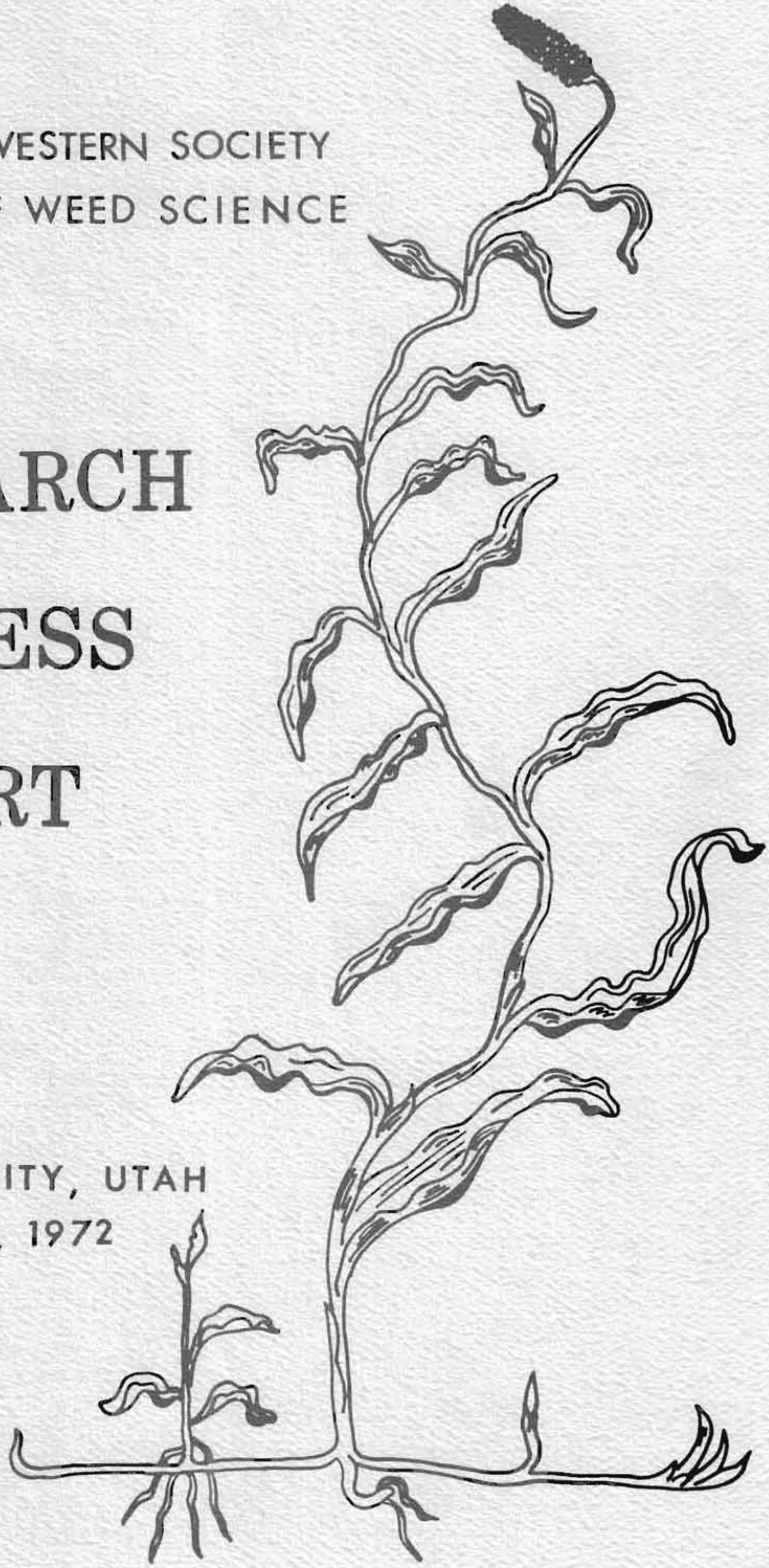
WESTERN SOCIETY
OF WEED SCIENCE

RESEARCH
PROGRESS
REPORT



SALT LAKE CITY, UTAH
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PREFACE

This Research Progress Report of the Research Committee of the Western Society of Weed Science is a compilation of voluntary papers contributed by members of the society. It reports the current status of weed science research in progress in the conference area. This report does not contain recommendations for the use of herbicides, nor does it imply that the chemicals or uses discussed are registered or approved by current Federal or State statutes regulating the use of agricultural chemicals.

The use of trade names by some authors is for information only. It does not constitute an endorsement of commercial products either by the Western Society of Weed Science or by the institution or agency by whom the author is employed.

Recognition is due the research workers of the Western Society of Weed Science whose contributions make this report possible. The cooperation of the seven Research Project Chairmen in compiling and summarizing their section reports is greatly appreciated. Especially noteworthy is the assistance of the Plant Science Research Division employees of Denver who contributed much of their time in the final review, assembly, and proofreading of the progress reports.

Peter A. Frank
Research Committee Chairman
Western Society of Weed Science

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PROJECT 1. PERENNIAL HERBACEOUS WEEDS

R. L. Collins, Project Chairman

SUMMARY

Seven reports were submitted on seven different perennial herbaceous weed species from California, Oregon, and Wyoming. The reports are summarized as follows:

Bermudagrass (*Cynodon dactylon*). Dalapon controlled this species at one rate on non-cropland. MSMA plus asulam showed some possibilities for control.

Canada thistle (*Cirsium arvense*). Applications of MON 0468 herbicide caused destruction of leaf and stem tissue, but regrowth occurred at all rates.

Colonial bentgrass (*Agrostis tenuis*). MON 0468 herbicide at high rates gave excellent control of this species, without apparent loss of sub-clover which emerged in the experimental area.

Field bindweed (*Convolvulus arvensis*). Dichlobenil, CGA 10832, UCB 3584, and trifluralin at high rates gave effective control of this weed with little detrimental effect on the vigor of young grape vines. MON 0468 herbicide showed some possible control of bindweed. The addition of paraquat or MH did not enhance the effectiveness of 2,4-D. Repeated applications of MSMA gave good initial control of bindweed. Fenac and 2,3,6-TBA applied to soil at high rates with a low rate of paraquat gave acceptable stand reduction for non-crop sites. Retreatment one year later provided further control.

Johnson grass (*Sorghum halepense*). Asulam showed promise for the control of Johnson grass as compared to MSMA and dalapon. The addition of additives to the above herbicides did not greatly influence the degree of Johnson grass control.

Musk thistle (*Carduus nutans*). Picloram plus 2,4-D combinations gave excellent control of this species at time of treatment and one year later on seedlings. Dicamba gave good control of musk thistle the first year, but showed no residual effect on seedlings.

Quackgrass (*Agropyron esculentus*). MON 0468 herbicide gave excellent control of quackgrass when used in combination with cultivation. Control of undisturbed quackgrass sod was apparently not as satisfactory with this herbicide.

Yellow nutsedge (*Cyperus esculentus*). MON 0468 herbicide gave complete destruction of the roots and rhizomes in one test.

Additives and the activity of dalapon, MSMA and asulam on Johnsongrass. Lange, A. Johnsongrass (*Sorghum halepense*) and bermudagrass (*Cynodon dactylon*) in full bloom on the bank of a shallow drain ditch were cut back, allowed to regrow to 12-16" and were sprayed 8/5/71 with four herbicides, combinations of herbicides, and with or without a water thickening agent, Vistik.

MSMA was more effective on Johnsongrass than was dalapon or asulam. The addition of Vistik did not greatly influence the activity of these herbicides. Vistik may have slightly enhanced the effect of dalapon on Johnsongrass and bermudagrass. Dalapon was much more effective on bermudagrass than were MSMA, asulam, or a combination of MSMA and cacodylic acid. (Agricultural Extension Service, University of Calif., Parlier, Calif.).

Dalapon, MSMA, asulam and combinations for Johnsongrass control.

		Average 1/			
		Johnsongrass Control		Bermudagrass Control	
Herbicide	lb/A	8/26	10/3	8/9	10/13
Dalapon	4	5.0	4.3	6.3	8.7
Dalapon + Vistik	4	6.7	5.3	8.0	9.3
Asulam	4	7.0	5.7	3.0	2.7
Asulam + Vistik	4	7.0	1.3	3.0	1.3
MSMA	4	9.7	5.7	8.0	1.7
MSMA + asulam	2+2	9.7	5.3	5.3	6.7
MSMA + Vistik	4	9.3	3.0	8.0	2.0
MSMA + cacodylic acid	2+2	9.7	3.0	9.7	1.0
Check	-	1.0	1.7	3.3	1.7

1/ Rated 3 weeks and 2 months after application, the average of 3 replications where 0 = no effect, 7 = apparent commercial control, 10 = all plants apparently dead.

Control of *Agrostis tenuis* with N-phosphonomethylglycine (MON 0468). Brewster, B. D., and A. P. Appleby. A study was established in Benton County, Oregon to determine the effectiveness of MON 0468 in controlling established colonial bentgrass (*Agrostis tenuis* Sibth.) at various growth stages.

MON 0468 (dimethylamine salt of N-phosphonomethylglycine) was applied at rates of 1, 2, and 4 lb/A with a bicycle sprayer on six dates in the spring and early summer of 1971 (see table below). A randomized block design with four replications was used, with individual plots measuring 8' x 30'.

Percent control was determined by averaging visual estimates made by two researchers. The estimates were made on November 29 and December 6, 1971 after the bentgrass had resumed active growth following fall rains. In general, better results were obtained with higher rates and later dates. Almost complete control was obtained at all three rates when applied after heading but before anthesis. Heavy dew and windy conditions may have reduced effectiveness of the lower rates on some dates.

A considerable amount of sub-clover (*Trifolium subterraneum*) emerged in the plots after treatment. Scattered plants of bracken fern (*Pteridium aquilinum*) and wild blackberry (*Rubus macropetalus*) were not controlled. Large numbers of grass and broadleaf seedlings emerged following fall rains, indicating a lack of residual soil activity.

Present short-residual herbicides have not been effective in controlling bentgrass in pasture renovation programs. This new herbicide may become a useful tool for such usage. (Crop Science Dept., Oregon St. University, Corvallis).

Susceptibility of Established *Agrostis tenuis* to MON 0468 on Selected Application Dates

Application Date-1971	Stage of Growth*	Percent Control Rate (lbs a.i./A) 1	2	4
April 19 foliage dry wind calm	2" - 3" tall	72	80	89
May 1 foliage dry wind gusting 0-8 mph	2" - 4" tall	82	90	91
May 19 foliage dry wind gusting 5-10 mph	3" - 5" tall	40	65	98
May 29 foliage wet wind 0-3 mph	4" - 6" tall	64	87	96

Application Date-1971	Stage of Growth*	Percent Control Rate (lbs a.i./A) 1	2	4
June 12 foliage wet wind gusting 3-6 mph	Beginning to head out	66	86	98
June 26 foliage dry wind calm	Fully headed out, prior to anthesis	97	98	99

*grazed by sheep and cattle through April 18, 1971

Layered trifluralin for bindweed control. Lange, A., Donaldson, D., Elmore, C. Heavy bindweed (*Convolvulus arvensis*) infestations were divided into 7' x 20' plots and treated with several chemicals on April 19, 1971. The herbicides were applied by an 80" spray blade, nozzle spaced at 4" intervals, using 110 02 nozzles delivering 80 gallons per acre. One week later an 18" shank slit was made in the center of each plot and rooted cuttings of 2 grape varieties were planted. The soil was a silty-clay loam with 3.5% organic matter, 8% sand, 48% silt and 44% clay. Plots were irrigated three times at approximately 6 week intervals.

Most herbicides showed very little detrimental effect on the vigor of the young grape vine. Considerable stunting was apparent from lack of bindweed control, as can be seen by the later vigor evaluations of the untreated check and low rate of herbicides. Trifluralin and several related compounds gave excellent season-long bindweed control. The herbicides of this group showing the most control were trifluralin, CGA 10832 and UCB 3584. Dichlobenil also gave excellent control, particularly at the 8 lb/A rate without symptoms and with excellent growth under the conditions of this trial. SAN 9789, R7465, MON 097, RP17623 and MC 3761 produced some effect on the bindweed but considerably less than trifluralin. (Agricultural Extension Service, University of California).

The effect of 11 herbicides on grape vine vigor and bindweed control.

		Average[1/] 2½ Months		5 Months	
Herbicide	lb/A	Bindweed Control	Grape Vigor	Bindweed Control	Grape Vigor
Trifluralin	2	8.8	7.2	7.0	8.8
Trifluralin	8	9.8	6.5	9.6	9.2
CGA 10832	2	7.8	8.8	5.5	7.8
CGA 10832	8	9.5	8.8	9.0	8.5
SAN 9789	2	4.0	8.5	4.2	7.0
SAN 9789	8	3.2	6.5	4.5	5.0

		Average 1/			
		2½ Months		5 Months	
Herbicide	lb/A	Bindweed Control	Grape Vigor	Bindweed Control	Grape Vigor
R7465	2	3.2	8.2	2.8	6.5
R7465	8	6.0	5.8	5.8	6.2
Dichlobenil	2	6.8	8.8	6.0	8.8
Dichlobenil	8	8.5	8.0	7.2	10.0
AN 56477	2	5.8	7.8	5.2	7.5
AN 56477	8	4.5	7.8	5.5	7.8
EL 119	8	4.2	7.0	5.2	7.8
UCB 3584	8	8.2	8.5	7.2	8.8
MON 097	8	5.8	6.2	4.5	6.8
RP17623	8	5.5	8.0	4.2	6.5
MC 3761	8	3.8	7.2	4.5	8.0
Check	-	3.0	7.2	1.5	4.5

1/ Average of 4 replications where 0=no effect and no grape growth and 10=all bindweed dead and the best grape vines.

Location: Trefethen Vineyards, Oak Knoll Avenue, Napa
Treatment Method and Date: 7 foot subsurface blade on April 12, 1971 (depth 1½ - 3").
Soil: 8% sand, 48% silt, 44% clay, 3.5% O.M.

Postemergence sprays and combinations for bindweed control. Lange, A., Donaldson, D., Elmore, C., Agamalian, H. Repeated applications of 2,4-D as an oil soluble amine gave the best control of bindweed (*Convolvulus arvensis*). The addition of paraquat or maleic hydrazide did not enhance the effectiveness of 2,4-D. The formulation as an invert (Viskorhap) may have improved the control. The addition of a non-phytotoxic oil may have also improved the effect slightly over the straight 2,4-D amine.

MSMA applied repeatedly also gave good initial bindweed control. The addition of cacodylic acid did not improve the effect on bindweed. (Agricultural Extension Service, University of California).

The effect of various foliage treatments on bindweed regrowth.

Herbicide	lb/A	Treatment Dates 5/22	6/20	7/13	8/25	10/1	Avg.[1/]
2,4-D	1+1+1+1	x	x		x	x	8.8
MSMA	4+4+4+4	x	x		x	x	8.8
MSMA + Cacodylic	4+4+4+4	x	x		x	x	8.0
MC3761	4			x			1.0
MC4379	4			x			2.0
MC4379	16			x			1.8
RP17623	4		x				1.5
RP17623	16		x				2.5
2,4-D + Paraquat	1+1+1+1	x	x		x	x	8.0
2,4-D + Paraquat	3/4+3/4+3/4+3/4	x	x		x	x	7.2
2,4-D + ATA	½ + 2		x				5.3
2,4-D + ATA	2 + 2		x				6.2
2,4-D + MH	½ + 4		x				7.2
2,4-D + MH	2 + 4		x				7.5
ATA + MH	1 + 4		x				2.0
ATA + MH	2 + 4		x				0.5
Nitralin + 2,4-D	2 + 2		x				7.8
Nitralin + 2,4-D	8 + 2		x				7.5
EL 119 + 2,4-D	2 + 2		x				7.8
EL 119 + 2,4-D	8 + 2		x				7.5
Asulam	2		x				0.5
Asulam	8		x				4.0
MCPA	2 + 2		x			x	6.8
2,4-D + Orchex 795	2 + 2		x			x	8.5
2,4-D + Viskorhap	2 + 2		x		x		9.3
2,4-D + Vistik	2 + 2		x			x	7.8
2,4-D + OSA	2 + 2		x			x	7.0
Check	-			x			0.5
Check	-						1.8

1/ Plot size: 5' x 20', 4 reps., rated 11/1/71.
Volume/plot: 1087, 4350/4 plots.

Response of field bindweed (*Convolvulus arvensis* L.) to one and two annual soil-applied herbicide treatments. McHenry, W. B.[1/], D. E. Bayer [2/], N. L. Smith [1/], and R. K. Glenn[2/]. Seven soil-applied herbicides were applied February 2, 1970, and one-half of each plot retreated at the original rate January 5, 1971, to assess the response of established field bindweed to recommended and experimental compounds. Three replications were utilized; the soil was a clay loam. All treatments included paraquat 1 lb ai/A in 100 gpa plus 0.25% surfactant (Surfax).

Field bindweed control following one or two annual soil-applied herbicide applications (10=100%)

Herbicide	Acre rate ai	Acre rate Formul	Treat: 2/3/70 Eval: 4/30/70 Precip: 4.8 in	Treat: 2/3/70 Eval: 5/14/71 Precip: 23.6 in	2/3/70 + 1/5/71 5/14/71 5.3 in
Bromacil	6 lb	7.5 lb	1.3	0.0	0.0
Bromacil	12	15	1.7	0.7	1.7
Fenac	12	8 gal	5.3	8.7	9.3
Fenac	18	12	7.7	8.3	9.7
Hexaflurate	10	10 lb	0.3	0.0	0.0
Hexaflurate	20	20	0.7	0.0	1.7
Hexaflurate	30	30	1.3	0.0	1.0
Karbutilate	6	7.5	1.0	1.0	1.0
Karbutilate	12	15	1.7	1.3	2.3
Picloram	2	1 gal	9.9	9.9	9.7
RP-17623*	2	0.6	4.0	1.7	2.3
RP-17623*	4	1.2	4.3	1.3	5.0
RP-17623*	8	2.4	5.7	2.7	6.0
2,3,6-TBA	12	6	9.5	8.7	9.8
2,3,6-TBA	18	9	9.8	9.0	9.9
Control	-	-	0.0	0.0	0.0

*RP-17623: 2-tertiobutyl-4-(2,4-dichloro-5-isopropyloxyphenyl)-5-oxo-1,3,4-oxadiazoline

Field bindweed control with bromacil, hexaflurate, karbutilate, and RP-17623 generally declined in 1971 following one application in 1970; retreatment in 1971 increased the control of these four compounds but not to an acceptable level at the rates used. Bindweed response to fenac increased in 1971 following one treatment in 1970, a typical response for this herbicide when inadequate leaching occurs the year of application. By contrast, 2,3,6-TBA provided acceptable stand reduction the first year and then declined somewhat in 1971 with no retreatment. Retreatments the second year provided increased stand reduction with both fenac and 2,3,6-TBA and illustrated the often observed declining return for the investment when attempting to move against the last remaining stand. Owing to the severe stunting effect on bindweed shoots, stand reductions of 80-90% are acceptable on most non-crop sites. (University of California, Agr. Ext. Ser.[1/] and Agr. Exp. Sta.[2/], Davis)

Johnsongrass control studies. Lange, A. H., Schweers, V. and Hall, D. Flowering Johnsongrass (*Sorghum halepense*) was sprayed with three herbicides, with and without additives at different gallonages on August 6, 1971. A conventional 3-nozzle boom was used for the 100 and 300 gpa applications and a mist-blower was used for the 10 gpa rate.

At 2 weeks MSMA showed the most activity; by 9 weeks asulam showed the most effect on regrowth.

Mist-blower applications were generally as good as 300 gpa sprays.

The Vistik and non-phytotoxic oil did not greatly improve the control with asulam or dalapon.

The combination of herbicides was not significantly better than the best herbicide in the combinations. (Agricultural Extension Service, University of California, Tulare County, California).

The effect of 3 herbicides and additives on the control of Johnsongrass sprayed when in the flowering stage as measured by the regrowth at 9 weeks after application.

Herbicide	lb/A	Gal/A	Average 1/ Regrowth rating at 9 weeks
MSMA	4	300	7.0
MSMA	4	100	5.0
MSMA	4	10	6.7
MSMA + Vistik	4	300	7.3
Asulam + 0 + S	4	300	8.3
Asulam + Vistik	4	300	8.3
Asulam + 0 + S	4	10	8.7
Dalapon + X77	4	300	6.3
Dalapon + Vistik	4	300	7.0
Dalapon + 0 + S	4	10	7.0
Dalapon + MSMA + 0 + S	2 + 2	300	6.0
Dalapon + MSMA + 0 + S	4 + 4	300	7.0
Dalapon + Asulam + 0 + S	2 + 2	300	6.7
Check	-	---	2.7

1/ Average of 3 replications.

Control of musk thistle (*Carduus nutans* L.) Alley, H. P. and G. A. Lee. An old established stand of musk thistle was selected for large scale (5 acre) demonstration plots, utilizing three herbicides commonly suggested for control of this weed species. The musk thistle had completely taken over a pasture; very little forage was evident. Canada thistle (*Cirsium arvense* L.) was interspersed within the musk thistle infestation. The second year's growth of the musk thistle was in the early bud-stage of growth with the ground literally covered with first year seedlings at time of treatment. The Canada thistle was also in the early bud-stage of growth.

Evaluations one year following treatment indicate the effectiveness of the various treatments in eliminating the first year's seedlings. The 2,4-D PGBE treatments resulted in only fair control of the seedlings, as evidenced by the two-year-old plants in the treated areas. Numerous

Field bindweed control following one or two annual soil-applied herbicide applications (10=100%)

Herbicide	Acre rate		Treat: 2/3/70		2/3/70 + 1/5/71
			Eval: 4/30/70	5/14/71	5/14/71
	ai	Formul	Precip: 4.8 in	23.6 in	5.3 in
Bromacil	6 lb	7.5 lb	1.3	0.0	0.0
Bromacil	12	15	1.7	0.7	1.7
Fenac	12	8 gal	5.3	8.7	9.3
Fenac	18	12	7.7	8.3	9.7
Hexaflurate	10	10 lb	0.3	0.0	0.0
Hexaflurate	20	20	0.7	0.0	1.7
Hexaflurate	30	30	1.3	0.0	1.0
Karbutilate	6	7.5	1.0	1.0	1.0
Karbutilate	12	15	1.7	1.3	2.3
Picloram	2	1 gal	9.9	9.9	9.7
RP-17623*	2	0.6	4.0	1.7	2.3
RP-17623*	4	1.2	4.3	1.3	5.0
RP-17623*	8	2.4	5.7	2.7	6.0
2,3,6-TBA	12	6	9.5	8.7	9.8
2,3,6-TBA	18	9	9.8	9.0	9.9
Control	-	-	0.0	0.0	0.0

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Johnsongrass control studies. Lange, A. H., Schweers, V. and Hall, D. Flowering Johnsongrass (*Sorghum halepense*) was sprayed with three herbicides, with and without additives at different gallonages on August 6, 1971. A conventional 3-nozzle boom was used for the 100 and 300 gpa applications and a mist-blower was used for the 10 gpa rate.

At 2 weeks MSMA showed the most activity; by 9 weeks asulam showed the most effect on regrowth.

Mist-blower applications were generally as good as 300 gpa sprays.

first year seedlings were also present. Dicamba at 0.5 lb/A gave 100 percent control of the musk thistle seedlings present at time of treatment; however, first year seedlings were present, indicating no residual control. Tordon-212 at 1 and 2 qt/A gave complete control of the musk thistle seedlings present at time of treatment and the residual eliminated all musk thistle that germinated one year following treatment. (Wyoming Agriculture Experiment Station, Laramie, SR-357).

Initial and residual control of musk thistle

Treatment[1/]	Rate/A	Percent control[2/]	Readings
2,4-D PGBE	1 lb	30	No residual control of musk thistle seedlings.
2,4-D PGBE	2 lb	60	No residual control of musk thistle seedlings.
dicamba	0.5 lb	100	No Canada thistle control. Poor residual control of seedlings.
Tordon-212	1 qt	100	90% Canada thistle control. No musk thistle seedlings in plots.
Tordon-212	2 qt	100	95% Canada thistle control. No musk thistle seedlings in plots.

1/ Chemicals applied in 25 gpa water.

2/ Percent control refers to control of first year seedlings present at time of treatment.

Preliminary experiments with N-phosphonomethylglycine (MON 0468), a new perennial weed killer. Appleby, A. P., D. R. Colbert, P. D. Olson, and R. J. Burr. MON 0468 (dimethylamine salt of N-phosphonomethylglycine), a new herbicide from Monsanto Company, was tested on several perennial species during 1971. Data collected will necessarily be incomplete until further evaluation can be made in 1972. However, results obtained to date have indicated considerable promise for a variety of uses.

MON 0468 was applied to quackgrass (*Agropyron repens*), both in an old, undisturbed sod and in an adjacent cultivated field on April 30, 1971. A second application was made to plots in the cultivated field on June 8. Control was better in the cultivated field (planted to wheat in the fall, 1970) than in the sod, suggesting that translocation might be inadequate in extensive undisturbed rhizome systems. Results appeared to be better from the second application when the quackgrass was heading out. Control was essentially complete at 4 lbs/A and very good at 2 lbs/A.

Applications of MON 0468 to Canada thistle (*Cirsium arvense*) in April and May caused complete destruction of leaf and stem tissue, but considerable regrowth occurred at all rates, including 2 lbs/A, the highest rate tested. Control from an application at bud stage, June 22, has appeared to be much more effective at rates of 2 and 4 lbs/A, pending further evaluation in 1972.

A May 14 application to field bindweed (*Convolvulus arvensis*) caused severe injury to the top-growth but considerable regrowth occurred, even at 4 lbs/A. More research on timing is needed. Control from applications to yellow nutsedge (*Cyperus esculentus*) on July 28 was evaluated on August 25 by pulling up treated plants and examining their roots. Rates of 2 and 4 lbs/A caused destruction of the roots and rhizomes in all plants observed. No viable tubers could be found in these treated plots. Plots of German velvetgrass (*Holcus mollis*) treated on July 8 were evaluated in the fall when rapid growth of this species occurs. Control was incomplete even at 4 lbs/A, although apparent kill of established plants exceeded 50%. This species has been very difficult to control with other herbicides and a series of treatments may be necessary.

Both annual grasses and annual broadleaves that were emerged at the time of treatment were completely killed in all plots at rates down to 0.5 lb/A. Weeds germinating after treatment were apparently not affected.

The broad spectrum of activity, the complete lack of soil activity, the ability to translocate in perennial weeds, and the low mammalian toxicity all indicate a high degree of promise for this new candidate herbicide. (Crop Science Dept., Oregon St. University, Corvallis).

PROJECT 2. HERBACEOUS RANGE WEEDS

W. F. Currier, Project Chairman

SUMMARY

Three progress reports of continuing studies of herbaceous range weeds in Wyoming were received. One report concerning herbicide tolerance trials of 12 native plants in New Mexico was submitted.

A study involving the effect of treatment date on initial and subsequent control of *Opuntia polyacantha* was established in 1969. One-year observations of these treatments were reported in the 1971 Research Progress Report. Data from observations made in 1971, two years following initial treatment, seem to reaffirm the conclusion that 2 lb/A of silvex provides more complete control of prickly-pear cactus than the 1 lb/A treatment. Both rates provided better control when applied in July, as compared to June treatments.

The control of Geyer larkspur following airplane application of Tordon-212 has been observed since the application in 1968. The percent control obtained from plant counts in permanent quadrats indicates a 10% lower control rate three years following treatment, as compared to one year after treatment. As in 1970, forage clippings from treated range indicate greater productivity than those obtained from untreated range.

Plots were established in 1970 to observe the effectiveness of a number of herbicides for controlling broom snakeweed. Evaluations were made one year following the initial application and it was observed that Tordon-212 and Tordon-225, as well as 2,4-D amine, provide excellent control of broom snakeweed at various reported treatment rates.

Five herbicides were evaluated for preemergence weed control in new seedings of eighteen native species of native plants useful for critical area stabilization. Emergence of eleven grasses and one shrub was adequate. The remaining species failed to emerge. Excellent control of Russian thistle was achieved with simazine. Siduron, trifluralin, and diphenamid gave 50% or less control of Russian thistle at rates tested.

Effect of treatment date upon the initial and subsequent control of plains pricklypear (*Opuntia polyacantha* Haw.). Alley, H. P., G. A. Lee and A. F. Gale. A cooperative study, between Amchem Products, Inc. and the University of Wyoming was established in 1969 to determine the most effective date of application for control of plains pricklypear. The effectiveness of the treatments one year following initial application was reported in the 1971 Research Progress Report. The data presented in this report are from readings made in 1971, two years following treatment.

There was an expected increase of cactus control, two years following treatment, on those plots exhibiting considerable pad discoloration and damage one year following treatment. Silvex at an application rate of 1 lb/A, applied at the early date of application, showed an increase of 15 percentage points control; whereas, the coded compound of ACP 66-60 at 1 lb/A and 2,4-DP + silvex at 1 + 1 lb/A resulted in 20 and 35 percent additional control, respectively.

All chemicals applied on both the early and late dates gave a higher percentage pricklypear control when applied at the latter date except ACP 66-60 at 1 lb/A which showed an 85 percent kill at the early date and 65 percent on the latter date of application; there was no apparent difference two years following application.

It would appear that the application of silvex, the recommended treatment, should be made from the middle of July or later for highly effective control. Silvex at 1 lb/A applied in July was more effective than 2 lb/A applied in June. (Wyoming Agriculture Experiment Station, Laramie, SR-369).

Pricklypear cactus control resulting from two dates of herbicide application one and two years following treatment[1/]

Treatment I 6/13/69	Rate/A	Percent control 1970	1971	Observations 1971
silvex	1 lb	40	55	Some yellowing of pads - many in flower. New pads evident. 95% control fringed sagebrush.
silvex	2 lb	85	70	Slight to severe damage to pads. Moderate yellow to orange. Some new pads.
ACP 66-60	1 lb	85	80	Some new pads.
ACP 66-60	2 lb	90	90	Best treatment of early series.
ACP 69-160	1 qt	15	25	No evidence of herbicide symptoms on pads.
Treatment II 7/14/69				
silvex	1 lb	85	90	Some new pads - no cactus plants blooming.
silvex	2 lb	96	99	Excellent - very few live pads.
ACP 66-60	1 lb	65	85	Few new pads - mostly old plants still alive.
ACP 66-60	2 lb	96	95	Good treatment - not as outstanding as 2 lb/A silvex.
ACP 69-160	2 lb	45	45	No plants in bloom but many healthy cactus pads.

Treatment II 7/14/69	Rate/A	Percent control 1970	1971	Observations 1971
2,4-DP	2 lb	45	35	Healthy pads - poor results.
2,4-DP + silvex	1 + 1 lb	50	85	Few new pads and old pads healthy.

1/ Herbicides applied in a volume of 2.75 gpa No. 2 diesel on early application date and 2.0 gpa on late application date.

Longevity of control and residual vegetation response following utilization of picloram + 2,4-D for the control of Geyer larkspur (*Delphinium geyeri* Greene). Alley, H. P. and G. A. Lee. Results of time series studies utilizing several formulations of the phenoxy compounds and picloram have been summarized in previous Research Progress Reports. The data presented herein is from an airplane, field scale application of Tordon-212 where the longevity of larkspur control and residual vegetative response has been recorded since the application in 1968.

Plant counts, obtained from permanent quadrats to determine the longevity of control, and forage clippings to determine the residual vegetative response have been taken the past three years. Larkspur counts indicate that percent control is approximately ten percentage points lower three years after treatment as compared to one year following treatment (attached table). Tordon at 1/2 qt and 1 qt/A are maintaining 76 and 89 percent reduction in stand of Geyer larkspur, respectively, three years following the initial application.

Air-dry grass production on the unsprayed range was 132 lb/A in 1970 as compared to a high of 602 lb/A where Tordon-212 at 1 qt/A was used. In 1971, three years following treatment, the non-treated rangeland produced 323 lb/A air-dry grass as compared to 853 lb/A on the area sprayed with Tordon-212 at 1 qt/A. (Wyoming Agriculture Experiment Station, Laramie, SR-366).

Geyer larkspur control and forage production resulting from aerial application of Tordon-212

Treatment	Rate/A	Percent control 1969	1970	1971	Air-dry grass/A 1970	1971
Tordon-212*	0.5 qt	86	70	76	400	806
Tordon-212*	1.0 qt	99	95	89	602	853
Non-treated					132	323

*Tradename of Dow Chemical Co.

Evaluation of selective herbicides for the control of broom snakeweed (*Gutierrezia sarothrae* (Pursh.) Britt. & Rusby). Alley, H. P., A. F. Gale and G. A. Lee. A replicated series of plots was established in 1970 to compare the effectiveness of several herbicides for the control of broom snakeweed. A heavily infested range area was selected for the evaluation site. The snakeweed plants were in the 3 to 4 in. vegetative growth stage at time of treatment. All treatments were applied in 40 gpa of water.

Evaluation was made one year after the initial application. Tordon-212 and Tordon-225 at 1 and 2 qt/A and 2,4-D amine at 2 lb/A all gave 100 percent control. Silvex at 2 lb/A, dicamba at 1 lb/A, dicamba + 2,4-D amine at 1/4 + 1 lb/A, and 2,4-D PGBE resulted in 85 to 90 percent reduction in stand of broom snakeweed. Of interest and significance was the excellent control of snakeweed obtained with the 2 lb/A 2,4-D amine formulation; however, other undesirable species growing in association with the broom snakeweed were not controlled; whereas, the Tordon-212 treatment eliminated the fringed sagebrush (*Artemisia frigida* Willd.) and silvery lupine (*Lupinus argenteus* Pursh). (Wyoming Agriculture Experiment Station, Laramie, SR-364).

Broom snakeweed control

Treatment 1/	Rate/A	Percent control	Observations
silvex	1.0 lb	0	No apparent activity on snakeweed; controlled fringed sagebrush and lupine.
silvex	2.0 lb	90	Controlled fringed sagebrush and lupine.
Tordon-212*	1 qt	100	Increased grass production evident. Controlled fringed sagebrush and lupine.
Tordon-212*	2 qt	100	Increased grass production evident. Controlled fringed sagebrush and lupine.
Tordon-225*	1 qt	100	Fair control of fringed sagebrush.
Tordon-225*	2 qt	100	Fair control of fringed sagebrush.
dicamba	0.5 lb	50	Small snakeweed seedlings in plots.
dicamba	1.0 lb	90	Small snakeweed seedlings in plots.
dicamba + 2,4-D amine	0.25 + 1.0 lb	75	No control of fringed sagebrush.

Treatment[1/]	Rate/A	Percent control	Observations
dicamba + 2,4-D amine	0.5 + 1.0 lb	95	Fair control of fringed sagebrush.
2,4-D amine	1.0 lb	35	
2,4-D amine	2.0 lb	100	Some fringed sagebrush not controlled.
2,4-D PGBE	1.0 lb	35	Poor control.
2,4-D PGBE	2.0 lb	85	Not as good a treatment as the corresponding rate of 2,4-D amine.

1/ Three replications, herbicides applied in 40 gpa water. Snakeweed plants 3 to 4 in. vegetative growth at time of treatment.

* Tradename of Dow Chemical Company.

