WESTERN SOCIETY of WEED SCIENCE

Research Progress Report

DENVER, COLORADO
MARCH 16-18, 1971

PREFACE

The 1971 Annual Progress Report of the Research Committee of the Western Society of Weed Science is comprised of papers voluntarily submitted by the membership. It includes reports of the current status of progress in research in weed science conducted throughout the Western United States. This Report does not contain recommendations for herbicides, or does it imply that the uses discussed in the text are registered under the Federal Insecticide, Fungicide and Rodenticide Act. Some authors have used trade names in their reports. This is done for information purposes only and does not imply endorsement of commercial products by the Western Society of Weed Science nor by the institution by whom the author is employed. Reports printed in the Annual Progress Report does not constitute prior publication.

Chairman of each of the seven Research Projects comprising the Research Committee contributed greatly in summarizing and assembling their sections and cooperating in meeting deadlines which was truly appreciated. A special debt of gratitude is extended Harold P. Alley for his invaluable assistance in assembling the final manuscript.

Gary A. Lee
Research Committee Chairman
Western Society of Weed Science

TABLE OF CONTENTS

Page

PROJECT 1. PERENNIAL HERBACEOUS WEEDS
Leslie W. Sonder, Project Chairman

PROJECT 2. HERBACEOUS RANGE WEEDS
Robert D. Martin, Project Chairman

PROJECT 3. UNDESIRABLE WOODY PLANTS
Howard L. Morton, Project Chairman

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

Page

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

PROJECT 1. PERENNIAL HERBACEOUS WEEDS

Leslie W. Sonder, Project Chairman

SUMMARY

Nine reports were submitted on five different perennial herbaceous weed species from Arizona, California, Nevada, and Wyoming. The reports are summarized as follows:

Bermudagrass (*Cynodon dactylon*). Bromacil effectively controlled this species at three rates on non-cropland. Tandex and GS-14254 showed some possibility at highest rates applied.

Field bindweed (*Convolvulus arvensis*). Soil placement of fenac and dicamba through liquid fertilizer injection shanks effective in reducing stands of this species in Wyoming. Fenac applied in early summer or dicamba in the fall resulted in 90 percent stand reduction. Dichlobenil when layered in a concentrated band below the surface is providing good control for 24 months after treatment in California vineyard. Foliar effects from dichlobenil on grape vines appear of minor significance, but a severe localized effect on the root or stem tissue occurs in the treated zone. Increased control of bindweed is indicated with the layering of trifluralin when compared to rototilling for incorporation. Picloram and 2,3,6-TBA greatest control of field bindweed with limited precipitation.

Johnsongrass (*Sorghum halepense*) and Dallisgrass. Greenhouse experiments suggest that bromacil, monuron, and Tandex R are effective in controlling seedlings of both these species. Atrazine was effective on dallisgrass and diuron on Johnsongrass.

Johnsongrass (*Sorghum halapense*). MSMA continues to be the most effective foliage-applied herbicide for control of this perennial grass, when compared to dalapon or dalapon plus MSMA and other herbicides.

Purple nutsedge (*Cyperus rotundus*). Repeated applications of MSMA for one growing season reduced the number of aerial stems by more than 99.9 percent.

Effect of preemergence herbicides on control of bermudagrass in non-cropland areas. Reeve, T. A. and G. D. Robison. Nine herbicides were applied to non-cropland areas heavily infested with bermudagrass in southern Nevada. Herbicides were applied October 14, 1969 to plots of 100 sq ft in size. Ratings were made in June. The area received 3.83 in of rain from October 1, 1969 to September 30, 1970. The purpose of this research was to evaluate herbicides applied to the soil surface when bermudagrass is dormant.

Effect of preemergence herbicides on control of bermudagrass in non-cropland areas

Treatment	Rate Lb/A	% Control
bromacil	10	93
	15	97
	20	94
GS-14254[1/]	400	33
	800	44
	1200	73
diuron	16	35
	40	25
	64	74
Tandex[2/]	12	23
	16	35
	20	83
prometone	8	20
	14	20
	20	43
Promitol 5 P[3/]	400	37
	800	32
	1200	57
simazine	9.6	17
	20	23
	40	33
prometryne	10	10
	20	30
	30	35
ACD 15 M[4/]	12	10
	16	20
	20	15
TBA	20	25
Check	0	0

1/ 2-Sec. butylamino-4-ethylamino-6-methoxy-s-triasine 5% GS-14254, 40% sodium chlorate and 50% sodium metaborate

2/ m-(3,3-dimethylureido) phenyl-tert-butylcarbamate

3/ 5% prometone, 40% sodium chlorate and 50% sodium metaborate

4/ Name unavailable

Summary. Results from this trial show bromacil effectively controlled bermudagrass at three rates in southern Nevada. Tandex at the highest rate controlled bermudagrass and GS-14254 showed some possibility at the highest rate. (Agriculture Experiment Station, Max C. Fleischmann College of Agriculture, University of Nevada, Reno).

Preliminary evaluation of injection of fenac (2,3,6-trichlorophenyl) acetic acid, dicamba (3,6-dichloro-O-anisic acid), and combinations of the two for control of field bindweed (*Convolvulus arvenis* L.). Lee, G. A., K. W. Dunster and H. P. Alley. Soil placement of herbicides by use of injection shanks has been reported as being effective in reducing stands of certain perennial weeds. The need for new practices prompted a cooperative study between Amchem Products, Inc. and the University of Wyoming to study the potential and feasibility of soil injection for control of field bindweed.

A dryland wheat growing area heavily infested with field bindweed was selected for the study. Both early summer and fall injections were made.

The herbicides, (see table), were injected through liquid fertilizer injection shanks on 12 in. centers 9 in. deep in a volume of 68 gpa water on the 6/19/69 date and with the same equipment for the fall treatment on 10/10/69 with an injection only 4-6 in. deep and in a volume of 92 gpa water. Plots were approximately 1/4 acre in size.

Readings made in early fall 1970, 14 months following the early treatments and 10 months following the fall injections show that fenac was more effective when injected early in the growing season (early summer) than later injections (fall).

Fenac, at 2.4, 3.0 and 4.5 lb/A injected in June, yielded a 90 percent or better reduction in field bindweed stand, whereas 3.0 and 4.5 lb/A injection in the fall resulted in only 65 and 70 percent stand reduction.

The activity of dicamba was completely reversed from that of fenac. Dicamba at 2 lb/A injected in the early summer resulted in only a 30 percent reduction in field bindweed stand with very little activity evident on the bindweed plants. Application in the fall at the same rate resulted in a 90 percent reduction in stand.

Fenac plus dicamba was no more effective than dicamba alone in the fall or fenac alone in early summer. (Wyoming Agriculture Experiment Station, Laramie, SR-291).

Stand reduction of field bindweed resulting from soil injection of fenac and dicamba

Early Treatment I[1]	Rate lb/A	Readings[2]
fenac	1.2	Fair control - activity on plants in plot. Set back bindweed, plants in non-treated area mature, plants in treated area just flowering.
fenac	2.4	90+ control. Chemical activity on Russian thistle. Roots of bindweed brittle.
fenac	3.0	90+ control. No seed formation on bindweed.
fenac	4.5	95+ control. Kochia, buckwheat, buffalobur, prostrate spurge actively growing.
fenac + 2,4-D	1.5 + 4.0	50-60% reduction bindweed stand.
2,4-D	4.0	No control.
fenac + dicamba	1.5 + 2.0	95+ reduction bindweed stand.
dicamba	2.0	30% control. Plants recovering, flowering, some malformation of lower leaves.
Late Treatment II[3]		
fenac	1.2	No control - delayed maturity of bindweed.
fenac	1.5	50% stand reduction - remaining plants maturity delayed and plants malformed.
fenac	3.0	65% stand reduction - plants malformed - setting seed.
fenac	4.5	70% control. Plants malformed - setting seed.
fenac + dicamba	1.5 + 2.0	85% reduction bindweed stand.
dicamba	2.0	90% reduction bindweed stand.

[1] Chemicals injected with liquid fertilizer injection shanks 12 in. centers, 9 in. deep, in volume of 68 gpa water 6/19/69.

[2] Visual estimates.

[3] Fall application 10/10/69. Chemicals injected with liquid fertilizer injection shanks 12 in. centers, 4-6 in. deep, in volume of 92 gpa water.

Control of field bindweed with dichlobenil and its effect on grapes. Leonard, O. A., L. A. Lider, D. E. Bayer, and R. K. Glenn. This abstract is aimed at summarizing the results of a series of tests on the control of field bindweed (*Convolvulus arvensis* L.) with dichlobenil, mainly in vineyards.

The initial experiment was conducted in 1967 on a heavy stand of field bindweed growing in a planting of French Colombard grapes on Yolo fine sandy loam at Davis. The soil was first worked with a rotary tiller to a depth of 4 in. To make the surface applications, the soil was then smoothed and 4 percent granules applied uniformly to a 6 ft strip that was 16 ft long in the vine row. To make the subsurface applications, the soil was removed to a depth of 3 in, the granules uniformly applied, the soil returned to the treated area and slightly compacted; thus a band of dichlobenil 3 in beneath the soil surface was created. Treatments were in triplicate using dosages of 5 and 10 lb/A. The high degree of control of bindweed by banding 3 in deep is shown in the Table. Although some control was achieved by surface application, this had largely disappeared by Oct. 27. In 1968, bindweed control by subsurface band application was still high and this control continued beyond April 14, 1969; the control was especially outstanding with the 10 lb/A treatment. No foliar symptoms on grape leaves developed in this test.

