyphosate and paraquat applications made in 2 to 8 leaf and early bloom stages. (Lusk, WY) Tom D. Whitson, Archie Lauer, D.C. Meyers and R.J. Swearingen. Plots were established on rangeland near Lusk, WY infested with downy brome (Bromus tectorum L. (BROTE) to evaluate the efficacy of various application rates of glyphosate and paraquat. 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 knapsack sprayer delivering 10 gpa at 30 psi May 13, 1993 when downy brome was in the 2 to 8 leaf stage (air temp. 69F, relative humidity 60%, wind SE 3-5 mph, sky clear and soil temp. - 0 inch 69F, 2 inch 75F and 4 inch 70F) and June 9, 1993 when downy brome was in early bloom (air temp. 75F, relative humidity 71%, wind S 2-3 mph, sky cloudy and soil temp. - 0 inch 85F, 2 inch 77F and 4 inch 78F). The soil was a clay loam (41% sand, 35% silt and 24% clay with 1.7% organic matter and a pH of 7.6). Live canopy counts were made July 2 and 3, 1993. Downy brome stands were heavy and uniform throughout the study site.

Treatments of glyphosate at 0.39 and 0.52 lb/A during the early bloom stage and all paraquat applications at the 2 to 8 leaf and early bloom stages controlled greater than 90% of the downy brome. No blue grama (Bouteloua gracilis (H.B.K.) Lag. ex. Steud or plains pricklypear (Opuntia polyacantha Haw.) stand reductions were found with any treatment. Bare ground was higher with treatments applied in the early bloom stage compared to the 2 to 8 leaf stage.

Table. Percent live canopy cover of rangeland infested with downy brome following glyphosate and paraquat applications made in 2 to 8 leaf and early bloom stages, Lusk, WY.

Treatment[1]	Rate	BROTE[2]		AGRSM		BOUGR		OPUPO		Misc forb		Bare G	
	lb/A	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB	2-8 lf	EB
		Percent live canopy cover[3]											
Glyphosate	0.13	9	36	21		61	59	1	1	2		6	3
Glyphosate	0.26	4	18			81	68	5	3		3	10	8
Glyphosate	0.39	8	2			79	76	2	4	2		8	17
Glyphosate	0.52	8	3			66	75	5	2	5	1	16	19
Glyphosate+NIS	0.13	14	34	5		69	57	2	2	3	1	6	5
Glyphosate+NIS	0.26	4	5	6		73	76	2	2	1	1	14	14
Glyphosate+NIS	0.39	7	4	20		57	54	1		2		11	42
Glyphosate+NIS	0.52	11	4	11	4	77	70	3	2	2	2	6	17
Paraquat+NIS	0.3	1	3	1		80	78	3	3	6	1	7	12
Paraquat+NIS	0.4	4	2	1		86	84	1	1	2	1	2	12
Paraquat+NIS	0.5	1	1	29	9	57	72		1	4	4	8	12
Paraquat+NIS	0.6	2	0			85	77	3		2	5	7	14
Paraquat+NIS	0.7	3	1	8		74	75	2	2	2	1	11	21
Check	--	49	38		4	38	50	2	1	5	2	4	3

[1]Treatments applied May 13, 1993 in the 2 to 8 leaf, June 9, 1993 in early bloom.
[2]BROTE - Bromus tectorum, AGRSM - Agropyron smithii, BOUGR - Bouteloua gracilis, OPUPO- Opuntia polyacantha, Misc forb - miscellaneous forbs, Bare G - Bare ground, 2-8 lf - 2 to 8 leaf, EB - early bloom, NIS - non-ionic surfactant
[3]Weed control based on 200 point frame counts/treatment, % live canopy cover, July 2 and 3, 1993.

Spring versus fall application of herbicides for silky crazyweed control. K.C. McDaniel. Silky crazyweed is common on western rangelands causing locolism in livestock if grazed. Research was conducted on Johnson Mesa near Folsom, New Mexico to compare spring (June) and fall (September) applications of selected herbicides. Plots were 30 by 30 ft. with three replications in a randomized complete block. Herbicides were broadcast with a CO_2 pressurized hand-held sprayer (10 ft.) delivering 21 gpa at 60 psi on September 11, 1991 (AT 57°F, ST 59°F @ 6", RH 83%), September 14, 1992 (AT 73°F ST 75°F @ 6", RH 31%), June 10, 1992 (AT 68°F, ST 67°F @ 6", RH 75%) and June 2, 1993 (AT 65°F, ST 77°F @ 6", RH 38%). Soil was a clay loam and moist during all applications. Plants were in early flower during spring spraying and in post-fruiting in fall. Ten plants were individually flagged in each plot at the time of spraying. The number of flagged plants dead 12 mos. post-treatment were used to calculate apparent mortality.

Herbicides generally provided more effective silky crazyweed control when applied in early June compared to September. Because removal of this plant is extremely important to prevent livestock toxicity, desired plant control should exceed 95%. Metsulfuron, picloram and 2,4-D applied alone or in combination provided effective control when applied during the early bloom stage. (Department of Animal and Range Sciences, New Mexico State University, Las Cruces, NM 88003)

Table. Evaluation of various herbicides for silky crazyweed control in northeastern New Mexico.

Herbicide	Rate	Application date 6/92	6/93	9/91	9/92
	(oz ai/ac)	Apparent Mortality			
Metsulfuron	0.1875	100	83	70	70
Metsulfuron	0.375	100	99	99	79
	(lb ai/ae)				
Picloram + 2,4-D	0.25 + 0.375	99	96	96	86
Picloram	0.25	100	86	89	72
Picloram	0.375	97	-	94	58
2,4-D LV amine	4.0	100	97	30	76
Dicamba	0.5	87	57	35	96
Dicamba + 2,4-D	0.25 + 1.0	82	44	-	71

Control of hairy goldenaster with various herbicides at two growth stages and two locations. Tom D. Whitson, Phil A. Rosenlund and R.J. Swearingen. Plots were established at two locations near Cheyenne, WY to evaluate the efficacy of various herbicides applied at two growth stages on hairy goldenaster (*Heterotheca villosa*) (Pursh) Shinners. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Herbicides were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 30 gpa at 41 psi. Application information on the True Ranch, May 21, 1992 when hairy goldenaster was 3 to 4" tall in the vegetative stage (air temp. 63F, relative humidity 50%, wind SW 2-5 mph, sky partly cloudy and soil temp. - 0 inch 83F, 2 inch 78F and 4 inch 65F) on July 2, 1992 when hairy goldenaster was in full bloom (air temp. 82F, relative humidity 43%, wind calm, sky clear, soil temp. - 0 inch 89F, 2 inch 84F and 4 inch 80F). The soil was sandy (88% sand, 5% silt and 7% clay with 4.7% organic matter and pH 6.1). Herbicides were applied on Warren Livestock Co., May 21, 1992 when hairy goldenaster was 3 to 4" tall in the vegetative stage (air temp. 60F, relative humidity 55%, wind W 3-5 mph, partly cloudy and soil temp. - 0 inch 68F, 2 inch 65F and 4 inch 60F). July 24, 1992 when hairy goldenaster was in full bloom (air temp. 81F, relative humidity 43%, wind 0, sky clear and soil temp. - 0 inch 81F, 2 inch 80F and 4 inch 75F). The soil was loamy sand (73% sand, 14% silt and 13% clay with 2.3% organic matter and a pH 6.8). Hairy goldenaster was moderate to heavy but well distributed throughout the experimental site.

Picloram at 0.5 lb/A provided greater than 85% control at the vegetative and bloom stages at both locations. Dicamba combined with 2,4-D at 1.0+1.0 lb/A provided greater than 93% control at both locations when applied in the vegetative growth stage.

Table. Control of hairy goldenaster with various herbicides at two growth stages and two locations.

		No. of hairy goldenaster and % control in vegetative and bloom stages[3]							
		True Ranch				Warren Livestock			
	Rate	vegetative		bloom		vegetative		bloom	
Treatment[1]	lb/A	no.	%	no.	%	no.	%	no.	%
Clopyralid+2,4-D	0.13+0.6	139	22	151	03	116	24	73	48
Clopyralid+2,4-D	0.19+1.0	85	52	153	01	96	37	66	53
Clopyralid	0.13	210	0	70	55	137	10	60	57
Clopyralid	0.19	170	05	138	11	77	49	107	24
Picloram	0.13	142	20	85	45	121	20	59	58
Picloram+2,4-D	0.13+0.5	96	46	46	70	72	53	14	90
Picloram	0.25	84	47	28	82	59	61	28	80
Picloram	0.5	17	90	05	97	22	85	02	99
Check	--	178	0	155	0	152	0	141	0
Dicamba	1.0	120	33	98	37	57	62	82	42
Dicamba	2.0	31	83	40	75	14	91	68	52
Dicamba+2,4-D	0.5+1.0	44	75	65	58	21	86	28	80
Dicamba+2,4-D	1.0+1.0	07	96	50	68	11	93	75	47
Dicamba+picloram	0.5+0.13	103	42	39	75	43	72	94	33
Dicamba+picloram	0.5+0.25	81	54	32	80	27	82	42	70
Dicamba+picloram	1.0+0.13	25	86	25	84	24	84	54	62
Dicamba+fluroxypyr	0.5+0.5	87	51	157	0	63	59	68	52
Dicamba+clopyralid	0.5+0.13	122	31	88	43	82	46	73	48
Dicamba+clopyralid	0.5+0.25	80	55	48	69	47	69	96	32
2,4-D(LVE)	2.0	23	87	48	69	83	46	18	87
	oz/AI/A								
Metsulfuron+NIS[2]	0.1+25%	171	04	137	12	99	35	133	06
Metsulfuron+NIS	0.2+0.25%	169	05	145	06	109	28	106	25
Metsulfuron+NIS	0.3+0.25%	161	10	79	49	97	36	102	28

[1]Treatments applied: True Ranch - May 21, 1992 vegetative stage, July 22, 1993/full bloom; Warren Livestock - May 21, 1992 vegetative stage, July 24, 1993/full bloom.
[2]NIS - non-ionic surfactant
[3]Weed control based on live plant counts/plot, percentages were calculated from untreated control comparisons.

Halogeton control with metsulfuron, dicamba, picloram, and 2,4-D on Colorado rangeland. Sebastian, J.R. and K.G. Beck. Two rangeland experiments were established near Maybell, CO to evaluate halogeton (HALGL) control with metsulfuron, dicamba, picloram, and three 2,4-D formulations. The design was a randomized complete block with 4 replications. All treatments were applied with X-77 surfactant (0.25% v/v). Treatments were applied June 17 and June 23, 1992 at site 1 and 2, respectively, with a CO_2-pressurized sprayer using 11003LP flat fan nozzles at 24 gal/A, and 15 psi. Other application information is presented in Table 1. Plot size was 10 by 30 feet. Site 1 had 1 to 3 foot tall greasewood overstory while site 2 was a solid, single species HALGL stand.

Visual evaluations compared with non-sprayed control plots were taken at both sites on October 12, 1992 and October 18, 1993. Metsulfuron provided good to excellent (73 to 94%) HALGL control at both sites approximately 5 months after treatment (MAT) while providing poor to good control 17 MAT. Dicamba (32 oz ai/A) or dicamba tank mixes provided poor to good (33 to 90%) and the three 2,4-D formulations poor (0 to 53%) HALGL control 5 and 17 MAT. Picloram provided poor to fair (19 to 50%) and poor to good (26 to 82%) HALGL control 5 and 17 MAT, respectively.

Halogeton at both sites only grew 3 inches from time of application to fall dormancy (in 1992) which may have decreased HALGL control. Also, at site 1 loss of HALGL control was apparent around the bases of greasewood plants due to poor herbicide coverage at application. In 1993, HALGL plants that survived within plots with 40-60% control were more robust and produced many more seeds per plant than check plants (loss of competition for water with slight control). Herbicide treatments will be evaluated again in 1994 for control longevity (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80538).

Table 1. Application data for halogeton control with metsulfuron, dicamba, picloram, and 2,4-D on Colorado rangeland.

Environmental data	Site 1	Site 2
Location	Site 1	Site 2
Application date	June 17, 1992	June 23, 1992
Application time	8:00 PM	5:00 PM
Air temperature, C	22	33
Cloud cover, %	0	10
Relative humidity, %	30	28
Wind speed, mph	0	0 to 1
Soil temperature, (2.0 in.), C	30	32

Application date	species	growth stage	height (in)	density ($plants/ft^2$)
Site 1				
June 17, 1992	HALGL	vegetative	1 to 3	7 to 14
Site 2				
June 23, 1992	HALGL	vegetative	1 to 3	20 to 34

Table 2. Halogeton control with metsulfuron, dicamba, picloram, and 2,4-D on Colorado rangeland.

Treatment	Rate	Timing	Halogeton			
			October 12, 1992		October 18, 1993	
			Site 1	Site 2	Site 1	Site 2
	(oz ai/A)		(% of check)			
metsulfuron	0.1	1-3"	83	73	58	34
	0.2	1-3"	88	81	85	43
	0.3	1-3"	93	90	80	50
	0.5	1-3"	80	84	76	65
	0.6	1-3"	83	94	87	61
metsulfuron + dicamba	0.1 +3	1-3"	64	76	30	33
	0.2 +3	1-3"	78	81	78	38
picloram	2	1-3"	49	19	60	26
	4	1-3"	26	28	58	69
	8	1-3"	36	40	73	82
dicamba	8	1-3"	49	45	43	40
	16	1-3"	61	50	58	78
	32	1-3"	78	68	90	90
dicamba + picloram	8 +2	1-3"	68	56	74	60
	16 +2	1-3"	70	56	70	78
	8 +4	1-3"	68	48	84	75
2,4-D amine	16	1-3"	38	41	0	5
dimethylamine + diethan.[1]	16	1-3"	53	36	0	0
2,4-D butoxy[2] + free acid	16	1-3"	51	35	0	0
dicamba + 2,4-D amine	8 16	1-3"	72	61	43	40
LSD (0.05)			25	17	25	17

[1] dimethylamine + diethanolamine salt (Hi-Dep)

[2] 2,4-D butoxyethyl ester + free acid (Weedone 638)

Extended control of yellow hawkweed with herbicides in mountain meadows. Lawrence W. Lass and Robert H. Callihan. This experiment examines herbicides that may be useful in control of the aggressive weed, yellow hawkweed.

The experiment was initiated on a Helmer silt loam, June 5, 1991 at Fernwood, Idaho. Plots measured 10 by 30 ft, with four replications of a split-strip block design. Plots were treated with a strip-plot application of 16-16-16 at a rate of 53 lbs/a on June 5, 1991. Treatments consisted of single applications of commercial preparations of metsulfuron (Ally) and sulfometuron (Oust), (each at 0.75, 1.0, and 1.5 oz/a); 2,4-D (32 oz/a); clopyralid (Stinger) (1 and 2 oz/a); clopyralid + 2,4-D (Curtail)(1.52 + 8 oz/a) dicamba (Banvel)(16 oz/a); and picloram (Tordon) (1.6, 6.4 and 9.6 oz/a). A surfactant (R11) was used (0.5% v/v) on all treatments. Treatments were applied on July 7, in 21 gal/a water carrier with flat-fan 8002 nozzles at 43 psi from a CO2-pressurized backpack sprayer operated at 3.4 mph. The air temperature at the time of treatment was 80F, the soil temperature at 2 and 6 inches were 64F and 59F and the relative humidity was 40%. The sky was clear and no dew was present. The wind was 0 to 1 mph from the west. The hawkweed was 3 to 6 inches tall and represented 90 to 100% of ground cover. At the time of herbicide application hawkweed plants in the fertilized strips were green while the unfertilized strips were yellow-green with a purple tinge. Herbicide treatment effects were evaluated on July 30, 1991. Hawkweed height, density and amount of grass cover were determined on June 17, 1992.

In 1991, hawkweed plants treated with metsulfuron, sulfometuron, dicamba, and clopyralid treatments did not show any response 23 days after application due to slow symptom expression (Table). Both picloram and 2,4-D or the herbicide combinations with 2,4-D showed plant die-back ranging from 50% to 100%.

In 1992, hawkweed height and density were highest in metsulfuron, sulfometuron, dicamba, and clopyralid treatments. Both picloram at higher rates and 2,4-D significantly reduced population density and height. Grasses were recovering in the picloram and 2,4-D treatment. The results of the 1992 evaluation show that hawkweed treated with 2,4-D and picloram will provide control for two years.

In 1993, yellow hawkweed cover was lowest in the 2,4-D, clopyralid, and picloram plots. Plant height was not reduced by any of the herbicides after 3 years. Some hawkweed plants in these plots were taller than check plants because of lower competition. Grass cover was increased in plots without hawkweed to the point where these plots would be considered to represent a healthy pasture. No visible differences between the fertilized and non-fertilized strips were detected. Results from this project and previous projects show that residual perennial grasses are stimulated when hawkweed is removed. Only subsequent evaluations will examine the long term control potential of yellow hawkweed. (University of Idaho, Dept. of Plant, Soil, & Ent. Sci., Moscow, 83843)

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

		Yellow hawkweed					Grass		
Herbicide	Rate	Plants Living (1991)	Height (1992)	Height (1993)	Density (1992)	Cover (1993)	Height (1993)	Cover (1992)	Cover (1993)
	(oz ai/A)	(%)	(cm)	(cm)	(plts/m2)	(%)	(cm)	(%)	(%)
Check		100	11 BCD	51	500	100	43	1	0
Metsulfuron	0.75	100	13 ABC	56	438	100	57	3	0
Metsulfuron	1	100	11 BDC	57	363	95	53	5	5
Metsulfuron	1.5	100	11 BCD	54	400	98	63	3	3
Sulfometuron	0.75	100	12 ABCD	49	500	100	39	0	0
Sulfometuron	1	100	14 AB	44	500	100	61	0	0
Sulfometuron	1.5	100	15 A	54	500	98	61	0	3
Check	0	100 A	11 BCD	49 BC	500 A	100 A	31 ED	1 D	0 C
2,4-D	32	24 D	6 E	68 AB	11 C	15 C	90 AB	28 AB	85 A
Clopyralid	1	99 A	12 BCD	46 C	475 A	100 A	28 E	1 D	0 C
Clopyralid	2	89 B	11 BCD	55 ABC	250 B	98 A	50 CDE	5 D	2 C
Curtail	2 pts/A	43 C	9 DE	69 A	44 C	45 B	77 ABC	13 C	55 B
Dicamba	16	91 BA	13 ABC	51 ABC	375 A	98 A	65 ABCD	3 D	3 C
Picloram	1.6	6 E	10 CD	68 AB	31 C	57 B	76 ABC	23 B	43 B
Picloram	6.4	5 E	0 F	56 ABC	0 C	1 C	92 AB	29 AB	99 A
Picloram	9.6	3 E	0 F	39 C	0 C	0 C	94 A	30 A	100 A

All rates are listed as oz ai/A except formulated clopyralid + 2,4-D at 1.52+8 oz/a Curtail applied at 2 pts/A). Percentage values are expressed as a percentage of cover component. Any two means having a common letter or without letters are not different at the 5% level of significance, using the Protected Duncan's test.

Houndstongue and plumeless thistle control on Colorado rangeland with metsulfuron, metsulfuron plus 2,4-D, picloram, and 2,4-D. Sebastian, J.R. and K.G. Beck. An experiment was established near Eagle, CO to evaluate houndstongue (CYWOF) and plumeless thistle (CRUAC) control with metsulfuron, metsulfuron plus 2,4-D, picloram, and 2,4-D. The design was a randomized complete block with 4 replications. Metsulfuron treatments were sprayed with X-77 surfactant (0.25% v/v). Treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 24 gal/A, 15 psi. Other application information is presented in Table 1. Plot size was 10 by 30 feet.

Visual evaluations compared to non-sprayed control plots were taken on September 6, 1993 (Table 2). All metsulfuron and metsulfuron plus 2,4-D treatments provided good to excellent (75 to 96%) control of rosette and bolted CYWOF and CRUAC approximately 2 months after treatment (MAT). Picloram controlled CYNOF poorly, but controlled rosette and bolted CRUAC 95 and 81%, respectively. 2,4-D controlled CYNOF and CRUAC poorly 2 MAT. Herbicide treatments will be evaluated again in 1994 for control longevity (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80538).

Table 1. Application data for houndstongue and plumeless thistle control with metsulfuron, metsulfuron plus 2,4-D, picloram, and 2,4-D on Colorado rangeland.

Environmental data	
Location	Eagle, Colorado
Application date	June 29, 1993
Application time	2:00 PM
Air temperature, F	89
Cloud cover, %	1
Relative humidity, %	25
Wind speed, mph	3 to 8
Soil temperature, (2.0 in.), F	70

Application date	species	growth stage	height (in)	density (plants/ft^2)
June 29, 1993	CYWOF	rosette	1 to 2	1 to 3
	CYWOF	late bloom	18 to 24	1 to 2
	CRUAC	rosette	1 to 2	4 to 10
	CRUAC	bolting	10 to 18	2 to 6

Table 2. Houndstongue and plumeless thistle control on Colorado rangeland with metsulfuron, metsulfuron plus 2,4-D, picloram, and 2,4-D.

Treatment	Rate	Houndstongue		Plumeless thistle	
		September 6, 1993			
		rosette	bolting	rosette	bolting
	(oz ai/A)	(% of check)			
metsulfuron	0.15	89	89	75	83
	0.2	90	93	80	86
	0.3	95	95	90	86
metsulfuron + 2,4-D	0.15 8.0	75	85	85	85
	0.2 8.0	93	93	89	86
	0.3 8.0	90	91	90	94
picloram	4.0	30	33	95	81
2,4-D	8.0	34	31	29	29
LSD (0.05)		13	10	8	7

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

Visual evaluations compared to non-treated control plots were taken at Eagle in June and August 1990, October 1991, and September 1992-3. Picloram fall applied at 1.0 lb/A provided good to excellent Russian knapweed control approximately 6, 11, 25, and 36, and 48 months after treatment (MAT) (Table 2). Picloram at 0.5 lb/A fall-applied provided good Russian knapweed control 11 MAT and fair control 25, 36, and 48 MAT, respectively. Picloram at 0.5 and 1.0 lb/A spring-applied provided 71 and 92% control 16 MAT, respectively. However only picloram at 1.0 lb/A spring-applied provided acceptable long-term control. Chlorsulfuron and metsulfuron did not provide acceptable long-term control. There were no differences within a herbicide treatment between fall and spring applications.

Herbicide treatments will be evaluated again in 1994 for control longevity. (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

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

Environmental data		
Location	Eagle, CO	
Application date	Sep 12,1989	Jun 18, 1990
Application time	1:00 P	9:00 A
Air temperature, C	12	16
Cloud cover, %	100	10
Relative humidity, %	60	44
Wind speed, mph	0	0
Soil temperature (2.0 in), C	11	16

Weed data

Application date	Species	Growth stage	Height (in.)	Density (shoots/ft^2)
September 12, 1989	CENRE	fall vegetative	10 to 12	1 to 6
June 18, 1990	CENRE	bolting	6 to 10	1 to 6

Table 2. Russian knapweed control on Colorado rangeland.

Treatment	Rate	Timing	Russian knapweed control				
			Jun 1990	Aug 1990	Oct 1991	Sep 1992	Sep 1993
	(lb ai/a)		(% of check)				
picloram	0.25	fall	75	60	46	42	40
picloram	0.5	fall	92	81	72	70	66
picloram	1.0	fall	100	94	92	86	86
dicamba	0.5	fall	51	13	8	8	9
dicamba	1.0	fall	77	41	8	3	0
picloram + dicamba	0.25 + 0.5	fall	92	49	38	36	35
picloram + dicamba	0.13 + 1.0	fall	96	71	49	43	40
chlorsulfuron[1]	0.02	fall	63	31	6	6	5
chlorsulfuron	0.05	fall	86	59	0	0	0
metsulfuron[1]	0.02	fall	78	48	0	0	0
picloram	0.25	bolting	-	59	44	40	35
picloram	0.5	bolting	-	70	71	65	65
picloram	1.0	bolting	-	80	92	91	89
dicamba	0.5	bolting	-	50	4	3	3
dicamba	1.0	bolting	-	67	15	22	20
picloram + dicamba	0.25 + 0.5	bolting	-	72	58	54	54
picloram + dicamba	0.13 + 1.0	bolting	-	65	25	20	19
chlorsulfuron	0.02	bolting	-	39	0	0	0
chlorsulfuron	0.05	bolting	-	68	24	13	11
metsulfuron	0.02	bolting	-	56	10	10	7
LSD (0.05)				11	20	26	24

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

Evaluation of several herbicides for fringed sagebrush control. Lym, Rodney G. Fringed sagebrush (*Artemisia frigida*) is the most widely distributed and abundant species of the *Artemisia* genus. It is found from Mexico throughout the western United States to Alaska in high plains, valleys, mountains, and grasslands. Fringed sagebrush is resistant to drought and overgrazing, and increased rapidly in North Dakota mixed- and short-grass rangelands following severe drought conditions in 1988. The purpose of this research was to evaluate imazethapyr, clopyralid and metsulfuron for fringed sagebrush control.

The experiment was established near Jamestown, ND in grazed pastureland on May 30, 1991. Fringed sagebrush was in the vegetative growth stage and actively growing. Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 35 ft in a randomized complete block design with three replications. Fringed sagebrush control evaluations were based on a visual estimate of percent stand reduction as compared to the untreated check.

Treatment	Rate	Months after treatment			
		3	12	15	24
	– oz/A –	% control			
2,4-D LVE	8	56	33	28	20
2,4-D LVE	12	67	45	53	53
2,4-D LVE	16	78	79	93	85
2,4-D amine	12	41	37	30	30
2,4-D mixed amine[a]	12	44	51	56	54
Imazethapyr+Sun-It II	2+1 qt	3	5	3	3
Picloram	4	28	33	33	37
Picloram+2,4-D LVE	2+8	81	72	76	73
Picloram+2,4-D LVE	4+8	84	90	94	89
Picloram+2,4-D amine	4+8	58	60	73	79
Dicamba+X-77	8+0.25%	35	41	32	33
Dicamba+X-77	16+0.25%	70	79	47	64
Clopyralid+2,4-D	1.5+8	83	77	85	62
Clopyralid+2,4-D	3+16	92	95	98	93
Metsulfuron+X-77	0.10+0.25%	4	9	3	3
Metsulfuron+X-77	0.30+8+0.25%	17	24	23	23
Metsulfuron+2,4-D LVE+X-77	0.10+8+0.25%	65	45	53	43
LSD (0.05)		23	34	45	43

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

Imazethapyr and metsulfuron did not control fringed sagebrush (Table). Clopyralid plus 2,4-D provided excellent long-term control especially when applied at 3 + 16 oz/A which averaged 93% control 24 months after treatment. However, 2,4-D LVE at 16 oz/A provided 85% control and would cost only $3 to $4/A compared to over $25/A for clopyralid plus 2,4-D. Fringed sagebrush control at the same 2,4-D rate was better with the LVE and mixed amine formulations than with 2,4-D amine. Picloram plus 2,4-D LVE at 4 + 8 oz/A provided similar control to 2,4-D LVE at 16 oz/A alone but would have to maintain control much longer than 2,4-D LVE alone to be cost-effective. Dicamba provided similar control to 2,4-D amine. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo 58105).

Broom snakeweed control with picloram and an organosilicone surfactant. K.C. McDaniel. Broom snakeweed (*Gutierrezia sarothrae*) is a common noxious range weed and often sprayed commercially by aircraft. In New Mexico, 100,000 to 200,000 acres are sprayed annually primarily with picloram. The accepted commercial rate is 0.25 lb/A applied from late September until December. This is the second year of an experiment established near Corona, New Mexico designed to investigate subrecommended rates with the inclusion of an organosilicone surfactant (XRM-5234). Treatments were replicated 3 times and applied under various environmental conditions on 5 dates. Sprays were broadcast with a CO_2 pressurized hand-held sprayer delivering 21 gpa at 60 psi under relatively high (morning) and low (afternoon) humidity conditions. Broom snakeweed mortality was estimated by 3 observers comparing plant reduction relatively to untreated buffers placed between each replication.

Addition of 0.125% v/v organosilicone surfactant generally did not enhance the effectiveness of picloram for broom snakeweed control (Table). Picloram activity was similar at 0.125 lb/A or higher with the exception of the May 1993 sprayed date when performance was poorer at all rates. Results from morning and afternoon spraying were inconclusive but snakeweed control tended to be higher when sprayed under relatively higher humidity and lower air temperature conditions during morning hours. Data suggest picloram can be applied below the label rate provided close attention is paid to spraying under ideal environmental conditions. (Department of Animal and Range Science, New Mexico State University, Las Cruces, NM 88003).

Table. Snakeweed mortality following applications of picloram and picloram plus organosilicone surfactant (XRM-523) under various environmental conditions on the NMSU Corona Research Ranch. Treatments evaluated by 3 observers on October 7, 1993.

Date		9/13/93	9/12/93	10/24/92	10/25/92	12/2/92	12/1/93	3/26/93	3/25/93	5/21/93	5/21/93
Spray time		9-10	5-6	9-10	9-10	8:30-9:30	4:30-5	9-10	5-6	8-9	2-3
Airtemp °C		25.0	25.0	15.2	16.5	-5.8	9.7	8.0	21.0	19.3	20.4
Soil temp (10, 50 cm)		19.7, 19.8	22.5, 19.7	15.4, 15.3	14.0, 14.9	0.5, 2.7	2.0, 2.8	9.5, 8.3	13.7, 7.8	15.9, 14.5	18.2, 14.5
% RH		17.5	15	50	48	68	18	38.5	13.5	14.2	13.8
Wind speed (km/h)		5.8	5.5	4.3	6.2	2.1	4.8	4.5	3.1	3.2	5.5
Soil water		moist	moist	moist	wet	very wet	very wet	mod.	mod.	dry	dry
	Dosage (kg/m)	----------------	----------------	----------------	(Snakeweed	Mortality %)	----------------	----------------	----------------	----------------	----------------
Picloram	.07	.54	34	76	85	72	59	53	52	40	46
+ Surfactant	.125%	65	58	71	79	69	70	68	44	48	38
Picloram	.14	98	96	100	90	100	94	95	87	63	69
+ Surfactant	.125%	94	87	100	100	100	99	92	95	84	66
Picloram	.21	99	100	100	100	100	100	97	99	84	56
+ Surfactant	.125%	100	99	100	100	100	100	100	96	83	76
Picloram	.25	100	100	100	100	100	100	100	100	88	93
Control		6	7	7	11	6	7	13	5	16	8
LSD (0.05)		15	26	21	20	22	10	14	16	19	27

Fall applied dicamba tankmixes for control of leafy spurge. Mark A. Ferrell. This research was conducted near Devil's Tower, Wyoming to evaluate leafy spurge control with fall applied tankmixes of dicamba, picloram, 2,4-D, and glyphosate. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 40 psi September 23, 1992 (air temp. 82 F, soil temp. 0 inch 115 F, 1 inch 105 F, 2 inch 95 F, 4 inch 75 F, relative humidity 23%, wind south at 3 mph, sky clear). The soil was a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was past seed production and 12 to 14 inches in height. Infestations were heavy throughout the experimental area. Visual evaluations were made June 21, 1993.

Treatments of 1.0 lb dicamba + 0.5 lb picloram and 1.0 lb dicamba + 0.5 lb picloram + 1.0 lb 2,4-D showed only moderate leafy spurge control one year after application. No other treatments were effective. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1689.)

Leafy spurge control

Treatment	Rate	Application date/evaluation date Sept. 23, 1992/June 21, 1993
	(lb ai/a)	%[1]
dicamba[2]	2.0	8
dicamba+2,4-D[2]	1.0+1.0	0
dicamba+picloram[2]	1.0+0.25	0
dicamba+picloram[2]	1.0+0.25	50
dicamba+picloram+2,4-D[2]	1.0+0.5+1.0	60
dicamba+glyphosate[2]	0.5+0.5	0
dicamba+glyphosate[2]	1.0+1.0	0
dicamba[2]	1.0	5
glyphosate	0.5	0
glyphosate	1.0	0
(LSD 0.05)		11
(CV)		66

[1]Percent control by visual estimation.
[2]Surfactant (X-77) added at 0.5% v/v.

Picloram with or without surfactant (Sylgard®) for control of leafy spurge. Mark A. Ferrell. This research was conducted near Devil's Tower, Wyoming to evaluate control of leafy spurge with picloram, with or without surfactant. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Herbicide treatments were applied broadcast with a CO_2 pressurized hand-held sprayer delivering 20 gpa at 30 psi on June 9. 1992 (air temp. 82 F, soil temp. 0 inch 125 F, 1 inch 110 F, 2 inch 95 F, 4 inch 85 F, relative humidity 27%, wind south 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. Leafy spurge was in full bloom and 14 to 20 inches in height. Infestations were heavy throughout the experimental area. Visual evaluations were made September 23, 1992 and June 21, 1993.

Evaluations four or 12 months after application indicate the surfactant Sylgard® had no effect on leafy spurge control with picloram at any rate. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1684.)

Leafy spurge control

Treatment[1]	Rate	Control[2]	Control[3]
	(lb ai/a)	(%)	(%)
picloram+Sylgard[1]	0.25	10	0
picloram+Sylgard[1]	0.5	40	5
picloram+Sylgard[1]	1.0	90	25
picloram	0.25	10	0
picloram	0.5	40	0
picloram	1.0	91	38
(LSD 0.05)		11	11
(CV)		19	79

[1]Surfactant (Sylgard®) added at 0.25% v/v.
[2]Visual evaluations September 23, 1992.
[3]Visual evaluations June 21, 1993.

Dicamba, picloram, 2,4-D tankmixes for control of leafy spurge. Mark A. Ferrell. This research was conducted near Devil's Tower, Wyoming to evaluate leafy spurge control with tankmixes of dicamba, picloram, and 2,4-D amine. Plots were 10 by 13.5 ft. with four replications arranged in a randomized complete block. Spring treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 40 gpa at 40 psi June 11, 1991 (air temp. 86 F, soil temp. 0 inch 95 F, 1 inch 85 F, 2 inch 80 F, 4 inch 80 F, relative humidity 30%, wind south at 5 mph, sky clear). Late summer treatments were applied September 11, 1991 (air temp. 70 F, soil temp. 0 inch 85 F, 1 inch 80 F, 2 inch 80 F, 4 inch 75 F, relative humidity 55%, wind west at 3 mph, sky 30% cloudy). The soil was a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in full bloom and 14 to 18 inches in height, for spring treatments and past seed production and 14 to 20 inches in height, for late summer treatments. Infestations were heavy throughout the experimental area. Visual evaluations were made September 25, 1992 and June 21, 1993.

Late summer applications of picloram+dicamba+2,4-D provided significantly better leafy spurge control than spring applications of picloram+dicamba+2,4-D in 1992. Herbicide combinations provided better control than individual herbicides for both spring and fall treatments in 1992. In 1993 most of the fall treatments were still providing better control than the spring treatments. The addition of surfactant to combination treatments had no effect on leafy spurge control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1687.)

Leafy spurge control

Treatment	Rate	Application date/evaluation date			
		June 11, 1991/ Sept. 25, 1992	June 11, 1991/ June 21, 1993	Sept 11, 1991/ Sept. 25, 1992	Sept 11, 1991/ June 21, 1993
	(lb ai/a)	(percent[1])			
picloram+dicamba+2,4-D amine[2]	0.25+1.0+1.	18	41	63	49
picloram+dicamba+2,4-D amine	0.25+1.0+1.	13	30	53	49
picloram+dicamba+2,4-D amine[2]	0.25+2.0+1.	23	40	71	59
picloram+dicamba+2,4-D amine	0.25+2.0+1.	55	74	78	83
picloram+dicamba+2,4-D amine[2]	0.5+1.0+1.0	28	53	89	75
picloram+dicamba+2,4-D amine	0.5+1.0+1.0	64	75	86	78
picloram+dicamba+2,4-D amine[2]	0.5+2.0+1.0	39	58	78	64
picloram+dicamba+2,4-D amine	0.5+2.0+1.0	61	68	83	74
picloram	0.25	0	13	18	25
picloram	0.5	23	30	68	49
dicamba[2]	1.0	0	13	15	15
dicamba[2]	2.0	0	15	8	15
2,4-D amine	1.0	5	5	5	13
(LSD 0.05)		26	29	22	26
(CV)		78	55	30	39

[1]Percent control by visual estimation. An LSD (0.05) of 24 is valid for comparison of treatment means between application dates (CV=45%) for 1992 data and an LSD (0.05) of 27 is valid for comparison of treatment means between application dates (CV=46%) for 1993 data

[2]Surfactant (X-77) added at 0.5% v/v.

Comparison of picloram dry acid and picloram liquid for leafy spurge control. Mark A. Ferrell. This research was conducted near Devil's Tower, Wyoming to compare picloram dry acid formulation with picloram liquid formulation on the control of leafy spurge. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Spring herbicide treatments were applied broadcast with a CO_2 pressurized hand-held sprayer delivering 20 gpa at 30 psi on June 9, 1992 (air temp. 82 F, soil temp. 0 inch 120 F, 1 inch 110 F, 2 inch 95 F, 4 inch 85 F, relative humidity 27%, wind south at 5 mph, sky 20% cloudy). Fall herbicide treatments were applied broadcast with a CO_2 pressurized hand-held sprayer delivering 30 gpa at 30 psi on September 23, 1992 (air temp. 82 F, soil temp. 0 inch 115 F, 1 inch 105 F, 2 inch 95 F, 4 inch 75 F, relative humidity 23%, wind south at 3 mph, sky clear). The soil was a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in full bloom and 14 to 20 inches in height for the spring treatments or past seed production and 14 to 18 inches in height for the fall treatments. Infestations were heavy throughout the experimental area. Visual leafy spurge control evaluations were made September 25, 1992 or June 21, 1993.

There was no difference in leafy spurge control between the (spring or fall applied) picloram dry acid formulation or the (spring or fall applied) picloram liquid formulation. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1688.)

Leafy spurge control

Treatment	Rate	Application date/evaluation date: June 9, 1992/ Sept. 25, 1992	June 9, 1992/ June 21, 1993	Sept. 23, 1992/ June 21, 1993
	(lb ai/a)	(%[1])		
picloram liquid	0.25	0	0	8
picloram liquid	0.5	15	0	46
picloram liquid	1.0	94	43	86
picloram dry acid	0.25	0	0	0
picloram dry acid	0.5	13	0	50
picloram dry acid	1.0	91	48	91
(LSD 0.05)		13	8	15
(CV)		29	44	24

[1]Percent control by visual evaluation.

Quinclorac tankmixes for control of leafy spurge. Mark A. Ferrell. This research was conducted near Devil's Tower, Wyoming to evaluate leafy spurge control with early or late summer applications of quinclorac, alone or in combination with 2,4-D LVE, dicamba or picloram. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Spring herbicide treatments were applied broadcast with a CO_2 pressurized hand-held sprayer delivering 40 gpa at 40 psi on June 10, 1991 (air temp. 70 F, soil temp. 0 inch 115 F, 1 inch 80 F, 2 inch 75 F, 4 inch 70 F, relative humidity 65%, wind south at 5 mph, sky partly cloudy). Fall herbicide treatments were applied broadcast with a CO_2 pressurized hand-held sprayer delivering 40 gpa at 40 psi on September 25, 1990 (air temp. 65 F, soil temp. 0 inch 70 F, 1 inch 65 F, 2 inch 60 F, 4 inch 60 F, relative humidity 34%, wind south at 3 mph, sky clear). The soil was a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in full bloom and 14 to 20 inches in height for the spring treatments or past seed production and 14 to 20 inches in height for the fall treatments. Infestations were heavy throughout the experimental area. Visual evaluations were made June 18, 1991, June 10 or September 25, 1992 and June 21, 1993.

Fall applications of quinclorac + picloram (1.0 + 0.5 lb/A), provided 80% control of leafy spurge nine months after treatment. However, control had dropped to 51% by June 1992. No other treatments provided effective leafy spurge control. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1690.)

Leafy spurge control

Treatment	Rate	Application date/evaluation date			
		Sept. 25, 1990/ June 18, 1991	Sept. 25, 1990/ June 10, 1992	June 10, 1991/ Sept. 25, 1992	June 10, 1991/ June 21, 1993
	(lb ai/a)	(control[1])			
quinclorac[2]	0.5	25	10	30	13
quinclorac + 2,4-D LVE[2]	0.5+1.0	35	18	51	33
quinclorac + dicamba	0.5+1.0	36	15	48	45
quinclorac + picloram[2]	0.5+0.5	46	20	60	56
quinclorac[2]	1.0	64	33	55	36
quinclorac + 2,4-D LVE[2]	1.0+1.0	71	33	65	56
quinclorac + dicamba	1.0+1.0	75	36	60	50
quinclorac + picloram[2]	1.0+0.5	80	51	65	70
(LSD 0.05)		11	20	19	26
(CV)		16	57	27	44

[1]Percent control by visual evaluation.
[2]Crop oil concentrate (Sunit) added at 1 quart/acre.

Dicamba tankmixes for control of leafy spurge. Mark A. Ferrell. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of tankmixes of dicamba or 2,4-D LVE or picloram on the control of leafy spurge. Treatments and retreatments have been applied to maintain or attain 80% leafy spurge control. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 40 psi May 24, 1989 (air temp. 56 F, soil temp. 0 inch 74 F, 1 inch 77 F, relative humidity 45%, wind west at 3 mph, sky partly cloudy). Retreatments were applied June 7, 1990 (air temp. 62 F, soil temp. 0 inch 55 F, 1 inch 53 F, 2 inch 52, 4 inch 50, relative humidity 55%, wind south at 3 mph, sky partly cloudy); June 18, 1991 (air temp. 74 F, soil temp. 0 inch 95 F, 1 inch 87 F, 2 inch 80, 4 inch 75, relative humidity 57%, wind south at 5 mph, sky partly cloudy) and September 23, 1992 (air temp. 84 F, soil temp. 0 inch 120 F, 1 inch 105 F, 2 inch 95, 4 inch 75, relative humidity 20%, wind south at 5 mph, sky clear). The soil was a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in full bloom and 12 to 20 inches high, for both initial treatments and retreatments. Infestations were heavy throughout the experimental area. Visual evaluations were made June 6, 1990; June 18, 1991; June 11, 1992 and June 21, 1993.

No initial treatment provided 80% control in 1990. 1990 retreatments provided 80% or greater control in all plots, except where the initial treatment was 2.0 lb dicamba or 2.0 lb dicamba plus 1.0 lb 2,4-D LVE. No 1991 retreatments provided 80% control in 1992. However, 1990 retreatments, where the initial treatment was 1.0 lb dicamba plus 0.5 lb picloram or 1.0 lb dicamba plus 0.5 lb picloram plus 1.0 lb 2,4-D have maintained 80% or better control in 1992. The only retreatment attaining 80% control in 1993 was the original treatment of 1.0 lb dicamba plus 0.5 lb picloram. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1686.)

Leafy spurge control

Treatment[1]	Rate	Retreatment[2]	Rate	Retreatment applied			Percent control[3]			
				6/7/90	6/18/91	9/23/92	6/6/90	6/18/9	6/11/92	6/21/93
	lb/a		lb/a							
dicamba	2.0	dicamba	2.0	yes	yes	yes	58	73	79	73
dicamba + 2,4-D LVE	1.0 + 1.0	dicamba + 2,4-D LVE	1.0 + 1.0	yes	yes	yes	50	79	79	79
dicamba + picloram	1.0 + 0.25	dicamba + picloram	1.0 + 0.25	yes	no	yes	58	80	78	80
dicamba + picloram	1.0 + 0.5	dicamba + picloram	1.0 + 0.5	yes	no	no	65	86	83	73
dicamba + picloram + 2,4-D LVE	1.0 + 0.5 + 1.0	dicamba + picloram + 2,4-D LVE	1.0 + 0.5 + 1.0	yes	no	no	73	88	83	75
(LSD 0.05)							9	5	5	4
(CV)							12	5	5	4

[1]Treatments applied May 24, 1989.
[2]Retreatments applied to maintain or attain 80% control.
[3]Percent control by visual estimation.

The control of leafy spurge (*Euphorbia esula* L.) with various rates of picloram. Mark A. Ferrell. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of various rates of picloram for leafy spurge control. Plots were retreated to maintain or attain 80% control with light rates of picloram or picloram/2,4-D tankmixes. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. The initial herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 40 psi May 24, 1989 (air temp. 56 F, soil temp. 0 inch 74 F, 1 inch 77 F, 2 inch 76 F, 4 inch 75 F, relative humidity 45%, wind west at 3-5 mph, sky partly cloudy). Retreatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 20 gpa at 40 psi June 6, 1990 (air temp. 72 F, soil temp. 0 inch 87 F, 1 inch 85 F, 2 inch 83 F, 4 inch 75 F, relative humidity 51%, wind south at 10 mph, sky partly cloudy); June 13, 1991 (air temp. 72 F, soil temp. 0 inch 82 F, 1 inch 80 F, 2 inch 79 F, 4 inch 77 F, relative humidity 60%, wind northwest at 5 mph, clear) and June 10, 1992 (air temp. 86 F, soil temp. 0 inch 100 F, 1 inch 95 F, 2 inch 90 F, 4 inch 80 F, relative humidity 30%, wind north at 5 mph, sky 20% cloudy). The soil was a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in full bloom and 12 to 14 inches in height, for the initial treatments and in full bloom and 20 inches in height for the retreatments. Infestations were heavy throughout the experimental area. Visual weed control evaluations were made June 6, 1990; June 13, 1991; June 10, 1992 and June 21, 1993.

Plots with initial treatments of 1.25 lb/A picloram or greater gave 80% or better leafy spurge control and did not require retreatment in 1990. All other plots required retreatment. Initial treatments maintaining 80% control or better in 1991 were two 1.5 lb picloram treatments, one 1.75 lb picloram treatment and all 2.0 lb picloram treatments. The only 1990 retreatment attaining 80% control or better in 1991 was 0.5 lb picloram over an initial 1.0 lb picloram. Plots with less than 80% control in 1991 were retreated. None of the retreatments applied in 1991 or 1992 attained 80% control in 1992 or 1993. Two of the three initial 2.0 lb picloram treatments applied in 1989 continued to maintain 80% leafy spurge control through 1992. The control in these treatments dropped below 80% in 1993. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1683.)

Leafy spurge control

Treatment[1]	Rate (lb/a)	Retreatment[2]	Rate (lb/a)	Retreatment applied 6-6-90	6-13-91	6-10-92	Percent control[3] 1990	1991	1992	1993
picloram	0.25	picloram	0.25	yes	yes	yes	30	43	33	35
picloram	0.5	picloram	0.25	yes	yes	yes	48	53	28	23
picloram	0.5	picloram	0.5	yes	yes	yes	50	79	71	68
picloram	0.5	picloram + 2,4-D amine	0.25 + 1.0	yes	yes	yes	44	71	74	79
picloram	0.75	picloram	0.25	yes	yes	yes	60	78	65	65
picloram	0.75	picloram	0.5	yes	yes	yes	65	71	64	55
picloram	0.75	picloram + 2,4-D amine	0.25 + 1.0	yes	yes	yes	63	65	69	73
picloram	1.0	picloram	0.25	yes	yes	yes	76	75	61	58
picloram	1.0	picloram	0.5	yes	no	yes	74	81	60	64
picloram	1.0	picloram + 2,4-D amine	0.25 + 1.0	yes	yes	yes	71	74	66	66
picloram	1.25	picloram	0.25	no	yes	yes	84	74	59	38
picloram	1.25	picloram	0.5	no	yes	yes	87	75	69	71
picloram	1.25	picloram + 2,4-D amine	0.25 + 1.0	no	yes	yes	81	63	65	68
picloram	1.5	picloram	0.25	no	no	yes	89	80	66	56
picloram	1.5	picloram	0.5	no	no	yes	91	80	69	63
picloram	1.5	picloram + 2,4-D amine	0.25 + 1.0	no	yes	yes	87	75	69	74
picloram	1.75	picloram	0.25	no	yes	yes	93	78	66	61
picloram	1.75	picloram	0.5	no	no	yes	93	84	73	65
picloram	1.75	picloram + 2,4-D amine	0.25 + 1.0	no	no	yes	92	79	69	68
picloram	2.0	picloram	0.25	no	no	yes	95	84	74	70
picloram	2.0	picloram	0.5	no	no	no	97	85	80	70
picloram	2.0	picloram + 2,4-D amine	0.25 + 1.0	no	no	no	98	87	84	78
picloram + 2,4-D amine	0.25 + 1.0	picloram + 2,4-D amine	0.25 + 1.0	yes	yes	yes	35	74	68	65
(LSD 0.05)							10	16	22	25
(CV)							10	16	25	30

[1]Treatments applied May 24, 1989.
[2]Retreatments applied to maintain or attain 80% control.
[3]Visual evaluations June 6, 1990; June 13, 1991; June 10, 1992 and June 21, 1993.

Control of leafy spurge with retreatments of picloram and 2,4-D LVE. Mark A. Ferrell and Thomas D. Whitson. This research was conducted near Devil's Tower, Wyoming to compare the efficacy of retreatments of picloram and 2,4-D LVE on the control of leafy spurge. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. The original herbicide treatments were applied broadcast with a CO_2 pressurized six-nozzle knapsack sprayer delivering 30 gpa at 35 psi May 28, 1987 (air temp. 60 F, soil temp. 0 inch 60 F, 1 inch 55 F, relative humidity 75%, wind west at 10 mph, sky cloudy). Retreatments were applied: July 6, 1988 (air temp. 93 F, soil temp. 0 inch 110 F, 1 inch 95 F, 2 inch 83 F, 4 inch 80 F, relative humidity 38%, wind south at 5 mph, sky partly cloudy); June 6, 1989 (air temp. 80 F, soil temp. 0 inch 100 F, 1 inch 97 F, 2 inch 80 F, 4 inch 73 F, relative humidity 45%, wind south at 3 mph, sky clear); June 6, 1990 (air temp. 70 F, soil temp. 0 inch 83 F, 1 inch 78 F, 2 inch 75 F, 4 inch 65 F, relative humidity 50%, wind south at 10, sky partly cloudy); June 13, 1991 (air temp. 72 F, soil temp. 0 inch 82 F, 1 inch 80 F, 2 inch 79 F, 4 inch 77 F, relative humidity 60%, wind northwest at 5 mph, sky clear) and June 10, 1992 (air temp. 84 F, soil temp. 0 inch 120 F, 1 inch 100 F, 2 inch 80 F, 4 inch 70 F, relative humidity 28%, wind south at 4 mph, sky clear). The soil was a silt loam (22% sand, 58% silt, and 20% clay) with 1.8% organic matter and a 6.3 pH. Leafy spurge was in full bloom and 8 to 12 inches in height for the original treatments and in seed set and 12 to 16 inches in height, for the retreatments. Infestations were heavy throughout the experimental area. Visual weed control evaluations were made June 8, 1988; May 25, 1989; June 6, 1990; June 12, 1991; June 9, 1992 and June 21, 1993.

Leafy spurge control in 1988 was 80% or better with picloram at rates greater than 1.0 lb/A. No 1988 retreatments increased leafy spurge control to 80% or better in 1989. Picloram at 0.25 lb/A and 2,4-D LVE at 1.0 and 2.0 lb/A were the only 1989 retreatments that didn't increase leafy spurge control to 80% or better in 1990. Picloram at 0.25 lb and 2,4-D at 1.0 lb were the only 1990 retreatments that did not increase leafy spurge control to 80% or better in 1991. Picloram at 2.0 lb/A maintained 80% or better shoot control through 1990 before retreatment was needed. Picloram at 1.0, 1.25, 1.5, 1.75 and 0.25 lb picloram + 1.0 lb 2,4-D, with retreatment, maintained 80% control or better in 1991. Picloram at 1.0, 1.25 and 2,4-D at 1.0 or 2.0, with retreatment, maintained 80% control or better in 1992. Picloram at 0.25, 0.75, 1.0 and 1.25 were the only treatments not maintaining 80% control in 1993. All original treatments required retreatment in order to attain or maintain 80% control or better. Original treatments of 0.25 lb picloram retreated with 0.25 lb picloram did not attain 80% control. Plots with less than 80% control were retreated again September 22, 1993. (Wyoming Agric. Exp. Sta., Laramie, WY 82071 SR 1685.)

Leafy spurge control

	Rate (lb/a)						Percent control[2]					
		Retreatment										
Treatment[1]	Original	1988	1989	1990	1991	1992	1988	1989	1990	1991	1992	1993
picloram	0.25	0.25	0.25	0.25	0.25	0.25	5	13	54	54	60	65
picloram	0.5	0.5	0.5	none	0.5	0.5	48	28	89	73	74	83
picloram	0.75	0.5	0.5	none	0.5	0.5	59	50	88	75	70	70
picloram	1.0	0.5	0.5	none	none	none	75	68	96	86	80	78
picloram	1.25	none	0.5	none	none	none	83	76	94	86	81	78
picloram	1.5	none	0.5	none	none	none	80	65	93	85	73	81
picloram	1.75	none	0.5	none	0.5	0.5	83	73	96	88	78	84
picloram	2.0	none	none	none	0.5	0.5	89	81	82	76	79	83
picloram + 2,4-D LVE	0.25 + 1.0	0.25 + 1.0	0.25 + 1.0	none	0.25 + 1.0	0.25 + 1.0	25	51	92	85	79	83
2,4-D LVE	1.0	1.0	1.0	1.0	1.0	none	0	15	70	74	88	85
2,4-D LVE	2.0	2.0	2.0	2.0	none	none	18	34	78	85	89	84
Check	none	none	none	none	none	none	0	0	0	0	0	0
(LSD 0.05)							17	21	11	14	15	13
(CV)							25	32	10	14	15	12

[1]Original treatments applied May 28, 1987. Retreatments applied July 6, 1988; June 6, 1989; June 6, 1990; June 13, 1991 and June 10, 1992.

[2]Visual evaluations June 8, 1988; May 25, 1989; June 6, 1990; June 12, 1991; June 9, 1992 and June 21, 1993.

Comparison of picloram amine, ester, and potassium salt formulations for leafy spurge control. Rodney G. Lym. Picloram formulated as the potassium (K) salt (Tordon 22K) has been the most effective herbicide for leafy spurge control. However, picloram is poorly absorbed into leafy spurge, so relatively high rates are used which means high treatment costs. The purpose of this research was to evaluate an amine and ester formulations of picloram for leafy spurge control.

The liquid picloram formulations evaluated included a triisopropanol amine, isooctyl ester, and K-salt. The amine formulation was commercially combined with 2,4-D triisopropanol amine at a ratio of 1:4 (Tordon 101) and the ester was commercially combined with triclopyr butoxyethyl ester at 1:2 (Access). Previous research at North Dakota State University has shown that triclopyr does not control leafy spurge so any control from the ester combination was assumed to be from only picloram.

A series of experiments was established during the true-flower, flower- to seed-set, and fall- regrowth growth stages of leafy spurge. Treatments were applied on June 8, 1992 near Valley City, June 26 near West Fargo, and September 9 near Hunter, ND for the true-flower, early-seed-set, and fall-regrowth growth stages, respectively. Treatments were reapplied on a similar date in 1993. Treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The experiments were in a randomized complete block design with four replications, and plots were 10 by 30 ft. Treatments were evaluated visually based on percent stand reduction as compared to the control.

Table. Comparison of picloram amine, ester, and potassium salt formulations for leafy spurge control, applied at three leafy spurge growth stages in 1992 (Lym).

		Growth stage — Months after first treatment						
		Flower[a]			Seed-set		Fall	
Treatment	Rate	3	12	15	2	11	9	12
	— oz/A —	— % control —						
Picloram amine + 2,4-D[b] + X-77	4 + 16 + 0.5%	96	76	97	96	12	82	2
Picloram amine + 2,4-D[b] + X-77	8 + 32 + 0.5%	99	92	97	98	6	94	25
Picloram[c] + 2,4-D amine + X-77	4 + 16 + 0.5%	92	69	93	95	9	87	2
Picloram[c] + 2,4-D amine + X-77	8 + 32 + 0.5%	98	80	97	98	9	97	49
Picloram ester + triclopyr[d] + picloram[c]	1 + 2 + 3	93	64	96	93	5	74	2
Picloram ester + triclopyr[d] + picloram[c]	1 + 2 + 7	97	81	95	96	7	..	..
Picloram ester + triclopyr[d] + picloram[c]	2 + 4 + 6	98	83	94	95	3	97	19
Picloram ester + triclopyr[d] + picloram[c] + 2,4-D amine	1 + 2 + 3 + 16	96	92	90	90	3	93	20
Picloram[c]	4	99	83	94	88	6	70	3
Picloram[c]	8	98	79	96	92	3	84	6
LSD (0.05)		NS	17	NS	5	NS	20	20

[a]Treatments were reapplied in June 1993.
[b]Picloram triisopropanol amine plus 2,4-D triisopropanol amine (1:4) - Tordon 101.
[c]Picloram potassium salt - Tordon 22K.
[d]Picloram isooctyl ester plus triclopyr butoxyethyl ester (1:2) - Access.