Herbicide trial in a new seeding of plants selected for stabilization of disturbed areas. Lohmiller, R. G., P. C. Quimby, Jr., and R. L. McDonald. Five herbicides were applied post-planting preemergence at one rate each and were evaluated for their effect on the emergence of 12 species considered to have value for stabilization of disturbed areas. Included were 11 species of grasses and one shrub (see attached table). The principal weed present in the experimental area was Russian thistle (*Salsola kali* L.var. *tenufolia* Tausch). Control of Russian thistle by each of the five herbicides was also evaluated.

The experimental area was located at the Middle Rio Grande Branch Station, New Mexico State University, Los Lunas, New Mexico. The soil was Vinton fine sandy loam. The crop species were drilled August 6, 1970, in 14-foot strips across one field in a split block experimental design. The herbicides were applied August 7, 1970, in 40-inch swaths with a tractor-mounted sprayer calibrated to deliver 92 gallons of water carrier per acre. Untreated 40-inch control swaths were left between each treated swath. The experimental area was sprinkler irrigated the day after application of the herbicides and approximately once each week for 4 weeks. About 1 inch of water was applied at each irrigation.

The herbicide treatments were randomized within each of five replications and each treated swath was the same across all planted species. Thus, statistical comparisons among herbicides could only be made within each species except for the weed control data which could be compared across all species. Data were collected November 6, 1970, as plant counts (crop and weeds) within a 0.5 $ft.^2$ (4 x 18 inches) quadrat thrown at random within each plot and the adjacent control plot. Values were converted to a percent of the check for each replication within each species and statistically analyzed as a randomized complete block design for each species.

Survival and vigor of 11 grasses and *Atriplex canescens* 3 months after preemergence treatment.

Item		Check	Herbicides: 2,4-D amide 1.5 lb/A	Siduron 2 lb/A	Simazine 0.25 lb/A	Trifluralin 0.5 lb/A	Diphenamid 4 lb/A	Standard error of mean
Species:		Plts/0.5 ft^2	% of check	% of check	% of check	% of check	% of check	%
Agropyron desertorum	Stand	5.2	66a[1/]	42 a	0 a	16 a	0 a	23.8
(Fisch.) Schult.	Vigor		100	70	0	70	0	
Agropyron smithii	Stand	5.8	108 a	76 a	12 b	7 b	0 b	11.3
Rydb.	Vigor		88	70	30	50	0	
Andropogon scoparius	Stand	7.5	17 a	0 b	5 ab	0 b	0 b	4.2
Michx.	Vigor		45	0	33	0	0	
Bothriochloa ischaemum	Stand	22.3	12 a	0 b	1 b	0 b	1 b	3.4
(1.) Keng	Vigor		77	0	25	0	25	
Bouteloua curtipendula	Stand	46.8	1 b	49 a	5 b	1 b	3 b	5.2
Michx.) Torr.	Vigor		45	58	50	10	23	
Bouteloua eriopoda	Stand	27.4	30 b	90 a	4 b	6 b	0 b	10.3
[Torr.] Torr.	Vigor		65	78	45	50	0	
Bouteloua gracilis	Stand	20.4	23 ab	43 a	2 b	0 b	3 b	8.7
(H.B.K.) Lag.	Vigor		78	54	20	0	50	
Buchloe dactyloides	Stand	4.0	38 a	0 a	22 a	0 a	0 a	13.0
(Nutt.) Engelm.	Vigor		65	0	62	0	0	
Eragrostis lehmanniana	Stand	7.4	17 a	0 b	2 b	0 b	0 b	4.4
Nees	Vigor		67	0	50	0	0	
Oryzopsis hymenoides	Stand	5.2	50 a	0 b	0 b	7 b	0 b	5.6
(Roem. & Schult.) Ricker	Vigor		100	0	0	100	0	
Sporobolus airoides	Stand	2.1	6 a	12 a	0 a	0 a	0 a	3.7
[Torr.] Torr.	Vigor		50	28	0	0	0	
Atriplex canescens	Stand	2.8	24 ab	66 a	0 b	22 ab	36 ab	18.5
(Pursh) Nutt.	Vigor		70	78	0	73	2	
% Control of *Salsola kali*[2/]		3.6	78 b	20 d	96 a	20 d	50 c	5.5
Injury to emerged weeds (100=dead)			66	23	81	4	72	

1/ Data followed by the same letter are not significantly different at the .05 level as determined by Duncan's New Multiple Range Test. Values may only be compared horizontally within each species. Statistical tests were not applied to crop vigor and weed injury data which are overall averages of 3 visual estimates per replicate.

2/ *Salsola kali* was the predominant weed in the experimental area. The weed stand (95% confidence limits) was 3.6 ± .6 plants per 0.5 ft.^{2}. The mean weed stand of all the replicates fell within the confidence limits and the F test indicated no significant difference among replications. The data on weed control are averages across all crop species.

The results of the experiment are shown in the table. In most cases, the herbicide treatments used were too toxic to the seeded species to be of practical value. Western wheatgrass (*Agropyron smithii* Rydb.) appeared resistant to 2,4-D amide (1.5 lb/A) and to siduron (2 lb/A) and warrants further testing. Also black grama (*Bouteloua eriopoda* [Torr.] Torr.) appeared resistant to siduron (2 lb/A).

The 2,4-D amide provided 78% control of Russian thistle. Excellent control (96%) of the Russian thistle was obtained with 0.25 lb/A simazine in the very sandy soil but all crop species failed to emerge under the treatment. Siduron, trifluralin, and diphenamid provided poor control (50% or less) of Russian thistle at the respective rates tested in this experiment. (Soil Conservation Service and Plant Science Research Division, Agricultural Research Service, U. S. Department of Agriculture in cooperation with the Middle Rio Grande Branch Station, Plant Materials Center, New Mexico State University, Los Lunas, and the New Mexico State Highway Department).

PROJECT 3. UNDESIRABLE WOODY PLANTS

Walter L. Gould, Project Chairman

SUMMARY

Six reports were received concerning herbicide treatments on red alder, vine maple, California hazel, salmonberry, western thimbleberry, western bracken, western swordfern, creosotebush, ponderosa pine, and eucalyptus.

In screening trials using stem application of several herbicides to Coast Range brush species, the best defoliation and topkill was obtained with 2,4,5-T and silvex. The addition of dicamba to these herbicide mixtures tended to reduce resprouting.

Granular applications of dicamba, picloram and karbutilate to red alder on four dates produced about 40 to 60 percent defoliation at the 15 lb/A rate. Lighter rates had little or no effect. The effect of treatments on associated species was variable, but all rates of picloram and the heavier rates of dicamba killed Sitka spruce.

Late spring applications of dicamba at 4 lb aehg were as effective on western swordfern and bracken as 8 lb aehg in midsummer. Bromacil at 12 lb aehg was effective on western swordfern at both times of application. Picloram, dichlobenil and bromacil were not effective on western bracken.

Young ponderosa pine were susceptible to damage from treatments with 2,4-D and 2,4,5-T from mid-February until late August. They were then resistant until late winter.

Repeated treatments of creosotebush in successive years with dicamba or dicamba-phenoxy mixtures were more effective than treatments in alternate years.

Of several herbicides applied to eucalyptus roots at 10 and 100 ppm for 1 hour, only picloram killed all the treated roots, but it also injured the shoots. The condition of eucalyptus roots at the time of treating with metham had little effect on extent of shoot injury induced. Photosynthesis or transport of assimilates out of the leaves and into the stem of eucalyptus were not affected except in tissue injured by treatment with metham or dichlobenil.

A high level of germination was induced in deerbrush caenothus seed when exposed to 90 C soil temperatures. Seeds exposed to very dry conditions lost moisture, but became impermeable again when exposed to high humidity.

<u>Field screening of stem applied herbicides on Coast Range brush species.</u> Stewart, R. E. Several herbicides and herbicide combinations were applied with a knapsack sprayer to individual plants of red alder, vine maple, California hazel, salmonberry, and western thimbleberry near Coos Bay, Oregon and Vancouver, Washington. Stems of the shrubs and trees were thoroughly wetted with 1 lb aehg formulations of the selected herbicides in diesel oil.

The sprays were applied in late February or early March of 1971 at the time of bud break for each species.

Herbicides and combinations tested were:

1. 2,4-D	6. Dicamba + 2,4-D
2. Dichlorprop	7. Dicamba + dichlorprop
3. 2,4,5-T	8. Dicamba + 2,4,5-T
4. Silvex	9. Dicamba + silvex
5. Dicamba	10. 2,4-D + dichlorprop

Results at the end of the first growing season showed that 2,4,5-T and silvex produced the best defoliation and topkill on all five species. Addition of 1 lb aehg dicamba to 2,4,5-T or silvex reduced resprouting by one-half on four of the species. Resprouting of red alder during the first growing season was negligible in all treatments. Final results will be observed at the end of the 1972 growing season. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon.)

Field screening of granular herbicides on pole-size red alder. Stewart, R. E. In 1971, granular formulations of fenuron TCA, bromacil, dicamba, and picloram were applied to 1/50-acre plots in pole-size red alder stands at five locations between Coos Bay, Oregon and Olympia, Washington. Karbutilate (m-[3,3-dimethylureido] phenyl tert-butylcarbamate) was also tested at three of these locations. All herbicides except karbutilate were applied at 0.5 and 1.5 lb ai per acre in mid-February and mid-March and at 5 and 15 lb ai per acre in mid-April and mid-May. Karbutilate was applied at 1.5 lb on the first two dates and at 15 lb on the last two.

Herbicide effect was observed on red alder, salmonberry, Pacific red elder and blueberry elder, western swordfern, grapeleaf blackberry, and herbaceous ground cover species in September of 1971. Fenuron TCA, bromacil, and low rates of dicamba and karbutilate were ineffective. First year results of the remaining treatments, combined by date and location, are tabulated below for three of the species:

Herbicide	Rate	Red alder	Salmonberry		Western swordfern
		Defoliation	Defoliation	Topkill	Topkill
	(lb ai/A)	(%)	(%)	(%)	(%)
Dicamba	5	18	32	2	44
	15	52	36	5	70
Picloram	0.5	0	23	8	0
	1.5	1	62	23	0
	5	5	79	39	11
	15	41	92	54	27
Karbutilate	15	63	89	23	1

Virtually complete topkill of the two elderberry species was achieved with 15 lb of dicamba or 5 lb of picloram. Picloram at 15 lb was the most effective herbicide on grapeleaf blackberry. Dicamba, picloram, and karbutilate at 15 lb reduced herbaceous ground cover by about 70 percent. Picloram at all rates and dicamba at 5 and 15 lb killed sapling-size Sitka spruce, while karbutilate did not damage this species. Rates of all three herbicides above 5 lb ai per acre were effective at all locations; lower rates were erratic.

March and April appear to be the best months for application of granular herbicides in coastal Oregon and Washington red alder communities. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon.)

Field screening of foliage applied herbicides on western swordfern and western bracken. Stewart, R. E. Picloram, dicamba, dichlobenil, and bromacil were applied in early June and early August of 1970 to individual plants of western swordfern and to 1/1000-acre plots of western bracken. The herbicides were applied in water to drip point on western swordfern and at 0.2 gal per plot on western bracken using a knapsack sprayer.

Results observed in September of 1971 show that late spring applications were more effective than midsummer applications. Dicamba at 4 lb aehg controlled western swordfern in late spring; 8 lb were required during midsummer. Bromacil at 12 lb aehg was effective on both dates. Late spring applications of 4 lb dicamba per acre reduced western bracken cover to less than 4 percent 1 year after treatment; 8 lb per acre were required during midsummer. Picloram, dichlobenil, and bromacil did not control this species. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon.)

Annual variation in susceptibility of ponderosa pines to phenoxy herbicides. Gratkowski, H. A knowledge of seasonal variation in susceptibility of conifers to herbicides is necessary in aerial spraying to release trees from brush competition. Sprays should be applied when they will produce maximum kill of brush species with minimum adverse effects on the conifers. Annual variation in susceptibility of ponderosa pines to phenoxy herbicides has been determined in the Cascade Range in southwestern Oregon.

Young ponderosa pines were sprayed with 2,4-D and 2,4,5-T in water and in oil-in-water emulsions each month except October and December. The trees were 3 to 7 feet tall when sprayed.

Briefly, young pines became susceptible to damage from phenoxy herbicides in mid-February, 2½ months before bud elongation signalled the beginning of the spring flush of growth in May. They remained susceptible until late August. Although susceptibility decreased rapidly after new buds began to form in late June, full resistance was not attained until the end of August. The pines were then resistant until late winter, as stated above. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon.)

The effect of repeated treatments with dicamba and phenoxy herbicides in successive or alternate years on the control of creosotebush. Gould, W. L. A low percentage of creosotebush (*Larrea tridentata)* plants have been killed from single applications of herbicides in herbicide evaluation tests. This experiment was set up to determine the effect of repeated treatments with dicamba, alone or in combination with 2,4-D or 2,4,5-T, on the degree of control.

One-half mile square areas were divided into seven 20-acre plots and initially sprayed via airplane each year in 1966 and 1967. The plot size was 360 x 2600 feet. One year after the initial treatment, 11 strips measuring 240 x 2600 feet were laid out across the initial plots and perpendicular to them. Five of the latter strips were sprayed the year after the initial spraying; five were sprayed two years after the initial spraying; and one strip was not sprayed a second time. A 40-foot buffer zone was left between treatments each year. This arrangement thus gave experimental blocks containing 77 200 x 320-foot plots that were sprayed with herbicide.

In the initial application on a block, the treatments were dicamba at 1/2, 1 and 2 lb/A, dicamba at 1/2 lb/A plus 2,4-D at 1/2 and 1 lb/A, and dicamba at 1/2 lb/A plus 2,4,5-T at 1/2 and 1 lb/A. The treatments for the subsequent sprayings were dicamba at 1/2, 1 and 2 lb/A, dicamba at 1/2 lb/A plus 2,4-D at 1 lb/A, and dicamba at 1/2 lb/A plus 2,4,5-T at 1/2 lb/A, except that one strip in the block initially treated in 1966 was sprayed with 2,4-D and dicamba at 1/2 lb/A each instead of 2,4,5-T plus dicamba at 1/2 lb/A each. The average degree of control from the initial and repeated treatments is presented in the accompanying Table.

The control from a single treatment varied from 6 percent for dicamba at 1/2 lb/A to 41 percent for dicamba at 2 lb/A; the 1 lb/A rate being intermediate. Dicamba at 1/2 lb/A plus 2,4-D or 2,4,5-T at 1/2 or 1 lb/A gave 10 to 16 percent control. There was a variation in degree of control from a single treatment between years. The average across the seven treatments in 1966 and 1967 was 13 and 23 percent, respectively.

For nearly all treatments, a higher degree of control was obtained from repeated treatments in successive years than in alternate years. As the rate of dicamba increased, the degree of control also increased. The degree of control was approximately the same on plots treated initially with dicamba at 1/2 lb/A or a combination of dicamba and 2,4-D or 2,4,5-T. However, the combination treatment was more effective than dicamba alone at 1/2 lb/A as the second treatment. (New Mexico Agr. Exp. Sta., New Mexico State University, Las Cruces).

The average percent control of creosotebush from repeated herbicidal treatments in successive or alternate years following initial treatment in 1966 and 1967.

Second Treatment		Initial Treatment							
		Dicamba			Dicamba + 2,4-D		Dicamba + 2,4,5-T		
		1/2	1	2	1/2+1/2	1/2+1	1/2+1/2	1/2+1	Average
Chemical	Rate	Successive Years							
Dicamba	1/2	25	32	42	27	34	32	30	32
Dicamba	1	56	54	64	64	53	51	42	55
Dicamba	2	64	74	88	68	66	72	70	72
Dicamba + 2,4-D	1/2 + 1	50	49	62	46	36	34	40	45
Dicamba + 2,4,5-T	1/2 + 1/2	32	48	54	36	42	34	38	41
Average		45	51	62	48	46	45	44	
		Alternate Years							
Dicamba	1/2	20	33	66	28	19	16	31	30
Dicamba	1	40	47	53	30	44	34	36	41
Dicamba	2	50	48	61	50	49	60	60	54
Dicamba + 2,4-D	1/2 + 1	21	59	61	26	27	34	48	39
Dicamba + 2,4-D	1/2 + 1/2[a]	25	23	50	27	19	30	17	27
Dicamba + 2,4,5-T	1/2 + 1/2[b]	35	49	78	38	40	48	60	50
Average		32	45	61	33	34	37	43	
Untreated		6	24	41	16	10	10	16	

[a] Data from 1966 block only

[b] Data from 1967 block only

Root control in relation to the problem in sewers and drains. Leonard, O. A., D. E. Bayer, and R. K. Glenn. Studies on the selective control of tree roots in sewers have continued, with several objectives, including (1) new chemicals which might be used, (2) health of treated roots at time of treatment on injury to shoots with metham, (3) effect of metham and dichlobenil on photosynthesis and transport of labeled assimilates. Most of these studies were conducted upon *Eucalyptus camaldulensis*.

Several herbicides were applied to eucalyptus roots at 10 and 100 ppm for 1 hour. Readings on root and shoot injury were recorded 5 weeks later following treatment. It may be noted in the table that picloram was the only herbicide tested that completely killed the portion of the root system that was treated. However, the appearance of appreciable injury to the shoots would rule this material out for general use. Paraquat and diquat did have an appreciable effect on the roots; however, killing was confined to those roots of less than 2 mm diameter. Some of the other materials killed only the very fine roots and/or caused stubby roots to form. Of the herbicides studied, only two were effective for root control following many repetitions of the 1-hour soak with metham and dichlobenil. Metham may be regarded as the general killer of roots, while dichlobenil is a supplement to retard regrowth.

Injury to shoots from metham treatment occasionally occurs in the field. A mulberry injured from a 5,000 ppm treatment for 1 hour in July 1969 in Sacramento County had essentially recovered in 2 years. Although the occurrence of injury in the field is relatively rare, we thought that root health at the time of treatment might be a factor effecting root injury. Eucalyptus roots were treated for 1 minute with 2,000 and 10,000 ppm metham and 1 hour with 100 ppm dichlobenil. Four weeks later these same roots were treated for 1 and 24 hours with 2,000 ppm metham. Out of 40 trees treated, only 6 showed evidence of shoot injury and 5 out of 6 had roots (part of root system previously treated with metham or dichlobenil) that were either dead or about dead at the time of treatment. The test was repeated using a concentration of 10,000 ppm metham for 24 hours. Only 2 plants developed shoot injury; on one of these, metham was applied to live roots and to the others, dead roots. These tests indicate that there probably is no appreciable difference in shoot injury, whether the treated roots are alive or dead at the time of treatment. Previous tests as well as those in the current study did show that the transfer of toxicity was through the roots, since removal of the roots below the pots before treatment resulted in no case of shoot injury.

A test was conducted to determine the effect of root treatment with 2,000 ppm metham or 100 ppm dichlobenil for 1 hour on photosynthesis and transport of assimilates in eucalyptus. The results of this study suggest that photosynthesis is not effected and that transport out of the leaves and into the plant is not effected except in those areas injured or killed by the treatment. With dichlobenil, there was an enhanced accumulation of assimilates in the treated part of the tap root. However, this effect soon disappeared (after 7 days); 4 to 6 weeks was required for the treated part of the root system to die with dichlobenil. The effect of metham seemed complete in 24 hours. (University of California, Botany Department, Davis, California).

Injury to roots and shoots from partial root treatment

	5 weeks after treatment			
	Concentration (ppm)			
	10		100	
Herbicide	Shoots[1]	Treated roots	Shoots	Treated roots
Paraquat	0	1	0	5
Diquat	0	0	0	5
Bromocil	0	0	0	0
Cacodylic acid[2]	0	0	0	0
MSMA[2]	0	0	0	0
2,4,5-T amine	0	0	0	2
Picloram	0	8	5	10
MER-6023	0	0	0	0
CF-125	0	1	0	2
RP-17623	0	0	0	0
Eli-119	0	0	0	1
R-7465	0	0	0	1
CGA-10832	0	0	0	1

[1] Evaluation based on a 0 to 10 scale. 0 meant no effect and 10 = complete kill.

[2] These 2 materials were also tested at 1000 ppm. The cacodylic acid gave a rating of 4 to the roots and the MSMA 0, while the shoots were both 0. Controls were 0.

Eucalyptus camaldulensis roots were soaked for 1 hr.

Sorption of deerbrush (*Ceanothus*) seeds. Gratkowski, H. Plants with seeds that can remain dormant but viable in soil for long periods are especially well adapted to survive adverse conditions such as wildfires and drought. Seeds of *Ceanothus* spp. may be of this type. Sorption of treated deerbrush ceanothus seeds exposed to changes in relative humidity was studied to obtain information concerning behavior of these seeds in forest soil.

A high percentage of mature deerbrush ceanothus seeds have seed coats that are impermeable to water. These impermeable seeds may lie dormant but viable in forest soil for years after dissemination. When wildfire or logging slash fires burn over an area where deerbrush seeds are present in the soil, soil and seeds are heated and the seed coats become permeable to water. During winter in the Pacific Northwest, these permeable seeds absorb moisture and stratify in the cold, wet soil. They germinate the following spring and produce a new stand of brush seedlings to occupy the denuded site.

Heated deerbrush seeds become permeable only at the hilum. Heat opens the hilar fissure and these fissures remain open after the soil cools.

In an earlier experiment, a 60C soil temperature was high enough to open fissures and induce germination of a few deerbrush seeds, but maximum germination was obtained from seeds that were exposed to 90C soil temperatures. Such temperatures occur in forest soils during wildfires and slash burning.

When deerbrush seeds are exposed to drier conditions than any previously experienced, hilar fissures open and the seeds lose moisture from endosperm and embryo. If they are then exposed to a higher humidity, they regain only a fraction of this moisture before the hilar fissures close and the seeds again become impermeable. The reduced moisture content probably reduces respiration rates of the embryo and conserves food stored in the endosperm. This response is considered a major factor in ability of deerbrush seeds to remain dormant but viable in forest soils for years. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon.)

PROJECT 4. WEEDS IN HORTICULTURE CROPS

Garry D. Massey, Project Chairman

SUMMARY

A total of 21 reports was submitted from California, Colorado, Oregon, Washington, and Wyoming. The reports included results from herbicide trials conducted on fruits, nuts, vegetables, and ornamentals.

FRUITS

Citrus: A three-year study of repeat applications of four herbicides (dichlobenil, MSMA, bromacil, and EPTC) showed all compounds providing some nutsedge control with granular dichlobenil providing the highest degree of weed control, but also providing the greatest citrus injury.

Grapes: Johnsongrass infested in grape vineyards was partially controlled in a number of California locations with layered and plowed trifluralin, dichlobenil, and EL-119. Trifluralin and dichlobenil provided the highest degree of control of this perennial weed.

In a screening trial conducted in California on Thompson seedless grape rootings and cuttings, using 16 herbicides, those herbicides showing more promise than simazine were: R 7465, RP 17623, EL 119, CGA 10832, SAN 9789, AN 56477, MON 097 and trifluralin.

Repeated foliage sprays of MSMA and dalapon alone and in combination with each other showed better control (partial control) of johnsongrass in grape vineyards when applied on 6 to 8 inch plants than when applied at later stages of growth.

Peaches: Nemagard peach rootstock when treated with surface sprayed herbicides (simazine, terbacil and SAN 9789) and irrigated with a precision irrigation machine, showed toxicity (chlorosis) of varying degrees from all herbicides. SAN 9789 proved the safest compound of the three materials tested.

Strawberries: Six postemergence herbicides evaluated on two varieties of strawberries showed that the outstanding compounds in this trial were nitrofen, C 6989, and phenmedipham.

NUTS

Almonds: Almonds and several stone fruits were treated with a number of new compounds in a deciduous tree screening trial. Most herbicides showed excellent weed control and several showed a good margin of safety on these trees. Herbicides showing the greatest selectivity were R 7465, RP 17623, EL 119, AN 56477, and CGA 10832.

Three herbicides were power-tilled and spray bladed in a young almond orchard to ascertain control of bindweed, bermudagrass, and annual weeds.

Trifluralin provided superior weed control over the other compounds tested and the rototiller provided better control than the spray blade method of application.

Pistachio: Five herbicides applied on pistachio rootstock showed S-6706 and terbacil caused injury to the young trees. In a second trial, five herbicides showed no crop injury when applied on this crop.

VEGETABLES

Asparagus: Dicamba provided fair Canada thistle control while the 2,4-D Na salt gave no control of this weed. Dicamba was also safe on asparagus as a directed spray, while causing no injury to the crop when applied as an over-the-top spray.

Lettuce and broccoli: Thirteen herbicides were applied (postplant preemergence) 7, 3, and 0 days prior to sprinkler irrigation on lettuce and broccoli. Most herbicides lost activity by the seventh day and a number lost activity by the third day after herbicide application.

Melons and other crops: Soil moisture affected the activity of trifluralin, R 7465 and RH 315, with RH 315 least affected by soil moisture. RH 315 gave outstanding control of puncturevine in this study.

Potatoes: Two irrigation experiments (rill and sprinkler irrigation) were used in connection with preemergence and postemergence applications of 12 herbicides or combinations of herbicides. Trifluralin + EPTC, oryzalin + linuron, alachlor + linuron, metabromuron + DCPA, and Bay-94337 were most effective for weed control in these studies.

Five herbicides applied at 6 and 3 days, and 4 and 0 hours before sprinkler irrigation were evaluated for puncturevine control. EPTC, alachlor, and R 315 provided the best control of this weed and all compounds were somewhat affected by irrigation schedule.

Tomatoes: A preplant soil incorporated trial was conducted on tomatoes using U-27,267 compared to diphenamid, diphenamid + trifluralin, and diphenamid + pebulate. No herbicide caused significant injury to the tomatoes and all herbicides provided good to excellent season-long control. U-27,267 provided comparable weed control to the other herbicides tested. Shallow incorporation of U-27,267 provided less control than deeper incorporated material.

ORNAMENTALS

Turf: Several herbicides were evaluated on bluegrass and dichondra and two groundcover species in California. No herbicides were safe on direct seeded bluegrass and only NIA-20439 appeared safe on direct-seeded dichondra. The most promising herbicides on the groundcovers appeared to be alachlor, NIA-20439, and EL 119 + nitrofen.

Selective removal of several coarse-leaved grasses in bluegrass turf was evaluated in Colorado. The "best" treatment for elimination of each of these grasses is presented.

Repeated annual applications on 2,4-D, bensulide, DCPA, dicamba, bandane, and silvex on six varieties of bluegrass were evaluated. No treatment except bandane showed cumulative phytotoxic response (minor toxicity). 2,4-D was the best herbicide for control of dandelion, followed in descending order by dicamba, silvex, DCPA, bandane, and bensulide.

Groundcovers: Tolerance of nine groundcover species was evaluated using five herbicides in a trial conducted in California. Linuron did not generally cause severe injury to the groundcover species (with one exception), while amino triazole was safe on all but two species. MCPP caused less injury than 2,4-D. Bromoxynil caused contact injury on a number of species but all of these species exhibited normal regrowth.

Container grown: Oryzalin showed excellent preemergence activity on *Oxalis corniculata* with apparent safety on *Pinus thunbergii* and *Raphiolepis indica*. Linuron gave excellent postemergence and residual preemergence control of *Oxalis* sp. but caused some injury to *Pinus* sp. while only slight injury to *Raphiolepis* sp. was noted from this compound.

Scotch Pine: All treatments of simazine, atrazine, sumitol and simazine + atrazine provided excellent weed control in this experiment. The combination of simazine + atrazine showed less injury to Scotch pine than either compound alone. Sumitol was also safe to these trees and also provided excellent weed control. Bladex gave poor weed control in this trial.

Cyperus rotundus control in citrus. Lange, A. H., L. Francis, and G. Suthers. A three year study of repeat applications of four herbicides in three-year-old Valencia oranges on Troyer rootstock started in 1968 and continued until 1970. The very sandy soil (O.M. 1.1%, 78.5% sand, 16.5% silt, and 5% clay) was irrigated under commercial management by dragline sprinkler.

All the chemicals tested gave some nutsedge control. At the end of 3 years granular dichlobenil gave the highest rating but also the greatest symptom expression. The degree of symptoms would not be acceptable at 16 lb/A.

Bromacil at 4 lb/A was as good as at 8 lb/A. The symptoms were pronounced the first year but did not increase with tree age.

The nutsedge control from granular EPTC and foliar applied MSMA was considerably less.

Combinations of MSMA and dichlobenil were not appreciably better than dichlobenil alone. (Agricultural Extension Service, University of California, Riverside).

A summary of three years' results on the control of Nutsedge (*Cyperus rotundus* L.)

Herbicide	Formulation	Active Ingredient lb/A	Nutsedge Control 1968	1969	1970	Phytotoxicity 1968	1969	1970
A Dichlobenil	4% granular	4	5.7	7.0	7.6	0.8	0.5	0.4
B Dichlobenil		8	6.8	8.6	8.4	1.2	1.9	0.9
C Dichlobenil		16	7.0	9.8	9.2	1.8	3.1	3.1
D MSMA*	4.5 lb/gal	4+4+4+4	5.4	5.1	6.2	1.4	0.0	0.6
E Dichlobenil	4% granular	4						
+ MSMA	4.5 lb/gal	4+4+4	6.9	7.5	8.3	0.9	0.4	0.3
F Dichlobenil		8						
+ MSMA		4+4	7.8	8.6	9.0	0.7	0.8	0.8
G Bromacil	80% WP	4	7.4	4.0	8.0	1.7	0.1	0.3
H Bromacil		8	7.6	3.1	7.6	2.8	0.4	0.3
J EPTC	5% granular	4	5.0	1.9	4.4	1.6	0.1	0.4
L EPTC	5% granular	16	6.3	3.5	6.0	1.3	0.1	0.3
X Check			1.4	2.3	2.4	0.0	0.0	0.4

*MSMA was applied at 4 lb/A four times during the growing season.

Soil composition at the test site was 78.5% sand, 16.5% silt, 5% clay with 1.1% organic matter.

<u>Layered herbicides for the control of Johnsongrass in vineyards.</u> Lange, A. H. The control of bindweed by layered trifluralin and dichlobenil has been successful in a number of California locations. Johnsongrass has been controlled both in the seedling and "separated" rhizome stages by the incorporation of trifluralin, reported elsewhere. The object of this experiment was to evaluate layered trifluralin for control of johnsongrass.

Results indicate trifluralin and a related compound, EL-119, as well as dichlobenil, gave partial johnsongrass control. There was considerable influence root length in the trifluralin plots as well as reduced stand and vigor. Many johnsongrass plants in trifluralin treated plots, although apparently normal, did not produce normal roots or rhizomes. Repeat applications of this technique may prove to be beneficial in reducing the johnsongrass stand in the vine row.

French plowing away the soil, spraying trifluralin and discing back partially treated soil gave results comparable to layering with a spray blade. (Agricultural Extension Service, University of California, Riverside).

Control of Johnsongrass with spray blade and French plow techniques.

		Average 1/			
		Spray blade		French plow	
Herbicide	lb/A	W/C	Phyto.	W/C	Phyto.
Trifluralin	2	5.0	0.0	4.0	0.0
Trifluralin	8	6.5	0.0	6.7	0.0
EL 119	2	6.8	0.0	5.3	0.0
EL 119	8	7.2	0.0	5.0	0.0
Dichlobenil	2	6.0	1.2	6.0	2.3
Dichlobenil	8	8.2	2.2	6.0	3.0
R 7465	2	5.2	0.0	1.7	0.0
R 7465	8	4.2	0.0	5.7	0.0
Check	-	2.8	0.0	1.3	0.0

1/ Average of 3 & 4 replications.

Evaluation at harvest (6 and 7 months after treatment just after knifing the plots and discing the centers).

Herbicide screening for grapes. Lange, A. H., Fischer, B. B., Lider, L. Several herbicides showed excellent weed control and some safety in the 1971 screening trials at the Kearney Field Station. Dormant Thompson Seedless rootings and cuttings were planted at a depth of 12 to 16 inches on March 26, 1971, and immediately sprinkle irrigated with 1 acre inch. Herbicides were applied on April 16, 1971, when the buds were swollen and some starting to break on the stem. Immediately after herbicide application, 1 acre inch of water was applied by sprinkler and followed by rain. Subsequent irrigations were applied by flooding.

The unrooted cuttings were erratic and were not evaluated. The rooted cuttings gave good uniform growth. Those herbicides showing lasting injury included: VCS 438 at 8 lb/A (2 lb showed sufficient safety and excellent weed control), EP 479 at 8 lb/A, DS 5328 at 8 lb/A; whereas, DS 17338 showed injury at 2 and 8 lb/A. High rates of dinitro plus oil also showed excessive injury. Those herbicides showing more promise than simazine were: R 7465, RP 17623, EL 119, CGA 10832, SAN 9789, AN 56477, MON 097 and trifluralin. (Agricultural Extension Service, University of California, Riverside).

Grape herbicide screening trial

Average 1/

Herbicide	lb/A	Phytotoxicity 3 weeks	Phytotoxicity 6 weeks	Grape vigor 6 weeks	Grape vigor 4 mos.	Weed control 3 weeks	Weed control 6 weeks	Weed control 4 mos.	Remaining Weed species 2/
Simazine	2	0.7	5.3	7.6	8.0	10.0	10.0	10.0	
R 7465	2	1.3	0.3	8.6	10.0	4.0	6.0	10.0	Sp,H,RM
R 7465	8	3.3	3.0	8.3	8.6	7.3	9.5	9.5	Sp
RP 17623	2	8.7	2.0	7.6	7.3	10.0	9.7	5.0	Ch
RP 17623	9	9.7	5.0	8.0	8.0	10.0	10.0	10.0	
VCS 438	2	2.3	1.0	8.6	10.0	10.0	9.7	10.0	Cl
VCS 438	8	3.3	6.0	0.3	1.0	10.0	10.0	9.5	
EL 119	2	0.7	0.3	9.0	9.6	9.0	9.3	10.0	Sp
EL 119	8	2.3	1.0	8.6	8.6	10.0	10.0	6.0	N
Alachlor	2	0.3	1.3	8.3	8.0	9.7	8.3	5.0	F,G,Sp,RM,N
Alachlor	8	4.7	2.7	9.3	8.6	10.0	9.0	8.5	Sp
EP 479	2	0.7	1.6	8.3	9.6	10.0	10.0	9.2	
EP 479	8	0.3	9.0	0.3	0.6	10.0	10.0	10.0	
DS 5328	2	2.0	1.0	10.0	10.0	10.0	10.0	7.0	N
DS 5328	8	3.7	7.6	3.6	5.3	10.0	10.0	6.5	
DS 17338	2	3.7	9.0	0.3	0.6	9.3	10.0	10.0	
DS 17338	8	5.3	9.0	0.6	1.3	10.0	10.0	9.2	
CGA 10832	2	6.3	1.7	9.0	8.0	10.0	6.7	6.5	Sp,H,N
CGA 10832	8	4.0	1.7	8.3	7.6	10.0	10.0	10.0	
SAN 9789	1	2.3	0.0	9.0	9.3	10.0	9.0	4.8	H,Pig,P,N
SAN 9789	4	3.7	3.0	6.6	7.0	10.0	10.0	8.0	
AN 56477	2	2.0	0.3	9.0	9.6	10.0	8.0	7.6	Sp
AN 56477	8	2.3	0.0	9.3	9.0	10.0	7.3	8.2	Sp
GS 38946	2	0.7	0.0	8.0	7.0	5.7	2.3	3.1	Sp,Pig,H,RM,N
GS 38946	8	1.7	0.3	9.0	9.0	9.7	7.3	8.6	Sp
MON 097	8	5.0	2.7	8.6	9.0	10.0	10.0	9.5	
Trifluralin	2	4.0	0.0	9.0	8.6	10.0	7.0	8.0	Sp
Dinoseb + NP	10+4	2.3	3.0	9.3	10.0	10.0	10.0	5.5	
Dinoseb + NP	40+4	4.7	7.7	2.0	3.3	10.0	9.7	5.8	Cl,N
Check	-	3.7	0.3	7.0	6.3	0.0	0.0	2.8	Sp,Pig,H

1/ Average of 3 replications.
2/ Weed species - Sp-Shepherdspurse, H-henbit, RM-Reds Maid, Ch-Chickweed, Cl-clover, N-Nutsedge, F-fiddleneck, G-groundsel, P-purslane, Pig.-pigweed.