Another set of plots were established in 1968 on a bindweed infested area which was close to the 1967 plot area but without grapes. Dichlobenil was applied at 3 and 6 lb/A as a spray of the wettable powder and as granules. Applications were made to the surface (with granules only), incorporated, and banded 3 in deep on 1/2/68 and 3/27/68. As judged on 7/17/68, a high degree of control was achieved by banding, appreciably less by incorporation, and poor by surface application. The wettable powder was just as effective as the granules when incorporated or banded 3 in deep.

In other trials, dichlobenil (in granule form) was applied to 6 ft wide stips in vine rows at 3, 6, 12, 24, and 48 lb/A, with the soil being well worked before the applications were made. Immediately after application, the soil was again worked on one-half of the plots to incorporate the dichlobenil on these plots to have a comparison with surface application. Dichlobenil was applied on March 4, 1968 and reapplied to the same plots in the same way on April 14, 1969. Bindweed was controlled with the 12 lb/A or more dichlobenil when incorporated, while 48 lb/A was required to obtain complete control with surface application (as observed on May 29, 1969). Further notes on bindweed control were not recorded; however, on Jan. 6, 1971 annual weed control was nearly complete with the 24 lb/A incorporated treatment, while the control for surface application was about 92 percent; the advantage to incorporation was still evident at lower dosages. Foliar symptoms on grapes did not develop until late August or September of 1968 and again in 1969. Symptoms were present as a marginal chlorosis on leaves on grape plants growing on plots that had received 12 lb/A or more dichlobenil. However, in terms of actual damage to the leaves, it was certainly not great. One small vine died in 1969 following two annual applications of 48 lb/A incorporated.

In order to obtain a more critical test on susceptibility of grape vines, dichlobenil was applied at 6, 12, 24, 48 lb/A to the soil surface, or incorporated in the top 3 in, or applied as a layer 3 in beneath the soil surface. The soil was Yolo fine sandy loam in glass-sided boxes. Holes 1.5, 3, and 6 in deep and about 0.5 in diameter were made in the soil and the rooted cuttings, with roots removed to enable planting, placed in the holes and fresh soil compacted around them. The boxes were tilted slightly to make root observations possible, with the glass covered except when making observations. The experiment was terminated after 6 months and the roots removed from the boxes to obtain a more precise picture on the effects of dichlobenil on root development. About 2/3 of the rootings survived the dichlobenil (plus root pruning), with 25 percent survival with 24 and 48 lb/A. It was interesting to note that some plants survived 48 lb/A dichlobenil banded 3 in below the surface; however, in such cases the roots were all concentrated within the top 1 in of soil. Rootings which were planted through the 3 in deep layer of dichlobenil died except for that part of the rooting (cutting) which was an inch or more above the layer of dichlobenil, except for the 6 lb/A treatment. With the latter, root development was extensive both above and beneath the layer of dichlobenil, except that there was a root-free area an inch or so above and below the layer. Only the old leaves developed a marginal chlorosis which varied from slight to moderate. It is concluded that the severe effects of dichlobenil on grape are localized to root or stem tissues in the soil where dichlobenil is concentrated, while foliar effects have very minor significance with respect to health of the plant. (Botany Department and the Department of Viticulture and Enology, University of California, Davis, California).

Field bindweed density as percent ground cover before and following dichlobenil applications[1/]

Treatments 2/24/67	lb/A	Before treatment 10/4/66	After treatment 6/12/67	10/27/67	4/14/69
		%	%	%	%
Control	0	25	57	80	41
Surface	5	23	22	57	34
Layer 3 in deep	5	35	<1	4	17
Surface	10	35	25	61	29
Layer 3 in deep	10	32	0	<1	4[2/]

[1/]Bindweed density influenced by annuals, especially on controls.

[2/]Bindweed density was still only 4 percent on 7/1/69.

Layering trifluralin to control field bindweed. Agamalian, H. and Kempen, H. Subsurface applications of trifluralin were made to field bindweed (*Convolvulus arvensis* L.) in spring and summer treatments. A uniform stand of field bindweed in established vineyard and fallow ground were used in these experiments located in Monterey and Kern County, California.

Applications of 2 and 4 lb/A (ai) were made to a Lockwood clay loam in Monterey on March 27, 1970 in ambient temperatures of 38° to 72° F. Trifluralin at 1, 2, and 4 lb/A (ai) was applied on a Hanford loam soil in Kern on September 9, 1970, with ambient temperatures of 65° to 102° F. Dichlobenil at 4 lb/A (ai) was used as the standard treatment. Supplemental water was applied at 1 and 2 days following treatment. Sprinkler irrigation of 2 in was used in Monterey and border-flood irrigation in Kern.

Two methods of application were evaluated--the blade or layering technique and rototilling-disc. A comparison depth of incorporation was used with the two methods.

The results from the following table indicate increased bindweed control with the blade when compared to rototilling or discing. The degree of control appears to be related to soil texture and that initial control is effective in spring and summer treatments over the extreme temperature ranges of these experiments. (University of California Agricultural Ext., Salinas, Calif.).

Table 1. Blade bindweed control

		Kern[1/]		Monterey[2/]	
Treatment	lb/A	9/30	10/24	5/14	10/20
trifluralin	1	9.8	9.4	-	-
trifluralin	2	9.9	9.5	8.3	7.6
trifluralin	4	9.9	9.7	9.1	8.7
dichlobenil	4	10.0	9.5	7.1	6.2
control	0	0	0	0	0

[1/] layered at the 4 to 5 in depth

[2/] soil, 26 percent sand, 47 percent silt, 26.3 percent clay, 1.5 percent O.M.

Table 2. Rototilled/disced bindweed control

Treatment	lb/A	Kern[1/]		Monterey[2/]	
		9/30	10/24	5/14	10/20
trifluralin	1	8.7	5.0	-	-
trifluralin	2	8.8	6.7	7.6	6.0
trifluralin	4	9.5	7.3	8.2	7.1
dichlobenil	4	7.5	3.8	5.0	4.3
control	0	0	0	0	0

[1/]treatments rototilled 5 in deep.

[2/]treatments disced 5 to 6 in deep.

Table 3. Grape Harvest

Treatment	lb/A	Crop Injury	lbs/Vine
trifluralin	2	0	20.7
trifluralin	4	0	20.7
control	0	0	20.0
			N.S.

Field bindweed (*Convolvulus arvensis* L.) control with soil-applied herbicides. McHenry, W. B.[1/], D. E. Bayer[2/], K. Glenn[2/], L. L. Buschmann[3/], and N. L. Smith[1/]. Eight soil-applied herbicides were applied February 3, 1970, on a Sutter County clay-loam soil. Paraquat at 1 lb ai/A in 100 gpa plus 0.25 percent surfactant (Surfax®) were included in all treatments including the controls (replicated 3 times).

Picloram and 2,3,6-TBA provided the greatest field bindweed control even with the limited precipitation and leaching. Lack of sufficient soil moisture greatly reduced annual weed germination following the treatment date and accounts for the relatively high weed control in the paraquat treated check plots. With the exception of fenac, all herbicides gave a high order of annual weed control, principally wild oat, *Avena fatua* L., and wild barley, *Hordeum* sp.). (University of California, Agr.

Ext. Serv., Davis[1], Agr. Exp. Sta., Davis[2], and Agr. Ext. Serv., Sutter County, Yuba City[3]).

Field bindweed and general annual weed control with 8 soil-applied herbicides following 4.8 in precipitation

Herbicide	Acre rate		Control (10=100%) 4/30/70	
	a.i.	Formul.	Annuals	Bindweed
bromacil	6 lb	7.5 lb	10	1.3
bromacil	12	15	10	1.7
fenac	12	8 gal	6.3	5.3
fenac	18	12	2.0	7.7
Hexaflurate	10	10 lb	9.8	0.3
Hexaflurate	20	20	9.3	0.7
Hexaflurate	30	30	9.5	1.3
picloram	2	1 gal	9.9	9.9
RP-17623	2	0.6	9.9	4.0
RP-17623	4	1.2	9.9	4.3
RP-17623	8	2.4	10	5.7
Tandex®	6	7.5 lb	10	1.0
Tandex®	12	15	10	1.7
TD 482	10	10	9.6	0
TD 482	20	20	9.5	0.7
TD 482	30	30	9.6	0.7
2,3,6-TBA	12	6 gal	9.9	9.5
2,3,6-TBA	18	9	9.8	9.8
Control	-	-	8.5	0

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

TD 482: potassium hexafluorophosphate

<u>Non-selective control of dallisgrass and johnsongrass seedlings with soil-applied herbicides.</u> McHenry, W. B. and N. L. Smith. A realistic perennial weed control program must not only be directed

toward the suppression or elimination of established plants but should also include a method of preventing re-establishment of the target species from seed produced over previous years. In cropland, timed cultivations or selective herbicides often accomplish this goal. Cultivation can be practiced on many non-crop sites as well but the operation of tilling equipment in fence lines, next to buildings, power and telephone poles, along railroad trackage, on the inside of canal berms, and other limited access sites is impractical. Herbicides offer a distinct advantage under such conditions.

Two greenhouse experiments were conducted to compare 7 herbicides applied preemergent for the control of dallisgrass and johnsongrass. A Yolo loam soil was used with the characteristic noted in Table 1. Approximately 2/3 of a teaspoon of seed was scattered over the soil surface in a No. 2 can and covered with about 1/4 in of soil. The herbicides were then applied in 24 ml of tap water. Overhead hand watering was accomplished with low volumes to minimize leaching in the container soil.