Leafy spurge control 12 months after treatment tended to be better with picloram amine plus 2,4-D than picloram K-salt plus 2,4-D when applied at the true flower growth stage (Table). However, control was similar with picloram amine or K-salt formulations when applied at the early-seed-set or fall-regrowth growth stages. Previous research at North Dakota State University has shown that picloram ester at 4 to 8 oz/A kills leafy spurge topgrowth rapidly and provides only short-term control. Picloram ester at 1 or 2 oz/A was applied with picloram K-salt in this study in an attempt to reduce initial leaf injury but still increase absorption and thus long-term control. However, leafy spurge control with treatments containing picloram ester were either similar to or less than treatments that contained picloram K-salt or amine formulations. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

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

The experiment was established near West Fargo on September 14, 1990, when leafy spurge was in the fall regrowth stage, 20 to 30 inches tall with 2 to 3 inch long new fall growth on stems. Retreatments were applied on approximately the same date in 1991 and 1992. Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 ft in a randomized complete block design with four replications. Evaluations were based on a visual estimate of percent stand reduction as compared to the control. Previous research has shown that quinclorac provided the best leafy spurge control when fall-applied.

		Evaluation date			
Treatment[a]	Rate	June 91	June 92	June 93	Sept 93
	— lb/A —	% control			
Quinclorac + BAS-090	1 + 1 qt	90	93	99	92
Quinclorac + Scoil	1 + 1 qt	74	95	99	94
Quinclorac	1	49	82	89	59
Quinclorac + picloram	1 + 0.5	85	97	97	94
Quinclorac + picloram + BAS-090	1 + 0.5 + 1 qt	91	99	99	97
Picloram + 2,4-D	0.5 + 1	81	92	94	90
Picloram + 2,4-D + Scoil	0.5 + 1 + 1 qt	43	69	92	61
Picloram + 2,4-D + BAS-090	0.5 + 1 + 1 qt	57	83	94	73
Picoram + Scoil	0.5 + 1 qt	71	82	95	60
Picloram	0.5	60	84	96	81
LSD (0.05)		28	14	6	28

[a]Treatments applied annually in September for 3 yr.

Quinclorac either alone or with Scoil provided better leafy spurge control in June 1992 following a second application compared to June 1991 (Table). Leafy spurge control in June 1993 following a third application averaged 92% or better with all treatments except when quinclorac was applied alone. Quinclorac at 1 lb/A plus BAS-090 or the methylated-seed-oil adjuvant Scoil provided better long-term leafy spurge control than quinclorac applied alone. Control in September 1993, which was 12 months after the third annual treatment averaged 93% with quinclorac plus an additive but only 59% when quinclorac was applied alone. Control with quinclorac plus BAS-090 or Scoil was similar to picloram plus 2,4-D at 0.5 plus 1 lb/A, the most commonly used fall-applied treatment. Quinclorac applied with picloram or picloram plus BAS-090 provided similar control to picloram plus 2,4-D and quinclorac plus BAS-090 or Scoil. Scoil applied with picloram did not improve leafy spurge control compared to picloram alone and both Scoil and BAS-090 reduced control when applied with picloram plus 2,4-D.

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

Comparison of liquid and powder picloram formulations applied alone or with glyphosate or adjuvants for leafy spurge control. Rodney G. Lym. Previous research at North Dakota State University has shown that the liquid picloram K-salt formulation provided better leafy spurge control than water-soluble powder (WSP) formulations. However, control from the picloram WSP formulations was improved when applied with 2,4-D or adjuvants compared to the dry formulation alone. The purpose of this research was to further evaluate various formulations of picloram alone and with additives for improved leafy spurge control compared to the picloram K-salt formulation.

A series of experiments was established in the spring or fall of 1992 at various locations in North Dakota. All treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi either in June or September when the plants were in the true-flower or fall- regrowth growth stages, respectively. The spring treatments were reapplied in June 1993. All experiments were in a randomized complete block design with four replications, and plots were 10 by 30 ft. Treatments were evaluated visually based on percent stand reduction as compared to the control.

The first experiment evaluated picloram formulated as the K-salt, an acid WSP (XRM-5255), or a K-salt WSP (XRM-5173) applied either alone or with Scoil (a methylated crop oil adjuvant) or 2,4-D. Picloram K-salt applied as a liquid formulation provided better leafy spurge control than the acid WSP and tended to be better than the K-salt WSP (Table 1). Control with the K-salt liquid averaged over rates was 71 and 84% 12 and 15 months after the first treatment (MAFT), compared to 53 and 65% for XRM-5255, respectively, and 64 and 72% for XRM-5173, respectively. XRM-5255 or XRM-5173 at 0.5 lb/A applied with Scoil, or 2,4-D at 0.25 lb/A provided control similar to the comparable picloram K-salt liquid formulation treatment.

The second experiment evaluated the various picloram formulations applied alone or with various liquid or powder formulations of 2,4-D at two locations in North Dakota. In general, picloram liquid and powder formulations provided similar leafy spurge control at comparable rates (Table 2). However, leafy spurge control with picloram plus 2,4-D tended to be higher when at least one of the herbicides was a liquid formulation, compared to when both were WSP formulations. The 1993 retreatments at West Fargo were delayed by wet conditions until mid-July and all treatments provided near 100% control in September (data not shown).

Picloram liquid K-salt, acid powder (XRM-5255), and K-salt powder (XRM-5173) applied in the late-flower to early-seed-set growth stage provided similar leafy spurge control when applied with 2,4-D LVE or 2,4-D amine or a seed-oil adjuvant (Table 3). Glyphosate plus 2,4-D applied at 4 + 7 oz/A provided the most consistent control at both locations. Control averaged 78 and 99% 3 and 15 MAFT applied alone or with picloram. Retreatments were delayed by wet conditions at West Fargo and were not evaluated in 1993. There was no grass injury at either location.

Glyphosate plus 2,4-D at 4 + 7 oz/A applied in September did not provide satisfactory leafy spurge control the following growing season (Table 4). Control was similar with all picloram formulations, whether applied alone or with 2,4-D or a seed-oil adjuvant. No treatment provided satisfactory control 12 months after treatment.

In summary, picloram K-salt formulation provided better leafy spurge control than the acid powder formulation when applied in mid-June during the true-flower growth stage but all formulations applied later in the growing season provided similar control. XRM-5255 or XRM-5173 provided similar leafy spurge control as liquid picloram K-salt when applied with 2,4-D or a seed-oil adjuvant. Glyphosate plus 2,4-D provided good leafy spurge control when applied in late June but not when fall-applied (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Table 1. Comparison of picloram liquid and water-soluble powder formulations for leafy spurge control applied in June 1992 and 1993, established near Valley City, ND. (Lym).

Treatment	Rate	Months after first treatment		
		3	12	15
	— lb/A —	% control		
Picloram[a]	0.25	67	48	68
XRM-5255[b]	0.25	36	45	61
XRM-5173[c]	0.25	51	38	52
Picloram[a]	0.5	96	73	85
XRM-5255[b]	0.5	46	37	57
XRM-5173[c]	0.5	85	70	71
Picloram[a]	1	100	92	98
XRM-5255[b]	1	97	78	76
XRM-5173[c]	1	99	84	92
XRM-5255[b] + Scoil	0.5 + 1 qt	98	88	75
XRM-5173[c] + Scoil	0.5 + 1 qt	97	88	83
Picloram[a] + 2,4-D	0.25 + 1	90	64	89
XRM-5255[b] + 2,4-D	0.25 + 1	91	57	93
XRM-5173[c] + 2,4-D	0.25 + 1	91	48	93
LSD (0.05)		17	25	13

[a]Picloram K-salt liquid - Tordon 22K.
[b]Picloram acid formulated as a water-soluble powder.
[c]Picloram K-salt formulated as a water-soluble powder.

Table 2. Comparison of picloram water-soluble acid powder, K-salt powder, and liquid K-salt formulations alone and with liquid and powder 2,4-D formulations for leafy spurge control when applied in June 1992 and 1993 at Valley City and West Fargo, ND.

Treatment	Rate	Months after first treatment					
		Valley City			West Fargo		Mean
		3	12	15	3	12	3
	– lb/A –	% control					
XRM-5255[a]	0.25	69	13	60	31	8	50
XRM-5173[b]	0.25	90	24	74	38	9	64
Picloram[c]	0.25	82	19	76	28	4	55
XRM-5238[d]	1	56	6	62	44	9	50
2,4-D amine WSP[e]	1	41	3	63	45	6	43
2,4-D amine liquid[f]	1	48	5	58	46	5	47
XRM-5255[a] + XRM-5238[d]	0.25 + 1	78	23	93	52	6	65
XRM-5173[b] + XRM-5238[d]	0.25 + 1	68	17	88	60	12	64
Picloram[c] + XRM-5238[d]	0.25 + 1	90	37	95	63	9	76
Picloram[c] + 2,4-D amine WSP[e]	0.25 + 1	83	20	95	62	19	72
Picloram[c] + 2,4-D amine liquid[f]	0.25 + 1	91	26	96	77	19	84
XRM-5255[a] + 2,4-D amine WSP[e]	0.25 + 1	90	30	96	68	18	78
XRM-5173[b] + 2,4-D amine WSP[e]	0.25 + 1	93	31	95	68	15	80
LSD (0.05)		22	12	18	17	9	27

[a]Picloram acid formulated as a water-soluble powder.
[b]Picloram K-salt formulated as a water-soluble powder.
[c]Picloram K-salt liquid - Tordon 22K.
[d]2,4-D amine water-soluble powder 85%.
[e]80% WSP (Savage)
[f]Dimethylamine (Weedar 64)

Table 3. Comparison of various picloram formulations alone or with additives and glyphosate plus 2,4-D applied during the late-flower to early seed set growth stage at Sheyenne and West Fargo, ND (Lym).

		Month after first treatment					
		Sheyenne			West Fargo		Mean
Treatment	Rate	3	12	15	3	12	3
	— oz/A —	% control					
Glyphosate + 2,4-D[a] + X-77	4+7+0.5%	99	69	99	91	80	74
Glyphosate + 2,4-D[a] + picloram + X-77	4+7+4+0.5%	99	87	97	96	76	81
XRM-5255[b]	4	97	42	26	18	12	27
XRM-5255[b] + 2,4-D LVE	4+16	97	36	98	85	21	28
XRM-5255[b] + 2,4-D amine	4+16	99	60	99	92	13	36
XRM-5173[c]	4	96	48	29	40	7	28
XRM-5173[c] + 2,4-D LVE	4+16	99	47	97	91	19	33
XRM-5173[c] + 2,4-D amine	4+16	99	41	78	96	22	32
Picloram[d]	4	99	60	51	74	12	39
Picloram[d] + 2,4-D amine	4+16	99	53	74	92	14	33
Picloram[d] + 2,4-D LVE	4+16	100	55	99	92	13	34
Picloram[d] + BAS-090	4+1 qt	100	63	99	95	28	45
Picloram[d] + 2,4-D + BAS-090	4+16+1 qt	99	56	99	90	12	31
Picloram[d] + Scoil	4+1 qt	99	41	96	90	17	29
Picloram[d] + 2,4-D + Scoil	4+16+1 qt	99	48	98	91	23	35
LSD (0.05)		2	NS	18	16	14	15

[a]Commercial formulation - Landmaster BW.
[b]Picloram acid formulated as a water-soluble powder.
[c]Picloram K-salt formulated as a water-soluble powder.
[d]Picloram K-salt liquid - Tordon 22K.

Table 4. Comparison of various picloram formulations alone or with additives and glyphosate plus 2,4-D applied in September 1992 near Hunter, ND (Lym).

		Months after treatment	
Treatment	Rate	9	12
	— oz/A —	% control	
Glyphosate + 2,4-D[a] + X-77	4+7+0.5%	30	0
Glyphosate + 2,4-D[a] + picloram + X-77	4+7+8+0.5%	98	32
XRM-5255[b]	8	92	15
XRM-5255[b] + 2,4-D LVE	8+16	96	33
XRM-5255[b] + 2,4-D amine	8+16	96	22
XRM-5173[c]	8	99	62
XRM-5173[c] + 2,4-D LVE	8+16	98	40
XRM-5173[c] + 2,4-D amine	8+16	95	33
Picloram[d]	8	83	11
Picloram[d] + 2,4-D amine	8+16	83	6
Picloram[d] + 2,4-D LVE	8+16	84	6
Picloram[d] + BAS-090	8+1 qt	87	20
Picloram[d] + 2,4-D + BAS-090	8+16+1 qt	90	31
Picloram[d] + Scoil	8+1 qt	86	5
Picloram[d] + 2,4-D amine + Scoil	8+16+1 qt	92	25
LSD (0.05)		14	35

[a]Commercial formulation - Landmaster BW.
[b]Picloram acid formulated as a water-soluble powder.
[c]Picloram K-salt formulated as a water-soluble powder.
[d]Picloram K-salt liquid - Tordon 22K.

Comparison of various liquid and powder 2,4-D formulations for leafy spurge control. Rodney G. Lym and Calvin G. Messersmith. The most cost-effective treatment for leafy spurge control is picloram plus 2,4-D. Previous research at North Dakota State University has shown that leafy spurge control is increased 15 to 25% when 2,4-D at 1 lb/A is applied with picloram at 0.5 lb/A or less compared to picloram alone. Control has been similar regardless of the 2,4-D formulation applied with picloram. Soon several formulations of 2,4-D will no longer be available because they will not be reregistered with the EPA. Also, several powder formulations of 2,4-D have been formulated to decrease the cost of container shipment and disposal. The purpose of this research was to evaluate several formulations of 2,4-D applied alone or with other herbicides for leafy spurge control.

The first experiment was established on June 7, 1990 near Valley City. Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. Retreatments were applied in 1991 and 1992. All plots were 10 by 30 ft in a randomized complete block design with four replicates. Evaluations were based on visible percent stand reduction as compared to the control.

Leafy spurge control was similar with picloram plus 2,4-D regardless of 2,4-D formulation (Table 1). Control gradually increased as the number of retreatments increased. Picloram at 0.25 lb/A provided better leafy spurge control than either 2,4-D formulation alone even when 2,4-D was applied at 4 lb/A. Control was similar at equal 2,4-D rates applied with picloram regardless of 2,4-D formulation.

The second experiment was established September 9, 1991 near Valley City using the same methods previously described. Leafy spurge was in the fall regrowth stage with red stems and leaves.

As in the previous experiment with spring-applied treatments, leafy spurge control was similar with picloram plus 2,4-D regardless of 2,4-D formulation (Table 2). No treatment provided satisfactory control 12 months after treatment including picloram plus 2,4-D at 0.5 plus 1 lb/A, the standard fall-applied treatment for leafy spurge. Control increased with all picloram plus 2,4-D treatments following a second treatment. However, picloram plus 2,4-D at 0.5 + 1 lb/A provided 73% control, which was better than picloram applied with 2,4-D at 2 lb/A which averaged 52% control averaged across all picloram rates. Previous research has shown that picloram plus 2,4-D at 0.5 + 1 lb/A will provide 90% or better leafy spurge control following 3 to 4 annual retreatments.

The third experiment was established June 8, 1992 near Valley City, ND when leafy spurge was in the yellow bract to flowering growth stage with lush growth and 18 to 24 inches tall. The 2,4-D formulations were added to water immediately prior to application and no surfactants were used.

The water soluble powder CL-782 provided only 68% topgrowth control 1 month after the first treatment (MAFT) compared to 97% or better for all other 2,4-D formulations (Table 3). Control was similar for all 2,4-D formulations 3 and 12 MAFT, including CL-782, and averaged 20 and 13%, respectively. 2,4-D butoxyethyl ester following a second treatment in June 1993 tended to provide better leafy spurge control 15 MAFT than the other 2,4-D formulations.

A fourth experiment was established August 27, 1992 near Chaffee when leafy spurge was in the fall regrowth stage. Picloram plus 2,4-D dimethylamine provided better leafy spurge control than picloram plus 2,4-D mixed amine 12 MAFT (Table 4). Imazaquin or imazethapyr applied at 4 oz/A with Scoil (methylated crop oil adjuvant) provided control similar to picloram plus 2,4-D. Control was not improved when 2,4-D mixed amine was applied with either imazaquin or imazethapyr.

In general, leafy spurge control was similar with all 2,4-D formulations. Control was enhanced when 2,4-D was applied with picloram but not with imazethapyr or imazaquin. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo 58105).

Table 1. Comparison of 2,4-D amine and mixed amine formulations applied alone and with picloram in June 1990 and 1991 and July 1992 for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Months after first treatment				
		3	12	24	36	39
	lb/A	% control				
2,4-D mixed amine[a]	1	27	0	0	3	20
2,4-D mixed amine[a]	2	33	0	0	27	36
2,4-D mixed amine[a]	4	29	0	6	47	34
2,4-D alkanolamine	4	43	0	8	44	39
2,4-D mixed amine[a] + picloram	2 + 0.25	59	18	29	92	53
2,4-D alkanolamine + picloram	2 + 0.25	58	13	33	93	52
2,4-D mixed amine[a] + picloram	2 + 0.5	83	50	79	99	79
2,4-D alkanolamine + picloram	2 + 0.5	78	47	77	99	78
Picloram	0.25	62	4	22	88	45
Picloram	0.5	79	35	65	97	70
Picloram	1	96	89	100	100	99
2,4-D alkanolamine + picloram	1 + 0.5	77	29	78	99	75
LSD (0.05)		18	22	22	19	17

[a]Mixed amine salts of 2,4-D (2:1 v/v dimethylamine:diethanolamine)-HiDep.

Table 2. Comparison of 2,4-D mixed amine and alkanolamine applied in September 1991 and 1992 for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Months after first treatment			
		9	12	21	24
	lb/A	% control			
2,4-D mixed amine[a]	1	16	0	20	3
2,4-D mixed amine[a]	2	15	0	15	8
2,4-D mixed amine[a]	4	20	0	12	9
2,4-D mixed amine[a] + picloram	2 + 0.25	67	5	94	28
2,4-D mixed amine[a] + picloram	2 + 0.5	94	11	98	56
2,4-D alkanolamine + picloram	2 + 0.5	97	9	97	47
2,4-D alkanolamine + picloram	1 + 0.25	66	0	95	22
2,4-D alkanolamine + picloram	1 + 0.5	96	35	99	73
LSD (0.05)		30	6	15	20

[a]Mixed amine salts of 2,4-D (2:1 v/v dimethylamine:diethanolamine)-Hi-Dep.

Table 3. Comparison of various 2,4-D formulations applied in June 1992 and 1993 for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Months after first treatment			
		1	3	12	15
	lb/A	% control			
2,4-D dimethylamine (Weedar 64)	2	98	20	19	46
2,4-D dimethylamine + diethanolamine (Hi-Dep)	2	98	13	11	56
2,4-D butoxyethyl ester (Weedone LV4)	2	100	18	22	57
2,4-D acid + butoxyethyl ester (Weedone 638)	2	99	18	13	75
2,4-D isooctyl(2-ethylhexyl)ester (Esteron 99)	2	99	18	10	47
2,4-D triisopropanolamine + diethylamine (Formula 40)	2	97	17	6	43
2,4-D dimethylamine 80% WSP (CL-782)	2	68	28	13	53
2,4-D dimethylamine 85% WSP (Savage)	2	99	26	11	47
Picloram	0.5	99	89	65	94
LSD (0.05)		11	27	17	25

Table 4. Comparison of 2,4-D formulations applied with imazaquin or imazethapyr in the fall near Chaffee, ND (Lym and Messersmith).

Treatment	Rate	Months after treatment	
		9	12
	oz/A	% control	
2,4-D mixed amine[a]	32	81	8
Picloram	8	95	27
Picloram + 2,4-D mixed amine[a]	8 + 16	98	39
Picloram + 2,4-D dimethylamine	8 + 16	99	61
Imazaquin + Scoil	2 + 1 qt	93	23
Imazethapyr + Scoil	2 + 1 qt	93	18
Imazaquin + Scoil	4 + 1 qt	98	43
Imazethapyr + Scoil	4 + 1 qt	85	50
2,4-D mixed amine[a] + imazaquin + Scoil	8 + 2 + 1 qt	97	15
2,4-D mixed amine[a] + imazethapyr + Scoil	8 + 2 + 1 qt	97	43
LSD (0.05)		14	24

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

Leafy spurge control with reduced rates of picloram, picloram plus 2,4-D, dicamba, and dicamba plus 2,4-D applied for 1 to 4 consecutive years. Sebastian, J.R. and K.G. Beck. An experiment was established near Pagosa Springs, CO to evaluate leafy spurge (EPHES) control with reduced rates of picloram, picloram + 2,4-D, dicamba, and dicamba + 2,4-D. The experiment was designed as a split-plot with four replications. Herbicides and rates comprised the main plots (arranged as a randomized complete block) and treatments applied for 1,2,3, or 4 consecutive years constituted the split. Herbicides were applied when leafy spurge was flowering on June 1, 1989 (year 1), May 31, 1990 (year 2), June 6, 1991 (year 3), and June 30, 1992 (year 4). All treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 24 gal/a, 15 psi. Other application information is presented in Table 1. Main plot size was 10 by 60 feet and sub-plots were 10 by 20 feet.

Visual evaluations compared to non-treated control plots were taken in May and September 1990, June and October 1991, and June and September 1992-3. All first year treatments provided poor (4 to 59%) EPHES control in May 1990, approximately 12 months after treatment (MAT) and little to no control was observed 16,24, and 29 MAT (Table 2). In June 1991, approximately 1 year after 2nd year treatments, picloram at 0.5 lb and picloram plus 2,4-D (0.5 + 1.0 lb) provided mariginal (66 to 68%) EPHES control. Third year treatments of picloram at 0.5 lb and picloram plus 2,4-D (0.5 + 1.0 lb) provided fair EPHES control 4 months after the third year application.

Good EPHES control became apparent after 4 consecutive years of picloram at 0.5 lb and picloram plus 2,4-D (0.25 + 1.0 lb and 0.5 + 1.0 lb). Dicamba 2.0 lb and dicamba + 2,4-D (1.0 + 2.0 lb) provided fair and good control 2 months after the fourth year application. Picloram (0.5 lb) and picloram plus 2,4-D (0.5 + 1.0) maintained fair EPHES control 12 and 15 months after 4 year treatments. All other herbicide treatments provided poor residual EPHES activity in 1993.

Lack of grass competition and severe drought conditions existed in 1989 and 1990 and may have decreased EPHES control from residual herbicide activity. Favorable growing conditions were apparent in 1991, 1992, and 1993 which reflected an increase in Kentucky bluegrass and western wheatgrass densities with EPHES control of 68% or greater (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80523).

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

Environmental data				
Application date	June 1, 1989	June 31, 1990	June 6, 1991	June 30, 1992
Application time	10:00 AM	2:00 PM	7:00 PM	10:00 AM
Air temperature, C	26	18	10	16
Cloud cover, %	5	0	80	15
Relative humidity, %	14	24	85	35
Wind speed, mph	3 to 5	2 to 5	0	3 to 7
Soil temperature, C	17	11	15	24

Application date	species	growth stage	height	density
			(in.)	($shoots/ft^2$)
June 1, 1989	EPHES	open bract	8 to 16	10 to 20
June 31, 1990	EPHES	flowering	13 to 16	10 to 20
June 6, 1991	EPHES	flowering	12 to 16	10 to 20
June 30, 1992	EPHES	flowering	16 to 24	10 to 20

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

Herbicide	Rate	Year of treatment	Leafy spurge							
			May 1990	Sep 1990	Jun 1991	Oct 1991	Jun 1992	Sep 1992	Jun 1993	Sep 1993
	(lb ai/a)		%							
picloram	0.25	1	38	0	4	0	0	0	0	5
picloram	0.25	2	-	74	38	39	11	5	9	9
picloram	0.25	3	-	-	-	55	18	23	25	16
picloram	0.25	4	-	-	-	-	-	60	44	40
picloram	0.5	1	59	0	11	0	5	4	8	5
picloram	0.5	2	-	80	66	55	23	19	21	18
picloram	0.5	3	-	-	-	75	56	41	34	33
picloram	0.5	4	-	-	-	-	-	81	70	68
picloram + 2,4-D	0.25 + 1.0	1	36	0	0	0	4	3	4	4
picloram + 2,4-D	0.25 + 1.0	2	-	66	43	54	24	19	13	8
picloram + 2,4-D	0.25 + 1.0	3	-	-	-	59	40	33	34	29
picloram + 2,4-D	0.25 + 1.0	4	-	-	-	-	-	85	53	49
picloram + 2,4-D	0.5 + 1.0	1	55	0	0	0	0	0	0	0
picloram + 2,4-D	0.5 + 1.0	2	-	78	68	66	25	20	19	15
picloram + 2,4-D	0.5 + 1.0	3	-	-	-	76	55	46	45	45
picloram + 2,4-D	0.5 + 1.0	4	-	-	-	-	-	91	74	74
dicamba	2.0	1	14	0	4	0	0	0	0	0
dicamba	2.0	2	-	53	20	20	13	11	16	15
dicamba	2.0	3	-	-	-	39	23	21	16	16
dicamba	2.0	4	-	-	-	-	-	70	49	49
dicamba + 2,4-D	1.0 + 2.0	1	19	0	4	0	0	0	0	0
dicamba + 2,4-D	1.0 + 2.0	2	-	34	23	4	11	15	13	13
dicamba + 2,4-D	1.0 + 2.0	3	-	-	-	54	57	26	18	21
dicamba + 2,4-D	1.0 + 2.0	4	-	-	-	-	-	85	51	48
LSD (0.05)			10	10	11	18	17	15	16	17

Fall application of herbicides to yellow starthistle. Lawrence W. Lass and Robert H. Callihan. Yellow starthistle has the potential to germinate in both the fall and spring. This study examines the effects of the experimental herbicides MON-13200, MON-12000 and UBI-4243 on control of yellow starthistle when applied in the fall, in comparison with standard treatments. The fall application of herbicides allows for better expression of absorption and translocation characteristics of many herbicides when rain placement into the root zone is required, and may allow for better grass recovery in warm periods during winter and early spring. All of the experimental herbicides tested in this study have shown soil activity on weeds of other crops.

The project was established near Julietta, Idaho, on a non-grazed west-facing slope that had been a bluegrass hay field. Treatments were applied to a 10 by 30 ft split-block plot with 4 replications. The site was mowed with a rotary mower to remove current-season plant stems. The experimental treatments were MON 13200 at 8 & 16 oz/a; MON-13200 + glyphosate at 3+8, 8+8 & 16+8 oz/a; MON-13200 + 2,4-D at 8+12 oz/a; MON-12000 at 0.25, 0.5 and 0.72 oz/a; UBI-C4243 at 0.75, 1.5 and 3 oz/a and a untreated check. Standard treatments for comparison were picloram at 1, 2 & 4 oz/a; metsulfuron at 0.25, 0.5 and 0.75 oz/a; dicamba at 4 & 8 oz/a; 2,4-D at 12 oz/a; Curtail at 1 pt/a (clopyralid+2,4-D 0.76+4 oz/a); atrazine at 16 oz/a and glyphosate at 8 oz/a.

Herbicide treatments were made with a CO_2 backpack sprayer fitted with 8002 flat fan nozzles on October 15, 1992. The sprayer was calibrated to deliver 22 GPA at a speed of 2.2 MPH. Prior to application the wind speed was 1 to 2 MPH from the west. Weather data were recorded at the time of application. The air temperature was 51F, the soil surface temperature of 55F and subsurface temperatures were 50F at 3 inches and 44F at 6 inches soil depth. The relative humidity was 60% and there was a 90% cloud cover. The wind speed was 1 MPH from the west. No dew was present. There was a 50% plant litter cover on the soil surface. Yellow starthistle stages ranged from cotyledons to 1 true leaf.

Late April germination of yellow starthistle took place in all plots. May 10, 1993 evaluations showed the average height of yellow starthistle was lower in all treatments but MON-13200 + glyphosate at 16 oz/a, MON-12000 at 0.5 oz/a, UBI-C4243 at 1.5 oz/a, metsulfuron at lower rates, and atrazine. Because of split germination there appeared to be two distinct heights in the plots. The tallest plants in the plot were measured. The tallest plants were the same height as the check in all treatments except MON-13200 + glyphosate at 16 + 8 oz/a, all rates of picloram, dicamba at 8 oz/a, 2,4-D, Curtail, and glyphosate.

Spring cover evaluations indicated yellow starthistle had been reduced in all picloram treatments and higher rates of MON-13200 or combinations with glyphosate. Grass cover, however, was highest in picloram treatments. Yellow starthistle had recovered by late summer and no treatment exhibited successful control. Evaluations showed no difference in height of the yellow starthistle and only a slight reduction in cover of the highest rate of picloram.

It is postulated that high moisture in the spring and late spring germination of yellow starthistle caused a failure to control the plants with the tested herbicides. The additional rain should have helped MON-13200 activate and some control was recorded early. The control provided by MON-13200 did not last because of the late germination of seedlings. MON-13200 may work in an IPM where annual grass control is required, if followed by a treatment to control escaped yellow starthistle. (University of Idaho, Dept. of Plant, Soil, and Ent. Sci., Moscow 83844)

Table. Effects of experimental and standard herbicides on yellow starthistle.

Treatments	Rate (oz ai/a)	Height: Avg (5/93)	Height: Tall (5/93)	Height: Ratio of Avg to Tall	Height: (7/93)	Cover: (5/93)	Cover: (7/93)	St Johns wort Count (5/93)	Grass Cover (5/93)
		---(cm)---		(%)	-(cm)-	----(%)----		(No./Plot)	(%)
Experimental Treatments									
Check	0	22	29	76%	93	87	90	69	6
MON-13200 + Glyphosate	3 + 8	15 *	26	57%	122	63	98	19	1
MON-13200 + Glyphosate	8 + 8	9 *	20	46%	132	14 *	98	2	0
MON-13200 + Glyphosate	16 + 8	14 *	19 *	76%	134	3 *	100	3	0
MON-13200	8	13 *	25	53%	104	70	86	83	1
MON-13200	16	17	25	68%	137	30 *	99	51	2
MON-13200 + 2,4-D	8 + 12	7 *	16 *	44%	129	8 *	73	89	1
MON-12000	0.25	14 *	22	65%	98	91 *	94	55	2
MON-12000	0.5	18	29	63%	98	80 *	94	8	1
MON-12000	0.72	13 *	25	51%	127	80 *	94	25	2
UBI-C4243	0.75	15 *	28	53%	92	79 *	92	18	14
UBI-C4243	1.5	19	25	77%	86	88 *	84	16	2
UBI-C4243	3	14 *	24	59%	115	80 *	91	43	4
Standard Treatments									
Picloram	0	14	25	55%	106	89	96	15	2
Picloram	1	7 *	11 *	63%	72	50 *	96	1	49*
Picloram	2	9 *	9 *	97%	78	56 *	78	0	40*
Picloram	4	7 *	10 *	74%	83	33 *	66 *	0	66*
Metsulfuron	3	17	24	70%	82	91	90	15	1
Metsulfuron	5	18	25	69%	97	91	93	23	3
Metsulfuron	8	12 *	24	48%	109	80	96	2	1
Dicamba	4	9 *	23	38%	71	73	91	8	26
Dicamba	8	8 *	13 *	66%	82	73	93	90	23
2,4-D	12	9 *	15 *	59%	78	82	90	24	15
Curtail	1	9 *	16 *	55%	82	67	86	15	33*
Atrazine	16	21	29	73%	118	79	96	23	1
Glyphosate	8	9 *	19 *	48%	95	86	95	5	3

Any mean without * is not different from Check using the Duncan's multiple range test.
Percentage values express data as a proportion of the values in the untreated check.

Herbicide evaluation for yellow starthistle control. Lawrence W. Lass and Robert H. Callihan. Yellow starthistle reduces land productivity to the point where many infested sites are sold to purchasers who do not realize the devastating effects of the weed on land use for grazing purposes. These sites often lie idle or are grazed for the limited, low-quality forage produced by the weed. Many such properties are in transition to home or industrial sites. These may be classified as non-crop sites for many years until construction begins. The purpose of this study is to examine the effects of herbicides with moderate residual periods on yellow starthistle on such lands.

The plot design was a split block with 4 replications. Treatments in block 1 were MON-13200 at 8 and 16 oz/a; MON-13200 + glyphosate at 3+8, 8+8, and 16+8 oz/a; MON-13200 + 2,4-D at 8+12 oz/a; MON-13200 + picloram at 8+2 oz/a; MON-12000 at 0.25, 0.5, and 0.75 oz/a and a check. Treatments in block 2 were UBI-C4243 at 0.75, 1.5, and 3 oz/a and a check. Block 3 contained standard treatments of picloram at 1, 2, and 4 oz/a; dicamba at 4 and 8 oz/a; 2,4-D at 12 oz/a; Clopyralid + 2,4-D at 0.76+4 and 1.52+8 oz/a as Curtail; atrazine at 16 oz/a; glyphosate at 8 oz/a; and a check.

Treatments were applied on April 15, 1992 with a CO_2 backpack sprayer with 8002 flat fan nozzles. The sprayer pressure was 40 PSI operated at a speed of 2.4 mph to deliver 23 gal/a. The plot size was 10 by 25 ft on a site with a 15% slope and a northern exposure. There was 80 to 90% trash cover over yellow starthistle plants 1 to 1.5 inches in diameter. At the time of application the air temperature was 75F; the soil temperatures were 82F at the surface, 58F at 2 inches soil depth and 49F at 6 inches soil depth. The relative humidity was 55% with no cloud cover. The wind speed was 1 mph from the west and no dew was present.

In 1992, Yellow starthistle plants present at the time of application were not killed with MON-13200 at rates of 8 and 16 oz/a (Table). MON-13200 at 8 oz/a reduced yellow starthistle height about half. The addition of glyphosate to MON-13200 killed emerged yellow starthistle plants and population counts reflected this. Populations of yellow starthistle treated with glyphosate alone or MON-13200 + glyphosate were not different, indicating that yellow starthistle continued to germinate after the application of MON-13200. The addition of 2,4-D to MON-13200 reduced plant populations, and plants surviving this treatment were escapes from direct application because of the heavy cover. The addition of picloram to MON-13200 killed all yellow starthistle. MON-12000 alone stunted yellow starthistle plants, but did not reduce yellow starthistle populations. UBI-C4243 significantly reduced yellow starthistle height when applied at 1.5 and 3.0 oz/a. Plant populations were not reduced with UBI-C4243. Picloram and dicamba at all rates killed all of the yellow starthistle. The application of 2,4-D and glyphosate reduced yellow starthistle numbers, but many plants escaped because of the cover provided by old yellow starthistle stems.

In 1993, only plots treated with picloram continued to reduce the height of yellow starthistle, but by summer the height was not suppressed by any herbicide applied the previous spring. Yellow starthistle cover remained lowest in the picloram, dicamba and 2,4-D treatments, but the summer evaluation showed starthistle cover in the dicamba plots equal to that in the checks. Yellow starthistle seeds germinated until mid summer because of a cool wet spring. Most of the treatments applied the previous spring were not active enough to control starthistle. (University of Idaho, Dept. of Plant, Soil, and Ent. Sci., Moscow, 83844)

<u>Table.</u> Effects of experimental and standard herbicides on yellow starthistle.

Treatments	Rate	Yellow Starthistle Height			Yellow Starthistle Count	Yellow Starthistle Cover		Field Bind weed Count
	(oz ai/a)	6/92	5/93	7/93	6/92	5/93	7/93	6/92
		-----(cm)-----			(plts/yd2)	----(%)----		(plts/plot)
Experimental (Block 1)								
Check	0	23	22	56	142	50	68	4
MON-13200 + Glyphosate	3 + 8	6 *	20	55	39 *	76	78	11
MON-13200 + Glyphosate	8 + 8	8 *	18	56	41 *	78	80	17
MON-13200 + Glyphosate	16 + 8	9 *	18	50	10 *	65	75	25
MON-13200	8	11 *	21	60	94	63	71	10
MON-13200	16	15	16	47	110	70	79	9
MON-13200 + 2,4-D	8 + 12	2 *	21	59	15 *	65	76	26
MON-13200 + Picloram	8 + 2	0 *	9 *	62	0 *	4 *	34 *	11
MON-12000	0.25	12	18	54	135	51	61	8
MON-12000	0.5	15	22	61	135	45	68	10
MON-12000	0.72	13	18	58	123	56	66	14
Experimental (block 2)								
Check	0	24	20	61	106	63	68	9
UBI-C4243	0.75	18 *	17	60	143	71	74	19
UBI-C4243	1.5	15 *	19	54	146	73	75	4
UBI-C4243	3	11 *	19	58	113	82	74	15
Standard Treatments								
Picloram	0	10	17	55	89	63	60	8
Picloram	1	0 *	15	58	0 *	6 *	30 *	12
Picloram	2	0 *	9	56	0 *	8 *	26 *	13
Picloram	4	0 *	3 *	50	0 *	1 *	16 *	10
Dicamba	4	0 *	16	58	0 *	39	50	9
Dicamba	8	0 *	15	57	0 *	23 *	47	5
2,4-D	12	7	16	59	43	40	44 *	5
Clopyralid+2,4-D 0.76+4	1	2	13	55	38	48	54	8
clopyralid+2,4-D 1.52+8	2	0 *	16	59	0 *	36	56	8
Atrazine	16	9	17	61	17 *	33	45	15
Glyphosate	8	7	13	52	15 *	70	56	10

Any mean without * is not significantly different from Check using the Duncan's multiple range test.

Long-term effects of pyridine herbicides in combination with atrazine used to aid grass establishment in yellow starthistle habitat. Lawrence W. Lass and Robert H. Callihan. Yellow starthistle has become a dominant species within the Columbia River drainages of the Pacific Northwest, and has entered the Great Basin. Yellow starthistle easily invades semiarid and subhumid range sites, particularly where annual grasses prevail. Yellow starthistle co-habits with annual weedy grasses like downy brome and medusahead. Controlling yellow starthistle with herbicides often releases undesirable annual grasses that are poor forages. The aggressive reinvasion by yellow starthistle in such annual grass sites has prevented effective economical range rehabilitation with a single herbicide application. Competitive grasses should be established to reduce the frequency of herbicide applications and prevent reinvasion by the weeds. The purpose of this study was to evaluate the tolerance of selected grasses to herbicides for controlling annual grasses used to revegetate rangeland.

The grasses were:

- bluegrass, Canby, (Poa secunda Presl.)
- fescue, sheep, (Festuca ovina L. cv. Covar) (L).
- fescue, hard, (Festuca ovina (L.) Koch var. duriuscula cv. Durar)
- oatgrass, tall, (Arrhenatherum elatius (L.) Presl. cv. Tualatin)
- wheatgrass, tall, (Thinopyrum ponticum (Podp.) Barkw.& D.R. Dewey (Agropyron elongatum) cv. Alkar)
- wheatgrass, crested, (Agropyron cristatum (L.) Gaertner cv. Ephraim)
- wheatgrass, crested, (Agropyron cristatum (L) Gaerthn. cv. Hycrest)
- wheatgrass pubescent, (Thinopyrum intermedium spp barbulatum (Schu)Barkw. cv. Luna (Agropyron tricophorum))
- wheatgrass, crested (Agropyron desertorum (Fisher ex link)Shultes cv. Nordan)
- wheatgrass, intermediate, (Thinopyrum intermedium spp intermedium (Host) Bark. & D.R. Dewey (Agropyron intermedium) cv. Oahe)
- wheatgrass bluebunch, (Pseuderogneria spicata (Nevski) A. Love (Agropyron spicatum) cv. Secar)
- wheatgrass, Siberian, (Agropyron fragile (Roth) Candargy (A. sibiricum) cv. P-27)
- wheatgrass, streambank (Elymus lanceolatus (Scribner & J.G. Smith)Gould (Agropyron riparium) cv. Sodar).

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

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

Yellow starthistle and grass stands were estimated by counting the number of plants in two 1.34-square meter rectangular quadrats in each plot in mid-July 1989. Visual estimates of grass and yellow starthistle density were recorded on March 27, 1990, June 29, 1991, July 10, 1992 and July 15, 1993.

1989 results: The average number of yellow starthistle in the untreated check was 7.5 plants per square meter. The addition of atrazine at 1.5 lb/a decreased living yellow starthistle plants by more than 75%. The numbers of grass plants in clopyralid and picloram treatments were not different from those in check. Atrazine at 0.5 and 1.0 lb/a did not reduce the number of grass plants. Atrazine symptoms were detected in 12 of 13 established grasses in the picloram main plots, in 10 of 13 established grasses in the clopyralid plots, and in 7 of 13 established grasses, where no pyridine herbicides were applied. Atrazine did not appear to interact with pyridine herbicides to the detriment of the seedling grasses, and additive effects were not apparent. All grasses showed 50% or more chlorosis except for Tualatin tall oatgrass, Paiute orchard grass, Alkar tall wheatgrass, Nordan crested wheatgrass, and Sodar streambank wheatgrass when treated with atrazine at 1.0 lb/a in combination with clopyralid or picloram (data not shown). Canby bluegrass failed to establish.

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

1991 results: the pyridine treatments continued to control 90 to 100% of the yellow starthistle in 1991. Yellow starthistle plants were in the clopyralid treatments but levels were low and generally inconsistent among replicates. After three years, direct residual affects of atrazine alone were not visible. Plots treated with only atrazine at 1.0 and 1.5 lb/a tended to have less yellow starthistle if perennial grasses were tall and/or provided a more dense cover than the checks.

1992 results: the effects of clopyralid were declining and some yellow starthistle plants were present in most plots. Grasses with lower populations of yellow starthistle were Durar hard fescue, Tualatin tall oatgrass, Alkar tall wheatgrass, Oahe intermediate wheatgrass, and Secar wheatgrass. The lower yellow starthistle populations were generally found in grass plots with substantial cover. Yellow starthistle height was reduced in clopyralid-treated areas within Tualatin tall oatgrass and Alkar tall wheatgrass plots.

1993 results: sparse populations of yellow starthistle plants were establishing the picloram treatments, but were generally inconsistant amoung replicates, much like the yellow starthistle reinvasion in the clopyralid treatments in 1991. The effects of clopyralid continued to decline. Grasses, within clopyralid treatments, wherein yellow starthistle cover was lower than in the check, were Tualatin tall oatgrass, Alkar tall wheatgrass, Oahe intermediate wheatgrass, and Secar wheatgrass. Although Durar hard fescue had about half the number of yellow starthistle the difference was not significant. Prickly lettuce and wild oat tended to be more troublesome in plots where yellow starthistle had been chemically removed (data not shown). The only grasses to establish satisfactorily without pyridine treatment for weed control were Tualatin tall oatgrass and Alkar tall wheatgrass. Since yellow starthistle has not fully reestablished in the pyridine treatments, subsequent evaluations will be necessary to further define the longer-term competitive nature of these grasses as influenced by the herbicides used for to aid grass establishment. (Univ. of Idaho, Dept. of Plant, Soil, & Ent. Sci., Moscow, 83843)

Table 1. Effects of pyridine herbicides in combination with atrazine on yellow starthistle height in 1993.

Herbicide	(lb ai/A)	Canby Blueg.	Covar Sheep Fescue	Durar Hard Fescue	Tutal. Tall Oatg.	Paiu. Orch. Grass	Alkar Tall Wheatg.	Ephr. Inter. Wheatg.	Hycr. Wheatg.	Luna Pub. Wheatg.	Nord. Wheatg.	Oahe Int. Wheatg.	Secar Wheatg.	P-27 Sib. Wheatg.	Sodar Stream. Wheatg.
		(cm)													
Check +															
Atrazine	0	124 A	135 A	100 A	114 AB	125 A	119 A	110 ABC	115 A	93 AB	131 A	139 A	130 ABC	132 B A	132 A
Atrazine	0.5	115 A	134 A	101 A	123 A	131 A	104 A	124 AB	125 A	129 AB	124 A	127 A	141 A	121 B	137 A
Atrazine	1	133 A	141 A	104 A	116 AB	121 A	123 A	143 A	116 A	131 AB	120 A	140 A	137 AB	150 A	133 A
Atrazine	1.5	121 A	129 A	86 AB	83 ABC	134 A	96 A	113 AB	113 A	141 A	136 A	129 A	127 ABC	130 AB	142 A
Clopyralid 0.12 +															
Atrazine	0	85 A	119 AB	63 ABC	53 CD	129 A	27 BC	126 AB	120 A	83 B A	128 A	129 A	84 B C	115 B	110 A
Atrazine	0.5	79 A	113 AB	54 ABC	65 BC	129 A	24 BC	81 BC	127 A	88 B A	112 A	121 A	110 B A	117 B	122 A
Atrazine	1	79 A	121 AB	60 ABC	65 BC	131 A	49 B	61 CD	122 A	80 B	138 A	116 A	94 B A	130 AB	126 A
Atrazine	1.5	80 A	81 B	52 ABC	34 CD	110 A	25 BC	82 BC	128 A	74 B C	123 A	99 A	76 D C	123 B	134 A
Picloram 1.0 +															
Atrazine	0	23 B	0 C	0 C	0 D	15 B	23 BC	0 E	39 B	18 D	27 B	27 B	29 DE	0 C	17 B
Atrazine	0.5	0 B	0 C	23 BC	0 D	0 B	0 C	0 E	0 B	0 D	27 B	0 B	0 E	0 C	0 B
Atrazine	1	16 B	29 C	0 C	0 D	17 B	25 BC	23 DE	17 B	24 CD	29 B	24 B	26 DE	0 C	24 B
Atrazine	1.5	22 B	0 C	0 C	0 D	0 B	0 C	0 E	31 B	0 D	0 B	0 B	0 E	0 C	21 B

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

Table 2. Effects of pyridine herbicides in combination with atrazine on yellow starthistle cover in 1993.

Herbicide	(lb ai/A)	Canby Blueg.	Covar Sheep Fescue	Durar Hard Fescue	Tutal. Tall Oatg.	Paiu. Orch. Grass	Alkar Tall Wheatg.	Ephr. Inter. Wheatg.	Hycr. Wheatg.	Luna Pub. Wheatg.	Nord. Wheatg.	Oahe Int. Wheatg.	Secar Wheatg.	P-27 Sib. Wheatg.	Sodar Stream. Wheatg.
		(Cover (%))													
Check +															
Atrazine	0	76 A	98 A	65 A	79 A	99 A	65 A	84 A	100 A	60 AB	100 A	99 A	93 A	89 A	100 A
Atrazine	0.5	56 A	90 A	68 A	55 A	100 A	51 AB	64 AB	100 A	95 A	100 A	93 AB	98 A	71 AB	100 A
Atrazine	1	79 A	91 A	60 A	71 A	100 A	63 A	73 AB	100 A	95 A	100 A	98 A	99 A	79 A	100 A
Atrazine	1.5	70 A	70 AB	55 A	50 A	99 A	30 BC	65 AB	99 A	88 A	100 A	96 A	88 A	74 AB	99 A
Clopyralid 0.12 +															
Atrazine	0	54 A	54 B	29 AB	6 B	64 B	9 CD	58 AB	99 A	41 BC	94 A	64 ABC	15 C	63 AB	58 B
Atrazine	0.5	39 AB	65 AB	25 AB	4 B	73 B	6 D	49 AB	98 A	49 B	98 A	59 BCD	30 BC	59 AB	65 B
Atrazine	1	51 A	43 B	28 AB	10 B	66 B	4 D	43 B	94 A	8 CD	98 A	38 CDE	30 BC	71 AB	71AB
Atrazine	1.5	51 A	35 BC	26 AB	16 B	29 C	13 CD	49 AB	94 A	11 CD	0 A	26 DE	45 B	44 B	81AB
Picloram 1.0 +															
Atrazine	0	1 B	0 C	0 B	0 B	1 D	1 D	0 C	24 B	1 D	4 B	1 E	1 C	0 C	3 C
Atrazine	0.5	0 B	0 C	1 B	0 B	0 D	0 D	0 C	0 C	0 D	1 B	0 E	0 C	0 C	0 C
Atrazine	1	1 B	8 C	0 B	0 B	1 D	4 D	3 C	3 BC	4 D	5 B	5 E	4 C	0 C	3 C
Atrazine	1.5	1 B	0 C	0 B	0 B	0 D	0 D	0 C	1 BC	0 D	0 B	0 E	0 C	0 C	1 C

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

Table 3. Effects of pyridine herbicides in combination with atrazine on grass cover in a yellow starthistle infestation in 1993.

Herbicide	(lb ai/A)	Canby Blueg.	Covar Sheep Fescue	Durar Hard Fescue	Tutal. Tall Oatg.	Paiu. Orch. Grass	Alkar Tall Wheatg.	Ephr. Inter. Wheatg.	Hycr. Wheatg.	Luna Pub. Wheatg.	Nord. Wheatg.	Oahe Int. Wheatg.	Secar Wheatg.	P-27 Sib. Wheatg.	Sodar Stream. Wheatg.
		(Grass cover (%))													
Check +															
Atrazine	0	15 DE	0 B	1 B	18 C	1 C	30 BC	0 C	0 A	11 AB	0 A	0 A	5 B A	0 A	0 B
Atrazine	0.5	20 CDE	0 B	0 B	40 C	0 C	36 ABC	1 C	0 A	3 B	0 A	0 A	0 B	1 A	0 B
Atrazine	1	11 DE	0 B	0 B	28 C	0 C	18 C	0 C	0 A	1 B	0 A	0 A	0 B	0 A	0 B
Atrazine	1.5	23 BCDE	0 B	0 B	48 BC	1 C	36 ABC	0 C	1 A	4 B	0 A	0 A	0 B	1 A	1 B
Clopyralid 0.12 +															
Atrazine	0	3 E	4 B	21 AB	85 A	4 C	74 AB	11 ABC	0 A	13 AB	1 A	1 A	31 AB	8 A	16 B
Atrazine	0.5	9 E	4 B	20 AB	91 A	11 BC	85 A	16 ABC	1 A	20 AB	1 A	4 A	6 AB	0 A	11 B
Atrazine	1	8 E	16 AB	20 AB	81 AB	9 BC	73 AB	0 C	0 A	43 A	0 A	0 A	30 AB	4 A	0 B
Atrazine	1.5	11 DE	4 B	3 B	78 AB	26 ABC	69 AB	4 BC	0 A	35 AB	0 A	19 A	5 AB	4 A	5 B
Picloram 1.0 +															
Atrazine	0	50 AB	29 AB	39 A	94 A	38 AB	58 ABC	39 A	21 A	29 AB	15 A	21 A	28 AB	29 A	45 A
Atrazine	0.5	39 ABCD	15 AB	19 AB	88 A	29 ABC	44 ABC	38 A	3 A	10 AB	9 A	0 A	10 AB	1 A	10 B
Atrazine	1	51 A	38 A	3 B	96 A	55 A	63 ABC	26 AB	21 A	13 AB	20 A	14 A	31 AB	26 A	45 A
Atrazine	1.5	46 ABC	15 AB	3 B	79 AB	49 A	30 8 C	31 AB	20 A	16 AB	21 A	15 A	35 A	11 A	26AB

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

Canada thistle management combining four mowing intervals during the growing season with fall-applied herbicides. Sebastian, J.R. and K.G. Beck. An experiment was initiated at a sub-irrigated pasture near Kersey, CO in 1991. The objective of this experiment was to determine if Canada thistle was controlled better when fall-applied herbicides were preceded by mowing.

The experiment was designed as a 14 (herbicides) by 4 (mowing frequencies) factorial arranged as a strip-block with four replications. Herbicide treatments are identified in Table 2 and there were four mowing frequencies; zero, one, two, or three mowings per season. Mowing was initiated when Canada thistle was 10 to 15 inches tall and in the early-bud stage. Subsequent mowings occurred when Canada thistle re-grew to 10 to 15 inches tall and in the bud to early-flower stage. Canada thistle tended to grow slowly after the first mowing each year and, especially in 1992, progressed slowly if at all into the flowering stage after it was mowed.

Percent Canada thistle control was assessed each spring before mowing and fall before herbicides were applied. Percent cover by plant species was measured each spring and fall to determine the impact of the management systems on the plant community. Canada thistle control data from fall, 1992 and 1993 are presented.

When mowing treatments were averaged over all herbicides, increase in mowing frequencies enhanced control by herbicides incrementally in 1992 whereas three and two mowings enhanced herbicide performance and control longevity in 1993 compared to one or no mowing (data not shown). In 1992, zero, one, two, or three mowings averaged over herbicide treatments controlled Canada thistle 69, 81, 92, and 96%, respectively; these treatments in 1993 controlled Canada thistle 82, 86, 96, and 97%, respectively. Generally in 1993, Canada thistle control longevity from herbicide treatments preceded by zero or one mowing increased while those herbicides preceded by two or three mowings did not change.

Picloram at 0.188 and 0.25 lb/A controlled Canada thistle better when preceded by two or three mowings compared to zero or one mowing during management input (Table 2); however, control longevity was similar in 1993. All mowings increased Canada thistle control over zero mowing in 1992 from picloram plus 2,4-D at 0.188 + 0.5 lb/A. All rates of clopyralid + 2,4-D when preceded by any mowing treatment controlled Canada thistle better compared to the non-mowed check in 1992. Increasing mowing frequency caused incremental increases in Canada thistle control with the two lowest rates of clopyralid + 2,4-D. Additionally, Canada thistle control longevity from clopyralid + 2,4-D was enhanced by mowing. Canada thistle control from dicamba at 1.0 lb/A benefitted from two or three mowings in 1992 and control longevity from this herbicide was enhanced by three mowings. Canada thistle control from picloram at 0.5 or 1.0 lb/A, picloram plus 2,4-D at 0.25 + 1.0 and 0.5 + 1.0 lb/A, and chlorsulfuron at 0.75 oz/A was not enhanced by mowing. Mowing alone controlled Canada thistle greater than 70% when mowing was done two or three times per season for 2 years (Weed Research Laboratory, Colorado State University, Fort Collins, CO 80538).

Table 1. Application information for Canada thistle management combining different mowing intervals during the growing season followed by fall-applied herbicides.

Environmental data		
Application date	October 18, 1991	October 26, 1992
Application time	10:30 AM	11:30 AM
Air temperature, C	19	18
Cloud cover, %	0	0
Relative humidity, %	45	48
Wind speed, mph	0	0 to 3
Soil temperature, C	13	12

Application date	species	number of mowings	growth stage	height (in)	density (shoots/ft^2)
October 18, 1991	CIRAR	0	post flower	24 to 27	3 to 5
		1	post flower	15 to 20	3 to 5
		2	green vegetative	2 to 6	3 to 5
		3	green vegetative	2 to 4	3 to 5
October 26, 1992	CIRAR	0	post flower	20 to 24	1 to 3
		1	post flower	5 to 7	1
		2	rosette	1	0 to 1
		3	rosette	1	0 to 1

Table 2. Canada thistle management combining different mowing intervals during the growing season followed by fall-applied herbicides.

		Canada thistle[a]							
		October 1992				October 1993			
Herbicide	Rate	0 mow	1 mow	2 mow	3 mow	0 mow	1 mow	2 mow	3 mow
	(lb/A)	%							
picloram	0.2	73 b	89 ab	95 a	97 a	91 a	94 a	100 a	100 a
	0.3	89 b	90 b	100 a	100 a	100 a	100 a	100 a	100 a
	0.5	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
	1.0	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
picloram + 2,4-D	0.2 +1.0	54 c	81 b	93 ab	100 a	94 a	96 a	100 a	100 a
	0.3 +1.0	92 a	93 a	96 a	96 a	98 a	100 a	100 a	100 a
	0.5 +1.0	98 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
clopyralid + 2,4-D	0.13 +0.8	46 c	56 bc	78 b	97 a	65 c	73 bc	89 ab	93 a
	0.19 +1.0	44 c	64 b	84 a	88 a	51 b	65 b	90 a	95 a
	0.25 +1.3	51 c	81 b	93 ab	100 a	78 c	86 bc	98 ab	100 a
	0.38 +2.0	70 b	73 b	92 a	95 a	83 b	88 b	96 ab	100 a
dicamba	1.0	63 b	65 b	88 a	91 a	71 b	79 b	88 ab	98 a
chlorsulfuron	0.75 oz	90 a	93 a	96 a	100 a	100 a	100 a	100 a	100 a
non-sprayed		0 c	58 b	74 ab	85 a	0 c	40 b	74 a	80 a

[a]Compare means within a row (i.e., within a herbicide treatment) and within an evaluation date only. Means followed by the same letter do not differ, LSD (P=0.05).

Control for Canada thistle with various herbicides applied at two growth stages. Tom D. Whitson, Phil A. Rosenlund and R.J. Swearingen. Plots were established at two growth stages to evaluate the efficacy of various herbicides. Plots were 10 by 27 ft. with four replications arranged in a randomized complete block. Herbicides were applied broadcast with a CO_2 knapsack sprayer delivering 30 gpa at 41 psi. Application information: early bud stage, July 7, 1992 (air temp. 77F, relative humidity 56%, wind NW 5 mph, sky partly cloudy and soil temp. - 0 inch 85F, 2 inch 77F and 4 inch 71F), late bloom stage, August 11, 1992 (air temp. 68F, relative humidity 64%, wind SW 2-6 mph, sky clear, soil temp. - 0 inch 70F, 2 inch 69F and 4 inch 69F). The soil was sandy loam (55% sand, 25% silt and 20% clay with 5.3% organic matter and a pH 8.3). Canada thistle (*Cirsium arvense* (L.) Scop. was moderate to heavy but well distributed throughout the experimental area.

Picloram applications of 0.5 lb/A in the late bloom stage and 0.75 at both stages provided excellent control. Clopyralid applied alone at 0.28 lb/A provided 87 and 69% control in the early bud and late bloom stage, respectively, while the combination with 2,4-D provided only 44 and 35% control. When the rate of clopyralid and 2,4-D combination were increased to 0.38+2.0 lb control decreased even further to 28% in the early bud stage and 16% in the late bloom stage.