Timing of application on Johnsongrass control. Lange, A. Repeated foliage sprays on johnsongrass in vineyards showed that initial applications of MSMA, followed by repeated sprays of dalapon, were comparable on young johnsongrass shoots but poorer when spraying was commenced in May. MSMA sprays showed that applications to intermediate johnsongrass growth was generally more beneficial for MSMA than dalapon. Dalapon applied to early growth (April) was as good as later (May).

Late applications of dalapon or MSMA commencing in June were unsuccessful. Not all the late repeated treatments were completed because of the size of the johnsongrass in relation to the grape plant. Single, and even double, sprays applied to large johnsongrass plants were not satisfactory. (Agricultural Extension Service, University of California, Riverside).

The effect of timing and numbers of applications on the control of Johnsongrass evaluated at grape harvest (9/5/71).

		Average 1/ control when treatments started at:		
Herbicide	lb/A	6-8" 2/	10-18" 3/	16-30" 4/
Dalapon	4+4+4+4	7.5	6.8	2.2
MSMA + Dalapon	(4)+4+4+4	6.8	7.0	2.5
MSMA + Dalapon	(4)+4+4	6.8	4.3	0.0
MSMA + Dalapon	(4)+4	6.2	5.2	4.5
MSMA	4	2.3	5.9	2.3
MSMA	4+4+4+4	6.8	8.5	3.0
Check	-	0.0		

1/ Average of 4 replications where 0 = no effect; 10 = complete control, ie no live johnsongrass.
2/ Applied 4/13/71, 1st treatment.
3/ Applied 5/14/71 repeat treatments of dalapon + initial treatment of MSMA (10 to 18).
4/ Applied 6/12/71 repeat treatments of dalapon + initial treatment of MSMA (16 to 30).

SPECIAL NOTE: 10-18 inch plots did not receive their 3rd spray. The 16-30 inch plots did not receive their 3rd and 4th sprays because of the oversize of the johnsongrass in relation to the grape vines.

The effect of irrigation on the activity of three herbicides on peach rootstocks. Lange, A. Dormant nemagard peach rootstocks were planted on March 16, 1971, in a sandy loam soil in the Hanford series, 0.5% organic matter, 56% sand, 30% silt and 14% clay. Herbicides were applied and irrigated by a precision irrigation machine. The rate of irrigation was 1/4 acre inch per irrigation compared to 1 acre inch per irrigation applied at 3-day intervals for a total of 1 inch vs. 4 inches.

All herbicides showed some toxicity expressed by chlorosis and/or marginal leaf burn at varying degrees rated on a scale of 0 to 10. Simazine was safer than terbacil, particularly at the high level of irrigation. SAN 9789 was safer than both simazine and terbacil at both levels of irrigation. These results indicated that if simazine and terbacil are irrigated with high increments of water after application, injury to peach trees would vary, according to the level of irrigation. One-quarter acre inch per irrigation was safer than one acre inch in all three herbicides.(Agricultural Extension Service, University of California, Riverside).

The effect of sprinkler irrigation on the activity of three herbicides as measured by the response of young nemagard peach rootstocks.

Herbicide	lb/A	Average1/ phytotoxicity ¼+¼+¼+¼ A"	1+1+1+1 A"
Simazine	2	3.5	6.8
Terbacil	2	4.5	9.5
SAN 9789	4	1.2	4.0
Check	-	1.0	0.5

1/ Average phytotoxicity where 0 = no effect; 10 = complete kill of species.

The effect of quantity of first four irrigations on the phytotoxicity of three herbicides to nemagard peach rootstock.

Herbicide	Act	lb/A	Average Fresh Weight Top1/ ¼+¼+¼+¼ A"		1+1+1+1 A"	
			gm	%	gm	%
Simazine	80	2	405	64	381	56
Terbacil	80	2	492	77	220	32
SAN 9789	80	4	462	73	601	86
Check		-	633	100	675	100

1/ Average of 4 replications with six trees per plot.

Postemergence weed control in strawberries. Lange, A. Most commercial strawberry plantings are preplant fumigated with a mixture of methylbromide and chloropicrin. Weeds such as cheeseweed, sour clover and filaree often escape this treatment, causing high hand-weeding costs. Also, some weed seed reinfestation occurs between planting and the application of plastic mulch. Once the clear plastic mulch is in place, hand weeding becomes prohibitive.

In this study six postemergence herbicides were evaluated on Tioga and Shasta varieties planted 2 weeks prior to treatment. The air temperature was 78 F during treatment.

The outstanding herbicides in this trial were nitrofen, C 6989, and phenmedipham. Excellent broadleaf weed control was obtained at the low rate with sufficient safety at four times this rate. Bromoxynil, pyrazon and dalapon were not selective in strawberries.

All chemicals were weak on volunteer barley and good to excellent on young broadleaf weeds in the 2 to 4-leaf stage. (Agricultural Extension Service, University of California, Riverside).

The effect of six herbicides on the foliar condition of newly planted Tioga and Shasta strawberries and the control of annual broadleaves and volunteer barley.

		Average[1/]			
Herbicide	lb/A	Phyto-toxicity 3 days	Phyto-toxicity 15 days	Annual broadleaf[2/] Control	Volunteer barley Control
Nitrofen	2	1.5	0.0	8.8	5.0
Nitrofen	8	2.8	0.0	10.0	7.2
C 6989	2	0.5	1.0	8.5	6.0
C 6989	8	0.8	0.8	9.8	4.0
Pyrazon	2	4.2	6.5	10.0	6.0
Pyrazon	8	5.8	9.8	10.0	8.3
Bromoxynil	1/2	8.0	8.3	10.0	2.1
Bromoxynil	1	8.8	9.3	10.0	6.7
Phenmedipham	1	2.0	1.8	7.2	4.3
Phenmedipham	4	0.7	1.0	8.8	7.2
Chloroxuron + Nitrofen	4+4	3.0	1.2	10.0	7.0

		Average[1]			
Herbicide	lb/A	Phyto-toxicity 3 days	Phyto-toxicity 15 days	Annual broadleaf[2] Control	Volunteer barley Control
Dalapon	2	1.9	8.0	7.2	5.0
Dalapon	4	2.4	9.0	9.2	6.4
Check	-	0.0	0.2	0.0	0.0

1/ Average of 4 replications; 0-10 rating where 0 = no effect on berries or no weed control; 10 = complete kill of berries or complete kill of weeds. Treated 10/3/71.

2/ Broadleaf weeds included: fiddleneck, shepherdspurse, sour clover and others in the 2-4 leaf stage.

Herbicide screening for deciduous fruit trees. Lange, A. H. and B. B. Fischer. Most herbicides showed excellent weed control and several showed a good margin of safety in the 1971 deciduous fruits screening trial. Dormant trees were planted (seven *Prunus* varieties and one Bartlett pear) in each plot and immediately sprinkle irrigated February 11, 1971. The herbicides were applied March 8, 1971, and immediately sprinkle irrigated with 2 acre inches of water. Nemagard rootstock was used in a few special plots designed to evaluate method of incorporation. *Prunus* varieties included a Nonpareil and Texas (Mission) almond, Santa Rosa plum, Elberta peach, French prune, Bing cherry, and Tilton apricot. The soil was a sandy loam with a poor subsoil drainage (organic matter 0.34%, sand 58%, silt 30% and clay 12%).

Simazine, usually quite toxic in this soil under sprinkler and flood irrigations, was excessively toxic this year at 2 lb/A on seven varieties of *Prunus* as well as Bartlett pears. Herbicides showing the greatest selectivity were R 7465, RP 17623, EL 119, AN 56477 (incorporated), and CGA 10832. Those showing intermediate toxicity included VCS 438, alachlor and SAN 9789. Those showing excessive injury included both DS compounds, EP 479, simazine and Zobar. Most herbicides, even at the low rates, showed season-long weed control under the conditions of this experiment.

Preplant incorporated R 7465 showed some slight injury, but was considerably less than occurred last year (data not shown here). Where R 7465 was applied to the surface and sprinkle irrigated, or incorporated after planting, there was no injury even at the 8 lb/A rate.

SAN 9789 was noticeably less toxic on pear and apricot than on other varieties. Alachlor was also less toxic on apricot than it was on other varieties. (Agricultural Extension Service, University of California, Riverside).

Relative phytotoxicity of thirteen herbicides on seven varieties of *Prunus* and Bartlett pear at 2 and 5 months after application.

Herbicide	lb/A	Non pareil almond 2 mo.	Non pareil almond 5 mo.	Texas almond 2 mo.	Texas almond 5 mo.	Santa Rosa plum 2 mo.	Santa Rosa plum 5 mo.	Elberta peach 2 mo.	Elberta peach 5 mo.	Tilton apricot 2 mo.	Tilton apricot 5 mo.	Bing cherry 2 mo.	Bing cherry 5 mo.	French prune 2 mo.	French prune 5 mo.	Bartlett pear 2 mo.	Bartlett pear 5 mo.
		Average[1/]															
Simazine	2	5.0	6.0	7.0	8.5	6.5	8.2	6.5	8.8	8.2	8.2	1.5	7.5	5.5	8.8	1.2	7.7
R 7465	2	0.0	1.2	0.5	1.0	0.5	0.8	1.0	1.5	0.0	0.5	0.8	0.8	0.2	0.8	0.5	0.5
R 7465	8	0.0	2.2	0.0	2.2	0.8	1.5	0.0	2.8	0.0	0.0	0.5	3.0	0.0	2.2	1.2	1.8
RP 17623	2	0.0	0.8	0.2	0.2	0.0	0.0	0.2	0.5	0.0	0.0	0.5	0.5	0.5	1.2	1.0	1.8
RP 17623	8	0.0	0.2	0.8	0.5	1.0	0.5	0.0	0.2	0.0	0.2	0.5	0.2	0.5	1.0	1.0	2.2
VCS 438	2	0.0	3.5	0.0	4.5	0.3	2.5	0.7	2.5	0.3	1.0	0.7	3.5	0.7	3.8	0.0	1.2
VCS 438	8	3.8	9.2	5.2	9.8	5.5	10.0	4.0	10.0	3.5	8.5	1.2	10.0	4.8	10.0	1.7	8.5
EL 119	2	1.8	3.2	0.8	2.5	2.0	1.2	0.2	0.8	0.2	0.8	0.0	3.8	0.7	2.8	0.5	1.2
EL 119	8	0.2	3.0	1.0	3.0	0.2	2.2	0.0	3.0	1.5	3.0	0.2	4.0	0.0	2.8	1.2	4.5
Alachlor	2	0.5	3.5	0.5	2.0	0.8	2.0	0.8	3.0	0.5	1.0	0.8	2.5	2.8	1.2	1.5	2.8
Alachlor	8	2.5	5.2	2.8	6.0	2.2	4.8	3.2	6.2	2.5	3.0	2.2	4.5	2.5	5.2	4.8	7.2
AN 56477 (Inc)	2	0.0	1.2	1.5	2.8	1.0	0.2	0.5	1.0	0.5	1.0	1.0	2.2	2.5	4.0	1.5	2.2
AN 56477 (Inc)	8	0.2	2.0	0.2	2.5	1.8	2.5	0.5	0.8	0.5	1.0	0.8	2.5	0.8	4.5	0.5	1.8
EP 479	2	5.0	9.5	6.5	9.8	8.0	10.0	5.8	9.0	6.8	9.2	4.8	9.5	5.8	9.8	1.5	3.5
EP 479	8	6.2	10.0	6.5	10.0	8.0	10.0	4.8	10.0	6.8	10.0	5.0	10.0	8.0	10.0	2.0	9.8
DS 5328	2	9.0	9.5	5.5	5.8	8.2	7.2	6.8	6.8	3.5	3.0	7.5	8.8	8.5	8.0	3.2	7.5
DS 5328	8	9.2	10.0	7.5	9.0	9.0	10.0	8.5	9.8	7.0	7.0	8.8	10.0	8.8	10.0	5.0	10.0
DS 17338	1	9.0	10.0	9.0	9.2	9.0	9.2	9.0	9.0	9.0	9.2	8.7	9.2	8.7	9.2	7.3	8.6
DS 17338	4	9.0	10.0	9.0	10.0	9.0	10.0	9.0	10.0	9.0	10.0	9.0	10.0	9.0	10.0	9.0	10.0
CGA 10832	2	1.8	3.0	0.2	1.8	2.2	2.8	0.2	1.0	0.0	0.0	0.8	1.0	0.8	2.2	0.2	0.0
CGA 10832	8	0.0	0.8	0.0	1.5	0.2	1.2	0.0	0.0	0.0	0.2	0.0	2.2	0.2	1.5	0.5	1.0
SAN 9789	1	3.2	4.2	3.8	4.8	1.8	2.3	2.2	4.2	1.5	1.2	2.2	3.8	2.5	5.2	0.5	0.0
SAN 9789	4	3.8	8.8	3.8	8.2	3.5	8.0	3.5	7.5	3.2	4.8	2.5	7.0	3.5	9.5	1.0	2.0
Zobar	2	5.2	7.8	6.5	9.8	5.5	9.5	6.8	9.8	6.2	10.0	6.0	10.0	8.0	10.0	3.5	8.8
Zobar	4	8.2	10.0	8.2	10.0	8.5	10.0	7.5	9.8	9.0	10.0	9.0	10.0	9.0	10.0	5.5	9.5
Check	–	0.0	2.2	0.0	3.2	0.0	3.2	0.0	3.2	0.0	2.8	0.0	2.2	0.0	5.5	0.0	2.8

1/ Average of 4 replications.

Herbicide	lb/A	Average weed control[1/] 2 months	5 months	Weed species[2/]
Simazine	2	10.0	10.0	
R 7465	2	7.8	9.5	P
R 7465	8	8.8	9.8	G
RP 17623	2	8.5	8.5	P,St,Cb,Ch
RP 17623	8	9.2	10.0	
VCS 438	2	10.0	7.5	P,E,Sp,Cp,St
VCS 438	8	10.0	9.2	P,N
EL 119	2	10.0	9.8	St,N
EL 119	8	10.0	10.0	
Alachlor	2	8.2	3.0	P,Sc,St,Cp,Sp,Cp,G
Alachlor	8	9.0	5.5	Cb,P,St,Cp,B
AN 56477 (Inc)	2	9.8	8.2	St,Sc
AN 56477 (Inc)	8	10.0	10.0	
EP 479	2	10.0	10.0	
EP 479	8	10.0	10.0	
DS 5328	2	10.0	3.0	P,L,G,Cb,Cp,St
DS 5328	8	10.0	5.5	P,L,Cb,Cp,St,Sp
DS 17338	1	10.0	7.5	P,L,Cb,Cp,Sp
DS 17338	4	10.0	9.0	P,L,Sp
CGA 10832	2	8.8	5.8	P,L,Sc,G,St,Cb,Cp
CGA 10832	8	9.0	8.5	P,St
SAN 9789	1	10.0	7.8	P,Cp
SAN 9789	4	10.0	9.8	E,Cp
Zobar	2	10.0	10.0	
Zobar	4	10.0	10.0	
Check	-	0.0	1.5	K,Cb,P,L,St,E,Cp, Cw,LQ

1/ Average of 4 replications.

2/ P-pineapple weed, G-annual grasses, St-sow thistle, Cb-crabgrass only, E-erigeron, Sp-sprangle top, Sc-sour clover, Cp-carpet weed, Lq-lambsquarter, Cw-cudweed, K-knotweed, L-lovegrass, Ch-chickweed, N-nutsedge.

Methods of incorporation on bermuda and bindweed control in almond orchards. Lange, A. H., C. Downing, V. Carlson. Three herbicides were incorporated by power tiller and spray blade on October 29, 1970, in a young almond orchard. The organic matter was 0.1%, sand 59%, silt 27%, and clay 14%. The orchard was irrigated by dragline sprinkler immediately after application and throughout the season.

Bindweed and bermudagrass as well as annual weeds were controlled by trifluralin at 4 lb/A under both methods of incorporation. Nine months after application both R 7465 and RH 315 had some effect on annual as well as perennial weed control. Neither gave as good control as trifluralin. When rototilled, R 7465 gave better perennial weed control than when applied by blade, i.e., as a layer. (Agricultural Extension Service, University of California, Riverside).

The effect of method of incorporation on weed control with three herbicides down the tree row in an almond orchard.

		Average 1/					
		Bladed 3/			Rototilled 4/		
Herbicide 2/	lb/A	General	Bindweed	Bermuda	General	Bindweed	Bermuda
Trifluralin	4	7.3	8.7	7.3	8.7	8.3	9.7
Trifluralin	16	9.3	10.0	9.3	9.7	9.7	10.0
R 7465	4	4.7	5.0	5.0	7.7	6.7	9.0
RH 315	4	4.7	4.0	7.3	7.0	6.0	6.7
Check	-	4.7	3.7	7.3	3.0	1.3	5.7

1/ Average of 3 reps, 9 months after application based on 0 to 10 control rating; where 0 = no effect, 10 = complete control.

2/ Note all plots were treated periodically with paraquat by grower-cooperator.

3/ The soil was tilled with power-driven tiller (N.W. tree-hoe) and applied at 4 inches by an hydraulically operated blade.

4/ The soil was tilled with power-driven tiller, the herbicides applied and the plots retilled to a depth of 2 to 4 inches with the same power tiller.

Soil: 0.10% organic matter, 59% sand, 27% silt and 14% clay.

Special note: There were no observable effects on the almond trees.

Tolerance of pistachios to herbicides. Kempen, H. M. Five herbicides were applied on 11/13/70 around Kerman pistachios on Terebinthus rootstock to evaluate tree tolerance under sprinkler irrigation. The trees had been transplanted into the field during the spring of 1970, and were dormant when treated.

Few weeds were present in plots when observed during the course of one year. Observations on 5/2/71 indicated only terbacil at 4 lb/A caused injury, but evaluations on 9/17/71 showed severe injury from terbacil and the two high rates of simazine.

Grower experience has shown tolerance to simazine is marginal with male plants more susceptible than female.

In a second trial under sprinkler irrigation S-6706 at 2 and 8 lb/A applied 9/1/70 caused severe injury. Oryzalin, R 7465, RP 17623, nitralin at 2 or 8 lb/A and VCS 438 at 2 and 4 lb/A caused no injury. (Univ. of Calif. Agr. Extens. Serv., Bakersfield, Calif.).

The tolerance of pistachios to herbicides. (F & N-1-71) Bakersfield, Calif.

Applied: 11/13/70
Sprinkled: 11/17/70
Temperature: 65 F
Plot size: 10' x 11'; 3 replications

Rootstock: Terebinthus
Scion: Kerman
Planted: Spring, 1970
Clay = 16%; Silt = 26%; Sand = 58%; Organic matter = 0.3%

Herbicide	lb/A ai	Injury rating 1/	Weed control rating 1/	Weeds left 2/
Untreated	--	--	9.1	FMLGS
R 7465 50WP	4	0.3	10.0	--
R 7465 50WP	16	0.0	10.0	--
RP 17623 2EC	2	0.0	10.0	--
RP 17623 2EC	8	0.0	10.0	--
Simazine 80WP	1	0.3	10.0	--
Simazine 80WP	2	6.0	10.0	--
Simazine 80WP	4	8.7	10.0	--
Terbacil 80WP	1	7.0	10.0	--
Terbacil 80WP	4	10.0	10.0	--
Nitralin	2	0.0	9.9	F
Nitralin	8	0.0	9.9	M,S

1/ Rated 0 to 10: 0 = no effect; 10 = kill, ave. of 3 replications.
2/ Weeds left: F = filaree; M = sweet clover; L = London rocket; G = common groundsel; S = shepherdspurse.

Evaluation of dicamba for Canada thistle control in asparagus. Collins, R. L. Dicamba and 2,4-D sodium salt were evaluated for post-emergence selectivity in asparagus and Canada thistle control.

For many years, 2,4-D Na salt has been used in Washington asparagus fields for the control of perennial broadleaf weeds. Treatments are usually applied in the cutting season and occasionally as directed spray to the ferns. Control of perennial weeds has been, at best, negligible. The practice of treating during the cutting season is more of a "harvest aid" practice, rather than offering any real weed control program towards elimination of perennial weeds.

Herbicides were applied postemergence to Canada thistle (*Cirsium arvense*) on June 12, 1970, at Homestead, Washington. Soil type was loamy sand. Dicamba was applied as a directed spray at the base of the ferns, and over the tops of the ferns. 2,4-D Na salt was applied as a directed spray. Five percent granular dicamba was applied by air. A 4-year-old established stand of asparagus averaged 4 feet tall at treatment time. The 54-inch rows were furrow irrigated. The ground applications were applied with a commercial sprayer, with 90 gpa of water on 1.3-acre single-replicate blocks. The air application was made on 5 acres. Weed and crop evaluations were made on July 15,1970; April 20, 1971; May 21, 1971; and July 28, 1971.

Results (see table) showed that 2 lb/A of dicamba gave fair Canada thistle control. 2,4-D Na salt gave no control. Dicamba, when applied as a directed spray, appeared to be safe for asparagus; however, when applied over the top, it gave moderate to serious injury. Granular dicamba was ineffective.

In future test work, consideration should be given to making treatments of dicamba and 2,4-D Na salt during the cutting season as well as directed fern treatments. A 2 to 3-year spray program may be required to reduce significantly Canada thistle stands in asparagus. (Agricultural Consultant, formerly Velsicol Chem. Corp., Hillsboro, Oregon).

			Weed Control 1/				Crop Tolerance 1/			
Treatment	Type Applic.	Rate lb/A	July 70	Apr. 71	May 71	July 71	July 70	Apr. 71	May 71	July 71
2,4-D Na	directed	2.5	2.5	N	0	0	2.0	N	0	0
Dicamba	directed	1.0	7.5	D	2.0	1.0	2.0	N	0	0
Dicamba	directed	2.0	8.5	DF	6.0	4.0	2.5	N	0	1.0
Dicamba	over-top	1.0	8.0	D	3.0	1.0	8.0	D	3.0	3.0
Dicamba	over-top	2.0	9.5	DF	7.0	6.0	9.0	D	5.0	8.0
Dicamba G	air	2.0	0	N	2.0	1.0	0	N	0	0
Check	--	--	0	N	0	0	0	N	0	0

1/ 0 = no effect, 10 = complete elimination.

D = delayed emerg. N = normal emerg. F = formative effects.

Timing of irrigation after herbicide application. Agamalian, H. and A. Lange. Thirteen herbicides were applied at 7, 3, and 0 days before irrigation. Lettuce and broccoli were planted in dry soil prior to the first application of herbicide. The soil was of the Salinas series (organic matter 2.9%, sand 30%, silt 44%, and clay 26%). The ambient soil temperature range at the one-quarter inch depth for the first 7 days was 56 to 84 F. The soil surface was dry.

Most herbicides lost some activity by the seventh day. No effect on weed control with RH 315, RP 17623, and nitrofen was caused by a delay in irrigation up to 7 days.

Several herbicides lost considerable activity when allowed to remain on the soil surface for even 3 days. R 7465 appeared to lose activity between 0 and 3 days after herbicide application. Trifluralin appeared to lose activity somewhat faster than nitralin, UCB 3584, A 820, and perhaps even EL 119. The activity of benefin may have been lost at the same rate as that of trifluralin in this experiment. (Agricultural Extension Service, University of California, Riverside).

The effect of sprinkler irrigation after herbicide application on 13 chemicals.

		Average 1/												
		Purslane			Broadleaf			Lettuce			Broccoli			
Herbicide	lb/A	0-day	3-day	7-day	0-day	3-day	7-day	0-day	3-day	7-day	0-day	3-day	7-day
RH 315	2	10.0	10.0	10.0	9.3	9.3	8.0	4.0	1.0	5.3	6.0	6.3	6.0
RH 315	4	10.0	10.0	10.0	10.0	10.0	10.0	5.0	3.6	5.3	9.6	10.0	9.3
R 7465	2	8.3	6.0	6.6	7.0	4.3	3.6	9.6	9.3	8.3	3.0	2.3	6.0
R 7465	4	7.3	9.0	9.0	6.6	2.0	4.6	10.0	10.0	10.0	3.3	3.6	2.0
Nitralin	1	7.0	8.3	8.0	4.6	0.6	4.3	5.6	5.6	6.6	2.6	1.6	3.3
Nitralin	2	6.3	9.3	8.3	7.3	7.3	3.0	6.3	7.3	4.6	4.6	1.6	3.3
A-820	2	10.0	10.0	10.0	9.6	8.3	8.0	10.0	10.0	9.6	7.3	5.0	3.3
A-820	4	10.0	10.0	10.0	9.3	8.6	9.3	10.0	10.0	10.0	9.6	8.3	7.0
Trifluralin	1	8.6	4.6	5.6	2.0	4.3	2.0	6.6	6.6	2.6	1.3	4.0	1.3
Trifluralin	2	7.1	9.0	8.3	4.6	3.6	8.0	5.0	7.0	6.6	0.6	3.3	3.3
UCB 3584	1/2	6.0	7.3	6.0	7.6	6.0	4.3	8.3	7.0	7.3	5.0	8.6	3.6
UCB 3584	1	10.0	9.3	9.0	7.6	8.6	4.3	9.3	7.3	6.0	4.6	2.3	2.3
CGA 10832	1	7.3	5.6	6.3	3.6	6.0	6.0	4.0	4.0	6.3	2.3	2.3	4.3
CGA 10832	2	7.6	8.3	7.3	6.0	8.3	5.6	8.3	6.0	6.0	6.6	3.6	3.6
RP 17623	1	9.6	10.0	10.0	10.0	10.0	10.0	9.6	10.0	10.0	7.6	9.3	9.0
RP 17623	2	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	9.6	10.0	10.0	9.0
EL 179	1	5.6	6.0	3.3	3.6	3.0	2.0	7.0	8.3	3.0	2.0	5.0	3.6
EL 179	2	4.0	6.6	7.0	7.0	1.0	3.0	5.6	5.3	6.0	3.6	1.0	4.3
Benefin	1	6.3	2.0	6.0	2.6	5.0	2.0	4.0	2.6	0.6	3.0	3.0	2.6
Benefin	2	8.6	5.6	5.6	3.6	4.3	5.3	4.6	4.1	5.3	2.6	3.3	2.6
Nitrofen	4	10.0	9.0	9.3	9.3	7.0	8.3	8.6	9.0	7.0	1.3	4.6	2.6
Nitrofen	8	10.0	10.0	10.0	10.0	10.0	9.0	10.0	10.0	7.0	3.6	3.6	2.3
CDEC	4	9.3	8.0	7.6	5.0	6.3	1.0	4.3	5.6	6.3	3.0	3.6	2.6
CDEC	8	9.0	10.0	9.0	9.3	3.6	3.3	6.0	4.0	4.0	7.6	4.3	4.6
Alachlor	2	10.0	9.0	10.0	10.0	9.6	10.0	10.0	9.6	10.0	7.0	5.3	4.6
Alachlor	4	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	7.6	6.0	7.6
Check	-	2.6	1.6	2.3	0.0	5.6	0.0	3.6	3.3	1.3	1.0	3.3	0.3
Check	-	2.3	3.6	0.3	2.6	3.0	0.3	1.3	3.3	2.6	1.3	2.6	2.6

1/ Average of 3 replications where 0 = no effect and 10 = complete kill of crop.

The effect of initial moisture on the activity of herbicides. Lange, A. Earlier work at the South Coast Field Station showed a dramatic effect of soil moisture at the time of herbicide application on herbicide activity. In this study crops were planted on July 17, 1971, in Hanford fine sandy loam with 0.13% organic matter, 72% sand, 22% silt and 6% clay. One half of the plots were irrigated with 1/8 acre inch of water and the herbicides applied on July 19, 1971, at the single rate of 2 lb/A. The crops included corn, milo, beans, melons, and sugar beets. The crop emergence was somewhat erratic. When all crops were rated there appeared to be a definite effect of initial soil moisture on reducing the activity of trifluralin and to a lesser extent, R 7465 and RH 315. Of the three herbicides, RH 315 was least affected by soil moisture. Of the three herbicides RH 315 gave outstanding puncture vine control. (Agricultural Extension Service, University of California, Riverside).

The effect of initial soil moisture at time of herbicide application.

		Average[1/]					
		General Crop		Corn/Milo		Puncture vine	
Herbicide[2/]	lb/A	Dry	Moist	Dry	Moist	Dry	Moist
Trifluralin	2	6.0	1.5	5.8	2.0	5.2	3.2
R 7465	2	7.0	5.0	7.2	5.3	7.2	6.0
RH 315	2	8.8	7.0	9.0	9.0	9.2	9.0
Check	-	2.2	1.2	2.0	4.0	3.0	1.0

1/ Average of 4 replications. 0 = no effect; 10 = all plants dead.
2/ Herbicides were applied on dry and moist soil and irrigated uniformly after 4 hours with 1 acre inch of water.

Effects of herbicide treatments and irrigation methods on annual weed control, crop tolerance, and yield of potatoes. Ogg, Alex G., Jr. Russet Burbank potatoes were planted at Prosser, Washington on April 27, 1971, in a loam soil with a low organic matter content (0.9%). The field was then divided into two areas. One area was rill irrigated, and the other was sprinkler irrigated. Herbicides were applied as preemergence treatments on May 14-17, 1971, and as postemergence treatments on June 24, 1971. Each treatment was replicated three times with plots four rows wide and 20 feet long. Rolling cultivators were used to incorporate certain herbicides with the soil.

Weed populations were sparse in the plot area. Barnyardgrass and pigweed were the dominant species. Plots were evaluated for weed control and tolerance of the crop to the herbicides by visual comparison with controls. Yields were determined by harvesting the two center rows of each plot.

Under rill irrigation, nine of the herbicide treatments were statistically equal to the handweeded control in terms of percent weed control and yield (Table 1). Trifluralin + EPTC, alachlor + linuron, and chlorbromuron + DCPA were the most effective of the nine treatments. Trifluralin + EPTC is currently being used by many potato growers in Washington.

Bay-94337 (4-amino-6-t-butyl-3-[methylthio]-1,2,4-triazin-5[4H]-one) provided good to excellent weed control as either a pre or postemergence treatment. However, yields were significantly lower on plots with postemergence treatments.

Eleven of the 22 herbicide treatments applied to potatoes grown under sprinkler irrigation did not reduce yields and provided equally good weed control (Table 2). Of these eleven, the most effective were trifluralin + EPTC, oryzalin + linuron, alachlor + linuron, metobromuron + DCPA, and Bay-94337 (postemergence). All of the treatments controlled a wide range of weed species.

Alachlor alone provided excellent weed control in this test. However, it reportedly has been rather ineffective on lambsquarters. Thus it will probably be necessary to use alachlor in combination with another herbicide such as linuron if lambsquarter is a problem.

Chlorbromuron and metobromuron were ineffective on barnyardgrass. Therefore, they were tested in combination with DCPA. The combination of metobromuron + DCPA appeared to be superior to chlorbromuron + DCPA under sprinkler irrigation; whereas, the reverse was true under rill irrigation.

Bay-94337 provided excellent weed control whether applied as a pre or postemergence treatment and yields were not reduced significantly.

The combination of trifluralin + RP-17623 (2-tertiobutyl-4-[2,4-dichloro-5-isopropyloxphenyl]-5-oxo-1,3,4-oxadiazoline) provided excellent control of pigweed, but was only partially effective on barnyardgrass. The treatment did not adversely affect yields.

Norea provided excellent weed control, but it reduced yields markedly in this experiment. (Cooperative investigations of the Plant Science Research Division, Agricultural Research Service, U. S. Department of Agriculture and the Washington Agricultural Experiment Station, Prosser, Washington).

Timing of irrigation after herbicide application. Lange, A. Five herbicides at a single rate were applied at 6 days, 3 days, 4 hours, and 0 time before irrigation on a newly prepared and irrigated sandy soil. The planted crops did not germinate uniformly but there was a uniform stand of puncture vine present. This was used to assay effects of timing of irrigation after herbicide application.

Table 1. Annual weed control, crop tolerance, and yield data for rill irrigated potatoes. Prosser, Washington.

Treatments	Rate lb ai/A	% Control 8-27-71 BG	PW	General weed control rating 8-27-71[1/][2/]	Crop tolerance rating 6-15-71[3/]	Tons No. 1's per acre[1/]
Preemergence, incorp.						
Trifluralin + EPTC	1/2 + 3	100	100	5.0 a	10.0	17.5 ab
Trifluralin	1/2	86	87	3.7 ab	9.7	14.4 a-d
Bay-94337	3/4	84	97	4.1 ab	9.3	18.4 a
Alachlor	2 1/2	85	98	4.1 ab	9.7	17.5 ab
Alachlor + Linuron	2 + 1	98	100	5.0 a	10.0	15.6 a-d
Alachlor + DNBP-amine[4/]	2 1/2 + 3	91	100	4.3 ab	9.0	17.4 abc
Metobromuron + DCPA	1 + 6	81	92	3.7 ab	9.0	14.9 a-d
Chlorbromuron + DCPA	1 1/2 + 6	99	100	5.0 a	10.0	14.5 a-d
DCPA	10	88	98	4.2 ab	9.7	17.6 ab
Handweeded	-	88	87	3.9 ab	10.0	18.9 a
Control	-	0	0	1.6 d	10.0	18.2 a
Postemergence						
Bay-94337	3/4	98	100	5.0 a	10.0	12.8 d

1/ Values followed by the same letter are not significantly different at the 5% level.

2/ General weed control rating: 5=Excellent; 4=Good; 3=Fair; 2=Poor; 1=Bad.

3/ Crop tolerance rating: 0=Dead; 10=Normal, vigorous, no symptoms.

4/ Applied after the alachlor was incorporated.

Table 2. Annual weed control, crop tolerance and yield data for sprinkler irrigated potatoes. Prosser, Washington.