Table 1. Characteristics of a Yolo loam soil used in greenhouse seedling control experiments.

SP	pH	EC	Sand	Silt	Clay	OM
42%	7.7	1.39	34%	48%	18%	0.8%

The herbicides tested were selected principally for their applicability (relatively long soil life) to non-crop sites where selectivity in most instances is not a program requirement. Degree of weed control was estimated by visual comparisons with the untreated controls.

Table 2. Comparison of 7 herbicides applied preemergent for the control of dallisgrass and johnsongrass seedlings. Control is given by time period to the nearest half month following seeding and herbicide treatment.

Herbicide	Acre rate		Seedling control (10=100%)						
			Dallisgrass			Johnsongrass			
	ai	Formul.	2.5 mos.	4 mos.	7 mos.	1 mo.	2.5 mos.	4.5 mos.	6 mos.
atrazine	2 lb	2.5 lb	8.5	10	10	1.0	0.5	0	0
atrazine	4	5	10	10	10	4.3	4.3	0.8	0
atrazine	6	7.5	10	10	10	2.8	7.8	5.0	3.5
bromacil	2	2.5	8	9.9	9.8	7.5	10	9.9	10
bromacil	4	5	9.9	10	10	7.8	9.9	9.8	10
bromacil	6	7.5	9.9	10	10	8.5	10	9.9	10

(continued)

Herbicide	Acre rate		Seedling control (10=100%)						
			Dallisgrass			Johnsongrass			
	ai	Formul.	2.5 mos.	4 mos.	7 mos.	1 mo.	2.5 mos.	4.5 mos.	6 mos.
diuron	2	2.5	3.0	0	0.5	8.0	10	9.9	10
diuron	4	5	5.0	7.5	7.5	6.7	9.0	9.9	10
diuron	6	7.5	10	10	10	6.7	10	9.7	9.9
monuron	2	2.5	9.9	7.5	7.7	6.0	9.9	9.9	10
monuron	4	5	10	10	10	7.5	9.9	10	10
monuron	6	7.5	10	10	10	8.3	10	9.9	10
prometone	2	1 gal	8	7.5	7.8	9.0	9.1	9.0	7.0
prometone	4	2	8.5	7.5	7.8	9.8	9.9	10	9.3
prometone	6	3	9.5	8.3	10	7.1	10	9.9	9.5
simazine	2	2.5 lb	1.8	0	0.5	4.5	5.3	2.5	1.5
simazine	4	5	0.5	0	0.5	5.0	9.7	9.0	8.5
simazine	6	7.5	4.8	5	4.0	5.8	9.9	9.8	9.8
Tandex®	2	2.5	10	10	10	8.3	9.9	9.9	9.8
Tandex®	4	5	10	10	10	8.0	10	9.8	10
Tandex®	6	7.5	10	10	10	8.1	9.9	9.9	10
Control	-	-	0.3	1.0	0.3	0	0	0	0

Results of these greenhouse experiments suggest that atrazine, bromacil, monuron, and Tandex® are good candidate herbicides for dallisgrass seedling control at 4-6 lb ai/A, and that bromacil, diuron, monuron, and Tandex® are effective for controlling johnsongrass seedlings. Simazine exhibited a low order of activity on dallisgrass, and similarly atrizine on johnsongrass seedlings. (University of California, Agr. Ext. Serv., Davis).

<u>Use of postemergence herbicides on johnsongrass</u>. Reeve, T. A. and G. D. Robison. Several herbicides were tested for control of johnsongrass in non-cropland areas in Logandale, Nevada during summer of 1969. Herbicides were applied in water at 50 gpa on May 7, June 27, and August 22, 1969 when johnsongrass was 8-10 in high. Length of control was observed and stand ratings were made in October. Dalapon and MSMA controlled johnsongrass longer than the other herbicides and resulted in a greater reduction in weed populations.

Table 1. Effect of foliar applied herbicides on johnsongrass

Herbicide	Rate lb/A	Length of control in weeks May 7	June 27	Aug. 22	% Stand reduction
MSMA	4	5	6	8	70
dalapon	20	5	7	8	70
paraquat	1	2	2	2	5
cacodylic acid	4	0	0	0	0
amitrole	4	0	0	0	0
DNBP	4	0	0	0	0
Check	-	0	0	0	0

In a second trial, control of johnsongrass with amitrole, dalapon and MSMA, at three rates, was studied at Logandale, during the summer of 1970. The herbicides were applied to johnsongrass growing along ditch banks on June 8 and August 5 when plants were 8-10 in high. The purpose of this study was to evaluate the johnsongrass control from different rates of these herbicides. Results of this trial showed MSMA at 3 and 4 lb/A controlled johnsongrass with the highest reduction in weed populations. Dalapon at 12 lb/A gave good control of johnsongrass and reduction in weeds. Amitrole was the least effective in controlling johnsongrass and reducing weeds. (Agricultural Experiment Station, Max C. Fleischmann College of Agriculture, University of Nevada, Reno).

Table 2. Control of johnsongrass with amitrole, dalapon and MSMA

Treatment	Rate lb/A	% Control 6/8/70	8/5/70	% Stand reduction
MSMA	2	55	74	65
	3	59	83	83
	4	83	91	95
dalapon	8	78	63	55
	10	75	70	65
	12	73	89	80
amitrole	4	33	62	40
	8	68	64	55
	12	64	64	65
Check	-	0	0	0

Response of johnsongrass (*Sorghum halepense* (L.) Pers.) to four foliage-applied herbicides. McHenry, W. B. and N. L. Smith. An experiment employing 3 replications was initiated in August, 1969, to compare ARD 13-02 (methyl-4-aminobenzene sulfonylcarbamate), dalapon, dalapon + MSMA, Glytac (ethylene glycol bis (trichloroacetate)), and MSMA on established johnsongrass. ARD 13-02 was applied with 10 percent emulsifiable low phytotoxic oil (Orchex N-795); one Glytac treatment was applied in 100 percent diesel oil, the second in water with no oil or surfactant. Dalapon, MSMA, and dalapon + MSMA treatments included 0.25 percent surfactant (Surfax). The application volume for all treatments was 200 gpa. Treatment dates were August 6, 1969, September 10, 1969 (ARD 13-02 exhibiting continued kill-back and not retreated); October 9, 1969, June 2, 1970, July 28, 1970 (Glytac treatments discontinued), and September 21, 1970 (no Glytac treatments).

MSMA continues to be the most effective foliage-applied herbicide for this perennial grass. The combination of dalapon and MSMA appeared superior to dalapon alone and comparable to or slightly more effective than MSMA alone during the 1969 season but during the following season, 1970, the combination was unexplainably less effective than MSMA alone. Neither Glytac applied at 14.5 gal of formulation/A (9.3 fluid oz/gal water) in diesel oil or water, nor ARD 13-02 at 2 and 4 lb ai/A and raised to 4 and 8 lb ai/A in 1970 provided appreciable stand reduction. (University of California, Agr. Ext. Serv., Davis).

Johnsongrass control with repeated foliage applications

Herbicide	Carrier + penetrant	Acre Rate		Control (10=100%)					
		ai	Formul.	10/19/69	10/30/69	11/14/69	6/5/70	7/28/70	9/21/70
dalapon	Water + 0.25% surfactant	15 lb	20 lb	2.7	6.3	9.0	0	2.0	2.0
MSMA	Water + 0.25% surfactant	4	0.6 gal	4.0	6.7	9.3	6.5	8.3	9.3
dalapon + MSMA	Water + 0.25% surfactant	15 +4	20 lb +0.6 gal	6.0	8.8	9.3	1.0	4.0	5.3
Glytac	Diesel oil	1/	14.5 gal	2.0	9.3	9.9	1.0	0.7	0
Glytac	Water	1/	14.5	3.0	8.0	9.8	0	0.7	0
ARD 13-02	Water + 10% emuls. oil	2 2/	0.6	0	0	0	0	1.0	1.0
ARD 13-02	Water + 10% emuls. oil	4 2/	1.2	0.7	0.3	1.0	0	2.0	1.7
Control	-	-	-	0	0	0	0	0	0

1/ Analysis not supplied. Glytac was included in the first 4 treatment dates, then discontinued.
2/ ARD 13-02 rates were increased to 4 and 8 lb ai/A for the three 1970 retreatments.

Response of purple nutsedge to repeated, foliar applications of MSMA. Hamilton, K. C. Response of purple nutsedge (*Cyperus rotundus* L.) to repeated, foliar applications of MSMA was studied in 1968 and 1969 at Tucson, Arizona. Plants were established from tubers from a single purple nutsedge plant in the spring of 1967 and 1968. Strain 1 was planted in the first test; strain 10, in the second. Plants were spaced 10 by 15 ft apart and maintained vegetatively by mowing during their first year. Annual weeds were controlled by applications of low rates of trifluralin and diuron or simazine to the soil. Plants averaged 220 and 50 aerial stems when treatments started on March 25, 1968 and April 25, 1969, respectively. Irrigations schedules were similar to that required by cotton.

Starting in March of 1968, 6 and 12 lb/A of MSMA in 80 gpa of water were applied at 2, 3, and 4-week intervals during the growing season. Starting in April of 1969, 5 and 10 lb/A of MSMA in 40 gpa of water were applied at 2, 3, and 4-week intervals during the growing season. Commercial herbicide formulations were used and .25 percent of a blended surfactant was added to spray solutions. Each plot contained four plants and treatments were replicated four times. The number of living aerial stems on each plant was estimated before each application and in the spring of the year after treatment.