When picloram at 0.25 lb/A or 0.5 lb/A was combined with 2,4-D at 1.0 lb/A and applied at early bud, Canada thistle control increased 19 and 32%, respectively, compared to picloram alone at the same rates. No changes were found with picloram, 2,4-D combinations in the late bloom stage from picloram alone.

Table. Control of Canada thistle with various herbicides applied at two growth stages.

Treatment[1]	Rate lb/A	% Control at two growth stages[2] early bud	late bloom
Picloram	0.25	16	48
Picloram	0.5	58	91
Picloram	0.75	93	98
Picloram+2,4-D	0.25+1.0	35	50
Picloram+2,4-D	0.5+1.0	90	81
Clopyralid+2,4-D	0.19+1.0	39	14
Clopyralid+2,4-D	0.28+1.5	44	35
Clopyralid+2,4-D	0.38+2.0	28	16
Chlorsulfuron	0.06	13	38
Chlorsulfuron+2,4-D	0.06+1.0	20	49
Metsulfuron	0.06	20	11
Metsulfuron+2,4-D	0.06+1.0	23	21
Dicamba	1.0	10	18
Dicamba	2.0	14	15
Clopyralid	0.28	87	69
Check	-----	0	0

[1]Treatments were applied at Canada thistle early bud July 7, 1992, and at late bloom August 11, 1992

[2]Weed control was visually evaluated on July 23, 1993.

PROJECT II

WEEDS OF HORTICULTURAL CROPS

Mark Sybouts - Project Chairperson

Grass control in sweet corn. Bill D. Brewster and William S. Donaldson. A trial was conducted at the Hyslop Agronomy Farm, Corvallis, OR, to compare the effectiveness of three herbicides in controlling barnyardgrass and proso millet in 'Jubilee' sweet corn. The trial design was a randomized complete block with five replications and 8 by 28 ft plots. The herbicide treatments were applied on May 18, 1993, one day after planting. The corn was seeded in 32-inch-wide rows, while the grass weeds were broadcast-seeded across the plots. A single-wheel compressed-air sprayer was used to deliver a broadcast spray of 20 gpa at 15 psi.

The soil was a Woodburn silt loam with a 2.5% organic matter content and a 5.7 pH. The soil surface was dry when the herbicide treatments were applied, and the first rain (0.19 inch) fell on May 20. A total of 3.8 inches of rain fell within 2 wks after application of the herbicide treatments. Visual evaluations of weed control and corn injury were conducted on July 1, 1993, and corn ears were harvested on September 3.

All of the herbicide treatments eliminated the barnyardgrass, but none of them controlled all of the proso millet. Acetachlor and treatments that included atrazine eliminated the shepherdspurse. Some crop stunting occurred with several treatments. Weed interference eliminated corn ear production in the weedy check, but all herbicide treatments significantly increased yield. (Dept. of Crop and Soil Science, Oregon State Univ., Corvallis, OR 97331-3002).

Table. Weed control in 'Jubilee' sweet corn, Corvallis, OR.

		Weed control[2]			Corn[2]	
Treatment	Rate	Barnyard-grass	Proso millet	Shepherds-purse	Injury	Yield
	(lb/A)			(%)		(T/A)
acetochlor	1.5	100	82	100	0	7.0
acetochlor	1.75	100	77	100	2	7.6
acetochlor	2.0	100	81	100	2	8.4
acetochlor + atrazine	1.5 + 1.0	100	82	100	0	8.0
acetochlor + atrazine	1.75 + 1.0	100	78	100	0	8.7
acetochlor + atrazine	2.0 + 1.0	100	80	100	4	7.5
alachlor	2.75	100	76	84	0	6.9
alachlor + atrazine	2.75 + 1.0	100	80	100	2	8.0
metolachlor	2.0	100	79	66	0	5.6
metolachlor + atrazine	2.0 + 1.0	100	71	100	0	7.1
dimethenamid	0.75	100	66	66	2	4.9
dimethenamid	1.25	100	80	85	8	6.5
dimethenamid + atrazine	0.75 + 1.0	100	66	100	0	7.7
dimethenamid + atrazine	1.25 + 1.0	100	83	100	12	6.7
check	0	0	0	0	0	0
					LSD(05)	1.7

[1] Treatments applied May 18, 1993.
[2] Weed control and corn injury evaluated visually on July 1 and corn ears harvested on September 3, 1993.

Evaluation of herbicides for wild-proso millet control in sweet corn grown for seed. Tate W. Carter, Robert W. Downard and Don W. Morishita. This research was conducted near Nampa, Idaho to investigate wild-proso millet control and crop tolerance of sweet corn grown for seed (vars. Silverqueen and Oasis). Both locations had treatments arranged in a randomized complete block design with 12.5 by 25 ft plots. Soil data and application information can be found in Table 1. Corn was planted at 35,000 seeds/A on May 12 and 17 at locations 1 and 2, respectively. Each location had herbicides applied preplant incorporated (PPI), postemergence (POST) and post-directed (PDIR). PPI and POST applications were made using a bicycle wheel sprayer equipped with 11001 flat fan nozzle tips calibrated to deliver 10 gpa at 3 mph. PDIR applications were made with a hand-held boom equipped with 24 inch drop nozzles and 15001 double outlet nozzle tips, also calibrated to deliver 10 gpa at 3 mph. Wild-proso millet densities ranged from 20 to 50 plants/ft^2 at each location, however location 2 seemed to be on the lower end of the range.

Corn (Silverqueen) at location 1 was injured 55 to 58% by nicosulfuron whereas the corn (Oasis) at location 2 was not injured by any of the herbicides. Although nicosulfuron controlled wild-proso millet 93 to 95%, crop injury was unacceptable (Table 2). On July 2, misinformed handweeding crews weeded half of all plots at location 1 and the study was abandoned. None of the herbicides satisfactorily controlled common lambsquarters. Redroot pigweed was best controlled by nicosulfuron + sethoxydim at 78%. This treatment also controlled wild-proso millet best, but only 3% better than nicosulfuron + linuron which was not significantly different. Nicosulfuron + linuron yielded more than twice as much seed as did any other treatment (Table 3). (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, Idaho 83303)

Table 1. Soil chacteristics and herbicide application information.

Location	1				2			
Soil type	silt loam				sandy loam			
pH	7.9				7.8			
Organic matter (%)	1.5				1.4			
CEC (meq/100 g soil)	20				-			
Timing	PPI	POST	PDIR		PPI	POST	PDIR	
Application Date	5/12	5/17	6/9	6/9	7/2	7/14	7/15	7/29
Air Temperature (F)	88	64	67	67	65	70	70	85
Soil Temperature (F)	68	60	62	62	64	60	60	76
Relative Humidity (%)	30	72	74	74	53	50	50	41
Wind Velocity (mph)	12-20	0	2	2	6	8	8	2

Table 2. Sweet corn injury and wild-proso millet control at location 1, near Nampa, Idaho.

Treatment	Rate	Applic. timing	Corn injury	PANMI control
	lb ai/A		%	
Check			0	0
Alachlor	2.0	PPI	0	16
paraquat	0.25	PDIR[1]		
EPTC & dichlormid	4.0	PPI	0	5
sethoxydim[2]	0.19	PDIR		
Dimethenamid	1.25	PPI	0	20
paraquat	0.25	PDIR		
Dimethenamid	1.25	PPI	15	36
sethoxydim	0.19	PDIR		
Nicosulfuron[3]	0.031	POST	55	93
28% N				
Sethoxydim	0.19	PDIR		
Nicosulfuron	0.031	POST	58	95
28% N				
linuron	2.25	PDIR		
28% N				
LSD (0.05)			18	29

[1]Post-directed paraquat and sethoxydim applied July 1.
[2]Crop oil concentrate added to all sethoxydim treatments at 1 quart/A.
[3]Surfactant added to all nicosulfuron and linuron treatments at 0.25% v/v.

Table 3. Sweet corn injury, wild-proso millet control and seed yield at location 2, near Nampa, Idaho.

					Weed control				
		Applic.	Crop injury		PANMI		AMARE	CHEAL	Corn
Treatment	Rate	timing	6/23	8/13	6/23	8/13	8/13	8/13	yield
	lb ai/A		%						lb/A
Check			0	0	0	0	0	0	55
Alachlor	2.0	PPI	0	0	5	31	25	63	139
paraquat	0.25	PDIR[1]							
EPTC & dichlormid	4.0	PPI	0	0	13	31	19	46	72
sethoxydim[2]	0.19	PDIR							
Dimethenamid	1.25	PPI	0	0	25	38	53	30	146
paraquat	0.25	PDIR							
Dimethenamid	1.25	PPI	0	0	23	41	43	49	200
sethoxydim	0.19	PDIR							
Nicosulfuron[3]	0.031	POST	0	0	90	91	78	60	263
28% N									
sethoxydim	0.19	PDIR							
Nicosulfuron	0.031	POST	0	0	91	88	68	41	574
28% N									
Linuron	2.25	PDIR							
28% N									
LSD (0.05)			0	0	22	27	32	43	159

[1]Post-directed paraquat and sethoxydim applied July 1.
[2]Crop oil concentrate added to all sethoxydim treatments at 1 quart/A.
[3]Surfactant added to all nicosulfuron and linuron treatments at 0.25% v/v.

Herbicide evaluation for weed control in sweet corn grown for seed. Tate W. Carter, Robert W. Downard and Don W. Morishita. Research was conducted near Nampa, Idaho to evaluate herbicide performance for weed control and crop tolerance. Sweet corn (var. 8386) was planted May 17 at a rate of 46,500 seeds/A in a silt-loam soil. The pH at this site was 7.8, CEC was 15 meq/100 g soil and organic matter was 1.65%. Treatments were arranged in a randomized complete block design with 12.5 by 25 ft plots. Weeds evaluated for control were barnyardgrass (ECHCG), common lambsquarters (CHEAL), hairy nightshade (SOLSA) and redroot pigweed (AMARE), however, weed populations were low at this site. Preplant incorporated (PPI) treatments were applied May 17 and postemergence (POST) treatments were applied June 24. These applications were made using a bicycle sprayer equipped with 11001 flat fan nozzle tips and calibrated to deliver 10 gpa at 3 mph. The post-directed (PDIR) treatments were applied July 14 and July 29 using a hand-held boom and 15001 double outlet nozzle tips also calibrated to deliver 10 gpa at 3 mph. See Table 1 for other application data. Weed control was significantly different for each weed species evaluated, but no differences in seed yield were observed. Paraquat injured corn at the initial application, however this was only minor leaf burn. Nicosulfuron applied POST and PDIR offered the best overall weed control. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, Idaho 83303).

Table 1. Application data.

Application date	5/17	6/24	7/14	7/29
Timing	PPI	POST	PDIR	PDIR
Air temperature (F)	64	66	74	85
Soil temperature (F)	60	62	64	78
Wind velocity (mph)	0	1 to 3	5 to 6	0 to 3
Soil moisture	fair	fair	good	excellent

Table 2. Herbicide evaluation for weed control in sweet corn grown for seed.

					Weed control[1]									
		Applic.[2]	Crop injury		ECHCG		AMARE		CHEAL		SOLSA		Corn
Treatment	Rate	timing	7/29	8/13	7/29	8/13	7/29	8/13	7/29	8/13	7/29	8/13	yield
	lb ai/a		%										lb/A
Check			0	0	0	0	0	0	0	0	0	0	1832
Alachlor	2.0	PPI	6	0	70	53	50	73	59	68	53	46	1914
paraquat[3]	0.25	PDIR											
EPTC & dichlormid	4.0	PPI	0	0	66	75	20	30	30	44	64	33	2028
sethoxydim[4]	0.19	PDIR											
Dimethenamid	1.25	PPI	7	0	86	74	80	88	41	39	58	44	2029
paraquat	0.25	PDIR											
Dimethenamid	1.25	PPI	0	0	82	65	58	38	29	30	30	20	1944
sethoxydim	0.19	PDIR											
Nicosulfuron[5]	0.50	POST	0	0	86	98	98	100	39	8	40	49	2127
sethoxydim	0.19	PDIR											
Nicosulfuron	0.50	POST	0	0	91	99	86	100	84	94	97	95	1955
linuron[6]	0.03	PDIR											
LSD (0.05)			3	0	36	43	46	50	41	36	34	37	451

[1]Weed control species evaluated were barnyardgrass (ECHCG), redroot pigweed (AMARE), common lambsquarters (CHEAL) and hairy nightshade (SOLSA).
[2]Application abbreviations were preplant incorporated (PPI), postemergence (POST) and post directed (PDIR).
[3]Surfactant added to all paraquat and nicosulfuron treatments at 0.25% v/v.
[4]Crop oil concentrate added to all sethoxydim treatments at 1 qt/a.
[5]28% N added to all nicosulfuron and linuron treatments at 4.0% v/v.
[6]Surfactant added at 0.50% v/v.

Influence of potato cultivar selection on chemical weed control. M.J. VanGessel and P. Westra. Potato cultivars differ in their ability to produce yield under high weed pressure or compete with weeds. This study was designed to examine the impact of reduced herbicide rates with a competitive and non-competitive potato cultivar. This study was conducted in Gilchrest, CO on loamy sand soil, 1.4% o.m. and pH 7.6. The experiment was arranged as a randomized block design with four replications for each cultivar; treatments are listed in Table 1. Potato cultivars 'Norkotah' and 'Frito Lay 1291' were planted side by side on April 29, 1993. The potatoes were planted in 34 inch rows and plots were four rows wide and 25 feet long. Pre-emergence (PRE) treatments were applied on May 27. Treatments with EPTC were incorporated immediately with a rake. Approximately 50% of the potato plants were emerged for both cultivars at time of PRE application. Postemergence (POST) treatments were applied on June 4. Treatments were applied with flat fan nozzles at 20 gpa, 30 psi, and 3 mph. Weed control was visually evaluated August 12, and plots were harvested August 23.

All treatments provided similar levels of weed control with the Frito Lay cultivar due to number and size of leaves, and the effectiveness of the Frito Lay cultivar to shade weed seedlings. Frito Lay yields were not influenced by treatment. Norkotah cultivar was not as competitive as the Frito Lay and poor weed control was observed with pendimethalin at 0.38 lb ai/A for barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) and toothed spurge (*Euphorbia dentata* Michx.). A trend for rate responses was observed for all of the herbicides used, but this was not significant. Norkotah yields were higher for plots treated with EPTC at 3 lbs ai/A; pendimethalin + EPTC, 0.38 + 2.6 lbs ai/A, respectively; metribuzin PRE at 0.3 lb ai/A; metribuzin POST at 0.67 lb ai/A; and metribuzin + metolachlor, 0.5 + 1.5 lbs ai/A, compared to pendimethalin at 0.38 lb ai/A. (Department of Plant Pathology and Weed Science, Colorado State University, Fort Collins, CO 80523.)

Table 1. Treatments, weed control, and yield for 'Frito Lay 1291'.

Weed/Crop Code Rating Data Type Rating Unit Rating Date				AMARE control % 8-12-93	ECHCG control % 8-12-93	EPHDE control % 8-12-93	YIELD cwt/A 8-24-93
Trt No	Treatment Name	Rate	Rate Unit	Timing			
1	Weedy Check				0.0 b	0.0 b	0.0 c	306 a
2	EPTC	4.0	lb ai/A	PRE	75.0 a	75.0 a	96.3 a	
3 3	Pendimethalin Metolachlor	0.38 1.5	lb ai/A lb ai/A	PRE PRE	71.3 a	75.0 a	70.8 ab	
4	Pendimethalin	0.75	lb ai/A	PRE	100.0 a	75.0 a	96.3 a	
5	Pendimethalin	0.38	lb ai/A	PRE	75.0 a	75.0 a	43.8 b	
6 6	Pendimethalin EPTC	0.38 3.5	lb ai/A lb ai/A	PRE PRE	97.5 a	100.0 a	92.8 a	
7	Metolachlor	2.5	lb ai/A	PRE	92.5 a	75.0 a	100.0 a	
8	Metolachlor	1.5	lb ai/A	PRE	87.5 a	75.0 a	87.5 a	
9	Metribuzin	0.33	lb ai/A	POST	100.0 a	100.0 a	97.0 a	
10	Metribuzin	0.33	lb ai/A	PRE	100.0 a	75.0 a	99.0 a	336 a
11 11	Metribuzin Metolachlor	0.5 1.5	lb ai/A lb ai/A	PRE PRE	100.0 a	100.0 a	100.0 a	330 a
12	Metribuzin	0.5	lb ai/A	POST	100.0 a	100.0 a	96.8 a	341 a
LSD (.05) =					36.5	54.4	29.5	42.3
Standard Dev.=					25.3	37.7	20.4	23.3
CV =					30.4	48.9	25.0	7.1

Table 2. Treatments, weed control, and yield for 'Norkotah'.

Weed/Crop Code Rating Data Type Rating Unit Rating Date				AMARE control % 8-12-93	ECHCG control % 8-12-93	EPHDE control % 8-12-93	YIELD cwt/A 8-24-93
Trt No	Treatment Name	Rate	Rate Unit	Timing			
1	Weedy Check				0.0 c	0.0 c	0.0 c	424 ab
2	EPTC	4.0	lb ai/A	PRE	50.0 b	71.3 a	56.3 ab	441 a
3 3	Pendimethalin Metolachlor	0.38 1.5	lb ai/A lb ai/A	PRE PRE	67.3 ab	48.8 ab	15.0 c	428 ab
4	Pendimethalin	0.75	lb ai/A	PRE	92.5 ab	60.0 ab	30.0 bc	432 ab
5	Pendimethalin	0.38	lb ai/A	PRE	54.8 ab	11.3 bc	30.0 bc	364 b
6 6	Pendimethalin EPTC	0.38 3.5	lb ai/A lb ai/A	PRE PRE	71.0 ab	70.0 a	87.5 a	440 a
7	Metolachlor	2.5	lb ai/A	PRE	96.3 ab	97.3 a	65.0 ab	431 ab
8	Metolachlor	1.5	lb ai/A	PRE	72.5 ab	73.8 a	15.0 c	409 ab
9	Metribuzin	0.33	lb ai/A	POST	95.0 ab	57.5 ab	77.5 a	428 ab
10	Metribuzin	0.33	lb ai/A	PRE	84.8 ab	50.8 ab	66.3 ab	459 a
11 11	Metribuzin Metolachlor	0.5 1.5	lb ai/A lb ai/A	PRE PRE	100.0 a	100.0 a	95.0 a	438 a
12	Metribuzin	0.5	lb ai/A	POST	97.5 ab	82.0 a	92.5 a	440 a
LSD (.05) =					40.6	46.3	35.8	61.8
Standard Dev.=					28.1	32.1	24.8	42.8
CV =					38.3	53.3	47.2	10.0

Broadleaf weed control in field potatoes with DPX-E9636 alone or in combination with metribuzin. Richard N. Arnold, Eddie J. Gregory and Daniel Smeal. Research plots were established on April 22, 1993 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of potatoes (var. Snowden) and broadleaf weeds to DPX-E9636 applied alone or in combination with metribuzin. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied after drag-off on May 17, 1993, and were immediately incorporated with 0.75 in of sprinkler applied water. Black nightshade infestations were heavy, redroot and prostrate pigweed infestations were moderate and Russian thistle infestations were light throughout the experimental area. Visual evaluations of crop injury and weed control were made June 16, 1993. Handweeded controls were hoed starting on May 20, about every two weeks until August 26, 1993. Potatoes were harvested on September 21, 1993 by harvesting 2 rows 5 ft long from the center of each plot, with a tractor-driven power digger. The harvested potatoes were then weighed and graded into sizes of 1 7/8 in to 3 in and 3 in and bigger. Culls such as diseased or less than 1 7/8 in were not included.

Effect of herbicides on broadleaf weed control are presented in table 1. All treatments gave good to excellent control of black nightshade, prostrate pigweed, and Russian thistle except DPX-E9636 applied at 0.015 lb ai/A and the check. Redroot pigweed control were excellent with all treatments except the check. No crop injury was observed in any of the treatments. Effect of herbicide treatments on yield of potatoes are presented in table 2. Potato yields for grading size 1 7/8 in to 3 in were 161 to 99 cwt/A higher in the herbicide treated plots as compared to the check. There were no significant differences among treatments for specific gravity.

Table 1. Control of broadleaf weeds with DPX-E9636 alone or in combination with metribuzin on June 16, 1993 in Snowden potatoes at Farmington, New Mexico.

Treatments	Rate	Weed Control[1] SOLNI	AMARE	AMABL	SASKR
	lb ai/A	-----	%	-----	-----
DPX-E9636	0.031	100	100	100	100
DPX-E9636/metribuzin	0.015/0.19	100	100	99	99
DPX-E9636/metribuzin	0.015/0.25	100	100	100	100
DPX-E9636/metribuzin	0.023/0.13	100	100	97	100
DPX-E9636/metribuzin	0.023/0.19	100	100	100	100
DPX-E9636/metribuzin	0.023/0.25	100	100	100	100
DPX-E9636/metribuzin	0.031/0.13	100	100	100	100
DPX-E9636/metribuzin	0.031/0.19	100	100	100	100
DPX-E9636/metribuzin	0.031/0.25	100	100	100	100
metribuzin	0.5	100	100	100	100
metribuzin/ metolachlor[2]	2.0	100	100	100	100
DPX-E9636	0.023	98	100	96	92
DPX-E9636/metribuzin	0.015/0.13	97	96	95	95
DPX-E9636	0.015	90	94	88	83
handweeded check		100	100	100	100
check		0	0	0	0
av weeds/M^2		17	11	8	4
LSD 0.05		1	1	2	2

1. Based on a visual scale from 0 - 100 where 0 = no control or crop injury and 100 = dead plants. SOLNI = black nightshade, AMARE = redroot pigweed, AMABL = Prostrate pigweed and SASKR = Russian thistle.
2. Applied as a packaged mix.

Table 2. Yield and specific gravity of Snowden potatoes affected by DPX-E9636 alone or in combination with metribuzin at Farmington, New Mexico, 1993.

Treatments	Rate	Total Yield	1 7/8-3 in	>3 in	Specific Gravity
	lb ai/A	-----	cwt/A	-----	#
DPX-E9636	0.031	449	319	74	1.104
DPX-E9636/ metribuzin	0.015/0.19	463	348	66	1.101
DPX-E9636/ metribuzin	0.015/0.25	501	328	115	1.099
DPX-E9636/ metribuzin	0.023/0.13	493	336	112	1.097
DPX-E9636/ metribuzin	0.023/0.19	458	341	69	1.100
DPX-E9636/ metribuzin	0.023/0.25	546	372	135	1.100
DPX-E9636/ metribuzin	0.031/0.13	463	377	44	1.098
DPX-E9636/ metribuzin	0.031/0.19	453	331	69	1.098
DPX-E9636/ metribuzin	0.031/0.25	432	360	35	1.097
metribuzin	0.5	504	338	109	1.094
metribuzin/ metolachlor[2]	2.0	487	372	58	1.097
DPX-E9636	0.023	509	338	118	1.100
DPX-E9636/ metribuzin	0.015/0.13	484	310	126	1.100
DPX-E9636	0.015	438	328	65	1.099
handweeded check		490	346	103	1.100
check		258	211	0	1.094
LSD 0.05		125	ns	63	ns

Broadleaf weed control in field potatoes. Richard N. Arnold, Eddie J. Gregory and Daniel Smeal. Research plots were established on April 22, 1993 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of potatoes (var. Snowden) and annual broadleaf weeds to herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied after drag-off on May 17, 1993, and were immediately incorporated with 0.75 in of sprinkler applied water. Black nightshade infestations were heavy, redroot and prostrate pigweed infestations were moderate and Russian thistle infestations were light throughout the experimental area. Visual evaluations of crop injury and weed control were made June 16, 1993. Handweeded controls were hoed starting on May 20, about every two weeks until August 26, 1993. Potatoes were harvested on September 22, 1993 by harvesting 2 rows 5 ft long from the center of each plot, with a tractor-driven power digger. The harvested potatoes were then weighed and graded into sizes of 1 7/8 to 3 in and 3 in and bigger. Culls such as diseased or less than 1 7/8 in were not included.

Effect of herbicides on broadleaf weed control are presented in table 1. All treatments gave good to excellent control of redroot and prostrate pigweed and Russian thistle except metolachlor II applied at 1.0 lb ai/A and the check. Black nightshade control was good to excellent with all treatments except metolachlor II applied at 1.0 and 1.5 lb ai/A and the check. No crop injury was observed in any of the treatments. Effect of herbicide treatments on yield of potatoes are presented in table 2. Potato yields for grading size 1 7/8 in to 3 in were 286 to 89 cwt/A higher in the herbicide treated plots as compared to the check. There were no significant differences among treatments for specific gravity.

Table 1. Control of broadleaf weeds with herbicides on June 16, 1993 in Snowden potatoes at Farmington, New Mexico.

Treatments	Rate	Weed Control[1,2] AMARE	AMABL	SASKR	SOLNI
	lb ai/A	---------------%	-------------		
dimethenamid	1.0	100	99	95	92
dimethenamid	1.25	100	100	99	96
metolachlor II	1.5	100	94	85	73
metolachlor II	2.0	100	100	100	90
dimethenamid/ metribuzin	0.75/0.3	100	100	100	98
dimethenamid/ metribuzin	1.0/0.3	100	100	100	98
dimethenamid/ metribuzin	1.25/0.3	100	100	99	98
metolachlor II/ metribuzin	1.0/0.3	100	97	100	99
metolachlor II/ metribuzin	1.5/0.3	100	100	100	96
metolachlor II/ metribuzin	2.0/0.3	100	100	100	96
metribuzin	0.6	100	100	100	98
dimethenamid	0.75	98	94	88	96
metribuzin	0.3	97	96	100	90
metolachlor II	1.0	88	72	53	68
handweeded check		100	100	100	100
check		0	0	0	0
av weeds/M^2		9	11	4	28
LSD 0.05		2	2	4	6

1. Based on a visual scale from 0 - 100 where 0 = no control or crop injury and 100 = dead plants.
2. AMARE = redroot pigweed, AMABL = prostrate pigweed, SASKR = Russian thistle and SOLNI = black nightshade.

Table 2. Yield and specific gravity of Snowden potatoes affected by herbicides at Farmington, New Mexico, 1993.

Treatments	Rate	Total Yield	1 7/8-3 in	>3 in	Specific Gravity
	lb ai/A	-------------cwt/A	----------		#
dimethenamid	1.0	489	300	49	1.094
dimethenamid	1.25	424	393	32	1.097
metolachlor II	1.5	375	266	61	1.099
metolachlor II	2.0	347	289	25	1.096
dimethenamid/ metribuzin	0.75/0.3	523	424	38	1.092
dimethenamid/ metribuzin	1.0/0.3	400	312	31	1.094
dimethenamid/ metribuzin	1.25/0.3	481	395	38	1.097
metolachlor II/ metribuzin	1.0/0.3	486	354	72	1.094
metolachlor II/ metribuzin	1.5/0.3	395	300	35	1.100
metolachlor II/ metribuzin	2.0/0.3	441	349	43	1.094
metribuzin	0.6	412	358	25	1.098
dimethenamid	0.75	347	297	14	1.094
metribuzin	0.3	484	350	92	1.100
metolachlor II	1.0	283	227	4	1.099
handweeded check		489	393	48	1.098
check		178	138	0	1.091
LSD 0.05		154	123	ns	ns

Reduced herbicide rates for strawberries. Gina Koskela, Ray William, and Bernadine Strik. The efficacy of terbacil and acifluorfen at newly reduced rates for control of selected weed species that occur in strawberries was studied. Plots were established under irrigation at the North Willamette Research and Extension Center, Aurora, OR. Plots were 3 by 18 ft. with four replications arranged in a randomized complete block design. Weeds seeded into all plots consisted of annual bluegrass, wild carrot, common chickweed, dogfennel, common groundsel, henbit, redroot pigweed, and Italian ryegrass at a rate of about 70 seeds total per square foot.

Herbicide treatments consisted of a maximum rate and a split rate applied on September 10, 1992 and October 27, 1992. Reduced labeled rates for acifluorfen are 0.50 lb maximum per season and 0.375 lb for split application with a minimum interval between applications of 15 days. Reduced labeled rates for terbacil are 0.375 lb maximum per season and 0.125 for split application. Two controls, a weedy control and a simazine control plot (at labeled rate), were used for comparison.

Treatments were applied when weeds were less than 1" tall or wide. The herbicide treatments were applied broadcast with a CO_2 backpack sprayer delivering 50 gpa at 30 psi. Efficacy ratings were made two, four and eight weeks after treatments were applied.

In this trial, reduced rates of terbacil were effective in controlling weeds. Both broadleaf and grass weeds were adequately controlled with results similar to simazine, the herbicide control. Acifluorfen, for the first few weeks after appplications were made, appeared to be controlling broadleaf weeds. However, after 4-6 weeks, chickweed, henbit and groundsel began to invade plots. Also, aciflourfen was not able to control the annual grasses. (North Willamette Research and Extension Center, Berry Research Program, Oregon State Univ., Aurora, OR 97002).

Table. Average weed control ratings.

Treatment	Rate	Weed control[1]							
		Annual bluegrass	Wild carrot	Common chickweed	Dog-fennel	Common groundsel	Henbit	Redroot pigweed	Italian ryegrass
	lb/A								
acifluorfen	0.5	0	10	5	10	10	7.5	10	0
acifluorfen	0.375	0	10	5	9	10	7.5	9	0
terbacil	0.375	10	10	10	10	10	10.0	10	10
terbacil	0.125	10	10	10	10	10	10.0	10	10
simazine	1.0	10	10	10	10	10	9.5	10	9
weedy check		0	0	0	0	0	0	0	0

[1] 0=no control, 10=adequate control.

Weed control in dry bulb onions. Carl E. Bell and Mike J. Ansolabehere. A field research experiment was conducted at the University of California Desert Research and Extension Center, Holtville, CA, to compare several herbicides for control of annual bluegrass and crop phytotoxicity in dry bulb onion (var. Contessa). The trial utiliized a randomized complete block design with four replications. Plot size was 2 raised beds (each 1 m wide) by 7.6 m. The crop was sown on November 9, 1992 and irrigated with sprinklers on the same day. Herbicide treatments are shown in the Table below. Treatments were made either preemergence (PREE) on November 9 or postemergence (POST), applied sequentially on November 24 and December 19 or applied once on December 19. Herbicides were applied with a CO_2 pressured sprayer at 140 kPa using 8003LP flat fan nozzles for a spray volume of 270 L/ha. The whole experiment was oversprayed with .28 kg/ha of oxyfluorfen on January 26 and again on February 9, 1993 to control london rocket and spiny sowthistle. Sowthistle control was not adequate with oxyfluorfen, this weed affected ultimate yield of several treatments.

Visual evaluations of annual bluegrass and spiny sowthistle control and crop injury were made on January 26. Visual evaluation of annual bluegrass control was made again on February 16, 1993. Onion standcounts were also made on these same days, counting the total number of onions per 2.0 m of bed by two beds. Crop harvest was made on May 19, 1993, recording fresh weight of onions in 3.1 m of bed by two beds. Analysis of variance and mean separation were conducted on standcount and harvest data.

Most treatments controlled annual bluegrass well, except for trifluralin at .28 kg/ha. Treatments which included DCPA controlled spiny sowthistle well, other herbicides did not. Stand counts varied considerably, but no clear trends were evident except that treatments which included trifluralin seemed to reduce onion numbers. Treatments which included DCPA, because of the sowthistle control, produced significantly higher yield than other treatments. (University of California Cooperative Extension, Holtville, CA 92250 and Valent USA Corporation, Fresno, CA 93722).

Table 1. Weed control in dry bulb onions in Holtville, CA.

Treatments	Rate	Appl.[1]	Weed control[2] POAAN 1/26	Weed control[2] POAAN 2/16	Weed control[2] SONAS 1/26	Vigor[2] 1/26	Stand[3] 1/6	Stand[3] 2/17	Yield[4] 5/19
	kg/ha		------- % -------				----#----		kg
DCPA	11.8	PREE	99	89	98	99	130	127	11.5
trifluralin	0.28	PREE	0	31	0	98	115	96	3.4
trifluralin	0.56	PREE	98	89	46	96	111	81	3.0
trifluralin	0.84	PREE	99	95	58	93	119	76	3.3
DCPA +	11.8	PREE							
trifluralin	0.28		99	98	98	96	132	108	8.5
DCPA +	11.8	PREE							
trifluralin	0.56		100	98	98	91	117	66	9.2
clethodim	0.10 + 0.14	POST	91	93	0	99	119	115	4.7
clethodim	0.21 + 0.14	POST	99	98	0	99	117	117	3.1
clethodim	0.21	POST	88	96	0	99	109	113	3.8
untreated control			0	0	0	100	114	94	2.2
			LSD(0.05)				15	20	3.5

[1] Appl. - application, PREE = preemergence, POST = postemergence, either a sequential application on 11/24 and 12/19/92 or one application on 12/19/92.

[2] Weed control and crop vigor visually evaluated on dates indicated above columns. POAAN = annual bluegrass, SONAS = spiny sowthistle.

[3] Stand counts are numbers of onions in a 2 m section of 2 beds, mean of four replications.

[4] Yield is kg of onion bulbs in a 3.1 m section of 2 beds, mean of four replications.

Weed control in dry bulb onions for dehydration. G. Clough and D.A. Ball. A study was conducted at the Hermiston Research and Extension Center, Hermiston, OR to evaluate options for chemical weed control in sprinkler irrigated dry bulb onions for dehydration. Treatments consisted of combinations of preplant incorporated (PPI), preemergence (PRE) residual, and late postemergence residual lay-by treatments (LPOST) with or without periodic contact type postemergence treatments (MPOST). Treatments containing metham were applied PPI on March 19, 1993 followed by 0.5" water application through sprinkler irrigation. The entire plot area was rototilled and seeded to dry bulb onions var. 'Southport white globe' on April 13. DCPA and pendimethalin were applied PRE on April 14, with a hand-held sprayer delivering 30 gpa at 40 psi. All early treatments except metham received sethoxydim + COC at 0.19 lb/A + 1% v/v for control of volunteer wheat (TRIAE). MPOST treatments consisted of oxyfluorfen + bromoxynil at 0.2 lb/A + 0.375 lb/A applied May 31, July 1, and August 10, and fluazifop-P + COC at 0.187 lb/A + 0.5% v/v applied on May 18, and June 17 using a hand-held boom delivering 60 gpa at 40 psi. LPOST treatments were made on June 20 with a hand-held boom sprayer delivering 30 gpa at 40 psi. Evaluations of onion plant stand, crop vigor, and percent visual control of weeds were made before MPOST treatments on May 13 (Table 1). Late percent visual weed control evaluations were made on July 14 (Table 1). Onions were harvested on September 15, and evaluations made on crop stand at harvest, marketable yield (bulbs > 1.25") (Table 1), and marketable bulb number (data not shown).

Results indicate that PPI metham treatments showed improved early plant vigor (0 = good vigor to 5 = dead) compared to other herbicide treatments, and stands were slightly better early in metham treated plots compared to DCPA or pendimethalin (Table 1). Early control of common lambsquarters (CHEAL) was better from DCPA treatments than from metham or pendimethalin PPI or PRE treatments (Table 2). Early season green foxtail (SETVI) control was fair from all treatments and better than an untreated control. Volunteer wheat (TRIAE) control was excellent from metham treatment. All other plots required sethoxydim treatment to control TRIAE. All treatments receiving the oxyfluorfen + bromoxynil contact treatment regime (MPOST) had very good to excellent overall late season weed control. Without the MPOST treatments, CHEAL control was inadequate resulting in yield and quality reductions (Table 1). Treatments of DCPA at 5.25 lb/A PRE and DCPA at 5.25 lb/A LPOST, and the higher rates of metham PPI with MPOST treatment gave the best season long control which was reflected in improved dry onion bulb yield and quality. MPOST treatments alone or PRE/PPI treatments alone did not provide acceptable weed control (Table 1). Current production practices which result in high N-fertility levels, frequent irrigations, and poor ground cover from the onion crop all contribute to the need for intensive weed control measures. (Hermiston Ag. Res. and Ext. Ctr., Hermiston, OR, 97838, and Columbia Basin Ag. Res. Ctr., Oregon State University, 97801).

Table 1. Crop response of dry bulb onions for dehydration to herbicide treatments.

Treatment PRE or PPI[1]	Rate	MPOST[2]	LPOST	Rate	Stand	Vigor[3]	Stand at Harvest	Marketable Yield
	lb/A			lb/A	(No./Ax1000)	(0-5)	(No./Ax1000)	(t/A)
DCPA	5.75	no	DCPA	5.25	88.7	1.7	264	20.1
DCPA	5.75	yes	DCPA	5.25	94.0	2.0	290	24.6
DCPA	6.0	no	DCPA	4.5	79.0	2.3	268	19.1
DCPA	6.0	yes	DCPA	4.5	99.7	1.7	254	20.1
DCPA	7.5	yes	Pend.	0.4	92.3	2.3	272	21.0
Metham	127.2	no	DCPA	7.5	96.0	0	140	5.0
Metham	127.2	yes	DCPA	7.5	104.0	0	314	18.8
Metham	127.2	yes	Pend.	0.4	102.7	0	292	17.7
Metham	254.4	no	DCPA	7.5	100.5	0	302	13.4
Metham	254.4	yes	DCPA	7.5	103.0	0	292	23.9
Metham	254.4	yes	Pend.	0.4	107.7	0	305	21.9
Pend.	0.4	yes	Pend.	0.4	90.5	1.7	260	21.1
Control	-	yes	Pend.	-	83.5	1.3	202	10.2

[1] DCPA and Pendimethalin applied PRE.
Metham applied PPI, and Pend. = pendimethalin.

[2] MPOST treatments - oxyfluorfen + bromoxynil May 31, July 1, August 10.
- sethoxydim or fluazifop-P April 29, May 18, June 17.

[3] Stand vigor, 0 = good to 5 = dead.

Table 2. Weed control in dry bulb onions for dehydration.

Treatment				-------May 13-------			--------- July 14 ---------			
PRE or PPI[1]	Rate	MPOST[2]	LPOST	CHEAL	SETVI	TRIAE	CHEAL	SOLTR	SASKR	SETVI
	lb/A			%						
DCPA	5.75	no	DCPA	90	83	0	53	97	77	89
DCPA	5.75	yes	DCPA	93	20	20	99	100	100	98
DCPA	6.0	no	DCPA	75	67	27	65	94	76	94
DCPA	6.0	yes	DCPA	73	67	33	93	100	95	82
DCPA	7.5	yes	Pend.	87	85	33	91	100	100	93
Metham	127.2	no	DCPA	63	15	97	20	75	90	75
Metham	127.2	yes	DCPA	57	60	97	85	100	100	95
Metham	127.2	yes	Pend.	43	45	97	93	100	100	91
Metham	254.4	no	DCPA	85	83	100	10	85	93	89
Metham	254.4	yes	DCPA	85	70	100	99	100	100	96
Metham	254.4	yes	Pend.	87	83	100	95	100	100	97
Pend.	0.4	yes	Pend.	75	70	10	94	100	100	91
Control	-	yes	Pend.	0	0	0	60	100	100	94

[1] DCPA and Pendimethalin applied PRE.
Metham applied PPI, and Pend. = pendimethalin.

[2] MPOST treatments - oxyfluorfen + bromoxynil May 31, July 1, August 10.
- sethoxydim or fluazifop-P April 29, May 18, June 17.

CHEAL = common lambsquarters, SETVI = green foxtail, SOLTR = cutleaf nightshade, SASKR = russian thistle.

Winter annual weed control in broccoli with Pyridate. B. R. Tickes, D. Monypeny, C. Bell, and M. McGiffen. This test was established to evaluate the efficacy of three rates of pyridate 45 WP for the control of winter annual broadleaf weeds in broccoli. The test was conducted in the Yuma Valley, Arizona on a silty clay loam soil with less than 1% organic matter. Irrigation was in level furrows with Colorado River water. Treatments included three rates; 0.45, 0.90 and1.8 lbs active ingredient per acre of pyridate and an untreated check. Plot size was 25 ft. by 2 beds laid out in a completely randomized block design with three replications. The weeds present were London Rocket, Nettleleaf goosefoot and little mallow at one to three per $ft.^2$. These weeds were from one-fourth to two inch rosette at the time of application on November 1, 1993. Treatments were applied with a CO_2 compressed air backpack sprayer calibrated to apply 20 gallons per acre. Visual evaluations of percent control and phytotoxicity were made on November 18, 1993. Excellent levels of nettleleaf goosefoot control (96 to 100%) resulted from all three rates of pyridate. Control of London Rocket and little mallow was acceptable (83 to 85%) at the 0.90 lb. rate and excellent (90 to 96%) at the 1.8 lb. rate. Unacceptable levels of control of both of these weeds resulted from the 0.45 lb. rate. Phytotoxicity in the form of necrosis to the leaves present at the time of application was observed; levels of 10% at the low (0.45 lb.) rate, 20% at the middle (0.90 lb.) rate and 40% at the high (1.8 lb.) rate.

Table. Winter annual broadleaf control in broccoli with three rates of Pyridate.

		Weed Control (%)[1]			
Treatment	Rate (lbs/A)	London Rocket	Nettleleaf Goosefoot	Little Mallow	Phytotoxicity (%)
Pyridate 45WP	0.45	70	96	58	10
Pyridate 45WP	0.90	83	100	85	20
Pyridate 45WP	1.8	90	100	96	40
Untreated	--	0	0	0	0

[1]Average of three replications.

Time of weed removal effects fresh carrot yield. Carl E. Bell. This project was a comparison of the effect on fresh carrot yield of allowing weed competition with the crop for various week periods before removal. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

Experimental design was a randomized complete block, with six replications. Plot size was 3 beds, each 1 m wide, by 4.6 m. The crop was sown in two seedlines per bed on November 9, 1992 and irrigated with sprinklers on the same day. No herbicides were applied. A natural infestation of spiny sowthistle served as the competing weed. Treatments were weeks before weed removal, (0, 1, 2, 4, and 8) beginning when the crop was in the cotyledon stage of growth on December 14, 1992. After the initial weeding, plots were weeded regularly to keep the plots weed free.

All plots were harvested on April 22, 1993. Harvested area was 3.1 m of the middle bed of the three beds of each plot. Yield data were subjected to analysis of variance, mean separation, and single degree of freedom orthogonal comparisons. Results are shown in the Table below. There was no significant difference ($P > 0.05$) between treatments for time of weed removal. A single degree of freedom comparison of yield for the 8 week period versus the other treatments was different ($P < 0.01$).(Cooperative Extension, University of California, Holtville, CA 92250.)

Table. Time of weed removal effect on yield of fresh carrots.

Weeks before removal	Yield[1]
	kg
0	18.0
1	16.9
2	19.4
4	16.4
8	13.7
LSD(0.05)	3.5

Single degree of freedom orthogonal comparison

Weeks 0 - 4 versus week 8 $F = 9.678$, $P = 0.006$

[1] Yield is in kg per 3.1 m of bed, mean of six replications.

Linuron for weed control in carrots. Carl E. Bell. This project was a comparison of linuron applied preemergence (PREE), postemergence (POST), or as sequential combinations for weed control in fresh market carrots. The objective was to determine the best timing, within label limitations, with regard to weed control and crop injury. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

Experimental design was a randomized complete block, with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. The crop was sown in two seedlines per bed on November 9, 1992 and irrigated with sprinklers on the same day. Preemergence treatments were also made on November 9. Postemergence applications were made on three dates: December 19, when the crop was in the cotyledon stage; January 26, 1993, when the crop was 7.6 cm tall; and one week later on February 2. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8003LP nozzles for a spray volume of 270 L/ha. Soil type was a clay loam.

Data collected were a stand count on January 12, 1993; a visual evaluation of spiny sowthistle control on January 26 and February 16, 1993; and crop yield on May 15, 1993. Standcount and yield data were subjected to analysis of variance and mean separation. Results are shown in the Table below.

Most treatments controlled spiny sowthistle very well at the first visual evaluation. At the second evaluation, most treatments still controlled spiny sowthistle well, except for the two single treatments at the cotyledon stage. Yield was significantly lower for the single treatment at the cotyledon stage at the lowest rate and for the untreated control. Crop stand was not decreased by any treatment (P > 0.05). (Cooperative Extension, University of California, Holtville, CA 92250.)

Table. PREE and POST linuron for fresh market carrots.

Linuron rate and application timing[1] PREE	Coty.	7.6 cm	1 WAT	SONAS control[2] Jan. 26	Feb. 16	Stand[3]	Yield[4]
				------- %	------	#	lbs
	0.56			85	61	176	27.5 b
	1.1			95	85	191	42.2a
	0.56	1.1		79	99	162	44.3a
	1.1	1.1		98	100	177	48.7a
		0.56	1.1	0	98	179	40.6a
		1.1	1.1	0	98	173	44.0a
		1.68	0.56	0	98	172	42.7a
0.56	0.56	1.1		98	100	189	46.8a
1.1		1.1		99	99	180	47.6a
Untreated control				0	0	170	15.3 c

[1] Rate is in kg/ha; PREE = preemergence, Coty. = cotyledon stage, 7.6 cm = 7.6 cm tall, WAT = one week after treatment at 7.6 cm stage.
[2] SONAS - spiny sowthistle.
[3] Stand count is number of carrots per 1.8 m of bed by two beds, mean of four replications.
[4] Yield is kg of carrots per 4.6 m of bed by two beds, mean of four replications. Numbers in the column followed by the same letter are not significantly different (P = 0.05) according to Fisher's Protected LSD.

Preemergence herbicides for weed control in carrots. Carl E. Bell. This project was a comparison of preemergence (PREE) and preplant incorporated (PPI) herbicide treatments for weed control in fresh market carrots. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

Herbicides compared were trifluralin, pendimethalin, and linuron. Experimental design was a randomized complete block, with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. The crop was sown in two seedlines per bed on November 9, 1992 and irrigated with sprinklers on the same day. Herbicide treatments were also made on November 9. Preplant incorporation was accomplished with a PTO driven rototiller, set to operate 5 cm deep. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8003LP nozzles for a spray volume of 270 L/ha. Soil type was a clay loam.

Data collected were a stand count on January 5, 1993; a visual evaluation of spiny sowthistle control on January 26, 1993; and crop yield on April 27, 1993. Standcount and yield data were subjected to analysis of variance and mean separation. Results are shown in the Table below.

Most treatments controlled spiny sowthistle very well, except for the preplant incorporated treatments. The PPI treatment of pendimethalin only provided 27% control of spiny sowthistle. Yield results were lower (P >0.05) for the PPI pendimethalin treatment and the untreated control compared to the other treatments. Crop stand was not decreased by any treatment. (Cooperative Extension, University of California, Holtville, CA 92250.)

Table. PREE and PPI herbicides for fresh market carrots.

Treatment	Rate	Appl.[1]	SONAS[2] control	Stand[3]	Yield[4]
	kg/ha		%	#	kg
Trifluralin	.84	PPI	79	207	49.9
Trifluralin	.84	PREE	95	202	49.9
Pendimethalin	.84	PPI	27	190	34.1
Pendimethalin	.84	PREE	99	183	59.0
Trifluralin	.84				
+ linuron	.56	PREE	98	197	53.6
Trifluralin	.84				
+ linuron	1.1	PREE	99	195	62.2
Pendimethalin	.84				
+ linuron	.56	PREE	99	199	56.8
Pendimethalin	.84				
+ linuron	1.1	PREE	100	182	63.6
Linuron	1.1	PREE	99	201	57.2
Untreated control			0	189	29.0
		LSD(0.05)		ns	15.0

[1] Treatments were applied either preplant incorporated (PPI) or preemergence (PREE).

[2] SONAS - spiny sowthistle.

[3] Stand is number of carrots per 3.1 m of bed by two beds, mean of four replications.

[4] Yield is kg of carrots per 4.6 m of bed by two beds, mean of four replications.

Preemergence linuron for weed control in carrots. Carl E. Bell. This project was an evaluation of the effect of preemergence application of linuron on crop stand and yield in fresh market carrots. This research was duplicated in two fields being grown by the same cooperative farmer near Brawley, CA.

Linuron was compared at three rates; 0.28, 0.56, and 1.1 kg/ha to an untreated control. Experimental design was a randomized complete block, with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. The carrots in the first field were sown on September 21 and on October 5, 1992 in the second field. Linuron treatments were made after sowing, but before the crop was irrigated by sprinklers on September 23 and October 7, 1992, respectively. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8002LP nozzles, delivering a spray volume of 170 L/ha. Soil type was a fine sand in both fields. Data collected were a stand count of 3.1 m of each bed per plot on November 11, 1992 in both fields, and yield (kg per 3.1 m of each bed per plot) of field one on February 23, 1993.

Both trials were observed frequently during the season, there was no visually apparent difference between treatments. There was no significant difference (P >0.05) between plots in either field for stand count or yield in field one. Linuron does not appear to pose any risk for crop stand or yield loss in fresh market carrots when applied preemergence at rates up to 1.1 kg/ha (Cooperative Extension, University of California, Holtville, CA 92250.)

Table. PREE linuron in fresh market carrots.

Treatment	Rate		Stand[1] Field one	Stand[1] Field two	Yield[2] Field one
	kg/ha		---------- #	----------	kg
Untreated control			235	309	16.3
Linuron	0.28		230	299	21.2
Linuron	0.56		225	247	18.8
Linuron	1.1		216	282	18.0
		LSD(0.05)	ns	ns	ns

[1] Stand is count of carrots per 3.1 m of bed by two beds, mean of four replications.
[2] Yield is kg of carrots per 4.6 m of bed by two beds, mean of four replications.

Residual effect of clomazone, imazethapyr and hexazinone on potatoes. John O. Evans, and R. William Mace. This plant-back study followed a previous alfalfa crop which was treated April 2, 1992 in 10 by 100 ft strips across the alfalfa in a RCB design with three replications. Herbicides were applied with a bicycle sprayer delivering 16 gpa at 40 psi using 8001 flatfan nozzles with 18 inch spacing. The alfalfa was chisel plowed under the fall of 1992.

On May 14, 1993, duplicate two row strips of Norgold russet potatoes were planted perpendicular to the herbicide plots to provide six replications. The potato seed pieces were planted 5 inches deep every 12 inches with 30 inch row spacings. The soil was a silt loam with a water table at 1.5 to 2 feet below the surface. The plots received 6 inches of rain and 8 inches of irrigation water prior to harvest on September 22, 1993. The crop was uniform and provided excellent comparisons among treatments. Weeds were controlled by hand every two weeks throughout the season.

All plants within the plot (50 ft^2) were harvested by hand and evaluated visually and by total tuber weight for herbicide injury and yield. There were no visible tuber deformities or injuries in any of the treatments. The ANOVA showed no significant difference in yield among any of the treatments. (Utah Agricultural Experiment Station, Logan, Ut. 84322-4820)

Table. Potato yields following alfalfa treated with several herbicides.

Treatment	Rate[1]	Yield[2]	Tuber injury
	lb/A	Cwt/A	%
Clomazone	0.5	202	0
Clomazone	1.0	201	0
Imazethapyr	.047	200	0
Imazethapyr	.094	197	0
Hexazinone	.75	186	0
Hexazinone	1.5	187	0
Untreated		206	0
$LSD_{(0.05)}$		NS	NS

[1] Application was on April 2, 1992.
[2] Harvest on September 22, 1993.

PROJECT III

WEEDS OF AGRONOMIC CROPS

Neal Hageman - Project Chairperson

Influence of interplanting of grasses into established alfalfa on yield and weed cover. W. Thomas Lanini, Steve Orloff, E. Roncoroni, and M. Canevari.

Interplanting of grasses into established alfalfa has been shown to increase forage yield in the final production year. The impact of this practice two years prior to stand removal have not been reported previously. This study examined the impact of interplanting of several perennial and one annual grass species on yield and forage composition. The 2-year study was located in Lancaster, CA. Grasses were seeded on December 21, 1991, and paraquat applications made on February 2, 1992. Plots were harvested 6 times in each year, with a flail type forage harvestor. Visual estimates of alfalfa, grass and weeds were made at each harvest.

Forage yield on 'Fawn' tall fescue plots was the highest in both years. Orchardgrass interseeding did not increase yields in 1992 compared to untreated plots, but did increase yields in 1993. Annual ryegrass and 'Kemal Festulolium' failed to improve yields compared to untreated plots.

Interplanting grasses provided better weed suppression in 1992, compared to untreated and paraquat treated plots. In 1993, grasses, with the exception of the annual ryegrass, continued to provide better weed control than untreated plots. (Department of Agricultural Botany, University of California, Davis 95616)

Table 1. Seasonal forage yield following grass interplanting into established alfalfa.

Treatment	1992	1993	Total
	--Forage Yield, tons/acre--		
'Fawn' Fescue @ 20lbs/a	9.30	9.33	18.63
Orchardgrass @ 20lbs/a	8.45	8.27	16.72
Tetraploid Ann. ryegrass @ 20 lbs/a	7.96	6.62	14.58
Tetraploid Ann. ryegrass @ 20 lbs/a + 'Fawn' Fescue @ 20lbs/a	8.98	8.45	17.43
'Kemal Festulolium' @ 20 lbs/a	8.30	7.13	15.43
Paraquat @ 0.5 lb/a	8.10	7.06	15.16
Untreated	8.49	7.09	15.58
LSD .05	0.74	0.97	

Table 2. Proportion of forage composed of weeds following interplanting into established alfalfa.

Treatment	1992	1993	Average
	--------% Weeds----------		
'Fawn' Fescue @ 20lbs/a	4.5	0.0	2.2
Orchardgrass @ 20lbs/a	2.9	2.0	2.4
Tetraploid Ann. ryegrass @ 20 lbs/a	6.5	20.8	13.6
Tetraploid Ann. ryegrass @ 20 lbs/a + 'Fawn' Fescue @ 20lbs/a	1.8	0.5	1.1
'Kemal Festulolium' @ 20 lbs/a	1.6	2.5	2.0
Paraquat @ 0.5 lb/a	16.0	27.0	21.5
Untreated	13.1	24.5	18.8
LSD .05	4.6	6.9	

EPTC granules for nutsedge control in established alfalfa. Barry R. Tickes. This project was initiated to evaluate the potential of EPTC 10% granules for the control of purple nutsedge in established alfalfa when applied after each cutting from February to August over multiple years. The test was conducted in Roll, Arizona on a silty loam soil. It was initiated in the spring of 1990 when the alfalfa stand was one year old (var. CUF101). Plots measured 33 ft. by 660 ft. A 20 ft. untreated strip was left on both sides of each treatment. The treatments consisted of 2.0, 3.0, and 4.0 pounds of EPTC 10% granules applied after each cutting from February to August. Treatments were replicated three times and set in a randomized complete block design. A valmar airflo forced air granular applicator with a 16.5 ft. boom was used. Five applications were made in 1990 and five in 1991. The application dates were 1990: February 17, April 6, May 8, June 7 and July 7; 1991: March 15, April 23, May 23, June 24, and July 24. Evaluations consisted of periodic counts of purple nutsedge stems that had emerged in 1 $ft.^2$ subplots and subplot harvest weights made in August of each year. Nutsedge was separated from alfalfa and each weighed. Nutsedge counts were made on nine 1 $ft.^2$ subplots per plot using a 1 $ft.^2$ grid. Harvest weights were collected in three subplots per plot using a 0.0001A grid. The alfalfa and nutsedge were hand harvested, separated, dried and weighed. Counts were made April 2, May 4 and July 3 of the first year and April 22, May 23, June 27 and July 24 of the second year. The infestation of nutsedge in this test increased from an average of 13.5 stems per square foot in the untreated checks at the conclusion of the first year to 48.9 stems per square foot at the conclusion of the second year. The EPTC treatments suppressed the infestation of nutsedge by 30 to 50 percent compared to the untreated check but did not stop the increase from the first to the second year. There was no significant difference between the 2.0 lb/A application of EPTC and the 4.0 lb/A application. The 2.0 lb/A rate was as effective at suppressing purple nutsedge as the 4.0 lb/A rate by the end of both the first and second year.

Table 1. Nutsedge control from five annual applications of EPTC.

		Nutsedge Stems/$Ft.^2$ on:						
		First Year			Second Year			
Rate Lbs ai/A	Total Applied Per Year (5 Applications Per Year) Lbs Active Ingred/A	April 2	May 4	July 3	April 22	May 23	June 27	July 24
2.0	10	0.4	3.4	7.4	9.1	23.7	28.7	25.9
3.0	15	0.3	1.6	5.9	9.0	22.3	20.7	29.9
4.0	20	0.0	0.3	6.1	17.5	28.6	18.3	34.5
Untreated	--	1.6	7.8	13.5	59.4	92.0	59.4	48.9

Table 2. Nutsedge and alfalfa yields.