Treatments	Rate lb ai/A	% Control 8-27-71 BG	% Control 8-27-71 PW	General weed control rating 8-27-71[1/2/]	Crop tolerance rating 6-15-71[3/]	Tons No. 1's per acre[1/]
Preemergence, incorp.						
Trifluralin + EPTC	1/2 + 3	88	98	4.2 a-f	10.0	13.7 ab
Trifluralin + RP-17623[4/]	1/2 + 1	80	100	3.6 efg	9.3	11.4 abc
Trifluralin	1/2	86	95	3.9 b-g	9.7	10.4 a-d
Preemergence, non-incorp.						
Bay-94337	3/4	98	100	5.0 a	9.0	9.0 a-d
Alachlor	2 1/2	98	100	5.0 a	9.3	14.5 a
Alachlor + Linuron	2 + 1	100	100	5.0 a	8.7	11.1 abc
Alachlor + DNBP-amine	2 1/2 + 3	98	100	5.0 a	9.7	8.9 a-d
Metobromuron	1	91	100	4.4 a-e	9.7	11.1 abc
Metobromuron	2	100	100	5.0 a	9.3	8.7 a-d
Metobromuron + DCPA	1 + 6	83	100	4.0 a-f	10.0	11.7 abc
Chlorbromuron	1 1/2	83	100	3.8 c-g	10.0	11.6 abc
Chlorbromuron	3	97	100	5.0 a	10.0	8.0 bcd
Chlorbromuron + DCPA	1 1/2 + 6	85	100	3.9 b-g	9.7	9.4 a-d
Oryzalin	1	81	98	3.7 d-g	10.0	11.0 abc
Oryzalin	1 1/2	80	97	3.6 efg	9.7	11.6 abc
Oryzalin	2	80	95	3.4 fg	10.0	11.1 abc
Oryzalin + Linuron	1 + 3/4	89	100	4.3 a-f	9.7	11.1 abc
Oryzalin + Linuron	1 + 1	78	97	3.4 fg	10.0	8.5 a-d
Oryzalin + Linuron	1 1/2 + 1	93	100	4.7 abc	9.7	9.9 a-d
Norea	1.6	98	98	4.9 a	8.7	4.8 de
Handweeded	-	83	87	3.5 efg	10.0	10.4 a-d
Control	-	0	0	1.3 h	10.0	11.7 abc

Treatments	Rate lb ai/A	% Control 8-27-71		General weed control rating 8-27-71 [1/] [2/]	Crop tolerance rating 6-15-71 [3/]	Tons No. 1's per acre [1/]
		BG	PW			
Postemergence						
Bay-94337	1/2	93	99	4.6 a-d	10.0	11.7 abc
Bay-94337	3/4	95	100	4.8 ab	10.0	13.6 ab

1/ Values followed by the same letter are not significantly different at the 5% level.

2/ General weed control rating: 5=Excellent; 4=Good; 3=Fair; 2=Poor; 1=Bad.

3/ Crop tolerance rating: 0=Dead; 10=Normal, vigorous, no symptoms.

4/ Applied after the trifluralin was incorporated.

RH 315 and alachlor appeared not to be affected by timing up to 6 days before irrigation. The activity of R 7465 appeared to be less after a 3-day delay in irrigation. Trifluralin was somewhat erratic, probably because puncture vine control is somewhat lesser with low rates under sprinkler. EPTC (Eptam) appeared to lose some activity after 3 days. (Agricultural Extension Service, University of California, Riverside).

Average[1/] puncture vine control

Herbicide	lb/A	Time between herbicide application and irrigation			
		6 days	3 days	4 hours	0 hours
RH 315	2	8.0	6.2	6.2	7.2
R 7465	2	3.2	3.5	6.2	7.0
Alachlor	2	8.0	7.2	8.0	7.8
Trifluralin	2	6.8	3.5	7.2	4.8
EPTC	4	5.5	7.5	8.0	8.2
Check	-	3.2	-	-	-

[1/] Average of 4 replications (Plots 5 ft x 5 ft). Treated 6/29-7/3/71.

Note the soil was 0.13% organic matter, 72% sand, 22% silt, and 6% clay. The soil temperature was 99 to 104 F during this experiment and the soil near field capacity.

Evaluation of U-27,267 for weed control in tomatoes. Bowers, R. C. A preplant incorporated trial was conducted in San Jose, California to ascertain effectiveness of U-27,267 (3,4,5-tribromo-N,N,α-trimethylpyrazole-1-acetamide) for weed control in direct seeded tomatoes. Diphenamid, diphenamid plus trifluralin, and diphenamid plus pebulate were included for comparative purposes. Herbicides were applied to the soil (49% sand, 35% silt, 16% clay, 4.6% OM) on May 22, 1971, and incorporated 1.5 or 3.0 inches deep with a power-driven tiller immediately after application. Tomatoes were direct seeded during the same operation as herbicide incorporation. Treatments were replicated three times on four-bed plots 100 ft long. Plots were sprinkle irrigated five times and furrow irrigated the balance of the season. Tomatoes were hand thinned to a commercial stand on June 24. One set of check plots was hoed clean of weeds during the thinning operation. The other set of check plots and all herbicide treated plots were hoed only as occurred incidental to the thinning operation, thus simulating random mechanical thinning. Crop and weed phytotoxicity ratings were made on June 11, June 21, and July 19. The experimental area was heavily infested with redroot pigweed (*Amaranthus retroflexus*) and later a small population of lambsquarters (*Chenopodium album*). Yield was obtained by harvesting two subplots (two rows x 10 ft) per replicate on October 12.

None of the herbicide treatments caused significant injury to tomatoes (see table). All chemical treatments provided excellent early

Comparison of U-27,267 with several herbicides for weed control and yield of tomatoes

Treatment	Rate lb ai/A	Depth of Incorporation	Phytotoxicity rating[2/] Tomato 20[3/]	Tomato 30	Tomato 58	Pigweed 20	Pigweed 30	Pigweed 58	Lambsquarters 30	Lambsquarters 58	Yield T/A
U-27,267	1.5	1.5	0	0	0	10.0	9.3	9.3	9.7	10.0	38.8[4/]ab
U-27,267	3.0	1.5	0	0	0	10.0	9.7	8.7	10.0	9.3	35.0bc
U-27,267	1.5	3.0	0	0	0	9.3	10.0	10.0	10.0	9.7	46.5a
U-27,267	3.0	3.0	0	0.3	0	10.0	10.0	10.0	10.0	10.0	47.0a
Diphenamid	6.0	1.5	0	0	0	10.0	10.0	8.0	9.7	8.3	29.1cd
Diphenamid + Trifluralin	4.0 0.25	1.5	0	0.7	0	9.3	10.0	9.7	10.0	9.7	44.9a
Diphenamid + Pebulate	6.0 4.0	3.0	0	0	0	10.0	10.0	9.7	10.0	9.3	35.0bc
Hoed check[1/]	-	-	0	0.7	0	0	2.3	7.3	2.3	9.0	31.0bc
Check	-	-	0	0	0	0	0	3.3	0	8.3	20.2d

[1/]Hoed after the 30 day observation.

[2/]0 = No injury or control, 10 = complete kill or control.

[3/]Days after incorporation and planting.

[4/]Values followed by the same letter are not significantly different.

pigweed control. Shallow incorporated U-27,267 and diphenamid began losing control by 58 days after application; however, they were still superior to the hoed check. Effective early season lambsquarters control was achieved with all treatments, including the hoed check. However, control with diphenamid started to break by 58 days after treatment. Depth of U-27,267 incorporation had more influence than rate on pigweed and lambsquarters control. The lack of late season pigweed control was reflected in tomato yield. Yield from unhoed checks was significantly lower than from all other treatments except diphenamid. Yield from diphenamid treatments was equal to that from shallow incorporated U-27,267, diphenamid plus pebulate and the hoed check. Yield from shallow incorporated U-27,267 and diphenamid plus pebulate were equal to each other, but all treatments except low rate of U-27,267 were significantly lower than deep incorporated U-27,267 and the diphenamid plus trifluralin plots. (Technical Extension, The Upjohn Co., Davis, Calif.).

Control of coarse-leaved grasses in bluegrass turf. Fults, Jess L. This study, a progress report of which was reported in 1970, has been continued in 1971. The treatments made in 1970 were repeated on the same plots in 1971. The study is concerned with the selective removal of coarse fescue (*Festuca arundinacea* Schreb.), orchard grass (*Dactylis glomerata* L.), redtop (*Agrostis alba* L.), timothy (*Phleum pratense*), perennial ryegrass (*Lolium perenne* L.), and smooth bromegrass (*Bromus inermis* Leyss.) from Kentucky bluegrass (*Poa pratensis* L.) turf. In Experiment 1, seven different herbicides, in all possible paired combinations, were studied for each coarse grass. These include the organic arsenicals Phytar 560 (sodium cacodylate plus dimethyl arsenic acid) applied at 1 pt in 50 gpa water; Ansar 529 (MSMA + surfactant) at 5.4 pt in 215 gpa water; amitrol at 8 lb in 86 gpa water; paraquat at 1 lb ai in 215 gpa water; potassium cyanate at 30 lb ai in 86 gpa water; dalapon at 6 lb ai in 86 gpa water; and picloram at 8 lb ai in 86 gpa water. In Experiment 2, the same chemicals were studied but each was used in combination with 4 levels of ammonium sulfate at 2, 4, 8, and 12 lb of active nitrogen per 1000 square feet per year. Quantitative data on the effects of the treatments were secured by making 3 one-square-foot quadrat ocular estimates in each plot and treatment on July 23, 1971. The trends in 1971 were similar to those reported in 1970, in that each coarse grass responded differently. The arbitrarily selected "best" treatments in Experiment 1 (paired herbicides) and Experiment 2 (single herbicides at 4 nitrogen levels) for the 6 coarse grasses are shown in the following table. (Weed Research Laboratory, Botany Department, Colorado State University, Fort Collins).

The selective removal of coarse grasses from Kentucky bluegrass turf. 1971 evaluation. Fort Collins, Colorado.

Coarse grass	"Best" Treatment	
	Experiment 1 (paired herbicides)	Experiment 2 (single herbicides + N)
1. Coarse fescue (*Festuca elatior*)	Paraquat + picloram 13 treatments reduced fescue to 0 percent	Phytar 560 + 8 lb N/1000 sq. ft. 10 treatments reduced fescue to 0 percent
2. Orchard grass (*Dactylis glomerata*)	Phytar 560 at single rate 18 treatments reduced orchard grass to 0 percent	Phytar 560 + 4 lb N/1000 sq. ft. 3 treatments reduced orchard grass to 0 percent
3. Redtop (*Agrostis alba*)	Ansar 529 at single rate 25 treatments reduced redtop to 0 percent	Aerocyanate + 8 lb N/1000 sq. ft. 24 treatments reduced red-top to 0 percent
4. Timothy (*Phleum pratense*)	Aerocyanate + Ansar 10 treatments reduced timothy to 0 percent	Aerocyanate + 8 lb N/1000 sq. ft. 6 treatments reduced timothy to 0 percent
5. Perennial rye-grass (*Lolium perenne*)	Ansar 529 at single rate 14 treatments reduced perennial ryegrass to 0 percent	8 lb N/1000 sq. ft. 26 treatments reduced perennial ryegrass to 0 percent
6. Smooth brome-grass (*Bromus inermis*)	Phytar 560 at 2X rate 56 treatments reduced bromegrass to 0 percent	Ansar 529 + 2 lb N/1000 ft.^{2} or 12 lb N/1000 sq. ft. 31 treatments reduced bromegrass to 0 percent

The effects of repeated annual applications of 2,4-D, bensulide, DCPA, dicamba, bandane, and silvex to six varieties of Kentucky bluegrass turf. Fults, Jess L. This study was begun in September 1963 when the Merion, Newport, Delta, Park, and common Kentucky bluegrass plots were originally established. A plot of "seeded" Windsor was established in October 1964 and a plot of "sodded" Windsor in October 1965. Applications of the six herbicides were made to the same subplots each year beginning July 12, 1966, and thereafter on April 24, 1967, May 20, 1967, May 22, 1968, July 25, 1969, July 16, 1970, and July 17, 1971. Within each variety one half of the plot area was kept fertilized and one half was not fertilized. One half of each of these subplots was kept mowed at a cutting height of 1 1/2 inches and the other half at 1/2 inch. Data consisting of ocular estimates of efficacy of weed control, toxicity symptoms, and color of turf were collected on August 2, 1969, July 16, 1970, and July 19, 1971. Line interceptions (plant frequencies) were made on July 16, 1970. Exploratory measurements of soil residues using bioassays were made November 30, 1971. These will be studied in detail during the 1972 season just prior to the sixth year of treatment. Annual rates of application have been at the usual rates generally recommended for adequate weed control. The annual rates used were: 2,4-D applied at 2 lb ai/A; bensulide at 15 lb ai/A; DCPA at 35 lb ai/A; and silvex at 2 lb ai/A. The only weed of significance was common dandelion (*Taraxacum officinale* Waggers).

Some of the significant trends in 1970 and 1971 are as follows:

1. The most effective weed control without regard to fertilization or height of cut was 2,4-D; the next best were dicamba, silvex, DCPA, Bandane with bensulide being the least effective.

2. None of the treatments except Bandane indicated any cumulative phytotoxic response. Even the toxic response from repeated Bandane treatment produced only minor toxicity--estimated at 4.2 percent.

3. The grass frequency analysis (turf density) indicated that the greatest average grass frequency occurred in the dicamba treatment followed by silvex, DCPA, 2,4-D, Bandane, Control, and bensulide.

4. Fertilized plots had a definitely higher grass frequency than unfertilized plots; plots mowed at 1 1/2 inches showed a higher frequency than those cut at 3/4 inch.

5. There was almost a complete lack of weeds in all fertilized plots whether cut at 1 1/2 or 3/4 inches without regard to herbicide treatment. (Weed Research Laboratory. Botany Department, Colorado State University, Fort Collins).

Tolerance of several established ground cover species to five postemergence herbicides. Elmore, C., D. Hamilton, E. Johnson, and T. Kretchun. Few herbicides can be used safely as a postemergence treatment over a broad spectrum of ground cover species. If weeds escape preemergence treatment or are not treated, they normally must be removed mechanically or by hand before a preemergence herbicide treatment is applied.

Five herbicides were applied as broadcast sprays over established rows of nine ground cover species at the San Jose Field Station. Treatments were applied July 26, 1971, using a Champion knapsack sprayer with three teejet 8004 nozzles at a pressure of approximately 30 psi. No surfactants were used with any treatment. Each treatment was replicated four times. Injury evaluations (Tables 1 and 2) were made September 1, 1971, September 30, 1971, and October 22, 1971.

Vinca minor

Vinca minor was initially injured severely by bromoxynil at a rate of 1 lb/A. However, regrowth was unaffected, as evidenced by complete defoliation. Also, amino triazole and 2,4-D amine produced their characteristic symptoms early with only amino triazole persisting more than a month. MCPP appeared to be much safer than 2,4-D amine on *Vinca minor*. Linuron did not injure *Vinca minor* at 1 or 2 lb/A.

Hypericum calycinum

Initially injury was evident from amino triazole shown by chlorotic symptoms, 2,4-D amine, and bromoxynil. Bromoxynil at 1 lb/A burned foliage; however, recovery was complete. Amino triazole symptoms remained 7 weeks after application.

Delasperma alba

Almost all herbicide treatments injured *Delasperma alba*. Amino triazole severely yellowed the plants with symptoms lasting over 7 weeks. 2,4-D amine and MCPP injury appeared as twisting of new growth and tip die back. Linuron reddened leaves and stunted the *D. alba* at both 1 and 2 lb/A; however, 1 lb/A would appear to be safe.

Gazania splendens

Although there was only a marginal stand of *Gazania splendens* for evaluating, it was apparent that linuron, MCPP, or bromoxynil did not excessively injure the plants. Amino triazole discolored foliage; however, it did not kill the plants at 1 lb/A. 2,4-D amine at 0.5 lb/A did not appear to injure *G. splendens*.

Hedera canariensis

Amino triazole turned *H. canariensis* leaves chlorotic. MCPP did not appear to cause injury at 1 or 2 lb/A nor did 2,4-D amine at 0.5 lb/A. Slight leaf turn was noted with bromoxynil at 1 lb/A; however, it was only slight and new growth was not affected. Linuron did not appear to injure *H. canariensis* at 1 or 2 lb/A.

Hedera helix

Amino triazole at 1 lb/A was the only treatment which appeared to affect *Hedera helix*. Chlorosis, the usual amino triazole response, was the major injury symptom. No injury was apparent from the other herbicides.

Carpobrotus edule

Several interesting herbicide effects were noted on *Carpobrotus edule*. Linuron caused a severe red spotted condition on the foliage which was apparently due to spray droplets. Amino triazole produced only slight chlorosis at 1 lb/A in this test. MCPP at 1 lb/A appeared to cause only slight distortion of growth; however, injury from the 2 lb/A treatment was more severe and unacceptable. The degree of injury was also unacceptable with 2,4-D amine at 0.5 lb/A for the first month after treatment. However, regrowth occurred and symptoms were reduced. Bromoxynil severely injured *C. edule* (Table 2) as observed by foliage necrosis.

Sedum brevifolium

All herbicides and rates appeared to be acceptable on *Sedum brevifolium*. Bromoxynil at 1 lb/A killed the flower stalks present at the time of treatment.

Ajuga repens

The herbicide, bromoxynil, at 1 lb/A did not injure *Ajuga repens*. MCPP and amino triazole severely injured *A. repens* and caused characteristic distortion and chlorosis, respectively. After 7 weeks, however, only slight leaf discoloration and stunting were observed. (Agricultural Extension Service, University of California, Davis).

Table 1. Tolerance of five ground cover species to five herbicides evaluated at two intervals after treatment.*

Herbicide	Rate lb ai/A	*Vinca minor*			*Hypericum calycinum*			*Delasperma alba*			*Gazania splendens*			*Hedera canariensis*		
		9/1	9/30	10/22	9/1	9/22	10/22	9/1	9/30	10/22	9/1	9/30	10/22	9/1	9/30	10/22
Linuron	1	1.2	0.2	1.0	0.2	0.5	0.5	1.8	0.5	2.2	0.8	0.3	1.0	0.8	0.2	1.0
Linuron	2	1.8	0.5	1.0	0.0	0.0	0.0	2.2	0.2	2.2	1.0	0.3	0.3	1.2	0.5	0.5
Amino triazole	1	3.0	3.0	2.0	3.0	3.7	2.7	5.8	6.8	6.5	4.0	3.0	1.5	3.2	3.5	3.0
MCPP	1	0.0	0.0	0.0	0.2	1.0	0.2	3.8	3.5	4.5	0.0	0.3	0.7	0.0	0.0	0.5
MCPP	2	0.2	0.0	0.0	0.5	0.8	1.0	3.2	3.8	5.5	2.0	0.7	0.0	0.0	0.0	0.0
2,4-D amine	0.5	3.8	1.2	0.0	2.8	2.8	0.0	5.5	2.0	3.2	1.0	0.3	0.0	0.5	0.5	0.0
Bromoxynil	1	6.8	0.2	0.0	2.8	1.2	0.0	4.2	1.2	2.2	0.0	0.7	0.7	1.2	0.8	0.0
Control	-	0.8	0.2	0.5	0.2	0.8	0.0	0.2	0.2	0.2	0.0	0.0	0.7	0.0	0.2	0.0

* Phytotoxicity: 0 = no effect; 10 = dead plants.

Table 2. Tolerance of four ground cover species to five herbicides evaluted at two intervals after treatment.*

Herbicide	Rate lb ai/A	*Ajuga repens* 9/1	*Ajuga repens* 9/30	*Ajuga repens* 10/22	*Sedum brevifolium* 9/1	*Sedum brevifolium* 9/30	*Sedum brevifolium* 10/22	*Carpobrotus edule* 9/1	*Carpobrotus edule* 9/30	*Carpobrotus edule* 10/22	*Hedera helix* 9/1	*Hedera helix* 9/30	*Hedera helix* 10/22
Linuron	1	2.0	0.8	0.5	0.0	0.2	0.0	2.0	4.0	4.5	0.5	Not evaluated	0.2
Linuron	2	2.2	2.0	0.2	0.5	0.2	0.2	3.5	5.0	6.5	0.8		0.0
Amino triazole	1	6.5	3.8	0.7	0.8	1.2	0.2	1.0	3.0	2.8	3.2		1.5
MCPP	1	4.0	6.8	1.0	0.2	0.5	0.5	0.5	1.2	0.8	0.2		0.0
MCPP	2	2.5	2.5	0.0	0.2	0.5	0.2	3.5	3.2	1.2	0.0		0.0
2,4-D amine	0.5	1.0	0.2	0.0	1.2	0.0	0.2	3.5	1.0	0.7	0.8		0.0
Bromoxynil	1	0.5	0.2	0.0	0.8	0.0	0.0	4.5	1.8	1.0	1.0		0.0
Control	-	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0		0.0

* Phytotoxicity: 0 = no effect; 10 = dead plants.

Oxalis corniculata control in container grown ornamentals and tolerance of *Pinus thunbergii* and *Raphiolepis indica* to several herbicides. Elmore, C. L., L. Frey, and E. Roncoroni. *Oxalis corniculata*, a creeping wood sorrel, is one of the major and more persistent plant weed pests in growing container ornamental plants. Because of extensive seeding from a single plant and running rootstocks, the plant is very prolific and difficult to control through cultural management. If only a few plants are allowed to seed in a nursery, soon the entire nursery can become infested.

Until the present time the soil persistent herbicides, simazine and monuron, have provided the only chemical means of control. Both of these materials are, however, non-selective to all but a few ornamental species, notably orchids and palms. Soil fumigation with methyl bromide is effective as a pre-plant treatment, but once plants are established this treatment cannot be used without killing desirable plants.

Young transplanted *Pinus thunbergii* and *Raphiolepis indica* plants in one gallon containers were selected to screen several herbicides for oxalis control. Containers of *Pinus thunbergii* with oxalis present were chosen for postemergence treatment. Four replications of each species were treated with a broadcast spray on April 2, 1971, with a CO_2 pressure sprayer. Treatments were hand watered immediately after treatment. All weeds were pulled from the containers after the first evaluation on May 7, 1971. Seed was scattered over the complete trial to assure oxalis reinfestation for preemergence activity. Subsequent evaluations were made as preemergence treatments, even though the soil in the *P. thunbergii* containers had been disturbed.

Oxalis control and phytotoxicity evaluations are summarized in Tables 1 and 2.

The soil was a modified U.C. mix containing 16.9% organic matter, 68% sand, 6% silt, and 6% clay.

Results

An herbicide that gave excellent preemergence activity with apparent safety to both ornamental species was oryzalin. No postemergence effect was observed. A rate of 2 lb/A gave 70% control at 4 months with the 4 lb and 8 lb/A rates producing 80 and 90% control, respectively. From previous tests, oryzalin was determined to be safe on four other species, as well.

Linuron (Lorox) gave èxcellent postemergence and residual preemergence control of *Oxalis corniculata* at all rates of application. After 4 months, 1 lb/A indicated reduced control; however, 2 and 4 lb/A were still giving 100% control. There was some injury to *Pinus thunbergii* at all treatment rates with only slight injury to *Raphiolepis indica*, except at 4 lb/A.

None of the other herbicides or combinations gave the residual control of linuron or oryzalin.

Activity was found with simazine in combination with CGA 10832. However, simazine has previously controlled oxalis and this combination does not appear to be an improvement.

Other herbicides that appear to be safe on *Raphiolepis indica* and *Pinus thunbergii* are R-7465, alachlor, A-820, and terbutryn (Igran). Alachlor (Lasso) is currently registered for use on ornamentals. (Agricultural Extension Service, University of California, Davis).

Table 1. Control of *Oxalis corniculata* by several herbicides and combinations of herbicides at various intervals after application.*

		Months after application			
	Rate	Postemergence	Preemergence		
Herbicide	lb ai/A	1 mo	2 mo	3 mo	4 mo
R-7465	4	1.5	5.8	5.0	4.0
R-7465	8	0.0	7.2	6.8	4.0
R-7465	32	1.8	8.0	7.6	5.0
Oryzalin	2	1.2	5.5	8.1	7.0
Oryzalin	4	0.8	6.5	9.2	8.0
Oryzalin	8	0.5	9.2	10.0	9.0
Alachlor	2	1.2	1.2	1.5	0.0
Alachlor	4	0.2	1.8	3.5	0.0
Alachlor	8	3.2	0.8	2.2	2.0
A-820	2	2.5	1.5	3.8	1.0
A-820	8	0.5	1.8	4.5	3.0
Nitralin	2	0.2	3.0	6.0	3.0
Terbutryn	1	0.2	0.0	0.2	0.0
Terbutryn	2	3.2	0.0	0.0	0.0
Terbutryn	4	6.0	0.8	4.2	1.0
Linuron	1	10.0	6.8	9.8	7.0
Linuron	2	10.0	10.0	10.0	10.0
Linuron	4	10.0	10.0	10.0	10.0
U-27267	2	0.0	0.0	1.5	0.0
U-27267	4	0.8	0.2	0.0	0.0
U-27267	8	0.8	5.8	1.2	3.0
Control - weeded	-	0.2	0.0	8.1	0.0
Control - non-weeded	-	1.8	0.5	7.8	2.0
Simazine + nitralin	1/2 + 2	3.8	5.5	1.0	5.0
Simazine + CGA 10832	1/2 + 2	5.5	1.8	9.0	1.0
Simazine + CGA 10832	1 + 4	9.0	2.5	4.8	4.0
MON 097	2	3.8	3.5	7.8	1.0
MON 097	8	1.5	0.8	5.2	2.0
U-27267 + simazine + nitralin	Overspray	1.5	5.8	4.8	4.0

* Weed control: 0 = no control; 10 = complete control.

Table 2. Phytotoxicity of several herbicides on *Raphiolepis indica* and *Pinus thunbergii* grown in containers for three months before treatment.*

Herbicide	Rate lb ai/A	*P. thunbergii* 1 mo	3 mo	4 mo	6 mo	*R. indica* 1 mo	3 mo	4 mo
R-7465	4	1.2	0.2	0.0	0.0	0.8	1.2	0.0
R-7465	8	0.0	0.0	0.0	0.0	0.8	1.2	0.0
R-7465	32	0.8	0.0	1.0	0.0	1.5	1.0	1.0
Oryzalin	2	1.0	0.0	0.0	0.8	0.0	1.5	2.0
Oryzalin	4	0.0	0.2	0.0	0.5	0.5	0.2	0.0
Oryzalin	8	0.2	0.0	0.0	0.2	0.8	0.5	0.0
Alachlor	2	0.0	0.0	0.0	0.0	0.0	0.5	1.0
Alachlor	4	0.5	1.0	0.0	0.0	0.2	0.7	1.0
Alachlor	8	0.5	1.7	2.0	0.0	0.5	0.2	1.0
A-820	2	1.2	0.5	0.0	1.8	0.0	3.7	3.0
A-820	8	0.0	0.0	0.0	0.5	0.0	1.0	1.0
Nitralin	2	0.5	0.5	0.0	0.0	0.0	0.7	0.0
Terbutryn	1	1.0	1.2	0.0	0.0	0.0	1.0	0.0
Terbutryn	2	2.0	1.2	0.0	0.0	0.0	0.7	0.0
Terbutryn	4	1.5	1.2	0.0	0.0	0.0	0.7	0.0
Linuron	1	1.5	0.5	0.0	0.0	0.0	2.0	3.0
Linuron	2	2.0	1.5	1.0	3.0	0.0	3.2	5.0
Linuron	4	4.8	1.2	0.0	7.0	0.0	6.5	6.0
U-27267	2	0.2	0.5	0.0	0.8	0.0	1.5	1.0
U-27267	4	0.0	1.5	0.0	0.0	0.0	2.0	1.0
U-27267	8	2.5	1.2	0.0	7.5	0.0	2.2	6.0
Control - weeded	-	1.0	1.0	0.0	0.0	0.0	2.5	1.0
Control - non-weeded	-	0.5	1.5	0.0	0.0	0.0	5.7	0.0
Simazine + nitralin	1/2 + 2	1.2	0.2	0.0	0.8	0.5	0.7	0.0
Simazine + CGA 10832	1/2 + 2	0.8	0.7	1.0	0.0	0.0	1.7	0.0
Simazine + CGA 10832	1 + 4	1.0	0.7	0.0	0.0	0.0	0.5	1.0
MON 097	2	1.5	0.7	0.0	0.0	0.0	1.0	1.0
MON 097	8	3.0	0.5	2.0	1.0	0.0	2.2	1.0
U-27267 + simazine + nitralin	Overspray	0.5	2.2	0.0	2.2	0.0	2.7	3.0

* Phytotoxicity: 0 = no effect; 10 = dead plants.

Evaluation of herbicides for weed control in Scotch pine (*Pinus sylvestris* L.) transplants. Alley, H. P. and G. A. Lee. Research plots were established in the spring of 1971 to further evaluate individual herbicides and the combinations of simazine and atrazine for weed control and phytotoxic activity toward Scotch pine transplants. Plots were established soon after transplanting; the soil was free of all weeds at time of treatment. Plots were 4.5 X 150 ft and replicated three times. The herbicides were applied directly over the transplants using 40 gpa water as carrier. Visual observations and evaluations were made on 7/16/71 and 9/23/71, approximately two and four months after the treatments were applied. The most prominent weed species common to the area were kochia (*Kochia scoparia* L.), common lambsquarter (*Chenopodium album* L.), tansy mustard (*Descurainia pinnata* Walt.), green foxtail (*Setaria viridis* L.) and field sandbur (*Cenchrus pauciflorus* Benth.).

All treatments of simazine, atrazine, and Sumitol (2-sec-butylamino-4-ethylamino-6-methoxy-s-triazine) plus the combination of simazine + atrazine showed excellent control of the weed species complex common to the area at both dates of evaluation. There was some reinfestation of field sandbur in the atrazine and simazine plots at the late date of evaluation. Both wettable powder and granular formulations of Bladex (2-[4-chloro-6-ethylamino-s-triazin-2-ylamino]-2-methylpropionitrile) gave poor weed control.

Simazine and atrazine caused leaf tip burning of pine at all rates of application. The combination of the two were excellent weed control mixtures and exhibited less damage to the Scotch pine than either compound applied alone. Sumitol treatments resulted in excellent control with no apparent phytotoxicity, as exhibited by leaf tip burning, evident on the transplants. Due to the limited infestation of field sandbur all treatments should be further evaluated relative to this species. (Wyoming Agriculture Experiment Station, Laramie).

Effectiveness of several herbicides for weed control in Scotch pine transplants

Treatment	Rate lb ai/A	Observations
Atrazine	0.75	Excellent control - less leaf tip burn than simazine. Showed weakness on sandbur at late evaluation date.
Atrazine	1.0	Excellent control - slight leaf tip burn - sandbur reinvading plots at late evaluation date.
Simazine	1.6	Excellent control - leaf tip burn.
Simazine	2.4	Excellent control - no apparent differences between the two rates.

Treatment	Rate lb ai/A	Observations
Atrazine + simazine	0.75 + 0.75	Excellent control - probably best for season long control and least damage to Scotch pine where simazine was used.
Sumitol	1.0	Outstanding treatment - excellent control - no pine damage.
Sumitol	1.5	Outstanding treatment - excellent control - no pine damage.
Bladex W.P.	1.5	Poor control - no tree damage.
Bladex W.P.	2.5	Poor control - no tree damage.
Bladex (gran)	1.5	Poor control - no tree damage.
Bladex (gran	2.5	Poor control - no tree damage.

Herbicide screening in ground covers and turf. Elmore, C. L., W. A. Humphrey, and A. H. Lange. Several herbicides were selected to be evaluated on two ground cover species, Kentucky bluegrass (*Poa pratensis*) and dichondra at the South Coast Field Station, Tustin. Generally, if weed control can be achieved at planting and for approximately 2 to 4 months after planting, ground covers will become established, thus reducing weed competition. The herbicides selected all have preemergence and residual activity.

Four plants each of *Hymenocyclus luteolus* as rooted cuttings and *Carpobrotus edule* as unrooted cuttings were planted September 30, 1970, and dichondra and Kentucky bluegrass were seeded into a moist prepared seedbed in each plot the same day. After planting, the trial was sprinkler irrigated, and all subsequent irrigations were with sprinklers.

The herbicides were applied August 5, 1970, using a CO_2 sprayer with 2-8004 teejet nozzles at 20 psi in an equivalent of 50 gpa water. The surface of the sandy loam soil (analysis: 0.99% o.m.; 58.5% sand; 22.5% silt; and 19.0% clay) was moist at application and the temperature was 75 F. Following herbicide application, the trial was irrigated to wash the herbicide from the treated foliage and slightly leach it into the soil.

Evaluations for weed control and phytotoxicity to the various plant species were made November 5 and December 22, 1970, and May 20, 1971, on most species, as noted in Tables 1 and 2.

Weed Control

All herbicides gave good weed control for 2 months in this trial except AN-56477 (Torpedo) at 1 lb/A and nitralin (Planavin) at 2 lb/A. With clover, sow thistle, and shepherdspurse as the principal weed species, these herbicides were not as effective. Using 70 percent control as commercial, 6 months after application the VCS 438, alachlor (Lasso), NIA 20439 at 8 lb/A and the EL 119 combinations effectively controlled fleabane. Alachlor and EL 119 gave excellent broad spectrum weed control in spite of being non-mechanically incorporated.

Phytotoxicity

No herbicide was safe to use on direct seeded Kentucky bluegrass. Although CGA 10832 and AN 56477 did not completely kill the grass, it was too phytotoxic.

In dichondra NIA 20439 at 2 and 4 lb/A appeared to be safe; however, at 8 lb/A injury was evident. VCS 438 at 1 lb/A injured dichondra early (1 and 2 mo); however, by 6 months, little injury was evident.

With the exception of VCS 438 at 1 and 4 lb/A, all herbicides and rates were safe to use on *Carpobrotus edule*. In the non-weeded control, severe injury resulting from competition was observed on *C. edule* at 6 months. As indicated by observing the early weed control and lack of injury to *C. edule* by most herbicides, it is apparent that by 6 months a 30 to 50% weed population may be present and still not cause phytotoxicity.

Hymenocyclus luteolus is slightly more sensitive to herbicide injury than *Carpobrotus edule*. VCS 438 at 1 and 4 lb/A was too injurious as was the EL 119 and RH 315 combination. From other tests it was apparent that the RH 315 was responsible for this injury. Alachlor at 8 lb/A and NIA 20439 at 8 lb/A would also appear to give only marginal safety. The other herbicides and the 2 and 4 lb/A rates of alachlor and NIA 20439 were safe to use in this trial. (Agricultural Extension Service, University of California, Riverside).

Table 1. Weed control from several preemergence herbicides in ground covers at 1, 2, and 6 months after application and the weeds remaining.

Herbicide	lb/A	1 mo		2 mo		Fleabane Control 6 mo	Total Weed Control 6 mo
VCS 438	1	9.7	L	9.5	C,U,T	6.8	7.5
VCS 438	4	9.9	L,F	10.0		9.2	7.8
CGA 10832	2	9.1	C,S,L, P,T	7.2	C,T,M,V, S,L,E	4.5	5.8
AN 56477	1	6.7	C,L,P, F,T,N	6.2	C,N,M,T, U	3.5	5.5
AN 56477	4	9.9	L,F,A	8.8	C,M,T	5.0	6.8
Nitralin	2	7.2	C,R,T,S	5.8	C,M,R,S, T,B	3.5	6.0
Alachlor	2	9.9	F,L	9.2	C,M,B,U, T,N	5.8	7.2
Alachlor	4	9.9	L	9.8	C	6.0	7.8
Alachlor	8	10.0	F	9.9	U	7.5	8.2
Chloroxuron	2	9.8	C	9.2	C,M	2.8	5.8
Chloroxuron	8	10.0	F	9.0	C,M,T,G	4.0	6.2
NIA 20439	2	9.6	S,L	9.5	M,U,E	4.5	5.5
NIA 20439	4	9.9	F,L,B	9.6	B,U,T	3.2	5.5
NIA 20439	8	9.9	L	9.8	U,E	5.5	7.0
EL 119 + nitrofen	2 + 2	9.6	C,L,F,A	9.8	C,T	9.2	9.2
EL 119 + RH 315	2 + 2	10.0	F	9.9	C,T	8.5	9.2
Control - weeded	-	0.0	F,C,T,L, B,R,U,G, S,N	0.0	C,T,U,N,S, T,P,M,E	4.8	5.2
Control - unweeded	-	0.0	F,C,T,L, B,R,U,G, S,N	0.0	C,T,U,N,S, T,P,M,E,L	1.2	0.0

Weed control: 0 = no effect; 10 = complete control.