All MSMA treatments destroyed topgrowth of purple nutsedge. Speed of destruction of topgrowth was influenced by rate of MSMA and was most rapid at higher temperatures. Applications of MSMA at 2 and 3-week intervals reduced nutsedge stands sooner than applications at 4-week intervals (see table). However, there was no difference in control of pruple nutsedge among MSMA treatments in the year following treatment. Repeated, applications of 5 to 12 lb/A of MSMA at 2, 3, or 4-week intervals for one growing season reduced the number of aerial stems by more than 99.9 percent in each test. (Arizona Agric. Expt. Sta., University of Arizona, Tucson).

Purple nutsedge plants with topgrowth after repeated, foliar applications of MSMA at two rates and three intervals in 2 years

lb/A	Weeks between	Number	Plants with topgrowth			
			Date of observations			
Treatments in 1968			3/25/68	6/17/68	9/9/68	4/15/69
6	2	12	16	5	0	1
6	3	9	16	16	4	0
6	4	8	16	15	11	2
12	2	14	16	9	2	0
12	3	10	16	15	4	0
12	4	8	16	16	7	1
Treatments in 1969			4/25/69	7/19/69	10/13/69	5/11/70
5	2	11	14	9	1	1
5	3	8	16	9	0	1
5	4	5	16	9	0	0
10	2	11	16	5	0	0
10	3	7	16	3	0	0
10	4	7	16	13	1	0

PROJECT 2. HERBACEOUS RANGE WEEDS

Robert D. Martin, Project Chairman

SUMMARY

Four abstracts of studies of three range weeds were received. Three of the progress reports were of continuing studies in Wyoming on larkspur and pricklypear.

Two formulations of 2,4-D were applied at three different stages of growth of Geyer larkspur, (*Delphinium geyeri*, Greene) for three consecutive years. There were no significant differences of control between the various rates and dates of application. No treatment resulted in over 38 percent reduction in Geyer larkspur at any date of treatment, formulation or rate of application of 2,4-D.

Three rates of mixtures of 2,4-D + picloram and 2,4,5-T + picloram were applied to larkspur (*Delphinium geyeri* Greene) for three successive years. There may be a light reinfestation of treated plots three years following treatment. However, all rates of application gave 89 percent or better control. Forage clippings show that 5+ times forage is being produced on treated plots as compared to nontreated plots.

Aerial application of silvex gave effective treatment of pricklypear cactus (*Opuntia polycantha* Harv.). Data indicate that 2 lb/A gave better control than 1 lb/A. Both rates gave better control in July treatment as compared to June treatments.

In Northern California a four year study showed that nitrogen at 80 lbs/A about doubled the yield of intermediate wheatgrass and with the addition of 1 lb/A of atrazine the yield was nearly quadrupled. The application of 1 lb/A of atrazine in mid-October effectively controlled downy brome (*Bromus tectorum*). In addition the atrazine plus nitrogen significantly increased the protein and nitrate levels in the wheatgrass.

Chemical control of pricklypear cactus (*Opuntia polyacantha* Haw.) as affected by dates of herbicide applications. Alley, H. P., G. A. Lee and A. F. Gale. Chemical control of pricklypear has been accepted as a range improvement practice in Wyoming and has been included in the state ACP cost sharing program. Aerial application of silvex (2,4,5-TP) has been a very effective treatment in most cases.

Suggestions as to the time of application have indicated that treatments be made when pricklypear is in the early bloom stage of growth. Observation and summarization of eight years of data indicate that later treatments, July or even early August, may result in more effective control than applications made at the early bloom-stage of growth.

A cooperative study, between Amchem Products, Inc. and the University of Wyoming was established in 1969. Aerial application of silvex and two coded compounds were applied at two different dates, approximately one month apart.

Evaluations made one year after application showed that the July treatments of silvex were more effective than the earlier June treatments.

Silvex applied at 1 lb/A gave only a 40 percent kill of the cactus pads when applied at the early date of application as compared to a 85 percent kill when the application was made in July. There was also considerable increase in pricklypear pad control with the 2 lb/A rate of silvex at the later date of treatment, the early date showing an 85 percent kill as compared to 96+ percent kill when silvex was applied in July (attached table).

The coded compound ACP 66-60, at the 1 lb/A rate was more effective at the June date of application than at the July date, however, this effectiveness of the early date of application was not apparent when the rate of application was increased to 2 lb/A. (Wyoming Agriculture Experiment Station, Laramie, SR-290).

Pricklypear cactus control resulting from two dates of herbicide application one year after treatment[1/]

Treatment I 6/13/69	Rate/A	Percent Control	Observations
silvex	1 lb	40	90% fringed sagebrush control - no damage to native grass species.
silvex	2 lb	85	100% fringed sagebrush control - grass healthy - cactus pads remaining were reddened.
ACP 66-60	1 lb	85	100% fringed sagebrush control - less yellowing of cactus pads than silvex treated plots - grass healthy.
ACP 66-60	2 lb	90	100% fringed sagebrush control - cactus pads yellowed - grass healthy.
ACP 69-160	1 qt	15	30% fringed sagebrush control - no discoloration of cactus pads.

(continued)

Treatment II 7/14/69	Rate/A	Percent Control	Observations
silvex	1 lb	85	50% fringed sagebrush control - cactus pads reddened.
silvex	2 lb	96	
ACP 66-60	1 lb	65	No control of rabbitbrush or eriogonum.
ACP 66-60	2 lb	96	Some control of eriogonum.
ACP 69-160	1 qt	45	
2,4-DP	2 lb	45	85% fringed sagebrush control.
2,4-DP + silvex	1 + 1 lb	50	

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.

Larkspur (*Delphinium geyeri* Greene) control resulting from application of picloram + 2,4-D and picloram + 2,4,5-T combinations. Alley, H. P. and G. A. Lee. A replicated series of plots was established 6/9/67 to evaluate the effectiveness of picloram + 2,4-D and 2,4,5-T combinations for Geyer larkspur control. All treatments were applied in 40 gpa water when the larkspur was 6-10 in tall. Percent control and soil residual effects have been determined for three successive years by recording all larkspur plants in the plots prior to treatment and comparing these counts to those obtained one, two, and three years following the original treatment.

Counts indicate that there may be a light reinfestation of the treated plots three years following treatment (attached table - part A.). However, all rates of application of Tordon-225* and Tordon-212* are giving 89 percent or better control.

Part B of the attached table presents the results of aerial application of Tordon-212. Applications were made of 1/2 and 1 qt/A of Tordon-212 in 3 gpa water carrier by fixed wing airplane. Plant counts and forage clippings are included in the attached table. One qt/A of Tordon-212 gave 95 percent control of Geyer larkspur two years following treatment.

Forage clippings showed that only 132 lb/A of air-dry forage was being produced on the nontreated plots as compared to the high of 602 lb/A air-dry forage on the plots treated with Tordon-212 at 1 qt/A. (Wyoming Agriculture Experiment Station, Laramie, SR-292).

Larkspur control resulting from ground and aerial applications of picloram + 2,4-D, 2,4,5-T combinations

Part A Treatment[1/]	Rate/A	Larkspur Counts[2/] 1967	1968	1969	1970	% Control 1968	1969	1970
picloram + 2,4,5-T (Tordon-225)*	1 qt	312	8	1	26	98	99+	92
picloram + 2,4,5-T (Tordon-225)*	2 qt	277	8	1	10	97	99+	94
picloram + 2,4,5-T (Tordon-225)*	3 qt	322	2	0	3	99	100	99
picloram + 2,4-D (Tordon-212)*	1 qt	324	6	0	36	98	100	89
picloram + 2,4-D (Tordon-212)*	2 qt	359	4	0	21	99	100	95
picloram + 2,4-D (Tordon-212)*	3 qt	336	0	1	9	100	99	97

Part B		Airplane Application[3/] Forage Production 1970[4/]	1969	1970
picloram + 2,4-D (Tordon-212)*	½ qt	400 lb/A	86	70
picloram + 2,4-D (Tordon-212)*	1 qt	602 lb/A	99	95
Check		132 lb/A		

1/Treatments made 6/9/67. Larkspur 6-10 in leaf height.

2/Total of all larkspur plants within three replicated square rod plots.

3/Five-acre plots. Permanent quadrats established at time of treatment

4/Air-dry forage per acre determined by clippings.

*Tradename of Dow Chemical Company.

Larkspur (*Delphinium geyeri* Greene) control resulting from three successive years treatment with two formulations of 2,4-D. Alley, H. P. and G. A. Lee. A time series study was initiated in the spring of 1967 to evaluate the effectiveness of two formulations of 2,4-D, applied at three different stages of growth, for the control of Geyer larkspur. The original plots established in 1967 have been retreated for three successive years at the same rate of herbicide application and on corresponding stages of growth as the original treatment.

The reduction in stand of larkspur was determined by recording all larkspur plants in the replicated series of plots prior to original treatment (1967) and prior to retreatments made in 1968, 1969 and 1970.

Progress reports, over the past three years as the studies developed, appear in the 1968 through 1970 Research Progress Reports.

As indicated in the attached table, no treatment was resulted in over 38 percent reduction in Geyer larkspur stand at any date of treatment, formulation of 2,4-D, or rate of application from three successive treatments. (Wyoming Agricultural Experiment Station, Laramie, SR-293).