		Yield in August (Lbs./A)			
		First Year		Second Year	
Rate Lbs ai/A	Total Applied Per Year (5 Applications Per Year) Lbs Active Ingred/A	Nutsedge	Alfalfa	Nutsedge	Alfalfa
2.0	10	11.0	1903	440	2480
3.0	15	8.8	1998	220	2276
4.0	20	6.6	1919	286	2173
Untreated	--	199.0	1838	1189	1865

Comparison of EPTC 10% granules and EPTC 7EC water run applications as a preplant treatment in alfalfa. B.R. Tickes. This test was conducted to compare preplant water run applications of EPTC 7EC with EPTC 10G applied just prior to and incorporated with the irrigations. The test was conducted at the Yuma Valley Agricultural Center on a silty clay loam soil with less than 1% organic matter. Plot size was 33 ft. by 250 ft. for the granule treatments and 120 ft. by 250 ft. for the water run treatments. Granules were applied with a valmar forced air applicator with a 16.5 ft. boom. Water run applications were metered into the germinator irrigation water with a dripelator. Treatments included 2.0, 3.0 and 4.0 lbs. per acre of EPTC 10% granules and 3.0 lbs. per acre of the 7 EC water run and an untreated check. Three replications of each treatment were set in a randomized complete block. The test was established on September 28, 1989. The weeds that emerged in this test were volunteer wheat and little mallow at 5 to 10 per square foot. Visual evaluations of percent control and phytoxicity were made on December 27, 1989. Harvest evaluations were made on December 27, 1989. Harvest evaluations were made on December 27 and March 10 using a 0.0001A grid. Three subplots per plot were hand harvested, dried and weighed. Stand counts were made on October 23 using a one square-foot grid.

Stand counts made 26 days after treatment revealed a significant reduction in stand as a result of the 3.0 and 4.0 lb. applicantions of EPTC 10G. Visual evaluations made 90 days after treatment indicated that phytotoxicity was still evident at these rates. A significant reduction in first cutting yields was measured from all treatments. The most significant yield reduction occurred as a result of the 3.0 and 4.0 lb. rates of the 10G formulation. Alfalfa yield differences as a result of the herbicide treatments were no longer present at the second harvest.

Control of wheat was excellent from all treatments. Control of little mallow was partial with the best control (approximately 70 percent) at the 3.0 and 4.0 lb. rates of the 10G formulation.

Table. Weed control and crop phytotoxicity from EPTC 7EC and EPTC 10G.

Treatment	Rate (Lbs. ai/Acre)	Stand Count (Seedling/Ft.²)	Weed Control (Visual-Percent) Volunteer Grain	Malva	Phytotoxicity (Visual-Percent)	Yield - 1st Cutting (Lbs./Acre) Alfalfa	Weeds	Total	Yield - 2nd Cutting (Lbs./Acre) Alfalfa	Weeds	Total
Untreated	--	27.5	0	0	0	1828	485	2313	2315	551	2866
EPTC 7E (water run)	3.0	20.0	98	57	2	1674	37	1711	2267	181	2448
EPTC 10G	2.0	20.6	98	66	4	1870	77	1947	2267	229	2496
EPTC 10G	3.0	13.6	99	72	17	1344	1	1345	2921	46	2967
EPTC 10G	4.0	11.7	99	70	32	1189	7	1196	2689	66	2755

Winter annual weed control in alfalfa. Barry R. Tickes. Plots were established under flood irrigation at the University of Arizona Yuma Mesa Agriculture Center, Yuma, AZ to evaluate the efficacy of fall treatments for weed control in established non-dormant alfalfa (2 year old stand var. CUF101). Plots measured 16 by 36 ft. with three replications arranged in a randomized complete block. Fourteen herbicide treatments included granular, dry flowable and emulsifiable concentrate formulations. The granular treatments were applied with a Valmar airflo forced air applicator with a 16 ft. boom. The EC and DF treatments were applied with a CO_2 pressurized knapsack sprayer delivering 20 gpa at 40 psi. All preemergence treatments were applied on October 16, 1992 and incorporated the following day with a five inch irrigation except 2,4-DB and Imazethapyr which were applied postemergence on January 26, 1993 and Clethodim applied on December 21, 1992. The alfalfa was 4 to 8 inches in height on October 6, 1992 and 6 to 12 inches on December 21 and January 26, 1993. The weeds present were annual bluegrass which was 2 to 3 leaf when treated, shepardspurse and London Rocket which were 2 to 6 inch rosette when treated. The soil was superstition sand with less than 1% organic matter. Visual evaluations of weed control were made on March 19, 1993. Excellent control of annual bluegrass resulted from preemergence applications of Trifluralin 10% granules, Mon 13203 5% granules, Metribuzin (3%)/Trifluralin (10%) granules and postemergence treatments of clethodim and Imazethapyr. All other treatments were ineffective in controlling this weed. Excellent levels of control of London Rocket resulted from preemergence applications of Mon 13203 (5% granule) Trifluralin (10% granule) at the high rate (2.0 lbs active ingredient per acre) and postemergence applications of 2,4-DB and Imazethapyr. All other treatments were ineffective in controlling this weed. Excellent levels of control of Shepardspurse resulted from preemergence applications of Mon 13203 (5% granules), Trifluralin (10% granules) at the high rate (2.0 lbs active ingredient per acre) and postemergence application of Imazethapyr. All other treatments were ineffective in controlling this weed. Excellent levels of annual sowthistle control resulted from applications of Mon 13203 (except at the low 0.38 lbs active ingredient per acre rate) and the high (2.0 lbs active ingredient per acre) rate of Trifluralin 10G. Moderate (78%) levels of control resulted from the low rate of Mon 13203. All other treatments were ineffective in controlling this weed.

Table. Fall applied herbicides in non-dormant established alfalfa.

				Weed Control (%)[1]			
Treatment	Formu-lation	Rate Lbs A	Time	Blue-grass	London Rocket	Shepards purse	Annual Sowthistle
Metribuzin	1% G	0.6	PPI	0	3	0	0
Metribuzin	1% G	0.5	PPI	10	7	7	0
Metribuzin	75%/DF	0.6	PPI	53	7	7	0
Metribuzin/ Trifluralin	10/3G	0.6/ 2.0	PPI	98	57	43	38
Trifluralin	10G	2.0	PPI	100	99	97	97
Mon 13203	5%G	0.38	PPI	100	98	98	98
Mon 13203	5%G	0.5	PPI	100	100	100	94
Mon 13203	5%G	0.75	PPI	100	100	100	97
Mon 13203 & Trifluralin	5G 10G	0.5	PPI	100	100	100	100
Trifluralin	10G	1.0	PPI	100	65	65	57
2,4-DB	2EC	1.0	Post	0	92	53	23
Imazethapyr	2EC	0.094	Post	95	95	95	7
FMC 6285	4EC	0.5	Post	0	0	20	0
Clethodim	2EC	0.188	Post	99	0	0	0
Untreated	--	--	--	0	0	0	0

Average of 3 replications. Evaluations made on March 19, 1993.

Response of established alfalfa to spring post-dormancy herbicide treatments. Steven A. Dewey, John O. Evans, and R. William Mace. Effects of early spring post-dormancy applications of glyphosate were compared to those of hexazinone, metribuzin, and paraquat on 5-year-old Fortress forage alfalfa in northern Utah. Treatments were applied to spring- emerging alfalfa shoots on March 23, April 1, and April 8, 1993, at stages corresponding to average shoot heights of 0.5, 2.0, and 3.5 inches, respectively. Herbicides were broadcast using a CO_2 pressurized knapsack sprayer delivering 9.3 gpa at 30 psi. Individual plots were 10 by 30 ft, arranged in a random block design, with four replications. The soil was a silt loam with good moisture during the entire treatment period.

Mild chlorosis was observed in all glyphosate-treated plots shortly after herbicide application, regardless of treatment timing. However, these symptoms disappeared within 7 to 10 days. Alfalfa height was measured on May 12, 1993 (Table). Height was not affected by glyphosate applied at the first growth stage (0.5 in.). However, slight height reduction was noted where glyphosate was applied at the second stage (2 in.), and severe stunting occurred when applied at the third growth stage (3.5 in). Alfalfa height was not reduced by hexazinone, metribuzin, or paraquat at any of the three application timings. Alfalfa was harvested on May 26, and July 21, 1993. No treatment significantly reduced fresh weight yield of the first or second crop when compared to the non-treated check. (USU Cooperative Extension Service, Logan, UT 84322-4820)

Table. Effects of spring post-dormancy herbicide applications on established alfalfa.

Treatment	Rate	Applic. Stage (Shoot height)	Alfalfa Height[1]	Alfalfa Fresh Wt I[2]	Alfalfa Fresh Wt II[3]
	lb/A	in.	in.	T/A	T/A
Glyphosate	0.5	0.5	10.0	3.6	2.0
Glyphosate	0.375	0.5	10.8	3.7	1.9
Glyphosate	0.25	0.5	10.5	3.1	2.1
Metribuzin	0.375	0.5	10.8	3.3	2.2
Hexazinone	0.5	0.5	10.5	3.5	2.1
Paraquat + X77[4]	0.5	0.5	10.8	3.2	1.8
Glyphosate	0.5	2.0	9.0	3.4	2.5
Glyphosate	0.375	2.0	9.0	3.5	2.2
Glyphosate	0.25	2.0	9.8	3.4	2.1
Metribuzin	0.375	2.0	10.5	3.3	1.7
Hexazinone	0.5	2.0	10.0	3.5	2.3
Paraquat + X77[4]	0.5	2.0	10.0	3.2	2.4
Glyphosate	0.5	3.5	6.3	2.9	2.2
Glyphosate	0.375	3.5	7.0	3.0	2.2
Glyphosate	0.25	3.5	8.3	3.5	1.8
Metribuzin	0.375	3.5	11.0	3.3	2.3
Hexazinone	0.5	3.5	10.3	3.2	2.2
Paraquat + X77[4]	0.5	3.5	10.3	3.2	2.4
Check	--	--	10.0	3.3	1.7
$LSD_{(0.05)}$			1.1	0.6	0.7

[1] Average height on May 12, 1993
[2] First cutting May 26, 1993
[3] Second cutting July 21, 1993
[4] X77 applied at 0.25% v/v

Height and yield of six alfalfa varieties in response to imazethapyr and sethoxydim applications. Corey V. Ransom, John O. Evans, and Steven A. Dewey. Six alfalfa varieties were planted in randomized strips on a silt loam soil having a pH of 8.2 and 2.4% O.M. on May 3, 1993 using a precision cone seeder. On June 9, 1993, herbicides were applied across varieties using a five-nozzle bicycle sprayer delivering 176 L ha^{-1} at 276 kPa through 80015 flat-fan nozzles spaced 46 cm apart. Imazethapyr was applied at 53, 71, and 105 g ha^{-1} with methylated seed oil (MSO) at 1.2 L ha^{-1}. Control plots were sprayed with sethoxydim (368 g ha^{-1}) to control wild oats (AVEFA) with the assumption that imazethapyr would control the wild oats in the treated plots. However, wild oats were not satisfactorily controlled by imazethapyr treatments, so a second application of sethoxydim was made on August 6, 1993, to all plots following first harvest. Alfalfa height was measured at two and four weeks after treatement (WAT), and first and second harvest yields were taken, but analyzed separately. This experiment was analyzed as a split-plot design with alfalfa variety and herbicide application representing subplots applied in strips and replicated three times.

No variety by herbicide interactions were significant in this study. Significant differences were observed between alfalfa varieties when comparing plant height and yield. At 2 WAT alfalfa height averaged across varieties was reduced by the 105 g ha^{-1} rate of imazethapyr when compared to the sethoxydim check. There were no significant differences between plots receiving different rates of imazethapyr. Plant height at 4 WAT was not different among treatments. First harvest alfalfa yields were higher in the sethoxydim treated plots when compared to the imazethapyr treatments; and application of the 105 g ha^{-1} rate of imazethapyr gave significantly higher yields than the 71 g ha^{-1} rate, but not at the 53 g ha^{-1} rate. Wild oat yields were also lowered significantly by the sethoxydim treatment when compared to the imazethapyr treatments because sethoxydim demonstrated greater wild oat control. The 105 g ha^{-1} rate of imazethapyr gave significantly lower wild oat yield than the 53 g ha^{-1} or 71 g ha^{-1} rates. At second cutting, only alfalfa was harvested because sethoxydim applications to the entire experimental plot had removed any remaining wild oats. Alfalfa yields were higher in the sethoxydim-only plots than in the imazethapyr plots, while there were no differences among the imazethapyr treatments. (Utah Agricultural Station, Logan, Utah 84322-4820).

Table. Alfalfa height and yield, and wild oat yield for six varieties of seedling alfalfa in response to imazethapyr and sethoxydim treatments in North Logan, Utah.

Variety	Treatment[a]	Height		First Harvest Yield	
		2 WAT	4 WAT	AVEFA	Alfalfa
	-----g ha^{-1}-----	-----cm-----		-----kg ha^{-1}-----	
Deseret	Check	23.7	33.0	33.2	69.6
	53	23.5	34.2	228.6	42.4
	71	22.2	32.0	317.0	12.6
	105	22.2	32.7	235.0	38.0
DK 133	Check	20.3	30.0	14.37	72.0
	53	19.5	30.5	241.7	33.3
	71	20.0	30.7	244.6	33.1
	105	18.7	29.2	212.3	39.9
Spreader	Check	19.5	29.0	15.8	56.5
	53	19.8	28.7	236.0	23.3
	71	18.8	28.8	249.1	31.7
	105	19.8	30.5	184.6	42.7
Vernema	Check	22.0	32.7	6.56	119.7
	53	21.2	33.0	236.3	55.9
	71	22.3	31.3	212.6	47.4
	105	20.2	32.5	137.9	78.0
WL-317	Check	21.0	30.7	18.4	91.1
	53	20.5	31.2	212.6	45.2
	71	20.8	31.3	209.3	45.3
	105	21.0	30.3	145.9	65.6
Wrangler	Check	20.2	29.5	14.5	78.5
	53	20.7	31.3	254.4	36.4
	71	20.5	30.2	200.3	41.7
	105	20.5	29.0	155.4	64
LSD(0.05)		1.12	ns	49.3	26.4

[a]The treatments are imazethapyr applied with MSO (Sun-It II, 1.2 L ha^{-1}) at 53, 71, and 105 g ha^{-1} and the check is sethoxydim (370 g ha^{-1}) applied with crop oil concentrate.

Annual grass and broadleaf weed control in fall-seeded alfalfa with imazethapyr alone or in combination with selected adjuvants. Richard N. Arnold, Eddie J. Gregory, and Daniel Smeal. Research plots were established in August 17, 1992 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of fall-seeded alfalfa (var. Champ) and annual grass and broadleaf weeds to imazethapyr alone or in combination with selected adjuvants. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 10 by 30 ft in size. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied on September 9, 1992 when alfalfa was in the second trifoliolate leaf stage and weeds were small. Barnyardgrass, tumble mustard, and downy brome infestations were moderate, redroot pigweed and black nightshade infestations were light throughout the experimental area. Alfalfa stand counts were made on September 24, 1992. Weed control evaluations were made on September 24, 1992 and May 17, 1993. Alfalfa was harvested June 8, 1993 using a self-propelled Almaco plot harvester.

Alfalfa stand counts and weed control ratings for September are presented in table 1. There were no significant differences among treatments for live plts/ft^2. All treatments gave excellent control of black nightshade and redroot pigweed except the check. Barnyardgrass control was good to excellent with all treatments except imazethapyr at 0.063 lb ai/A and the check. Tumble mustard control were excellent with all treatments except the check, table 2. Downy brome control were poor with all treatments except the handweeded check. All treatments had a significantly higher protein content than imazethapyr at 0.063 lb ai/A and the check, table 2. Data showed that there were no significant differences among treatments for yield. The check had the highest yield of 3.0 t/A due to heavy weed content.

Table 1. Control of annual grass and broadleaf weeds with imazethapyr alone or in combination in fall-seeded Champ alfalfa at Farmington, New Mexico, on September 24, 1992.

Treatments[1,2]	Rate	Stand Count	Weed Control[3,4] SOLNI	AMARE	ECHCG
	lb ai/A	plts/ft^2		%	
imazethapyr/X-77/ 28%N	0.047	45	100	100	98
imazethapyr/X-77/ 28%N	0.063	50	100	100	98
imazethapyr/X-77/ 28%N	0.094	56	100	100	94
imazethapyr/Sun-it II/ 28%N[5]	0.047	51	100	100	99
imazethapyr/Sun-it II/ 28%N[5]	0.063	58	100	100	94
imazethapyr/Sun-it II/ 28%N[5]	0.094	56	100	97	95
imazethapyr/Sun-it II/ 28%N[6]	0.047	51	100	100	99
imazethapyr/Sun-it II/ 28%N[6]	0.063	42	100	100	97
imazethapyr/Sun-it II/ 28%N[6]	0.094	41	100	100	90
imazethapyr/2,4-DB/ X-77/28%	0.063/0.25	46	100	100	94
imazethapyr/2,4-DB/ Sun-it II/28%N[5]	0.063/0.25	45	100	100	96
imazethapyr/bromoxynil/ X-77/28%N	0.063/0.125	41	100	100	89
imazethapyr/bromoxynil/ Sun-it II/28%N[5]	0.063/0.125	42	100	100	98
imazethapyr	0.063	40	100	100	67
handweeded check		52	100	100	100
check		37	0	0	0
av weeds/m^2			5	4	13
LSD 0.05			1	2	11

1. X-77 applied at 0.25% v/v.
2. 28% N applied at 1 qt/A.
3. Based on a visual scale from 0-100 where 0 = no control and 100 = dead plants.
4. SOLNI = black nightshade, AMARE = redroot pigweed, ECHCG = barnyardgrass.
5. Sun-it II was applied at 1 pt/A.
6. Sun-it II was applied at 2 pt/A.

Table 2. Control of tumble mustard and downy brome with imazethapyr alone or in combination in fall-seeded Champ alfalfa, protein and yield, at Farmington, New Mexico, on May 17 and June 8, 1993.

Treatments[1,2]	Rate	Weed Control[3,4] SSYAL	BROTE	Protein	Yield
	lb ai/A	%		%	t/A
imazethapyr/X-77/ 28%N	0.047	100	63	17.0	2.6
imazethapyr/X-77/ 28%N	0.063	100	50	17.3	2.7
imazethapyr/X-77/ 28%N	0.094	100	53	17.7	2.5
imazethapyr/Sun-it II/ 28%N[5]	0.047	100	71	17.9	2.8
imazethapyr/Sun-it II/ 28%N[5]	0.063	100	57	18.0	2.7
imazethapyr/Sun-it II/ 28%N[5]	0.094	100	78	17.6	2.6
imazethapyr/Sun-it II/ 28%N[6]	0.047	100	68	18.1	2.9
imazethapyr/Sun-it II/ 28%N[6]	0.063	100	68	18.1	2.7
imazethapyr/Sun-it II/ 28%N[6]	0.094	100	47	17.6	2.4
imazethapyr/2,4-DB/ X-77/28%	0.063/0.25	100	42	16.6	2.6
imazethapyr/2,4-DB/ Sun-it II/28%N[5]	0.063/0.25	100	62	17.8	2.6
imazethapyr/bromoxynil/ X-77/28%N	0.063/0.125	100	72	17.1	2.7
imazethapyr/bromoxynil/ Sun-it II/28%N[5]	0.063/0.125	100	45	16.8	2.6
imazethapyr	0.063	97	55	15.2	2.7
handweeded check		100	100	18.0	2.7
check		0	0	12.5	3.0
av weeds/m^2		10	20		
LSD 0.05		1	44	2.3	ns

1. X-77 applied at 0.25% v/v.
2. 28% N applied at 1 qt/A.
3. Based on a visual scale from 0-100 where 0 = no control and 100 = dead plants.
4. SSYAL = tumble mustard and BROTE = downy brome.
5. Sun-it II was applied at 1 pt/A.
6. Sun-it II was applied at 2 pt/A.

Adjuvant effect on imazethapyr efficacy in alfalfa. Bell, C.E. A field experiment was conducted to evaluate the effect of various spray adjuvants on the ability of imazethapyr to control weeds when applied postemergence in established alfalfa. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

The alfalfa field was in the third year of production. Experimental design was a randomized complete block with four replications, plot size was 1.5 by 7.6 m. Applications were made on December 19, 1992, using a CO_2 pressured sprayer at 140 kPa using 8003LP nozzles for a spray volume of 235 L/ha. Imazethapyr was applied at 48 g/ha in all treatments. Adjuvants were a non-ionic surfactant at 0.25% v/v, a crop oil concentrate at 2.1 L/ha, and ammonium nitrate at 4.5 kg N/ha. Weeds present at time of application were London rocket, little mallow, and wild oat. These weeds were in the 4 to 6 leaf stage of growth at time of application.

Weed control was assessed visually twice, on January 12 and March 2, 1993. There was little apparent difference between most treatments which included an adjuvant, but these treatments controlled the three weeds in this experiment better than imazethapyr applied without adjuvant. The addition of ammonium nitrate appears to have improved control of little mallow at the second evaluation. (Cooperative Extension, University of California, Holtville, CA 92250.)

Table. Adjuvant effect on imazethapyr efficacy in Holtville, CA

Imazethapyr treatment[1]	Weed Control					
	SSYIR[2]	MALPA	AVEFA	SSYIR	MALPA	AVEFA
	--- Jan. 12, 1993 ---			--- Mar. 2, 1993 ---		
	%					
no adjuvant	93	76	76	100	46	21
COC	98	93	95	100	58	79
Non-ionic	98	95	96	100	66	76
AMMN	98	95	95	100	91	73
COC + AMMN	98	91	93	100	79	79
Non-ionic + AMMN	98	93	95	100	73	76
Untreated control	0	0	0	0	0	0

[1] All treatments included imazethapyr at 48 g/ha, COC = crop oil concentrate at 2.1 L/ha, Non-ionic surfactant at 0.25% v/v, AMMN = Ammonium nitrate at 4.5 kg N/ha.

[2] SSYIR = London rocket, MALPA = little mallow, AVEFA = wild oat.

Effect of barley seeding rate and herbicide rate on weed control and crop yield in spring barley. Don W. Morishita, Robert W. Downard, and Randall Brooks. A study was initiated near Aberdeen, Rupert, and Kimberly, Idaho to investigate using barley (vars. AB1202 and Galena) seeding rate for broadleaf weed management. This study also is part of a two-year experiment to evaluate the effect of how weed management intensity affects weed control in the rotational crop. Each experiment was established as a split plot randomized complete block design with four replications. Seeding rate was the main plot and herbicide rate was the sub-plot. Barley seeding rate varied at each location and plant population counts were taken in main plots. Soil characteristics and herbicide application information are in Table 1. Crop injury and weed control was evaluated visually at least one time at each location. Due to difference in weed species composition, the data are presented separately for each location. All plots were harvested with a small-plot combine.

Table 1. Soil conditions and application information.

Location	Rupert	Kimberly	Aberdeen
Soil type	sandy loam	silt loam	sandy loam
pH	8.1	8.0	8.2
Organic matter (%)	1.35	1.5	1.26
CEC (meq/100 g soil)	9	15	-
Application date	5/24	5/28	5/24
Air temperature (F)	73	78	76
Soil temperature (F)	67	74	68
Relative humidity (%)	40	36	40
Wind speed (mph)	6	3	6 to 10

Barley plant population was different with each seeding rate treatment at all locations (data not shown). The crop was not injured at any of the locations (Tables 2, 3 and 4). Weed populations were variable at the three locations. Weed populations were heaviest at Kimberly (22 plants/ft^2) with light infestations at Aberdeen and Rupert (1 and 3 plants/ft^2, respectively). Reduced rates of thifensulfuron & tribenuron tank mixed with bromoxynil & MCPA controlled weeds 87% or better at all locations. Even with differences in barley populations and a high weed density at Kimberly, barley yield was not reduced by lack of weed control at any location. (Department of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls, ID 83301)

Table 2. Seed and herbicide rate effect on weed control and yield. at Rupert. ID.

Treatment[1]	Herbicide rate	Seeding rate	CROP injury	CHEAL control	HORVU yield
	lb ai/A	lb/A	--------%	--------	bu/A
Check	-	95	0	0	152
		125	0	0	151
		155	0	0	148
Thifen & triben +	0.0104 +	95	0	99	150
bromoxynil &	0.25	125	0	100	158
MCPA		155	0	100	157
Thifen & triben +	0.021 +	95	0	99	152
bromoxynil &	0.50	125	0	100	152
MCPA		155	0	100	146
LSD (0.05)			ns	ns	ns

[1]Thifen & triben = thifensulfuron and tribenuron. All were applied with 0.25% v/v nonionic surfactant.

Table 3. Seed and herbicide rate effect on weed control and yield, Kimberly, ID.

Treatment[1]	Herb rate	Seed rate	Crop injury 6/23	Crop injury 7/27	Weed control AMARE 6/23	AMARE 7/27	CHEAL 6/23	CHEAL 7/27	KCHSC 6/23	KCHSC 7/27	SOLSA 6/23	SOLSA 7/27	HORVU yield
	lb ai/A	lb/A	-----	-----	-----	-----	%	-----	-----	-----	-----	-----	bu/A
Check		60	0	0	0	0	0	0	0	0	0	0	96
		100	0	0		0							
		140	0	0		0							
Thifen &	0.01 +	60	0	0	93	100	89	93	87	88	88	98	102
triben +		100	0	0		100							
bromoxynil &	0.25	140	0	0		100							
MCPA													
Thifen &	0.02 +	60	0	0	92	100	90	97	92	93	92	98	107
triben +		100	0	0		98							
bromoxynil &	0.50	140	0	0		100							
MCPA													
LSD (0.05)			ns	ns	1	1	2	4	3	5	3	3	7

[1]Thifen & triben = thifensulfuron and tribenuron. All were applied with 0.25% v/v nonionic surfactant.

Table 4. Seeding rate and herbicide rate effect on weed control and barley yield near Aberdeen, ID.

Treatment[1]	Herbicide rate	Seeding rate	Crop injury	Weed control CHEAL	Weed control SOLSA	HORVU yield
	lb ai/A	lb/A	----------	%	----------	bu/A
Check		60	0	0	0	164
		100	0			175
		140	0			174
Thifen & triben +	0.01 +	60	0	92	92	159
bromoxynil &	0.25	100	0			176
MCPA		140	0			186
Thifen & triben +	0.02 +	60	0	99	100	166
bromoxynil &	0.50	100	0			170
MCPA		140	0			174
LSD (0.05)			ns	14	14	ns

[1]Thifen & triben = thifensulfuron and tribenuron. All were applied with 0.25% v/v nonionic surfactant.

Broadleaf weed control in spring barley with postemergence herbicides. Robert W. Downard and Don W. Morishita. Research plots were established near Kimberly, Idaho to evaluate broadleaf weed control in spring barley with postemergence herbicides. Barley (variety Steptoe) was planted May 3, 1993, at 80 lbs/A, and grown under sprinkler irrigation. Soil type was a silt loam with a pH of 8.0, a CEC of 15 meq/100 g soil and 1.90% organic matter. Weeds present at application were kochia (KCHSC), and common lambsquarters (CHEAL). Treatments were applied with a bicycle sprayer calibrated to deliver 20 gpa at 20 psi pressurized with CO_2. Additional application data is shown in Table 1. Crop injury and weed control evaluations were taken on June 30 and July 26. Grain was harvested September 2 with a plot combine.

Crop injury was most severe with 2,4-D and 2,4-D plus dicamba at tillering (Table 2). Poor barley germination resulted in varying growth stages and consequently damage to the crop. All treatments controlled kochia 85 to 98% 7 weeks after treatment except thifensulfuron and tribenuron. Common lambsquarters control was 80 to 98% with all treatments. Highest yielding treatments were thifensulfuron and tribenuron alone or in combination with MCPA and bromoxynil and MCPA and bromoxynil plus dicamba. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83303).

Table 1. Application data

Application date	5/21	5/26	6/9
Application timing[1]	<4 leaf	E post	tillering
Air temperature (F)	68	81	65
Soil temperature (F)	72	78	54
Wind velocity (mph)	0 to 16	0 to 4	6
Relative humidity (%)	42	33	62

[1]Application timing abbreviations are: <4 leaf = less than 4 leaf barley and E post = early postemergence.

Table 2. Crop injury, weed control and yield in spring barley, near Kimberly, Idaho.

Treatment	Rate	Applic. timing	Crop injury 6/30	Crop injury 7/26	Weed Control[1] KCHSC 6/30	KCHSC 7/26	CHEAL 6/30	CHEAL 7/26	HORVU yield
	lb ai/A		%						bu/A
Check			0	0	0	0	0	0	92
MCPA & bromox[2]	1.0	E Post	0	0	100	95	100	89	111
MCPA & bromox	0.75	E Post	0	0	96	93	99	91	110
MCPA & bromox gel	0.75	E Post	1	0	98	94	97	94	103
Thifen & triben[3]	0.0206	E Post	0	0	78	61	95	80	134
MCPA & bromox + thifen & triben	0.38 + 0.0206	E Post	0	0	95	88	98	90	127
MCPA & bromox + thifen & triben	0.50 + 0.0206	E Post	1	0	99	99	99	91	124
MCPA & bromox + dicamba	0.38 + 0.063	<4 lf	1	1	91	81	95	85	130
MCPA & bromox + dicamba	0.19 + 0.125	<4 lf	11	4	91	85	91	83	116
MCPA ester thifen & triben	0.25 0.0206	E Post	0	0	95	90	100	94	120
2,4-D amine + thifen & triben	0.25 + 0.0206	E Post	0	0	89	85	96	90	113
2,4-D amine	1.0	Tillering	15	9	99	94	99	94	106
2,4-D amine + dicamba	0.5 + 0.125	Tillering	14	7	98	91	99	93	106
Dicamba + thifen & triben	0.125 + 0.016	<4 lf	3	0	100	98	99	98	113
Dicamba + thifen & triben	0.125 + 0.008	<4 lf	4	0	98	93	97	88	119
LSD (0.05)			4	2	9	11	4	8	17

[1]Weed species evaluated were kochia (KCHSC) and common lambsquarters (CHEAL).
[2]MCPA & Bromox = MCPA and bromoxynil commmerical formulation.
[3]Thifen & Thiben = Thifensulfuron and tribenuron commerical formulation. Surfactant R-11 was added at 0.25% v/v to all thifen & triben treatments.

Broadleaf herbicide dose response in spring barley. Robert W. Downard and Don W. Morishita. Research plots were located near Buhl. Idaho to examine broadleaf weed control in response to herbicide dose. Barley (variety Galena) was planted April 3, 1993. at 110 lbs/A and grown under furrow irrigation. Weed species present at time of application were common lambsquarters (CHEAL) at 2 plants/ft^2 and annual sowthistle (SONOL) at 1 plant/ft^2. Soil type was a silt loam with a pH of 8.1, CEC of 9 meq/100 g soil and 1.35% organic matter. Plots were 8 by 25 feet replicated four times. Treatments were arranged in a 3 by 4 factorial split plot design. Main plots were the herbicides, MCPA, bromoxynil and MCPA, and thifensulfuron and tribenuron. Sub-plot was herbicide rate. Full (1X) rates of the previously mentioned herbicides were 0.75, 0.5, and 0.019 lb ai/A, respectively. Additionally, there was a 2/3X, 1/3X, and 0X rate for each herbicide. Herbicide treatments were applied with a bicycle sprayer calibrated to deliver 10 gpa at 26 psi pressurized with CO_2. Weather conditions during application were air temperature 73 F, soil temperature 70 F, relative humidity 46% and wind velocity 12 to 20 mph. Crop injury and weed control evaluations were taken June 9 and July 12. Barley was harvested August 23, with a plot combine.

No treatment injured the crop (Table). Weed control among herbicides was not different and therefore averaged across rate. CHEAL and SONOL control at 1X and 2/3X rates were better than the 1/3X or 0X rates. Grain yields were higher at the 0X and 1/3X than the 1X rate indicating there may have been other conditions affecting yield such as, fertilizer or watering problems. (Departments of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83303).

Table. Broadleaf herbicide dose response comparison in spring barley.

	Crop injury		Weed control[1]				
			CHEAL		SONOL		HORVU
Rate	6/9	7/12	6/9	7/12	6/9	7/12	yield
	%						bu/A
0 X	0	0	0	0	0	0	107
1/3 X	0	0	86	77	82	84	106
2/3 X	0	0	95	98	94	89	103
1.0 X	0	0	97	100	99	94	95
LSD (0.05)	NS	NS	12	16	12	7	10

[1]Weed species evaluated were common lambsquarters (CHEAL) and annual sowthistle (SONOL).

Early postemergence dicamba applications for weed control in barley. Don W. Morishita and Robert W. Downard. A field study was conducted near Kimberly, Idaho to compare early postemergence applications of dicamba applied alone and in combination with other broadleaf herbicides for weed control in spring barley (var. Steptoe). The experiment was established as a randomized complete block design with four replications. Plots were 8 by 25 ft. All herbicide treatments were applied broadcast with a bicycle wheel sprayer May 20, 1993. Air temperature at the time of application was 84 F, soil temperature 76 F, relative humidity 42%, and wind speed 6 to 10 mph. Soil type was a silt loam with 1.9% o.m., pH 8.0, and a CEC of 15 meq/100 g soil. Weed species present were common lambsquarters (CHEAL), redroot pigweed (AMARE), and kochia (KCHSC). Average total weed density was 10 plants/ft^2. Crop injury and weed control were evaluated visually 3 and 9 weeks after treatment. Plots were harvested with a small-plot combine.

Only 2,4-D alone or dicamba + 2,4-D tank mixtures injured the crop (Table). This was because the barley was too small for a 2,4-D application. Addition of dicamba improved CHEAL and KCHSC control with MCPA and 2,4-D treatments, but did not improve weed control when tank mixed with thifensulfuron & tribenuron. The highest yielding treatment was dicamba + thifensulfuron & tribenuron which yielded 137 bu/A. Dicamba + 2,4-D tank mixtures yielded lower than the untreated check. This was probably due to the observed injury in these treatments. (Department of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls, ID 83301).

Table. Crop injury, broadleaf weed control and barley yield with early postemergence herbicides, near Kimberly, ID.

		Crop injury		Weed control				
				CHEAL		KCHSC		HORVU
Treatment	Rate	6/9	7/26	6/9	7/26	6/9	7/26	yield
	lb ai/A	%						bu/A
Check	0.0	0	0	0	0	0	0	126
MCPA Amine	0.25	0	0	81	71	50	60	119
Thifensulfuron & tribenuron[1]	0.016	0	0	91	88	96	91	113
2,4-D LVE	0.38	4	1	95	73	94	79	97
Dicamba	0.094	1	0	64	71	50	61	128
Dicamba + MCPA Amine	0.094 + 0.25	0	1	95	90	97	95	122
Dicamba + thifensulfuron & tribenuron	0.094 + 0.016	0	0	80	85	65	80	137
Dicamba + 2,4-D LVE	0.094 + 0.38	1	4	98	86	100	98	108
Dicamba	0.125	0	0	50	64	76	75	124
Dicamba + MCPA Amine	0.125 + 0.25	1	1	90	95	97	100	113
Dicamba + thifensulfuron & tribenuron	0.125 + 0.016	0	0	89	88	97	91	115
Dicamba 2,4-D LVE	0.125 0.38	3	5	92	85	98	85	104
LSD (0.05)	NS	3	19	19	24	25	22	

[1]All thifensulfuron & tribenuron treatments applied with 0.25% v/v nonionic surfactant.

Wild oat herbicide and dose response comparison in spring barley at two locations. Don W. Morishita, Robert W. Downard, and Charles C. Cheyney. A study was conducted near Picabo and Arco, Idaho to compare wild oat control with diclofop, difenzoquat, and imazamethabenz applied at 0, 0.25, 0.5, 0.75, and 1 times their normal use rates in irrigated spring barley (vars. Galena and Sunbar 560). Normal use rates for diclofop, difenzoquat, and imazamethabenz were 1.0, 1.0, and 0.41 lb ai/A, respectively. Experimental design at each location was a 3 herbicide by 5 rates factorial arrangement in a randomized complete block design. Treatments were replicated four times and individual plots were 8 by 25 ft. Soil characteristics and herbicide application information is shown on Table 1. Wild oat densities at Picabo and Arco averaged 6 to 10 plants/ft^2. Wild oat control and crop injury were evaluated visually on August 10 and September 3, 1993, at Picabo and Arco, respectively. Grain was harvested with a small-plot combine at the respective locations on August 27 and October 22.

Table 1. Soil characteristics and application information.

Location	Picabo	Arco
Soil type	sandy loam	silt loam
pH	7.4	-
Organic matter (%)	1.0	-
CEC (meq/100 g soil)	12	-
Application date	5/27	6/28
Air temperature (F)	79	73
Soil temperature (F)	-	72
Relative humidity (%)	23	40
Wind velocity (mph)	6 to 12	6 to 12

None of the herbicides or rates injured the barley at either location (Table 2). At Picabo, wild oat control was somewhat variable, but improved as herbicide rate increased when averaged across all herbicides. At Arco, there was a significant herbicide by rate interaction for wild oat control. Similar to Picabo, diclofop and difenzoquat wild oat control increased as herbicide rate increased. However, imazamethabenz controlled wild oat 96% or better with all rates except the untreated check. Barley yield at Picabo was not different among herbicides or herbicide rates (Table 2). Grain yield at Arco was highest with imazamethabenz when averaged across all rates (data not shown). Also, barley yields averaged across herbicides were higher with herbicide rates greater than 0.5X compared to the 0X (Table 2). According to malting barley standards, wild oat seed impurity cannot exceed 1.5% w/w. Wild oat seed contamination was greater than 1.5% with the 0 and 0.25X herbicide rates at both locations. Thus, even though grain yield was not reduced by wild oat interference at Picabo, grain quality was. (Department of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls, ID 83301)

Table 2. Crop injury, wild oat control, barley yield and wild oat contamination, near Picabo and Arco, ID[1].

Treatment[2]	Herbicide rate	Relative rate	Crop injury Picabo	Crop injury Arco	AVEFA control Picabo	AVEFA control Arco	HORVU yield Picabo	HORVU yield Arco	AVEFA impurity Picabo	AVEFA impurity Arco
	lb ai/A		%		%		bu/A		%	
Diclofop	0.0	0X	0	0	0	0	69	28	2.1	5.0
Imazamethabenz	0.0		0	0		0				
Difenzoquat	0.0		0	0		0				
Diclofop	0.25	0.25X	0	0	27	26	71	31	1.6	2.8
Imazamethabenz	0.1025		0	0		96				
Difenzoquat	0.25		0	0		5				
Diclofop	0.50	0.5X	0	0	58	63	79	40	0.7	1.1
Imazamethabenz	0.205		0	0		99				
Difenzoquat	0.50		0	0		55				
Diclofop	0.75	0.75X	0	0	65	84	75	43	0.9	0.6
Imazamethabenz	0.3075		0	0		100				
Difenzoquat	0.750		0	0		76				
Diclofop	1.0	1.0X	0	0	76	81	77	44	0.7	0.3
Imazamethabenz	0.41		0	0		100				
Difenzoquat	1.0		0	0		86				
LSD (0.05)			ns	ns	18	13	ns	9	0.8	2.3

[1]Wild oat control and wild oat impurity at Picabo and barley grain yield and wild oat impurity at Arco were significantly different among relative herbicides rate averaged across all herbicides. Wild oat contamination represents a percentage of wild oat seed in the harvested grain. For malting barley, 1.5% contamination results in rejection of the grain.

[2]All imazamethabenz and difenzoquat treatments applied with 0.25% v/v nonionic surfactant.

Broadleaf weed management influenced by barley variety, plant population, and herbicide rate. Robert W. Downard and Don W. Morishita. Research plots were established near Aberdeen, ID to examine the effect barley variety, plant population and herbicide rate had on broadleaf weed control. Barley (varieties Moravian and Galena) was planted April 30, 1993, at 600,000, 1,000,000 and 1,400,000 seeds per acre. Soil type was a sandy loam with a pH of 8.2 and 1.26% organic matter. Weed species present prior to application were common lambsquarters (CHEAL) at 2 plants/ft^2, and hairy nightshade (SOLSA) at 12 plants/ft^2. Herbicide treatments were applied May 24, 1993 with a bicycle sprayer calibrated to deliver 10 gpa at 22 psi pressurized with CO_2. Weather conditions during application were air temperature 76 F, soil temperature 68 F, relative humidity 40%, and winds 6 to 10 mph. Crop injury and weed control evaluations were taken June 18. Barley was harvested September 8 with a plot combine.

No treatment injured the crop. Hairy nightshade control was 99 to 100% for both herbicide treatments averaged across all seeding rates (Table). Common lambsquarters control was 96 to 100%. Control was influenced by barley seeding rate and herbicide treatment, but these differences are probably not biologically significant. Barley yield was significantly influenced by barley variety and seeding rate interaction (data not shown). Galena had significantly higher yields than Moravian at all seeding rates. These data suggest that even at low weed populations herbicide rate, barley variety and seeding rate all contribute to effective weed control and grain yield. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83303).

Table. Weed control in spring barley[1].

		Weed control							
			CHEAL						HORVU
Treatment	Rate	SOLSA	600	1000	1400	600	1000	1400[2]	yield
	lb ai/A	%							bu/A
Check		0	0	0	0	0	0	0	157
Thifen & triben[3] + MCPA & bromoxynil	0.0103 + 0.25	99	99	100	96	100	100	100	158
Thifen & triben + MCPA & bromoxynil	0.0206 + 0.25	100	100	99	100	100	100	99	153
LSD (0.05)		1			2				3

[1]Weed species evaluated on June 18 were hairy nightshade (SOLSA) and common lambsquarters (CHEAL).
[2]Numbers represent planting rate times 1,000 seeds/acre.
[3]Thifen & triben = thifensulfuron and tribenuron commercial formulation. Surfactant X-77 added at 0.25% v/v to all thifen & triben treatments.

Evaluation of wild oat control with a difenzoquat soluble granule formulation. Tate W. Carter, Robert W. Downard and Don W. Morishita. This research was conducted to compare wild oat control of difenzoquat SG applied alone and in combination with other herbicides. Barley (var. Sunbar 560) was planted in silt loam soil May 25, 1993. Treatments were arranged as a randomized complete block design with four replications. Plots were 8 by 25 feet. Applications were made June 28 using a bicycle sprayer equipped with 11001 flat fan nozzles calibrated to apply 10 gpa at 3 mph. Environmental conditions at application were air and soil temperature 73 and 72 F, respectively, relative humidity 40%, wind velocity 6 mph and soil moisture was good. Wild oat growth stage was 2 to 4 leaves and density averaged 7 plants/ft^2.

Barley yields were exceptionally low due to severe frosts during late anthesis. Analysis of variance showed a significant difference among treatments for wild oat control and barley yield. Although some plots had better wild oat control than others, this was not reflected in barley yields, possibly due to some unseen crop injury. Treatments with the highest yields were difenzoquat and difenzoquat + clopyralid, both yielding 50 bu/A. Treatments with the highest wild oat control were imazamethabenz + difenzoquat + surfactant, imazamethabenz + difenzoquat + COC and imazamethabenz + difenzoquat + thifensulfuron & tribenuron + MCPA. These had control ratings of 95, 94 and 98%, respectively. Barley yield did not correspond well with wild oat control. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, Idaho 83303).

Table. Wild oat control and barley yield with difenzoquat SG, near Arco, Idaho.

Treatment	Rate	AVEFA control	Barley yield
	lb ai/A	%	bu/A
Check		0	32
Difenzoquat ASU[1]	1.0	79	40
Difenzoquat + NIS[2]	1.0	64	50
Imazamethabenz + difenzoquat + NIS	0.23 + 0.5	95	39
Difenzoquat +MSO[3]	1.0	36	32
Imazamethabenz + difenzoquat + MSO	0.23 + 0.5	94	44
Difenzoquat + MCPA LVE + NIS	1.0 + 0.5	51	38
Difenzoquat + MCPA & bromoxynil + NIS	1.0 + 0.5	64	48
Difenzoquat + 2,4-D LVE + NIS	1.0 + 0.5	46	46
Difenzoquat + clopyralid & 2,4-D + NIS	1.0 + 0.6	66	50
Difenzoquat + thifensulfuron & tribenuron MCPA LVE + NIS	1.0 + 0.023 0.25	41	32
Imazamethabenz + difenzoquat thifensulfuron & tribenuron MCPA LVE	0.23 + 0.5 0.023 0.25	98	35
Difenzoquat + tribenuron + NIS	0.5 + 0.1875	71	36
Diclofop	1.0	83	32
Imazamethabenz	0.46	38	24
LSD (0.05)		26	13

[1]Difenzoquat formulated as ASU, remainder formulated as SG.
[2]Nonionic surfactant added at 0.5% v/v.
[3]Methylated sunflower oil added at 0.25% v/v.

Wild oat control with difenzoquat formulations in winter wheat and with imazamethabenz in spring barley. Charles D. Grasham, Curtis R. Thompson, and Donald C. Thill. A water soluble granular (SG) formulation of difenzoquat combined with spray adjuvants and various herbicide tank mixes was evaluated for wild oat control in winter wheat near Potlatch, Idaho. A water soluble granular formulation of imazamethabenz was evaluated in spring barley near Bonners Ferry, Idaho in a similar study. Plots were 10 by 30 feet and arranged in a randomized complete block design with 4 blocks. In the winter wheat study, imazamethabenz treatments were applied to 1 to 2 leaf wild oat (AVEFA) on April 28. All other treatments were applied on May 12 to 2 to 4 leaf wild oat (Table 1). In the spring barley study imazamethabenz treatments were applied on May 17, diclofop treatments on May 18, and difenzoquat treatments on May 24. All treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/A at 37 psi and 3 mph. Wild oat, lentil (LENCU), wild buckwheat (POLCO), and prickly lettuce (LACSE) control were evaluated visually on August 3 in winter wheat. Wild oat, mayweed chamomile (ANTCO), and common chickweed (STEME) control were evaluated visually on July 27 in spring barley. Winter wheat was harvested from 4.5 by 27 foot plot areas on August 25. Barley grain was not harvested due to severe lodging prior to grain fill.

Table 1. Application and soil analysis data

	Winter wheat		Spring barley		
Application date	April 28	May 12	May 17	May 18	May 24
Wild oat leaf stage	1 to 2	2 to 4	2 to 3	2 to 3	3 to 5
Air temperature (F)	63	70	60	50	78
Relative humidity (%)	53	47	80	94	45
Wind speed (mph) - direction	3 E	0	2 W	0	0
Soil temperature (F)	54	66	60	56	76
pH	5.6		7.6		
organic matter (%)	3.4		5.1		
CEC (meq/100g)	18.6		23.1		
texture	silt loam		clay loam		
Variety	Madsen		Morex		

All treatments in the difenzoquat study controlled wild oat at least 93% except imazamethabenz with thifensulfuron-tribenuron and bromoxynil (Table 2). Difenzoquat formulation or adjuvant choice did not influence wild oat control. Winter wheat was not visually injured by treatments. Difenzoquat SG combined with clopyralid-2,4-D or thifensulfuron-tribenuron controlled lentil and wild buckwheat at least 89% and 93%, respectively. All broadleaf herbicide combinations controlled prickly lettuce equally. Difenzoquat treatments alone or combined with broadleaf herbicides did not increase yield compared to control. Imazamethabenz, imazamethabenz plus difenzoquat, and diclofop treatments combined with broadleaf herbicides resulted in a winter wheat yield increase compared to control. A competitive wheat stand may have reduced the influence of weed competition.

All imazamethabenz treatments controlled wild oat equally except when combined with 2,4-D amine (Table 3). Wild oat control with imazamethabenz plus 2,4-D amine was only 32%. Diclofop applied alone or in combination with bromoxynil did not control wild oat adequately. Wild oat control with imazamethabenz SG combined with Sun-It II tended to be greater than with R-11, especially at reduced imazamethabenz rates. Imazamethabenz combined with thifensulfuron-tribenuron, bromoxynil, or tribenuron controlled mayweed chamomile and common chickweed. Imazamethabenz combined with clopyralid-2,4-D controlled mayweed chamomile. Injury and yield were not evaluated due to barley lodging. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Effect of difenzoquat formulations on weed control and yield of winter wheat

Treatment	Rate	AVEFA	LENCU	POLCO	LACSE	Yield
	lb/A	-----------------	----% control----	-----------------		bu/A
Control		---	---	---	---	110
Difenzoquat L[1]	1.0	94	0	0	0	114
Difenzoquat SG +	1.0					
R-11[2]	0.5%	93	0	0	0	112
Imazamethabenz +	0.23					
Difenzoquat SG +	0.5					
R-11	0.5%	95	0	4	0	122
Difenzoquat SG +	1.0					
Sun-It II[3]	2.0 pints	99	0	0	0	119
Imazamethabenz +	0.23					
Difenzoquat SG +	0.5					
Sun-It II	2.0 pints	95	0	4	0	118
Difenzoquat SG +	1.0					
MCPA +	0.5					
R-11	0.5%	97	32	54	96	120
Difenzoquat SG +	1.0					
Bromoxynil-MCPA +	0.5					
R-11	0.5%	97	53	56	92	115
Difenzoquat SG +	1.0					
2,4-D +	0.5					
R-11	0.5%	98	56	66	99	116
Difenzoquat SG +	1.0					
Clopyralid-2,4-D +	0.6					
R-11	0.5%	95	97	99	99	119
Difenzoquat SG +	1.0					
Thifen-triben[4] +	0.023					
MCPA +	0.25					
R-11	0.5%	95	90	93	94	118
Imazamethabenz +	0.23					
Difenzoquat SG +	0.5					
Thifen-triben +	0.023					
MCPA +	0.25					
R-11	0.5%	98	91	98	98	124
Difenzoquat SG +	1.0					
Thifen-triben +	0.023					
MCPA +	0.25					
R-11	0.5%	96	89	95	98	114
Diclofop	1.0	99	0	0	0	117
Diclofop +	1.0					
Thifen-triben +	0.014					
Bromoxynil +	0.25					
R-11	0.25%	93	58	86	91	124
Imazamethabenz +	0.47					
R-11	0.25%	96	6	9	5	118
Imazamethabenz +	0.47					
Thifen-triben +	0.014					
Bromoxynil +	0.25					
R-11	0.25%	76	76	87	98	124
$LSD_{(0.05)}$		10	27	27	8	11
Density (plants/ft^2)		36	4	8	1	

[1]L = liquid formulation, SG = water soluble granule
[2]nonionic surfactant, rate expressed as % v/v
[3]methylated crop seed oil applied at 2 pints/A
[4]thifensulfuron-tribenuron in a commercial formulation

Table 3. Effect of imazamethabenz formulations on weed control in spring barley

Treatment	Rate	AVEFA	ANTCO	STEME
	lb/A	--------------------% control--------------------		
Control		---	---	---
Imazamethabenz LC[1] +	0.47			
R-11 [2]	0.25%	90	0	2
Imazamethabenz LC +	0.38			
R-11	0.25%	84	0	1
Imazamethabenz LC +	0.31			
R-11	0.25%	86	0	1
Imazamethabenz SG +	0.47			
R-11	0.25%	97	0	0
Imazamethabenz SG +	0.38			
R-11	0.25%	87	0	0
Imazamethabenz SG +	0.31			
R-11	0.25%	80	0	0
Imazamethabenz SG +	0.23			
Difenzoquat +	0.5			
R-11	0.25%	86	0	0
Imazamethabenz SG +	0.47			
Sun-It II[3]	2 pints	92	0	0
Imazamethabenz SG +	0.38			
Sun-It II	2 pints	96	0	0
Imazamethabenz SG +	0.31			
Sun-It II	2 pints	91	0	0
Imazamethabenz SG +	0.23			
Difenzoquat +	0.5			
Sun-It II	2 pints	95	0	0
Imazamethabenz SG +	0.38			
MCPA +	0.5			
R-11	0.25%	97	10	22
Imazamethabenz SG +	0.38			
Bromoxynil +	0.25			
R-11	0.25%	77	99	82
Imazamethabenz SG +	0.38			
2,4-D +	0.5			
R-11	0.25%	32	4	19
Imazamethabenz SG +	0.38			
Clopyralid-MCPA +	0.69			
R-11	0.25%	88	96	51
Imazamethabenz SG +	0.38			
Thifen-triben[4] +	0.023			
MCPA +	0.25			
R-11	0.25%	86	99	99
Imazamethabenz SG +	0.23			
Difenzoquat +	0.5			
MCPA +	0.25			
R-11	0.25%	94	9	15
Imazamethabenz SG +	0.38			
Tribenuron +	0.012			
MCPA +	0.25			
R-11	0.25%	92	99	99
Diclofop	0.75	42	0	0
Diclofop +	0.75			
Bromoxynil	0.38	60	73	71
Difenzoquat	0.75	73	0	0
$LSD_{(0.05)}$		18	16	19
Density (plants/ft^2)		6	5	6

[1]LC = liquid concentrate, SG = water soluble granule
[2]nonionic surfactant, rate expressed as % v/v
[3]methylated crop seed oil applied at 2 pints/A
[4]thifensulfuron-tribenuron in a commercial formulation

Phenoxy herbicide formulations and safeners for broadleaf weed control in spring barley. Traci A. Brammer, Curtis R. Thompson, and Donald C. Thill. A study was established to evaluate phenoxy herbicide formulations, herbicide safening with MON13900, herbicide injury, and weed control in 'Gallatin' spring barley northwest of Potlatch, ID. Herbicide safening was evaluated with treatments applied June 6 to 2 to 2.5 leaf spring barley. MCPA and 2,4-D liquid and soluble granule (SG) formulations were applied to 3 to 3.5 leaf barley on June 17. Herbicides were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 38 psi and 3 mph (Table 1). Plots were 10 by 30 ft and arranged as a randomized complete block and replicated four times. Mayweed chamomile (ANTCO) and henbit (LAMAM) were at the cotyledon stage June 6, and 1 to 1.5 in. and 0.5 to 1 in., respectively, on June 17. Weed densities were counted within two 1 ft^2 areas within each control plot on June 17. Weed control and injury was evaluated visually on July 9. Barley was harvested from a 4.5 by 27 ft area of each plot on September 9.

Table 1. Application and soil analysis data.

Application date	June 6	June 17
Temperature (F)	60	66
Soil temperature at 2 in. (F)	56	62
Relative humidity (%)	75	73
Wind speed (mph - direction)	0.5-E	1-W
Soil		
pH	5.5	
OM (%)	2.6	
CEC (meq/100g soil)	13.3	
Texture	silt loam	

All treatments controlled mayweed chamomile 93% or greater and henbit 85% or greater (Table 2). MON13900 did not prevent injury with all 2,4-D amine treatments applied to 2 to 2.5 leaf barley, which was injured at least 23% and grain yield was reduced compared to the control. 2,4-D SG with Activator 90 applied at the 3 to 3.5 leaf stage injured spring barley 21%, but yield was not reduced. Spring barley yields were not different from the control for all other treatments. (Idaho Agricultural Experiment Station, Moscow, Idaho 83844)

Table 2. Effects of phenoxy herbicides on yield, injury, and weed control in spring barley.

Treatment[1]	Rate	App.[2] time	Barley yield	Barley injury	LAMAM	ANTCO
	lb/A		bu/A	-- % --	-- % control --	
Control	--	--	84	--	--	--
MCPA amine	0.5	3.5-4 lf	83	1	85	93
MCPA amine	1.5	3.5-4 lf	78	4	99	98
MCPA SG +	0.5	3.5-4 lf	81	3	89	95
Activator 90	0.25%					
MCPA SG +	1.5	3.5-4 lf	82	8	95	99
Activator 90	0.25%					
2,4-D amine	1.4	2-2.5 lf	64	23	99	99
2,4-D amine +	1.4	2-2.5 lf	69	26	94	99
MON13900	1.4					
2,4-D amine +	1.4	2-2.5 lf	71	28	99	99
MON13900	2.8					
Bromoxynil	0.25	2-2.5 lf	86	1	99	99
Thifensulfuron-						
tribenuron +	0.019	3.5-4 lf	85	4	99	99
Activator 90	0.25%					
2,4-D amine	1.4	3.5-4 lf	79	3	99	99
2,4-D SG +	1.4	3.5-4 lf	84	21	99	99
Activator 90	0.25%					
$LSD_{(0.05)}$			8	6	9	6
Density (plants/ft^2)					2	1

[1] Activator 90 non-ionic surfactant applied at 0.25% v/v; SG = soluble granule.
[2] App. time = Application time based on the growth stage of the crop; lf = leaf.

Control of spurred anoda in pinto beans with reduced rates of herbicides. M.J. VanGessel and P. Westra. Spurred anoda (*Anoda cristata*, (L.) Schlecht.) was first identified in Colorado pinto bean fields in 1987. Since then problems with spurred anoda have increased. This experiment was designed to examine postemergence (POST) control of spurred anoda in pinto beans with reduced rates of bentazon and imazethapyr. This study was conducted in Windsor, CO on sandy loam soil, 1.4% o.m. and pH 7.7. The experiment was arranged as a randomized block design with three replications; treatments are listed in Table 1. Pinto bean variety 'Bill Z' was planted May 25, 1993. Beans were planted in 30 inch rows and plots were 4 rows wide and 30 feet long. Pre-plant incorporated (PPI) treatments were applied May 21, 1993. Pre-emergence (PRE) treatments were applied on May 27. Early POST (EPOST) treatments were applied when the beans were in the unifoliate stage (June 15) and late POST (LPOST) were applied when the first trifoliate leaf was completely expanded (June 21). Treatments were applied with flat fan nozzles at 20 gpa, 30 psi, and 3 mph. Weed control was visually evaluated 2, 5, and 10 weeks after treatment (WAT). Plots were harvested September 1 and weight of 200 beans seeds was determined as quality factor.