Weeds present:
A - spiny aster
B - bristly ox-tongue
C - clover
E - scarlet pimpernel
F - field bindweed
G - grass fescue
L - *Lupinus* sp.
M - marestail
N - nettleleaf goosefoot
P - pigweed
R - London rocket
S - shepherdspurse
T - sow thistle
U - purslane
V - groundsel

Table 2. Average phytotoxicity from several herbicides on two ground cover and two turf species.[1/]

Herbicide	Rate lb/A	*Poa pratensis* 11/5/70	*Poa pratensis* 12/22/70	Dichondra 11/5/70	Dichondra 12/22/70	Dichondra 5/20/71	*Carpobrotus edule* 11/5/70	*Carpobrotus edule* 12/22/70	*Carpobrotus edule* 5/20/71	*Hymenocyclus luteolus* 11/5/70	*Hymenocyclus luteolus* 12/22/70	*Hymenocyclus luteolus* 5/20/71
VCS 438	1	10.0	9.8	9.0	8.2	1.5	3.2	3.8	1.2	3.5	3.8	1.8
VCS 438	4	10.0	10.0	10.0	9.8	8.2	7.8	9.5	9.0	9.8	9.5	9.2
CGA 10832	2	6.2	5.8	5.0	8.8	8.2	0.0	0.2	0.0	0.2	0.0	0.5
AN 54577	1	7.5	6.0	4.5	7.8	4.5	0.8	0.0	1.0	0.2	0.5	1.0
AN 54577	4	7.0	5.5	5.8	9.4	9.2	0.5	0.0	0.5	0.2	0.8	0.5
Nitralin	2	8.5	9.0	4.0	8.5	8.8	0.0	0.0	1.2	0.0	1.0	1.5
Alachlor	2	10.0	10.0	10.0	10.0	9.2	1.0	0.0	0.5	1.8	3.0	0.5
Alachlor	4	10.0	10.0	10.0	10.0	10.0	1.0	0.5	0.0	1.2	1.0	0.0
Alachlor	8	10.0	10.0	10.0	10.0	10.0	0.8	0.0	0.0	2.0	3.0	0.5
Chloroxuron	2	10.0	10.0	9.5	8.5	5.5	0.2	0.2	0.2	1.0	1.2	0.5
Chloroxuron	8	10.0	10.0	10.0	9.8	8.2	2.0	0.0	0.8	0.8	0.8	0.2
NIA 20439	2	10.0	10.0	1.0	1.8	0.0	0.2	0.0	0.5	0.0	0.0	0.5
NIA 20439	4	10.0	10.0	1.5	2.2	0.8	1.0	1.0	0.8	0.2	2.0	0.2
NIA 20439	8	9.9	10.0	4.2	5.5	0.0	1.2	2.0	0.8	1.0	3.0	1.0
Oryzalin + nitrofen	2 + 2	10.0	10.0	9.8	10.0	9.5	0.8	0.0	0.0	0.5	0.5	0.2
Oryzalin + Kerb	2 + 2	10.0	10.0	9.2	10.0	10.0	1.0	0.0	0.5	2.2	5.8	3.2
Control (weeded)		0.0	0.0	0.2	0.0	0.8	0.5	0.0	1.0	0.2	0.0	1.2
Control (non-weeded)		0.0	0.0	0.0	0.0	1.2	0.2	0.0	4.5	0.0	0.0	7.0

[1/] Phytotoxicity evaluations: 0 = no effect; 10 = dead plants.

PROJECT 5. WEEDS IN AGRONOMIC CROPS

J. O. Evans, Project Chairman

SUMMARY

Over thirty abstracts are included in this section this year dealing mainly with the control of annual weeds in ten agronomic crops. As in past years, combinations or programs of herbicides provided the best broad spectrum weed control.

Abstracts, also, covered the use of herbicides for weed control on fallow land and non-crop areas. Two papers dealt with carry-over of several herbicides on crops grown on soil previously treated with high dosages of herbicides.

Alfalfa. Three abstracts are included which deal with the control of annual weeds in established alfalfa fields.

Several herbicides show tremendous promise for controlling broadleaved and grassy weeds. Simazine, terbacil, GS 14254 (2-sec. butylamino-4-ethylamino-6-methoxy-s-triazine), SD 15418 [2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrile] or combinations of these were consistently among the best treatments. A variety of locations were studied, and it was indicated that annual grassy and broadleaved weed control of 90% or better can be expected with these materials.

Field and sweet corn. New herbicides and new techniques for using older ones are emphasized in the corn abstracts for 1971. Included are demonstrations of the activity of SD 15418 and MON 097 [2-chloro-N-(ethoxymethyl)-6'-ethyl-o-acetotoluidide] against annual weeds in corn. Other herbicides that show promise are butylate, Bay-KNE-2236 and GS-13529 (2-chloro-4-ethylamino-6-tert. butylamino-s-triazine). Crop stand reductions were evident with some herbicides, especially when the corn was grown on lighter soils.

One antidote (R 25788) for protection of corn against EPTC injury was demonstrated to provide sufficient protection to allow control of several troublesome weeds with EPTC treatments.

Sugar beets. Annual weeds received considerable attention and the standard herbicides or combinations were effective. One new preplant herbicide, UC 27267 (3,4,5-tribromo-N,N-trimethyl-pyrazole-1-acetamide), was shown to be especially effective against redroot pigweed under a variety of application conditions. It also performed more favorably against some other weeds than did the standard herbicides.

Several promising herbicides or combinations of herbicides gave post-emergence control of redroot and lambsquarters significantly better than phenmedipham alone. One compound EP-475 (ethyl-*m*-hydroxycarbanilate) has much greater activity than phenmedipham. Combination of these two compounds show considerable promise for broad spectrum control of annuals in sugar beets.

Small grains. Abstracts stressed the fact that infestations of troublesome weeds not responsive to commonly used phenoxy herbicides are increasing in winter wheat acreages in the intermountain area. At present, the control of several of these weeds is not readily apparent. Eight papers were submitted for the small grains. Wild oat control in winter wheat was satisfactorily obtained by using barban or SD 30053 (ethyl-2-[N-benzoyl-3,4-dichloroanilino]-propionate). SD 30053 demonstrated greater phytotoxicity toward wild oats as the plant increased in size or if a wetting agent was included with the chemical. BAY 94337 [(4-amino-6-t-butyl-3-methylthio)-*as*-triazin-5-(4H)-one], atrazine and SD 15418 at rates ranging from 0.75 to 3 lb/A controlled weeds on fallow grain land in the absence of cultivation.

Dicamba, 2,4-D and bromoxynil were reported to give satisfactory broadleaved weed control in spring wheat. Linuron, terbutryn and C-6313 controlled mustards in barley with preemergence or postemergence applications; postemergence treatments were considerably more phytotoxic to the crop. Best control of mustard was obtained with preemergence treatments of 0.5 lb/A of linuron.

Field peas and field beans. The competitive influence of wild oats was demonstrated using field peas as the test crop. The yield of field peas was reduced by wild oat stands as low as one wild oat plant per square yard. Wild oats allowed to compete with a crop of peas until the oats reach the 2 to 3-leaf stage were shown to reduce the yield of peas approximately 10 percent. Slightly more than one half of the crop was lost if the weeds were left untouched.

Mixtures of nitralin and EPTC, A-820 and EPTC, trifluralin and EPTC, and others, gave excellent control of weeds in field beans when the herbicides were used as preplant treatments. Higher rates of Kerb reduced the stand of beans but gave excellent weed control; using lower dosages in combination with trifluralin provided good weed control and crop safety.

Potatoes. Several new herbicides have been shown to increase potato tuber yields. Among the promising new herbicides that are being used alone or in combination are MON 097, BAY 94337 and RP 17623 [2-t-butyl-4-(4,4-dichloro-5-isopropyloxyphenyl)-5-oxo-1,3,4-oxadiozaline].

A residual study was made with some of the hormone-like herbicides applied to soil during the crop season prior to potato planting. High dosages of dicamba resulted in yield reduction of potatoes for two growing seasons beyond the treatment date.

Evaluation of spring applied herbicides for weed control in dormant dryland alfalfa. Lee, G. A. and H. P. Alley. Research results have indicated that terbacil, Bladex [2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrile] and Sumitol (2-sec. butylamino-4-ethylamino-6-methoxy-s-triazine) are effective for weed control in dormant alfalfa. These herbicides were applied at four locations in Wyoming on cooperators' farms to demonstrate the advantages of weed control in alfalfa to growers in the various communities.

Plots ranged in size from 0.5 to 1.0 acres. The herbicides were applied with a truck mounted boom sprayer which delivered 17.5 gpa of water carrier. The plots were established April 6-12, 1971, while the alfalfa was still dormant. Alfalfa and weed yields were determined by harvesting three subsamples from the plot area, separating the plant species, drying in a forced air oven, and weighing.

The most prevalent weed species were downy bromegrass (*Bromus tectorum* L.) and tansy mustard (*Descurainia pinnata* (Walt.) Britt). Some kochia (*Kochia scoparia* (L.) Roth) was present at both Casper locations.

Terbacil at 1.0 lb/A and Bladex at 1.6 lb/A completely eliminated all weed species at all locations (accompanying table). Sumitol at 2.0 lb/A eliminated all weed species at all locations except Lusk, Wyoming. However, 82 percent of the weeds (weight basis) were controlled at this location.

At the Casper location "A", the yields of pure alfalfa were 410 to 1398 pounds greater in the herbicide plots than in the nontreated check plots. Weeds constituted 23 percent of the total forage produced in the check plot. At a second location near Casper, yields from the terbacil, Bladex, and Sumitol treated plots were 773, 1747 and 2112 lb/A greater than nontreated check plots, respectively. Over 36 percent of the total herbage harvest from the nontreated plots consisted of weeds. Yields at the Sheridan location were 886 to 1700 lb/A greater from herbicide treated plots than from the nontreated check plots. Under dryland conditions at Sheridan, 66 percent of the total weight was downy bromegrass and tansy mustard. At the Lusk location, yields where herbicides were employed were increased 2140 to 2246 lb/A compared to the nontreated check plot. All herbicide treated plots at all locations produced higher yields than the nontreated check plots. (Wyoming Agriculture Experiment Station, Laramie).

Effect of herbicides on pounds of alfalfa and weeds produced per acre at four locations in Wyoming

		Casper (A)		Casper (B)		Sheridan		Lusk	
Treatment	lb/A	Alfalfa	Weeds	Alfalfa	Weeds	Alfalfa	Weeds	Alfalfa	Weeds
Terbacil	1.0	3500	0	3153	0	3327	0	3373	0
Bladex	1.6	3940	0	4127	0	2767	0	3293	0
Sumitol	2.0	2952	0	4493	0	2513	0	3267	160
Check		2542	1960	2380	1280	1627	2447	1127	893

Evaluation of fall applied herbicides for weed control in dormant dryland alfalfa. Alley, H. P. and G. A. Lee. Three herbicides, simazine, Sumitol (2-sec-butylamino-4-ethylamino-6-methoxy-s-triazine), and Sencor (4-amino-6-t-butyl-3-(methylthio)-as-triazin-5-(4H)-one) were applied on 0.5 to 1.0 acre plots in the fall of 1970 to demonstrate their effectiveness for weed control purposes and effect upon alfalfa yield.

Plots were established in Niobrara and Campbell Counties on November 21 and November 31, respectively. All treatments were applied in 17.5 gpa of water with a truck-mounted boom sprayer. Alfalfa and weed yields were determined by harvesting three subsamples from each plot area. The weeds were separated from the alfalfa prior to being dried in a forced air oven and were then weighed.

The major weed species consisted of downy bromegrass (*Bromus tectorum* L.), tansy mustard (*Descurainia pinnata* Walt.), and a minor infestation of green-flower pepperweed (*Lepidium densiflorum* Schrad.) and kochia (*Kochia scoparia* (L.) Roth).

All three treatments resulted in complete elimination of the predominant weed infestations as indicated by the yield data.

Considerable phytotoxicity was evident where simazine was used in Niobrara County, as shown in the yield reduction of alfalfa compared to the yield where Sumitol was used. This was not the case in Campbell County where the alfalfa yield was greater where simazine was utilized. Sencor badly damaged the alfalfa and killed all the perennial grasses. Alfalfa yield was reduced by approximately 1000 lb/A as compared to the other two treatments. (Wyoming Agriculture Experiment Station, Laramie).

Yield of alfalfa and weeds from herbicide treated areas

		Yield lb/A[1/]			
	Rate	Alfalfa		Weeds	
Treatment	lb/A	Niobrara Co.	Campbell Co.	Niobrara Co.	Campbell Co.
Simazine	1.6	2127	2640	0	0
Sumitol	2.0	3113	2206	0	0
Sencor	1.4		1347		0
Check		1127	1333	893	2933

[1/] Air-dry forage.

Summer annual grass control in established alfalfa. Norris, Robert F. and Renzo A. Lardelli. The weed problem in established alfalfa creating the greatest concern to Sacramento Valley hay growers is summer annual grasses. Barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) infestations have become severe. Yellow foxtail (*Setaria glauca* (L.) Beauv.) has become increasingly prevelant and is considered the more serious weed problem. It seems to outcompete alfalfa and can act as an irritant in the mouths of livestock. Tests in 1970 indicated that split applications of different herbicides could control these weeds, whereas, single applications were only partially effective.

Herbicides were applied in 35 gpa of water during the winter of 1971, at two locations to plots 24 ft x 100 ft using a CO_2 hand held sprayer. Forty gallons of weed oil fortified with 1.25 lb/A of dinoseb (oil/dinitro) diluted with water to a total volume of 100 gpa were applied on February 3, 1971, at 80 psi using hollow cone nozzles. Flaming was carried out on February 4, 1971, using J-12 Manchester burners and propane at 45 psi; tractor speed was 2.0 mph. Granule applications were made after the first spring cutting directly before flood irrigation. A cub-tractor was used to tow a Grandy applicator. The experimental design was a randomized split-plot, using winter treatments as main plots, and spring granule applications as sub-plots. The sub-plot size was 16 ft x 24 ft. A heavy infestation of barnyard grass developed at the UCD site; both summer grass species were severe at the Davis site.

Winter weed control was good to excellent at both locations with GS-14254; the ratings at Davis improved to better than 90% control with time. Weed oil/dinitro also provided good weed control. Diuron gave excellent weed control except for almost no effect on groundsel (*Senecio vulgaris* L.), which reduced overall weed control considerably. Flaming gave good control of chickweed (*Stellaria media* (L.) Cyrillo) and groundsel, but only slight control of sowthistles (*Sonchus oleraceus* L. & S. Asper (L.) Hill), shepherdspurse (*Capsella bursa-pastoris* (L.) Medic.) and annual bluegrass (*Poa annua* L.). Pronamide was almost totally ineffective on this weed spectrum except for good chickweed and annual bluegrass control. The flamed plots at first cutting were outstanding, due to considerable suppression of Egyptian alfalfa weevil larvae damage in addition to the weed control.

Summer grass control by the winter only treatments was partial and decreased later in the season. Grass and alfalfa were separated in samples from these plots. The UCD diuron plots in the winter, and flame or oil/dinitro plots at both locations, had more grass than was present in the check plots. This finding will be further investigated. GS-14254 applied in the winter seemed to offer high levels of barnyardgrass control in the summer, as seen by the ratings at UCD where barnyardgrass predominated. Control of yellow foxtail was slight and accounted for the lower control at the Davis site. Diuron in the winter controlled some summer barnyardgrass, but was not effective on yellow foxtail. Pronamide seemed to offer early grass suppression but this decreased markedly by the end of the summer.

Spring only treatments with granular herbicides provided inadequate grass control. GS-14254 5G was most active. Alachlor 10G and pronamide

2G were also tested and were less active than PPG-116 20G.

Combinations of winter treatments followed by spring applications were very effective. No alfalfa injury was observed from any of these treatments. Diuron followed by GS-14254 5G or GS-14254 followed by either diuron 10G, GS-14254 or PPG-116 20G gave acceptably high levels of summer grass control. These treatments controlled both species. The GS-14254 followed by GS-14254 5G was the overall best treatment, and resulted in a significant increase in alfalfa yield. A winter treatment with weed oil/dinitro or flame increased the effectiveness of the spring applications. Flaming followed by GS-14254 5G produced a lower rating at Davis as noted on August 23, 1971. However, dry weight data indicated an actual control of 96%. Soil residue data are being obtained. (Botany Department, University of California, Davis).

Preplant weed control in corn. Lee, G. A. and H. P. Alley. Preplant screening trials were established at the Torrington Agricultural Substation on May 19, 1971. The soil type at the location consisted of a sandy loam soil (70.8% sand, 10.5% silt, 18.7% clay and 1.25% organic matter). Soil moisture conditions were dry at the time of herbicide application. The herbicide treatments were applied with a knapsack sprayer which delivered 40 gpa total volume of water and chemical. All herbicide treatments were incorporated 0.5 to 1.0 inch deep with a spring-tine harrow immediately following application. The treatments were replicated three times in a randomized complete block design.

The weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.), common purslane (*Portulaca oleracea* L.) and green foxtail (*Setaria viridis* (L.) Beauv.). Lesser infestations of kochia (*Kochia scoparia* (L.) Roth) and Russian thistle (*Salsola kali* L.) were, also, present and were classified as "others" in the accompanying table. Percent weed control was obtained by actual counts of weed species within a 5 foot x 6 inch quadrat and compared to the number of each species found within an equal area in the nontreated check.

In this trial, 16 of the 26 treatments resulted in 99.0% or better total weed control (accompanying table). There were five treatments which gave less than 94% control of the total weed spectrum.

Comparisons of atrazine formulations indicate that the flowable material is essentially equivalent to the wettable powder in herbicidal activity. The flowable and wettable powder formulations of Bladex [2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2 methylpropionitrile] at 1.5 lb/A were slightly better than the granular formulation; however, the slight differences may have been the result of less adequate coverage of the treated area with the granular material. Several rates of GS-13529 (2-chloro-4-ethylamino-6-tert.-butylamino-1,3,5-triazine) were evaluated to determine the dosage toxic to corn. Rates up to 6.0 lb/A resulted in essentially no stand reductions and only slight stunting was noted in plants growing in plots treated with the 6.0 lb/A rate. Excellent weed

Effect of split herbicide applications on winter broadleaved, and summer annual grass, control in alfalfa.

Winter treatment	Lb/A	Spring treatment***	Lb/A	Winter Weed Control 2/23/71 UCD	Winter Weed Control 2/27/71 Davis	Summer Grass Control 7/15/71 UCD	Summer Grass Control 6/8/71 Davis	Summer Grass Control 9/13/71 UCD	Summer Grass Control 8/23/71 Davis
Diuron	2.4*	Diuron 10G	3.0	-	-	9.6	4.7	9.5	7.0
		GS-14254 5G	2.0	-	-	10.0	9.5	9.3	9.4
		PPG-115 20G	5.0	-	-	9.9+	3.5	8.5	5.1
		Untreated check		6.8	5.6	6.6	2.5	6.1	1.3
GS-14254	1.25*	Diuron 10G	3.0	-	-	9.9	7.9	9.9	6.1
		GS-14254 5G	2.0	-	-	9.8	9.7	10.0	8.9
		PPG-116 20G	5.0	-	-	9.7	8.0	9.3	6.4
		Untreated check		9.8	7.6	8.6	4.1	9.1	4.6
GS-14254	2.0*	Diuron 10G	3.0	-	-	9.9+	9.5	10.0	8.7
		GS-14254 5G	2.0	-	-	10.0	9.6	9.4	9.9+
		PPG-116 20G	5.0	-	-	9.9	9.3	9.8	9.4
		Untreated check		9.9	8.5	10.0	8.0	9.6	6.4
Pronamide	1.5*	Diuron 10G	3.0	-	-	8.9	4.8	7.3	7.0
		GS-14254 5G	2.0	-	-	8.8	9.7	7.4	9.9
		PPG-116 20G	5.0	-	-	8.8	5.9	4.4	6.1
		Untreated check		2.1	2.3	5.5	4.5	1.8	3.0
Weed oil/ dinitro	40 gal ** 1.25	Diuron 10G	3.0	-	-	4.8	6.7	8.3	6.8
		GS-14254 5G	2.0	-	-	7.3	8.4	8.4	9.8
		PPG-116 20G	5.0	-	-	4.9	6.6	3.6	6.0
		Untreated check		8.0	7.2	0.0	2.4	0.3	2.5

Winter treatment	Lb/A	Spring treatment***	Lb/A	Winter Weed Control		Summer Grass Control			
				2/23/71 UCD	2/27/71 Davis	7/15/71 UCD	6/8/71 Davis	9/13/71 UCD	8/23/71 Davis
Flamed, once**		Diuron 10G	3.0	-	-	7.2	5.0	8.9	6.3
		GS-14254 5G	2.0	-	-	9.2	9.3	8.4	8.1
		PPG-116 20G	5.0	-	-	6.7	7.0	4.0	3.8
		Untreated check		5.1	4.6	1.5	2.1	0.8	1.5
Untreated check		Diuron 10G	3.0	-	-	5.1	6.1	6.5	6.5
		GS-14254 5G	2.0	-	-	7.3	9.0	7.5	8.7
		PPG-116 20G	5.0	-	-	2.0	6.1	2.3	3.1
		Untreated check		0.0	0.0	1.0	1.0	0.5	0.8

All data are means of 4 replications, 0 = no effect, 10 = complete control.
*   Applied 1/15/71 at Davis, 1/5/71 at UCD.
** Applied 2/4/71 at both locations.
*** Applied 4/23/71 at UCD, 5/1/71 at Davis.

control was obtained with all rates of GS-13529. Alachlor and butylate continued to perform well under Wyoming climatic conditions resulting in over 99% total weed control. Bay-KNE-2236 (chemical name unavailable) at 1.0 and 2.0 lb/A gave 99.3 and 98.5% total weed control, respectively; however, some phytotoxicity symptoms were observed in the corn plants. MON-094 (2-chloro-N-(ethoxymethyl)-6'-ethyl-o-acetotoluidide) at 1.5 lb/A appears to be the maximum rate which can be used on sandy loam soil. The 2.0 lb/A rate reduced the corn stand by 37%. AC-92390 (chemical name unavailable) did not give adequate control of the entire weed spectrum in this study. DS-5328 (chemical name unavailable) at 2.0 and 4.0 lb/A resulted in 97.5 and 99.0% control, respectively, of the total weeds present. These rates did reduce the corn stand substantially. (Wyoming Agriculture Experiment Station, Laramie).

Comparison of surfactants for postemergence weed control in corn. Lee, G. A. and H. P. Alley. A study was conducted to compare the effect of surfactants on the herbicidal activity of relatively low rates of atrazine and Bladex [2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methyl-propionitrile] for postemergence weed control in corn.

The herbicides were applied at 1.0 lb/A with 1 pint of X-77 in 100 gallons of water, 1 gallon of Agri-oil Plus (paraffin base petroleum oil) in 60 gallons of water, and with no surfactant. The herbicides were applied with a knapsack sprayer which delivered 40 gpa total volume of water and chemical. The plots were replicated three times and arranged in a randomized complete block design.

The weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.) and green foxtail (*Setaria viridis* (L.) Beauv.). Lesser infestations of common purslane (*Portulaca oleracea* L.) and Russian thistle (*Salsola kali* L.) were also present and were classified as "others" in the table. All weed species were in the 4 to 6-leaf stage of growth at the time of herbicide treatment. Corn was in the 4-leaf stage and was 8 to 10 inches tall.

Comparisons of herbicide treatments indicate that Bladex did not result in weed control comparable to that obtained with atrazine (accompanying table). When Agri-oil Plus was added to the atrazine treatment, the broadleaf weeds were completely eliminated. Bladex at 1.0 lb/A gave the greatest percentage of broadleaf weed control when applied with Agri-oil Plus. The addition of X-77 to the spray solutions did not enhance the activity of the herbicide for the control of redroot pigweed or species classified as "others". The rates of herbicides used were not sufficient to control the green foxtail present. (Wyoming Agriculture Experiment Station, Laramie).

Percent stand of corn and percent weed control as affected by preplant herbicides

Treatment	Rate lb/A	% Stand corn	Night-shade	Redroot pigweed	Lambs-quarter	Purslane	Others	Green foxtail	Total avg control
Butylate	4.0	73.3	99	100	97	100	100	99	99.1
Bay KNE-2236	1.0	76.7	99	99	100	100	100	98	99.3
Bay KNE-2236	2.0	90.0	99	100	100	100	88	100	98.5
MON-094	1.5	96.7	99	100	100	100	67	100	94.3
MON-094	2.0	63.3	100	100	100	100	22	100	87.0
Alachlor	2.5	98.3	98	100	100	100	100	100	99.7
Atrazine (flowable)	0.75	100	100	100	100	100	100	95	99.2
Atrazine (flowable)	1.0	98.3	99	100	100	100	100	96	99.2
Atrazine (W.P.)	0.75	100	100	100	100	100	100	99	99.8
Atrazine (W.P.)	1.0	93.3	100	100	100	100	100	99	99.8
Bladex (W.P.)	1.5	100	100	96	100	100	100	99	99.2
Bladex (W.P.)	2.5	100	100	96	100	100	100	98	99.0
Bladex (flowable)	1.5	100	100	98	100	100	100	98	99.3
Bladex (flowable)	2.5	95	99	95	100	100	99	97	98.1
Bladex (Gran)	1.5	100	95	93	100	100	100	90	96.3
Bladex (Gran)	2.5	100	99	98	100	100	100	97	99.0
GS-13529	1.0	100	99	100	100	100	100	97	99.3
GS-13529	2.0	100	100	100	100	100	100	97	99.5
GS-13529	4.0	100	100	100	100	100	100	98	99.7
GS-13529	6.0	98.3	100	100	100	100	100	100	100.0
AC-92390	0.5	96.7	68	88	67	100	11	88	70.3
AC-92390	0.75	100	60	97	86	33	22	93	65.2
AC-92390	1.0	100	49	95	97	100	67	99	84.5
DS-5328	1.0	96.7	93	91	92	100	67	35	79.7
DS-5328	2.0	83.3	99	100	100	100	100	86	97.5
DS-5328	4.0	61.7	100	100	100	100	100	94	99.0
Check									

Influence of various surfactants on the effectiveness of atrazine and Bladex for postemergence weed control in corn

Treatment	Rate lb/A	% Stand corn	Percent control Night-shade	Redroot pigweed	Lambs-quarter	Others[1/]	Green foxtail
Atrazine	1.0	96.7	96.5	75	93.1	0	0
Atrazine + X-77	1.0	100	100	50	95.6	0	6.1
Atrazine + Agri-oil	1.0	100	100	100	100	100	0
Bladex	1.0	100	94.2	0	56.9	0	0
Bladex + X-77	1.0	93.1	97.1	0	74.8	0	0
Bladex + Agri-oil	1.0	93.4	97.1	50	90.0	41.7	0

[1/] Russian thistle (*Salsola kali* L.) and common purslane (*Portulaca oleracea* L.).

Control of annual weeds in field corn with herbicides. Evans, J. O. Preplant treatments were made on May 5, and immediately incorporated to a depth of 1.5 inches. Corn was planted on May 5, 1971. Stand counts and evaluations were made on June 9 and July 16. Harvests were made October 15. SD 15418 [2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrile] was observed to give satisfactory control of redroot (*Amaranthus retroflexus* L.), lambsquarters (*Chenopodium album* L.) and green foxtail (*Setaria viridis* L.). Atrazine and MON 097 [2-chloro-N-(ethoxymethyl)-6'-ethyl-o-acetotoluidide] were also very effective in controlling the three species either alone or when they were used in combination with each other. MON 097 and alachlor have demonstrated excellent selectivity for annual grass control in corn in Utah. (Utah State University, Logan).

Subsurface layering of herbicides for band weed control in corn. Kempen, H. M. Five herbicides were compared when incorporated into moist, listed beds with a spray-sweep attached to the front of the corn planter. The planter shoe cut through the layer and deposited the seeds at a 2 inch depth.

Control of *Echinochloa crus-galli* and *Setaria* spp. was excellent with all herbicides. A rainfall of 0.4 inch two days after the treatment-planting operation probably enhanced weed control. Corn tolerance was good but MON 097 delayed emergence. (University of California Agricultural Extension Service, Bakersfield).

Response of field corn and annual weeds to preplant application of herbicides - 1971.
Tremonton, Utah

		Crop Response		Weed Control Number/100" of Row		
Treatment	Rate lb/A	Injury Index	Yield % of Control	Redroot	Lambsquarters	Foxtail
Atrazine	2.0	0	114	0	1.0	1.3
Atrazine	3.0	0	123	0	0.8	1.9
SD 15418	2.0	0	117	0.8	3.0	3.5
SD 15418	3.0	0	109	0	3.3	5.5
Alachlor	2.0	0	113	0	11.8	2.3
Alachlor	2.5	0	117	0	11.2	0.7
MON 097	1.0	0	122	1.2	8.9	1.5
MON 097	2.0	0	116	0	2.5	0.5
MON 097	5.0	0	97	0	1.9	0.9
Alachlor + Atrazine	1.5 + 1.25	0	120	0	0.7	4.9
MON 097 + Atrazine	1.5 + 1.25	0	115	0	1.1	5.8
Alachlor + SD 15418	1.5 + 1.5	0	98	1.8	9.3	6.3
MON 097 + SD 15418	1.5 + 1.5	0	113	0	5.2	4.2
Control	---	0	---	6.7	21.4	10.8

Results from subsurfaced layered herbicides on grasses in white corn. (Bakersfield)

Established: 3/11/71

Early rainfall: 3/13/71 - 0.4"

Furrow irrigated: 4/27/71

Soil type: Hesperia sandy loam

PSA: clay 18%, silt 14%, sand 68%

O.M. .06% SP 23%

Corn variety: Asgrow ATC 403 W

Planting Depth: Almost 2" deep. Layer placed 1/4 - 1/2" above seed

Grasses were barnyardgrass and summer foxtail (*Setaria* sp.), which were largely covered when cultivated 4/2/71.

Evaluated: 4/1/71

Harvested: 10/4/71

Evaluation - 4 repl.	Lasso 4E				Untreated		Sutan 6E			
	1	2	3	6	4 mph	2 mph	1 1/2	3	4 1/2	9
Grass counts - 5 sq. ft.	3.1	1.9	1.1	0.0	45.0	27.0	28.0	3.0	5.7	2.0
Corn counts - 10 ft.	22	25	23	17.4	26	23	22	26	22	27
Corn yield - cobs/20 ft.	13.2	14.0	13.3	12.8	14.0	13.2	13.4	13.5	14.1	14.2

Evaluation - 2 repl.	Bladex 80W		Aatrex 80W		Untreated		MON 097	
	2	4	1/2	1	4 mph	2 mph	1	2
Grass counts - 5 sq. ft.	0.5	0.5	2.5	0.3	25.0	18.0	0	0
Corn counts - 10 ft.	24	25	22	25	33	27	21	15

Comments: In earliest observation, on 3/30/71, corn was 0 to 4" tall and retarded by MON 097 at both rates. On 4/1/71, 4/27/71 and at harvest no retardation or injury was evident. Grass in the drill row was evident in untreated plots at harvest and in all furrows but was no competition to the corn. Probably the control obtained was enhanced by the early rainfall after treatment.

Foam applications of 2,4-D amine and dicamba combinations in sweet corn. Colbert, D. R., P. D. Olson, and A. P. Appleby. A field experiment was designed to evaluate a combination treatment of 2,4-D amine plus dicamba (Banvel) for weed control activity, sweet corn injury, and spray pattern when applied alone and in combination with a spray adjuvant (Foamwet). Foamwet was designed for use with special nozzles with the objective of applying herbicides in a "foam" and thus reducing spray drift.

The volumes of water used for application of the treatments were 5, 7.5, 10, and 20 gpa with the Foamwet being used at 0.5% by volume. Special generators and nozzles were supplied by Velsicol Chemical Corporation for the Foamwet treatments. The non-Foamwet treatments were sprayed with 8001 Tee-Jet nozzle tips.

Treatments applied with Foamwet at the low volume of 5 gpa of water resulted in a very poor spray pattern and gave a strip effect. The higher volumes gave a fairly good pattern. Weed control at the 7.5, 10, and 20 gpa volumes was average to good. The low volume of 5 gpa resulted in only fair to average weed control. The addition of Foamwet to the treatments resulted in a marked increase in sweet corn injury compared to the non-Foamwet treatments.

All treatments without Foamwet gave good weed control with some corn injury but not nearly as much as from the Foamwet treatments.

Foamwet studies were also evaluated on winter wheat in the fall of 1970. The wheat yields showed no significant differences between treatments. Height measurements were taken, and there appeared to be a slight reduction in height from Foamwet treatments in comparison to the non-Foamwet herbicide treatments. (Crop Science Dept., Oregon State University, Corvallis).

Foam applications of 2,4-D and dicamba combinations in sweet corn

Treatment	Lbs ai/A	Volume of Carrier H_2O gpa	% Corn Injury	Visual Evaluations % Control LQ	PW	M*
Dicamba + 2,4-D	1/8 + 1/2	5	17	93	87	80
Dicamba + 2,4-D + Foamwet[a]	1/8 + 1/2	5	70	78	73	67
Dicamba + 2,4-D	1/8 + 1/2	7.5	25	90	80	67
Dicamba + 2,4-D + Foamwet[a]	1/8 + 1/2	7.5	77	92	85	75
Dicamba + 2,4-D	1/8 + 1/2	10	12	92	82	68
Dicamba + 2,4-D + Foamwet[a]	1/8 + 1/2	10	75	88	82	70
Dicamba + 2,4-D	1/8 + 1/2	20	7	88	80	68
Dicamba + 2,4-D + Foamwet[a]	1/8 + 1/2	20	57	85	80	72
Foamwet	---------	20	0	0	0	0
Check	---------	--	0	0	0	0

Evaluation Scale: 0 = no effect; 100 = complete kill.

a/ Foamwet applied at 0.5% by volume of water.

Sweet Corn (Northrup Kings Hybrid NK-75).

*/ LQ = Lambsquarters (*Chenopodium album*).

PW = Pigweed (*Amaranthus retroflexus*).

M = Mustard (*Brassica campestris*).

R-25788 as an antidote for EPTC in corn. Appleby, A. P., Ercan Guneyli, and D. R. Colbert. An experimental compound, R-25788, from Stauffer Company was tested in greenhouse and field studies for antidote properties against EPTC. Toxicity was measured when corn and several weeds were planted in soil treated with a combination of EPTC and R-25788. The antidote was also applied as a seed treatment to corn and rapeseed. Three varieties of corn were tested along with three sorghum varieties, four shattercane biotypes, wild oats (*Avena fatua*), purple nutsedge (*Cyperus rotundus*), yellow nutsedge (*Cyperus esculentus*), barnyardgrass (*Echinochloa crusgalli*), redroot pigweed (*Amaranthus retroflexus*), and johnsongrass (*Sorghum halepense*).

Rates of 0.5 lb/A of R-25788 completely protected Golden Jubilee sweet corn from 12 lb/A EPTC. Protection was incomplete at lower rates. A seed treatment with 0.25% (the lowest rate tested) gave complete protection from 12 lb/A EPTC when applied to NB 501 D field corn, NK 75 sweet corn, and Golden Jubilee sweet corn. A slight protective effect from R-25788 was noted in EPTC-treated rapeseed when applied either as a tank-mix with EPTC or as a seed treatment. No protection was obtained from as high as 1 lb/A of R-25788 applied with EPTC at 3 and 6 lb/A to cultivated sorghum, shattercane, barnyardgrass, purple nutsedge, yellow nutsedge, redroot pigweed, and wild oats.