Larkspur control resulting from two formulations of 2,4-D with three successive years of treatment[1/]

		Percent Control[2/]								
		5/9/67			5/16/67			5/26/67		
Treatment	lb/A	1968	1969	1970	1968	1969	1970	1968	1969	1970
2,4-D (Butyl ester)	1	2	34	16	10	21	0	27	31	19
2,4-D (Butyl ester)	2	30	43	24	21	36	24	34	26	30
2,4-D (Butyl ester) + X-77[3/]	1	19	36	20	9	40	29	46	42	38
2,4-D (Butyl ester) + X-77	2	30	43	25	21	38	14	23	30	16
2,4-D (PGBE)	1	24	31	12	7	29	7	30	25	5
2,4-D (PGBE)	2	18	42	30	24	39	30	38	38	33
2,4-D (PGBE) + X-77	1	19	37	21	17	31	0	35	36	20
2,4-D (PGBE) + X-77	2	23	33	14	24	43	22	33	46	38

[1/] Original treatment dates and stage of growth of larkspur:

5/9/67 - seedlings to 3-4 in leaf height
5/16/67 - 4-6 in leaf height
5/26/67 - 6-8 in leaf height

Retreatments 1968 - 1969 - 1970 made at respective dates of the original 1967 treatments.

[2/] Percent control determined by comparing counts obtained from plots receiving one, two and three successive treatments with original counts taken prior to the 1967 application.

[3/] X-77 applied at 1 pt/100 gal mix.

<u>Atrazine increases yield and quality of intermediate wheatgrass.</u> Kay, B. L. Growth and protein concentration have been increased in many crops by applying sub-leathal rates of atrazine and simazine.

The mechanism by which triazines effect an increase is not fully understood. It has been shown, however, that nitrate level and nitrate reductase activity in plants increased within a few hours of simazine application. Both atrazine and simazine appear promising as agents for chemical fallow, and for weed control in both new and established range seedings. The present study was done to determine whether these compounds might also increase total forage production and protein concentration on rangeland.

The study was near the town of Likely, in the extreme northeast corner of California. Annual precipitation in the four years reported was 12.23, 8.16, 9.20, and 8.36 inches. The elevation is 4,760 ft. Big sagebrush (*Artemisia tridentata* Nutt.) grew on the site before it was burned, in 1957, and seeded to Greenar intermediate wheatgrass (*Agropyron intermedium* (Host) Beauv.), in 1958.

To remove the downy brome (*Bromus tectorum* L.) in Greenar intermediate wheatgrass, atrazine at 1 lb/A was sprayed annually in mid-October to one-half of each treatment in a fertilizer trial. Ammonium nitrate at 80 lb/A nitrogen was applied immediately after the atrazine. Wheatgrass yields and the protein and nitrate contents of the wheatgrass plants were measured during flowering in the 1967-68-69-70 growing seasons. Yields were measured by clipping the wheatgrass to 2 in. at flowering stage from an area of 9 sq ft in each treatment and oven drying. The entire sample was ground, and a single subsample was drawn for laboratory measurements.

Mean wheatgrass yields were nearly doubled by nitrogen alone, and nearly quadrupled with nitrogen plus atrazine. The addition of atrazine to nitrogen did not further increase yields over nitrogen alone in 1968 (the driest year). The unfertilized treatments were not affected by the atrazine in any year. Control of downy brome was 100% in all atrazine treatments. Downy brome production in 1968 was essentially zero in any treatment because of the dry spring.

The mean protein levels averaged over four years were increased by either nitrogen or atrazine (Table). Increases were greater from nitrogen than atrazine. Nitrogen plus atrazine did not further increase protein over those with nitrogen alone except in the dry spring of 1968.

The mean nitrate levels averaged over four years were increased by nitrogen but not significantly by atrazine alone. Addition of atrazine to nitrogen, however, increased nitrate above that with nitrogen alone. (Agronomy and Range Science, University of California, Davis).

Effects of fertilizer nitrogen (N) and 1 lb/A atrazine (A) on yield and quality of wheatgrass[1/]

Treatment	1967	1968	1969	1970	Mean
			Dry forage yield (lb/A)		
Check	870a[2/]	350a	600a	430ab	560a
Check + A	620a	470ab	830ab	200a	530a
N_{80}	1200ab	720c	1310bc	660bc	970b
N_{80} + A	2450b	670bc	2690c	1940d	1940c
			Protein (%)		
Check	4.6a	8.2a	6.6a	7.7a	6.8a
Check + A	5.8a	12.9b	10.1b	17.5b	11.6b
N_{80}	9.6b	14.7c	13.6c	16.2b	13.5c
N_{80} + A	9.6b	16.9d	12.2c	15.7b	13.6c
			Nitrate (ppm)		
Check	100a	0a	100a	30a	60a
Check + A	80a	60ab	270a	760c	290ab
N_{80}	470ab	570b	320a	170ab	380b
N_{80} + A	800b	1130c	830b	670bc	860c

[1/]Values are means of 4 replications.

[2/]Means followed by the same letter are not significantly different at the .05 probability level as determined by Duncan's multiple-range test.

PROJECT 3. UNDESIRABLE WOODY PLANTS

Howard L. Morton, Project Chairman

SUMMARY

Thirteen reports were submitted to the Undesirable Woody Plant Project.

In Wyoming, 97 to 100% control of fringed sagebrush was obtained two years after treatment with 2,4-D, silvex, or mixtures of picloram + 2,4-D. Only the picloram + 2,4-D mixture gave complete control of fringed sagebrush.

In New Mexico, picloram, dicamba, picloram + 2,4-D, and picloram + 2,4,5-T gave good control of creosotebush when applied during the summer rainy season.

In a field study in California, ester of silvex controlled Himalaya blackberry at concentration of 8 lb aehg nearly as effectively as 12 and 16 lb aehg in May and June but was 25% less effective in July. Invert emulsion of silvex offers promise of reducing spray drift.

NIA 11092 at 16 lb/A controlled from 85 to 90% of interior live oak in California. NIA 11092 controlled 80% or more chamise at 4 and 8 lb/A rates and 100% at 16 lb/A rate. When applied in 2.5 or 5 ft grids, rather than broadcast, percentage of chamise kill was only slightly reduced but the survival of forage grasses was increased.

In a field study experiment in Oregon at the end of the first growing season, foliage treatments of MSMA + 2,4,5-T looked promising on all species of coast range brush which were treated. Picloram showed promise on all species except swordfern.

In Washington, rates of atrazine or atrazine + linuron which gave best weed control also reduced growth of shore pine. Nitrogen fertilizer applied over a three-year period did not overcome this suppression of shore pine growth.

In southwestern Oregon, terbacil at 2.5 lb/A provided good control over a broad spectrum of grasses and forbs in a Douglas fir plantation for two years without damaging the trees.

Seeds of Scotch broom were induced to germinate when buried in sand heated to temperatures ranging from 60 to 90 C. Maximum germination occurred in seeds buried in sand heated at 90 C but higher temperatures killed the seeds.

In New Mexico, control of mesquite on a severely duned, sandy site with aerial applications of 2,4,5-T resulted in substantial increases in grass yield. Grass yield was influenced by amount of summer rainfall, length of time of reduced mesquite competition, length of time between treatments as well as the degree of mesquite control.

In California, scientists showed that metham stored in an open container, killed *Eucalyptus* roots as well eight days after the solution was prepared as on the first day after preparation. Sodium hydroxide killed *Eucalyptus* roots at concentrations of 20,000 and 40,000 ppm and dichlobenil added to the sodium hydroxide increased the kill but the combination was inferior to dichlobenil alone. They further showed that *Eucalyptus* roots can be killed by spraying with metham + dichlobenil.

In Hawaii, control of non-productive jungle vegetation with helicopter-applied herbicides markedly increased carrying capacity of grazing lands at several locations.

In greenhouse studies in Arizona, type of penetrants, oil and surfactant were shown to be important factors in obtaining maximum enhancement of responses of mesquite seedlings to 2,4,5-T or a mixture of 2,4,5-T and picloram.

Evaluation of a time series study, various herbicides, and longevity of control of fringed sagebrush (*Artemisia frigida* Willd.). Alley, H. P., G. A. Lee and G. A. Stephenson. A time series study was established in 1968 to determine if stage of growth had any effect on the control of fringed sagebrush. Other variables were herbicides used and longevity of control. Applications were made at three stages of growth of the fringed sagebrush (1) early rosette, (2) 3½ - 4 in. plant height, and (3) 4 - 5 in. plant height. All treatments were applied with a truck-mounted spray rig in a total volume of 25 gpa water carrier.

The experimental area was a heavily infested rangeland pasture, soil type was a sandy loam, and precipitation during the months of treatment was above normal.

Percentage control was determined by making point-transect counts and native grass, forb, and fringed sagebrush production determined by clipping.

Presented in the attached table is the control obtained and total forage production for the two-year study. One year's results were reported in the 1970 Research Progress Report.

Outstanding control, 97 to 100 percent, was still present two years after initial applications. There is evidence of some recovery and/or reinfestation of fringed sagebrush in the 2,4-D and silvex-treated plots; however, total production of the infestation was quite limited.

Total air-dry forage production increased on all treated plots the first year following treatment with a further increase the second year. (Wyoming Agriculture Experiment Station, Laramie, SR-294).

Degree of fringed sagebrush control and resulting herbage production as affected by kind of herbicide rates, and dates of application.