Ethalfluralin treatments were not incorporated for 3 days after treatment which reduced its effectiveness. Full season spurred anoda control was best with split applications of bentazon at 0.75 lbs ai/A, imazethapyr applied PRE and EPOST at 0.032 lb ai/A, and bentazon plus imazethapyr EPOST, 0.75 lb ai/A + 0.032 lb ai/A, respectively. Yields were greater than the untreated check when imazethapyr was applied at PRE, EPOST stage, or LPOST at 0.032 lb ai/A rate. Also, yields were greater than untreated check when bentazon was applied at 1.0 lb ai/A or reduced rates were applied in split applications. Percent of splits (determined by weight) did not differ among treatments. Weight of 200 bean seeds was higher for split application of bentazon at 0.75 lb ai/A than bentazon at 0.75 lb ai/A at LPOST, imazethapyr at 0.024 lb ai/A at LPOST, and bentazon + imazethapyr, 1.0 + 0.032 lb ai/A, respectively, applied LPOST. (Department of Plant Pathology and Weed Science, Colorado State University, Fort Collins, CO 80523.)

Table 1. Treatments, spurred anoda control, and pinto bean yield.

Trt No	Treatment Name	Rate (lb ai/A)	Timing	ANCVR control % 6-28-93	ANCVR control % 7-26-93	ANCVR control % 9-1-93	YIELD cwt/A 9-1-93
1	Weedy Check			0.0 e	0.0 d	0.0 h	5.88 c
2	Ethalfluralin	1.0	PPI	0.0 e	28.3 c	28.3 e-h	11.39 abc
3	Bentazon	0.5	EPOST	90.7 a	90.0 ab	81.7 a-d	10.60 abc
3	COC	1.25 % v/v					
4	Bentazon	0.75	EPOST	97.0 a	94.0 a	82.7 abc	11.42 abc
4	COC	1.25 % v/v					
5	Bentazon	1.0	EPOST	99.3 a	100.0 a	78.3 a-d	13.16 ab
5	COC	1.25 % v/v					
6	Bentazon	0.5	LPOST	88.3 a	86.7 ab	10.0 gh	9.75 abc
6	COC	1.25 % v/v					
7	Bentazon	0.75	LPOST	94.3 a	63.3 b	43.3 d-g	10.58 abc
7	COC	1.25 % v/v					
8	Bentazon	1.0	LPOST	97.0 a	86.7 ab	65.0 a-e	13.40 ab
8	COC	1.25 % v/v					
9	Bentazon	0.5	EPOST	97.3 a	100.0 a	71.7 a-d	12.68 ab
9	Bentazon	0.5	LPOST				
9	COC	1.25 % v/v					
10	Bentazon	0.75	EPOST	100.0 a	100.0 a	92.3 ab	15.26 a
10	Bentazon	0.75	LPOST				
10	COC	1.25 % v/v					
11	Bentazon	1.0	LPOST	96.0 a	94.0 a	67.0 a-d	10.40 abc
11	Imazethapyr	0.032	LPOST				
11	X-77	0.25 % v/v					
12	Ethalfluralin	1.0	PPI	95.3 a	80.0 ab	52.7 c-f	10.99 abc
12	Bentazon	0.5	LPOST				
12	COC	1.25 % v/v					
13	Ethalfluralin	1.0	PPI	94.7 a	87.7 ab	56.7 b-f	13.80 ab
13	Bentazon	1.0	LPOST				
13	COC	1.25 % v/v					
14	Imazethapyr	0.032	PRE	97.7 a	100.0 a	97.3 a	14.57 ab
15	Imazethapyr	0.024	EPOST	74.3 bc	77.0 ab	78.0 a-d	14.55 ab
15	X-77	0.25 % v/v					
16	Imazethapyr	0.032	EPOST	85.3 ab	93.7 a	92.3 ab	15.69 a
16	X-77	0.25 % v/v					
17	Imazethapyr	0.024	LPOST	46.7 d	33.3 c	21.7 fgh	8.91 bc
17	X-77	0.25 % v/v					
18	Imazethapyr	0.032	LPOST	67.7 c	65.0 b	42.7 d-g	11.91 ab
18	X-77	0.25 % v/v					
19	Bentazon	0.75	EPOST	89.3 a	100.0 a	97.0 a	14.87 ab
19	Imazethapyr	0.032	EPOST				
19	X-77	0.25 % v/v					
20	Bentazon	0.75	LPOST	92.3 a	87.7 ab	77.7 a-d	11.81 ab
20	Imazethapyr	0.032	LPOST				
20	X-77	0.25 % v/v					
LSD (.05) =				13.0	23.1	33.0	5.0
Standard Dev.=				6.5	7.9	20.0	3.0
CV =				7.5	9.8	32.3	25.1

<u>Broadleaf weed control in pinto beans</u>. Richard N. Arnold, Eddie J. Gregory and Daniel Smeal. Research plots were established on May 17, 1993 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of pinto beans (var. Flint) and annual broadleaf weeds to preplant incorporated and preemergence herbicides. Soil type was a Wall sandy loam with pH of 7.8 and an organic matter content less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Preplant incorporated treatments were applied on May 17, 1993 and were immediately incorporated to a depth of 2 to 4 in using a tractor-driven rototiller. Preemergence treatments were applied on May 19, 1993 and were immediately incorporated with 0.75 in a sprinkler applied water. The sequential postemergence treatment was applied at crack or just before the first trifoliolate leaf stage, on May 31, 1993. A surfactant was added at 0.25% v/v. Black nightshade, prostrate and redroot pigweed infestations were moderate, and Russian thistle and kochia infestations were light throughout the experimental area. Visual evaluations of crop injury and weed control were made on June 17, 1993. Handweeded controls were hoed starting on June 8 about every two weeks until August 31, 1993. Stand counts were made on June 21, 1993 by counting individual plants per 10 ft of one row of each plot. Dry beans were harvested for yield on September 9, 1993 with a self-propelled John Deere combine equipped with a load cell.

Pinto bean weed control ratings are given in table 1. All treatments gave good to excellent control of all weeds evaluated in the study, except the check. No injury was apparent in any of the treatments. Effect of herbicides treatments on yield and stand count of pinto beans are presented in table 2. All treatments yielded significantly more lb/A than the check. Yields ranged from 1826 to 1524 lb/A higher in the treated plots than the check. There were no significant differences among treatments for stand count.

Table 1. Annual broadleaf weed control with preplant incorporated and preemergence herbicides in Flint pinto beans on June 17, 1993, at Farmington, New Mexico.

Treatment	Rate	Weed Control[1] SASKR	KCHSC	AMABL	AMARE	SOLNI
	lb ai/A	-------------------%-----------------				
dimethenamid[2]	1.5	100	100	100	100	100
metolachlor II[2]	2.5	100	100	100	100	100
alachlor MT[2]	3.0	100	100	100	100	96
dimethenamid/ ethalfluralin HFP[2]	1.0/0.75	100	100	100	100	100
metolachlor II/ ethalfluralin HFP[2]	1.5/0.75	100	100	100	100	100
alachlor MT/ ethalfluralin HFP[2]	2.0/0.75	100	100	100	100	100
ethalfluralin HFP[2]	0.75	100	100	100	100	93
ethalfluralin HFP[2]/ imazethapyr[3]	0.75/0.032	100	100	100	100	100
dimethenamid[4]	1.5	100	100	100	100	100
metolachlor II[4]	2.5	100	100	100	100	100
dimethenamid/ imazethapyr[4]	1.0/0.032	100	100	100	100	100
metolachlor II/ imazethapyr[4]	1.5/0.032	100	100	100	100	100
alachlor MT/ imazethapyr[4]	2.0/0.032	100	100	100	100	100
imazethapyr[4]	0.032	100	100	100	100	100
handweeded check		100	100	100	100	100
check		0	0	0	0	0
av weeds/M^2		3	3	8	8	18
LSD 0.05		1	1	1	1	3

1. Based on a visual scale from 0 to 100, where 0 = no control and 100 = dead plants. SASKR = Russian thistle, KCHSC = kochia, AMABL = prostrate pigweed, AMARE = redroot pigweed and SOLNI = black nightshade.
2. Preplant incorporated.
3. Postemergence with X-77 at 0.25% v/v.
4. Preemergence.

Table 2. Yield and stand count of Flint pinto beans as affected by preplant incorporated and preemergence herbicides, at Farmington, New Mexico in 1993.

Treatment	Rate	Yield	Stand Count
	lb ai/A	lb/A	#
dimethenamid[1]	1.5	2208	38
metolachlor II[1]	2.5	2164	36
alachlor MT[1]	3.0	2098	34
dimethenamid/ ethalfluralin HFP[1]	1.0/0.75	2235	37
metolachlor II/ ethalfluralin HFP[1]	1.5/0.75	2137	40
alachlors MT/ ethalfluralin HFP[1]	2.0/0.75	2274	37
ethalfluralin HFP[1]	0.75	2082	34
ethalfluralin HFP[1]/ imazethapyr[2]	0.75/0.032	2384	36
dimethenamid[3]	1.5	2145	35
metolachlor II[3]	2.5	2235	37
dimethenamid/ imazethapyr[3]	1.0/0.032	2228	35
metolachlor II/ imazethapyr[3]	1.5/0.032	2318	35
alachlor MT/ imazethapyr[3]	2.0/0.032	2192	38
imazethapyr[3]	0.032	2200	34
handweeded check		2384	34
check		558	35
LSD 0.05		390	ns

1. Preplant incorporated.
2. Postemergence with X-77 at 0.25% v/v.
3. Preemergence.

Trifluralin 10% granules for summer annual grass control in established bermudagrass. Barry R. Tickes. This test was conducted in a 2 year old established stand of common bermudagrass at the Yuma Mesa Agriculture Center. This center is located on superstition fine sand approximately five miles south of the city of Yuma. Trileaf 2 pearl millet was used as a bioassay crop to determine the efficacy of two rates of Trifluralin ten percent granules in controlling summer annual grasses in established bermudagrass. Pearl millet was chosen because of its similarity in seed size and growth characteristics to most summer annual grasses present in the region. The millet was planted 1/2 inch deep into the established bermudagrass at a rate of 20 lbs/A prior to regrowth of the crop. Trifluralin granules were spread immediately after planting of the indicator crop and incorporated with a five inch irrigation on March 4, 1993. Treatments included: 1.0 lb. active ingredient per acre of Trifluralin 10% granules (Gowan Company); 2.0 lbs active ingredient per acre of Trifluralin granules and an untreated check. Three replications of each treatment were set in a randomized complete block design. Plot size was 16-1/2 ft. by 80 ft. A valmar airflo ground driven granular applicator with 16-1/2 ft. boom was used to apply the treatments. Visual evaluations of percent control were made on April 14, 1993, 41 days after treatment.

Visual evaluation of control made 41 days after treatment indicated that excellent levels of control (90 percent or better) were achieved with 2.0 lbs active ingredient per acre rate. Levels of control at the 1.0 lb active ingredient per acre rate were variable, from 50 to 80 percent with an average of 63 percent. This would be unacceptable under most commercial conditions. It is of value to note that in other tests conducted at the same location but on bare soil with no crop present, that rates of Trifluralin granules as low as 0.5 lb active ingredient per acre did an excellent job of controlling pearl millet. Trifluralin is tied up by organic matter and the lower levels of control achieved in bermudagrass could be the result of the organic matter normally present on the surface of established fields.

Table. Annual grass control in established bermudagrass with Trifluralin 10G.

Treatment	Rate (ai/A)	Control (%)
Trifluralin 10G	1.0	63
Trifluralin 10G	2.0	92
Untreated	--	0

[1]Average of three replications.

Interrupted windgrass control in established Kentucky bluegrass seed. D.A. Ball and D.L. Walenta. A study was established west of Elgin, OR in Union County to evaluate early (EPOST) and late (LPOST) spring postemergence herbicide treatments for control of interrupted windgrass (APEIN) and crop tolerance in established bluegrass grown for seed. The experimental area was located in an established stand of Kentucky bluegrass var. 'Baren' planted in fall 1989. The prior residue treatment consisted of open field burning. EPOST treatments were made on April 13, 1993 to 6-8 leaf windgrass vigorously growing. Bluegrass was 3-4" height and breaking dormancy. LPOST treatments were made on April 26, 1993 to 8-10 leaf vigorously growing windgrass. Bluegrass was 4-8" height and vigorously growing. All treatments were applied with a hand held CO_2 sprayer delivering 15 gpa at 35 psi. Plots were 6' x 30' in size, in an RCB arrangement, with 4 replications. The soil was an Imbler fine sandy loam (56.4% sand, 31.8% silt, 11.8% clay, 5.3 pH, 2.9% OM, 17.6 Meq/100g CEC). Visual evaluations of windgrass control and crop injury were made on May 11, and May 25, 1993.

Application details:

EPOST

Air temp: 39°F	Sky: clear
Wind: Calm	Soil temp: 0" 45°F, 1" 42°F, 2" 38°F, 4" 38°F
Relative humidity: 92%	Soil moisture: field capacity

Note: Heavy dew on plot area at time of application.

LPOST

Air temp: 50°F	Sky: mostly cloudy
Wind: West at 3 to 8 mph	Soil temp: 0" 56°F, 1" 55°F, 2" 54°F, 4" 50°F
Relative humidity: 65%	Soil moisture: moist, good condition

Note: Rain showers occurred within 1 hr of LPOST applications.

Results indicate that imazamethabenz did not adequately control windgrass at either stage of windgrass growth (Table 1). Crop injury was negligible from any imazamethabenz treatment rate or timing. Fenoxaprop + MCPA (Tiller®) provided excellent (97%) control of windgrass, but caused unacceptable crop injury at the LPOST application timing. Crop injury from this treatment at the EPOST timing was noticeable, but not unacceptable, and symptoms diminished at time of later evaluation. Injury was not visibly evident as crop approached maturity. (Columbia Basin Agric. Res. Ctr., Oregon State Univ., Pendleton, OR 97801).

Table 1. Interrupted Windgrass control in established Kentucky bluegrass seed.

Treatment	Rate	Timing	May 11 Injury	May 11 Control	May 25 Injury	May 25 Control
	lb/A		%			
Imazamethabenz + R-11	0.41 + 0.25%	EPOST	0	15	0	0
Imazamethabenz + R-11	0.47 + 0.25%	EPOST	0	18	1	9
Imazamethabenz + Sun-It	0.47 + 0.25%	EPOST	0	23	3	8
Imazamethabenz + Kinetic	0.47 + 0.125%	EPOST	0	18	3	16
Imazamethabenz + R-11	0.63 + 0.25%	EPOST	0	21	0	9
Imazamethabenz + R-11	0.94 + 0.25%	EPOST	3	44	5	20
Fenoxaprop+MCPA (PM)	0.080	EPOST	20	86	9	97
Imazamethabenz + R-11	0.47 + 0.25%	LPOST	0	11	3	8
Imazamethabenz + R-11	0.94 + 0.25%	LPOST	1	45	3	19
Fenoxaprop+MCPA (PM)	0.080	LPOST	10	69	63	97
Control	-	-	0	0	0	0

(PM) = a commercially available package mix formulation.
R-11®, Sun-It®, and Kinetic® are expressed on a percent v/v basis.

Weed control in established Kentucky bluegrass for seed production. Kathryn A. Hamilton, Curtis R. Thompson, and Donald C. Thill. Two studies were initiated in the fall of 1992 on established Kentucky bluegrass to determine the effects of a range of herbicide treatments. At Worley, Idaho the treatments were applied in Kentucky bluegrass variety "Banff". The second site was established in Kentucky bluegrass variety "Classic" at Nezperce, Idaho. Both sites were in the second seed year, and prior to trial establishment the residue was cut short (height 1 to 2 inches) using a plot size grass crew cutter. The residue was not burned. Herbicide treatments were applied with a CO_2 backpack sprayer. The fall treatments were applied at 20 gal/A 40 psi, and 3 mph on September 11 at Worley and October 2 at Nezperce (Table 1). The spring treatment was applied at 10 gal/A and 38 psi on March 25 at Nezperce and on March 26 at Worley. The experimental design was a randomized complete block, replicated four times with plot size 8 by 25 feet at Worley and 8 by 20 feet at Nezperce. Seed yield and the number of panicles were obtained from a 1.6 ft^2 quadrat from each plot on July 13 and August 7 for the Nezperce and Worley sites, respectively. Percent weed control was assessed on March 26 at the Nezperce site, and level of redstem filaree (EROCI) control was evaluated at Worley on May 13. Weeds evaluated at Nezperce were shepherdspurse (CAPBP), mayweed chamomile (ANTCO), narrowleaf montia (MONLI), henbit (LAMAM) and interrupted windgrass (APEIN).

Table 1. Application and soil analysis data

Location	Nezperce		Worley	
Application time	October 2	March 25	September 11	March 26
Air temperature (F)	54	50	52	50
Soil temperature (F)	58	50	56	51
Relative humidity (%)	84	80	92	74
Wind speed (mph) - direction	2, W	3, N	0	2, W
Soil moisture condition	dry	wet	marginal	wet
pH			4.9	
OM (%)			3.1	
CEC (meq/100g soil)			19.2	
Texture			silt loam	

At both locations the spring applied treatment of fenoxaprop-MCPA-2,4-D reduced the number of panicles and seed yield (Table 2). The fenoxaprop-MCPA-2,4-D treatment injured the bluegrass 98% (data not shown) which is reflected in the low seed yield. The other treatment effects were not consistent between the two sites. Seed yield was reduced when quinclorac + Sun-It II, the high rate of UCC4243, and MON 13280 were fall applied at Worley but not at Nezperce. The response of panicle number to herbicide treatment was similar to seed yield. Redstem filaree weed control was 86% or higher for all the treatments at Worley (Table 3). At Nezperce weed control was 90% or greater for the fall applied treatments except quinclorac. (Idaho Agricultural Experiment Station, Moscow ID 83844)

Table 2. Effect of herbicides on Kentucky bluegrass seed yield and panicle number.

Treatment	Form.[1]	Rate	Applic.[2] time	Yield Nezperce	Yield Worley	Panicles Nezperce	Panicles Worley
		lb/A		lb/A		No./ft²	
Control	-	-	-	337	412	100	110
UCC4243	50WP	0.094	fall	320	319	61	77
UCC4243	50WP	0.188	fall	353	352	79	77
Quinclorac +	75DF	0.25	fall	287	300	83	85
Sun-It II[3]	L	1					
Quinclorac +	75DF	0.5	fall	342	290	82	82
Sun-It II	L	1					
Terbacil	80WP	0.4	fall	326	372	66	104
Terbacil	80WP	0.8	fall	402	354	93	101
Dithiopyr	1EC	0.5	fall	336	400	94	97
MON 13280	50WG	0.375	fall	369	242	90	83
Fenoxaprop-[4] MCPA-2,4-D	2.7L	0.574	spring	4	16	3	9
LSD (0.05)				130	83	30	26

[1] Form. is the formulation of herbicide used.
[2] Applic. refers to application timing.
[3] Sun-It II is a methylated crop seed oil applied at 2 pt/A.
[4] Fenoxaprop-MCPA-2,4-D is a commercially formulated herbicide mixture.

Table 3. Weed control in established Kentucky bluegrass for seed production.

Treatment	Form.[1]	Rate	Applic.[2] time	WEED CONTROL Nezperce CAPBP	ANTCO	MONLI	LAMAM	APEIN	Worley EROCI
		lb/A		---%control[3]---					
Control									
UCC4243	50WP	0.094	fall	99	96	99	99	97	100
UCC4243	50WP	0.188	fall	99	99	99	99	99	100
Quinclorac +	75DF	0.25	fall	7	9	6	6	17	86
Sun-It II[4]	L	1							
Quinclorac +	75DF	0.5	fall	76	48	94	83	61	99
Sun-It II	L	1							
Terbacil	80WP	0.4	fall	99	91	97	99	90	99
Terbacil	80WP	0.8	fall	99	94	99	99	96	100
Dithiopyr	1EC	0.5	fall	99	97	99	99	99	100
MON 13280	50WG	0.375	fall	99	94	99	99	99	95
Fenoxaprop-[5] MCPA-2,4-D	2.7L	0.574	spring	-	-	-	-	-	100
LSD (0.05)				9	15	8	8	14	13

[1] Form. is the formulation of herbicide used.
[2] Applic. refers to application timing.
[3] visually evaluated.
[4] Sun-It II is a methylated crop seed oil applied at 2 pt/A.
[5] Fenoxaprop-MCPA-2,4-D is a commercially formulated herbicide mixture.

Broadleaf weed control in field corn with postemergence herbicides. John O. Evans, R. William Mace, and Steven A. Dewey. Postemergence herbicides were evaluated for control of black mustard (BRANI), redroot pigweed (AMARE), common lambsquarter (CHEAL), and prickly lettuce (LACSE) in field corn (Grand Valley 134L). Treatments were replicated three times on June 18, 1993 in a RCB design. Herbicides were applied with a bicycle sprayer delivering 16 gpa at 40 psi using 8001 flatfan nozzles with 18 inch spacing. There was a dense, uniform stand of broadleaf weeds over the entire plot ranging from 2 to 3 leaf growth stages. There were few, if any, grasses within the plots. The corn averaged 6 inches in height at treatment. Visual evaluations were taken 11 DAT, then again at 38 DAT when the furrowing had been completed. Corn was harvested by hand cutting two center rows on September 22, 1993.

Broadleaf weed control was good to excellent for all herbicide treatments. There were no signs of injury to the corn. Yields were very uniform for all treated plots with only the control being significantly lower with a 40% yield loss due to weed density. (Utah Agricultural Experiment Station, Logan, Ut. 84322-4820)

Table. Weed control with postemergence herbicides in field corn.

Treatment	Rate	Injury	Yield	weed control			
				BRANI	AMARE	CHEAL	LACSE
	(oz/A)	%	(T/A)	%			
CGA 152005+ 2,4-D amine+COC[1]	0.42 12	0	19.9	100	100	100	100
CGA 152005+ 2,4-D amine+COC[1]	0.57 12	0	18.4	100	100	100	100
CGA 152005+COC[1]	0.57	0	20.1	100	90	100	100
MON 12000[2]	1.01	0	20.7	100	100	80	100
MON 12000+ MON 13900[2]	1.01	0	22.1	100	100	90	100
primisulfuron+COC[1]	0.76	0	20.1	100	100	90	100
nicosulfuron+COC[1]	0.5	0	22.0	100	100	80	100
untreated		0	12.9	0	0	0	0
$LSD_{(.05)}$		NS	5.1	NS	10	10	NS

[1]crop oil concentrate at 2 pt/A
[2]X77 at .25% v/v

Herbicide evaluation for weed control in field corn. Tate W. Carter, Robert W. Downard and Don W. Morishita. Field research was conducted near Gooding, Idaho to evaluate weed control and crop tolerance in field corn (var. Golden Grain). Weed species evaluated were common lambsquarters (CHEAL), redroot pigweed (AMARE) and barnyardgrass (ECHCG). Corn was planted on 30-inch rows at approximately 42,000 seeds/A. Plots were 10 by 25 ft arranged in a randomized complete block design with four replications. Preplant incorportated (PPI) and postemergence (POST) applications were applied with a bicycle sprayer and 11001 flat fan nozzles. Post-directed (PDIR) applications were made with a hand-held boom using 24 inch drop nozzles with 15001 double outlet nozzle tips. The carrier was water at 10 gpa and 20 psi for all applications. Additional application data are shown in Table 1. Crop injury and weed control evaluations were taken visually June 30, July 14, and July 28, 1993. Yield was not measured. Analysis of variance showed significant differences among treatments for all variables except crop injury. Control of CHEAL on the last evaluation date was not different. Nicosulfuron POST treatments 13 days after treatment controlled ECHCG 71 to 95% and AMARE 68 to 90%. However, CHEAL control was only 14 to 15% with nicosulfuron until the PDIR treatments were applied. Nicosulfuron followed by paraquat and nicosulfuron followed by nicosulfuron applied POST and PDIR seemed to offer the best overall weed control. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, Idaho 83303).

Table 1. Application data.

Application date	5/17	6/17	6/30
Application timing	PPI	POST	PDIR
Air temperature (F)	80	69	70
Soil temperature (F)	76	64	69
Relative humidity (%)	44	61	15
Wind velocity (mph)	2 to 4	0 to 2	5
Soil moisture	good	good	dry

Table 2. Crop injury and weed control in field corn near Gooding, Idaho.

						Weed control[1]								
		Applic.[2]	Crop injury			ECHCG			AMARE			CHEAL		
Treatment	Rate	timing	6/30	7/14	7/28	6/30	7/14	7/28	6/30	7/14	7/28	6/30	7/14	7/28
	lb ai/A		%											
Check			0	0	0	0	0	0	0	0	0	0	0	0
Aceto & R25788[3]	1.6	PPI	0	6	3	66	88	79	60	88	84	46	66	53
paraquat[4]	0.25	PDIR												
Aceto & R25788	1.6	PPI	0	1	0	85	93	90	89	96	99	83	68	74
nicosulfuron[4,5]	0.047	PDIR												
Aceto & MON 8407	2.25	PPI	0	2	0	91	94	95	96	95	90	88	73	54
paraquat	0.25	PDIR												
Aceto & MON 8407	2.25	PPI	0	0	0	81	90	93	88	93	96	59	58	46
nicosulfuron	0.047	PDIR												
Dimethenamid	1.25	PPI	0	6	2	93	98	96	69	88	85	68	69	54
paraquat	0.25	PDIR												
Dimethenamid	1.25	PPI	0	0	1	76	93	84	33	88	63	69	70	53
nicosulfuron	0.047	PDIR												
Nicosulfuron	0.047	POST	0	10	8	71	83	75	68	89	53	15	80	70
paraquat	0.25	PDIR												
Nicosulfuron	1.50	POST	3	2	2	95	99	98	90	100	98	14	63	59
nicosulfuron	0.047	PDIR												
Alachlor	2.0	PPI	3	1	1	59	81	83	48	83	85	78	66	34
nicosulfuron	0.047	PDIR												
LSD (0.05)			3	3	4	26	19	28	31	16	35	26	28	47

[1]Weeds evaluated were barnyardgrass (ECHCG), redroot pigweed (AMARE) and common lambsquarters (CHEAL).
[2]Application abbreviations are preplant incorporated (PPI), postemergence (POST), and post directed (PDIR).
[3]Aceto = Acetochlor and safener.
[4]Surfactant was added to all paraquat and nicosulfuron treatments at 0.25% v/v.
[5]28% N added to all nicosulfuron treatments at 4.0% v/v.

Control of kochia and wild proso millet in imidazolinone resistant corn with imazethapyr combinations. D'Amato, T.J. and P. Westra. Seven various herbicide combinations containing imazethapyr were evaluated for control of kochia (Kochia scoparia (L.) Schrad.) and wild proso millet (Panicum miliaceum L.) in IR (imidazolinone resistant) corn (Zea maize L.). Herbicides were applied preemergent (PRE) and post emergent (POST). The experiment was located in Weld County Colorado and was arranged in a randomized complete block design with 3 replications, plot size was 10 feet by 30 feet. The corn variety, Pioneer 3417 IR, was planted on May 10, 1993. Terbufos insecticide was applied at planting at the rate of 8 pounds of product per acre. Preemergent treatments were applied on May 11, 1993 using a CO_2 pressurized backpack sprayer delivering 12 gpa at 23 psi using 11001LP tips. Post emergent treatments were applied on June 10, 1993 with a CO_2 pressured backpack sprayer delivering 22 gpa at 25 psi and using 11002LP tips. At the time of the post emergent treatments the corn was in the 4 leaf stage and 6 inches tall, the kochia was 2-6 inches tall with a density of 6 plants per square foot, and the wild proso millet was 2-4 inches tall, at the 2-4 leaf stage, and present at a density of 10 plants per square foot. Visual evaluations based on percent control were made on June 21 and July 16, 1993.

The post emergent application of imazethapyr with a 28% nitrogen solution and crop oil concentrate provided good to excellent control of kochia and wild proso millet. The split application of pendimethalin applied preemergent and followed with the post emergent treatment of imazethapyr, 28% nitrogen solution, and crop oil concentrate improved weed control, particularly for wild proso millet early in the season. Post emergent tank mixes of imazethapyr with atrazine, dicamba, or bromoxynil were less effective than imazethapyr alone. The preemergent treatments of imazethapyr tank mixed with dimethenamid, with or without atrazine provided the best broad spectrum weed control in this study. No corn injury was observed in any of the plots. (Department of Plant Pathology and Weed Science, Colorado State University, Fort Collins, CO 80523.)

Control of kochia and wild proso millet in IR corn with imazethapyr combinations.[1]

Treatment	Rate lbs ai/a	Application Timing	wild proso millet 6-21-93	kochia 6-21-93	wild proso millet 7-16-93	kochia 7-16-93
			% control			
CHECK			0 g	0 f	0 g	0 f
imazethapyr	0.0625	POST	70 f	92 c	90 c	93 b
28% N[2]	1.0	POST				
COC[3]	1.5	POST				
pendimethalin	1.0	PRE	95 c	97 b	95 b	92 c
imazethapyr	0.0625	POST				
28% N	1.0	POST				
COC	1.5	POST				
imazethapyr	0.0625	POST	71 e	75 d	73 f	85 e
atrazine	0.5	POST				
28% N	1.0	POST				
COC	1.5	POST				
imazethapyr	0.0625	PRE	100 a	100 a	100 a	100 a
dimethenamid	1.0	PRE				
imazethapyr	0.0625	PRE	98 b	100 a	100 a	100 a
dimethenamid	0.75	PRE				
atrazine	0.5	PRE				
imazethapyr	0.0625	POST	90 d	67 e	78 e	85 e
dicamba	0.125	POST				
nonionic surf.[4]	0.25	POST				
28% N	0.1	POST				
imazethapyr	0.0625	POST	70 f	92 c	88 d	90 d
nonionic surf.	0.25	POST				
bromoxynil	0.125	POST				
28% N	1.0	POST				

[1] Means within a column followed by the same letter are not statistically different (P=0.05).
[2] 28% nitrogen solution appied at rate in quarts of product per acre.
[3] Crop oil concentrate applied at rate in pints of product per acre.
[4] Nonionic surfactant applied at rate in percent volume per volume.

Control of velvetleaf and barnyardgrass in corn. Howatt, K.A., T.J. D'Amato, and P. Westra. Nine herbicides were evaluated for control of velvetleaf and barnyardgrass in corn. Herbicides were applied preemergence (PRE) and post emergence (POST). The experiment was located in Morgan County Colorado on a clay loam soil consisting of 28% clay, 27% silt, and 45% sand with 1% organic matter and a pH of 7.9. Plot size was 10 by 30 feet arranged in a randomized complete block having three repetitions. Imidazolinone-tolerant corn 'Garst IT' was planted April 26, 1993. All spray applications were applied with a CO_2 powered backpack sprayer using 11002LP tips delivering 23 gpa at 25 psi. Preemergence treatments were applied April 27, 1993. Post emergence treatments were applied June 2, 1993. Corn stage was 2 to 5 leaf, velvetleaf was in the cotyledon stage at a density of six plants per square foot, and barnyardgrass was in the second leaf stage at a density of three plants per square foot. Control of weeds was visually evaluated on June 14 and July 9, 1993.

All treatments provided good to excellent control of barnyardgrass. All treatments except metolachlor/cyanazine provided good to excellent control of velvetleaf. The post emergence application of pendimethalin/dicamba/atrazine provided the highest level of control for both velvetleaf and barnyardgrass. No corn injury was observed for any treatment in this study. (Weed Research Laboratory, Colorado State Univ., Fort Collins, CO 80523).

Table. Control of velvetleaf and barnyardgrass in corn.

Weed/Crop Code Rating Data Type[1] Rating Date			VELVETLEAF CONTROL 6-14-93	BARNYARD- GRASS CONTROL 6-14-93	VELVETLEAF CONTROL 7-9-93	BARNYARD- GRASS CONTROL 7-9-93
Treatment Name	Rate lb ai/A	Growth stage	- - - - - - - -	%	- - - - - - - -	
Metolachlor cyanazine	2.0 1.0	PRE PRE	40	99	23	95
Dimethenamid MON-12000	1.2 0.065	PRE PRE	83	95	96	96
Alachlor MON-12000	2.0 0.065	PRE PRE	87	95	95	95
Dimethenamid dicamba	1.12 0.25	PRE POST	95	95	95	95
Metolachlor dicamba	1.5 0.25	PRE POST	85	93	82	99
Dimethenamid dicamba	1.12 0.25	POST POST	80	90	95	95
Dimethenamid MON-12000	1.12 0.016	POST POST	95	88	99	95
Dimethenamid MON-12000 dicamba	1.12 0.016 0.125	POST POST POST	95	89	99	95
Pendimethalin dicamba + atrazine	1.0 0.3 + 0.5	POST POST	99	98	100	98
Weedy check			0	0	0	0

[1] Percent weed control visually evaluated.

Annual grass and broadleaf weed control in field corn with metribuzin applied postemergence alone or in combination. Richard N. Arnold, Eddie J. Gregory, and Daniel Smeal. Research plots were established on May 7, 1993 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. Grand Valley SX 1230) and annual grass and broadleaf weeds to postemergence applications of metribuzin applied alone or in combination. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with four replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied postemergence on May 25, 1993 when corn was in the 3 to 4-leaf stage and weeds were small. Redroot pigweed and cutleaf nightshade infestations were heavy and prostrate pigweed, green foxtail, and barnyardgrass infestations were moderate and Russian thistle infestations were light throughout the experimental area. Visual evaluations of crop injury and weed control were made June 28, 1993. Handweeded controls were hoed starting on May 28, 1993 about every two weeks until August 23, 1993. Stand counts were made on June 28, 1993 by counting individual plants per 10 ft of the third row of each plot. Plant heights were taken on September 16, 1993 by recording and averaging the height of three plants per plot.

Field corn injury and weed control ratings are presented in table 1. Prostrate pigweed, cutleaf nightshade, green foxtail, and barnyardgrass control was excellent with all treatments except the check. Redroot pigweed and Russian thistle control was good to excellent with all treatments except metribuzin applied at 0.09 lb ai/A, and the check. Metribuzin applied at 0.19 and 0.28 lb ai/A showed severe stunting and yellowing of young corn plants. Effect of herbicide treatments on yield, height, and stand count of field corn are presented in table 2. Data showed that there were no significant differences among treatments for plant height and stand count. Metribuzin applied at 0.19 and 0.28 lb ai/A yielded significantly less bu/A than any other treatment except the check. Field corn yields were 100 to 20 bu/A higher in herbicide treated plots than the check.

Table 1. Control of annual grass and broadleaf weeds with postemergence applications of metribuzin applied alone or in combination, in Grand Valley SX-1230 field corn on June 28, 1993 at Farmington, New Mexico.

Treatment	Rate	Crop Injury[1]	AMABL	AMARE	SOLTR	SASKR	SETVI	ECHCG
			Weed control[1,2]					
	lb ai/A	%						
metribuzin	0.19	41	100	99	99	100	100	100
metribuzin	0.28	75	100	99	100	100	100	100
metribuzin/ 2,4-D	0.09/0.25	6	100	97	98	88	94	100
metribuzin/ bromoxynil	0.09/0.25	2	100	100	100	100	98	100
metribuzin/ nicosulfuron	0.09/0.31	0	100	97	93	91	99	100
metribuzin/ primisulfuron	0.09/0.035	0	100	100	100	95	94	97
atrazine[3]	1.5	0	100	100	95	88	100	100
metribuzin/ bentazon	0.09/0.5	0	100	98	99	98	97	99
metribuzin/ dicamba	0.09/0.25	1	100	99	98	98	99	98
metribuzin	0.09	0	100	83	95	66	96	100
handweeded check		0	100	100	100	100	100	100
check		0	0	0	0	0	0	0
av weeds/M^2			10	27	20	2	8	8
LSD 0.05		10	1	10	5	9	5	2

1. Based on a visual scale from 0- 100. where 0 = no control or crop injury and 100 = dead plants.
2. AMABL = prostrate pigweed, AMARE = redroot pigweed, SOLTR = cutleaf nightshade, SASKR = Russian thistle, SETVI = green foxtail, and ECHCG = barnyardgrass.
3. Applied with X-77 at 0.25% v/v.

Table 2. Yield, plant height, and stand count of Grand Valley SX-1230 1230 field corn affected by postemergence applications of metribuzin alone or in combination, Farmington, New Mexico, in 1993.

Treatment	Rate	Yield	Plant Height	Stand Count
	lb ai/A	bu/A	in	#
metribuzin	0.19	164	94	16
metribuzin	0.28	129	91	14
metribuzin/ 2,4-D	0.09/0.25	194	94	16
metribuzin/ bromoxynil	0.09/0.25	202	97	16
metribuzin/ nicosulfuron	0.09/0.31	201	95	16
metribuzin/ primisulfuron	0.09/0.035	193	89	17
atrazine[1]	1.5	200	96	16
metribuzin/ bentazon	0.09/0.5	192	92	16
metribuzin/ dicamba	0.09/0.25	196	94	16
metribuzin	0.09	189	89	17
handweeded check		209	93	16
check		109	87	14
LSD 0.05		19	ns	ns

1. Applied with X-77 at 0.25% v/v.

Annual grass control in field corn with delayed preemergence herbicides. Richard N. Arnold, Eddie J. Gregory, and Daniel Smeal. Research plots were established on May 7, 1993 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. Grand Valley SX-1230) and annual grasses to delayed preemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were on May 12, 1993 and immediately incorporated with 0.75 in of sprinkler applied water. Barnyardgrass and green foxtail infestations were moderate throughout the experimental area. Dicamba was applied postemergence for broadleaf control at 0.25 lb ai/A on June 2, 1993. Visual evaluations of crop injury and weed control were made June 2, 1993. Handweeded controls were hoed starting on May 28, about every two weeks until August 23, 1993. Stand counts were made on June 2, 1993 by counting individual plants per 10 ft of the third row of each plot. Plant heights were taken on September 20, 1993 by recording and averaging the height of three plants per plot.

Field corn injury and weed control rating are presented in table 1. All treatments gave good to excellent control of barnyardgrass and green foxtail. Metolachlor at 3.0 lb ai/A caused significantly more damage than any other treatment. Effect of herbicide treatments on yield, plant height, and stand count are presented in table 2. Plant height ranged from 98 to 87 in. Metolachlor applied at 3.0 lb ai/A had fewer plants per 10 ft than did any other treatment. Corn yields were 69 to 4 bu/A higher in the herbicide treated plots than the check. Metolachlor applied at 3.0 lb ai/A and the check yielded significantly less bu/A than did any other treatment.

Table 1. Control of annual grass weeds with delayed preemergence herbicides in Grand Valley SX-1230 field corn on June 2, 1993 at Farmington, New Mexico.

Treatments	Rate	Crop[1] Injury	Weed Control[1,2] SETVI	ECHCG
	lb ai/A	-----------------%	-----------------	-----------------
dimethenamid	0.75	0	100	98
dimethenamid	1.0	0	100	100
dimethenamid	1.25	4	100	100
dimethenamid	2.0	8	100	100
metolachlor	1.5	0	100	100
metolachlor	3.0	10	100	100
alachlor MT	4.0	0	100	100
vernolate	1.6	0	100	100
vernolate	3.0	0	100	100
metolachlor II	1.5	0	100	100
metolachlor II	3.0	0	100	100
alachlor MT	2.0	0	97	98
vernolate	1.2	0	95	95
vernolate	0.8	0	90	90
handweeded check		0	100	100
check		0	0	0
av weeds/M^2			11	12
LSD 0.05		1	1	2

1. Based on a visual scale from 0-100 where 0 = no control or crop injury and 100 = dead plants.
2. SETVI = green foxtail and ECHCG = barnyardgrass.

Table 2. Yield, plant height, and stand count of Grand Valley SX-1230 field corn affected by delayed preemergence herbicides, Farmington, New Mexico, 1993.

Treatments	Rate	Yield	Plant Height	Stand Count
	lb ai/A	bu/A	in	#
dimethenamid	0.75	186	94	16
dimethenamid	1.0	191	88	18
dimethenamid	1.25	184	90	16
dimethenamid	2.0	168	87	17
metolachlor	1.5	189	94	17
metolachlor	3.0	138	90	13
alachlor MT	4.0	197	98	17
vernolate	1.6	193	88	18
vernolate	3.0	193	96	16
metolachlor II	1.5	183	92	18
metolachlor II	3.0	163	92	18
alachlor MT	2.0	181	88	17
vernolate	1.2	185	91	17
vernolate	0.8	184	90	16
handweeded check		203	95	17
check		134	89	18
LSD 0.05		17	6	2

Broadleaf weed control in field corn with NM-498 applied preplant incorporated and preemergence. Richard N. Arnold, Eddie J. Gregory and Daniel Smeal. Research plots were established on May 10, 1993 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. Grand Valley SX-1230) and broadleaf weeds to preplant incorporated and preemergence applications of NM-498. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Preplant incorporated treatments were applied on May 10, 1993 and immediately incorporated to a depth of 2 to 4 in with a tractor-driven rototiller. Preemergence treatments were applied on May 11, 1993 and immediately incorporated with 0.75 in of sprinkler applied water. Prostrate and redroot pigweed and black nightshade infestations were moderate and Russian thistle and kochia infestations were light throughout the experimental area. Visual evaluations of crop injury and weed control were made June 10, 1993. Hand-weeded control were hoed starting on May 28, about every two weeks until August 23, 1993. Stand counts were made on June 10, 1993 by counting individual plants per 10 ft of the third row of each plot. Plant heights were taken on September 16, 1993 by recording and averaging the height of three plants per plot.

Field corn injury and weed control ratings are presented in table 1. All treatments gave good to excellent control of broadleaf weeds employed in this study. NM-498 applied preplant incorporated at 0.089 lb ai/A gave the highest injury rating of 3. Effect of treatments on yield, plant height, and stand count are presented in table 2. Data showed that there were no significant differences among treatments for plant height and stand count. Corn yields were 88 to 63 bu/A higher in the herbicide treated plots than the check.

Table 1. Control of annual broadleaf weeds with NM-498 applied preplant incorporated and preemergence in Grand Valley SX-1230 field corn on June 10, 1993, at Farmington, New Mexico.

Treatments	Rate	Crop Injury[1]	Weed control[1,2] AMABL	AMARE	KCHSC	SASKR	SOLNI
	lb ai/A	--------	--------	--------	%	--------	--------
NM-498[3]	0.036	0	100	100	97	100	99
NM-498[3]	0.054	0	100	100	100	100	98
NM-498[3]	0.062	1	100	100	98	100	99
NM-498[3]	0.071	1	100	100	100	100	100
Nm-498[3]	0.089	3	100	100	100	100	100
NM-498[4]	0.036	0	100	100	97	100	100
NM-498[4]	0.054	0	100	100	100	100	99
NM-498[4]	0.062	0	100	100	100	100	99
NM-498[4]	0.071	0	100	100	100	99	99
Nm-498[4]	0.089	1	100	100	100	100	99
atrazine/ metolachlor[3,5]	3.5	1	100	100	100	100	100
atrazine/ metolachlor[4,5]	3.5	0	100	100	100	100	100
cyanazine[3]	1.25	0	100	100	100	100	100
cyanazine[4]	1.25	0	100	100	100	100	98
handweeded check		0	100	100	100	100	100
check		0	0	0	0	0	0
av weeds/M^2			8	11	2	2	11
LSD 0.05		1	1	1	4	1	8

1. Based on a visual scale from 0- 100. where 0 = no control or crop injury and 100 = dead plants.
2. AMABL = prostrate pigweed, AMARE = redroot pigweed, KCHSC = kochia, and SASKR = Russian thistle, and SOLNI = black nightshade.
3. Preplant incorporated.
4. Preemergence.
5. pm = packaged mix.

Table 2. Yield, plant height, and stand count of Grand Valley SX-1230 field corn affected by preplant incorporated and preemergence applications of NM-498, Farmington, New Mexico, in 1993.

Treatments	Rate	Yield	Plant Height	Stand Count
	lb ai/A	bu/A	in	#
NM-498[1]	0.036	189	94	16
NM-498[1]	0.054	182	95	16
NM-498[1]	0.062	186	94	16
NM-498[1]	0.071	183	99	16
Nm-498[1]	0.089	198	99	16
NM-498[2]	0.036	193	98	17
NM-498[2]	0.054	202	99	16
NM-498[2]	0.062	192	93	16
NM-498[2]	0.071	188	102	17
NM-498[2]	0.089	181	95	14
atrazine/ metolachlor[1,3]	3.5	182	97	17
atrazine/ metolachlor[2,3]	3.5	201	94	16
cyanazine[1]	1.25	196	97	15
cyanazine[2]	1.25	197	99	16
handweeded check		201	99	16
check		118	93	14
LSD 0.05		19	ns	ns

1. Preplant incorporated.
2. Preemergence.
3. Packaged mix.

Evaluation of sulfosate and glyphosate for chemical fallow weed control. Tate W. Carter, Robert W. Downard and Don W. Morishita. This research was conducted east of Idaho Falls, Idaho to investigate the efficacy of sulfosate and glyphosate alone and tank mixed with 2,4-D amine or dicamba at various rates for weed control on fallow ground. The previous crop was oats (AVESA). Predominant weed species were tumble mustard (SSYAL), prickly lettuce (LACSE) and downy brome (BROTE). Plots were 8 by 25 ft. and treatments were arranged in a randomized complete block with four replications. Soil type at this location was a silt soil with 1.75% organic matter, pH of 8.0 and CEC of 17 meq/100 g soil. Applications were made on June 11 using a CO_2 pressurized bicycle sprayer. The sprayer was equipped with 11001 flat fan nozzle tips and calibrated to deliver 10 gpa at 3 mph. Soil and air temperature was 59 and 50 F, respectively, relative humidity was 77%, soil moisture was good and winds were gusting to 12 mph. Weed control was evaluated visually on June 22 and July 8, 1993.

Sulfosate + 2,4-D amine, at the high rate, controlled tumble mustard 94% and offered fair to good control of the other three species. Glyphosate + 2,4-D amine at the low rate and sulfosate + dicamba at the high rate also provided adequate weed control. The control overall was lower than expected possibly due to rain within four hours after application. The reduced control was especially evident in the poor volunteer oat control. Normally the oat control would have been much better, but the rain was apparently sufficient to significantly suppress the control. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, Idaho 83303).

Table 2. Comparison of Touchdown and Roundup alone in combination for chemcial fallow weed control.

		Weed Control[1]							
		AVESA		SSYAL		LACSE		BROTE	
Treatment	Rate	6/22	7/8	6/22	7/8	6/22	7/8	6/22	7/8
Check		0	0	0	0	0	0	0	0
Sulfosate[2]	0.25	34	20	21	40	10	18	34	14
Sulfosate	0.375	51	43	53	76	41	53	48	33
Sulfosate	0.5	76	74	54	68	45	56	68	54
Sulfosate + 2,4-D amine	0.25 + 0.25	36	28	86	76	68	68	46	26
Sulfosate + 2,4-D amine	0.375 + 0.25	50	36	91	76	83	78	54	48
Sulfosate + 2,4-D amine	0.5 + 0.25	78	74	96	94	80	81	74	61
Sulfosate + dicamba	0.25 + 0.125	34	20	71	59	74	65	43	29
Sulfosate + dicamba	0.375 + 0.125	55	40	71	74	65	83	58	54
Sulfosate + dicamba	0.5 + 0.125	69	58	80	80	75	80	69	53
Glyphosate	0.25	48	29	38	34	39	50	43	40
Glyphosate	0.375	76	54	70	63	63	61	71	63
Glyphosate + 2,4-D amine	0.25 + 0.25	71	51	91	93	70	71	75	58
Glyphosate + 2,4-D amine	0.375 + 0.25	60	48	93	71	81	73	64	50
Glyphosate + dicamba	0.25 + 0.125	46	50	80	76	76	84	35	39
Glyphosate + dicamba	0.375 + 0.125	68	45	83	79	79	78	60	51
LSD (0.05)		16	25	14	21	16	18	16	26

[1]Weed species abbreviation are as follows: AVESA = oats, SSYAL = tumble mustard, LACSE = prickly lettuce and BROTE = downy brome.
[2]Surfactant was added at 0.25% v/v.

Control of kochia and Russian thistle at three growth stages with UCC-C4243. Dennis J. Tonks and Philip Westra. A field experiment was initiated in the spring of 1993 near Fort Collins, CO to evaluate the control of kochia and Russian thistle with UCC-C4243. Four kochia biotypes and two Russian thistle species (*Salsola iberica*, common Russian thistle and *Salsola collina*, spineless Russian thistle) were planted in rows at three dates. Planting dates were April 16, April 28, and May 10 to provide three growth stages for herbicide treatment. Plant heights were 30-38 and 25-30 cm for stage 1, 15-20 and 10-15 cm for stage 2, and 7-10 cm for stage 3 for kochia and Russian thistle respectively within stages when treatments were made. Herbicides and rates are listed in the table below and were applied perpendicular to rows. Plot size was 7 by 20 feet and was replicated three times. Crop oil concentrate was applied at 1 qt/A to all herbicide treatments. Herbicides were applied on June 15 with a backpack sprayer using 11002LP tips at 24 psi and delivering 24 gpa.

Visual evaluations were made at 15, 25 and 50 days after treatment (DAT) with only 15 and 50 DAT presented. Interactions between growth stages, species, and herbicide treatments were significant. Percent control for each of the kochia biotypes was not different, so only biotypes from the San Luis Valley are presented. In every case, kochia within the same growth stage and treatment were not different (see table). At stage 1, both species of Russian thistle were controlled equally well by UCC-C4243, but *S. collina* overcame herbicide effects possibly because of differential growth rates over *S. iberica*. Mixtures of UCC-C4243 with dicamba suppressed kochia regrowth more than UCC-C4243 alone. As the rate of UCC-C4243 increased control increased. Dicamba controlled kochia better than 2,4-D and Russian thistle was controlled better by 2,4-D than dicamba. The addition of 2,4-D or dicamba to UCC-C4243 slowed initial plant burn down which was observable within a few hours of application. The addition of 2,4-D or dicamba enhanced overall control of kochia and Russian thistle. Small plants did not recover from the initial burn down as well as larger plants. Though not evaluated, UCC-C4243 at 0.5 lb/A also suppressed green foxtail growth. (Weed Research Lab, Colorado State University, Fort Collins CO, 80523.)

Table Control of Kochia and Russian thistle at three growth stages with UCC-C4243[1].

Treatment	Rate	Accession	----Stage 1----		----Stage 2----		----Stage 3----	
	lb/A		15 DAT	50 DAT	15 DAT	50 DAT	15 DAT	50 DAT
			---------------------Control		%	-------------------		
UCC-C4243	0.125	*S.iberica*	87	48	100	97	100	100
		S. collina	78	30	98	87	100	100
		San Luis Valley (R)	60	27	85	47	97	60
		San Luis Valley (S)	60	33	95	50	97	60
UCC-C4243	0.25	*S. iberica*	97	82	100	97	100	100
		S. collina	88	36	100	100	100	100
		San Luis Valley (R)	77	27	98	85	100	85
		San Luis Valley (S)	73	27	98	85	100	87
UCC-C4243	0.5	*S. iberica*	93	58	100	87	100	100
		S. collina	85	23	100	87	100	98
		San Luis Valley (R)	77	27	100	93	100	88
		San Luis Valley (S)	77	27	98	98	100	93
UCC-C4243 + 2,4-D amine	0.125 + 1.0	*S. iberica*	98	62	100	100	100	100
		S. collina	92	43	100	100	100	100
		San Luis Valley (R)	57	22	87	57	93	68
		San Luis Valley (S)	57	22	85	57	93	68
UCC-C4243 + 2,4-D amine	0.25 + 1.0	*S. iberica*	97	80	100	100	100	100
		S. collina	93	45	100	100	100	100
		San Luis Valley (R)	72	25	95	60	98	65
		San Luis Valley (S)	72	25	93	67	98	87
UCC-C4243 + 2,4-D amine	0.5 + 1.0	*S. iberica*	95	75	100	100	100	87
		S. collina	95	52	100	100	100	92
		San Luis Valley (R)	77	33	98	67	100	23
		San Luis Valley (S)	77	33	98	70	100	23

Table cont.

Treatment	Rate	Accession	----Stage 1----		----Stage 2----		----Stage 3----	
	lb/A		15 DAT	50 DAT	15 DAT	50 DAT	15 DAT	50 DAT
			----------------------Control %				--------------------	
2,4-D amine	1.0	*S. iberica*	73	53	75	78	86	91
		S. collina	62	57	85	78	83	92
		San Luis Valley (R)	7	30	52	27	20	23
		San Luis Valley (S)	13	30	36	27	20	23
UCC-C4243 + Dicamba	0.25 + 0.50	*S. iberica*	98	50	100	97	100	100
		S. collina	93	50	100	90	100	100
		San Luis Valley (R)	87	57	98	78	100	85
		San Luis Valley (S)	87	57	98	78	100	86
Dicamba	0.50	*S. iberica*	73	60	70	70	58	65
		S. collina	73	46	63	63	58	70
		San Luis Valley (R)	70	68	78	85	80	76
		San Luis Valley (S)	50	68	78	85	80	76
Untreated		*S. iberica*	0	0	0	0	0	0
		S. collina	0	0	0	0	0	0
		San Luis Valley (R)	0	0	0	0	0	0
		San Luis Valley (S)	0	0	0	0	0	0
		San Luis Valley (S)	0	0	0	0	0	0
LSD (0.05)			23	23	23	23	23	23

[1]DAT = days after treatment, R = acetolactate synthase resistant, S = acetolactate synthase susceptible

Sulfosate and glyphosate for weed control in fallow. Curtis R. Thompson, Joan M. Lish, and Donald C. Thill. Experiments were established to compare weed control with sulfosate and glyphosate alone or tank-mixed with dicamba or 2,4-D, to compare weed control with glyphosate liquid and dry formulations, and to compare weed control with glyphosate tank-mixed with each of two surfactants that contain ammoniated salts. Experiments were conducted south of Lewiston, ID in the Tammany area and a second surfactant study was conducted 1 mile west of Potlatch. Treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/a at 38 psi traveling 3 mph. Application data and weed stages are shown in Table 1. Control was evaluated visually 2 and 4 weeks after treatment (Tables 2, 3, 4, and 5). Plots were 10 by 20 ft and were arranged as a randomized complete block with four replications.

Table 1. Application and soil analysis data

Experiment	Glyphosate & sulfosate	Glyphosate formulation	Surfactant	Surfactant
Location	Lewiston	Lewiston	Lewiston	Potlatch
Application date	5/12	5/11	5/11	5/13
Plant height (inch)				
Flixweed (DESSO)	6-16	6-16	6-16	--
Catchweed bedstraw (GALAP)	4-12	--	4-12	--
Brome species (BROMUS)[1]	6-8	6-8	6-8	4-8
Wild oat (AVEFA)	8	--	8	--
Wheat	--	--	--	8-10
Interrupted windgrass (APEIN)	--	--	--	4
Temperature (F)	64	84	85	58
Soil temperature at 2 inch (F)	58	66	66	56
Relative humidity (%)	84	50	45	72
Wind speed (mph - direction)	3-S	3-S	3-S	1-E
Soil pH	6.1	6.1	6.1	7.0
OM (%)	3.3	3.3	3.3	3.4
CEC (meq/100g soil)	25.8	25.8	25.8	18.6
Texture	silt loam	silt loam	silt loam	silt loam

[1] Brome species were downy brome and ripgut brome at the Lewiston site and downy brome, Japanese brome, and cheat at the Potlatch site.

Glyphosate controlled brome better than sulfosate over all treatments, but the differences were greatest with the 0.25 lb ai/a rate and with tank-mixes (Table 2). Glyphosate controlled flixweed better than sulfosate, but the difference in flixweed control was most evident when no broadleaf herbicides were added to the tank-mix.

Weed control with the two soluble granule glyphosate formulations was equal to the current Roundup-RT formulation. Weed control with one of the two liquid formulations tested also was equal to Roundup-RT, but weed control with the second liquid formulation was worse than any of the other formulations tested.

At the Lewiston fallow site, downy brome and wild oat control with glyphosate + S(0030) was better than glyphosate + Cayuse, but flixweed and catchweed bedstraw weed control was not affected. At the Potlatch site, wheat, downy brome, and interrupted windgrass control also was better with the addition of S(003) compared to Cayuse. (Idaho Agricultural Experiment Station, Moscow, Idaho 83844)

Table 2. Sulfosate and glyphosate for weed control in fallow, Lewiston, Idaho

Treatment[2]	Rate	BROMUS[1] A	BROMUS[1] B	DESSO[1] A	DESSO[1] B
	lb ai/a	(% control)			
Sulfosate +	0.25				
R-11	1.0%	81	87	54	83
Sulfosate +	0.375				
R-11	1.0%	89	98	68	91
Sulfosate +	0.5				
R-11	1.0%	94	98	70	91
Sulfosate +	0.25				
2,4-D amine +	0.25				
R-11	1.0%	80	90	88	97
Sulfosate +	0.375				
2,4-D amine +	0.25				
R-11	1.0%	88	97	90	98
Sulfosate +	0.5				
2,4-D amine +	0.25				
R-11	1.0%	87	93	88	96
Sulfosate +	0.25				
dicamba +	0.125				
R-11	1.0%	78	88	83	88
Sulfosate +	0.375				
dicamba +	0.125				
R-11	1.0%	83	91	76	93
Sulfosate +	0.5				
dicamba +	0.125				
R-11	1.0%	91	97	89	99
Glyphosate +	0.25				
R-11	0.5%	84	93	75	92
Glyphosate +	0.375				
R-11	0.5%	93	99	71	94
Glyphosate +	0.25				
2,4-D amine +	0.25				
R-11	0.5%	83	92	86	96
Glyphosate +	0.375				
2,4-D amine +	0.25				
R-11	0.5%	93	98	89	99
Glyphosate+	0.25				
dicamba +	0.125				
R-11	0.5%	82	93	73	89
Glyphosate+	0.375				
dicamba +	0.125				
R-11	0.5%	89	96	77	95
LSD $_{(0.05)}$		6	6	10	6
Orthoganal contrasts:					
Sulfosate, all treatments		83	92	77	92
Glyphosate, all treatments		87	95	78	94
p>F		0.002	0.01	0.031	0.039
Sulfosate alone, all rates		85	92	61	87
Glyphosate alone, all rates		88	96	73	93
p>F		0.156	0.093	0.001	0.005
Sulfosate + 2,4-D		84	94	89	98
Glyphosate + 2,4-D		88	95	87	98
p>F		0.064	0.481	0.659	0.950
Sulfosate + dicamba		80	90	80	90
Glyphosate + dicamba		86	94	75	92
p>F		0.029	0.030	0.238	0.450
Sulfosate, 0.25 lb/A		80	88	75	89
Glyphosate, 0.25 lb/A		83	93	78	92
p>F		0.060	0.022	0.295	0.094
Sulfosate, 0.375 lb/A		87	95	78	94
Glyphosate, 0.375 lb/a		92	98	79	96
p>F		0.120	0.154	0.698	0.201

[1] A = 13 days after treatment and B = 27 days after treatment.
[2] R-11 is a 90% nonionic surfactant from Wilbur-Ellis applied at 1.0 or 0.5% v/v. Dicamba and 2,4-D were dimethylamine salt formulations and rates were ae/a.