These results suggest that R-25788, either as a tank-mix or a seed treatment, may reduce EPTC toxicity to corn sufficiently that such weeds as shattercane, nutsedge, and seedling johnsongrass may be controlled. (Crop Science Department, Oregon St. University, Corvallis).

Evaluation of U-27,267 for weed control in sugar beets. Bowers, R. C. A preplant incorporated trial was conducted in Santa Clara County, California to test effectiveness of U-27,267 (3,4,5-tribromo-N,N,α-trimethylpyrazole-1-acetamide) for weed control in sugar beets. Cycloate and phenmedipham were included for comparative purposes. U-27,267 was applied to the soil (49% sand, 35% silt, 16% clay, 4.6% O.M.) on May 13 and May 20, 1971, and cycloate on May 20. Phenmedipham was applied on June 17 when sugar beet and pigweed plants were in the 2 to 6 leaf stage of growth. U-27,267 and cycloate were incorporated 1.5 or 3.0 inches deep with a power-driven tiller on May 20. Sugar beets were seeded 0.75 inch deep immediately after herbicide incorporation. Treatments were replicated three times on four-bed plots 100 ft long. Plots were sprinkle irrigated five times and furrow irrigated the balance of the season. Sugar beets were hand thinned to a commercial stand on June 24. Plots were hoed only as occurred incidental to the thinning operation, thus simulating random mechanical thinning. Crop and weed phytotoxicity ratings were made on June 11, June 21 and July 19. The experimental area was heavily infested with redroot pigweed (*Amaranthus retroflexus*) and later a small population of little mallow (*Malva parviflora*) and lambsquarters (*Chenopodium album*). Yield (lb net weight), number of beets and percent sugar was obtained by harvesting six, 10-ft subplots from the center two rows of each replicate on October 13.

None of the chemical treatments caused commercially unacceptable injury to sugar beets (see table). U-27,267 at 3.0 lb/A caused slight stunting early in the season, but plants outgrew this by 60 days after planting. Redroot pigweed was controlled by U-27,267 for the duration of the experiment, regardless of rate or depth and time of incorporation. The 3.0 lb/A rate of U-27,267 incorporated 3 inches deep gave effective control of little mallow. However, control with the low rate and shallow incorporation was unsatisfactory. The high rate and deep incorporation of U-27,267 were required to give consistent and satisfactory control of lambsquarters. Little mallow control was not affected by a 7-day delay between application and incorporation of U-27,267. However, lambsquarters control at the low rate was somewhat better when the chemical was incorporated the same day as application. Cycloate gave adequate control of pigweed early, but failed to maintain control. Control of little mallow and lambsquarters with cycloate was not satisfactory. Phenmedipham failed to give acceptable control of any of the three weed species. U-27,267 and cycloate had no effect on yield. Because of a heavy pigweed infestation, yields in the phenmedipham and check treatments were significantly reduced. Chemical treatments had little effect on the number of beets. Percent sugar was significantly reduced at the $P > .05$ level by the high rate, deep incorporation and 0-day U-27,267 treatment compared to standard sugar beet herbicides. The other U-27,267 treatments had no effect on sugar accumulation. (Technical Extension, The Upjohn Co., Davis, Calif.).

Treatment	Rate lb ai/A	Depth of Incorporation	Days after application when Incorporated	Phytotoxicity rating[1] Sugar beets 22[2]	Sugar beets 32	Sugar beets 60	Pigweed 22	Pigweed 32	Pigweed 60	Little mallow 60	Lambsquarters 60	Yield T/A	No. Beets/ 10 ft	% Sugar
U-27,267	1.5	1.5	0	0	0	0	9.0	9.0	7.3	7.3	9.7	27.7[3]ab	21.2[3]ab	11.1[3]ab
U-27,267	1.5	1.5	7	0	0	0	9.3	7.3	9.3	8.0	8.7	30.7a	20.5abc	10.5abc
U-27,267	3.0	1.5	7	0	0	0	10.0	9.0	10.0	8.3	9.3	33.5a	21.7ab	10.5abc
U-27,267	1.5	3.0	0	0	0	0	9.7	10.0	10.0	7.3	9.3	33.8a	21.6ab	11.2a
U-27,267	1.5	3.0	7	0	0.3	0	10.0	10.0	10.0	7.7	6.7	30.1ab	18.8bc	10.1bc
U-27,267	3.0	3.0	0	1.3	1.3	0	10.0	10.0	9.7	9.7	9.7	32.7a	21.0ab	9.7c
U-27,267	3.0	3.0	7	1.3	1.3	0	10.0	10.0	10.0	9.3	9.7	35.7a	23.0a	11.1ab
Cycloate	4.0	3.0	0	0	0	0	8.0	2.7	6.3	5.0	6.7	31.8a	22.7a	11.0ab
Phenmedipham	1.0	-	-	-	0.7	0	-	2.3	3.3	4.7	6.3	18.1c	18.5bc	11.0ab
Check	-	-	-	0	0	0	0	0	0.7	3.3	3.3	19.5bc	17.3c	11.0ab

[1] 0 = No injury or control, 10 = complete kill or control.

[2] Days after incorporation and sugar beet planting.

[3] Values followed by the same letter are not significantly different.

Comparison of phenmedipham and phenmedipham analogues for redroot pigweed control in sugar beets. Olson, P. D., and A. P. Appleby. Phenmedipham has been an effective herbicide for the control of annual weeds in sugar beets in Oregon for the past two years. One predominant weed species, pigweed (*Amaranthus retroflexus*), has shown some tolerance to phenmedipham. In an attempt to overcome phenmedipham's weakness on pigweed, two analogues of phenmedipham, EP 474 and EP 475, have been tested at comparative rates to phenmedipham and in combination with phenmedipham.

EP 474 and EP 475 have increased control of pigweed by 15 to 20% in comparison to phenmedipham. Various combination rates of EP 475 and phenmedipham have given a 15 to 45% increase in control of pigweed over 1.50 lb ai/A phenmedipham alone.

NorAm's SN 503 and SN 504 formulated mixtures of phenmedipham and EP 475 in a 2:1 and 1:1 ratio, respectively, were compared with phenmedipham alone. Both SN 503 and SN 504 at rates of .75 lb ai total herbicide/A gave satisfactory control of pigweed. These two mixtures had a 30% increase in visual control compared to phenmedipham at 1.50 lb ai/A. Plant counts of pigweed showed that .75 lb ai/A SN 503 or SN 504 were significantly better at the 1% level in comparison to 1.50 lb ai/A phenmedipham.

The following table is an average of four replications of visual evaluations of SN 503, SN 504, and phenmedipham's effects on sugar beets and various weeds. Phenmedipham is definitely less effective for pigweed control compared to all SN 503 and SN 504 rates. Phenmedipham performed slightly better than either SN 503 and SN 504 on lambsquarters (*Chenopodium album*) and barnyardgrass (*Echinochloa crusgalli*).

Summary of average visual effects of phenmedipham and phenmedipham analogues on sugar beets and weeds[1]

Herbicide	Rate Lb ai/A	SB	BG	GF	LQ	PW	CM[*]
SN 503	.75	0	0	5	64	88	100
SN 503	1.0	0	0	13	76	94	99
SN 503	1.5	0	4	30	90	93	99
SN 504	.75	0	1	0	70	81	96
SN 504	1.0	0	5	8	85	86	99
SN 504	1.5	0	5	23	84	88	100
Phenmedipham	1.0	0	15	21	91	33	98

1/ Evaluation scale: 0 = no effect 100 = complete kill.

*/ SB = Sugar beets.
BG = Barnyardgrass (*Echinochloa crusgalli*).
GF = Green Foxtail (*Setaria viridis*).
LQ = Lambsquarters (*Chenopodium album*).
PW = Pigweed (*Amaranthus retroflexus*).
CM = Common Mustard (*Brassica campestris*).

Postemergence pigweed (*Amaranthus retroflexus* L.) and general weed control in sugar beets. Norris, Robert F. Seven field trials were established in the Central Valley of California to evaluate the effectiveness of pyrazon plus dalapon, phenmedipham, or EP-475 (ethyl *m*-hydroxycarbanilate carbanilate) primarily for postemergent pigweed (*Amaranthus retroflexus* L.) and general weed control in spring and summer sown sugar beets. All plot treatments were applied with a hand held CO_2 sprayer and replicated at least 4 times. Plot size, pressure, and gpa used varied at different locations. Visual evaluations were made for crop vigor on the basis of 0 = dead, and 10 = normal vigor; for weed control on the basis of 0 = no effect, and 10 = complete kill. Pigweed counts were made at several locations as indicated in the accompanying tables.

EP-475 provided excellent pigweed control at all locations. Although data for 1.5 lb/A are presented, in several instances the pigweed control that resulted from 1.0 lb/A almost equaled that for 1.5 lb/A, as seen in the Patterson test (Table 1). Broadleaved weed control was generally good, but EP-475 was 20 percent weaker than phenmedipham for controlling mustard (Fresno, Table 2). Injury to sugar beets was lower during cooler weather in April and early May (20 to 22 C than at the later dates 30 to 40 C). EP-475 was generally slightly more injurious to sugar beets than phenmedipham; at Woodland (Table 2), however, it was less injurious.

Phenmedipham continued to provide excellent general broadleaved weed control coupled with acceptable sugar beet safety. When afternoon high temperatures were in excess of 35 C severe sugar beet injury did occur (Colusa, U.C.D. and Woodland - Table 2). This injury was greater if the temperatures following were higher than those preceeding application. Pigweed control was erratic, ranging from very poor (23% control at Fresno, Table 2) to good (80% at Davis, Table 2). This variability was at least partially due to pigweed size at application (better control of small pigweeds, *i.e.*, less than 2 leaves) and temperature (better kill at higher temperatures). EP-475 seemed able to effectively control pigweeds with up to 8 leaves and 1.5 inches across at application.

Mixtures of phenmedipham and EP-475 performed as would be expected on the basis of the relative amount of each active ingredient present.

Pyrazon plus dalapon, used with 0.5% X-77 by volume, provided fair to good general broadleaved weed control, but was only partially effective on pigweed. Injury to sugar beets was variable. This herbicide mixture did not perform as well as either phenmedipham or EP-475 in these tests.

No treatment provided effective annual grass control. Pyrazon plus dalapon was almost totally ineffective and phenmedipham only provided moderate grass suppression (Patterson, Table 1; UCD, Table 2). EP-475 seemed marginally more active against barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) than phenmedipham at Patterson (Table 1), but slightly less active against Japanese millet (*Echinochloa crus-galli* var. *frumentacea* (Roxb) Wight) at UCD (Table 2). (Botany Department, University of California, Davis. Cooperation of Bill Fischer at Fresno trial, and Robert Peterson at the Colusa trial is gratefully acknowledged).

Table 1. Influence of postemergence herbicides on sugar beet vigor and weed control.

Staten Island, treated 3/24/71, assessed 5/4/71
Plot size: 2 rows x 20'.

Patterson, treated 4/16/71, assessed 4/23/71, counts on 5/6/71
Plot size: 4 beds x 40' (11" bands).

		Staten Island			Patterson				
		Sugar beet	Weed Control		Sugar beet	Weed Control			
Herbicide treatment	lb/A	vigor	Lambs-quarters	Smart-weed	vigor	Barnyard grass	Redroot pigweed	Pigweed Count Per 10"x40'	% Control
Pyrazon + dalapon*	4.0+2.2	9.5	6.0	8.0	9.0	0.6	4.0	20.0	50
Phenmedipham**	1.0	9.6	8.6	9.0	9.8	2.0	0.5	42.5	0
Phenmedipham	1.5	9.9	9.0	8.0	9.3	5.0	2.8	26.0	35
EP-475**	1.0	9.1	6.0	2.3	8.6	3.8	7.3	1.5	96
EP-475	1.5	10.0	9.1	5.5	8.0	5.5	9.2	1.25	97
Phenmedipham + EP-475	0.5+0.5	9.6	9.3	7.3	8.6	5.5	7.3	3.8	91
Phenmedipham + EP-475	0.75+0.75	9.3	7.8	7.5	6.1	6.6	8.3	2.2	94
Phenmedipham + EP-475	0.66+0.33	-	-	-	9.5	5.8	7.6	19.5	51
Phenmedipham + EP-475	1.0+0.5	-	-	-	8.0	6.5	8.3	2.0	95
Untreated check	-	10.0	2.5	2.5	9.6	0.0	0.0	40.0	0

* 70 gpa, 34 psi, 8004 nozzles, +0.5% X-77.
** 30 gpa, 26 psi, 8002 nozzles.

Table 2. Effect of postemergence herbicides on sugar beet vigor, pigweed and other weed control.

Location of trial		Davis	Fresno WSFS	Colusa	UCD	Woodland
Application date		5/5/71	5/25/71	7/7/71	7/20/71	8/18/71
Assessment date		5/17/71	6/4/71	7/12/71	8/17/71	8/24/71
Herbicide treatment	Lb/A	Sugar Beet Vigor				
Pyrazon + dalapon	4.0+2.2	7.9	7.5	-	8.6	6.6
Phenmedipham	1.5	9.7	8.2	7.0	6.0	6.1
EP-475	1.5	9.3	7.9	6.3	6.3	7.0
Untreated check	-	9.9	9.3	9.3	9.5	9.5
		Pigweed Control				
Pyrazon + dalapon	4.0+2.2	-	-	-	2.5	8.8
Phenmedipham	1.5	-	-	6.0	9.3	9.6
EP-475	1.5	-	-	9.7	9.9	9.8
Untreated check	-	-	-	0.0	0.2	0.0
		Pigweed Count				
Pyrazon + dalapon	4.0+2.2	76.8*	-	-	-	-
Phenmedipham	1.5	23.2	30.2**	-	-	9.5***
EP-475	1.5	2.2	4.2	-	-	1.1
Untreated check	-	110.8	39.4	-	-	17.8
		% Pigweed Control				
Pyrazon + dalapon	4.0+2.2	35.0	-	-	-	-
Phenmedipham	1.5	80.3	23.5	-	-	47.0
EP-475	1.5	98.3	98.2	-	-	93.8
Untreated check	-	0.0	0.0	-	-	0.0
		Other Weed Control				
		Several spp.1/	Mustard	Purslane	Japanese Millet	Purslane
Pyrazon + dalapon	4.0+2.2	9.2	0.6	-	0.7	7.8
Phenmedipham	1.5	9.4	7.2	9.0	3.4	9.6
EP-475	1.5	9.4	5.1	9.0	3.1	9.1
Untreated check	-	0.0	0.0	0.0	0.6	0.0

* Count per 30" x 40' plot, 1. Shepherdspurse, purslane, groundsel and chickweed.

** Count per 40" x 20' plot, mean for 16 plots.

*** Count per 20" x 20' plot, mean for 24 plots.

Application notes:

Davis: Pyrazon + dalapon, 75 gpa, 8005 nozzles.
Phenmedipham, EP-475, 30 gpa, 8002 nozzles.

Fresno: All treatments at 60 gpa, 8004 nozzles, 34 psi.

Colusa: All treatments at 65 gpa.

UCD & Woodland: Pyrazon + dalapon, 64 gpa, 8005 nozzles, 30 psi.
Phenmedipham, EP-475, 30 gpa, 8002 nozzles, 40 psi.

Evaluation of several preplant herbicides for sugar beets in Utah. Rosier, G. and J. O. Evans. Several herbicides were evaluated for control of broadleaved and grassy weeds in sugar beets. The trial was conducted in Layton, Utah on a clay-loam soil. Plots were 37 feet long and 6 rows of beets wide. All herbicides were applied preplanting and were incorporated 1.5 to 2.0 inches deep with a hooded, power incorporator in a 7 inch band. Sugar beets were planted simultaneously with the application of herbicides.

NC 8438 (2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulphonate) was shown to be especially effective in controlling redroot pigweed; in combination with cycloate or pyrazon it also proved to be effective against lambsquarters. In combination with cycloate, NC 8438 gave excellent control of grassy weeds. Some initial beet injury was observed with NC 8438 but no reduction in yield or growth abnormalities were observed at harvest. NC 8438 performed less favorably when used alone as a preplant herbicide compared to combining it with cycloate or pyrazon.

R-7465 controlled grassy weeds either alone or in combination with other herbicides without injury to sugar beets except when combined with EPTC. The R-7465 - EPTC combination provided excellent weed control but resulted in considerable injury to the sugar beets. RH-892 also proved to be quite phytotoxic to sugar beets at the dosages evaluated. Triallate demonstrated satisfactory selectivity on the crop but failed to provide weed control equivalent to the standard herbicides. (U. & I. Sugar Company, Salt Lake City; Utah State University, Logan).

Combinations of preplant and postemergence herbicide applications for sugar beets. Evans, J. O. and G. Rosier. An experiment to evaluate the performance of several postemergence herbicides on weeds and beets that had previously been treated with herbicides was conducted in Layton, Utah. The trial consisted of several postemergence herbicides being applied in varying dosages to beets that had 3.5 lb/A of cycloate applied as a preplant treatment or to beets that were not pretreated. Each plot was 6 rows wide by 37 feet in length. Sugar beets were planted on May 6, with a 6-row drill; three rows were treated with cycloate and three were left untreated. Postemergence treatments were made on the six rows of each plot on June 1. Evaluation of beet stand and percent weed control was made June 10.

SN 503 and SN 504, which are combinations of phenmedipham and EP 475, provided better control of redroot pigweed (*Amaranthus retroflexus*) than did phenmedipham alone. EP 475 (ethyl *m*-hydroxycarbanilate carbanilate) was only slightly better in redroot control than either SN 503 or SN 504 in our tests. EP 475, SN 503 or SN 504, in the absence of preplant applications of cycloate, were consistently more effective in controlling redroot pigweed than was phenmedipham. The rather low percentage of control in the absence of cycloate was probably due to the heavy and vigorous stand of weeds; in addition, the evaluations were made early to facilitate thinning and furrowing the beets. (Utah State University, Logan; U. & I. Sugar Co., Salt Lake City).

Response of sugar beets and weeds (percent control) to preplant herbicides

Treatment	Rate lb/A	Sugar beet stand*	Beet Yield T/A	Redroot pigweed	Lambs-quarters	Setaria Species
Cycloate	3.0	16.2	19.4	84	93	38
Cycloate	4.0	16.3	17.8	91	98	15
Cycloate	5.0	14.7	18.3	98	100	85
Cycloate + R 7465	2.0+1.0	15.2	15.6	93	98	88
Cycloate + R 7465	3.0+1.0	16.1	11.8	93	90	81
Cycloate + pyrazon	3.0+3.0	15.7	13.3	91	98	82
Cycloate + pyrazon	4.0+4.0	15.1	14.9	100	100	92
Cycloate + NC 8438	2.0+2.0	14.7	16.5	98	93	96
Cycloate + NC 8438	3.0+2.0	15.5	17.3	98	98	98
Cycloate + NC 8438	3.0+3.0	14.1	22.1**	100	98	94
R 7465	1.0	16.1	18.6	68	73	90
R 7465	2.0	16.8	19.6	82	80	98
Pyrazon	4.0	14.4	17.4	30	76	72
Pyrazon + NC 8438	3.0+2.0	14.4	17.3	98	80	43
Pyrazon + H 283	3.0+2.0	17.0	21.1	55	66	29
NC 8438	3.0	16.4	15.6	100	52	68
NC 8438	4.0	14.4	18.8	96	85	79
Triallate	1.5	15.5	16.5	0	59	66
Triallate	2.0	17.2	16.5	57	78	49
Triallate	3.0	16.7	17.8	5	46	22
EPTC	1.5	9.6	10.6	98	100	100
RH 892	1.0	7.5	12.7	100	93	59
EPTC + R 7465	1.5+0.5	8.8	11.5	98	98	100
Check	--	15.6	14.7	--	--	--

* Stand counts are average of 4 counts made per plot on 100 inches of row.

** Significant at the .05 percent level.

Response of sugar beets and percent weed control to combinations of postemergence and preplant herbicides

Treatment	Rate lb/A	With preplant treatment of Cycloate (3.5 lb/A)			Without preplant treatment of Cycloate		
		Sugar beet stand*	Redroot pigweed	Grassy weeds	Sugar beet stand*	Redroot pigweed	Grassy weeds
Phenmedipham	.75	12.1	100	72	14.4	50	37
Phenmedipham	1.00	14.0	96	85	12.5	42	46
Phenmedipham	1.50	12.7	96	72	12.5	47	61
SN 503	.75	14.6	100	58	14.7	61	30
SN 503	1.00	14.0	94	66	15.3	66	31
SN 503	1.50	13.2	100	67	14.7	62	42
SN 504	.75	11.6	100	87	12.2	56	33
SN 504	1.00	14.5	100	58	14.0	61	42
SN 504	1.50	13.5	100	71	13.7	74	48
EP 475	.75	13.1	100	67	15.1	51	26
EP 475	1.00	12.8	100	73	15.1	76	46
EP 475	1.50	13.8	100	75	16.5	75	31
Pyrazon	12.0	14.8	94	82	15.8	46	27
Pyrazon + phenmedipham	2.0+1.0	12.2	100	73	13.8	47	32
Pyrazon + phenmedipham	3.0+1.0	13.8	97	56	14.7	58	31
Pyrazon + phenmedipham + oil	3.0+1.0+2%	13.2	100	76	15.3	68	41
Check	---	14.7	88	45	14.4	0	0

* Stand counts are averages of 4 counts per plot in each of 4 replications. Counts made on 100" row.

Preemergence soil activity of N-phosphonomethylglycine on winter wheat. Brewster, B. D., and A. P. Appleby. A greenhouse study was conducted to confirm the lack of soil activity by MON 1139 (monoisopropylamine salt of N-phosphonomethylglycine) on winter wheat (*Triticum aestivum* var. Druchamp). Fifty-five grams of sandy loam soil were placed in 2 3/4" x 2 3/4" plastic pots and sprayed with 0, 30, and 60 lb ai/A of MON 1139. The soil from each treatment was then placed in a glass jar and shaken for 30 seconds to incorporate the herbicide. After incorporation, the soil was returned to the pots and eight seeds of Druchamp winter wheat were planted in each pot at a depth of 0.5 inch.

The treatments were arranged in a randomized block design with four replications. The pots were watered as needed by sub-irrigation.

Emergence counts were taken starting four days after planting to note both the rate and number of emerging plants. No differences were found in either the rate or number of plants emerging and no visible signs of injury were noted.

In subsequent experiments MON 1139 was applied to moist soil in which wheat had been planted. Applications were made immediately, 1,2, or 4 days after planting. The pots were irrigated either by flood or sub-irrigation immediately after application in each case. A substantial number of plants showed injury symptoms from rates as low as 1.5 lb/A, especially from the last applications. These results suggest that MON 1139 is not instantaneously inactivated in soil, particularly in moist soil. (Crop Science Dept., Oregon St. University, Corvallis).

Response of Druchamp winter wheat to preplant - soil incorporated applications of N-phosphonomethylglycine (MON 1139)

Application rates (lb ai/A)	Emergence counts[a]
0	21
30	19
60	24

[a/] Total of four replications. No significant differences between means at the 5% level.

Evaluation of SD 30053 for controlling wild oats in winter wheat in Western Oregon. Colbert, D. R. and A. P. Appleby. Experiments were established in the fall of 1969 and 1970 at various locations in the Willamette Valley with the following objectives: (1) determine the optimum rate and time of application of SD 30053 for wild oat (*Avena fatua*) control when applied alone and in combination with oil, (2) evaluate SD 30053 for wheat selectivity, and (3) obtain yield data from plots treated at different times, providing information on competitive effects vs. maximum control.

Treatments of SD 30053 were applied to the following three growth stages of the wild oat: (1) two leaves to beginning of tillering, (2) first node of stem visible, and (3) one to two stem nodes visible.

Yields, visual evaluations of wild oat control, and crop injury were recorded from each location. The results from one of these locations are recorded in the following table.

The results from two years of research show that postemergence application of SD 30053 can be effective in controlling wild oats in winter wheat. When SD 30053 was applied without oil, the wild oats were controlled more effectively on the second and third date of application. However, the yields from the first application (depending upon location) were comparable or higher than those from the second application even though wild oat control was less adequate in the first application. The lowest yields were obtained from the third date of application which could be attributed to competition from wild oats.

The addition of oil to SD 30053 definitely increased its effectiveness on wild oat control. The chemical became more active, even on the first date of application. The rate of 1.5 lb/A of SD 30053 plus oil gave similar wild oat control to 3.0 lb/A of SD 30053 applied alone. Overall, the best treatments for wild oat control and grain yields were the SD 30053 oil applications.

Wade winter barley was seriously injured from applications of SD 30053 at the early jointing stage. Nugaines winter wheat appeared to have a good tolerance to SD 30053 at any growth stage. (Crop Science Dept., Oregon State University, Corvallis).

SD 30053 for Wild Oat Control in Winter Wheat

Treatment	Lb ai/A	% Visual Evaluations: Wild Oat Control	% Visual Evaluations: Wheat Injury	Average Yield - Bu/A
1st Application				
SD 30053	1.0	4	0	65.6
SD 30053	1.5	31	0	77.4
SD 30053	2.0	32	0	75.3
SD 30053	3.0	62	0	85.5
SD 30053 (oil)[a]	0.75	28	0	79.6
SD 30053 (oil)[a]	1.0	44	0	81.2
SD 30053 (oil)[a]	1.5	81	0	89.3
SD 30053 + oil[b]	1.5 + 1 qt/A	80	0	90.4
2nd Application				
SD 30053	1.0	56	0	76.4
SD 30053	1.5	74	0	79.1
SD 30053	2.0	83	0	78.0
SD 30053	3.0	93	0	81.7
SD 30053 (oil)	0.75	86	0	79.6
SD 30053 (oil)	1.0	91	0	76.9
SD 30053 (oil)	1.5	95	0	76.9
3rd Application				
SD 30053	1.0	63	0	65.6
SD 30053	1.5	82	0	66.7
SD 30053	2.0	88	0	71.5
SD 30053	3.0	92	0	72.6
Others				
Barban	0.33	69	0	85.5
Check	-	0	0	62.4
Hand-weeded check	-	100	0	89.3

a - Formulation contained oil.
b - Superior spray oil added as a tank mix.

Evaluation Scale: 0 = no effect; 100 = complete kill.
Growth Stage of Wild Oat
1st Application - two leaves to beginning of tillering
2nd Application - first node of stem visible
3rd Application - one to two stem nodes visible

Blue mustard (*Chorispora tenella* (Willd.) D.C.) control in winter wheat. Zimdahl, R. L., and Rahn, P. R. Several herbicides and herbicide combinations were evaluated for their postemergence control of blue mustard in dryland winter wheat in Colorado. Treatments were applied on April 2, 5, and 7, 1971. At this time, the blue mustard was in the six to eight-leaf rosette stage with some already in bloom. The low wheat yields indicate the seriousness of the weed infestation.

The most obvious increases in yields were obtained with BAY-94337 + .5% X-77 surfactant, and BAY-94337 alone, both at 0.5 lb/A. The fact that the latter produced more wheat injury than the former is contrary to observations taken in 1970. However, with the surfactant, the yield was higher and weed control superior. BAY-94337 at 1 lb/A severely injured the wheat and reduced yield even though weed control was excellent.

Bromoxynil at .25 lb/A and Linuron at .75 lb/A also produced increased yields. However, when they were applied in combination with surfactants, the yields were lower. When these herbicides were applied in combination with each other or with other herbicides, the yields were also lower. 2,4-D at 0.5 lb/A as the amine or ester gave reasonably good suppression, but not effective kill.

This study will be continued in 1972 with fall and spring applications. To date we do not have a satisfactory control method. (Colorado State University, Weed Research Lab., Fort Collins, Colorado, 80521).

Comparisons among treatments
Weed control in winter wheat - 1971

Herbicide	Rate lb ai/A	Visual rating of blue mustard control[1] Avg	Yield of wheat[2] bu/A
2,4-D amine	.5	4.1	5.3
2,4-D ester	.5	5.3	4.0
Bromoxynil	.25	1.1	6.3
Bromoxynil +.5% Dow Corning surfactant	.25	1.3	3.6
Bromoxynil + dicamba	.125 + .0625	0.3	2.8
Bromoxynil + linuron (ACP 69-219)	.125 + .125	0.4	3.5
Bromoxynil + diuron (ACP 69-386)	.125 + .125	1.1	3.6
Linuron	.75	2.7	5.9
Linuron + .5% X-77	.75	2.1	4.7
BAY-94337	.5	4.1	6.7
BAY-94337 +.5% X-77	.5	4.4	7.8
BAY-94337	1.0	6.4	3.7
Check	---	---	4.0

1/ 0 = No control, 10 = Complete control of blue mustard

2/ Yields were obtained by harvesting 2 adjacent eight-foot rows per plot, and are averages of 4 reps.

Herbicidal control of annual weeds in wheat fallow in Wyoming. R. D. Kukas, G. A. Lee and H. P. Alley. Studies were initiated at the Archer Agricultural Substation and at Torrington to evaluate several herbicides for weed control in winter wheat fallow ground. At the Archer location chemical treatments were made October 29, 1970, and April 17, 1971. Spring treatments were applied April 13, 1971, at the Torrington location. Herbicides were applied in 40 gpa of water carrier on a full coverage basis. Both locations consisted of a sandy loam soil type.

The weed population at the Archer Substation consisted of downy bromegrass (*Bromus tectorum* L.) and volunteer wheat (*Triticum aestivum* L.). At the Torrington location, the weed spectrum was comprised of kochia (*Kochia scoparia* (L.) Roth), tumbling mustard (*Sisymbrium altissimum* L.), redroot pigweed (*Amaranthus retroflexus* L.), wild sunflower (*Helanthus annuus* L.), Russian thistle (*Salsola kali* L.), wild oats (*Avena fatua* L.) and downy bromegrass.

Weeds were harvested by clipping a 2 ft x 2 ft area at the Archer Substation and the Torrington location on June 13 and July 16, 1971, respectively. Subsequent visual evaluations were made at both locations throughout the growing season.

Comparisons of weed weights taken from plots treated in the fall and spring at the Archer Substation indicate that the spring treatments were more effective than the fall applications with the exception of Igran (attached table). Sencor [4-amino-6-t-butyl-3-(methylthio)-as-triazin-5-(4H)-one] at 3 lb/A resulted in complete elimination of all weed species present regardless of time of application. Atrazine + Bladex [2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrile] at 1 + 2 lb/A applied in the spring gave 100 percent control of the weed spectrum. Atrazine at 1.0 lb/A, Sencor at 1.0 lb/A and atrazine + Igran (2-tert-butylamino-4-ethylamino-6-methylthio-s-triazine) at 0.75 + 2.0 lb/A treated plots yielded 7, 13 and 13 pounds, respectively, of weed herbage per acre compared to 2460 pounds from the nontreated check.

Atrazine, atrazine + Igran, atrazine + Bladex and Sencor at 3.0 lb/A were the best treatments at the Torrington location. Igran, regardless of rate, did not give adequate weed control at either location. (Wyoming Agriculture Experiment Station, Laramie).

Effect of herbicide treatments on total pounds of weeds produced per acre at Archer Substation and Torrington

Treatment	lb/A	Archer[1] (Fall)	Archer[1] (Spring)	Torrington[2] (Spring)
Atrazine	.75	820	53	47
Atrazine	1.0	580	7	27
Igran[3]	1.0	2287	2633	1860
Igran	2.0	1528	2053	1093
Atrazine + Igran	.75 + 1.0	407	53	0
Atrazine + Igran	.75 + 2.0	500	13	7

Treatment	lb/A	Archer[1] (Fall)	Archer[1] (Spring)	Torrington[2] (Spring)
Bladex[4]	1.0	2528	673	2120
Bladex	2.0	953	100	2060
Atrazine + Bladex	.75 + 1.0	413	20	67
Atrazine	1.0 + 2.0	260	0	13
Sencor[5]	1.0	233	13	1420
Sencor	3.0	0	0	50
Check		3200	2460	2180

1/ Weeds consisted of volunteer wheat and downy bromegrass.

2/ Weed population was primarily Russian thistle, kochia and redroot pigweed.

3/ 2-tert-butylamino-4-ethylamino-6-methylthio-s-triazine.

4/ 2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrile.

5/ 4-amino-6-t-butyl-3-(methylthio)-as-triazin-5-(4H)-one.

Postemergence weed control in wheat. Lange, A. Five herbicides were applied at about two week intervals to young broadleaf weeds and volunteer barley infested INA 66R wheat on a sandy soil under sprinkler irrigation. Herbicide applications were made on September 17, 1971, October 2, 1971, and October 22, 1971. Ratings were made on October 22 and November 5, 1971. There were a number of adverse conditions including gophers, some disease and inadequately uniform soil moisture, hence the phytotoxicity readings in the untreated check.

The outstanding herbicide was bromoxynil. The lower rate was effective on the earlier weed growth but inadequate at weed maturity (10/22/71). The 1 lb/A rate was no more phytotoxic than the 0.5 lb/A rate. The 0.5 lb/A rate of dicamba was slightly more active at the later treatment date than the 0.5 lb/A rate of bromoxynil. The 1 lb/A rate of bromoxynil was more selective than the 1 lb/A rate of 2,4-D.

The paraquat and MSMA treatments were less selective than the other 3 herbicides. There was no observable difference between the effect of the herbicides in this study on INA wheat and volunteer barley. (Agricultural Extension Service, University of California, Parlier).

Annual weed control in wheat with 5 postemergence herbicides applied at 3 different times

		Average[1]					
		Weed Control[2]			Phytotoxicity[3]		
		Date Sprayed					
Herbicide	lb/A	9/17	10/2	10/22	9/17	10/2	10/22
2,4-D	0.5	9.2	8.2	5.2	4.2	2.8	4.2
2,4-D	1.0	10.0	7.0	4.8	4.5	4.2	2.2
Bromoxynil	0.5	9.5	7.8	4.8	3.0	3.8	2.5
Bromoxynil	1.0	9.0	9.2	8.8	2.5	4.2	3.0
Dicamba	0.25	8.5	8.5	5.2	3.5	3.2	3.5
Dicamba	0.5	9.8	8.5	6.2	5.5	4.2	4.5
Paraquat	0.125	4.8	4.5	6.0	2.5	5.5	7.5
MSMA	2.0	6.5	5.0	4.5	4.0	4.0	3.0
Check	---			2.0			2.0

1/ Average of 4 replications, rated 11/5/71. Timings randomized within blocks.

2/ Weed control ratings were 0 = no effect, 10 = complete weed control of lambsquarter and puncture vine.

3/ Phytotoxicity ratings where 0 = no effect, 10 = all wheat plants dead.

Differential selectivity of wheat varieties to triallate. Norris, Robert F., and Renzo A. Lardelli. Field testing of preemergence incorporated triallate for wild oat (*Avena fatua* L.) control in cereal grains during the last three years has consistently shown wheat to be more susceptible to this herbicide than barley. These results have been reported in the WSWS 1970 and 1971 Progress Report. In 1971 a field trial was established on wheat (*Triticum aestivum* L. var. Inia 66). The wheat was drilled, and the triallate applied and spike-tooth harrow incorporated. Wild oat control increased with increasing rate, but increasingly severe crop stand loss also occurred (Table 1). Yields were below those of the untreated check for all triallate treatments. Wild oat competition in this experiment was light and thus wild oat control was not able to compensate for the early stand loss. The results of this experiment and those previously reported led us to the conclusion that the commonly grown wheat varieties differed in their sensitivity to triallate. Greenhouse experiments were established to further investigate this possibility.