				Production lb/A[3]				
		Percent Control[2]		Grass		Forbs	Sage	
Treatment[1]	Rate/A	1969	1970	1969	1970	1970	1969	1970
2,4-D (LVE)	1 lb	99+	98	611	966	73	14	8
2,4-D (LVE)	2 lb	99+	98	633	1012	69	10	9
silvex	1 lb	99+	99	562	910	86	0	20
silvex	2 lb	99+	97	697	1095	47	0	19
Tordon-212[4]	1 qt	99+	99+	842	1228	66	0	0
Tordon-212	2 qt	100	100	822	1457	33	0	0
Tordon-101	1 qt	100	99+	802	1161	79	0	0
Check				140	429	182	996	327

[1] Replicated series of plots established on three different dates and stages of fringed sagebrush growth.
1) 5/28/68 - early rosette
2) 6/12/68 - 3½ - 4 in. growth
3) 7/1/68 - 4 - 5 in. growth

[2] Percent control an average of all three dates of application.

[3] Dry weight production obtained from clipping treated areas.

[4] Tradename of Dow Chemical Company.

Herbicide evaluation and time series study for the control of creosotebush (*Larrea tridentata*). Gould, Walter L. Creosotebush is the dominant species on several million acres of rangeland in the southwestern United States. Selective chemical methods of control are desirable on ranges where sufficient remnants of desirable forage species are present to revegatate the range in a reasonable period of time. Previous work indicated that the summer rainy season was the beginning period of greatest susceptibility. This study was conducted to further elucidate the best period of application and the optimum rate of herbicide for creosotebush control.

Simulated aerial applications were made on 15 by 100 foot plots using a hand-carried boom sprayer calibrated to deliver 8 gpa of spray material. Treatments were initiated on July 14 in 1966 and on July 25 in 1967, and a new series of plots were sprayed at semi-monthly intervals from July through October in both years. Each plant within the plots was evaluated for degree of defoliation two years after treatments were applied. Percent control is the percent of plants completely defoliated when ratings were made.

The best control was obtained with picloram and dicamba at the 2 and 4 lb/A rates, and with picloram at 2 lb/A plus 2,4-D or 2,4,5-T. The tank mix of picloram and 2,4,5-T was more effective than the formulated amine salts. The period of greatest toxicity for most of the treatments was late August and early September, but fair toxicity was evident throughout these months. Mixtures of picloram, dicamba and 2,3,6-TBA were no more effective than the best single herbicide used alone at a comparable rate. (New Mexico Agri. Expt. Sta., New Mexico State University, Las Cruces)

Percent control of creosotebush from treatments applied semi-monthly during the first or last half of the month in 1966 and 1967

		Spray date[1/]						
	Rate	July	Aug		Sept		Oct	
Herbicide	lb/A	2	1	2	1	2	1	2
picloram	1/2	2	43	33	38	3	12	9
picloram	1	0	35	62	52	37	30	10
picloram	2	28	31	80	62	46	44	62
picloram	4	40	76	84	88	90	75	60
dicamba	1/2	0	4	18	2	4	0	6
dicamba	1	5	28	36	42	6	8	8
dicamba	2	27	44	56	84	22	30	6
dicamba	4	47	66	87	70	52	48	38
2,3,6-TBA	1/2	3	15	1	10	2	10	11
2,3,6-TBA	1	4	7	13	30	0	4	6
2,3,6-TBA	2	9	16	7	33	13	14	12
2,3,6-TBA	4	32	51	24	48	40	18	22
M-225[2/]	1/4 + 1/4	0	0	0	6	4	3	6
M-225	1/2 + 1/2	2	25	20	15	13	4	7
M-225	1 + 1	0	47	50	56	30	30	0
M-225	2 + 2	21	33	69	48	70	64	38
M-212[3/]	1/4 + 1/2	4	40	22	15	15	0	6
M-212	1/2 + 1	0	42	38	16	51	6	5
M-212	1 + 2	18	38	66	64	24	32	26
M-212	2 + 4	28	58	77	95	72	60	35
2,4,5-T	1	0	16	14	11	16	0	0
2,4,5-T	2	5	27	3	1	0	0	0
2,4,5-T	4	2	12	4	23	3	5	0
2,4-D	1	-	4	-	15	0	0	0
2,4-D	2	-	0	1	0	0	2	3
2,4-D	4	4	6	8	22	2	0	0

(continued)

Herbicide	Rate lb/A	Spray date July 2	Aug 1	Aug 2	Sept 1	Sept 2	Oct 1	Oct 2
picloram + 2,4,5-T[4/]	1/2 + 1/2	6	34	18	26	47	7	15
picloram + 2,4,5-T	1 + 1	5	55	58	82	47	40	24
picloram + 2,4,5-T	2 + 2	11	79	68	81	75	60	52
picloram + dicamba	1/2 + 1/2	13	3	46	36	0	9	9
picloram + dicamba	1 + 1	2	48	57	61	31	35	11
picloram + 2,3,6-TBA	1/2 + 1/2	7	31	24	17	15	5	7
pciloram + 2,3,6-TBA	1 + 1	11	45	68	33	40	22	24
dicamba + 2,3,6-TBA	1/2 + 1/2	10	9	7	12	4	0	-
dicamba + 2,3,6-TBA	1 + 1	19	47	34	40	12	9	10

[1/]Spray date - the numbers 1 or 2 under the month designate the 1st or 2nd half of the month

[2/]M-225 - is a formulated mixture of the triisopropanolamine salts of picloram and 2,4,5-T at concentrations of 1 pound per gallon of each

[3/]M-212 - is a formulated mixture of the triisopropanolamine salts of picloram and 2,4-D at concentrations of 1 and 2 pounds per gallon, respectively

[4/]A tank mix of picloram and 2,4,5-T

Comparison of silvex concentrations and application diluents for the control of Himalaya blackberry (*Rubus procerus* P.J. Muell.). McHenry, W. B.[1/]; O. A. Leonard[2/]; N. L. Smith[1/]; J. E. Herr[3/]; B. Washburn[4/]; J. J. Smith[3/]; J. E. Street[1/]; and L. J. Berry[1/]. Himalaya blackberry is a troublesome weed on irrigated uplands, along irrigation canals, and wet roadsides. Previous testing has demonstrated that picloram or low volatile esters of silvex or 2,4,5-T at 3-4 lb aehg of water will readily eradicate established plants on sites where the soil is well drained during summer months. Under conditions of sustained high soil moisture where blackberry is more common, relatively low herbicide concentrations in the water are appreciably less effective. Under these more vigorous growing conditions, an oil carrier with relatively high silvex or 2,4,5-T concentrations require fewer retreatments to effect 100% control but costs are greatly increased.

Field experiments employing 4 replications were initiated in September, 1969, to compare isooctyl ester of silvex in oil at a standard mixture, 16 lb aehg, with lower, less expensive concentrations. In addition, an oil-water invert emulsion containing the ethylhexyl ester of silvex, water carrier, and mist blower treatments were added for comparison using 2 replications. The diesel oil carrier, water + diesel oil, and water + surfactant treatments were applied on a spray-to-wet basis. The invert emulsion carrier treatments were applied at a predetermined spray volume and acre rate: the mist blower applications were made with a Solo® backpack model in sufficient volume to provide an oil-soaked appearance to the berry leaves. The blackberry stands were located on an irrigation canal, along a creek bank, and in a fenceline at the edge of an irrigated pasture where presumably soil moisture status in each instance was near optimum.

Response of Himalaya blackberry to silvex esters at varying concentrations in diesel oil and with water and invert emulsion carriers

Herbicide	lb aehg	Carrier	gpa	Control (10 = 100%)		
				5-12-70	6-9-70	7-7-70
silvex[1/]	4	Diesel	(spray-to-wet)	8.8	6.8	3.5
silvex[1/]	8	Diesel	(spray-to-wet)	8.6	8.5	5.0
silvex[1/]	12	Diesel	(spray-to-wet)	9.5	9.6	7.5
silvex[1/]	16	Diesel	(spray-to-wet)	9.6	9.8	7.8
silvex[2/]	8	Invert	50	5.0	2.0	1.0
silvex[2/]	8	Invert	100	9.5	4.5	5.5
silvex[1/]	20	Diesel	(mist blower)	4.0	3.5	7.0
silvex[1/]	40	Diesel	(mist blower)	5.5	4.0	7.0
silvex[1/]	3	Water + 1% diesel	(spray-to-wet)	6.5	7.3	8.0
silvex[1/] + MSMA	3+4	Water + 1% surfactant	(spray-to-wet)	9.0	2.0	1.0
control	-	-	-	0	0	0

[1/]isooctyl ester
[2/]ethylhexyl ester

High volume oil carrier treatments increased stand reduction with increase in silvex concentration. The 8 lb aehg concentration although some 25% less effective by July may well be more economical than 12 or 16 lb aehg. The invert emulsion carrier applied at 10 gpa appeared to be comparable by September to diesel oil with 8 lb aehg. The invert emulsion offers promise in reduction of spray drift over the high volume spray-to-wet and mist blower application techniques. The water carrier treatment with 1% diesel added gave exceptionally good results, more than perhaps is typical for a single treatment judging from previous experimental work. Mist blower applications of silvex in diesel oil were comparable in results to most other application techniques. The silvex + MSMA results were appreciably less effective, however the data presented for this treatment is from a single observational plot. (University of Calif., Agr. Ext. Serv., Davis[1/]; Agr. Exp. Sta., Davis[2/]; Agr. Ext. Serv., Placer Co., Auburn[3/]; Washburn Agr. Serv., Davis[4/]).