Table 3. Glyphosate formulations for weed control in fallow, Lewiston, Idaho

Treatment[2]	Rate	DESSO[1] A	DESSO[1] B	GALAP[1] A	GALAP[1] B	BROMUS[1] A	BROMUS[1] B	AVEFA[1] A	AVEFA[1] B
	lb ae/a	(% control)							
Glyphosate	0.14	36	80	35	63	53	82	54	85
MON 65005	0.14	41	76	34	55	56	82	61	83
Glyphosate	0.28	54	87	48	64	78	91	85	91
Glyphosate +	0.28								
R-11	0.5%	55	90	45	73	89	97	94	96
Glyphosate+	0.28								
2,4-D amine +	0.5								
R-11	0.5%	93	98	75	85	93	98	95	98
Mean		*67*	*92*	*56*	*74*	*87*	*95*	*91*	*95*
MON 65005	0.28	49	89	49	73	87	97	92	97
MON 65005 +	0.28								
R-11	0.5%	58	85	51	70	88	98	91	97
MON 65005 +	0.28								
2,4-D amine +	0.5								
R-11	0.5%	92	99	56	76	92	99	92	99
Mean		*66*	*91*	*52*	*73*	*89*	*98*	*92*	*98*
MON 60603	0.28	34	73	32	53	53	83	56	84
MON 60603 +	0.28								
R-11	0.5%	48	90	46	75	86	99	89	99
MON 60603 +	0.28								
2,4-D amine +	0.5								
R-11	0.5%	90	99	74	86	89	98	91	98
Mean		*57*	*87*	*51*	*71*	*76*	*93*	*79*	*94*
MON 60696	0.28	51	87	48	78	84	99	90	99
MON 60696 +	0.28								
R-11	0.5%	65	92	48	83	88	97	89	95
MON 60696 +	0.28								
2,4-D amine +	0.5								
R-11	0.5%	90	99	63	85	89	97	88	98
Mean		*69*	*93*	*53*	*82*	*87*	*98*	*89*	*97*
MON 60698	0.28	52	85	48	73	82	94	90	95
MON 60698 +	0.28								
R-11	0.5%	53	87	48	73	86	94	92	96
MON 60698 +	0.28								
2,4-D amine +	0.5								
R-11	0.5%	92	98	68	86	88	97	94	96
Mean		*66*	*90*	*55*	*77*	*85*	*95*	*92*	*96*
LSD $_{(0.05)}$		13	6	16	15	9	5	9	60
Orthogonal contrast of means (p>F):									
glyphosate vs MON 65005		0.778	0.534	0.383	0.845	0.380	0.053	0.855	0.097
glyphosate vs MON 60603		0.009	0.003	0.286	0.545	0.001	0.133	0.001	0.309
glyphosate vs MON 60696		0.725	0.750	0.474	0.053	0.973	0.105	0.320	0.200
glyphosate vs MON 60698		0.613	0.205	0.774	0.380	0.550	0.752	1.000	0.829
MON 60603 vs MON 60696		0.003	0.001	0.724	0.012	0.001	0.002	0.001	0.025
MON 60603 vs MON 65005		0.018	0.017	0.844	0.681	0.001	0.001	0.001	0.009
MON 60603 vs MON 60698		0.032	0.075	0.434	0.141	0.001	0.233	0.001	0.219
MON 60698 vs MON 65005		0.822	0.513	0.557	0.285	0.143	0.026	0.855	0.146
MON 60698 vs MON 60696		0.392	0.115	0.666	0.276	0.572	0.054	0.320	0.285
MON 60696 vs MON 65005		0.527	0.348	0.876	0.034	0.362	0.747	0.240	0.695

[1] A = 14 days after treatment and B = 28 days after treatment

[2] Glyphosate formulation was Roundup-RT. MON 65005 and MON 60603 are 3 lb ae/gal glyphosate. MON 60696 and MON 60698 are 66% ae glyphosate soluble granule. Dimethylamine salt of 2,4-D was applied. R-11 is a 90% nonionic surfactant from Wilbur-Ellis applied at 0.5% v/v.

Table 4. Surfactants tankmixed with glyphosate for weed control in fallow, Lewiston, Idaho

Treatment[2]	Rate	DESSO[1] A	DESSO[1] B	GALAP[1] A	GALAP[1] B	BROMUS[1] A	BROMUS[1] B	AVEFA[1] A	AVEFA[1] B
	lb ae/a	(% control)							
glyphosate + Cayuse	0.094 0.5%	34	71	34	50	51	76	50	79
glyphosate + S (003)	0.094 0.5%	36	77	40	56	61	85	63	86
glyphosate + Cayuse	0.188 0.5%	43	84	48	66	80	92	85	93
glyphosate + S (003)	0.188 0.5%	49	83	45	76	81	97	88	96
glyphosate + Cayuse	0.281 0.5%	55	89	48	81	86	97	90	96
glyphosate + S (003)	0.281 0.5%	54	87	51	79	88	98	93	98
LSD $_{(0.05)}$		13	6	16	15	9	5	9	6
Cayuse mean		44	81	43	66	72	88	75	89
S (003) mean		46	82	45	70	77	93	81	93
Orthogonal contrast(p>F)		0.284	0.313	0.492	0.181	0.016	0.001	0.238	0.007

[1] A = 14 days after treatment and B = 28 days after treatment
[2] S (003) is a surfactant with 21.1% alkyl glucoside, oligosaccharides, and dimethylpolysiloxane, and 30% ammoniated salts from Monterey Chemical. Cayuse is a surfactant with 42.5% phosphate ester of polyglycolethers and 16.5% blend of ammoniated salts from Wilbur-Ellis.

Table 5. Surfactant evaluations with glyphosate for weed control in fallow, Potlatch, Idaho

Treatment[2]	Rate	Wheat[1] A	Wheat[1] B	BROMUS[1] A	BROMUS[1] B	APEIN[1] A	APEIN[1] B
	lb ae/a	(% control)					
glyphosate + Cayuse	0.094 0.5%	38	48	38	40	40	41
glyphosate + S (003)	0.094 0.5%	69	66	73	64	73	61
glyphosate + Cayuse	0.188 0.5%	79	86	78	83	80	79
glyphosate + S (003)	0.188 0.5%	85	96	84	94	87	91
glyphosate + Cayuse	0.281 0.5%	89	99	88	97	89	96
glyphosate + S (003)	0.281 0.5%	90	99	87	98	88	97
LSD $_{(0.05)}$		10	17	7	12	8	11
Cayuse mean		69	78	68	73	69	72
S (003) mean		81	87	81	85	83	83
Orthoganal Contrast (p>F)		0.001	0.064	0.001	0.002	0.001	0.002

[1] A = 14 days after treatment and B = 27 days after treatment
[2] S (003) is a surfactant with 21.1% alkyl glucoside, oligosaccharides, and dimethylpolysiloxane, and 30% ammoniated salts from Monterey Chemical. Cayuse is a surfactant with 42.5% phosphate ester of polyglycolethers and 16.5% blend of ammoniated salts from Wilbur-Ellis.

Cutleaf nightshade control in red lentils. D.A. Ball and D.L. Walenta. A study was established at the Pendleton Experiment Station to evaluate postplant incorporated (POPI) and preemergence (PRE) herbicides for weed control in dryland small red lentils. A seedbed was prepared by moldboard plowing in the autumn of 1992, then chiseling, skew treading 2x, and field cultivating in the spring. Red lentils, var. 'Crimson' were planted April 7, 1993 at 40 lb/A, in 7 in. rows, at a 1 in. seeding depth, with a John Deere 8300 double disk drill. All POPI and PRE applications were made on April 7, 1993 with a hand held CO_2 sprayer delivering 15 gpa at 30 psi. POPI treatments were incorporated with a Flex-tine harrow, 2 passes at 90 degrees to a 1 in. depth. Plots were rolled on April 7 after planting. Soil at the site was a Walla Walla Silt Loam (22% sand, 69.6% silt, 8.4% clay, 2.1% OM, 5.8 pH). Plots were 10 ft by 25 ft in size, in a randomized complete block arrangement, with 3 replications. Lentil stand counts were taken on May 11. Percent visual crop injury and weed control were made on June 2 and June 23. Lentil yields were taken with a Hege plot combine on August 2, 1993 and expressed as dry seed yield in lb/A.

Application details:

POPI and PRE

Air temp: 60°F	Sky: clear
Wind: N at 3 to 7mph	Soil temp: surface 0" 80°F, 1" 63°F, 2" 60°F, 4" 55°F
Relative humidity: 64%	Soil moisture: field capacity

Treatments containing imazethapyr provided good control of cutleaf nightshade (SOLTR) with slight visible crop injury. PRE imazethapyr treatments provided slightly better control, likely due to wet conditions following applications. Wet conditions at planting prevented deeper planting which minimizes crop injury. Treatments containing metribuzin, pendimethalin, SAN 582H, and UBI C4243 caused moderate to severe injury to red lentils. Crop injury led to yield reductions from UBI C4243, SAN 582H, pendimethalin applied POPI, and metribuzin. (Columbia Basin Agr. Res. Ctr., Oregon State Univ., Pendleton, OR. 97801).

Table 1. Cutleaf nightshade control in red lentils.

				June 2		June 23		
Treatment	Rate	Timing	Lentils	Injury	Control	Injury	Control	Yield
	lb/A		#/m²	-------------	%	-------------		lb/A
Imazethapyr	0.031	POPI	54	1	92	2	90	2080
Imazethapyr	0.047	POPI	48	5	95	11	97	1760
SAN 582H	1.25	POPI	33	39	74	50	53	1400
Pendimethalin	0.75	POPI	38	19	60	16	14	1400
Metribuzin	0.25	POPI	51	8	0	14	0	1520
Imazethapyr + SAN 582H	0.031 1.25	POPI POPI	32	30	95	39	84	1340
Pendimethalin + Metribuzin	0.50 0.25	POPI POPI	46	18	53	14	14	1370
Imazethapyr + Metribuzin	0.031 0.25	POPI POPI	53	5	90	8	88	1870
Imazethapyr + Metribuzin	0.047 0.25	POPI POPI	53	9	97	13	92	1870
Imazethapyr + Pendimethalin	0.031 0.50	POPI POPI	50	13	95	11	91	1840
UBI-C4243	0.125	POPI	4	89	100	93	92	190
Imazethapyr	0.031	PRE	56	0	98	1	98	2040
Imazethapyr	0.047	PRE	51	4	99	3	99	2010
Pendimethalin	0.75	PRE	59	3	80	2	59	2000
Metribuzin	0.25	PRE	53	0	1	4	10	1750
Pendimethalin + Metribuzin	0.50 0.25	PRE PRE	50	4	79	3	63	2040
Imazethapyr + Pendimethalin	0.031 0.50	PRE PRE	47	1	99	3	98	2080
Imazethapyr + Metribuzin	0.031 0.25	PRE PRE	57	0	95	3	95	2000
Imazethapyr + Metribuzin	0.047 0.25	PRE PRE	57	5	98	4	98	1930
UBI-C4243	0.125	PRE	12	80	100	88	100	260
Imazethapyr + Metribuzin	0.031 0.25	POPI PRE	58	0	88	3	86	2120
Control	-	-	61	0	0	0	0	2030
LSD (0.05)			11	7	6	13	16	270

Population dynamics of three winter annual grasses. Stump, W.L. and P. Westra. The winter annual grasses jointed goatgrass (AEGCY), downy brome (BROTE), and volunteer rye (SECCE) infest more than 1.2 million acres of Colorado winter wheat. These weeds cost Colorado wheat producers in excess of $20 million annually in lost production. Since there are no selective control measures for these grasses in winter wheat, rotations with alternative dryland crops are being implemented by some growers. The objective of this study was to determine the effects of various crop rotations on the population dynamics of these three weedy grasses.

In the fall of 1991, blocks of jointed goatgrass, downy brome, and volunteer rye were seeded at a rate of 600,000 seeds per acre for each species in a split block design on a dryland site near Platteville, Colorado. Superimposed over these blocks are four different crop rotation regimes utilizing winter wheat, proso millet, and sunflower in various combinations. The combinations allow for one, two and three years out of wheat production. All rotations were started with winter wheat to allow for establishment of the grasses. Population dynamics were measured by seedling emergence.

Volunteer rye established best, followed by jointed goatgrass and downy brome (Table 1, Spring 92). After one season following wheat, all grasses experienced an increase in emerged populations. Both the fall and spring cohorts were important contributing factors in the total emerged population. Since the fall of 1992 and the following spring was either a fallow period or prior to sowing of the summer crops, all the emerged populations were chemically controlled and no new seed had entered the system. In 1993, fall emergence of jointed goatgrass was still increasing while downy brome and volunteer rye had slightly decreased from the previous fall. This was probably due to dormancy mechanisms present in jointed goatgrass that buffer it better to changes in the system. The effects of the previous crop environment on grass emergence is shown in Table 2. Emergence for all grasses was greatest in the fallow plots. This was probably due to increased moisture availability. Proso millet had less of a stimulatory effect on emergence than sunflower. A possible reason for this is that proso millet typically depletes the upper soil moisture profile, decreasing grass emergence. The study will be monitored for three more years.

Table 1. Weed emergence over time.

	Grass counts per m^2			
Weed	Spring 92	Fall 92	Spring 93	Fall 93*
AEGCY	40.8	179	100	262
BROTE	11	46.3	67	25.3
SECCE	70.5	515	373	345

* Average from all rotation treatments.

Table 2. Effects of cropping environment on winter annual grass emergence.

	Fall emergence 1993 - counts per m^2		
Crop in 1993	AEGCY	BROTE	SECCE
Fallow	312	35	531
Sunflower	287	22	287
Proso millet	187	19	217

Imazethapyr carry-over effects to winter wheat following application to peas in rotation. D.A. Ball, and C. Boerboom. In response to concern from growers in the dryland winter wheat-pea production areas in the Pacific Northwest (PNW), a study was initiated in 1992 to determine if imazethapyr or other residual herbicides applied to dry or green peas would persist and injure subsequent winter wheat crops grown the following year. Plots were established at four locations in Washington and Oregon which represent the range of wheat-pea production areas in the PNW. Two dryland sites for dry pea production near Pullman, WA were selected, one located on a toeslope field position, and the other on a summit position. The toeslope soil was a silt loam (15.2% sand, 71.8% silt, 13.0% clay, 3.5% OM, 5.4 pH, and 17.8 meq/100g CEC). The summit location soil was a silt loam (12.2% sand, 70.8% silt, 17.0% clay, 2.0% OM, 5.4 pH, and 21.8 meq/100g CEC). A dryland site for green peas near Pendleton, OR was selected with a Walla Walla silt loam (22.0% sand, 69.6% silt, 8.4% clay, 2.1% OM, 5.8 pH). An irrigated site for green peas near Hermiston, OR was the forth site selected with a sandy loam soil (66.0% sand, 30.4% silt, 3.6% clay, 1.0% OM, 6.4 pH). Treatments at the WA sites were applied at time of dry pea planting either preplant incorporated (PPI) on April 5, 1992 or preemergence (PRE) on April 15 using a CO_2 hand-held boom delivering 10 gpa at 35 psi. Both WA sites were seeded to dry peas var. 'Columbia' at 200 lb/A on April 8. Treatments at both OR sites were applied at time of green pea planting either PPI or PRE using a CO_2 hand-held boom delivering 15 gpa at 30 psi. Pendleton PPI and PRE treatments were applied on April 7, 1992, and green peas var. 'Dual' were planted on April 7 at 180 lb/A. Hermiston PPI and PRE treatments were applied on March 24, 1992, and planted to green peas var. 'Bolero' at 230 lb/A on March 24. Pea crops were grown to harvest at all sites. All sites were prepared for wheat planting by chiseling and sweeping, as typically performed prior to planting winter wheat in each region. Winter wheat var. 'Stephens' was planted at each location and grown as typical for that location.

The 1993 growing season at each location had greater than normal precipitation and lower than normal growing season temperatures. Evaluations of wheat plant stand count, plant height, tillering, head count, and grain yield at each location could reveal no detectable effect on growth or yield of winter wheat crops in 1993 from the treatments applied to peas in 1992 (Table 1). --

Table 1. Herbicide carry-over effect on winter wheat grain yield following application in peas.

Treatment	Rate	Timing	Pendleton	Hermiston	Toeslope	Summit
	lb/A		bu/A			
Imazethapyr	0.031	PPI	120	40	138	87
Imazethapyr	0.047	PPI	114	42	133	93
Imazethapyr	0.063	PPI	105	47	142	87
Trifluralin	0.50	PPI	114	41	138	88
Trifluralin	0.75	PPI	113	35	123	90
Trifluralin + Imazethapyr	0.50 0.031	PPI PPI	113	41	133	88
Trifluralin + Imazethapyr	0.50 0.047	PPI PPI	116	49	138	81
Ethalfluralin	0.56	PPI	116	43	142	91
Ethalfluralin	0.75	PPI	121	41	139	89
Imazethapyr	0.031	PRE	110	45	143	93
Imazethapyr	0.047	PRE	109	46	131	90
Imazethapyr	0.063	PRE	112	47	142	88
Pendimethalin	0.50	PRE	109	41	142	88
Pendimethalin	0.75	PRE	112	41	143	87
Pendimethalin + Imazethapyr	0.50 0.031	PRE PPI	106	46	141	84
Pendimethalin + Imazethapyr	0.50 0.047	PRE PPI	108	55	143	83
Control	-	-	110	45	140	86
LSD (0.05)			NS	NS	NS	NS

Evaluation of dry pea tolerance to selected herbicides for dicot weeds. Timothy W. Miller and Robert H. Callihan. The purpose of this experiment was to determine the tolerance of dry peas to several herbicides for dicotyledonous weeds under nonirrigated conditions. Plots were established on a commercially prepared and seeded field near Moscow, Idaho. Plots measured 10 by 30 feet, and treatments were arranged in a randomized complete block design with four replicates. The dry pea variety 'Columbia' was seeded into soil treated with triallate (1 lb ai/a) and the field was rolled on May 17, 1993. Pre-emergence (pre) herbicide treatments were applied on May 18 (temperature: 90 F, wind: SW 3 to 5 mph). Post-emergence (post) treatments were made June 23, when peas were in the 6-leaf stage of growth (temperature: 60 F, wind: W 7 to 10 mph; maximum temperature on the day of application was 75 F). All treatments were made in a carrier volume of 19 gal water/A using a 9-foot boom plot sprayer equipped with flat fan nozzles. Plots were sampled using a 12" by 17" quadrat on August 26. All shoot vegetation within the sample area was bagged and air-dried for 7 days, at which time vines were threshed and pea weight recorded. Statistical anaysis was performed using an analysis of variance procedure. Means were separated using Tukey's Studentized Range (HSD) Test.

Plots treated with bentazon + MCPA (post) yielded significantly lower than those treated with imazethapyr (pre), but yields from other treatments, including those from check plots, were not significantly different from those two treatments or from one another. Precipitation in April and early May was unusually high, which delayed seedbed preparation until after most weeds had germinated, resulting in good control of annual weeds. Cool, moist weather after seeding provided excellent conditions for pea growth through the summer. As a result of these two factors, the annual weed population in the plots was low enough to be considered insignificant, providing reasonably good evaluation of the tolerancae of peas to these herbicides, even though herbicide efficacy could not be critically evaluated. Likewise, comparisons of pea tolerance among herbicides could not be critically evaluated; however, differences in pea response among herbicides were not observed in the field. Differences among yields were not statistically different, indicating that dry peas were sufficiently tolerant to all of the treatments investigated. Field horsetail was present in appreciable amounts but was variably distributed within the plots. (Idaho Agricultural Experiment Station, Moscow, ID 83844-2339)

Table. Response of dry peas to selected herbicides.

Herbicide	Rate	Timing	Pea Yield
	(lb/A)		(lb/A)
Imazethapyr	0.047	pre	4696
Bentazon + COC[1]	0.5 + 1 pt	post	4271
Metribuzin	0.2	pre	4220
Metribuzin	0.25	pre	4203
Metribuzin	0.2	post	4186
Bentazon	0.5	post	4101
Bentazon + MCPA	0.5 + 0.25	post	4050
Metolachlor + metribuzin	1.64 + 0.36	pre	4033
Bentazon + COC	0.25 + 2 pts	post	4016
Imazethapyr + metribuzin	0.047 + 0.25	pre	3999
Check	-	-	3914
Check	-	-	3914
Metolachlor + metribuzin	1.06 + 0.24	pre	3896
Bentazon + MCPB	0.5 + 0.5	post	3879
Bentazon	0.75	post	3811
Metribuzin	0.25 + 0.2	pre + post	3794
Bentazon	0.25	post	3794
Bentazon + MCPB	0.25 + 1	post	3573
Bentazon + MCPA	0.25 + 0.38	post	2944
Minimum Significant Difference (0.05)			1507
R2			0.50
C.V.			14.6

[1]COC = Crop Oil Concentrate

Broadleaf weed control in spring pea with bentazon and tank mixes. Charles D. Grasham, and Donald C. Thill. An experiment was established near Genesee, ID, to evaluate broadleaf weed control in spring pea with bentazon alone, bentazon with crop oil concentrate, and bentazon tank mixed with MCPB. Herbicide treatments were applied to 4-5 node pea, and cotyledon to 2 leaf common lambsquarters (CHEAL) and redroot pigweed (AMARE) on June 13, 1993 (Table 1). Treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 20 gal/A at 37 psi traveling 3 mph. Weed populations were estimated by counting two separate 1 ft^2 areas in each control plot. Spring pea injury, common lambsquarters, and redroot pigweed control were evaluated visually on August 4. Spring pea was harvested from 4.5 by 27 ft plot areas on August 31. Plots were arranged as a randomized complete block with four replicates.

Table 1. Application and soil analysis data

Date of application	6/13
Crop growth stage	4-5 nodes
Temperature (F)	73
Soil temperature at 2 in. (F)	70
Relative humidity (%)	47
Wind speed (mph - direction)	3-e
Soil pH	5.4
OM (%)	3.4
CEC (meq/100g soil)	20.4
Texture	Silt loam

All treatments injured spring pea compared to the control (Table 2). Spring pea injury was greatest with bentazon plus Sun-It II (19%). Injury was not reflected by a difference in pea seed yield. All herbicide treatments did not control redroot pigweed. Bentazon alone controlled common lambsquarters 36%. Bentazon with Sun-It II or MCPB controlled common lambsquarters. (Idaho Agricultural Experiment Station, Moscow, ID 83843)

Table 2. Effect of bentazon and combinations on weed control, injury, and yield in spring pea

Treatment	Rate	Injury	AMARE	CHEAL	Yield
	lb/A	%	---- % control----		lb/A
Control		---	---	---	2460
Bentazon	0.5	5	20	36	2580
Bentazon Sun-It II[1]	0.5 2 pints	19	25	99	2290
Bentazon MCPB	0.5 0.5	14	25	99	2350
Bentazon MCPB	0.75 0.75	14	22	99	2640
$LSD_{(0.05)}$		5	10	6	560
Density (plants/ft^2)			20	7	

[1]Methylated crop seed oil applied at 2 pints/A.

Post-harvest control of common groundsel in central Oregon peppermint and spearmint. Marvin D. Butler, Bill D. Brewster, and Larry C. Burrill. Control of common groundsel is a major concern to mint growers in central Oregon. Common groundsel can germinate, flower, and produce seed nearly year around. The objective of this research was to evaluate bromoxynil applied alone and in combination with bentazon or oxyfluorfen as a post-harvest treatment for common groundsel control in peppermint and spearmint in central Oregon.

Treatments were applied on October 16 or 17, 1992, to common groundsel infested peppermint stands at three locations and on October 26, 1992, to a common groundsel infested spearmint stand. The herbicides were applied to 9 by 25 ft plots with a CO_2 pressurized boom sprayer at 40 psi and 20 gpa. Peppermint treatments were replicated four times and spearmint treatments were replicated three times in randomized complete block designs. The peppermint locations were at the Boyle, Johnson, and Macy farms. Treatments at the Boyle location were applied on common groundsel that was at two growth stages, 1 to 2 inches tall with 4 to 6 leaves and 8 to 10 inches tall with flowers. Common groundsel at the Johnson location was 2 to 3 inches tall with 6 to 8 leaves, and at the Macy location was 1 to 3 inches tall with flower buds. The common groundsel at the High Country spearmint location had 2 to 8 leaves when treated. Visual evaluations of the peppermint trials were conducted on November 11, 1992. The spearmint trial was evaluated on November 23, 1992. The spearmint location experienced sub-freezing temperatures immediately following application of the treatments.

Bromoxynil at 0.37 lb/A provided nearly total control at all locations, so the addition of oxyfluorfen had no beneficial effect in controlling the emerged common groundsel (Tables 1 and 2). The low rate of bromoxynil with bentazon was less effective at the three peppermint sites, but provided excellent control at the spearmint site and caused less injury to the spearmint than the other treatments. Smaller common groundsel plants were controlled somewhat better than larger ones at the Boyle location.

Since spearmint is usually more susceptible than peppermint to bromoxynil and oxyfluorfen, the combination of a low rate of bromoxynil with bentazon may provide at least partial control of common groundsel with minimal crop injury. (Oregon State University, Central Oregon Agricultural Research Center, Madras, OR 97441 and Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002).

Table 1. Effect of herbicides on common groundsel at three Jefferson County, Oregon peppermint locations.

Treatment[2]	Rate	SENVU Control[3]			
		Boyle		Johnson	Macy
		SENVU height (inches)			
		1-2	8-10	2-3	1-3
	lb/A	%			
Bromoxynil	0.25	96 A[1]	91 A	100 A	86 AB
Bromoxynil	0.37	100 A	99 A	100 A	98 A
Bromoxynil + bentazon	0.12 + 1.0	86 B	74 B	65 B	73 B
Bromoxynil+ oxyfluorfen	0.37 + 0.05	99 A	97 A	100 A	100 A
Untreated	---	0 D	0 D	0 C	0 D

[1] Treatments were statistically different with Duncan's Multiple Range test at $P \leq 0.01$.
[2] Treatments applied October 16 or 17, 1992
[3] Visual evaluations November 11, 1993.

Table 2. Effect of herbicides on common groundsel and spearmint at Culver, Jefferson County, Oregon.

Treatments[2]	Rate	SENVU[3] Control	Spearmint[3] Injury
	lb/A	%	
Bromoxynil	0.25	100 A[1]	27 BC
Bromoxynil	0.37	100 A	37 AB
Bromoxynil + bentazon	0.12 + 1.0	98 A	7 D
Bromoxynil + oxyfluorfen	0.37 + 0.05	100 A	42 A
Untreated	---	0 C	0 D

[1] Treatments were statistically different with Duncan's Multiple Range test at $P \leq 0.01$.
[2] Herbicides applied on October 26, 1992.
[3] Visual evaluations conducted on November 23, 1992.

Replant interval for DPX-66037 in rotational crops. Carl E. Bell and Jeff Pacheco. This project was a comparison of the interaction of four rates of DPX-66037 and three replant intervals for effect on six possible rotational crops with sugarbeets. These crops were wheat, alfalfa, broccoli, onion, lettuce, and carrot. The objective was to assess the potential effect of soil residual DPX-66037 after a sugarbeet crop failure and then replanting to another crop. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

Experimental design was a split plot factorial (rate by replant interval) with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. The crops were sown in two seedlines per bed on October 22, 1992 and irrigated with sprinklers on October 28. Herbicide treatments were made to preformed beds 34 days before planting (DBP), 20 DBP, and 13 DBP. Beds were rototilled to a depth of 5 cm after herbicide application and before crop sowing. Herbicide rates were 0, 70, 140, and 210 g/ha. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8002LP nozzles for a spray volume of 190 L/ha. Soil type was a clay loam.

Data collected were: stand counts for all crops on November 16 throught 18, 1992; alfalfa and weed biomass on February 22, 1993; and wheat biomass on February 1, 1993. Heavy infestations of weeds in the other crops prevented crop biomass sampling. Stand counts and biomass are for 1.8 m of bed by two beds per plot. Stand count and biomass data were subjected to analysis of variance. Results are shown in the Tables below.

Visual observations during the season indicated that DPX-66037 had no obvious effect on any of the crops sown. There was no difference (P>0.05) between treatments for stand counts for any of the crops sown after treatment. There was also no difference between treatments for alfalfa weights and weed weights in the alfalfa. Wheat weights, however, were affected by DPX-66037 treatments. Although the interaction of rate on replant interval was tenuous (P = .13), wheat weights were significantly decreased as replant interval decreased and as rate increased. (Cooperative Extension, University of California, Holtville, CA 92250 and E.I.DuPont deNemours Co., Phoenix, AZ 85046.)

Table 1. DPX-66037 rate by replant interval effect on rotational crop stand counts.

DPX-66037 replant[3] interval	rate	Stand counts[1] Wheat	Alfalfa	Broccoli	Onion	Lettuce	Carrot	Biomass[2] Wheat	Alfalfa	Weeds in alfalfa
days	oz ai/A	#						grams		
34	0	138	196	31	63	79	299	530	183	555
	70	150	243	31	78	87	254	583	185	526
	140	134	208	37	59	84	315	494	166	600
	210	151	209	36	76	86	296	507	157	630
20	0	125	182	32	66	83	315	555	156	516
	70	120	201	34	73	83	268	436	192	498
	140	139	211	27	63	85	233	464	177	512
	210	175	204	39	67	84	388	471	177	458
13	0	147	212	32	65	87	279	522	166	462
	70	125	193	39	66	85	284	484	165	462
	140	139	200	29	73	87	319	505	172	435
	210	140	196	28	63	81	305	398	119	564

[1] Stand count is number of plants per 1.8 m of plot by two beds, mean of four replications.
[2] Biomass is dry weight of plants in grams per 1.8 m of plot by two beds, mean of four replications.
[3] Replant interval is days after herbicide treatment until crop sowing, beds were rototilled 5 cm deep before sowing.

Broadleaf weed control with preplant, preemergence and postemergence applications in sugarbeets. Robert W. Downard and Don W. Morishita. Research plots were located at the University of Idaho Research and Extension Center near Kimberly, ID to examine weed control in sugarbeets following preplant (PPI), preemergence (PRE), cotyledon (Cotyl) and 7 days later (7 d later) applications. Sugarbeets (variety WS PM-9) were planted April 28, 1993, on 22 inch rows at 47,520 seeds/A and grown under sprinkler irrigation. Soil type was a silt loam with a pH of 8.0, CEC of 19 meq/100 g soil and 1.95% organic matter. Plots were 4 rows by 30 feet replicated four times in a randomized block design. Herbicide treatments were applied with a bicycle sprayer calibrated to deliver 20 gpa at 36 psi pressurized with CO_2. Additional application information is shown in Table 1. Crop injury and weed control evaluations were taken on June 21 and August 2. Sugarbeets were harvested September 30.

Crop injury was most severe with pyrazon PRE (Table 2). Stand reduction was the major component of crop injury . Signficant stand reduction from these treatments resulted in yields equal to or 3 tons per acre higher than the untreated check. Kochia control on August 2 was 80% with phenmedipham and desmedipham plus ethofumesate applied at Cotyl and followed 7 d later. All treatments controlled common lambsquarters 85 to 100%. Hairy nightshade control was 94 to 100% with all treatments except ethofumesate PRE followed by desmedipham and phenmedipham plus triflusulfuron postemergence. The highest yielding treatments were desmedipham and phenmedipham plus ethofumesate plus triflusulfuron and the handweeded check. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83303).

Table 1. Application data.

Application date	4/21	5/6	5/7	5/19	5/27
Application timing	PPI	PRE	PRE	Cotyl	7 d later & 1 to 2 leaf
Air temperature (F)	54	51	46	73	78
Soil temperature (F)	40	46	41	61	70
Wind velocity (mph)	0	10 to 15	10 to 15	10 to 14	0
Relative humidity (%)	48	58	100	56	33

Table 2. Crop injury, weed control and sugarbeet yield, near Kimberly, ID.

Treatment	Rate	Applic[2] timing	Crop injury 1	Crop injury 2	Weed Control[1] KCHSC 1	KCHSC 2	CHEAL 1	CHEAL 2	SOLSA 1	SOLSA 2	BETVU yield
	lb ai/A		%								T/A
Check			0	0	0	0	0	0	0	0	13
Handweeded			0	0	0	100	0	100	0	100	22
Cycloate	3.0	PPI	0	0	74	63	96	83	100	94	19
desm & phen[3]	0.33	1-2 lf									
Cycloate	3.0	PPI	0	0	74	46	93	94	100	100	21
desm & phen+	0.33+	1-2 lf									
triflusulfuron	0.0156										
Ethofumesate	1.12	PRE	5	1	74	49	91	96	100	94	18
desm & phen	0.33	1-2 lf									
Ethofumesate	1.12	PRE	5	0	90	65	86	91	94	75	21
desm & phen+	0.33+	1-2 lf									
triflusulfuron	0.0156										
Pyrazon	3.25	PRE	49	34	69	53	100	100	100	100	13
desm & phen	0.33	1-2 lf									
Pyrazon	3.25	PRE	31	25	90	63	99	98	100	100	16
desm & phen+	0.33+	1-2 lf									
triflusulfuron	0.0156										
Desm & phen	0.33	Cotyl	1	3	51	28	84	85	100	100	18
desm & phen	0.33	7 d ltr									
Desm & phen+	0.33+	Cotyl	3	5	95	76	99	96	100	100	20
triflusulfuron	0.0156										
desm & phen+	0.33+	7 d ltr									
triflusulfuron	0.0156										
Desm & phen+	0.20	Cotyl	0	0	60	59	98	90	100	100	19
ethofumesate	0.20										
desm & phen+	0.20+	1-2 lf									
ethofumesate	0.20										
Desm & phen+	0.20+	Cotyl	1	0	96	80	100	90	100	100	23
ethofumesate +	0.20+										
triflusulfuron	0.0156										
desm & phen+	0.20+	1-2 lf									
ethofumesate+	0.20+										
triflusulfuron	0.0156										
LSD (0.05)			17	11	23	25	13	13	3	22	4

[1]Weed species evaluated were kochia (KCHSC), common lambsquarters (CHEAL), and hairy nightshade (SOLSA).

[2]Application is as follows: PPI=preplant incorporated, PRE=preemergence, 7 d ltr=7 days later, and 1-2 lf= 1 to 2 leaf.

[3]Desm & Phen = Desmedipham and phenmedipham commerical formulation.

Potential interaction between triflusulfuron with at-planting applications of organophosphate insecticides. Robert W. Downard and Don W. Morishita. Research plots were established near Kimberly, Idaho to examine the potential interaction between a new sulfonylurea herbicide, triflusulfuron and two organophosphate insecticides, aldicarb and terbufos in sugarbeets (variety WS-88). The crop was planted on April 26, 1993, at 47,520 seeds/A and grown under sprinkler irrigation. Plots were 4 rows by 30 feet replicated four times in a randomized complete block design. Insecticides were applied modified in-furrow at planting. Herbicide treatments were applied in a 10 inch band with a bicycle sprayer calibrated to deliver 20 gpa at 38 psi pressurized with CO_2. Additional application data is shown in Table 1. All treatments were maintained weed free to eliminate weed interference. Stand counts and two visual crop injury ratings were taken on June 10, 21 and July 5, respectively. Two sugarbeet rows were harvested in each plot September 30.

There was little or no visual injury (0 to 3 %) on June 21 or July 6 (Table 2). Stand counts, yield and percent sugar showed no significant differences between any treatment indicating that triflusulfuron does not have an antagonistic effect with organophosphate insecticides terbufos and aldicarb. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83303).

Table 1. Application data.

Application date	5/19	5/27
Application timing	Cotyl	7 days later
Air temperature (F)	73	80
Soil temperature (F)	61	76
Wind velocity (mph)	10 to 14	4
Relative humidity (%)	56	24

Table 2. Sugarbeet crop injury, stand, yield and sugar content, near Kimberly, ID.

Treatment	Formulation	Rate	Applic[1] timing	Stand count	Crop injury 6/21	Crop injury 7/6	BETVU yield	Sugar content
		lb ai/A		plants/ 50 ft	%	%	ton/A	%
Handweeded check				81	0	0	22	17.50
Terbufos	15G	1.78	MIF	58	3	0	24	17.39
Terbufos	15G	1.78	MIF	88	1	0	27	17.55
triflusulfuron[2]		0.25	Cotyl					
triflusulfuron		0.25	7 d ltr					
Terbufos	15G	1.78	MIF	79	0	0	24	17.38
triflusulfuron		0.50	Cotyl					
triflusulfuron		0.50	7 d ltr					
Terbufos	20CR	1.78	MIF	58	0	0	25	17.57
Terbufos	20CR	1.78	MIF	79	0	0	22	17.73
triflusulfuron		0.25	Cotyl					
triflusulfuron		0.25	7 d ltr					
Terbufos	20CR	1.78	MIF	88	1	0	27	17.57
triflusulfuron		0.50	Cotyl					
triflusulfuron		0.50	7 d ltr					
Aldicarb		2.0	MIF	77	0	0	24	17.41
Aldicarb		2.0	MIF	73	0	0	25	17.62
triflusulfuron		0.25	Cotyl					
triflusulfuron		0.25	7 d ltr					
Aldicarb		2.0	MIF	84	0	0	26	17.22
triflusulfuron		0.50	Cotyl					
triflusulfuron		0.50	7 d ltr					
Triflusulfuron		0.25	Cotyl	75	3	0	23	17.42
triflusulfuron		0.25	7 d ltr					
Triflusulfuron		0.50	Cotyl	86	0	0	24	17.46
triflusulfuron		0.50	7 d ltr					
LSD (0.05)				NS	NS	NS	NS	NS

[1]Application timing abbreviations are as follows: MIF = Modified in-furrow, Cotyl = Cotyledon and 7d ltr = 7 days later.
[2]Nonionic surfactant added at 0.25% v/v.

Comparison of tillage implements for herbicide incorporation. Robert W. Downard and Don W. Morishita. Research plots were established near Kimberly, ID to compare weed control with herbicides incorporated using a roller harrow or band incorporater. Sugarbeets (variety WS PM-9) were planted April 28, 1993, on 22 inch rows at 47,520 seeds per acre and grown under sprinkler irrigation. Soil texture was a silt loam with a pH of 8.0, CEC of 19 meq/100 g soil and 1.95% organic matter. Plots were 4 rows wide by 30 feet replicated four times in a randomized block design. Herbicide treatments were applied with a bicycle sprayer at 20 gpa and 34 psi pressurized with CO_2. Additional application data is shown in Table 1. Crop injury and weed control evaluations were taken May 20, and July 9. Two center rows from each plot were harvested September 28.

All treatments showed no significant crop injury (Table 2.) There were no differences in common lambsquarters control (CHEAL) between the roller harrow or band incorporator but there were differences among herbicide treatments. Control of common lambsquarters (CHEAL) declined throughout the season. Green foxtail (SETVI) control was reduced by the band incorporator. Herbicide treatments applied in the fall controlled green foxtail better when they were incorporated with the roller harrow. In comparison, band incorporated spring applied treatments were comparable to roller harrow incorporated treatments until later in the season with the exception of cycloate plus ethofumesate. Sugarbeet yields were not significantly affected by the incorporation implement, but were by chemical treatment. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83303).

Table 1. Application data.

Application date	11/17/92	11/18/92	4/20/93
Application timing	PPI	PPI	PPI
Air temperature (F)	45	40	56
Soil temperature (F)	42	38	48
Wind velocity (mph)	4	0	0
Relative humidity (%)	80	90	66

Table 2. Sugarbeet injury, weed control and crop yield, near Kimberly, Idaho.

				Weed control[1]										
				SETVI										
				Fall				Spring						
		Crop injury		Roller harrow		Band incorporator		Roller harrow		Band incorporator		CHEAL		BETVU
Treatment	Rate	5/20	7/9	5/20	7/9	5/20	7/9	5/20	7/9	5/20	7/9	5/20	7/9	yield
	lb ai/A	%												ton/A
Check		0	0	0	0	0	0	0	0	0	0	0	0	18
Handweeded		0	0	0	100	0	100	0	100	0	100	0	100	24
Cycloate	4.0	0	1	96	85	44	3	93	94	94	79	91	64	20
Ethofumesate	2.0	1	1	95	99	70	8	99	89	94	70	89	59	21
Cycloate + ethofumesate	2.0 + 1.0	1	2	100	95	74	4	100	70	67	56	95	62	22
LSD (0.05)		NS	NS	22	11	22	11	16	25	16	25	11	15	2

[1]Weed species evaluated were green foxtail (SETVI) and common lambsquarters (CHEAL).

Comparison of preplant, preemergence, and postemergence herbicide applications applied alone, sequentially, and in combination with handweeding. Don W. Morishita and Robert W. Downard. A field experiment was conducted to compare combinations of soil-applied and postemergence herbicides with and without handweeding for weed control, crop yield and economic return in sugarbeet (var. WS-PM9). The crop was planted in 22-inch rows at a density of 47,520 plants/A. Plots were 4 rows by 30 ft and the treatments were arranged in a randomized complete block design with four replications. All herbicides were applied in a 10 inch band with a bicycle wheel plot sprayer. Soil type at the location was a silt loam with a pH of 8.0, 1.95% o.m., and CEC of 19 meq/100 g soil. Application information is listed in Table 1. Handweeded treatments were timed so that hoeing costs could be calculated into the economic return. Cost of herbicide applications and handweeding, based on a charge of $5.50/hr, were averaged for each treatment. Net return was calculated by subtracting the total weed control cost from the gross return on sugarbeet yield. Crop injury and weed control were evaluated visually twice and the two center rows from each plot was harvested September 29, 1993.

Table 1. Application information

Appl. date	5/7	5/19	5/27	6/25
Appl. timing	PRE	Cotyledon	7 days later	Layby
Air temp. (F)	46	73	80	83
Soil temp. (F)	41	61	76	79
Rel. humidity (%)	100	56	24	41
Wind speed (mph)	10 to 15	10 to 14	4	0
Cloud cover (%)	15	0	50	0

Crop injury among the weed control treatments was minimal although ethofumesate applied PRE followed by two phenmedipham and desmedipham POST applications and EPTC layby had the highest injury ratings. Redroot pigweed (AMARE), common lambsquarters (CHEAL), and hairy nightshade (SOLSA) control generally ranged from 85 to 100% with few exceptions. Kochia (KCHSC) was the most difficult weed to control. Kochia control ranged from less than 60% to better than 90%. However all but one of the treatments that controlled kochia better than 90% included handweeding. All weed control treatments had sugarbeet yields higher than the untreated check. Total handweeding, ethofumesate followed by handweeding, and POST applications of phenmedipham and desmedipham followed by trifluralin Layby were among the highest yielding treatments. Weed control treatments with the highest net return included ethofumesate applied PRE followed by phenmedipham and desmedipham POST, ethofumesate followed by handweeding, and total handweeding. (Department of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls, ID 83843)

Table 2. Weed control, crop yield, and net return from chemical applications and handweeding in sugarbeets, near Kimberly, Idaho[1]

Treatment[2]	Rate	Applic. timing	Crop injury 7/12	Crop injury 8/2	Weed control AMARE 7/12	AMARE 8/2	CHEAL 7/12	CHEAL 8/2	KCHSC 7/12	KCHSC 8/2	SETVI 7/12	SETVI 8/2	SOLSA 7/12	SOLSA 8/2	BETVU yield	Net return[3]
	lb ai/A		%												ton/A	$/A
Check			0	0	0	0	0	0	0	0	0	0	0	0	11	421
Handweed			0	0	100	100	100	100	100	100	100	100	100	100	25	792
Ethofumesate handweed	1.12	PRE	0	1	100	100	93	96	71	88	88	91	88	61	25	811
ethofumesate/ phen & desm handweed	1.12/ 0.33	PRE 1-2 leaf	0	0	100	100	89	95	83	90	89	96	81	100	24	790
Ethofumesate/ phen & desm/ phen & desm	1.12/ 0.33/ 0.33	PRE 1-2 leaf 7 d later	0	1	100	100	93	94	44	41	93	88	93	80	23	818
Ethofumesate/ phen & desm/ phen & desm/ EPTC	1.12/ 0.33/ 0.33/ 3.0	PRE 1-2 leaf 7 d later Layby	3	4	100	100	100	93	93	86	98	96	100	100	22	772
Ethofumesate/ phen & desm/ EPTC handweed	1.12/ 0.33/ 3.0	PRE 1-2 leaf Layby	0	0	100	100	95	100	89	98	96	96	100	100	22	764
Phen & desm/ phen & desm/	0.33/ 0.33/	Cotyl 7 d later	0	3	100	93	81	88	25	19	81	80	100	100	18	674
Phen & desm + ethofumesate phen & desm + ethofumesate	0.20 + 0.20 0.20 + 0.20	Cotyl 7 d later	0	0	89	85	81	81	41	34	70	69	100	100	19	704
Phen & desm/ phen & desm handweed	0.33/ 0.33	Cotyl 7 d later	1	1	100	100	99	94	85	96	90	95	94	83	21	629
Phen & desm/ phen & desm/ EPTC	0.33/ 0.33/ 3.0	Cotyl 7 d later Layby	0	0	100	100	96	88	74	71	89	85	100	100	21	773
Phen & desm/ phen & desm/ EPTC handweed	0.33/ 0.33/ 3.0	Cotyl 7 d later Layby	0	0	99	93	100	100	100	96	94	95	100	88	19	602
Phen & desm/ phen & desm/ trifluralin	0.33/ 0.33/ 0.5	Cotyl 7 d later Layby	0	0	100	100	99	94	93	90	93	91	100	95	23	838
Phen & desm/ phen & desm/ trifluralin handweed	0.33/ 0.33/ 0.5	Cotyl 7 d later Layby	0	0	95	98	93	98	96	100	89	95	100	98	25	788
LSD (0.05)			1	ns	7	10	11	12	22	26	9	9	15	21	4	153

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

[2]All handweeded treatments were timed for calculating weed control cost. Phen & desm = phenmendipham and desmedipham.

[3]Net return = sugarbeet yield X sugar price - total weed control cost.

Comparison of phenmedipham, desmedipham, and ethofumesate co-formulations for weed control in sugarbeets. Don W. Morishita and Robert W. Downard. Co-formulations of phenmedipham, desmedipham, and ethofumesate were compared for weed control, crop tolerance and effect on sugarbeet (var. WS-91) yield near Aberdeen, Idaho. Sugarbeets were planted April 27, 1993, at 47,520 seeds/A. Individual plots were 4 rows by 30 ft. Experimental design was a randomized complete block with four replications. Herbicides were applied in a 10-inch band with a CO_2-pressurized bicycle sprayer. First applications were made at the cotyledon growth stage and followed 7 days later with a repeat application. Additional application information is in Table 1. Soil type at this location was a sandy loam with 1.26% o.m., and a pH of 8.2. Crop injury and weed control evaluations were taken June 14 and July 14. Sugarbeets were harvested September 27 with a two-row harvester.

Table 1. Herbicide application information.

Application date	5/18	5/24
Application type	Cotyledon	7 days later
Air temperature (F)	70	76
Soil temperature (F)	65	68
Relative humidity (%)	42	40
Wind velocity (mph)	6	4 to 6

None of the herbicide treatments injured the crop (Table 2). All the herbicide treatments controlled common lambsquarters (CHEAL) 81 to 99% over both evaluations, with the exception of CQ 1451/2 at 0.25 lb ai/A. Kochia (KCHSC) control was much less at the second evaluation, for all herbicide treatments, compared to the first evaluation. Hairy nightshade (SOLSA) control was similar to CHEAL control for most treatments. NA 307/2 and CQ 1451/2, applied at the lowest rate combinations, did not control hairy nightshade later in the season. Overall there was not much difference in weed control among the formulations. Most of the differences in weed control were a result of rate response within formulation. All herbicide treatments yielded better than the untreated check. There were no sugarbeet yield differences among herbicide treatments. (Department of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls, ID 83301)

Table 2. Crop injury, broadleaf weed control and sugarbeet yield, near Aberdeen, ID[1].

Treatment[2]	Rate	Applic. type[3]	Crop injury	Weed control CHEAL 6/14	CHEAL 7/14	KCHSC 6/14	KCHSC 7/14	SOLSA 6/14	SOLSA 7/14	AMARE 6/14	BETVU yield
	lb ai/A		%								ton/A
Check			0	0	0	0	0	0	0	0	20
Phen & desm	0.25	Cotyl	0	89	81	90	58	75	78	86	30
phen & desm	0.33	7 d later									
Phen & desm	0.375	Cotyl	3	98	94	81	16	86	95	86	33
phen & desm	0.50	7 d later									
NA 305/2	0.25	Cotyl	1	89	83	83	25	74	86	81	34
NA 305/2	0.33	7 d later									
NA 305/2	0.375	Cotyl	3	97	86	94	56	93	90	81	29
NA 305/2	0.50	7 d later									
NA 307/2	0.25	Cotyl	1	86	85	76	23	74	88	61	31
NA 307/2	0.33	7 d later									
NA 307/2	0.375	Cotyl	0	95	88	91	45	94	93	80	32
NA 307/2	0.50	7 d later									
NA 308/1	0.25	Cotyl	0	89	88	64	24	86	91	81	31
NA 308/1	0.33	7 d later									
NA 308/1	0.375	Cotyl	5	99	94	86	41	97	100	93	32
NA 308/1	0.50	7 d later									
CQ 1451/2	0.25	Cotyl	0	85	76	78	18	75	73	56	35
CQ 1451/2	0.33	7 d later									
CQ 1451/2	0.375	Cotyl	3	99	91	81	26	95	90	86	32
CQ 1451/2	0.50	7 d later									
Phen & desm + ethofumesate	0.17 + 0.083	Cotyl	1	100	84	81	45	96	95	86	33
phen & desm + ethofumesate	0.22+ 0.11	7 d later									
LSD (0.05)		ns	11	10	19	27	12	12	18	6	

[1]Weeds evaluated for control were common lambsquarters (CHEAL), kochia (KCHSC), hairy nightshade (SOLSA), and redroot pigweed (AMARE). Crop injury ratings shown were taken June 14.

[2]Phen & desm = phenmedipham and desmedipham.

[3]Abbreviations for applications are: Cotyl = cotyledon, 7 d later = 7 days later.

Simulated drift of postemergence herbicides on sugarbeets. Robert W. Downard and Don W. Morishita. Research plots were established near Twin Falls, Idaho to evaluate simulated drift of postemergence grain herbicides on sugarbeets (variety HM WS-91). The crop was planted April 26, 1993, on 22 inch rows at 47,520 seeds per acre and grown under furrow irrigation. Soil type was a silt loam with a pH of 8.1, CEC of 19 meq/100 g soil and 1.45% organic matter. Plots were 4 rows by 30 feet replicated four times in a randomized complete block design. Herbicide treatments were applied in a 10 inch band with a bicycle sprayer calibrated to deliver 20 gpa at 40 psi pressurized by CO_2. Additional application data is shown in Table 1. All treatments were handweeded until August to eliminate weed interference. Visual crop injury evaluations were taken 7, 15, 22, 37, 50, and 72 days after treatment (DAT). Sugarbeets were harvested October 1.

Rates of 0.05X and 0.01X of MCPA and bromoxynil, thifensulfuron and tribenuron, or tank mix combinations did not significantly reduce yield from the untreated check (Table 2). These treatments showed 4 to 21% injury 7 DAT but were able to recover. Rates for which 2,4-D or 2,4-D plus thifensulfuron and tribenuron did not significantly impact sugarbeet yields were 0.01X. Sugarbeets were able to recover from the initial injury of 4 to 9% by these treatments. Sugarbeets were more tolerant to injury resulting from MCPA and bromoxynil than from 2,4-D and thifensulfuron and tribenuron. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83303).

Table 1. Application data.

Application date	6/14
Application timing	4 to 6 leaf
Air temperature (F)	84
Soil temperature (F)	69
Wind velocity (mph)	0 to 2

Table 2. Simulated drift of postemergence herbicides on sugarbeets near Twin Falls, Idaho.

Treatment[1]	Applic. rate	Crop injury 6/21	6/29	7/6	7/21	8/3	8/25	BETVU yield	Sugar content
	lb ai/A	%						Tons/A	%
Untreated		0	0	0	0	0	0	23	16.89
Thifen & triben (0.5x)	0.113	40	88	94	98	92	88	5	16.14
Thifen & triben (0.3x)	0.0675	41	75	88	86	81	73	5	15.67
Thifen & triben (0.1x)	0.0225	21	25	23	25	16	14	13	16.39
Thifen & triben (0.05x)	0.0113	4	4	3	6	4	3	18	17.40
Thifen & triben (0.01x)	0.0023	4	6	6	6	9	6	21	16.37
MCPA & bromoxynil (0.5x)	0.375	83	81	80	55	43	36	9	15.96
MCPA & bromoxynil (0.3x)	0.225	78	66	60	35	23	19	16	16.55
MCPA & bromoxynil (0.1x)	0.075	56	43	31	15	9	8	17	16.73
MCPA & bromoxynil (0.05x)	0.0375	21	16	13	5	1	1	24	16.79
MCPA & bromoxynil (0.01x)	0.0075	5	4	4	1	1	0	24	16.40
2,4-D (0.5x)	0.5	51	76	89	89	93	88	2	--[2]
2,4-D (0.3x)	0.3	45	74	78	66	65	54	6	15.16
2,4-D (0.1x)	0.1	38	39	34	35	21	13	9	16.38
2,4-D (0.05x)	0.05	30	13	18	13	9	6	16	15.96
2,4-D (0.01x)	0.01	9	5	4	5	3	0	20	16.41
Thifen & triben + MCPA & bromoxynil (0.5x)	0.113 + 0.375	85	95	97	97	91	75	7	15.15
Thifen & triben + MCPA & bromoxynil (0.3x)	0.0675 + 0.225	81	78	84	68	66	51	6	16.05
Thifen & triben + MCPA & bromoxynil (0.1x)	0.0225 + 0.075	65	75	76	60	40	38	9	16.35
Thifen & triben + MCPA & bromoxynil (0.03x)	0.0113 + 0.0375	24	19	18	8	4	3	19	16.33
Thifen & triben + MCPA & bromoxynil (0.01x)	0.0023 + 0.0075	0	3	5	4	3	0	23	16.33
Thifen & triben + 2,4-D (0.5x)	0.113 + 0.05	58	91	99	99	99	97	2	--[2]
Thifen. & Triben. + 2,4-D (0.3x)	0.0675 + 0.03	50	89	94	97	96	84	5	14.71
Thifen & triben + 2,4-D (0.1x)	0.0225 + 0.01	36	55	51	50	39	28	12	15.45
Thifen & triben + 2,4-D (0.05x)	0.0113 + 0.05	29	23	28	11	4	4	16	16.67
Thifen & triben + 2,4-D (0.01x)	0.0023 + 0.01	4	4	6	3	0	1	22	16.50
LSD (0.05)		8	13	12	12	12	12	5	1.08

[1]Thifen & triben = thifensulfuron & tribeuron commercial formulation. Surfactant added at 0.25% v/v to all thifensulfuron & tribenuron treatments.

[2]--=Not large enough samples to run percent sugars.

Preemergence and postemergence applied treatments in sugarbeets. Robert W. Downard and Don W. Morishita. Plots were established at the Research and Extension Center near Aberdeen, Idaho to evaluate preemergence (PRE) and postemergence (POST) weed control in sugarbeets. Sugarbeets (variety WS-91) were planted April 27, 1993, on 22 inch rows at 47,520 seeds per acre and grown under sprinkler irrigation. Weeds present were hairy nightshade (SOLSA) at 11 plants/ft^2, and common lambsquarters (CHEAL) at 1 to 3 plants/ft^2. Plots were 4 rows wide by 25 feet long with four replications arranged in a randomized complete block design. Soil type was a sandy loam with a pH of 8.2 and 1.26% organic matter. Herbicide treatments were applied at 20 gpa and 38 psi using CO_2 as the propellant. Additional application data is shown in Table 1. Crop injury and weed control ratings were taken on June 14 and July 14. Sugarbeets were harvested on September 27.