Table 1. Effect of preemergence incorporated triallate in Inia 66 wheat stand and yield, and wild oat control (treated 10/30/70)

		Wild Oats		Wheat			
Treatment	lb/A	4/21/71 count*	% control	4/21/71 count*	% control	Yield** 6/22/71	% Yield loss
Triallate	0.5	8ab	69	37c	20	26.3b	8
"	0.75	7ab	75	28bc	40	22.3b	21
"	1.0	6ab	81	21ab	55	23.8b	17
"	2.0	2a	95	12a	74	15.0a	47
Untreated check	-	29c	0	46d	0	28.5b	0

All data means of 4 replications.

Data within column followed by different letter significantly different at p = 0.05 level.

*/ Number per 9 ft^2.

**/ Harvest area 16' x 100'.

Seeds of five commonly grown wheat varieties, barley (*Hordeum vulgare* L. var Winter Tennessee) and wild oats were sown on sterilized Yolo loam soil contained in 6" deep plastic dish pans, into which drainage holes had been cut. The seeds were either covered with 1 inch of soil treated with triallate, or were covered with 0.5 inch of the untreated soil onto which a 1 inch layer of triallate-treated soil was placed. Appropriate quantities of triallate were thoroughly mixed into the soil using a small concrete mixer. Sub-irrigation was employed throughout. The results of these tests are shown in Table 2.

Overall, selectivity was lower, and wild oat control slightly better when the seeds were directly below the treated soil than when the 0.5 inch layer of untreated soil separated the seeds and the treated soil. Wild oat suppression was excellent even at 0.25 lb/A which probably reflected the more even distribution of chemical throughout the soil in comparison with usually much less complete mixing in the field.

Winter Tennessee barley was much more tolerant to triallate than any wheat variety tested. The selectivity was good, except at the 1.0 lb/A rate when treated soil contacted the seed. The wheat varieties showed considerable difference in their ability to tolerate triallate. Ranking the varieties on the basis of fresh weight per plant gave the following result. Nadadores was slightly less susceptible than Pitic, Siete Cerros was slightly more susceptible. Inia 66 was considerably more susceptible,

Table 2. Influence of triallate rate and placement on relative selectivity to five varieties of wheat.

Treated soil 1" deep, seeds sowed 1.5" deep (i.e. 0.5" below treated layer).

	Plant Number				Height (cm)				Fresh weight/plant (mg)			
Triallate rate, lb/A	0.0	0.25	0.5	1.0	0.0	0.25	0.5	1.0	0.0	0.25	0.5	1.0
Crop												
Wheat var. Pitic	10.0	8.8	9.6	7.6	27.4	24.0	17.6	13.4	840	590	420	340
Inia 66	9.8	7.8	7.6	5.4	23.0	15.2	12.8	12.2	740	430	250	230
Sonora 64	9.4	7.8	8.8	5.8	26.8	15.4	12.2	9.0	1160	450	330	230
Nadadores	8.4	7.4	7.4	5.8	19.6	15.4	13.0	8.4	490	390	260	150
Siete Cerros	9.8	8.4	8.6	6.2	28.8	25.0	16.2	11.4	940	640	370	260
Barley var. Winter tennessee	10.0	9.4	9.8	8.0	36.2	32.8	31.8	31.2	1780	1730	1590	1610
Wild oats	9.9	5.8	5.0	3.4	26.0	2.2	1.4	0.8	850	40	30	10

Treated soil 1" deep, seeds sowed 1" deep (i.e. at bottom of treated layer).

	Plant Number				Height (cm)				Fresh weight/plant (mg)			
Triallate rate, lb/A	0.0	0.25	0.5	1.0	0.0	0.25	0.5	1.0	0.0	0.25	0.5	1.0
Crop												
Wheat var. Pitic	9.8	9.6	6.4	1.6	30.8	21.2	13.6	1.6	1330	570	280	40
Inia 66	9.6	7.4	4.2	2.4	30.0	15.0	6.8	2.4	840	250	300	20
Sonora 64	9.6	8.6	5.6	1.6	33.2	17.4	7.6	4.4	1650	440	280	60
Nadadores	8.6	5.8	6.0	2.6	31.6	21.0	12.6	4.4	810	370	140	40
Siete Cerros	9.6	8.0	7.2	3.6	34.8	30.8	12.6	5.6	1420	890	230	80
Barley var. Winter Tennessee	8.6	7.4	7.4	5.0	40.0	33.4	29.4	16.4	1940	1770	1740	650
Wild oats	7.6	0.2	0.0	0.0	30.8	0.4	0.0	0.0	480	50	0	0

and Sonora 64 very susceptible. The higher rates, and treated soil contacting the seed, reduced these differences and caused uniformly severe wheat suppression regardless of variety. Stand losses seemed to be uniformly high for all varieties at the higher rates. Thus, the relative susceptibility was more a function of the ability of surviving plants to grow or to remain suppressed. Tests to further evaluate the relative susceptibility of wheat varieties under field conditions are planned. (Botany Department, University of California, Davis).

Herbicides in row-planted, furrow-irrigated barley. Hamilton, K. C. and H. F. Arle. Study of herbicides to control weeds in row plantings of barley on shaped beds was continued during the past year at Mesa, Arizona. Mustard (*Brassica japonica* (Thunb.) Sieb.) was seeded on the test area. On November 13, 1970, barley (hybrid Amy) seed was planted at the rate of 15 lb/A in two rows, 12 inches apart, on vegetable beds spaced on 40-inch centers. On November 16, 1970, linuron, terbutryn, *N*-(4-bromo-3-chlorophenyl)-*N*'-methoxy-*N*'-methylurea (C-6313), and 2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione (VCS-438) were applied to the soil (sand 40%, silt 40%, clay 20%, and organic matter 1%) as preemergence treatments. Then we irrigated by the furrow method. On December 9, 1970, linuron, terbutryn, C-6313, and bromoxynil were applied to emerged barley (4 inches tall) and mustard (0.5 inch tall). Herbicides were applied in 40 gpa of water containing 0.25% of a blended surfactant. Treatments were replicated four times on four-bed plots 30 ft long. Furrows of the test area were cultivated once. Development of barley and weeds was observed every few weeks and plots were harvested by combine in May, 1971.

Preemergence applications of herbicides did not significantly affect emergence, growth, or yield of barley (see table). Best control of mustard was obtained with 0.5 lb/A of linuron. Initial control of mustard with other treatments was less complete. Vigorous growth of barley suppressed most mustard later in the growing season.

Postemergence applications of linuron, terbutryn, and C-6313 discolored or burned barley foliage. All postemergence herbicide applications controlled mustard. Postemergence application of 0.25 lb/A of either linuron or C-6313 reduced the yield of barley. (Cooperative investigations of Arizona Agric. Expt. Sta., Tucson, and Plant Science Research Division, Agricultural Research Service, U S Department of Agriculture, Phoenix).

Response of barley and mustard to preemergence and postemergence applications of herbicides in row-planted barley.

Treatments		Percent crop injury and weed control estimated 12/29/70		Yield of grain[a]
Herbicide	lb/A	Barley	Mustard	lb/A
Preemergence				
Linuron	0.50	0	100	4,870 a
Linuron	0.25	0	80	4,800 a
Terbutryn	0.50	0	90	4,700 a
Terbutryn	0.25	0	60	4,540 a
C-6313	0.50	0	85	4,780 a
C-6313	0.25	0	60	4,610 a
VCS-438	0.50	0	60	4,710 a
Untreated check		0	0	4,770 a
Postemergence				
Linuron	0.25	25	100	4,360 c
Linuron	0.12	5	100	4,940 ab
Terbutryn	0.25	10	100	4,990 ab
Terbutryn	0.12	15	100	4,860 ab
C-6313	0.25	10	100	4,670 bc
Bromoxynil	0.50	0	100	5,230 a
Bromoxynil	0.25	0	100	5,160 a
Untreated check		0	0	5,160 a

[a] For each method of application, values followed by the same letter are not significantly different at the 5% level of probability.

Postemergence application of herbicides in row-planted, furrow-irrigated barley. Arle, H. F. and K. C. Hamilton. Two rates of four herbicides were applied postemergence at two dates to determine their effects on weeds and row-planted, furrow-irrigated barley. Mustard (*Brassica japonica* (Thunb.) Sieb.) was seeded on the test area. Two rows of barley (hybrid Hembar) were planted at the rate of 20 lb/A on vegetable beds on 40-inch centers. Bromoxynil, linuron, terbutryn, and *N*-(4-bromo-3-chlorophenyl)-*N*-methoxy-*N*-methylurea (C-6313) were applied at rates of 0.25 and 0.5 lb/A in 40 gpa of water containing 0.25% of a blended surfactant. Herbicides were applied over barley and weeds on December 3, 1969, (barley 4 inches and mustard 0.5 inch tall) and December 10, 1969, (barley 6 inches and mustard 1 inch tall). Treatments were replicated four times on two-bed plots 32 ft long. Treatments were followed by rainfall, .38 inches was received December 4 and .39 inches fell during December 28 and 29. The soil contained 44% sand, 36% silt, 20% clay, and 1% organic matter. Development of barley and mustard was observed every few weeks and plots were harvested by combine in May, 1970.

Barley was injured by all linuron, terbutryn, and C-6313 treatments (see table). Bromoxynil caused slight injury to barley. All treatments controlled mustard. Vigorous barley growth suppressed weeds late in the growing season. Treatments that initially injured barley, also reduced plant height, delayed maturity, and reduced lodging. Applications of 0.5 lb/A of linuron, terbutryn, and C-6313 on December 3 reduced yields of grain and no treatment increased yields. (Cooperative investigations of Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Phoenix and Arizona Agric. Expt. Sta., University of Arizona, Tucson).

Response of barley and mustard after postemergence application of herbicides in row-planted barley

Treatments			Percent crop injury and weed control estimated 12/24/69		Yield of grain[a]
Date	Herbicide	lb/A	Barley	Mustard	lb/A
12/3	Bromoxynil	0.50	6	100	5,100ab
12/3	Linuron	0.50	66	100	3,940cd
12/3	Linuron	0.25	41	100	5,080ab
12/3	Terbutryn	0.50	61	100	3,800d
12/3	Terbutryn	0.25	58	100	4,340bcd
12/3	C-6313	0.50	60	100	4,280bcd
12/3	C-6313	0.25	50	100	4,770abcd
Untreated check			0	0	5,340a

Treatments			Percent crop injury and weed control estimated 12/24/69		Yield of grain[a]
Date	Herbicide	lb/A	Barley	Mustard	lb/A
12/10	Bromoxynil	0.50	7	100	5,200a
12/10	Bromoxynil	0.25	7	100	5,460a
12/10	Linuron	0.50	35	100	4,530abcd
12/10	Linuron	0.25	34	100	4,710abcd
12/10	Terbutryn	0.50	27	100	4,550abcd
12/10	Terbutryn	0.25	40	100	4,890abc
12/10	C-6313	0.50	32	100	4,650abcd
12/10	C-6313	0.25	39	100	4,950abc
Untreated check			0	0	5,360a

a/ Values followed by the same letter are not significantly different.

Competition between spring peas and nine densities of wild oat (*Avena fatua* L.) plants. Gargouri, Taieb and C. I. Seely. Field studies were conducted in 1971 at the University farm at Moscow, Idaho. The soil was a fertile silt loam. A randomized complete block design with 6 replications was used. The plots were 51 inches square. Wild oat seeds were uniformly planted by hand following pea sowing on May 22. The number of wild oat seeds planted in each plot was as follows: 0, 1, 4, 8, 16, 32, 64, 128, 256. The average number of plants resulting was 0, 1, 2, 4, 8, 14, 25, 40, 75, 132. The peas emerged in 7 days approximately 5 days before the wild oats. Weeds other than wild oats were removed by hand, throughout the season. The experimental area was in fallow in 1970 and climatic conditions were favorable for plant growth in 1971. As a result, the average yield of the controls was 2,303 lb/A. Although the rainfall was above normal, the competitive effect was pronounced. Wild oat plants were well developed with some having 14 tillers. Peas were harvested from the center 1 square yard of the plots. Pea yields were affected by one wild oat plant per square yard. The yield decreased as follows:

Wild oat plants per 2 sq yds	0	1	2	4	8	14	25	40	75	132
% Yield decrease	0	0	9	15	31	33	38	45	51	67

An identical experiment will be attempted in 1972 in order to obtain an indication of the effect of weather conditions on the competition between wild oats and peas. (Plant Science Department, University of Idaho, Moscow).

Time of competition between wild oats (*Avena fatua* L.) and spring peas. Gargouri, Taieb and C. I. Seely. Two trials were conducted at the University farm at Moscow, Idaho in 1971. One experiment was conducted on an area with a natural infestation of wild oats following a wheat crop and the second one on a fallow area artificially infested. This study was to compare the two methods. The soil was a silt loam. Although the area which had been in wheat was fertilized the preceding fall with nitrogen and sulfur, the fertility level on the fallowed area was higher than on the non-fallowed. Randomized complete block designs with five replications were used. Wild oats were hand-weeded at seven different times. The first one was weeded two weeks after wild oat emergence, which corresponds to 2-1/2 to 3 leaf stage, the second after three weeks or 4 to 5 leaf stage, the third after four weeks, the fourth after five weeks, the fifth after six weeks, the sixth after seven weeks, and the seventh at harvest time. The plots were 51 inches square. The average number of wild oat plants varied from 600 to 800 per plot on the naturally infested area. On the artificially seeded area, there were 100 seeds planted, but there were only 50 plants per plot. The seeds were uniformly distributed throughout the plot. One plot in each replication was hand-weeded throughout the season. In the other plots, weeds other than wild oats were carefully controlled. Conditions were unusually favorable for peas in 1971 and the yields were 1,981 lb/A on the weed-free plots of peas following wheat and 2,749 lb/A on the peas following fallow. Peas were harvested from a 1 sq. yd. area at the center of the plots.

Summary of data for both experiments:

Naturally infested:

Date weeded	After 2 wks.	After 3 wks.	After 4 wks.	After 5 wks.	After 6 wks.	After 7 wks.	Harvest
% Yield decrease	11	22	33	28	20	30	44

Artificially infested:

Date weeded	2 wks.	3 wks.	4 wks.	5 wks.	6 wks.	7 wks.	Harvest
% Yield decrease	10	24	44	64	72	69	60

The competitive effect was manifest after 2 weeks or at the 2-1/2 to 3 leaf stage of wild oat development. The yield of peas decreased 11% on the naturally infested area and 10% on the artificially infested plot irrespective of wild oat stand or soil fertility.

These data further show that the total competitive effect is greater with high fertility even though the starting date is the same. This experiment will be repeated in 1972 to check seasonal effects. (Plant Science Department, University of Idaho, Moscow).

Preemergence weed control in field beans in Wyoming. Lee, G. A. and H. P. Alley. A study was initiated at the Torrington Agricultural Substation to determine the preemergence weed control activity of several herbicides under Wyoming climatic conditions. The herbicides were applied with a knapsack sprayer which delivered 40 gpa total volume of water and chemical. Treatments were made June 2, 1971, when the bean plants were in the crook stage prior to emergence. The chemicals were applied to the soil surface with no incorporation. Each treatment was replicated three times in a randomized complete block design.

The weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.), green foxtail (*Setaria viridis* (L.) Beauv.) and "others" which were a composite of Kochia (*Kochia scoparia* (L.) Roth), Russian thistle (*Salsola kali* L.) and common purslane (*Portulaca oleracea* L.). Percent weed control was obtained by actual counts of weed species within a 5 ft x 6 in quadrat from the treated plots and compared to counts from the nontreated check. A total of two subsamples was taken from each replication.

Preforan [p-Nitrophenyl 2-nitro-4-(trifluoromethyl) phenyl ether] at 3.0 and 4.5 lb/A eliminated all weed species present (accompanying table). However, the bean stands were severely reduced by both rates of the herbicide. Alachlor at 2.5 lb/A gave excellent control of black nightshade, redroot pigweed and green foxtail with only slight reductions in bean stands. CGA-10832 at 1.0 and 2.0 lb/A and GS-38946 at 1.0 and 2.0 lb/A did not result in satisfactory control of any weed species present.

Yields from all treated plots were lower than the nontreated check plots. Although Preforan at 4.5 lb/A reduced the bean stand the greatest percentage, the resulting yields were the highest of any of the herbicide treatments. (Wyoming Agriculture Experiment Station, Laramie).

Effect of preemergence herbicides on percent stand of field beans, percent weed control and field bean yields

Treatment	Rate lb/A	% Stand field beans	Black night-shade	Redroot pigweed	Lambs-quarter	Others	Green foxtail	Yield
Alachlor	2.5	95.2	96.2	97.8	62.5	72.7	96.2	915.0
Preforan	3.0	67.5	100.0	100.0	100.0	100.0	100.0	905.0
Preforan	4.5	53.2	100.0	100.0	100.0	100.0	100.0	1042.3
CGA-10832[1/]	1.0	95.2	44.2	25.0	83.3	54.5	50.0	773.8
CGA-10832	2.0	94.4	0	0	66.7	72.7	42.3	936.8
GS-38946[1/]	1.0	94.4	42.3	0	45.8	9.1	1.9	773.8
GS-38946	2.0	84.9	11.5	0	41.7	54.5	40.4	638.5
Check		100.0						1499.8

1/ Name unavailable.

Preplant weed control in field beans in Wyoming. Lee, G. A. and H. P. Alley. The study was conducted at the Torrington Agricultural Substation on a sandy loam soil (70.8% sand, 10.5% silt, 18.7% clay, and 1.25% organic matter). Herbicide treatments were applied with a knapsack sprayer in 40 gpa of water. The herbicides were incorporated with a spring tine harrow to a soil depth of 0.5 to 1.0 inch immediately after application. The herbicide treatments were applied May 19 and field beans were planted May 20, 1971. The experiment was arranged in a randomized complete block for statistical analysis.

The weed complex consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.), green foxtail (*Setaria viridis* (L.) Beauv.), and "others" which included a lesser population of kochia (*Kochia scoparia* (L.) Roth), wild buckwheat (*Polygonum convolvulus* L.), common purslane (*Portulaca oleracea* L.), and Russian thistle (*Salsola kali* L.). Percent weed control was obtained by comparing actual counts of weed species within a 5 ft. x 6 in. quadrat with counts taken from a nontreated check.

Nitralin + EPTC at .75 + 2.0 lb/A eliminated all weed species present. At the time of harvest the plots were nearly weed free (accompanying table). Kerb [N-(1,1-dimethylpropynyl)-3,5-dichlorobenzamide] at 2.0 lb/A ranked second in effectiveness but reduced the bean stand 49 percent.

A-820 [N-sec.-butyl-4-tertiary-butyl-2,6-dinitroaniline] + EPTC at 1.5 + 2.0 and 1.0 + 2.0 lb/A ranked 3rd and 4th, respectively, in total weed control for the trial. The 1.5 + 2.0 lb/A rate was required to eliminate black nightshade. Preforan [p-Nitrophenyl 2-nitro-4-(trifluoromethyl) phenyl ether] + EPTC at 3.0 + 2.0 lb/A gave excellent weed control except for those species categorized as "others". The bean stand was moderately reduced with this treatment. GS-38946 at 1.5 and 3.0 lb/A ranked 10th and 7th, respectively, for weed control but the treatments did not completely eliminate black nightshade. Alachlor + linuron at 2.0 + .75 lb/A resulted in 100 percent control of all species except those designated as "others".

Bean yields from all herbicide treated plots exceeded the yields from the nontreated check plots excluding Kerb at 2.0 lb/A and trifluralin + Kerb at .5 + 2.0 lb/A. The percent moisture of the harvested beans ranged from 8 to 11 percent indicating that no treatment resulted in substantial delay in maturity. (Wyoming Agriculture Experiment Station, Laramie).

Effect of herbicides on percent stand of field beans, percent weed control and field bean yields

Treatment	Rate lb/A	% Stand field beans	Black night-shade	Redroot pigweed	Lambs-quarter	Others	Green foxtail	Yield lb/A	Rank-ing
RH-892	1.0	92	60	89	64	63	69	2174.1	28
RH-892	2.0	93	89	97	98	59	100	2353.1	16
Kerb	1.0	88	100	88	100	76	88	2174.0	12
Kerb	2.0	51	100	100	100	100	99	1106.4	2
TOK (Surface)	2.0	93	25	45	81	17	34	1977.5	32
TOK (Surface)	4.0	96	87	94	75	33	71	2144.2	26
Trifluralin + Kerb	.5 + 1.0	86	100	100	100	89	95	1923.4	8
Trifluralin + Kerb	.5 + 2.0	59	100	100	100	83	100	1302.8	9
Alachlor + linuron	2.0 + .75	94	100	100	100	59	100	2152.2	11
USB-3584	.5	92	100	88	100	56	100	2227.8	14
USB-3584	1.0	94	93	85	100	59	100	1957.2	17
GS-10832	.5	98	56	54	83	100	100	2374.9	23
GS-10832	1.0	94	46	57	92	93	87	2222.1	24
GS-10832	2.0	92	56	75	100	100	100	1937.4	20
GS-38946	.75	96	34	62	100	7	91	1790.1	31
GS-38946	1.5	97	95	100	98	85	100	2124.3	10
GS-38946	3.0	88	92	100	100	93	100	2138.2	7
AC-92390	.5	92	78	78	100	52	100	2108.4	22
AC-92390	.75	91	38	100	83	17	99	2126.3	29
AC-92390	1.0	88	88	88	100	61	97	2058.7	19
EPTC	3.0	95	100	100	100	37	100	2040.8	18
Preforan (Surface)	3.0	87	82	100	98	48	90	1827.9	21
Preforan (Surface)	4.5	77	99	100	98	67	85	1583.0	13
Preforan + EPTC	3.0 + 2.0	83	100	100	100	89	100	2011.0	5
Trifluralin + EPTC	.5 + 2.0	95	100	100	100	85	100	1859.8	6
Nitralin + EPTC	.75 + 2.0	90	100	100	100	100	100	1859.8	1
Trifluralin	.5	92	31	100	79	37	85	1822.0	30
Nitralin	.75	89	44	60	100	56	97	2018.9	27

Treatment	Rate lb/A	% Stand field beans	Black night-shade	Redroot pigweed	Lambs-quarter	Others	Green foxtail	Yield lb/A	Rank-ing
A-820	1.0	96	67	61	81	65	86	1897.6	25
A-820	1.5	95	83	65	100	96	100	1569.4	15
A-820 + EPTC	1.0 + 2.0	95	97	100	100	96	100	1690.7	4
A-820 + EPTC	1.5 + 2.0	94	100	100	100	96	100	2158.1	3
Check		100	--	--	--	--	--	1499.8	

Complementary treatments for weed control in field beans. Lee, G. A. and H. P. Alley. The practice of preplant plus postemergence herbicide treatments for weed control in sugar beets has proven quite successful. Research plots were established at the Torrington Agricultural Substation to determine if there is a potential for such a practice in the production of dry beans.

Preplant treatments consisted of trifluralin at 0.5 lb/A, nitralin at 0.75 lb/A and A-820 [N-*sec.*-butyl-4-*tert.*-butyl-2,6-dinitroaniline] at 1.0 lb/A. The postemergence treatments were bromoxynil at 0.125 and 0.25 lb/A, 2,4-DB at 0.25 and 0.38 lb/A and ACP-69-405 at 1.0 and 1.5 lb formulation/A. The preplant treatments were applied on May 19, 1971. The field beans (pinto Wyo-166) were planted on May 20, 1971. When the beans reached the trifoliate leaf stage of growth the postemergence treatments were directed below the bean foliage on a 4 inch band. The treatments were arranged in a split-plot design where the preplant treatments were whole plots and the postemergence treatments were the subplot or split-plot portion of the experiment.

The weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.), green foxtail (*Setaria viridis* (L.) Beauv.) and "others" which consisted of lesser infestations of kochia (*Kochia scoparia* (L.) Roth), Russian thistle (*Salsola kali* L.) and common purslane (*Portulaca oleracea* L.). Percent weed control was obtained by actual counts of weed species within a 5 ft x 6 in quadrat placed over the bean row and compared to the nontreated check. The broadleaf weeds were in the 2 to 4-leaf stage at time of postemergence application.

The initial control obtained with trifluralin at 0.5 lb/A, nitralin at 0.75 lb/A and A-820 at 1.0 lb/A was excellent except for black nightshade. Nitralin and A-820 resulted in substantially better control of black nightshade than trifluralin. The postemergence treatments did not give sufficient control of black nightshade following treatments with trifluralin. All postemergence treatments applied in conjunction with nitralin, except 2,4-DB at 0.25 lb/A, resulted in 90.5% or better control of nightshade. Bromoxynil at 0.125 and 0.25 lb/A as a post treatment on the A-820 treated plots did not give satisfactory control of the *Solanum* species. However, all other species were effectively controlled. Since the postemergence treatments were not effective grass herbicides, the data indicate that the preplant treatments gave continuing effective green foxtail control throughout the study period.

Some proliferation of tissue was noted in the leaf axis of beans treated with bromoxynil and 2,4-DB.

This approach to weed control in field beans warrants further consideration both from an efficacy and economic standpoint. (Wyoming Agriculture Experiment Station, Laramie).

Effect of complementary preplant and postemergence herbicide treatments on percent field bean stand and percent weed control

Treatment	Rate lb/A	% Stand field beans	Night-shade	Redroot pigweed	Lambs-quarter	Others	Green foxtail
Trifluralin	0.5	98.0	41.0	99.4	91.8	93.3	99.0
Bromoxynil	0.125	100.0	62.0	100.0	66.7	92.3	97.3
Bromoxynil	0.25	94.4	85.7	98.7	100.0	92.3	100.0
2,4-DB	0.25	100.0	47.7	100.0	100.0	100.0	100.0
2,4-DB	0.38	100.0	76.2	100.0	100.0	92.3	100.0
ACP-69-405	1.0 form	100.0	33.3	100.0	100.0	84.6	100.0
ACP-69-405	1.5 form	100.0	52.4	100.0	100.0	100.0	100.0
Nitralin	0.75	90.0	88.2	99.0	94.0	97.4	99.8
Bromoxynil	0.125	100.0	100.0	77.8	98.7	84.6	97.3
Bromoxynil	0.25	89.8	95.2	88.9	98.7	100.0	98.6
2,4-DB	0.25	97.9	85.7	77.8	98.7	100.0	100.0
2,4-DB	0.38	100.0	95.6	100.0	100.0	100.0	100.0
ACP-69-405	1.0 form	93.6	90.5	100.0	100.0	100.0	98.6
ACP-69-405	1.5 form	91.8	95.3	100.0	100.0	100.0	100.0
A-820	1.0	88.6	81.0	98.2	94.5	98.0	98.4
Bromoxynil	0.125	94.0	42.9	98.7	100.0	100.0	100.0
Bromoxynil	0.25	75.0	76.2	98.7	100.0	100.0	100.0
2,4-DB	0.25	100.0	90.5	100.0	100.0	100.0	98.6
2,4-DB	0.38	85.7	95.2	100.0	100.0	100.0	98.6
ACP-69-405	1.0 form	100.0	95.2	100.0	100.0	100.0	100.0
ACP-69-405	1.5 form	75.0	100.0	100.0	100.0	100.0	100.0

Weed control in potatoes in Oregon. Olson, P. D., A. P. Appleby, L. A. Fitch, and R. C. Hindes. Three trials were established in Oregon in the spring of 1971 on Norgold and Russet Burbank varieties of potatoes. The objectives of the experiments were to test compounds close to registration applied alone or in combination with other herbicides under sprinkler and furrow irrigation, test these treatments under light soil conditions, and test new experimental materials for potato selectivity and weed control.

Two yield trials were conducted using herbicides that are near registration. One was conducted under sprinkler irrigation on Russet Burbank potatoes in the Hermiston, Oregon area in a light sandy loam soil with organic matter of .7%. The other trial was conducted on Norgolds in Ontario, Oregon under furrow irrigation in a silt loam soil with 1.5 to 2.0% organic matter. Treatments in the Hermiston trial that gave excellent control of barnyardgrass (*Echinochloa crus-galli*), lambsquarters (*Chenopodium album*), and hairy nightshade and cutleaf nightshade (*Solanum sarachoides* and *S. triflorum*) and had yields equal to the handweeded checks were trifluralin .50 lb/A plus Ronstar (RP 17623)[2-tertio=

butyl-4-(4,4-dichloro-5-isopropyloxyphenyl)-5-oxo-1,3,4-oxadiozaline] 1 or 1.25 lb/A, DCPA 6 lb/A plus Ronstar 1 or 1.25 lb/A, alachlor 2 lb/A plus linuron .75 lb/A, metobromuron 1 lb/A plus DCPA 6 lb/A, and Sencor, BAY 94337 [4-amino-6-*t*-butyl-3-(methylthio)-*as*-triazin-5-(4H)-one] alone at .33, .50, and .75 lb/A.

Trifluralin was applied preplant incorporated; Ronstar, DCPA, alachlor, linuron, and metobromuron were applied preemergence; and Sencor was applied postemergence when the potatoes were 4 to 6 inches in height and the weeds were 1 to 3 inches in height. Linuron at 1.50 lb/A significantly (5% level) reduced the yields below the hand-weeded check.

Treatments in the Ontario trial that gave excellent control of barnyardgrass, pigweed, lambsquarters, and nightshade and produced higher yields than the untreated checks were alachlor 2 lb/A, alachlor 2 lb/A plus Sencor .50 lb/A, Ronstar 1 and 2 lb/A, Sencor .50 lb/A preemergence plus alachlor granules 2 lb/A postemergence and Sencor 1 lb/A preemergence plus Sencor 1 lb/A postemergence. All of these treatments produced higher yields than the standard treatment of trifluralin plus EPTC. Bladex 2 lb ai/A, metobromuron 2 lb/A, and linuron 1.50 lb/A yielded significantly (1% level) below the weedy check. The experimental compound MON 097 [2-chloro-N-(ethoxymethyl)-6´-ethyl-o-acetotoluidide] yielded much higher than the weedy check.

The third trial was conducted in Redmond, Oregon on a sandy loam with 1.9% organic matter. The objective of this trial was to determine visual potato tolerance and weed control abilities of several experimental compounds and herbicide combinations. Treatments that gave excellent control of pigweed, lambsquarters, barnyardgrass, and nightshade without any visual potato tuber yield reductions or malformations were EPTC 3 lb/A plus R 7465 [2-naphthoxy)-*N,N*-diethylpropionamide] 1 lb/A, R 7465 4 lb/A, NIA 20439 [3-(2-methylphenoxy) pyridazine] 2 lb/A plus Sencor .50 lb/A, alachlor 1.50 lb/A plus Sencor .50 lb/A, MON 097 1.5 lb/A, and oryzalin 1 lb/A plus Sencor .25 lb/A. EPTC and R 7465 were applied preplant incorporated; NIA 20439, Sencor, alachlor, MON 097, and oryzalin were applied preemergence. (Crop Science Dept., Oregon St. University, Corvallis).

<u>Residual effects of dicamba and 2,4-D herbicides on potatoes.</u> Collins, R. L. This study was initiated to determine the residual effects of dicamba and 2,4-D on potatoes. Application of the herbicides was made at a time when they would normally be used for perennial weed control, and during the fallow period between crops.

Treatments were applied to soil previously planted to potatoes on October 21, 1969, at Moses Lake, Washington. Soil type was Winchester sand. Treatments were replicated three times and were 4 sq. rods in size. Herbicides were applied to the soil in 40 gpa water. The plot area was furrow irrigated. Russet Burbank potatoes were planted on May 1, 1970, and May 5, 1971. Visual evaluations were taken on May 9, June 9, July 16, 1970; June 20 and July 28, 1971. Potatoes were harvested on October 8, 1970, and October 15, 1971.

During the 1970 crop year, little or no injury could be determined with 1 lb/A dicamba or 3 lb/A 2,4-D treatments early in the season. By midsummer no symptoms of injury occurred in the 3 lb/A treatment with 2,4-D and only trace symptoms with 1 lb/A of dicamba. The remaining dicamba treatments produced slight to severe effects. The principal symptoms were: delayed plant growth, formative leaf and stem effects, enlarged roots, numerous small tubers, brittle tubers, basal stem and tuber sprouting, and an excessive number of seed pods. All treatments reduced yields.

During the 1971 crop year, no crop injury symptoms could be found except for very slight formative effects in the 10 lb/A dicamba treatment. There were some irrigation problems which probably affected the yields during the 1971 season. The 4 and 10 lb/A dicamba treatments appeared to reduce yields. (Agricultural Consultant, formerly Velsicol Chem. Corp., Hillsboro, Oregon).

		1970	1970		1971	1971	
	Rate	Visual	Av. Tuber Yield		Visual	Av. Tuber Yield	
Treatment	lb/A	Rating	Total	#2 or better	Rating	Total	#2 or better
Dicamba	1	0.5	140.8	43.0	0	215.5	130.5
Dicamba	2	1.0	97.8	27.1	0	210.7	155.0
Dicamba	4	2.0	60.8	14.3	0	152.0	88.5
Dicamba	6	4.0	47.1	14.5	0	265.3	188.3
Dicamba	10	5.0	50.8	7.0	1.0	168.0	118.0
Dicamba + 2,4-D	1+3	0.5	133.6	46.5	0	215.3	155.5
2,4-D	3	0	133.1	48.0	0	219.1	148.6
Check	-	-	177.0	102.6	0	265.8	155.3

Trifluralin-diuron combinations for weed control in four populations of cotton. Arle, H. F. and K. C. Hamilton. Two combinations of trifluralin and diuron were applied to four populations of Deltapine 16 cotton at Phoenix, Arizona in 1970. On March 23, trifluralin (.25 and .75 lb/A) was incorporated in the soil by disking before furrowing (listing) for the preplanting irrigation. The soil contained 36% sand, 42% silt, 22% clay, and 1% organic matter. Cottonseed was planted in moist soil under a dry mulch in April. The rows were 40 inches apart. After emergence, cotton seedlings were thinned to provide 4, 6, 12, and 18 inches between individual plants within rows. Treatments were replicated four times in four-row plots 41 ft long. The test area was cultivated twice.

On June 24, when cotton was 16 inches tall, diuron (1 lb/A) was applied as a directed spray covering the furrow and base of cotton plants. Moderate to severe infestations of browntop panicum (*Panicum fasciculatum* Sw. var. *reticulatum* (Torr.) Beal), junglerice (*Echinochloa colonum* (L.) Link), red sprangle top (*Leptochloa filiformis* (Lam.) Beauv.), Wright groundcherry (*Physalis wrightii* Gray), and Palmer amaranth (*Amaranthus palmeri* S. Wats.) were present. Weed control was estimated at midseason and harvest. In October boll samples for fiber analyses were taken from each plot and the center rows were machine-picked.

Emergence of cotton appeared normal in all plots but the high rate of trifluralin stunted seedlings temporarily. The higher rate of trifluralin gave better early control of annual grass. Later in the season, vigorous growth of the cotton in all plots combined with the herbicide treatments gave complete control of annual weeds. At harvest there were no differences in cotton yield, boll components, or fiber properties due to plant populations or herbicide treatments. (Cooperative investigations of Plant Science Research Division, Agricultural Research Service, U. S. Department of Agriculture, Phoenix, and Arizona Agricultural Experiment Station, University of Arizona, Tucson).