<u>Chamise and interior live oak control with m-(3,3-dimethylureido) phenyl tert-butylcarbamate</u>. Leonard, O. A. and R. K. Glenn. We studied the control of chamise (*Adenostoma fasciculatum*) and interior live oak (*Quercus wislizenii*) following soil application of NIA 11092 at 4, 8 and 16 lb/A during the winter season. The 4 or 10% granules were applied to soil which was less than one foot deep, mainly clay and underlain by shale. It is estimated that 5 to 15 in. of rain fell during the winter and spring following the applications. Plant kills were estimated in August or September, 1970, which was 1½ to 2½ years following the applications.

Interior live oak was treated on January 9, 1968 at the Fiddletown location in the Sierra. Plant kills were about 90% with the 16 lb/A treatment, but was slight with 4 and 8 lb. On a similar soil situation near Hopland in the Coast Range similar results were obtained, except that the kill with 16 lb/A was about 85%; the applications were made on December 27, 1967. Fenuron pellets (25%) applied at the same rates at the same time killed none of the live oak in these tests.

Tests on chamise were only made at the Fiddletown location. The first trial was on February 21, 1967 using 4, 8 and 16 lb/A of NIA 11092. Plant kill was 80% or better with the 4 and 8 lb/A rates and 100% with the 16 lb/A treatment. Another trial was conducted on February 6, 1969 to determine the effect of a grid application on the kill of chamise and grass. Results in the table show that a high degree of chamise kill was obtained with 4 lb/A applied broadcast but grass was nearly eliminated. When applied as a 2½ or 5 ft. grid at 8 lb/A, chamise kill was about the same as with the 4 lb/A treatment applied broadcast but there was greater survival of grass. Bromacil (10% granules) was appreciably less effective on chamise than NIA 11092. Yerba santa (*Eriodictyon californicum*) was killed by NIA 11092 but seedlings of these plants became established on the plots one or two years after the applications. Bromacil was less effective than NIA 11092 on yerba santa. (Botany Department, University of California, Davis, California).

Kill of chamise and grass control following applications of two herbicides to the soil. Applied 2/6/69 and readings made 9/30/70

Herbicide	lb/A	How Applied	Chamise Kill (%)	Grass Control
NIA 11092 10 G[1/]	4	broadcast	95	complete
NIA 11092 10 G	8	broadcast	100	complete
NIA 11092 10 G	8	2.5 ft grid	97	some survival
NIA 11092 10 G	8	5 ft grid	93	some survival
Bromacil 10 G	4	broadcast	0	complete
Bromacil 10 G	8	broadcast	60	complete

[1/] Chamise control with 10 G was slightly greater than with 4 G in this test.

Field screening of foliage applied herbicides on coast range brush species. Stewart, R. E. Various herbicides and herbicide combinations were applied in water on 3% oil-in-water emulsion carriers to drip point on individual plants of red alder, vine maple, California hazel, salmonberry, western thimbleberry, and western swordfern in the Coast Range of Oregon. Applications were made early (May 19 - June 17) or late (July 28 - August 12) in the 1970 growing season to determine herbicide effect and seasonal variation in response of these six major brush species that compete with desirable conifers in the Coast Ranges of Oregon and Washington.

Herbicides and combinations tested on woody species were:

2,4-D	Amitrole-T	dicamba + 2,4-D
2,4,5-T	picloram	dicamba + 2,4,5-T
silvex	MSMA + 2,4-D	2,4-D + 2,4-DP
MSMA	MSMA + 2,4,5-T	2,4-D + 2,4-DP + 2,3,6-TBA
dicamba	MSMA + amitrole-T	

Picloram, dicamba, dichlobenil, and bromacil were tested on swordfern.

At the end of the first growing season, the following treatments looked promising:

Species	Application time	Herbicide or herbicide combination
Red alder	Early	All except MSMA
	Late	All except MSMA

(continued)

Species	Application time	Herbicide or herbicide combination
Vine maple	Early	MSMA + 2,4,5-T and picloram
	Late	Same
California hazel	Early	Picloram, MSMA + 2,4,5-T, dicamba + 2,4,5-T and 2,4-D + 2,4-DP
	Late	Same
Salmonberry	Early	2,4,5-T emulsion, amitrole-T, picloram, MSMA + 2,4,5-T, dicamba + 2,4,5-T, and 2,4-D + 2,4-DP
	Late	2,4,5-T emulsion, picloram, and MSMA + 2,4,5-T
Thimbleberry	Early	2,4,5-T emulsion, picloram, MSMA + 2,4,5-T, dicamba + 2,4,5-T, and 2,4-D + 2,4-DP
	Late	Same
Swordfern	Early	Dicamba and bromacil
	Late	None, plants resistant to herbicides in water carriers

Further analysis of results and discussion of specific treatment effects must be based on degree of top kill and number and size of resprouts at the end of the 1971 growing season. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon).

Chemical weed control in Christmas tree (Shore Pine) plantations. Peabody, Dwight V., Jr. Principal objectives of this field test were (1) to determine the effect of relatively high rates of atrazine, linuron, and the combination of atrazine and linuron on growth of Shore Pine Christmas trees, (2) to determine the effect of annual nitrogenous fertilizer applications on the growth of Shore Pine Christmas trees and (3) to determine the interaction, if any, of these fertilizer and herbicide treatments.

Two years after the final herbicide-fertilizer application, the best weed control treatments (high rates of atrazine alone and high rates of the combination atrazine plus linuron) were causing the greatest reduction in Shore Pine growth as measured by stem diameter. Fertilizer (nitrogen) applications made over a three-year period seemed to have little influence on overcoming this apparent growth reduction caused by these herbicide treatments. It would seem that in order to obtain long term weed control with high rates of linuron and/or atrazine, a certain amount of growth reduction in Shore Pine must be tolerated. (Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon).

Grass and forb control in Douglas fir plantations. Gratkowski, H. Grasses and forbs provide serious competition for young Douglas firs in the Pacific Northwest, reducing survival and growth of the trees. Although shading and matting affect survival, root competition for limited soil moisture during the dry summer season is probably most important. Atrazine is widely used for grass control in plantations, but it is relatively ineffective on broadleaf weeds. For site preparation in grass-forb communities, foresters need a herbicide that will eliminate both types of competing vegetation without damaging the conifers.

During March 1969, eight chemicals were tested for grass and forb control at four locations in southwestern Oregon: two were on the wet coastal slope of the Coast Range; two were in the dry interior valleys. Herbicides tested were atrazine, propazine, terbacil, dichlobenil, and dalapon, as well as 2,4-D and cacodylic acid in combination with atrazine.

Terbacil proved most promising in these tests. It released young Douglas firs from a broad spectrum of grasses and forbs without damaging the trees. At 2½ lb/A, terbacil remained active in the soil and provided good control for two growing seasons after application. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon).

High soil temperatures induce germination of Scotch broom seeds. Gratkowski, H. Dormant seeds of Scotch broom (*Cytisus scoparius*) in soil are induced to germinate when the soil is heated to temperatures simulating effects of wildfire or prescribed burning. In a laboratory experiment, these seeds showed a response remarkably similar to seeds of *Ceanothus* spp.

Scotch broom seeds were buried for 4, 13, 22, 31, or 40 minutes in fine dry sand preheated to temperatures of 30, 45, 60, 75, 90, 105, and 120 C. Each treatment was replicated four times in a 5 x 7 factorial experiment in a randomized block design. Thermocouples and a recording potentiometer were used to control soil temperatures during treatment. After heat treatment, all seeds were stratified for 12 weeks and germinated in a perlite-vermiculite mixture.

Soil temperatures of 45 C or less did not increase germination. Seeds exposed to 60 C soil temperatures showed a slight increase in germination, but maximum germination occurred in seeds that had been buried in sand heated to 90 C. Mortality occurred in seeds subjected to 105 C soil temperatures, and number of seeds killed increased with length of exposure. A 120 C soil temperature killed all Scotch broom seeds in this seed lot, including those exposed for only 4 minutes. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon).

The response of native grasses to mesquite control under a repeat spray treatment program. Gould, W. L. and C. H. Herbel. Mesquite invasion of rangeland on sandy sites in the arid and semiarid sections of New Mexico and Texas often results in severe duning around the mesquite plants with little or no vegetation between the dunes. Some areas, whether grazed or ungrazed by livestock, have deteriorated from good range condition to a very poor condition with little or no remnants or perennial grasses. Rodent and rabbit activity is associated with this depletion.

A study was initiated in 1966 to determine the best interval for treatment of a badly duned site to control mesquite and to study the rate of revegetation by perennial grasses. A 180-acre area was initially sprayed each year over a 3-year period, 1966-1968, with 2,4,5-T at 1/2 lb/A. Each block was subdivided into nine 20-acre plots and repeated treatments with 2,4,5-T were applied to each plot in various years. Half of each plot was protected from grazing by livestock. Belt transects, 2 inches wide by 100 feet long, located at random intervals within each plot were clipped in 1968 and 1969 to determine the production of perennial grasses. The rainfall during the summer growing season was 6.02 inches in 1968 and 5.13 inches in 1969; the long-time average for this period is 4.93 inches.