Pyrazon at 1.8 lb ai/A plus ethofumesate at 1.0 lb ai/A applied PRE and desmedipham and phenmedipham at 0.165 lb ai/A applied three times POST slightly injured the crop (Table 2). Longest lasting weed control was provided by pyrazon at 1.8 lb ai/A plus ethofumesate at 1.0 lb ai/A PRE and desmedipham and phenmedipham at 0.33 lb ai/A plus sethoxydim at 0.1 lb ai/A POST followed by a pyrazon layby. These treatments were also the highest yielding along with the handweeded check. In general, herbicide treatments with 3 to 4 applications controlled weeds better and had higher yields. (Department of Plant, Soil and Entomological Sciences, University of Idaho, Twin Falls, ID 83303).

Table 1. Application data.

Application date	5/10	5/18	5/24	6/2	7/1
Application timing	PRE	Cotyl	7 day later	7 day later	Layby
Air temperature (F)	80	70	76	67	62
Soil temperature (F)	68	65	68	64	61
Wind velocity (mph)	6 to 9	6	4 to 6	4	4 to 6

Table 2. Preemergence and postemergence applications for weed control in sugarbeets near Aberdeen, Idaho.

					Weed control[1]				
			Crop injury		CHEAL		SOLSA		BETVU
Treatment[2]	Rate	Applic. timing[3]	6/14	7/14	6/14	7/14	6/14	7/14	yield
	lb ai/A		%						Tons/A
Check			0	0	0	0	0	0	17
Pyrazon + ethofumesate	1.0 + 0.7	PRE	0	0	75	54	90	94	29
Pyrazon + ethofumesate	1.5 + 1.0	PRE	0	0	90	74	96	100	29
Pyrazon + ethofumesate	1.8 + 1.0	PRE	10	0	89	74	98	96	26
Pyrazon + ethofumesate desmed & phen + sethoxydim	1.0 + 0.7 0.33 + 0.1	PRE 2 lf/7 d ltr/ 7 d ltr	4	0	97	93	97	98	31
Pyrazon desmed & phen + sethoxydim	2.4 0.33 + 0.1	PRE 2 lf/7 d ltr/ 7 d ltr	0	0	97	95	98	95	27
Ethofumesate desmed & phen + sethoxydim	2.0 0.33 + 0.1	PRE 2 lf/7 d ltr/ 7 d ltr	8	1	97	95	97	98	30
Desmed & phen + sethoxydim pyrazon	0.33 + 0.1 2.0	Cotyl/7 d ltr/ Layby	3	0	91	94	91	96	35
Desmed & phen + sethoxydim pyrazon	0.33 + 0.1 3.0	Cotyl/7 d ltr/ Layby	4	0	95	89	93	96	29
Desmed & phen + sethoxydim	0.33 + 0.1	Cotyl/7 d ltr	4	0	96	90	91	91	32
NA 308/1 + sethoxydim	0.33 0.1	Cotyl/7 d ltr/ 7 d ltr	1	0	100	94	100	70	33
Desmed & phen + sethoxydim + triflusulfuron	0.25 + 0.1 + 0.0156	Cotyl/7 d ltr/ 7 d ltr	1	0	100	95	100	95	32
Desmed & phen	0.165	Cotyl/7 d ltr/ 7 d ltr	11	0	86	69	84	73	32
Desmed & phen[4]	0.165	Cotyl/7 d ltr/ 7 d ltr	0	0	84	75	78	74	31
Desmed & Phen[5]	0.165	Cotyl/7 d ltr/ 7 d ltr	0	0	96	79	94	83	28
Handweeded check			8	0	100	100	100	100	34
LSD (0.05)			8	NS	11	13	8	20	7

[1]Weed species abbreviations are common lambsquarters (CHEAL) and hairy nightshade (SOLSA).
[2]Desmed. & Phen. = desmedipham and phenmedipham commercial formulation.
[3]Application timing PRE = preemergence, 2 lf = 2 leaves, cotyl = cotyledon and 7 d ltr = 7 days later.
[4]Bivert added at 4 oz/A.
[5]Crop oil concentrate added at 1 qt/A.

Postemergence herbicide combinations in sugarbeets. Carl E. Bell. This project was an evaluation of two way combinations of desmedipham/phenmedipham, endothall, and DPX-66037 for weed control and phytotoxicity in sugarbeets. Research was conducted in a commercial sugarbeet field near Holtville, CA.

Experimental design was a randomized complete block with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. Herbicide treatments were made when the crop had 2 to 4 true leaves on October 27, 1992. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8003LP nozzles for a spray volume of 280 GPA. Soil type was a clay loam.

Data collected were visual estimates of nettleleaf goosefoot control and crop phytotoxicity on November 4 and December 1, 1992. Results are shown in the Table below.

According to the first visual evaluation, the desmedipham/phenmedipham plus endothall or DPX-66037 controlled nettleleaf goosefoot well, but the endothall plus DPX-66037 did not do very well. At the second evaluation, all the combination treatments controlling nettleleaf goosefoot adequately, but the endothall plus DPX-66037 treatment was not as good as the combinations with desmedipham/phenmedipham. Crop injury was evident, but not commercially unacceptable from any treatment. (Cooperative Extension, University of California, Holtville, CA 92250.)

Table. Desmedipham/phemmedipham, endothall, and DPX-66037 two way combinations for postemergence weed control in sugarbeet.

Treatment[1]	rate	CHEMU control[2]		phytotoxicity[3]	
		Nov. 4	Dec. 1	Nov. 4	Dec. 1
	kg/ha	------- % -------			
Des/Phen +	0.84				
DPX-66037	0.070	99	100	1.5	1.0
Endothall +	0.84				
Des/Phen	0.84	99	99	2.0	1.0
Endothall +	0.84				
DPX-66037	0.070	31	80	1.5	0.5
Untreated control		0	0	0	0

[1] Treatment; Des/Phen - desmedipham + phenmedipham.
[2] CHEMU - nettleleaf goosefoot.
[3] Phytotoxicity, 0 = no injury, 10 = all plants dead.

DPX-66037 and desmedipham/phenmedipham postemergence in sugarbeets. Carl E. Bell and Jeff Pacheco. This project was an evaluation of DPX-66037, desmedipham/phenmedipham, and tankmix combinations for postemergence weed control and phytotoxicity in sugarbeets. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.
Experimental design was a randomized complete block with four replications. Plot size was 4 beds, each 1 m wide, by 7.6 m. The crop was sown in two seedlines per bed on September 29, 1992 and irrigated with sprinklers on the same day. Herbicide treatments were made sequentially, when the crop was in the 2 to 4 leaf stage on October 14, 1992 and 3 weeks later on November 5. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8003LP nozzles for a spray volume of 280 L/ha. Soil type was a clay loam. DPX-66037 treatments, when applied alone, included a crop oil concentrate surfactant at 1% v/v.

Data collected were visual estimates of nettleleaf goosefoot control on October 26 and November 23, crop phytotoxicity on October 26, and crop yield on June 16, 1993. Yield was the weight of beets in a 4.6 m section of the two inner beds of each plot. A 9 kg random subsample from each yield sample was analyzed for percent sugar (courtesy of Holly Sugar Co., Brawley, CA). Yield and percent sugar data were subjected to analysis of variance. Results are shown in the Table below.

According to the first visual evaluation, herbicide treatments which included desmedipham/phenmedipham controlled nettleleaf goosefoot very well. DPX-66037 treatments, when applied alone, did not control nettleleaf goosefoot. At the second evaluation, nettleleaf goosefoot control with DPX-66037 had improved, but was still not as good as the desmedipham/phenmedipham treatments or the combination. Crop injury was evident, but not commercially unacceptable from any treatment. Yield of the low rate treatment of DPX-66037 appears to be lower than the other treatments. Large differences in plot weights for this treatment, however, resulted in a non-additivity error in the analysis of variance which could not be corrected. There was no significant difference ($P>0.05$) between treatments for percent sugar content. (Cooperative Extension, University of California, Holtville, CA 92250 and DuPont Co. Phoenix, AZ 85044.)

Table. DPX-66037, desmedipham/phemmedipham and combinations for postemergence weed control in sugarbeet.

Treatment[1]	rate	Visual evaluations[2] CHEMU control Oct. 26	CHEMU control Nov. 23	phytotoxicity Oct. 26	Yield[3] sugarbeet June 15, 1993	Sugar[4] sugarbeet June 15, 1993
	kg/ha	%	%		kg	%
DPX-66037	0.035	4	73	0.3	57.7	16.3
DPX-66037	0.070	4	88	0.3	64.5	16.4
Des/Phen	0.55	95	99	1.5	73.5	16.1
Des/Phen +	0.55					
DPX-66037	0.035	99	99	1.5	78.1	16.8
Des/Phen +	0.55					
DPX-66037	0.070	100	99	1.8	73.5	15.8
Untreated control		0	0	0	74.0	14.9

1 Treatment; Des/Phen - desmedipham + phenmedipham.
2 CHEMU - nettleleaf goosefoot; Phytotoxicity, 0 = no injury, 10 = all plants dead.
3 Yield - kg/4.6 m of bed by 2 beds, mean of four replications.
4 Sugar - determined from 9 kg subsample from yield data, mean of 4 replications.

Evaluation of desmedipham/phenmedipham and DPX-66037 postemergence in sugarbeets. Carl E. Bell. This project was an evaluation of desmedipham/phenmedipham, with and without DPX-66037, and DPX-66037 alone for weed control and phytotoxicity in sugarbeets. Research was conducted in a commercial sugarbeet field near Brawley, CA.

Experimental design was a randomized complete block with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. Herbicide treatments were made twice, when the crop had 2 to 4 true leaves on October 13 and 7 days later when the crop had 6 true leaves. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8003LP nozzles for a spray volume of 260 L/ha. Soil type was a clay loam.

Data collected were visual estimates of nettleleaf goosefoot control and crop phytotoxicity on October 20 and November 4, 1992. Results are shown in the Table below.

According to the visual evaluations, all herbicide treatments controlled nettleleaf goosefoot very well. Crop injury was evident, but not commercially unacceptable from any treatment. DPX-66037 did not increase crop injury compared to desmedipham/phenmedipham alone, or in combination. (Cooperative Extension, University of California, Holtville, CA 92250.)

Table. Desmedipham/phemmedipham, DPX-66037, and tankmix combinations for postemergence weed control in sugarbeet.

Treatment[1]	rate	CHEMU control[2]		phytotoxicity[3]	
		Oct. 20	Nov. 4	Oct. 20	Nov. 4
	kg/ha	------- % -------			
Des/Phen	0.43	76	85	0.8	0.3
Des/Phen	0.56	99	100	1.5	0.5
Des/Phen	0.84	99	100	2.5	1.3
DPX-66037	0.035	99	100	1.3	0.3
DPX-66037	0.070	98	100	1.5	0.3
Des/Phen +	0.56				
DPX-66037	0.035	100	100	1.3	0.8
Des/Phen +	0.56				
DPX-66037	0.070	99	100	2.3	0.5
Untreated control		0	0	0	0

[1] Treatment; Des/Phen - desmedipham + phenmedipham.
[2] CHEMU - nettleleaf goosefoot.
[3] Phytotoxicity, 0 = no injury, 10 = all plants dead.

Evaluation of desmedipham/phenmedipham and endothall postemergence in sugarbeets. Carl E. Bell. This project was an evaluation of desmedipham/phenmedipham, with and without endothall, and endothall alone for weed control and phytotoxicity in sugarbeets. Research was conducted in a commercial sugarbeet field near Brawley, CA.

Experimental design was a randomized complete block with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. Herbicide treatments were made when the crop had 2 to 4 true leaves on October 14. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8003LP nozzles for a spray volume of 290 L/ha. Soil type was a clay loam.

Data collected were visual estimates of nettleleaf goosefoot control and crop phytotoxicity on October 20 and November 4, 1992. Results are shown in the Table below.

According to the visual evaluations, all herbicide treatments controlled nettleleaf goosefoot very well. Crop injury was evident, but not commercially unacceptable from any treatment. (Cooperative Extension, University of California, Holtville, CA 92250.)

Table. Desmedipham/phemmedipham, endothall, and tankmix combinations for postemergence weed control in sugarbeet.

Treatment[1]	rate	CHEMU control[2] Oct. 20	CHEMU control[2] Nov. 4	phytotoxicity[3] Oct. 20	phytotoxicity[3] Nov. 4
	kg/ha	------- %	-------		
Endothall	0.84	38	85	0.8	0
Endothall	1.27	82	100	2.3	1.0
Des/Phen	0.84	99	100	2.5	1.0
Des/Phen	1.12	99	100	2.5	1.0
Endothall +	0.84				
Des/Phen	0.84	100	100	2.8	0.8
Endothall +	0.84				
Des/Phen	1.12	100	100	2.3	0.5
Endothall +	1.27				
Des/Phen	1.12	100	99	3.0	1.5
Untreated control		0	0	0	0

[1] Treatment; Des/Phen - desmedipham + phenmedipham.
[2] CHEMU - nettleleaf goosefoot.
[3] Phytotoxicity, 0 = no injury, 10 = all plants dead.

Desmedipham/phenmedipham combined with ethofumasate in sugarbeets. Carl E. Bell and Phil Odom. This project was an evaluation of desmedipham/phenmedipham, tank mix combinations of desmedipham/phenmedipham plus ethofumasate, and co-formulations of desmedipham/phenmedipham with ethofumasate for postemergence weed control and phytotoxicity in sugarbeets. Research was conducted in a commercial sugarbeet field near Holtville, CA.

Experimental design was a randomized complete block with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. Herbicide treatments were made when the crop had 2 to 4 true leaves on October 27. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8003LP nozzles for a spray volume of 280 L/ha. Soil type was a clay loam.

Data collected were visual estimates of nettleleaf goosefoot and junglerice control and crop phytotoxicity on November 4 and nettleleaf goosefoot control and crop phytotoxicity on December 1, 1992. Results are shown in the Table below.

According to the visual evaluations, all herbicide treatments controlled nettleleaf goosefoot very well. Crop injury was evident, but not commercially unacceptable from any treatment. The addition of ethofumasate to the spray mix, either in the tank or as a co-formulation, increased crop injury compared to desmedipham/phenmedipham alone. Junglerice control was greater with addition of ethofumasate, but still did not control the grass adequately. (Cooperative Extension, University of California, Holtville, CA 92250 and Nor-Am Chemical Co, Phoenix, AZ, 85044.)

Table. Desmedipham/phemmedipham, desmedipham/phenmedipham plus ethofumasate, and co-formulations of desmedipham/phenmedipham with ethofumasate for postemergence weed control in sugarbeet.

Treatment[1]	rate	weed control[2]			phytotoxicity[3]	
		---- CHEMU ----		ECHCO		
		Oct. 15	Nov. 4	Oct. 15	Oct. 15	Nov. 4
	kg/ha	---------- % ----------				
Des/Phen	0.84	100	100	4	1.3	0.8
NA307	0.63	100	100	4	1.5	1.0
NA307	1.26	100	100	38	2.3	1.5
NA308	0.63	100	99	15	2.5	0.8
NA308	1.26	85	85	21	2.3	1.8
Des/Phen + ethofumasate	0.43 0.40	99	100	7	1.8	1.8
Des/Phen + ethofumasate	0.84 0.81	100	100	21	3.0	1.3
Untreated control		0	0	0	0	0

[1] Treatment; Des/Phen - desmedipham + phenmedipham, NA307 and NA308 are co-formulations of desmedipham, phenmedipham, and ethofumasate.

[2] CHEMU - nettleleaf goosefoot, ECHCO - junglerice.

[3] Phytotoxicity, 0 = no injury, 10 = all plants dead.

Desmedipham/Phenmedipham plus ethofumasate combinations in sugarbeets. Carl E. Bell and Phil Odom. This project was an evaluation of desmedipham/phenmedipham compared to co-formulations of desmedipham/phenmedipham with ethofumasate for postemergence weed control and phytotoxicity in sugarbeets. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

Experimental design was a randomized complete block with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. The crop was sown in two seedlines per bed on September 29, 1992 and irrigated with sprinklers on the same day. Herbicide treatments were made sequentially, when the crop was in the cotyledon to 2 leaf stage and 5 days later on October 9 and 14, or once, when the crop was in the 2 to 4 leaf stage on October 15. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8003LP nozzles for a spray volume of 280 L/ha. Soil type was a clay loam.

Data collected were: visual estimates of nettleleaf goosefoot control and crop phytotoxicity on October 15 and November 4; a crop stand count on November 15; and crop and weed biomass on December 16. Biomass samples were kg fresh weight for 1.5 of bed by two beds. Biomass and stand count data were subjected to analysis of variance and mean separation. Results are shown in the Table below.

According to the visual evaluations, all herbicide treatments controlled nettleleaf goosefoot very well. Crop injury was evident, but not commercially unacceptable from any treatment. There were no significant differences between treatments for stand count (data not shown) and crop biomass. Weed biomass was considerably higher in the untreated control plots compared to the herbicide treatments. (Cooperative Extension, University of California, Holtville, CA 92250 and Nor-Am Chemical Co., Phoenix, AZ 85044.)

Table. Desmedipham/phemmedipham and co-formulations of desmedipham/phenmedipham with ethofumasate for postemergence weed control in sugarbeet.

Treatment[1]	rate	Visual evaluations[2]				Biomass[3]	
		CHEMU control		phytotoxicity		Sugarbeet	CHEMU
		Oct. 15	Nov. 4	Oct. 15	Nov. 4	----- Dec. 16 -----	
	kg/ha	------ % ------				------- kg -------	
Des/Phen	0.21	99	99	0.8	1.3	13.2	0.45
Des/Phen	0.34	100	100	1.0	1.5	12.0	0.23
Des/Phen	0.43	100	100	2.0	2.0	12.2	0.23
NA307	0.31	99	99	1.3	1.5	13.4	0.36
NA307	0.50	100	100	2.0	2.0	12.3	0.23
NA307	0.63	100	100	2.3	2.3	14.2	0.23
NA308	0.31	100	100	1.3	1.0	14.7	0.36
NA308	0.50	100	99	2.3	2.3	12.2	0.45
NA308	0.63	100	100	2.0	2.3	13.3	0.36
Des/Phen	0.84	0	100	0	1.3	13.5	0.36
NA307	1.26	0	100	0	2.8	11.8	0.91
NA308	1.25	0	100	0	1.8	13.8	0.23
Untreated control		0	0	0	0	9.0	5.81
	LSD(0.05)					3.9	

[1] Treatment; Des/Phen - desmedipham + phenmedipham, NA307 and NA308 are coformulations of desmedipham, phenmedipham, and ethofumasate.

[2] CHEMU - nettleleaf goosefoot; Phytotoxicity, 0 = no injury, 10 = all plants dead.

[3] Biomass - kg/1.5 m of bed by 2 beds, mean of four replications.

Replant interval for DPX-66037 in sugarbeets. Carl E. Bell and Jeff Pacheco. This project was a comparison of the interaction of four rates of DPX-66037 and three replant intervals for effect on sugarbeet phytotoxicity. The objective was to assess the potential effect of soil residual DPX-66037 on replanted sugarbeets. Research was conducted at the University of California Desert Research and Extension Center in Holtville, CA.

Experimental design was a split plot factorial, with replant interval as the main plot factor and herbicide rate as the subplot factor, with four replications. Plot size was 2 beds, each 1 m wide, by 7.6 m. The crop was sown in two seedlines per bed on September 29, 1992 and irrigated with sprinklers on the same day. Herbicide treatments were made 5 days before planting (DBP), 3 DBP, and 1 DBP. Beds were rototilled to a depth of 5 cm after DPX-66037 application and before sowing. Herbicide rates were 0, 70, 140, and 210 g/ha. Applications were made with a CO_2 pressured sprayer at 140 kPa, using 8002LP nozzles for a spray volume of 190 L/ha. Soil type was a clay loam.

Data collected were a visual estimate of crop phytotoxicity on October 15, after sugarbeet emergence; and crop and nettleleaf goosefoot biomass on December 2. Biomass samples were pounds fresh weight for 1.5 m of bed by two beds. Biomass data were subjected to analysis of variance. Results are shown in the Table below.

The visual evaluation indicated that DPX-66037 had some effect on early sugarbeet growth, particularly at higher rates. According to analysis of variance, replant interval had a significant effect (P= 0.053) on sugarbeet biomass, however, the shortest replant interval had the highest weights. There was a suggestion (P = 0.14) that increasing herbicide rate reduced sugarbeet biomass. A linear regression of herbicide rate to sugarbeet biomass showed a significant (P = 0.073) inverse relationship, but it was not strong (r = -0.261). (Cooperative Extension, University of California, Holtville, CA 92250. and E.I. DuPont deNemours Co, Phoenix, CA 85046.)

Table. DPX-66037 rate by replant interval effect on sugarbeet.

DPX-66037 replant[3] interval	rate	Phytotoxicity[1]	Biomass[2] Sugarbeet	CHEMU
days	g/ha		------- kg	-------
5	0	0	9.1	3.9
	70	1.0	9.1	2.7
	140	0.8	9.2	3.4
	210	2.3	9.1	2.0
3	0	0	9.0	3.2
	70	0.5	9.2	2.9
	140	1.5	6.7	3.2
	210	1.8	6.7	2.7
1	0	0	9.1	2.5
	70	2.0	6.8	3.5
	140	2.0	8.6	3.3
	210	1.8	6.5	2.9

[1] Phytotoxicity; visual evaluation, 0 = no injury, 10 = all plants dead.

[2] Biomass - kg/1.5 m of bed by 2 beds, mean of four replications. CHEMU = nettleleaf goosefoot.

[3] Replant interval is days after herbicide treatment until crop sowing, beds were rototilled to 5 cm inches deep before sowing.

Broadleaf weed control in spring wheat. Traci A. Brammer, Curtis R. Thompson, and Donald C. Thill. An experiment was established near Moscow, Idaho to evaluate gel and emulsifiable concentrate (EC) formulations of bromoxynil and bromoxynil + MCPA, a sulfonylurea herbicide CGA-152005, and F-8426 a postemergence herbicide in 'Penewawa' spring wheat. Herbicides were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/A at 38 psi to 4-5 leaf wheat, 1 to 2 in. redroot pigweed (AMARE), 1 to 2 in. common lambsquarters (CHEAL), 0.5 to 1 in. mayweed chamomile (ANTCO) and 0.5 to 1 in. henbit (LAMAM) on June 18 (Table 1). Weed densities were counted within two 1 ft^2 areas within each control plot on June 18. Plots were 10 by 30 ft and arranged in a randomized complete block and replicated four times. Weed control and injury were evaluated visually on July 29. Wheat was harvested from a 4.5 by 27 ft area of each plot for grain yield on September 22.

Table 1. Application and soil analysis data.

Application date		June 18
Temperature (F)		64
Soil temperature at 2 in. (F)		62
Relative humidity (%)		70
Wind speed (mph - direction)		0.5 - S
Soil	pH	5.1
	OM (%)	4.1
	CEC (meg/100g soil)	21.3
	Texture	silt loam

All treatments controlled redroot pigweed 85% or greater and common lambsquarters 89% or greater (Table 2). All treatments controlled mayweed chamomile 97% or greater except F-8426, F-8426 + R-11, and F-8426 + 2,4-D amine which controlled mayweed chamomile 52, 75, and 54%, respectively. Henbit control was 90% or greater except with F-8426, F-8426 + R-11, and F-8426 + 2,4-D amine treatments which controlled henbit 85, 80, and 70%, respectively. Bromoxynil and bromoxynil-MCPA EC formulation treatments injured wheat 10 to 18% while gel formulation injured wheat 6 to 8%. Wheat grain yield was not different likely due to variability in crop density among plots (the crop was seeded late due to very wet spring), weed control and injury. (Agricultural Experiment Station, Moscow, Idaho 83844)

Integrating herbicide and tillage to manage jointed goatgrass densities in summer fallow of a wheat-fallow rotation. Troy M. Price, John O. Evans, and Steven A. Dewey. Tillage operations representing the dominant tillage regimes in Utah were initiated in 30 ft wide strips in a field heavily infested with jointed goatgrass. Fall and spring primary tillage were complimented with superimposed spring and summer secondary tillage operations in several combinations. Clomazone was applied at 0.38 and 0.5 lb/A on November 18, 1992 in 36 ft wide strips perpendicular to the tillages creating plots 30 by 36 ft with 4 replications. Glyphosate plus 2,4-D was applied to equal sized plots on May 17 at 0.38 plus 0.62 lb/A respectively, as a single treatment and also as half dosages at 10 day intervals. Jointed goatgrass populations were counted in four separate 81 cm^2 quadrants randomly selected within each plot.

The interaction of tillage with herbicides on jointed goatgrass populations in the early summer fallow plant community demonstrated that non-tilled plots contained greater numbers of jointed goatgrass seedlings particularly where herbicides were not applied. Foliar applications of glyphosate plus 2,4-D were superior to preemergence treatments of clomazone when tillage was omitted but they were equal in jointed goatgrass control when integrated with either conservation or conventional tillage. The most promising combination of tillage and herbicides was a single application of glyphosate plus 2,4-D in combination with any of the three conventional tillage regimes. A single application of glyphosate plus 2,4-D at the dosages examined was equal to applying one-half the dosage at each of two intervals, 10 days apart.

Table. Jointed goatgrass stands in early summer fallow following combinations of herbicide and tillage practices in wheat-fallow rotation.

Tillage Practice	Jointed Goatgrass Seedlings				
	Clo[a] 0.38 lb/A	Clo 0.5 lb/A	Gly[a]+2,4-D 40 oz/A	Gly+2,4-D 40 oz/A split	Control
	no. m^{-2}				
No-tillage					
Non-tilled	798	585	6	15	985
Conservation tillage					
Chisel plow (F[b]) Skewtreader (Sp[b])	81	39	6	24	89
Subsoiler (F) Skewtreader (Sp)	31	20	3	15	50
Conventional tillage					
Chisel plow (F) Rodweeder (Su[b])	9	7	0	2	12
Chisel plow (Sp) Rodweeder (Su)	11	5	1	0	7
Subsoiler (F) Rodweeder (Su)	9	10	2	1	13
LSD @ 0.05	15.5				

[a]Clo = Clomazone, Gly = Glyphosate.
[b]F = Fall 1992, Sp = Spring 1993, Su = Summer 1993.

Table 2. Broadleaf weed control in spring wheat with various herbicide tankmixes

Treatment[1]	Rate	Wheat yield	Wheat injury	AMARE	CHEAL	ANTCO	LAMAM
	lb/A	bu/A	-- % --				
Control	--	45	--	--	--	--	--
Bromoxynil-MCPA EC	0.75	36	18	91	99	99	97
Bromoxynil-MCPA Gel	0.75	42	8	89	99	99	98
Thifensulfuron-tribenuron+ R-11	0.016 0.25%	45	3	98	98	97	95
Bromoxynil EC+ thifensulfuron-tribenuron+ R-11	0.187 0.016 0.25%	34	13	97	99	97	96
Bromoxynil Gel+ thifensulfuron-tribenuron+ R-11	0.187 0.016 0.25%	38	6	96	99	98	95
Bromoxynil EC+ thifensulfuron-tribenuron+ R-11	0.25 0.016 0.25%	44	10	99	99	97	98
Bromoxynil Gel+ thifensulfuron-tribenuron+ R-11	0.25 0.016 0.25%	41	6	93	99	98	97
Bromoxynil-MCPA EC+ thifensulfuron-tribenuron+ R-11	0.375 0.016 0.25%	44	10	99	99	99	97
Bromoxynil-MCPA Gel+ thifensulfuron-tribenuron+ R-11	0.375 0.016 0.25%	45	7	98	99	98	97
Bromoxynil-MCPA EC+ thifensulfuron-tribenuron+ R-11	0.5 0.016 0.25%	40	10	94	99	98	97
Bromoxynil-MCPA Gel+ thifensulfuron-tribenuron+ R-11	0.5 0.016 0.25%	43	6	98	99	98	97
MCPA ester+ thifensulfuron-tribenuron+ R-11	3.7 0.016 0.25%	42	6	95	99	98	98
F-8426	0.031	42	9	95	92	52	85
F-8426+ R-11	0.031 0.25%	42	5	94	98	75	80
F-8426+ 2,4-D amine	0.031 0.25	41	9	92	94	54	70
CGA-152005+ R-11	0.016 0.25%	49	3	86	89	99	94
CGA-152005+ R-11	0.027 0.25%	46	5	85	90	99	90
$LSD_{(0.05)}$		10	8	10	6	21	8
Density (plants/ft^2)				4	1	1	1

[1] R-11 non-ionic surfactant applied at 0.25% v/v; bromoxynil-MCPA Gel is a a 4EC gel formulation; bromoxynil Gel is a 5EC gel formulation.

Italian ryegrass control in winter wheat with pre- and post-emergence herbicide treatments. Carol A. Mallory-Smith, Curtis R. Thompson, and Donald C. Thill. Italian ryegrass (LOLMU) is becoming a more prevalent weed in Northern Idaho with some fields containing diclofop resistant biotypes; therefore, two studies were established near Potlatch, ID, to evaluate herbicide treatments for control of Italian ryegrass in winter wheat. Plots were 8 by 30 ft. with four replications arranged in a randomized complete block design. Herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 20 and 10 gpa for pre- and post-emergence treatments, respectively. Study 1 was planted to 'Madsen' winter wheat September 28 and pre-emergence treatments were applied September 29, 1992 (Table 1). Study 2 was planted to 'Daws' winter wheat on September 29 and pre-emergence treatments were applied September 30. Triallate was incorporated in perpendicular directions to a depth of 1 in. with a harrow immediately after application. Post-emergence fall treatments were applied to 1 to 3 lf wheat and Italian ryegrass on October 15. Post-emergence spring treatments were applied to 5 to 6 lf wheat and ryegrass April 16, 1993. Visual evaluations of Italian ryegrass control were made on May 21 for Study 1 and June 15 for Study 2. Biomass samples were taken in Study 1 on May 25 and June 24. Wheat was not harvested.

Table 1. Application and soil data.

	STUDY 1				STUDY 2			
Application date	9/29/92	9/29/92	10/15/92	4/16/93	9/30/92	9/30/92	10/15/92	4/16/93
Application timing[1]	POPI	PRE	1 to 3 lf	5 to 6 lf	POPI	PRE	1 to 3 lf	5 to 6 lf
Air temp. (F)	74	62	50	61	42	48	46	64
Soil temp. @ 2 in. (F)	70	68	52	54	54	54	52	56
Relative humidity (%)	45	64	55	66	85	48	52	65
Wind velocity (mph)	3	1	2	2	1	1	1	3
Variety	Madsen				Daws			
Soil pH	6.0				5.5			
OM (%)	3.1				3.0			
CEC	14.0				15.6			
Texture	silt loam				silt loam			

[1] POPI = post plant incorporated; PRE = pre-emergence; 1 to 3 lf = growth stage of wheat and ryegrass; 5 to 6 lf = growth stage of wheat and ryegrass.

In Study 1, pre-emergence applications of triasulfuron or chlorsulfuron controlled 90% or more of the Italian ryegrass and UCC C-4243 at 0.125 lb/A controlled 86% (Table 2). None of the other pre-emergence treatments provided acceptable control. Triasulfuron or chlorsulfuron tank-mixed with metribuzin controlled Italian ryegrass 90% or more when applied at the 1 to 3 lf stage. At the 5 to 6 lf stage, diclofop and metribuzin at 0.38 lb/A controlled more than 90% of the Italian ryegrass. In Study 2, Italian ryegrass control with pre-emergence treatments of diclofop, triasulfuron, and chlorsulfuron was 94, 88, and 91%, respectively. Italian ryegrass control was unacceptable with all of the treatments applied at the 1 to 3 lf stage. At the 5 to 6 lf stage, Italian ryegrass was controlled 88% with diuron, and 98 and 100% with diclofop at 1.0 and 3.0 lb/A, respectively.

On May 25, Italian ryegrass biomass was less for all treatments except triallate, UCC C-4243 at 0.06 lb/A, metribuzin applied at the 1 to 3 lf stage, and metribuzin tank-mixed with thifensulfuron-tribenuron (Table 3). Wheat biomass in the triasulfuron and diuron applied at the 1 to 3 lf stage treatments was greater than in the untreated check. On June 24, Italian ryegrass biomass was less for all treatments except triallate, metribuzin applied at the 1 to 3 lf stage, metribuzin tank-mixed with thifensulfuron-tribenuron, and diuron applied at the 5 to 6 lf stage. There was no difference in wheat biomass among treatments or when compared to the untreated check. (Idaho Agricultural Experiment Station, Moscow, ID 83843).

Table 2. Control of Italian ryegrass in winter wheat.

Treatment[1]	Rate	App.[2] time	Study 1	Study 2
			LOLMU	
	lb/A		-----------% control-----------	
Triallate	1.0	POPI	10	6
Triallate	1.25	POPI	13	26
UCC C-4243	0.06	PRE	39	10
UCC C-4243	0.09	PRE	71	49
UCC C-4243	0.125	PRE	86	80
Diclofop	1.0	PRE	75	94
Triasulfuron	0.0268	PRE	90	88
Chlorsulfuron	0.0268	PRE	94	91
Metribuzin	0.125	1 to 3 lf	4	6
Metribuzin +	0.125	1 to 3 lf	90	75
triasulfuron +	0.018			
R-11	0.25%			
Metribuzin +	0.125	1 to 3 lf	92	82
chlorsulfuron +	0.018			
R-11	0.25%			
Metribuzin +	0.125	1 to 3 lf	9	5
thifensulfuron-				
tribenuron +	0.031			
R-11	0.25%			
Diuron	1.2	1 to 3 lf	83	71
Diclofop	1.0	5 to 6 lf	98	98
Diclofop	3.0	5 to 6 lf	99	100
Metribuzin	0.25	5 to 6 lf	85	82
Metribuzin	0.38	5 to 6 lf	93	85
Diruon	1.2	5 to 6 lf	76	88
Check	----		---	---
LSD(0.05)			10	16

[1] R-11 is a nonionic surfactant added at 0.25% v/v.
[2] App. = Application; POPI = post plant incorporated; PRE = pre-emergence; 1 to 3 lf = growth stage of wheat and ryegrass; 5 to 6 lf = growth stage of wheat and ryegrass.

Table 3. Effect of herbicide treatments on Italian ryegrass and wheat biomass.

Treatment[1]	Rate	App.[2] time	Biomass May 25, 1993 LOLMU	Biomass May 25, 1993 WHEAT	Biomass June 24, 1993 LOLMU	Biomass June 24, 1993 WHEAT
	lb/A		-------------------g/0.1 m²-------------------			
Triallate	1.0	POPI	23	12	36	45
Triallate	1.25	POPI	24	26	48	37
UCC C-4243	0.06	PRE	32	18	31	59
UCC C-4243	0.09	PRE	15	23	26	56
UCC C-4243	0.125	PRE	9	30	11	70
Diclofop	1.0	PRE	6	27	12	85
Triasulfuron	0.0268	PRE	9	38	18	78
Chlorsulfuron	0.0268	PRE	3	35	5	72
Metribuzin	0.125	1 to 3 lf	30	16	58	50
Metribuzin +	0.125	1 to 3 lf	3	28	11	81
triasulfuron +	0.018					
R-11	0.25%					
Metribuzin +	0.125	1 to 3 lf	3	25	6	43
chlorsulfuron +	0.018					
R-11	0.25%					
Metribuzin +	0.125	1 to 3 lf	29	17	39	62
thifensulfuron-						
tribenuron +	0.031					
R-11	0.25%					
Diuron	1.2	1 to 3 lf	15	38	31	34
Diclofop	1.0	5 to 6 lf	1	33	3	63
Diclofop	3.0	5 to 6 lf	0	28	0	38
Metribuzin	0.25	5 to 6 lf	9	24	24	48
Metribuzin	0.38	5 to 6 lf	8	31	16	77
Diuron	1.2	5 to 6 lf	16	15	45	77
Check	----		30	21	52	31
LSD(0.05)			11	14	20	NS

[1] R-11 is a nonionic surfactant added at 0.25% v/v.
[2] App. = application; POPI = post plant incorporated; PRE = pre-emergence; 1 to 3 lf = growth stage of wheat and ryegrass; 5 to 6 lf = growth stage of wheat and ryegrass.

UCC4243 time of application in winter wheat. Kathryn A. Hamilton, Curtis R. Thompson, and Donald C. Thill. An experiment was established in the fall of 1992 near Viola, Idaho, to determine the optimum time for UCC4243 application in winter wheat. 'Cashup' winter wheat was seeded on September 20 into burned wheat stubble. The study was arranged as a randomized complete block design, replicated four times with 8 x 30 ft plots. Herbicides were applied with a pressurized CO_2 backpack sprayer calibrated to deliver 20 gal/A at 40 psi for pre-emergence treatments, or 10 gal/A at 38 psi for postemergence treatments. UCC4243 was applied to spike to 1 inch winter wheat on September 28, 1 to 1.5 leaf wheat on October 2, and 2.8 to 3 leaf wheat on October 15 (Table 1). An untreated control treatment and a spring applied thifensulfuron-tribenuron + bromoxynil + R11 treatment were included for comparison. The spring treatment was applied to 5.5 to 6 leaf wheat on April 16, 1993. Plots were evaluated on June 10, 1993 for control of cornflower (CENCY), annual brome species (BROMUS), wild buckwheat (POLCO) and field pennycress (THLAR). Wheat grain was harvested from a 4.5 by 27 feet area on August 6.

Table 1. Application and soil analysis data.

Application timing (wheat)	Pre	Spike-1 in.	1-1.5 lf	2.8-3 lf	5.5-6 lf[1]
CENCY growth stage	-	-	-	coty[2] -2 in.	4-6 in.
BROMUS growth stage	-	-	-	-	till[3] 5-6 in.
Air temperature (F)	62	72	83	48	58
Soil temperature (F)	68	72	78	46	54
Relative humidity (%)	72	45	46	55	65
Wind speed (mph)-direction	2,W	2,S	4,W	3,S	2,SE
Soil moisture condition	good	good	good	good	wet
pH	5.4				
OM (%)	3.2				
CEC (meq/100g soil)	21.0				
Texture	loam				

[1] lf is an abbreviation for leaf.
[2] coty. is an abbreviation for cotyledon.
[3] till. is an abbreviation for tiller.

Wheat treated with UCC4243 (0.045 and 0.015 lb/A) at the 1 to 2 leaf wheat yielded the least grain (Table 2). UCC4243 controlled field pennycress 72% or more regardless of the rate or application time. However, control of cornflower and wild buckwheat was variable and in most cases the UCC4243 was less effective than the thifensulfuron-tribenuron + bromoxynil spring treatment. None of the treatments effectively controlled brome. (Idaho Agricultural Experiment Station, Moscow, ID 83844)

Table 2. Effect of UCC4243 time of application on weed control in winter wheat.

Treatment	Rate	Time[1]	Yield	CENCY	BROMUS	POLCO	THLAR
	lb/a		bu/a	% control[2]			
Control	-	-	106	-	-	-	-
UCC4243	0.06	Pre	103	83	41	88	89
UCC4243	0.09	Pre	101	86	56	74	87
UCC4243	0.125	Pre	111	83	70	94	96
UCC4243	0.015	Spike	94	31	7	68	85
UCC4243	0.03	Spike	99	49	19	69	88
UCC4243	0.045	Spike	101	30	21	68	93
UCC4243	0.06	Spike	102	60	11	85	94
UCC4243	0.09	Spike	108	86	48	92	92
UCC4243	0.015	1-2 lf	86	26	6	65	83
UCC4243	0.03	1-2 lf	100	58	10	79	92
UCC4243	0.045	1-2 lf	82	60	11	86	89
UCC4243	0.06	1-2 lf	100	53	22	93	92
UCC4243	0.09	1-2 lf	105	92	43	98	97
UCC4243	0.015	3-4 lf	104	3	3	47	72
UCC4243	0.03	3-4 lf	107	26	5	70	87
UCC4243	0.045	3-4 lf	104	36	3	88	94
UCC4243	0.06	3-4 lf	102	53	1	78	91
UCC4243	0.09	3-4 lf	110	61	26	93	91
Thifensulfuron-[3]		Spring	105	94	0	97	95
tribenuron +	0.016						
bromoxynil +	0.25						
R11	0.25% [4]						
LSD (0.05)			13	45	24	29	15

[1] Time refers to herbicide application timing.
[2] visual estimations
[3] '-'between herbicides indicates a commercially formulated mixture of the herbicides.
[4] R-11 surfactant was applied at 0.25% v/v.

UCC4243 combinations for weed control in winter wheat. Michael J. Wille, Curtis R. Thompson, and Donald C. Thill. A study was established at the University of Idaho Plant Science Farm to determine the effectiveness of various combinations of UCC4243 for weed control in winter wheat. Plots were arranged as a randomized complete block with four replications and were seeded to 'Madsen' winter wheat on October 1, 1992. Each plot measured 8 ft by 30 ft. Herbicides were applied with a CO_2 pressurized backpack sprayer calibrated to deliver either 20 gpa at 40 psi and 3 mph for preplant incorporated (PPI) and postplant preemergence surface (POPES), or 10 gpa at 38 psi and 3 mph for postemergence (POST) treatments. Preplant incorporated treatments were applied on September 29 and incorporated twice with a spike-toothed harrow and postplant preemergence surface (POPES) treatments were applied on October 1. Postemergence treatments were applied on May 10 to 5 leaf winter wheat, 1 to 2.5 leaf wild oat (AVEFA), and 0.5 to 2 inch mayweed chamomile (ANTCO). Wild oat and mayweed chamomile densities were 20 to 50 and 30 to 40/ft^2, respectively, when postemergence treatments were applied (table 1). Wheat was not harvested.

Table 1. Application data and soil analysis

Application date	Sept.29	Oct. 1	May 10
Application timing	PPI	POPES	POST
Wheat leaf stage	-	-	5
Wild oat leaf stage	-	-	2-2.5
Air temperature (F)	82	86	50
Relative humidity (%)	40	38	95
Wind speed (mph, direction)	3,E	4,NW	1,W
Soil temperature (F)	74	72	62
pH		4.7	
Organic matter (%)		6.2	
CEC (meq/100g)		42.6	
Texture		silt loam	

UCC4243 at either 0.094 or 0.125 lb/A applied preplant incorporated or postplant preemergence surface, and thifensulfuron-tribenuron + bromoxynil did not control wild oat (Table 2). Average wild oat control with triallate was 75%. Diclofop at 1.0 lb/A alone or in combination controlled wild oat at least 86%. UCC4243 combined with triallate or diclofop did not increase wild oat control compared to triallate or diclofop alone.

Mayweed chamomile control with UCC4243 applied postplant preemergence surface (94%) was greater than UCC4243 applied preplant incorporated (82%). Mayweed chamomile control was not different between thifensulfuron-tribenuron (95%) and UCC4243 applied postplant preemergence surface. Diclofop or triallate combined with UCC4243 did not reduce mayweed chamomile control compared to UCC4243 applied alone. (Idaho Agricultural Experiment Station, Moscow, Idaho 83844)

Table 2. Effect of UCC4243 combinations on weed control in winter wheat

Treatment[1]	Rate	Application Timing[2]	AVEFA	ANTCO
	lb/A		----% control------	
Control				
Triallate	1.25	PPI	75	0
Triallate +	1.25	PPI	82	95
thifen-triben +	0.016	POST		
bromoxynil +	0.25	POST		
R-11	0.25% v/v	POST		
UCC4243	0.094	PPI	2	80
UCC4243	0.125	PPI	3	85
UCC4243 +	0.094	PPI	76	78
triallate	01.25	PPI		
UCC4243 +	0.125	PPI	61	83
triallate	1.25	PPI		
UCC4243 +	0.094	POPES	81	91
triallate	1.25	PPI		
UCC4243 +	0.125	POPES	75	94
triallate	1.25	PPI		
UCC4243	0.094	POPES	6	94
UCC4243	0.125	POPES	0	97
Thifen-triben +	0.016	POST	0	99
bromoxynil +	0.25	POST		
R-11	0.25% v/v	POST		
Diclofop	0.5	POST	76	0
Diclofop	1.0	POST	97	0
UCC4243 +	0.094	POPES	62	92
diclofop	0.5	POST		
UCC4243 +	0.094	POPES	86	90
diclofop	1.0	POST		
UCC4243 +	0.125	POPES	72	97
diclofop	0.5	POST		
UCC4243 +	0.125	POPES	91	96
diclofop	1.0	POST		
Diclofop +	1.0	POST	90	91
thifen-triben +	0.016	POST		
bromoxynil +	0.25	POST		
R-11	0.25% v/v	POST		
$LSD_{(0.05)}$			16	6
Plant density (plants/ft^2)			20-50	30-40

[1]thifen-triben = thifensulfuron-tribenuron; R-11, nonionic surfactant applied at 0.25% v/v

[2]PPI = preplant incorporated; POPES = postplant preemergence surface; POST = postemergence

UCC4243 tank mixtures with wild oat herbicides for weed control in winter wheat. Jeffery S. Brennan, Curtis R. Thompson, and Donald C. Thill. Field experiments were established in 'Madsen' winter wheat near Moscow and Potlatch, Idaho and in 'Hill 81' winter wheat near Plummer, Idaho to evaluate wheat and weed response to UCC4243 and wild oat herbicides. Plots were 10 by 30 feet and arranged as a randomized complete block with four replications. Herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 20 gpa preemergence (PRE) or 10 gpa postemergence (POST) at 3 mph and 40 or 38 psi, respectively (Table 1). Preemergence treatments were applied on October 1 and 2, 1992 and September 28, 1992 at Moscow, Potlatch, and Plummer, respectively. Postemergence treatments were applied on May 10, 1993 at Moscow to 5 leaf winter wheat, 1 to 2.5 leaf wild oat (AVEFA) and 1 to 2 inch mayweed chamomile (ANTCO). On May 11, 1993, postemergence treatments were applied at Potlatch to prejoint wheat, 0.5 to 2 inch mayweed chamomile, 1 to 2 inch tillered windgrass (APEIN), and 1 to 4 leaf Italian ryegrass (LOLMU), and May 13, 1993 at Plummer to 6 leaf winter wheat, 1 to 3 leaf wild oat, and 1 to 2 inch mayweed chamomile. Wheat injury and weed control were evaluated visually on July 10, May 27, and July 12, 1993 at Moscow, Potlatch, and Plummer, respectively. Wheat was harvested from a 4.5 by 27 ft area on August 25, 1993 at Potlatch and September 3, 1993 at Plummer. Wheat was not harvested at the Moscow site due to poor wheat stand.

Table 1. Herbicide application and soil analysis data

Location	Moscow		Potlatch		Plummer	
Application timing	PRE	POST	PRE	POST	PRE	POST
Temperature (F)	86	60	78	64	70	62
Soil temperature at 2 in. (F)	74	64	66	68	64	56
Relative Humidity (%)	38	82	52	75	50	76
Wind speed (mph-direction)	4-NW	0	3-W	3-W	0	5-SW
Soil pH	4.7		5.2		4.8	
OM (%)	3.2		3.4		3.0	
CEC (meq/100g soil)	42.6		14.8		14.2	
Texture	silt loam		silt loam		silt loam	

UCC4243 applied alone or tank-mixed with wild oat herbicides injured wheat up to 58% and 3 to 10% at Potlatch and Plummer, respectively. Wheat yield was not affected. Wheat was not injured at Moscow. (Table 2 and 3). No treatment effectively controlled Italian ryegrass at Potlatch. Mayweed chamomile control was variable between sites with UCC4243 alone. Thifensulfuron-tribenuron controlled mayweed chamomile 84 to 99 percent across sites. UCC4243 alone controlled windgrass 95 to 99 percent and 68 to 99 percent when tank-mixed with diclofop or imazmethabenz. UCC4243 alone did not control wild oat. UCC4243 tank-mixed with a wild oat herbicide controlled wild oat 91 to 96 percent at Moscow and 71 to 87 percent at Plummer. The reduction in wild oat control at Plummer when UCC4243 was tank-mixed with wild oat herbicides may be an antagonistic response (observation only). Wheat yield did not consistantly reflect level of weed control at Potlatch and Plummer. (Idaho Agriculture Experiment Station, Moscow, Idaho 83844)

Table 2. UCC4243 tank mixtures with wild oat herbicides at Moscow and Potlatch, Idaho.

Treatment[1]	Rate	App.[2] timing	Moscow: Wheat Injury	Moscow: Control AVEFA	Moscow: Control ANTCO	Potlatch: Wheat Yield	Potlatch: Wheat Injury	Potlatch: Control APEIN	Potlatch: Control ANTCO	Potlatch: Control LOLMU
	lb/A		---------%---------			bu/A	------------%------------			
Control			0	--	--	48	0	--	--	--
UCC4243	0.09	PRE	0	0	93	61	0	99	98	25
UCC4243	0.13	PRE	0	3	97	53	0	95	99	25
UCC4243	0.05	POST	0	0	34	46	30	95	87	9
UCC4243	0.09	POST	0	0	63	51	46	99	99	25
Imazmeth +	0.47									
R-11	0.25%	POST	0	98	0	44	0	52	6	0
UCC4243 +	0.05 +									
Imazmeth +	0.47									
R-11	0.25%	POST	0	92	10	44	45	98	94	19
UCC4243 +	0.09 +									
imazmeth +	0.47									
R-11	0.25%	POST	0	91	25	43	58	99	99	23
Diclofop	1.0	POST	0	74	25	49	0	0	0	23
UCC4243 +	0.05									
diclofop	1.0	POST	0	95	1	47	49	96	94	21
UCC4243 +	0.09 +									
diclofop	1.0	POST	0	96	98	46	0	68	99	10
Diclofop +	1.0									
thifen-										
triben +	0.02									
bromo + R-11	0.25 + 0.25%	POST	0	96	98	52	0	58	99	10
Thif-triben +	0.02 +									
bromo +	0.25 +									
R-11	0.25%	POST	0	0	98	48	0	58	99	10
Weed density (plants/ft^2)			--	15	33	--	--	5	30	15
$LSD_{(0.05)}$			--	20	30	9	7	16	9	27

[1]UCC4243 is a 50 WP formulation, imazmeth = imazmethabenz, R-11 a nonionic surfactant from Wilbur Ellis applied at 0.25% v/v, thif-triben is a commercial formulation of thifensulfuron-tribenuron, bromo = bromoxynil.
[2]App. = application, PRE = preemergence, POST = postemergence.

Table 3. UCC4243 tank mixtures with wild oat herbicides at Plummer, Idaho

Treatment[1]	Rate	App.[2] timing	Wheat Yield	Wheat Injury	Control AVEFA	Control ANTCO
	lb/A		bu/A	-----------%------------		
Control			31	0	--	--
UCC4243	0.09	PRE	35	0	0	60
UCC4243	0.13	PRE	41	3	3	89
UCC4243	0.05	POST	30	0	6	66
UCC4243	0.09	POST	35	3	11	88
Imazmeth +	0.47					
R-11	0.25%	POST	41	0	94	14
UCC4243 +	0.05 +					
Imazmeth +	0.47					
R-11	0.25%	POST	33	5	78	60
UCC4243 +	0.09 +					
imazmeth +	0.47					
R-11	0.25%	POST	35	10	87	88
Diclofop	1.0	POST	34	0	98	0
UCC4243 +	0.05					
diclofop	1.0	POST	28	8	80	61
UCC4243 +	0.09 +					
diclofop	1.0	POST	32	5	71	84
Diclofop +	1.0					
thifen-						
triben +	0.02					
bromo + R-11	0.25 + 0.25%	POST	46	0	95	98
Thif-triben +	0.02 +					
bromo +	0.25 +					
R-11	0.25%	POST	31	0	0	99
Weed Density (plants/ft^2)			--	--	6	6
$LSD_{(0.05)}$			13	8	11	24

[1]UCC4243 is a 50 WP formulation, imazmeth = imazmethabenz, R-11 a nonionic surfactant applied at 0.25% v/v, thif-triben is a commercial formulation of thifensulfuron-tribenuron, bromo = bromoxynil.
[2]App. = application, PRE = preemergence, POST = postemergence.

Broadleaf weed control in winter wheat with dicamba tank mixtures. Jeffery S. Brennan, Curtis R. Thompson, and Donald C. Thill. Experiments were established in winter wheat at two sites near Potlatch, Idaho to evaluate weed response to herbicide tank-mixes containing the soluble granular formulation (SFG) of dicamba. Plots were 10 by 30 feet and herbicide treatments were arranged as a randomized complete block with four replications. 'Madsen' winter wheat was planted at both sites. Herbicides were applied April 27 to 6 to 7 leaf wheat, cotyledon to 1.5 inch mayweed chamomile (ANTCO) and 0.5 to 2 inch shepherdspurse (CAPBP) at site 1 and April 22 to 5 leaf wheat, cotyledon to 1.5 inch field pennycress (THLAR) and mayweed chamomile, and cotyledon to 1 inch wild buckwheat (POLCO) at site 2 (Table 1). All treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gal/A at 38 psi and 3 mph. Weed control was evaluated visually June 10 at both sites. Winter wheat was combine harvested at site 1 on August 20 from a 5 by 27 ft area and site 2 on August 25 from a 4.5 by 27 ft area.

Table 1. Herbicide application and soil analysis data

Location	Site 1	Site 2
Application date	April 27	April 22
Air temperature (F)	42	48
Soil temperature at 2 in. (F)	52	42
Relative humidity (%)	87	86
Wind speed (mph-direction)	2-NW	0
Soil pH	5.3	5.4
OM (%)	2.6	3.9
CEC (meq/100g soil)	12.8	17.7
Texture	silt loam	silt loam

Shepherdspurse and mayweed chamomile control was 91% or greater at site 1 (Table 2). Mayweed chamomile, field pennycress, and wild buckwheat control at site 2 ranged from 84 to 99% when dicamba was tank-mixed with thifensulfuron-tribenuron or tribenuron. In contrast, weed control with dicamba + 2,4-D was no greater than 72%. Mayweed chamomile control at site 2 with dicamba + MCPA was 79%. Mayweed chamomile and wild buckwheat control with tribenuron + R-11 was no greater than 79 and 62%, respectively. Wheat yields were not different for the control at either site and wheat yield was greater with thifensulfuron-tribenuron at 0.023 lb/A and tribenuron at 0.006 lb/A at site 2. (Idaho Agriculture Experiment Station, Moscow, Idaho 83844)

Table 2. Broadleaf herbicides applied to winter wheat near Potlatch, Idaho.

		Site 1			Site 2			
		Wheat	Control		Wheat	Control		
Treatment[1]	Rate	yield	CAPBP	ANTCO	yield	THLAR	ANTCO	POLCO
	lb/A	bu/A	----- % -----		bu/A	---------- % ----------		
Control		107	--	--	120	--	--	--
Dicamba + 2,4-D	0.13 + 0.38	106	99	96	121	72	59	70
Dicamba + MCPA	0.13 + 0.38	93	99	91	125	94	79	91
Dicamba + thifensulfuron-tribenuron + R-11	0.13 + 0.012 + 0.25%	106	99	99	124	97	92	84
Dicamba + thifensulfuron-tribenuron + R-11	0.13 + 0.023 + 0.25%	111	99	99	125	99	96	96
Dicamba + tribenuron + R-11	0.13 + 0.006 + 0.25%	111	99	99	129	98	96	97
Dicamba + tribenuron + R-11	0.13 + 0.012 + 0.25%	102	99	99	126	98	93	96
Thifensulfuron tribenuron + R-11	0.012 + 0.25%	106	99	99	129	99	94	95
Thifensulfuron-tribenuron + R-11	0.023 + 0.25%	106	99	99	133	99	96	85
Tribenuron + R-11	0.006 + 0.25%	98	99	99	132	86	78	54
Tribenuron + R-11	0.012 + 0.25%	102	99	99	123	92	79	62
Weed density (plants/ft^2)		---	3	10	---	2	3	1
LSD $_{(0.05)}$		14	1	4	11	23	24	28

[1]Dicamba applied as SGF formulation, 2,4-D and MCPA as the amine formulation, R-11 a nonionic surfactant from Wilbur Ellis applied at 0.25% v/v, and thifensulfuron-tribenuron a commercial formulation.

Control of catchweed bedstraw in winter wheat. Bill D. Brewster and William S. Donaldson. A trial was conducted in a wheat field in Marion County, OR, to evaluate the control of catchweed bedstraw in winter wheat. The trial design was a randomized complete block with four replications and 8 by 25 ft plots. Herbicide treatments were applied on December 15, 1992, with a compressed-air single-wheel sprayer which delivered a broadcast spray of 20 gpa at 15 psi. The wheat was in the 3- to 4-leaf stage of growth, and the catchweed bedstraw was in the cotyledon stage to 4 inches in diameter.

Control of catchweed bedstraw with F-8426 was superior to bromoxynil plus thifensulfuron-tribenuron (see table). Although bromoxynil plus thifensulfuron-tribenuron provided some suppression of the bedstraw during the winter months, the bedstraw had completely recovered by late spring. The wheat injury caused by F-8426 was outgrown within 6 wks after the treatment was applied, and the reduced interference from the bedstraw led to an increase in wheat grain yield. (Dept. of Crop and Soil Science, Oregon State Univ., Corvallis, OR 97331-3002).

Table. Catchweed bedstraw control and wheat injury and yield following herbicide applications, Marion County, OR, 1992-93.

Herbicide[1]	Rate	GALAP[2] control		Wheat[2]		
				Injury		Yield
	(lb/A)	(%)				(Bu/A)
F-8426	0.031	100	100	13	0	100
bromoxynil + thifensulfuron-tribenuron	0.25 + 0.031	0	0	0	0	75
Check	0	0	0	0	0	74
					LSD(05)	19

[1] Treatments applied December 15, 1992. A non-ionic surfactant was added to the bromoxynil + thifensulfuron-tribenuron treatment at 0.25% v/v.