<u>The response of three grass species to picloram, dicamba, and 2,4-D.</u> Gesink, R. W., G. A. Lee, and H. P. Alley. A replicated series of plots was established June 6, 1971, to study the effects of various herbicides upon the density, seed and forage production, protein and carbohydrate levels, and possible phytotoxic responses of three grass species.

Various rates of 2,4-D, dicamba and picloram were applied to established stands of Kentucky bluegrass, western wheatgrass, and smooth bromegrass which were heavily infested with Canada thistle and dandelion. The applications were applied in a total volume of 40 gpa water and replicated three times.

The protein and carbohydrate analyses have not yet been completed, however, the effect of the herbicides on forage and seed production during the first season is presented in the following tables. Increases in production of bluegrass were apparently due to elimination of weed competition and none of the treatments appeared to have phytotoxic effects on this species. The untreated plots, which were heavily infested with Canada thistle and dandelion, produced a low of 830 lb/A of oven-dry bluegrass, while all herbicide treatments which eliminated the weed competition resulted in high increases in forage.

The dicamba and picloram treatments appeared to have slight phytotoxic effects on western wheatgrass. This was observed in the field as a slight reduction in the height and vigor of the treated plants, and is also evident from production data. The untreated checks, which were weed infested, produced the greatest amount of grass per acre. The dicamba and picloram treatments effectively controlled all weed species, however, grass production was lower than the check which may indicate an adverse effect of the herbicide upon the grass.

Of the three grasses, bromegrass appeared to be the most susceptible to the herbicide treatments. This again was borne out in the production data and in the field. The untreated checks provided the highest production at 2460 lb/A and the 2,4-D treatments resulted in a somewhat reduced yield of 1780 lb/A. The picloram and dicamba plots were much lower with 1480 lb/A for dicamba, and 1367 lb/A and 1347 lb/A, respectively, for picloram treatments at 1.0 lb/A and 1.5 lb/A.

There was no apparent effect on bluegrass seed production resulting from the herbicides used in this study. There were, however, substantial reductions of both western wheatgrass and smooth bromegrass seed production. Seed production of smooth bromegrass was most severely affected resulting in a 99% reduction in the dicamba plots and a 95% reduction in the picloram plots. The reduction of 30% caused by 2,4-D was less detrimental, but it should be noted that it had no effect on the seed production of either bluegrass or western wheatgrass. The herbicide effects were less severe on western wheatgrass seed production; picloram reduced the yield by 50% and dicamba 80%. (Wyoming Agriculture Experiment Station, Laramie).

Oven-dry herbage yields of grass and weed species expressed as pounds per acre

		Bluegrass	Thistle	Dandelion
Untreated		830	1130	337
2,4-D	2 lb/A	1293	353	19
Dicamba	6 lb/A	1520	35	19
Picloram	1 lb/A	1667	0	0
Picloram	1.5 lb/A	1360	0	0

		Wheatgrass	Thistle	Dandelion
Untreated		1960	303	106
2,4-D	2 lb/A	1753	82	10
Dicamba	6 lb/A	1480	0	0
Picloram	1 lb/A	1600	0	0
Picloram	1.5 lb/A	1387	0	0

		Bromegrass	Thistle	Dandelion
Untreated		2460	155	9
2,4-D	2 lb/A	1780	22	0
Dicamba	6 lb/A	1247	0	0
Picloram	1 lb/A	1367	0	0
Picloram	1.5 lb/A	1347	0	0

Percent reduction in seed produced as compared to untreated check

		Blue-grass	Wheat-grass	Brome-grass
2,4-D	2 lb/A	0	0	30
Dicamba	6 lb/A	0	80	99
Picloram	1 lb/A	0	50	95
Picloram	1.5 lb/A	0	50	95

Evaluation of soil-active herbicides for short term weed control on non-crop sites. McHenry, W. B., B. B. Fischer, L. S. Frey, W. D. Hamilton, H. M. Kempen, V. H. Schweers, and N. L. Smith. Weed abatement on sites destined for future landscaping poses unique problems of efficiently preventing, or greatly reducing, weed growth without jeopardizing the future establishment of turf or ornamental plants. A number of soil-active herbicides such as chlorpropham, nitrofen, R 7465 [2-(a Naphthoxy)-*N*,*N*-dimethyl-propionamide], prometryne, and Sirmate (3,4-dichlorobenzyl methylcarbamate) have been tested in recent years but discarded due to selective release of common weeds such as mustard or because of excessive soil persistence. Simazine has been the most common soil-applied herbicide utilized by municipalities for vacant lot weed control; consequently, this herbicide was included in all trials as a standard. Linuron is labeled for vacant lot weed abatement.

Soil applied herbicides were applied postemergence with amitrole 1 lb/A at all sites except Fresno County. Here the treatments were applied preemergence on recently tilled soil. Plot size was 20 ft square; four replications were employed at each location.

General annual weed control with four soil-applied herbicides on vacant lot sites

Herbicide	lb ai/A	Weed Control (10=100%)				
		Alameda Co	Fresno Co	Kern Co	Sac Co	Tulare Co
		4/1/71	4/23/71	8/31/71	5/18/71	9/1/71
		12.8"*	6.2"*	3.9"*	4.1"*	4.8"*
Ametryne	1	4.0	0.8	5.0	8.3	4.8
Ametryne	2	4.0	2.5	6.3	9.4	7.3
Ametryne	3	7.0	4.3	5.5	9.6	8.3
Linuron	1	5.5	5.3	3.8	7.4	5.8
Linuron	2	5.5	7.5	5.5	9.6	7.3
Linuron	3	4.0	6.5	4.8	9.3	7.5
Terbutryn	1	4.8	1.0	4.8	7.6	4.3
Terbutryn	2	5.3	1.3	6.0	9.7	3.5
Terbutryn	3	5.8	8.4	7.8	9.2	7.8
Simazine	1	8.5	8.5	5.8	7.8	6.0
Simazine	2	9.5	9.4	8.0	9.5	7.5
Control	-	-	0.5	0.0	0.0	0.5

* Precipitation between treatment and evaluation dates.

With the exception of the Sacramento County results, ametryne, linuron and terbutryn did not attain the degree of weed control observed with simazine. Summer annual broadleaf species such as bursage (*Franseria acanthicarpa* (Hook) Coville), redstem filaree (*Erodium cicutarium* (L.) L'Her.), puncturevine (*Tribulus terrestris* L.), and Russian thistle (*Salsola kali* var. *tenuifolia* Tausch) were the predominant escapees. Russian thistle was notably tolerant to linuron and filaree to simazine.

Greenhouse bioassay tests of soils collected at 1 inch increments to a depth of 5 inches from the five test locations (2 lb/A treatments only) were planted to Kentucky bluegrass (*Poa pratensis* L.), Kanota oats (*Avena sativa*), dichondra (*Dichondra repens* Forst. var. *caroliniensis* (Michx.) Choisy), and sugar beets USH9B (*Beta vulgaris*). Simazine at 2 lb/A was particularly more persistent than any of the other herbicides approximately 6 months following application. (University of Calif., Agr. Ext. Ser., Botany Dept., Davis).

<u>Persistence of trifluralin and related compounds at 3 months after application.</u> Fischer, B. B. and A. H. Lange. Trifluralin and nine related compounds were applied to the soil surface of prepared 30 inch beds and tilled by a straight-toothed power tiller on March 19, 1971. They were seeded behind the incorporator, evaluated and later destroyed. Three months later, the beds were reshaped and planted to sorghum, cotton, tomatoes, and sugar beets.

All herbicides exhibited carryover activity 3 months after herbicide application. The least residual activity on the sensitive crop, sorghum, was produced by A-820, benefin, and EL 179. Most active on sorghum were BAS 3921H and EL 119.

The least active after 3 months on sugar beets were AN 56477 and benefin. Most active were trifluralin, UCB 3584, BAS 3921H, EL 119, EL 179, nitralin, and A-820.

The safest on cotton was UCB 3584 although most showed good cotton tolerance up to 1.5 lb/A.

The safest herbicide on tomatoes was A-820 and benefin. The most toxic to tomatoes was UCB 3584 and BAS 3921H. (University of California, Fresno, Parlier).

Herbicide residue at 3 months after application

Herbicide	lb/A	Milo	Cotton	Tomatoes	Sugar beets
			Average[1/]		
Trifluralin	.75	6.3	0.0	0.7	10.0
Trifluralin	1.5	10.0	1.0	7.6	10.0
Trifluralin	3.0	10.0	2.0	10.0	10.0
Nitralin	.75	6.6	0.7	2.3	9.0
Nitralin	1.5	9.3	0.7	8.6	10.0
Nitralin	3.0	10.0	1.0	10.0	10.0
AN 56477	.75	5.3	0.0	2.3	5.3
AN 56477	1.5	8.6	3.3	6.0	9.0
AN 56477	3.0	10.0	0.3	9.3	10.0
A-820	.75	1.0	0.0	4.0	9.0
A-820	1.5	3.3	0.0	4.3	10.0
A-820	3.0	7.6	1.3	4.6	10.0
CGA 10832	.75	4.0	0.0	2.3	8.0
CGA 10832	1.5	9.3	0.0	7.6	9.6
CGA 10832	3.0	6.6	3.3	9.3	10.0
UCB 3584	.75	6.3	0.0	6.3	10.0
UCB 3584	1.5	7.0	0.0	8.3	10.0
UCB 3584	3.0	8.3	0.0	9.3	10.0
BAS 3921H	.75	9.0	0.7	7.6	9.6
BAS 3921H	1.5	10.0	0.7	10.0	10.0
BAS 3921H	3.0	10.0	1.0	10.0	10.0
Benefin	.75	1.3	0.0	1.6	5.3
Benefin	1.5	8.0	0.7	7.6	10.0
Benefin	3.0	10.0	1.0	9.3	10.0
EL 119	.75	8.6	0.0	3.3	9.6
EL 119	1.5	9.3	0.0	8.0	10.0
EL 119	3.0	7.6	4.0	9.6	10.0
EL 179	.75	0.7	0.0	3.6	9.6
EL 179	1.5	5.6	1.0	7.0	10.0
EL 179	3.0	8.0	2.0	8.3	10.0
Untreated	.75	1.0	0.0	1.3	6.6
Untreated	1.5	1.3	1.3	1.0	8.3
Untreated	3.0	5.3	3.3	2.0	4.0

1/ Average of 3 replications where 0 = no effect on crop; 10 = complete kill.

Antagonistic effect of 2,4-D amine and SD 30053 on wild oats. Colbert, D. R. and A. P. Appleby. Our field data have shown that a tank-mix combination of 2,4-D amine and SD 30053 results in a significant reduction in wild oat control. To study this further, a greenhouse experiment was initiated in the fall of 1971. SD 30053 (formulation contained oil) was applied at 1.0, 1.5, and 2 lb/A to wild oats that were in the five leaf to beginning of tillering stage of growth. The SD 30053 was applied in the following ways: (1) alone, (2) two weeks after the application of 3/4 lb/A of 2,4-D amine, (3) one week after the application of 3/4 lb/A of 2,4-D amine, and (4) tank-mix combination with 3/4 lb/A of 2,4-D amine. Dry weights of the wild oat plants are recorded in the table below.

SD 30053 was much more effective in reducing wild oat growth when applied alone to wild oat plants which hadn't been previously sprayed with 2,4-D amine. The application of 2,4-D amine, either as a tank mix with SD 30053 or applied 1 or 2 weeks prior to SD 30053 applications caused an antagonistic effect and reduced the effectiveness of SD 30053 for wild oat control. It appears from these data that the closer the application of 2,4-D amine prior to SD 30053 applications the less effective it will be for controlling wild oats. (Crop Science Dept., Oregon State University, Corvallis).

Dry Weights of Wild Oat Plants
Treated With 2,4-D amine and SD 30053

Treatment	lb/A	Date of Application SD 30053[a]	2,4-D[b]	Average Dry wt-gm	% Growth Reduction
Without 2,4-D					
SD 30053	1.0	10/21/71	-----	1.039	64.1
SD 30053	1.5	10/21/71	-----	0.970	66.5
SD 30053	3.0	10/21/71	-----	0.817	71.8
Check	---	--------	-----	2.898	0
2,4-D 2 wks prior					
SD 30053 + 2,4-D	1.0+0.75	10/21/71	10/7/71	0.904	48.0
SD 30053 + 2,4-D	1.5+0.75	10/21/71	10/7/71	0.836	51.9
SD 30053 + 2,4-D	3.0+0.75	10/21/71	10/7/71	0.739	57.5
Check + 2,4-D	0+0.75	--------	10/7/71	1.738	0
2,4-D 1 wk prior					
SD 30053 + 2,4-D	1.0+0.75	10/21/71	10/14/71	1.507	31.6
SD 30053 + 2,4-D	1.5+0.75	10/21/71	10/14/71	1.240	43.7
SD 30053 + 2,4-D	3.0+0.75	10/21/71	10/14/71	1.004	54.4
Check + 2,4-D	0+0.75	--------	10/14/71	2.203	0

Treatment	lb/A	Date of Application SD 30053[a]	2,4-D[b]	Average Dry wt-gm	% Growth Reduction
Tank-mix					
SD 30053 + 2,4-D	1.0+0.75	10/21/71	10/21/71	1.771	28.3
SD 30053 + 2,4-D	1.5+0.75	10/21/71	10/21/71	1.456	41.0
SD 30053 + 2,4-D	3.0+0.75	10/21/71	10/21/71	0.881	64.3
Check + 2,4-D	0+0.75	--------	10/21/71	2.469	0

a - 1.6 lb/gal formulation (contained oil).
b - Dimethylamine salt of 2,4-D.

Effects of copper concentrations on the germination of rice seeds. Nemo, A. J. Laboratory tests were conducted to determine the effect of varying copper concentrations on the germination of rice seeds. Colusa foundation rice (1970) seeds were used in these tests.

Copper-triethanolamine (cutrine) algaecide was the source of copper. Copper concentrations were determined by the Cuprethol Method (Standards Methods, 12th Edition, 1965) using the Spectrophotometer. Tap water (average hardness 750 ppm $CaCO_3$) was used for the controls. The rice seeds and cutrine solutions were placed in petri dishes and observed for 9 days. Observations were recorded at 3, 6, and 9 day intervals. Percent of germination and length of sprouts were recorded for each concentration. Three series of tests were conducted.

In Series #1, cutrine concentrations ranged from 2.80 ppm to 12.69 ppm; Series #2, 21.09 ppm to 120.95 ppm; Series #3, 6.49 ppm to 56.35 ppm. As much as 120.95 ppm cutrine (8.20 ppm copper) had no deleterious effect on the germination of the rice seeds (average length of sprout--16 mm, 97% germination).

The average lengths recorded in Series #1, #2, and #3 are the arithmetic averages of three seeds selected at random for the ninth day's reading.

While these laboratory studies lend themselves to the testing of product safety for germinating seeds, field testing will be needed to further augment these findings. (Research Associate, Applied Biochemists, Inc., Mequon, Wisconsin).

SERIES #1

Average length	Average germination	Concentration (ppm) Copper	Cutrine
37 mm	96%	0.19	2.80
41 mm	95%	0.22	3.24
42 mm	96%	0.40	5.90
38 mm	98%	0.41	6.05
32 mm	94%	0.42	6.20
43 mm	96%	0.51	7.52
34 mm	99%	0.80	11.80
31 mm	94%	0.86	12.69
Control:			
40 mm	97%		

SERIES #2

Average length	Average germination	Copper	Cutrine
29 mm	97%	1.43	21.09
16 mm	97%	2.24	33.04
21 mm	97%	3.44	50.74
17 mm	98%	4.06	59.88
19 mm	100%	4.88	71.98
16 mm	96%	5.98	88.21
19 mm	98%	6.80	100.30
17 mm	99%	7.80	115.05
16 mm	97%	8.20	120.95
Control:			
14 mm	96%		

SERIES #3

Average length	Average germination	Copper	Cutrine
54 mm	94%	0.44	6.49
66 mm	90%	1.08	15.96
44 mm	96%	2.26	33.34
56 mm	93%	2.70	39.83
39 mm	91%	2.78	41.00
57 mm	97%	3.20	47.20
63 mm	96%	3.82	56.35
Control:			
68 mm	90%		

PROJECT 6. AQUATIC AND DITCHBANK WEEDS

W. B. McHenry, Project Chairman

SUMMARY

Four research reports were received in contribution to this section.

Results from field testing during 1971 near Orlando, Florida, indicate a combination of diquat and a copper-triethanolamine complex is effective in controlling a number of submersed and floating aquatic plants. Reports of field evaluations with a proprietary copper-triethanolamine complex suggest effective control of chara and nitella in recreational and irrigation waters and rice plantings. Preliminary results of monitoring studies of pond water treated with copper triethanolamine indicate copper levels in fish are lower than previously published data, presumably where copper sulfate was the copper source.

A new aquatic herbicide. Vedder, Dennis L. During the 1971 growing season, 53 one acre test plots were established near Orlando, Florida, to test aquatic herbicides for the control of hydrilla (*Hydrilla verticillata*). Hydrilla is presently confined to Florida, but conditions are favorable for a future invasion of this exotic plant in other areas of the United States.

In addition to the herbicide screening series, different rates of application were tested. Several replications of the more promising herbicides were also tested. The plots were evaluated at 30, 60, and 90 day intervals by scuba divers. As a part of the evaluations, non-target organisms were surveyed. Vertebrate and invertebrate fauna, as well as target and non-target flora were observed and quantitatively enumerated.

The chemicals were supplied by the following companies: Applied Biochemists, Inc., Chevron Chemical Co., Glidden-Durkee, Minnesota Mining and Manufacturing Co., and Pennwalt Chemical Co. The work was directed by Robert Blackburn of the USDA-ARS Lab in Plantation, Florida. Technicians from the Plantation Laboratory did the evaluating.

The results of the testing led to the registration of the combination of a copper-triethanolamine complex (Cutrine) and diquat dibromide for the control of *Hydrilla verticillata* and other aquatic weeds in the state of Florida. Fish toxicity and efficacy tests were also performed by the Florida Game and Freshwater Fish Commission, the Army Corps of Engineers, as well as by the registrant, Applied Biochemists, Inc., of Mequon, Wisconsin. The new aquatic herbicide is registered under the tradename, Weedtrine. It is 9.8% active ingredient and contains 0.5 lb/gal elemental copper and 0.6 lb/gal diquat cation.

Some preliminary work has been started in southern California using the copper-diquat combination for emergent and marginal vegetation control at several potable water reservoirs. In addition to its effectiveness against hydrilla and marginal weeds, the combination has also controlled coontail (*Ceratophyllum* sp.), elodea (*Elodea* sp.), naiad *Najas* sp.), pondweeds (*Potamogeton* sp.), watermilfoil (*Myriophyllum* sp.), duckweed (*Lemna* spp. and *Spirodela* spp.) and watermeal (*Wolffia* spp. and *Wolffiella* spp.). In 1972, Applied Biochemists, Inc., will be testing the copper plus diquat herbicide in other parts of the country, including California. (Technical Services, Applied Biochemists, Inc., Mequon, Wisconsin).

Chara and nitella control with a granular copper-triethanolamine algaecide. Vedder, Dennis L. Chara (*Chara* sp.) and nitella (*Nitella* sp.) control with a granular formulation containing a copper-triethanolamine complex has been obtained recently in California, Texas, Ohio, and Wisconsin. Applied Biochemists, Inc., Mequon, Wisconsin, has Federal Registration pending on this granular formulation.

In the Western States, chara and nitella have been significant problems. Recreational and irrigation waters and rice production have suffered from the invasions of chara and nitella. Tests have shown that, as a rule, one treatment early in the season has been effective in controlling these algae. At the present time, state and federal registration procedures are underway to include this granular formulation in the war against unwanted aquatic growth. (Applied Biochemists, Inc., Mequon, Wisconson).

Copper residue, fate and persistence studies. Vedder, Dennis L. Several ponds were treated periodically with a copper-triethanolamine complex (Cutrine) algaecide for algae control. Samples were collected on a regular schedule to monitor the copper. Water, plant, plankton, mud, and fish samples were collected and are presently being analyzed for copper residue.

Preliminary data indicate that the level of copper in the whole fish is well below previously published concentrations. These low levels of copper residue in the tests seem to be following the pattern of Lin, et.al. (1971). Approximately 1.0 ppmw above the background level of copper residue was detected in the test fish. (Applied Biochemists, Inc., Mequon, Wisconsin).

Response of sago pondweed (*Potamogeton pectinatus* L.) to dichlobenil, diuron, and fenac. McHenry, W. B., R. K. Glenn, and N. L. Smith. Diuron and fenac were applied to the full profile of a drained canal with a wetted perimeter of 23 ft, using knapsack sprayers. Granular dichlobenil was applied to the same canal with a centrifugal chest-held granular applicator to a plot width of 12 ft on the nearly flat canal bottom. A uniform plot length of 25 ft was used with a 10 ft long untreated buffer zone between each plot. Three replications were employed. Rain fell in the afternoon of the day following treatment; rainfall of 12.3 inches was received on the treatments prior to filling the canal in March 1971. The soil was a clay loam. Control observations were made after the canal was drained in November, some 12 months after treatment.

Herbicide	Acre Rate		Control
	Active ingredient	Formulation	(10=100%)
Dichlobenil	10 lb	250 lb	0.3
Dichlobenil	15	375	0.3
Dichlobenil	20	500	0.7
Diuron	20	25	0.0
Diuron	40	50	0.0
Diuron	60	75	0.0
Fenac	10	6.7 gal	3.3
Fenac	15	10	3.0
Fenac	20	13.3	4.3
Control	-	-	0.0

While the occurrence of precipitation the day following application and the total precipitation of 12 inches would appear to be near optimum conditions for favorable performance, none of the herbicides provided adequate control of sago pondweed. Occasional canal-side visits during the summer did not indicate a higher degree of control earlier in the irrigation season. Insufficient water clarity made it difficult to make evaluations during the months the canal was in use. (University of California, Agr. Ext. Ser., Davis, and Agr. Exp. Sta., Davis).

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NOMENCLATURE AND ABBREVIATIONS

Tables 1 and 2 below are nomenclature and abbreviation lists of the Weed Society of America (Nomenclature Weeds 19(1), 1971). Authors are urged to use this terminology and abbreviation whenever applicable.

Table 1. Common and Chemical Names of Herbicides1/

Common name	Chemical name
A	
acrolein	acrolein
alachlor	2-chloro-2',6'-diethyl-*N*-(methoxymethyl) acetanilide
ametryne	2-(ethylamino)-4-(isopropylamino)-6-(methylthio)-*s*-triazine
amiben (see chloramben)	
amitrole	3-amino-*s*-triazole
AMS	ammonium sulfamate
asulam	methyl sulfanilylcarbamate
atratone	2-(ethylamino)-4-(isopropylamino)-6-methoxy-*s*-triazine
atrazine	2-chloro-4-(ethylamino)-6-(isopropylamino)-*s*-triazine
B	
barban	4-chloro-2-butynyl *m*-chlorocarbanilate
benefin	*N*-butyl-*N*-α,α,α,-trifluoro-2,6-dinitro-*p*-toluidine
bensulide	*O,O*-diisopropyl phosphorodithioate -*S*-ester with *N*-(2-mercaptoethyl)benzenesulfonamide
benzadox	(benzamidooxy)acetic acid
bromacil	5-bromo-3-*sec*-butyl-6-methyluracil
bromoxynil	3,5-dibromo-4-hydroxybenzonitrile
butachlor	*N*-(butoxymethyl-2-chloro-2',6'-diethylacetanilide
buturon	3-(*p*-chlorophenyl)-1-methyl-1-(1-methyl-2-propynyl)urea
butylate	*S*-ethyl diisobutylthiocarbamate
C	
cacodylic acid	hydroxydimethylarsine oxide
carbetamide	*D*-*N*-ethyllactamide carbanilate (ester)
CDAA	*N,N*-diallyl-2-chloroacetamide
CDEA	2-chloro-*N,N*-diethylacetamide
CDEC	2-chloroallyl diethyldithiocarbamate
chloramben	3-amino-2,5-dichlorobenzoic acid
chlorazine	2-chloro-4,6-bis(diethylamino)-*s*-triazine
chloroxuron	3-[*p*-(*p*-chlorophenoxy)phenyl]-1,1-dimethylurea
chlorpropham	isopropyl *m*-chlorocarbanilate
CIPC (see chlorpropham)	
CMA	calcium methanearsonate
cycloate	*S*-ethyl N-ethylthiocyclohexanecarbamate
cycluron	3-cyclooctyl-1,1-dimethylurea
cypromid	3',4'-dichlorocyclopropanecarboxanilide

Table 1. Common and Chemical Names of Herbicides (continued)

Common name	Chemical name
D	
dalapon	2,2-dichloropropionic acid
dazomet	tetrahydro-3,5-dimethyl-2*H*-1,3,5-thiadiazine-2-thione
DCPA	dimethyl tetrachloroterephthalate
DCU	1,3-bis(2,2,2-trichloro-1-hydroxyethyl)urea
delachlor	2-chloro-*N*-(isobutoxymethyl)-2',6'-acetoxylidide
desmetryne	2-(isopropylamino)-4-(methylamino)-6-(methylthio)-*s*-triazine
diallate	*S*-(2,3-dichloroallyl) diisopropylthiocarbamate
dicamba	3,6-dichloro-*o*-anisic acid
dichlobenil	2,6-dichlorobenzonitrile
dichlormate	3,4-dichlorobenzyl methylcarbamate
dichlorprop	2-(2,4-dichlorophenoxy)propionic acid
dicryl	3',4'-dichloro-2-methylacrylanilide
dinosam	2-(1-methylbutyl)-4,6-dinitrophenol
dinoseb	2-*sec*-butyl-4,6-dinitrophenol
diphenamid	*N,N*-dimethyl-2,2-diphenylacetamide
diquat	6,7-dihydrodipyrido[1,2-*a*:2',1'-*c*]pyrazinediium ion
diuron	3-(3,4-dichlorophenyl)-1,1-dimethylurea
DMTT (see dazomet)	
DNAP (see dinosam)	
DNBP (see dinoseb)	
DNC (see DNOC)	
DNOC	4,6-dinitro-*o*-cresol
DSMA	disodium methanearsonate
E	
endothall	7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
EPTC	*S*-ethyl dipropylthiocarbamate
erbon	2-(2,4,5-trichlorophenoxy)ethyl 2,2-dichloro=propionate
EXD	*O,O*-diethyl dithiobis[thioformate]
F	
fenac	(2,3,6-trichlorophenyl)acetic acid
fenuron	1,1-dimethyl-3-phenylurea
fenuronTCA	1,1-dimethyl-3-phenylurea mono(trichloroacetate)
fluometuron	1,1-dimethyl-3-(α,α,α,-trifluoro-*m*-tolyl)urea
H	
HCA	1,1,1,3,3,3-hexachloro-2-propanone
hexaflurate	potassium hexafluoroarsenate
I	
ioxynil	4-hydroxy-3,5-diiodobenzonitrile
ipazine	2-chloro-4-(diethylamino)-6-(isopropylamino)-*s*-triazine

Table 1. Common and Chemical Names of Herbicides (continued)

Common name	Chemical name
IPC (see propham)	
isocil	5-bromo-3-isopropyl-6-methyluracil
isopropalin	2,6-dinitro-*N*,*N*-dipropylcumidine
K	
KOCN	potassium cyanate
L	
lenacil	3-cyclohexyl-6,7-dihydro-1*H*-cyclopentapyrimidine-2,4(3*H*,5*H*)-dione
linuron	3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea
M	
MAA	methanearsonic acid
MAMA	monoammonium methanearsonate
MCPA	[(4-chloro-*o*-tolyl)oxy]acetic acid
MCPB	4-[(4-chloro-*o*-tolyl)oxy]butyric acid
MCPES	2-[(4-chloro-*o*-tolyl)oxy]ethyl sodium sulfate
MCPP (see mecoprop)	
mecoprop	2-[(4-chloro-*o*-tolyl)oxy]propionic acid
metham	sodium methyldithiocarbamate
metobromuron	3-(*p*-bromophenyl)-1-methoxy-1-methylurea
MH	1,2-dihydro-3,6-pyridazinedione
molinate	*S*-ethyl hexahydro-1*H*-azepine-1-carbothioate
monolinuron	3-(*p*-chlorophenyl)-1-methoxy-1-methylurea
monuron	3-(*p*-chlorophenyl)-1,1-dimethylurea
monuronTCA	3-(*p*-chlorophenyl)-1,1-dimethylurea mono(trichloro=acetate)
MSMA	monosodium methanearsonate
N	
naptalam	*N*-1-naphthylphthalamic acid
neburon	1-butyl-3-(3,4-dichlorophenyl)-1-methylurea
nitralin	4-(methylsulfonyl)-2,6-dinitro-*N*,*N*-dipropylaniline
nitrofen	2,4-dichlorophenyl *p*-nitrophenyl ether
norea	3-(hexahydro-4,7methanoindan-5-yl)-1,1-diethylurea
NPA (see naptalam)	
O	
oryzalin	3,5-dinitro-N^4,N^4-dipropylsulfanilamide
P	
paraquat	1,1'-dimethyl-4,4'bipyridinium ion
PBA	chlorinated benzoic acid
PCP	pentachlorophenol
pebulate	*S*-propyl butylethylthiocarbamate
phenmedipham	methyl *m*-hydroxycarbanilate *m*-methylcarbanilate

Table 1. Common and Chemical Names of Herbicides (continued)

Common name	Chemical name
picloram	4-amino-3,5,6-trichloropicolinic acid
PMA	(acetato)phenylmercury
prometone	2,4-bis(isopropylamino)-6-methoxy-*s*-triazine
prometryne	2,4-bis(isopropylamino)-6-(methylthio)-*s*-triazine
propachlor	2-chloro-*N*-isopropylacetanilide
propanil	3',4'-dichloropropionanilide
propazine	2-chloro-4,6-bis(isopropylamino)-*s*-triazine
propham	isopropyl carbanilate
pyrazon	5-amino-4-chloro-2-phenyl-3(2*H*)-pyridazinone
pyriclor	2,3,5-trichloro-4-pyridinol
S	
sesone	2-(2,4-dichlorophenoxy)ethyl sodium sulfate
siduron	1-(2-methylcyclohexyl)-3-phenylurea
silvex	2-(2,4,5-trichlorophenoxy)propionic acid
simazine	2-chloro-4,6-bis(ethylamino)-*s*-triazine
simetone	2,4-bis(ethylamino)-6-methoxy-*s*-triazine
simetryne	2,4-bis(ethylamino)-6-(methylthio)-*s*-triazine
SMDC (see metham)	
solan	3'-chloro-2-methyl-*p*-valerotoluidide
swep	methyl 3,4-dichlorocarbanilate
T	
terbacil	3-*tert*-butyl-5-chloro-6-methyluracil
terbutol	2,6-di-*tert*-butyl-*p*-tolyl methylcarbamate
terbutryn	2-(*tert*-butylamino)-4-(ethylamino)-6-(methylthio)-*s*-triazine
TCA	trichloroacetic acid
triallate	*S*-(2,3,3-trichloroallyl) diisopropylthiocarbamate
tricamba	3,5,6-trichloro-*o*-anisic acid
trietazine	2-chloro-4-(diethylamino)-6-(ethylamino)-*s*-triazine
trifluralin	α,α,α,-trifluoro-2,6-dinitro-*N*,*N*-dipropyl-*p*-toluidine
trimeturon	1-(*p*-chlorophenyl)-2,3,3-trimethylpseudourea
2,3,6-TBA	2,3,6-trichlorobenzoic acid
2,4-D	(2,4-dichlorophenoxy)acetic acid
2,4-DB	4-(2,4-dichlorophenoxy)butyric acid
2,4-DEB	2-(2,4-dichlorophenoxy)ethyl benzoate
2,4-DEP	tris[2-(2,4-dichlorophenoxy)ethyl] phosphite
2,4-DP (see dichlorprop)	
2,4,5-T	(2,4,5-trichlorophenoxy)acetic acid
2,4,5-TES	sodium 2-(2,4,5-trichlorophenoxy)ethyl sulfate
V	
vernolate	*S*-propyl dipropylthiocarbamate

1/As tabulated in this paper, a chemical name occupying two lines separated by an equal (=) sign is joined together without any separation if written on one line.

Table 2. Abbreviations of terms used in weed control

Abbreviations	Definitions
A	acre(s)
ae	acid equivalent
aehg	acid equivalent per 100 gallons
ai	active ingredient
aihg	active ingredient per 100 gallons
bu	bushel(s)
cfs	cubic feet per second
cu	cubic
diam	diameter
fpm	feet per minute
ft	foot or feet
g	gram(s)
gal	gallon(s)
gpa	gallons per acre
gph	gallons per hour
gpm	gallons per minute
hr	hour(s)
ht	height
in	inch(es)
l	liter(s)
lb	pound(s)
mg	milligram(s)
mi	mile(s)
min	minute(s)
ml	milliliter(s)
mm	millimeter(s)
mp	melting point
mph	miles per hour
oz	ounce(s)
ppmv	parts per million by volume
ppmw	parts per million by weight
ppt	precipitate
psi	pounds per square inch
pt	pint(s)
qt	quart(s)
rd	rod(s)
rpm	revolutions per minute
sp gr	specific gravity
sq	square
T	ton(s)
tech	technical
temp	temperature
wt	weight
w/v	weight per volume. Do not use this abbreviation. Instead give specific units (examples: g/l or lb/gal)
NCWCC	North Central Weed Control Conference
NEWCC	Northeastern Weed Control Conference
SWSS	Southern Weed Science Society
WSSA	Weed Science Society of America
WSWS	Western Society of Weed Science

The Metric System

Metric Units		English Equivalents
Length		
Centimeter	= 0.3937	inch
Meter	= 3.28	feet
Kilometer	= 0.621	statute mile
Kilometer	= 0.5396	nautical mile
Inch	= 2.540	centimeters (or 1000 mils)
Foot	= 30.48	centimeters
Yard	= 0.914	meter
Rod (16.5 feet)	= 5.029	meters
Statute mile (1,760 yards)	= 1.61	kilometers
Area		
Hectare	= 2.471	acres
Acre (43,560 square feet)	= 0.405	hectare
Volume		
Liter	= 1.05	quarts, U. S.
Quart, liquid, U. S. (32 ounce)	= 0.946	liter
Quart, imperial (40 ounce)	= 1.136	liters
Gallon, U. S. (4 quarts)	= 3.785	liters
Gallon, imperial	= 4.546	liters
Weight		
Gram	= 0.035	Avoirdupois ounces
Kilogram	= 2.205	Avoirdupois pounds
Metric ton	= 0.984	gross or long ton
Metric ton	= 1.102	short or net tons
Avoirdupois pound (16 ounces)	= 0.4536	kilogram
Avoirdupois ounce	= 28.35	grams
Ounce (British Fluid)	= 28.41	ml
Ounce (U. S. Fluid)	= 29.57	ml
Gross or long ton (2240 pounds)	= 1.016	metric tons
Short or net ton (2000 pounds)	= 0.907	metric ton
Other conversions		
Square inch	= 6.45	square centimeters
Pound per square inch	= 70.31	grams per square centimeter
30 pounds per square inch	= 2.11	kilograms per square centimeter
Pound per acre	= 1.12	kilograms per hectare
Gallon per acre	= 9.35	liters per hectare
Pound per gallon	= 8.337	kilograms per liter
Foot candle	= 10.764	lumens per square meter