[2] First visual evaluation December 28, 1992; second evaluation June 11, 1993; plots harvested August 9, 1993.

Effect of fly ash on herbicide performance. Bill D. Brewster, William S. Donaldson, and Susan Aldrich-Markham. A trial was conducted at the Hyslop Agronomy Farm, Corvallis, OR to evaluate the effect of industrial fly ash on herbicide performance. Fly ash is being applied at a typical rate of 25 dry T/A to fields in the Willamette Valley as a lime substitute and as a means of disposing of a waste product. The soil was a Woodburn silt loam with 3.0% OM and 6.1 pH. Herbicide treatment subplots were 8 by 20 ft with four replications in a split block arrangement, and main plots were fly ash rates of 0, 25, and 50 T/A in 6-ft-wide strips across the subplots. The fly ash was incorporated into the soil to a depth of 6 inches with a rototiller. After incorporation of 25 T/A of fly ash, the soil organic matter was 3.2% and the pH was 6.3. After application of 50 T/A of fly ash, the values were 3.1% and 6.5 respectively.

The herbicide treatments were applied with a single-wheel, compressed-air sprayer which delivered 20 gpa at 15 psi as a broadcast spray. The soil incorporated treatments were applied on October 13, 1992. EPTC was incorporated into the soil to a depth of 3 inches with a rototiller, while triallate and diclofop-methyl were incorporated by raking the soil surface twice at right angles with a garden rake. The postemergence treatments were applied to 1-leaf stage Italian ryegrass on November 2, 1992, under muddy soil conditions.

Control of Italian ryegrass was much greater with all herbicides when no fly ash was applied; while the level of control with the two rates of fly ash was about equal (see table). (Dept. of Crop and Soil Science, Oregon State Univ., Corvallis, OR 97331-3002)

Table. Effect of 0, 25, and 50 T/A of fly ash on control of Italian ryegrass with herbicides.

Treatment[2]	Rate[3]	Timing[1]	Italian ryegrass control[4]		
			No ash	25 T/A	50 T/A
	(lb/A)		(%)		
EPTC	3.0	PEI	83	13	8
Triallate	1.25	PEI	80	18	8
Diclofop-methyl	1.0	PEI	95	38	20
Pronamide	0.75	POE	86	40	30
Diuron	1.6	POE	91	68	63
Metribuzin	0.14	POE	93	60	55
Chlor-mets	0.023	POE	96	63	50
Check			0	0	0

[1] Preemergence incorporated treatments applied October 13, 1992; postemergence treatments applied November 2, 1992.
[2] Chlor-mets = chlorsulfuron plus metsulfuron.
[3] Preemergence incorporated treatments (PEI) applied October 13, 1992; postemergence treatments (POE) applied November 2, 1992.
[4] Italian ryegrass control evaluated visually on December 10, 1992.

PROJECT IV

EXTENSION, EDUCATION AND REGULATORY

Phil Peterson - Project Chairperson

Newly reported weed species; potential weed problems in Idaho. Robert H. Callihan, Timothy W. Miller and Sherri L. Carson. The occurrence and distribution of weed species is a dynamic phenomenon. Weed science works within a framework of ecological plant geography. Few programs devote resources to systematically surveying weed floras or documenting changes in weed species distributions. The distribution of weed species submitted from all sources for identification by weed science diagnostic personnel, and of weed species otherwise called to our attention, were examined to discover recent changes in distributions. As in previous years the distribution was categorized into three groups. No species were found to be new to the Pacific Northwest (Idaho, Oregon and Washington) in 1993. Two species were found to be new records for Idaho in 1993. Extensions of the ranges of several species that have been present in Idaho for several years were also recorded. Nineteen species, including the two species new to Idaho, were found to be new records for individual counties in 1993. As this diagnostic service continues to build the data base, as extension weed identification programs increase, and as county staff and consultants gain in diagnostic ability, fewer questions are submitted, and fewer unrecorded specied are reported. This is considered to be a measure of successful state and county extension programs. These new records document the reporting and verification of the presence of these species, not necessarily their time of entry into the state or county. Not all are recognized weeds; some are native to the continent, region, state or district; others are simply escaped ornamentals or crops; none are native to the location reported. The reporting period for these data was November 1, 1992 to November 30, 1993. The following lists cite the scientific name, Bayer code (when available), Weed Science Society of America common name (or common name from other references when WSSA common name is not available), family name and location(s) of each new record. Additional data are maintained on permanent file. (Idaho Agricultural Experiment Station, University of Idaho, Moscow, Idaho, 83844)

GROUP I: New regional records: species not previously documented for Idaho, nor currently listed in Flora of the Pacific Northwest (new regional as well as state and county records).

None reported.

GROUP II: New state records: species not previously documented for Idaho, although currently listed in Flora of the Pacific Northwest (new state as well as county records).

1. *Malva sylvestris* L. (MALSI) high mallow; Malvaceae.
   County: Minidoka.

2. *Rorippa austriaca* (Crantz)Bess. (RORAU) Austrian fieldcress; Brassicaceae.
   County: Minidoka.

GROUP III: New county records: species not previously reported in the county listed, although previously reported in one or more counties in Idaho.

1. *Ambrosia acanthicarpa* Hook. (FRSAC) annual bursage; Asteraceae.
   County: Washington.

2. *Bryonia alba* L. (BYOAL) white bryony; Cucurbitaceae.
   County: Kootenai, Bannock.

3. *Cenchrus longispinus* (Hack.) Fern. (CCHPA) longspine sandbur; Poaceae.
   County: Idaho.

4. *Centaurea maculosa* Lam. (CENMA) spotted knapweed; Asteraceae.
   County: Minidoka.

5. *Chondrilla juncea* L. (CHOJU) rush skeletonweed; Asteraceae.
   County: Latah.

6. *Crepis capillaris* (L.) Wallr. (CVPCA) smooth hawksbeard; Asteraceae.
   County: Bonner, Boundary.

7. *Galeopsis tetrahit* L. (GAETE) common hempnettle; Lamiaceae.
   County: Latah.

8. *Hieracium aurantiacum* L. (HIEAU) orange hawkweed; Asteraceae.
   County: Lewis.

9. *Lapsana communis* L. (LAPCO) nipplewort; Asteraceae.
   County: Idaho.

10. *Matricaria perforata* Merat (MATIN) scentless chamomile; Asteraceae.
    County: Power.

11. *Myriophyllum spicatum exalbescens* (Fern.) Jeps. (*) common water-milfoil; Haloragaceae.
    County: Latah.

12. *Phragmites australis* (Cav.) Trin. ex Steud. (PHRCO) common reed; Poaceae.
    County: Latah.

13. *Ranunculus sceleratus multifidus* Nutt. (*) celeryleaved crowfoot; Ranunculaceae.
    County: Fremont.

14. *Rumex venosus* Pursh (RUMVE) veiny dock; Polygonaceae.
    County: Bonneville.

15. *Silene alba* (Mill.) E.H.L.Krause (MELAL) white campion; Caryophyllaceae.
    County: Ada.

16. *Torilis arvensis* (Huds.) Link (TOIAR) hedgeparsley; Apiaceae.
    County: Clearwater.

17. *Xanthium spinosum* L. (XANSP) spiny cocklebur; Asteraceae.
    County: Twin Falls.

(*) No Bayer Code listed in WSSA Composite List of Weeds.

1993 weed identifications for county extension and weed control programs in Idaho. Robert H. Callihan, Timothy W. Miller and Sherri L. Carson. The extension weed identification program at the University of Idaho provides a service to those desiring authoritative identifications on plant specimens. The reasons people submit specimens vary from mild curiosity to a bona fide need by a property manager to control a species that is unknown. The data generated in this program are useful in determining educational needs as well as documenting changes in the Idaho weed flora. Information obtained in this program enable: (1) compiling of weed species present in Idaho, (2) determining distribution of weeds, (3) recording weed dispersal into new areas, (4) detecting new alien species (5) recognizing the season(s) that particular weed identification problems arise, (6) identifying education deficiencies to assist in planning programs for extension and regulatory personnel on weed identification, and (7) compiling of an available historical data base. This report serves the important function of advising research, extension, and regulatory personnel in Idaho, as well as other states, of weed distributions in Idaho that may significantly affect those states.

A total of 357 plants were submitted for identification or verification in the reporting period November 1, 1992 to November 30, 1993. Three hundred thirty-three of these were from the state of Idaho, with twenty-four submitted from other Pacific Northwest states. Two hundred thirteen of these data (listed below) are from identification requests submitted to weed identification personnel by county extension agents and county weed superintendents in the state of Idaho; one hundred fifty-nine were from other sources. This list indicates species of interest that warrant development of educational material and instruction. In addition, many samples are submitted because of unusual circumstances (novelty, growth stage, specimen condition or specimen inadequacy) that call for specialist capabilities. Many of these are native species, some are crops, and some are ornamentals submitted by homeowners for curiosity rather than weed concerns. (Idaho Agricultural Experiment Station, University of Idaho, Moscow, Idaho, 83844).

Identification	County	Date
Achillea millefolium, Asteraceae	Idaho	04/14/93
Acroptilon repens, Asteraceae	Boundary	06/28/93
Adonis annua, Ranunculaceae	Bear Lake	06/30/93
Agoseris aurantiaca, Asteraceae	Shoshone	10/07/93
Agoseris grandiflora, Asteraceae	Idaho	06/21/93
Agropyron spicatum, Poaceae	Ada	07/14/93
Agropyron spicatum, Poaceae	Idaho	08/04/93
Agropyron trichophorum, Poaceae	Lewis	06/21/93
Agropyron trichophorum, Poaceae	Bannock	08/02/93
Agropyron triticeum, Poaceae	Canyon	06/16/93
Amaranthus caudatus, Amaranthaceae	Twin Falls	09/03/93
Ambrosia acanthicarpa, Asteraceae	Washington	10/26/93
Ambrosia artemisiifolia, Asteraceae	Fremont	08/12/93
Amelanchier alnifolia, Rosaceae	Ada	08/02/93
Amelanchier alnifolia, Rosaceae	Canyon	08/27/93
Amorpha fruticosa, Fabaceae	Ada	07/01/93
Aquilegia formosa, Ranunculaceae	Ada	06/30/93
Arctium minus, Asteraceae	Bannock	08/31/93
Artemisia douglasiana, Asteraceae	Idaho	06/21/93
Asperugo procumbens, Boraginaceae	Latah	04/29/93
Barbarea orthoceras, Brassicaceae	Idaho	08/02/93
Berberis vulgaris, Berberidaceae	Latah	06/30/93
Brassica nigra, Brassicaceae	Minidoka	09/20/93
Brassica nigra, Brassicaceae	Cassia	09/20/93
Bromus inermis, Poaceae	Bannock	08/02/93
Bryonia alba, Cucurbitaceae	Kootenai	09/07/93
Bryonia alba, Cucurbitaceae	Bannock	09/15/93
Capsella bursa-pastoris, Brassicaceae	Lewis	04/07/93
Cardamine oligosperma, Brassicaceae	Kootenai	10/21/93
Cenchrus longispinus, Poaceae	Lewis	01/19/93
Cenchrus longispinus, Poaceae	Idaho	02/23/93
Centaurea cyanus, Asteraceae	Gem	10/22/93
Centaurea maculosa, Asteraceae	Minidoka	07/15/93
Cerastium dubium, Caryophyllaceae	Gem	05/10/93
Cercis occidentalis, Fabaceae	Kootenai	04/26/93
Cercocarpus ledifolius, Rosaceae	Bannock	10/05/93
Chenopodium capitatum, Chenopodiaceae	Nez Perce	09/02/93
Chondrilla juncea, Asteraceae	Latah	07/30/93
Chorispora tenella, Brassicaceae	Ada	06/07/93
Collomia linearis, Polemoniaceae	Teton	06/28/93
Conyza canadensis, Asteraceae	Lewis	01/19/93
Conyza canadensis, Asteraceae	Bonneville	08/31/93
Cordylanthus ramosus, Scrophulariaceae	Minidoka	10/04/93
Cordylanthus ramosus, Scrophulariaceae	Butte	10/14/93
Cordylanthus ramosus, Scrophulariaceae	Washington	10/26/93
Cornus baileyi, Cornaceae	Kootenai	08/23/93

Corydalis aurea, Fumariaceae	Boundary	05/11/93
Cotoneaster multiflorus, Rosaceae	Ada	10/25/93
Crepis acuminata acuminata, Asteraceae	Lincoln	06/07/93
Crepis acuminata acuminata, Asteraceae	Minidoka	06/11/93
Crepis capillaris, Asteraceae	Bonner	08/11/93
Crepis capillaris, Asteraceae	Boundary	08/11/93
Cydonia oblonga, Rosaceae	Idaho	11/15/93
Danthonia californica, Poaceae	Idaho	06/07/93
Danthonia californica, Poaceae	Idaho	06/16/93
Datura innoxia, Solanaceae	Ada	04/30/93
Dianthus armeria, Caryophyllaceae	Nez Perce	06/28/93
Dianthus armeria, Caryophyllaceae	Idaho	08/02/93
Distichlis stricta dentata, Poaceae	Canyon	06/17/93
Elaeagnus angustifolia, Elaeagnaceae	Kootenai	09/01/93
Elymus giganteus, Poaceae	Canyon	06/15/93
Elymus glaucus, Poaceae	Nez Perce	06/28/93
Elytrigia repens, Poaceae	Ada	06/21/93
Elytrigia repens, Poaceae	Latah	07/30/93
Epilobium paniculatum, Onagraceae	Fremont	07/15/93
Epilobium paniculatum, Onagraceae	Idaho	08/23/93
Epilobium paniculatum, Onagraceae	Kootenai	09/20/93
Equisetum arvense, Equisetaceae	Jerome	07/08/93
Eragrostis minor, Poaceae	Lewis	01/19/93
Eriogonum heracleoides, Polygonaceae	Franklin	06/30/93
Erodium cicutarium, Geraniaceae	Latah	05/11/93
Erodium cicutarium, Geraniaceae	Teton	10/20/93
Erysimum cheiranthoides, Brassicaceae	Boundary	05/06/93
Euphorbia myrsinites, Euphorbiaceae	Latah	05/10/93
Festuca scabrella, Poaceae	Lewis	06/14/93
Fritillaria pudica, Liliaceae	Minidoka	06/07/93
Fritillaria pudica, Liliaceae	Cassia	06/07/93
Gaillardia aristata, Asteraceae	Latah	06/30/93
Galium pedemontanum, Rubiaceae	Lewis	07/20/93
Gaura parviflora, Onagraceae	Nez Perce	07/09/93
Glechoma hederacea, Lamiaceae	Benewah	08/02/93
Glycyrrhiza lepidota, Fabaceae	Twin Falls	07/23/93
Hesperis matronalis, Brassicaceae	Idaho	07/01/93
Hieracium albertinum, Asteraceae	Shoshone	10/07/93
Hieracium albertinum, Asteraceae	Shoshone	10/07/93
Hieracium albiflorum, Asteraceae	Bonner	06/30/93
Hieracium albiflorum, Asteraceae	Shoshone	10/07/93
Hieracium albiflorum, Asteraceae	Shoshone	10/07/93
Hieracium aurantiacum, Asteraceae	Lewis	06/14/93
Hieracium pratense, Asteraceae	Latah	06/15/93
Hordeum vulgare, Poaceae	Lewis	04/05/93
Hydrophyllum capitatum, Hydrophyllaceae	Gem	04/26/93
Iva axillaris, Asteraceae	Washington	10/26/93
Iva xanthifolia, Asteraceae	Ada	09/13/93
Iva xanthifolia, Asteraceae	Boundary	09/29/93
Juglans nigra, Juglandaceae	Ada	06/01/93
Kochia scoparia, Chenopodiaceae	Lewis	01/19/93
Kochia scoparia, Chenopodiaceae	Canyon	06/16/93
Lactuca ludoviciana, Asteraceae	Idaho	10/12/93
Lamium purpureum, Lamiaceae	Latah	05/10/93
Lapsana communis, Asteraceae	Idaho	07/09/93
Lapsana communis, Asteraceae	Idaho	08/02/93
Lomatium ambiguum, Apiaceae	Lewis	05/17/93
Lomatium dissectum multifidum, Apiaceae	Latah	05/05/93
Lomatium dissectum, Apiaceae	Idaho	05/10/93
Lomatium grayi, Apiaceae	Latah	05/05/93
Lomatium triternatum, Apiaceae	Bannock	05/21/93
Lotus purshiana, Fabaceae	Clearwater	06/28/93
Lycium halimifolium, Solanaceae	Bonneville	06/07/93
Lycium halimifolium, Solanaceae	Twin Falls	08/16/93
Malva sylvestris, Malvaceae	Minidoka	09/08/93
Matricaria perforata, Asteraceae	Power	05/27/93
Matricaria perforata, Asteraceae	Blaine	09/29/93
Monotropa uniflora, Ericaceae	Benewah	08/02/93
Oenothera pallida pallida, Onagraceae	Minidoka	09/07/93
Ornithogalum umbellatum, Liliaceae	Payette	05/07/93
Oxalis corniculata, Oxalidaceae	Latah	06/16/93
Paeonia brownii, Paeoniaceae	Camas	06/21/93
Penstemon attenuatus attenuatus, Scrophulariaceae	Idaho	06/08/93
Penstemon perpulcher, Scrophulariaceae	Minidoka	06/11/93
Phacelia hastata leucophylla, Hydrophyllaceae	Franklin	06/30/93

Phacelia hastata leucophylla, Hydrophyllaceae	Benewah	08/02/93
Phacelia nemoralis, Hydrophyllaceae	Lewis	04/30/93
Physalis longifolia, Solanaceae	Ada	06/01/93
Poa annua, Poaceae	Ada	05/10/93
Poa annua, Poaceae	Kootenai	10/12/93
Poa compressa, Poaceae	Latah	07/22/93
Poa gracillima, Poaceae	Canyon	06/16/93
Polygonum amphibium, Polygonaceae	Fremont	08/12/93
Polygonum cupsidatum, Polygonaceae	Ada	07/06/93
Polygonum cuspidatum, Polygonaceae	Ada	07/06/93
Polygonum cuspidatum, Polygonaceae	Bonneville	08/16/93
Potentilla biennis, Rosaceae	Ada	06/11/93
Potentilla gracilis, Rosaceae	Valley	07/29/93
Potentilla recta, Rosaceae	Latah	06/16/93
Potentilla recta, Rosaceae	Idaho	06/16/93
Potentilla recta, Rosaceae	Lewis	08/02/93
Prunella vulgaris, Lamiaceae	Benewah	08/02/93
Ranunculus acriformis, Ranunculaceae	Idaho	06/02/93
Ranunculus alismaefolius alismellus, Ranunculaceae	Lewis	05/14/93
Ranunculus scleratus multifidus, Ranunculaceae	Fremont	06/21/93
Rhamnus cathartica, Rhamnaceae	Fremont	09/09/93
Rorippa austriaca, Brassicaceae	Minidoka	06/07/93
Rorippa islandica hispida, Brassicaceae	Fremont	06/21/93
Rosa rubiginosa, Rosaceae	Canyon	06/14/93
Rumex crispus, Polygonaceae	Benewah	05/27/93
Rumex venosus, Polygonaceae	Canyon	06/15/93
Rumex venosus, Polygonaceae	Bonneville	06/21/93
Salsola iberica, Chenopodiaceae	Lewis	01/19/93
Salsola iberica, Chenopodiaceae	Bonner	08/02/93
Sanguisorba minor, Rosaceae	Latah	06/11/93
Schoenocrambe linifolia, Brassicaceae	Butte	06/16/93
Senecio integerrimus exaltatus, Asteraceae	Bonner	06/16/93
Senecio integerrimus exaltatus, Asteraceae	Latah	06/16/93
Senecio integerrimus, Asteraceae	Shoshone	10/07/93
Senecio pseudaureus, Asteraceae	Shoshone	06/16/93
Setaria viridis, Poaceae	Lewis	01/19/93
Silene alba, Caryophyllaceae	Ada	07/01/93
Sitanion hystrix brevifolium, Poaceae	Franklin	07/20/93
Sium suave, Apiaceae	Camas	08/02/93
Smilacina stellata, Liliaceae	Ada	07/01/93
Solanum melanocercasum, Solanaceae	Ada	09/13/93
Solidago occidentalis, Asteraceae	Gem	07/16/93
Sonchus arvensis uliginosus, Asteraceae	Cassia	08/05/93
Spergularia rubra, Caryophyllaceae	Kootenai	08/17/96
Spergularia rubra, Caryophyllaceae	Kootenai	08/26/93
Stanleya pinnata, Brassicaceae	Twin Falls	06/14/93
Thlaspi arvense, Brassicaceae	Gem	05/10/93
Tilia americana, Tiliaceae	Ada	11/12/93
Torilis arvensis, Apiaceae	Clearwater	08/02/93
Trifolium arvense, Fabaceae	Idaho	06/28/93
Trifolium arvense, Fabaceae	Bonner	09/14/93
Trifolium aureum, Fabaceae	Lewis	08/02/93
Urtica dioica gracilis, Urticaceae	Kootenai	08/02/93
Ventenata dubia, Poaceae	Idaho	06/28/93
Verbascum blattaria, Scrophulariaceae	Ada	08/02/93
Veronica anagallis-aquatica, Scrophulariaceae	Minidoka	09/07/93
Veronica officinalis, Scrophulariaceae	Bonner	06/04/93
Veronica officinalis, Scrophulariaceae	Bonner	06/16/93
Xanthium spinosum, Asteraceae	Idaho	06/04/93
Xanthium spinosum, Asteraceae	Twin Falls	06/29/93
Zigadenus paniculatus, Liliaceae	Bannock	05/21/93

Fifteen specimens identified only to genus and twenty-five specimens which were not identified due to the condition of the plant are not included in this list.

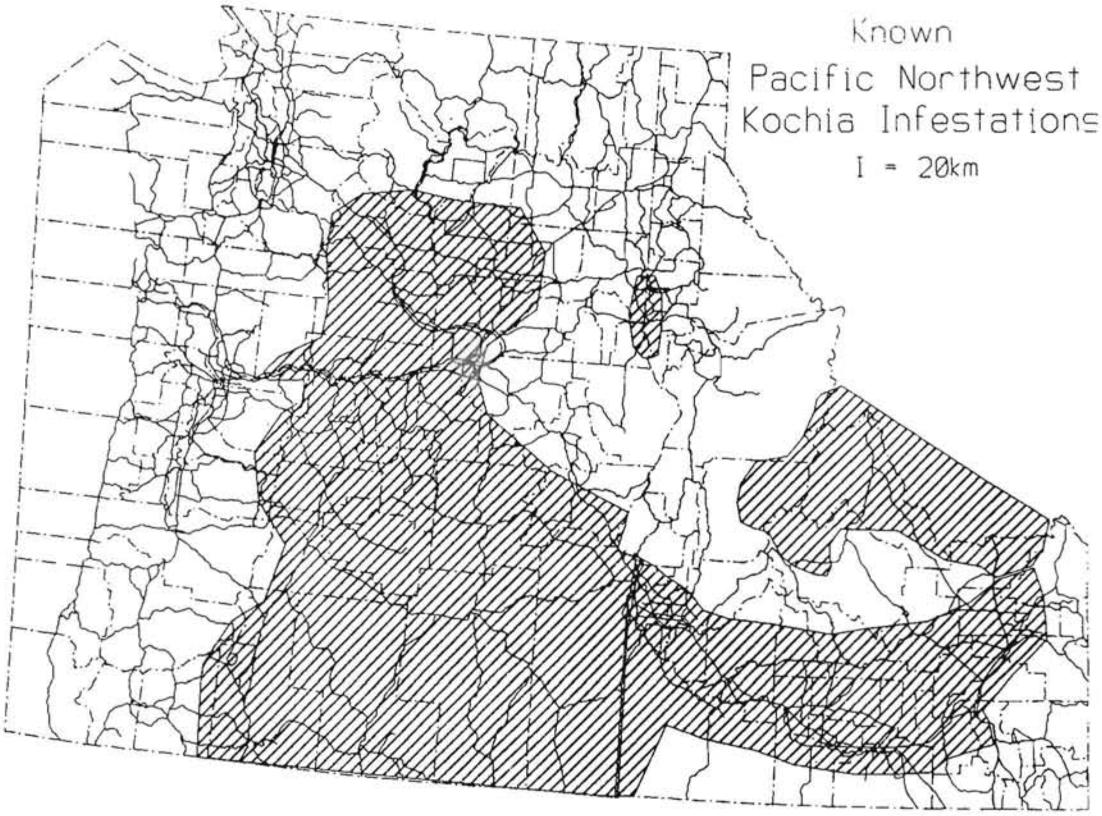
Simple method to map state and regional weed infestations. Lawrence W. Lass and Robert H. Callihan. Most weed infestations are tracked on paper maps. It is difficult to compile information from these maps as to the infestation size and location. Keeping an updated set of paper maps is often a formidable task. Phase I of this project developed COUNTYCAD to allow customized computer mapping of weed infestations on a county level. COUNTYCAD displays detailed map features and allows the user to input weed locations. Information on COUNTYCAD was published in the 1992 W.S.W.S. Progress Report. COUNTYCAD data sets are generally large (0.5 to 3 MB) because of the amount of detailed information. This prevents practical multiple county compilation of the original data set found in COUNTYCAD into a state or regional map. A single state containing the original COUNTYCAD data could take 40 to 120 minutes to read from the hard disk. Phase II of this project has developed a method to summarize data from multiple counties into a state-based or region- based map.

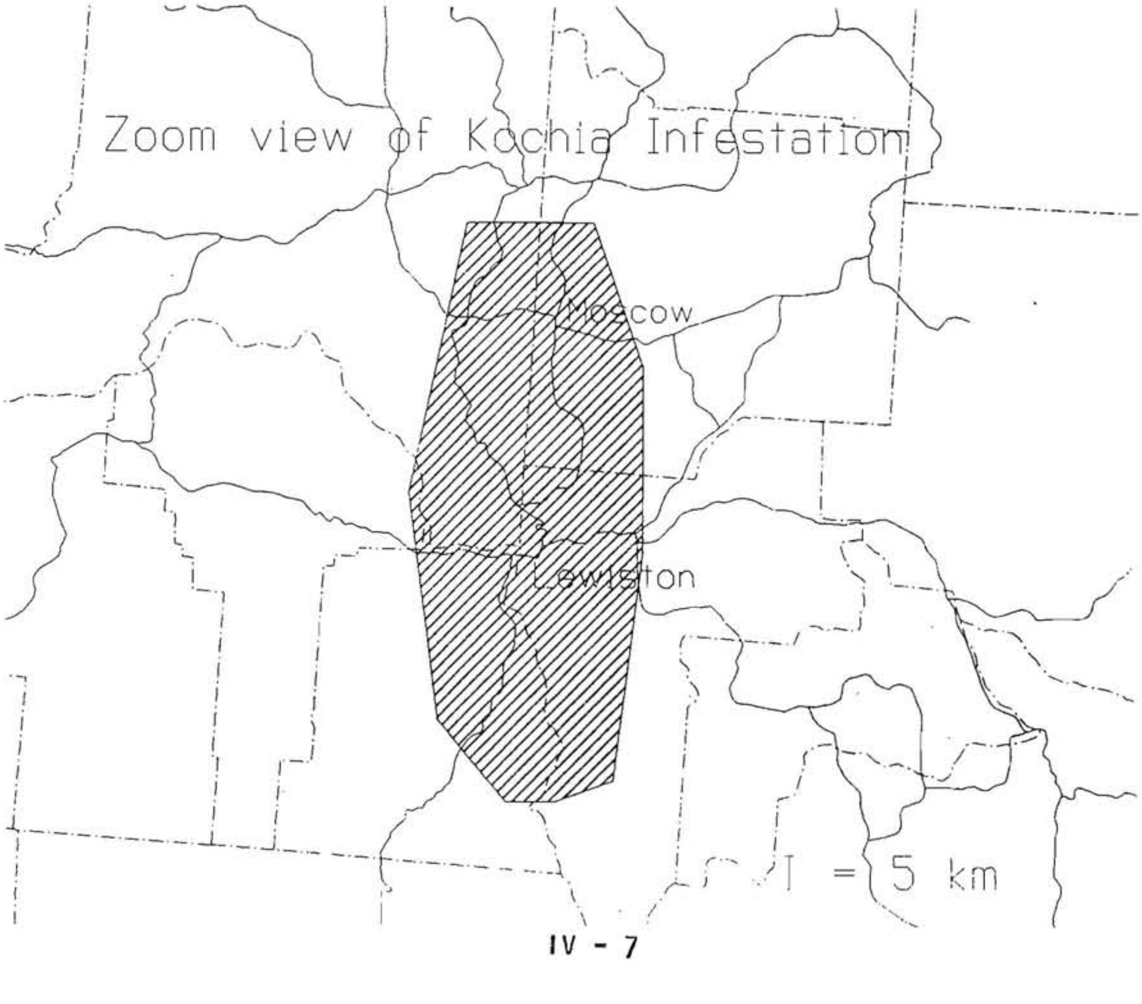
REGIONCAD is computer-driven mapping software that allows the user to map weed infestations on a regional scale. A REGIONCAD data base enables the computer to generate an editable map of one or more states. Each of the 48 contiguous states and Hawaii are a single data set for each state and Alaska is contained within 5 data sets. Data sets from adjacent states may be combined to form a region. The data base provides displays of major highways, railroads, rivers, lakes, reservoirs, and boundaries of county and federally administered land. REGIONCAD has about the same position accuracy as a road atlas and units are measured in feet. REGIONCAD is ideal for displaying noxious weed or other pest infestations, crop production, pest quarantine or restricted crops, road conditions, and any other geographically-distributed data.

Positions or boundaries of weed populations and other things are easily entered with a mouse or digitizer. REGIONCAD can record 240 layers or kinds of information. These records can be tracked for many years using 15 color codes and 256 symbols and shadings. With combinations of these, a total of 100,800 records are possible. Data may be exchanged with GIS packages to be combined with other databases such as topography or soils. Data generated by users of COUNTYCAD are importable into REGIONCAD.

The program runs on any IBM or compatible computer with a hard disk and printer. Best performance is obtained on a 386 with a math co-processor, or on a 486. A mouse, color monitor, and laser printer improve efficiency. This low-cost mapping software will allow for simple record-keeping of pest locations and management planning within a state or region. (Univ. of Idaho, Dept. of Plant, Soil, and Ent. Sci., Moscow 83844)

REGIONCAD Laser Output





PROJECT V

WEEDS OF AQUATIC, INDUSTRIAL AND NON-CROP AREAS

Scott M. Stenquist - Project Chairperson

Black henbane control with metsulfuron. Steven A. Dewey, Kim Chapman, and R. William Mace. Metsulfuron, 2,4-D amine, and metsulfuron + 2,4-D herbicide treatments were applied to black henbane (HSYNI) at two sites in northern Rich County, Utah. Plots were located along the rights-of-way of two gravel roads. Individual plots were 15 ft by 20 ft. Treatments were applied with a backpack sprayer using 25 gpa application rate at 30 psi, arranged in a randomized block design, and replicated 3 times. Herbicides were applied at Site 1 on June 4, 1991, when black henbane plants were approximately 16 to 20 inches tall and were applied at Site 2 on May 5, 1992, when black henbane plants averaged 10 to 12 inches tall. Stands at both sites were fairly uniform at time of treatment, and black henbane growth appeared to be vigorous with adequate soil moisture.

Herbicide efficacy was determined twice by visual evaluation at each location (Tables 1 and 2). The metsulfuron plots exhibited excellent control of bolted and seedling black henbane plants during the first and second season at all rates at both locations. Control with 2,4-D alone was unsatisfactory. There was some indication of possible mild antagonism when 2,4-D was tank mixed with the low rate of metsulfuron. The bases of henbane plants in those plots were still green, erect, and very much enlarged 2 months after treatment (MAT); whereas plants treated with the low rate of metsulfuron alone were completely necrotic and collapsed. (USU Cooperative Extension Service, Logan, UT 84322-4820)

Table 1. Black henbane control with metsulfuron at Site 1.

Treatment	Rate	Henbane control 2 MAT[1]	Henbane control 12 MAT[2]
	oz ai/A	-%-	-%-
Metsulfuron + X77[3]	0.45	100	99
Metsulfuron + X77	0.60	100	100
Metsulfuron + X77	0.90	100	100
Metsulfuron + 2,4-D amine + X77	0.45 + 16	99	100
2,4-D amine + X77	16	52	32
Weedy check	--	0	0
LSD $_{(0.05)}$		2	14

[1] Evaluated 2 months after treatment (MAT) on August 1, 1991.
[2] Evaluated 12 months after treatment on June 3, 1992
[3] X77 included in all treatments at 0.25% v/v

Table 2. Black henbane control with metsulfuron at Site 2.

Treatment	Rate	Henbane control 4 MAT[1]	Henbane control 13 MAT[2]
	oz ai/A	-%-	-%-
Metsulfuron + X77[3]	0.45	97	93
Metsulfuron + X77	0.60	100	100
Metsulfuron + X77	0.90	100	100
Metsulfuron + 2,4-D amine + X77	0.45 + 16	99	100
2,4-D amine + X77	16	47	17
Weedy check	--	0	0
LSD $_{(0.05)}$		11	11

[1] Evaluated 4 months after treatment (MAT) on September 11, 1992.
[2] Evaluated 13 months after treatment on June 8, 1993
[3] X77 included in all treatments at 0.25% v/v

Parrotfeather (*Myriophyllum aquaticum*) control with sub-injection treatments with triclopyr. W. Thomas Lanini and Lars Anderson. Parrotfeather plots were established at Park Lake, near Marysville, CA, to evaluate underwater (sub-injection) treatments with triclopyr. Plots were 1 acre in size, averaging 5 foot in depth, with a large buffer area between plots. Parrotfeather covered over 95% of the lake surface when the study was initiated. Treatments, consisting of 100 injections in the 1 acre area, made on a 20 foot by 20 foot grid pattern, were applied on May 14, 1993. Total amount of triclopyr applied equaled 37.5 lbs/a.

Parrotfeather began to show visible injury symptoms 14 days after treatment. At 27 days, above-water biomass was substantially reduced. By 55 days, most parrotfeather above-water biomass had been eliminated, with over 50% of the treated area being free of aquatic vegetation. New parrotfeather growth began to appear in the treated area at approximately 100 days after treatment. (Department of Agricultural Botany, University of California, Davis 95616).

Table. Parrotfeather above-water biomass as influenced by sub-injection treatment with triclopyr.

Days after treatment	Biomass Reduction	Untreated Biomass
	-%-	-kg/ha
27	59	3809
55	98	3665
77	99	4866
116	79	4111

Evaluation of imazapyr and glyphosate for saltcedar control. Keith W. Duncan. Saltcedar is an aggressive, exotic phreatophyte which dominates riparian areas throughout the southwest. Saltcedar has been shown in numerous studies to have very high evapotranspiration rates and is therefore suspected of lowering water tables thus destroying wetlands and wildlife habitats.

Beginning in 1989, a series of trials were established in eastern New Mexico to evaluate the efficacy of imazapyr and glyphosate applied alone or in combination for control of saltcedar. The trials were established during mid to late summer (July-September) in 1989, 1990 and 1991. Some trials were applied with a backpack sprayer, while other trials were applied with a trailer sprayer handgun at 40 psi. All trials were applied with a straight-stream nozzle and plants were sprayed to wet, but not to runoff. Glyphosate was applied in combination with imazapyr as both the 3 lb/gal and 4 lb/gal formulations. Glyphosate was applied alone as the 4 lb/gal formulation. A surfactant was included with all treatments at a rate of 0.25% v/v. Saltcedar mortality was determined by plant counts.

Table. Comparison of imazapyr and glyphosate alone or in combination for saltcedar control in eastern New Mexico.

Treatment	Rate	Plant Mortality	Number of trials evaluated
	--- % v/v ---	- % -	
Imazapyr	0.5	77	5
Imazapyr	0.75	88	8
Imazapyr	1.0	94	11
Imazapyr+glyphosate	0.25 + 0.25	97	2
Imazapyr+glyphosate	0.25 + 0.5	97	2
Imazapyr+glyphosate	0.375 + 0.375	95	1
Imazapyr+glyphosate	0.5 + 0.5	97	7
Imazapyr+glyphosate	0.5 + 0.75	92	3
Imazapyr+glyphosate	0.5 + 1.0	95	4
Imazapyr+glyphosate	0.75 + 0.75	97	4
Glyphosate	2.0	32	3

Imazapyr applied alone at 1% v/v and imazapyr applied in combination with glyphosate at any rate provided excellent control of saltcedar (Table). No differences in control were detected between the two glyphosate formulations, therefore the data were combined for presentation. Glyphosate as the 4 lb/gal formulation applied alone did not provide acceptable saltcedar mortality. Imazapyr applied alone or in combination with glyphosate appears to be an acceptable tool for saltcedar management. (Coop. Ext. Serv., New Mexico State Univ., Artesia, NM 88210).

Comparison of imazapyr and glyphosate for saltcedar control. Keith W. Duncan. Saltcedar is an introduced phreatophyte which dominates millions of acres of riparian areas throughout the western United States. Saltcedar is an aggressive competitor and often grows in near monoculture stands. Numerous studies have shown saltcedar to have very high evapotranspiration rates. Therefore, it is suspected of lowering water tables thus destroying wetlands and wildlife habitats.

Previous research at New Mexico State University has shown that saltcedar may be controlled with ground applications of imazapyr applied alone or in combination with glyphosate. Also, one trial started in 1989 suggested that saltcedar could be controlled with aerial applications of imazapyr. Much of the saltcedar in the Pecos River Valley of eastern New Mexico is inaccessible to ground-based application of herbicides. Therefore, a trial was established on September 12, 1992 to evaluate the efficacy of aerial applications of imazapyr and glyphosate applied alone or in combination for control of saltcedar.

Herbicides were applied with a helicopter in a total volume of seven gpa with 0.25% v/v surfactant. Thirteen plots were established, nine plots were five acres in size and four plots were 25 acres in size. Swath width was 30 ft.

Table. Saltcedar defoliation 12 months after application of imazapyr and glyphosate alone or in combination near Artesia, New Mexico.

Treatment	Rate	Defoliation	Plot size
	-- lb/a --	- % -	- A -
glyphosate	8.0	65	5
glyphosate + imazapyr	1.0 + 0.5	95	5
glyphosate + imazapyr	3.0 + 0.25	95	5
glyphosate + imazapyr	2.63 + 0.25	90	5
glyphosate + imazapyr	1.5 + 0.5	95	5
glyphosate + imazapyr	1.5 + 0.25	95	5
glyphosate + imazapyr	2.25 + 0.5	95	5
glyphosate + imazapyr*	3.0 + 0.5	90	5
glyphosate + imazapyr*	1.5 + 0.5	85	5
glyphosate + imazapyr	3.0 + 0.5	95	25
glyphosate + imazapyr	0.75 + 0.5	95	25
glyphosate + imazapyr	0.5 + 0.5	95	25
imazapyr	0.5	95	25

*invert spray solution

Two of the thirteen treatments were applied as invert solutions. The two invert solution plots apparently did not receive uniform coverage as skips were noticeable during the 1993 defoliation evaluations. All of the glyphosate + imazapyr treatments and the imazapyr only treatment showed good defoliation during 1993. Saltcedar defoliation in the glyphosate only treatment was substantially less than the other plots. Defoliation was determined by visual estimations in September, 1993. Mortality will be determined in summer 1994. (Coop. Ext. Serv., New Mexico State Univ. Artesia, NM 88210).

PROJECT VI

BASIC SCIENCES: ECOLOGY, BIOLOGY, PHYSIOLOGY, GENETICS AND CHEMISTRY

William McCloskey - Project Chairperson

NO REPORTS SUBMITTED

PROJECT VII

ALTERNATIVE METHODS OF WEED CONTROL

Dan Ball - Project Chairperson

Influence of rotation and management on the density of field dodder (*Cuscuta campestris*). W. Thomas Lanini and Gene Miyao. Field dodder parasitism has been increasing in processing tomatoes throughout California. This study conducted over a three-year period in two fields near Davis, California, examined the emergence and growth of dodder relative to rotation and control measures.

The fields were monitored for dodder emergence and attachment in a 75 ft by 150 ft area originally identified as an area of heavy dodder infestation. Each dodder seedling was marked at emergence. One field was planted to tomatoes in 1991, safflower in 1992, and wheat in 1993. The second field site was planted to tomatoes in 1991 and 1993 with a corn crop in 1992. In field 1, dodder in the 1991 tomatoes was prolific throughout the plot area producing an abundance of seed. In 1992, the safflower crop was inundated with dodder, covering over 75% of the study area at harvest. In 1993, no dodder was observed in the wheat crop during the period that dodder had emerged in previous years.

The field 2, the dodder infestation in 1991 tomatoes was about half as dense as what was observed field 1. The dodder plants, which were individually marked as part of the study, were accidentally removed by a weeding crew at approximately 43 days after planting. In the 1992 corn crop, only 1 dodder plant was observed, growing on a weed (nightshade - *Solanum* sp.). In the 1993 tomatoes, only 3 infestations were found in the original study area. Dodder germination was reduced over 90% by 2 years of no or minimal seed production. (Department of Agricultural Botany, University of California, Davis 95616)

Table. Dodder seedlings observed from March 15 to May 15, 1991-1993, in two fields.

	1991	1992	1993
Field 1			
Crop	Tomatoes	Safflower	Wheat
No. Dodder seedlings	40	735	0
Field 2			
Crop	Tomatoes	Corn	Tomatoes
No. Dodder seedlings	23[1]	1	3

[1] Dodder was removed without seed being produced.

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HERBACEOUS WEED INDEX

(alphabetically by common name)

Woody Plant Index
(alphabetically by scientific name)

Woody Plant Index
(alphabetically by common name)

CROP INDEX

Page/Pages

HERBICIDE INDEX

(by common name or code designation)

This table was compiled from nomenclature approved by the Weed Science Society of America Terminology Committee (Published in each issue of Weed Science) and the Herbicide Handbook of the WSSA (6th edition). "Page" refers to the page where a report about the herbicide begins; actual mention may be on a following page.

Common Name or Designation	Chemical Name	Page
acetochlor	2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)-acetamide	II-2;III-36
acifluorfen	5-[2-chloro-4-(trifluoromethyl) phenoxy]-2-nitrobenzoic acid	II-12
alachlor	2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl)acetamide	II-2,3,5;III-29,36,39,43
asulam	methyl sulfanilycarbamate	I-2
atrazine	6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine	I-2,39,41,43;II-2;III-37,39,41,45
bentazon	3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide	III-27,41,59,60,61
bromoxynil	3,5-dibromo-4-hydroxybenzonitrile	II-14;III-10,14,16,17,21,22,23,26,37,41,61,72,82,87,91
CGA 152005	not available	III-35,82
chlorsulfuron	2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] benzenesulfonamide	I-16,46;III-84,92
clethodim	(E,E)-(±)-2-[1-[[(3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one	II-13;III-6
clomazone	2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone	II-19;III-82

clopyralid	3,6-dichloro-2-pyridinecarboxylic acid	I-10,13,18,39,41, 43,46,48;III-23
CQ 1451/2	coformulation of desmedipham, ethofumesate and phenmedipham	III-70
cyanazine	2-[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]amino]-2-methyl-propanenitrile desmedifam ethyl[3-[[(phenylamino)carbonyl] oxy]phenyl]carbamate	III-39,45
cycloate	S-ethyl cyclohexylethylcarbamothioate	III-64,67
DCPA	dimethyl 2,3,5,6-tetrachloro-1, 4-benzenedicarboxylate	II-13,14
desmedipham	ethyl[3[[(phenyamino)carbonyl]oxy] phenyl]carbamate	III-64,68,70,74,75, 76,77,78,79,80
dicamba	3,6-dichloro-2-methoxybenzoic acid	I-9,10,11,13,16,18, 20,22,24,25,37,39, 41,46,48;III-16,18, 37,39,41,47,48,51, 123
diclofop	(±)-2-[4-(2,4-dichlorophenoxy) phenoxy]propanoic acid	III-19,22,23,84,87, 88,92
difenzoquat	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium	III-19,22,23
dimethenamid	2-chloro-N-(2,4-dimethyl-3-thienyl) -N-(2-methoxy-1-methylethyl)-acetamide	II-2,3,5,10;III-29, 36,37,39,43,55
dithiopyr	5,5-dimethyl-2-(difluoromethyl)-4-(2-methylpropyl)-6-(trifluoromethyl) -3,5-pyridinedicarbothioate	III-33
diuron	N'-(3,4-dichlorophenyl)-N,N-dimethylurea	III-84,92
DPX-66037	2-[[[[[(4-dimethylamino)-6-(2,2,2-trifluoroethoxy)-1,3,5-triazin-2-yl]amino] carbonyl]amino]sulfonyl]-3-methylbenzoic acid	III-63,75,76,77,81

DPX-E9636	N-[[(4,6-dimethoxy-2-pyrimidinyl)amino] carbonyl]-3-(ethylsulfonyl)-2-pyridinesulfonamide	II-8
endothall	7-oxabicyclo[2.2.1]heptane-2, 3-dicarboxylic acid	III-75,78
EPTC	S-ethyl dipropylcarbamothioate	II-3,5,6;III-4,5, 68,92
ethafluralin	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl) benzenamine	III-27,29,58
ethofumesate	(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate	III-64,67,68,74, 79,80
F 6285	not available	III-6
F 8426	not available	III-82,91
fenoxaprop	(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy]phenoxy] propanoic acid	III-32,33
fluazifop-P	(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid	II-14
fluroxypyr	[(4-amino-3,5-dichloro-6-fluoropyridinyl) oxy]acetic acid	I-10
glyphosate	N-(phosphonomethyl) glycine	I-5,6,7,8,20,31, 39,41;III-7,47,51, 82;V-4,5
hexazinone	3-cyclohexyl-6-(dimethylamino)-1- methyl-1,3,5-triazine-2,4 (1H,3H)-dione	II-19;III-7
imazamethabenz	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-4(and 5)-methylbenzoic acid (3:2)	III-19,22,23,32,88
imazapyr	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-4(and 5)-methylbenzoic acid (3:2)	I-2;V-4,5

imazaquin	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-quinolinecarboxylic acid	I-34
imazethapyr	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-l-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid	I-18,34;II-19;III-6,8,10,13,27,29,37,55,58,59
linuron	N'-(3,4-dichlorophenyl)-N--methoxy-N-methylurea	II-3,5,17,18,19;III-58,60
MCPA	(4-chloro-2-methylphenoxy) acetic acid	III-14,17,18,21,22,23,26,33,59,72,82
MCPB	4-(4-chloro-2-methylphenoxy) butanoic acid	III-59,60
metham	methylcarbamodithioic acid	II-14
metolachlor	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide	II-3,6,10;III-29,39,43,45,59
metribuzin	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one	II-6,8,10;III-6,7,41,55,59,84,92
metsulfuron	2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]benzoic acid	I-9,10,11,13,14,16,18,39,48;III-92;V-2
MON 12000	not available	I-39,41;III-35,39
MON 13200	not available	I-39,41
MON 13280	not available	III-33
MON 13900	not available	III-26
NA 305/2	coformulation of desmedipham, ethofumesate and phenmedipham	III-70
NA 307/2	coformulation of desmedipham, ethofumesate and phenmedipham	III-70,80
NA308/1	coformulation of desmedipham, ethofumesate and phenmedipham	III-70,74,80

nicosulfuron	2-[[[[(4,6-dimethoxy-2-pyrimidinyl) amino]carbonyl]amino]sulfonyl]-N,N-dimethyl-3-pyridinecarboxamide	II-3,5;III-35,36,41
NM 498	not available	III-45
oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitro-phenoxy)-4-(trifluoromethyl) benzene	II-14;III-45
paraquat	1,1'-dimethyl-4,4'bipyridinium ion	I-5,6,7,8;II-3,5; III-7,36
pendimethalin	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine	II-6,14,18;III-37,39, 55,58
phenmedipham	3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate	III-64,68,70,74,75, 76,77,78,79,80
picloram	4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid	I-9,10,11,13,14, 16,18,19,20,21,22, 23,24,25,26,28,29, 30,31,34,37,39,41, 43,46,48
primisulfuron	2-[[[[[4,6-bis(difluoromethoxy)-2-pyrimidinyl]amino]carbonyl] amino]sulfonyl]benzoic acid	III-35,41
pronamide	3,5-dichloro(N-1,1-dimethyl-2-propynyl)benzamide	III-92
pyridate	O-(6-chloro-3-phenyl-4-pyridazinyl) -S-octyl carbamothiate	II-16
pyrazon	3-allyl-2-methyl-3-oxycyclopent-2-enyl (1RS)-cis/trans chrysanthemate	III-64,74
quinclorac	3,7-dichloro-8-quinoline-carboxylic acid	I-24,30;III-33
SAN 582H	2-chloro-N-(2,4-dimethyl-3-thienyl) -N-(2-methoxy-1-methylethyl)-acetamide	III-55
sethoxydim	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one	II-3,5,14;III-8,74

sulfentrazone	not available	III-6
sulfosate	N-phosphonomethylglycine	III-47,54
sulfometuron	2-[[[[(4,6-dimethyl-2-pyrimidinyl) amino]carbonyl]amino]sulfonyl] benzoic acid	I-2,13
terbacil	5-chloro-3-(1,1-dimethylethyl)-6-methyl-2,4(1H,3H)-pyrimidinedione	II-12;III-33
thifensulfuron	3-[[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino] carbonyl] amino]sulfonyl]-2-thiophene-carboxylic acid	III-14,16,17,18,21, 22,23,26,72,82,84, 87,88,91
triallate	S-(2,3,3-trichloro-2-propenyl) bis(1-methylethyl)carbamothioate	III-84,87,92
triasulfuron	2-(2-chloroethoxy)-N-[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzene-sulfonamide	III-84
triazophyr	not available	III-6
tribenuron	2-[[[[(4-methoxy-6-methyl-1,3,5-traizin-2-yl)methylamino]carbonyl]amino] sulfonyl]benzoic acid	III-14,16,17,18, 21,22,23,26,72, 82,84,87,88,91
triclopyr	[(3,5,6-trichloro-2-pyridinyl) oxy]acetic acid	I-29;V-3
trifluralin	2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)benzenamine	II-13,18;III-6,31, 58,68
triflusulfuron	2-[[[[[(4-dimethylamino)-6-(2,2,2-trifluoroethoxy)-1,3,5-triazin-2-yl]amino] carbonyl]amino]sulfonyl]-3-methylbenzoic acid	III-64,66,74
2,4-D	(2,4-dichlorophenoxy)acetic acid	I-9,10,11,13,14,16, 18,20,22,24,25,26, 28,29,30,31,34,37, 39,41,46,48;III-16, 18,22,23,26,33,35, 41,47,48,51,72,82

2,4-DB	4-(2,4-dichlorophenoxy)butanic acid	III-6,10
UBI-C4243	not available	I-39,41
UCC C4243	not available	III-33,48,55,84, 87,88
vernolate	S-propyldipropylthiocarbamate	III-43

ABBREVIATIONS

+	plus
>	greater than
%	percent
#	number
A, a, or ac	acre(s)
ae	acid equivalent
AEGCY	jointed goatgrass
Ag or Agric.	Agriculture
AGRSM	Agropyron smithii
ai or a.i.	active ingredient
ai/a	active ingredient per acre
AMABL	prostrate pigweed
AMARE	redroot pigweed
AMMN	ammonium nitrate
ANCVR	spurred anoda
ANOVA	analysis of variance
ANTCO	mayweed chamomile
APEIN	interrupted windgrass
APHDE	toothed spurge
Appl.	application
ARLU	Alnus rubra
AT	air temperature
Aug.	August
AVEFA	wild oats
AVESA	oats
AZ	Arizona
Bare G	Bare ground
BETVU	sugar beet
BOUGR	Bouteloua gracilis
BRANI	black mustard
BROMUS	brumus species
BROTC	Bromus tectorum
BROTE	downy brome
bu/A	bushel(s) per acre
C	degrees Celsius
CA	California
CAPBP	shepherd's purse
CARFI	Carex filifolia
CEC	cation exchange capacity
CENCY	cornflower
CENTRE	Centaurea repens
CHEAL	common lambsquarter
CHEMU	nettleleaf goosefoot
CIRAR	Cirsium arvense
cm	centimeter(s)
CO	Colorado

CO2 or CO_2	carbon dioxide
COC	crop oil concentrate
Cotyl or coty.	cotyledon
CRP	Conservation Reserve Program
CRUAC	Carduus acanthoids
CV or cv	coefficient of variation
cwt	one hundred weight
cwt/A	hundred weight per acre
CYWOF	Cynoglossum officinale
DAT	days after treatment
DBP	days before planting
Dept	Department
DESSO	flixweed
Dev.	deviation
DF	dry flowable
E	east
E post or EPOST	early postemergence
EB	early bloom
EC	emulsifiable concentrate
ECHCO	junglerice
ECHCG	barnyardgrass
Ent	entomology
EPHES	Euphorbia esula
EROCI	redstem filaree
Exp	Experiment
Ext.	extension
F	value of statistical test
F	degrees Fahrenheit
ft or '	foot or feet
ft^2	square feet
g ha^{-1} or g/ha	gram(s) per hectare
g	gram(s)
G/A, GPA or gpa	gallon(s) per acre
G	granule
GALAP	catchweed bedstraw
gpa or gal/a	gallon(s) per acre
ha	hectare
HALGL	Halogeton glomeratus
HORVU	barley
hr	hour(s)
ID	Idaho
in or "	inch(es)
IR	imidazolinone resistant
IT	imidazolinone tolerant
Jun	June
K	potassium
KCHSC	kochia
kg	kilogram

kg/m . . . . Kilogram(s) per meter
kg/ha . . . . kilogram(s) per hectare
km/h . . . . Kilometer(s) per hour
kPa . . . . kilopascal
L ha^{-1} or L/ha . . . . liter(s) per hectare
L . . . . litre(s)
L . . . . liquid
LACSE . . . . prickly lettuce
LAMAM . . . . henbit
lb ai/A . . . . pound(s) active ingredient per acre
lb or lbs . . . . pound(s)
lb ae/gal . . . . pound(s) acid equivalent per gallon
lb/A or lbs/A . . . . pound(s) per acre
lb . . . . pound(s)
LC . . . . liquid concentrate
LENCU . . . . lentil
lf . . . . leaf
LOLMU . . . . Italian ryegrass
LP . . . . low pressure
LP . . . . low pressure
LPOST . . . . late postemergence
LSD . . . . Least Significant Difference
LVE . . . . low volatile ester
m . . . . meter(s)
m^2 . . . . square meters
MAFT . . . . months after first treatment
MALPA . . . . little mallow
MAT or mat . . . . months after treatment
meq . . . . millequivalent
MIF . . . . modified in furrow
misc . . . . miscellaneous
MONLI . . . . narrowleaf montia
mph . . . . miles per hour
MPOST . . . . periodic contact type postemergence treatment
MSO . . . . methylated seed oil
N . . . . nitrogen or north
ND . . . . North Dakota
NIS . . . . nonionic surfactant
NM . . . . New Mexico
NMSU . . . . New Mexico State University
NS or ns . . . . non significant
NW . . . . northwest
Oct . . . . October
OM or o.m. . . . . organic matter
OPUPO . . . . Opuntia polycantha
OR . . . . Oregon
oz/A . . . . ounce(s) per acre
oz . . . . ounce

p or %	percent
P	probability
PANMI	wild proso millet
PDIR	post-directed
PEI	preemergence incorporated
pH	(-) log hydrogen ion concentration
plts/ft^2 or plants/ft^2	plants per square foot
PM or pm	package mix
PNW	Pacific Northwest
POLCO	wild buchwheat
POPES	postplant preemergence surface
POPI	postplant incorporated
POST, Post, post or POE	postemergence
PPI or ppi	preplant incorporated
PRE, pree or pre	preemergence
psi	pounds per square inch
PSME	Pseudotsuga menziesii
pt/A	pint(s) per acre
PTO	power take-off
qt/A	quart(s) per acre
RCB	randomized complete block
Res	research
RH	relative humidity
S	south
SASKR	Russian thistle
Sci	Science
SE	southeast
SECCE	volunteer rye
SENVU	common groundsel
SEP	September
SETVI	green foxtail
SG	soluble granule
SGF	soluble granule formulation
SOLNI	black nightshade
SOLSA	hairy nightshade
SOLTR	cutleaf nightshade
SONAS	spiny sowthistle
SONOL	sowthistle
SSYAL	tumble mustard
SSYIR	London rocket
ST	soil temperature
Sta	Station
STEME	common chickweed
STICO	Stipa comata
SW	southwest
T/A, tpa or t/A	ton(s) per acre
Temp	temperature
THLAR	field pennycress

TRIAE . . . . volunteer wheat
Univ . . . . university
USA . . . . United States of America
Ut . . . . Utah
v/v . . . . volume per volume
var . . . . variety or varieties
var . . . . variation
vars . . . . varieties
w/w . . . . weight to weight
W . . . . west
WA . . . . Washington
WAT . . . . weeks after treatment
WG . . . . water dispersible granule
wks . . . . weeks
WP . . . . wettable powder
wsp . . . . water soluble powder
WY . . . . Wyoming