The perennial grass production in 1968 and 1969 for each treatment group is presented below. The principal grasses increasing in the treated areas are mesa dropseed (*Sporobolus flexuosus*) and bush muhly (*Muhlenbergia porteri*). There appear to be several factors affecting grass yield. These include (1) the amount of summer rainfall, (2) the length of time of reduced competition from mesquite, (3) the degree of reduction in competition by mesquite as indicated by degree of control and (4) the amount of time between treatments. (Cooperative investigations of Plant Science Research Division, Agricultural Research Service, U. S. Dept. of Agriculture and New Mexico Agri. Expt. Sta., New Mexico State University, Las Cruces).

Mesquite control and perennial grass production on severely depleted rangeland following treatment with 2,4,5-T

Year(s) Treated	Mesquite Control (%)	Grass Yield 1968 lb/A C.I.[1/]	Grass Yield 1969 lb/A C.I.[1/]
1966	22	63	54
1966 + 67	33	146	122
1966 + 67 + 68	78	153	101
1966 + 67 + 69	54[2/]	-	140
1966 + 68	74	94	84
1966 + 69	45[2/]	-	68
Average 1966 block		107 ± 42	92 ± 32

(continued)

Year(s) Treated	Mesquite Control (%)	Grass Yield 1968 lb/A C.I.	Grass Yield 1969 lb/A C.I.
1967	9	45	23
1967 + 68	54	60	114
1967 + 68 + 69	53[2]	-	107
1967 + 69	44[2]	-	32
Average 1967 block		52 ± 21	64 ± 19
1968	42	31	26
1968 + 69	66[2]	-	56
Average 1968 block		31 ± 14	49 ± 22
Untreated		6	1

[1]C.I. is the confidence interval at the 95 percent level.

[2]Preliminary evaluation one year after last spray treatment.

Control of tree roots with metham, dichlobenil and sodium hydroxide. Leonard, O. A. Although tree roots in drains and sewers cause losses of millions of dollars each year in the U. S., research on the problem of killing roots has been limited. This report is a continuation of previous work with J. Ahrens and N. Townley. The plants used were 2-year old *Eucalyptus camaldulensis* grown in a lathhouse. As in previous work, the roots were allowed to grow through the base of pots into moist air in cans partially filled with vermiculite and provided with holes for drainage. The roots in the cans were very well developed, being in weight equal to 47% of the weight of the entire root system on an average (including the tap root). Some of the roots in the cans were 5 mm diameter or greater. When treated by soaking, all but the upper 3.8 cm of the lower roots were exposed to the solutions for 1 hr and then allowed to drain before returning to the original cans containing some vermiculite and drainage holes.

The test in Table 1 was done to check on the effectiveness of metham after being used repeatedly over a period of several days. Metham was still effective after being used the 5th time, 8 days after the solution was prepared. There was no indication that the solution kept open to the air had deteriated more than the one kept in a closed jug.

The test in Table 2 was conducted to determine the effect of sodium hydroxide alone and in combination with dichlobenil on killing roots. Sodium hydroxide killed roots to 4 or 5 mm diameter when concentrations of 20,000 or 40,000 ppm were used but the root kills usually did not extend beyond that actually soaked, even with smaller roots. Dichlobenil added to the sodium hydroxide increased the kill over sodium hydroxide alone but was inferior to dichlobenil alone.

Similar tests on peach and prune indicated that dichlobenil used alone did not kill the roots, but that there was an advantage in using it in combination with sodium hydroxide; the latter combination did not enhance root kill but did retard regrowth of the roots far more than when sodium hydroxide was used alone. However, metham was the most effective root killer of all species and the combination of metham and dichlobenil always more effective than metham alone in retarding root regrowth.

The test in Table 3 was done to determine whether spray applications of metham plus dichlobenil might be effective for killing roots. It is clear that roots can be killed by spraying and that the kill can extend into the unsprayed parts of the same roots. The concentration of the treatment solution was an important factor affecting kill; kill of the unsprayed part of the root increased with concentration of the solution which was sprayed. The wetting agent seemed to slightly depress root kill in these tests but the roots were fairly clean and might be different on debris-laden roots in drains and sewers. It may be mentioned that Townley did perform a spray test in Sacramento County using a commercial mixture with the wetting agent, with root kills extending through the joints. However, it is believed that soaking is a more effective method than spraying but that there are situations in which the latter would be preferred. (Botany Department, University of California, Davis, California).

Table 1. Effect of a 1-hr soak of lower roots of eucalyptus on root kill as affected by time and method solution stored. Kill was determined 6 weeks following treatment.

Days after solution prepared[1/]	Distance of root kill above point of treatment (cm)		Plant kill	
	container open	container closed	container open	container closed
0	(18)		(1 alive, 2 dead)	
1	14	13	2 alive, 1 dead	2 alive, 1 dead
2	8	12	3 alive	3 alive
4	14	9	3 alive	3 alive
8	8	12	2 alive, 1 dead	3 alive

[1/] Same solution used throughout test, so after 8 days the solution was used the 5th time. A 5000 ppm metham solution was used in this test.

Table 2. Effect of sodium hydroxide and dichlobenil alone and in combination on kill of eucalyptus roots. Lower roots soaked 1-hr. Root kill was determined 7 weeks later.

Herbicide solution in ppm	Distance of root kill above point of treatment (cm)	Root kill[1/] (rating 0-10)
NaOH 5,000	-40	1
NaOH 5,000 + dichlobenil 100	1	10
NaOH 20,000	-16	8
NaOH 20,000 + dichlobenil 100	- 5	9
NaOH 40,000	- 1	9
NaOH 40,000 + dichlobenil 100	- 2	9
Metham 1,000 + dichlobenil 100	4	10
Dichlobenil 100	3	10

[1/]Treated part of root.

Table 3. Effect of spraying[1/] eucalyptus roots (roots below the pots in open cans) on root kill. Kill determined 7 weeks after spraying.

Treatment solution	With 0.5% Triton X-100		Without Triton X-100	
	Rating	Root kill above point sprayed (cm)	Rating	Root kill above point sprayed (cm)
Metham 10,000 ppm Dichlobenil 200 ppm	7	-10	8	- 6
Metham 20,000 ppm Dichlobenil 400 ppm	-	-	10	7
Metham 40,000 ppm Dichlobenil 800 ppm	10	2	10	13

[1/]Sprays applied with a USDA belt sprayer with the trees and roots in a horizontal position and sprayed once and allowed to drain. Sprays applied with a 8004 Teejet tip @ 30 psi, 0.5 mph, and tip 6 to 10 inches from roots during spraying. Volume used would be equivalent to about 40 gallons per mile of drain.

Increasing carrying capacity of Hawaiian rangelands by aerially applied herbicides. Purdy, Warren G. III. Nonproductive jungle and worthless brush and trees cover approximately 25 percent of the State of Hawaii. In addition, large areas either owned or leased for cattle ranching are also covered by this unwanted vegetation.

For the past twenty years various herbicides, both alone and in combination, have been applied by aircraft in an attempt to control these pest species. Until the past few years, these efforts have been singularly unsuccessful.

Beginning six years ago, a concerted effort was made to expand the number of compounds tested and to include rotary-wing aircraft as test vehicles.

Extensive plot work, including comparative efficacy, proved the helicopter to be superior for our needs. Based on the results of trials conducted under the guidance of Dr. Donald Plucknett, of the University of Hawaii's Kauai Branch Station, subsequent application has taken place commercially on several thousand acres with excellent success.

Currently our test work is centered around increasing penetration and translocation by the addition of various compounds. Some of the materials in test include: Sodium Cacodylate, MSMA, Paraquat, Urea, Isoparaffin 370, and phytonomic oils. Certain of these have shown promise on several hard-to-control species.

Our conclusions are that nonproductive jungle vegetation can be effectively controlled by helicopter-applied herbicides. Subsequent burning, fertilization and aerial seeding can produce excellent quality grazing land for under $90.00 per acre. Land actually cleared under test in this program has a carrying capacity of one animal unit per acre. Subsequent commercial applications have demonstrated that effective control can be established at a cost of $15.00 per acre. Resprays are scheduled every fourth year under this type of program.

Depending on soil type, moisture, and whether the acreage is subsequently seeded and fertilized, our experience has been that we can double the carrying capacity of what are at best marginal lands.

The following are the tabulated results on a statewide basis of some 84 separate plots. All plots are applied at ten gallons per acre and include a nonionic surfactant at one-half percent by volume. Rating is on a 1-10 basis, with 1 being no effect and 10 being complete kill.

	Rating After 1 Year
dicamba at 8 lb/A	
Melastoma (*Melastoma malabathricum*)	2.0
Lantana (*Lantana camara*)	2.0
Guava (*Psidium guajava*)	8.5
Ohia (*Metrosideros collina*)	8.0
Christmas Berry (*Schinus terebinthifolius*)	6.0
Java Plum (*Eugenia cumini*)	6.0

(continued)

	Rating After 1 Year
Haole Koa (*Lucaena leucocephala*)	3.0
Silver Oak (*Grevillea robusta*)	3.0
silvex at 8 lb/A	
Melastoma	7.0
Lantana	2.0
Guava	2.5
Ohia	8.0
Christmas Berry	4.5
Java Plum	4.0
Haole Koa	3.0
Silver Oak	3.5
pichloram-2,4-D at 6 lb/A (Tordon 101)	
Melastoma	4.0
Lantana	2.0
Guava	4.0
Ohia	8.0
Christmas Berry	4.0
Java Plum	3.5
Haole Koa	3.5
Silver Oak	3.0
2,4-D; 2,4,5-T at 4 lb and 4 lb/A	
Melastoma	4.0
Lantana	2.0
Guava	5.0
Ohia	4.0
Christmas Berry	8.0
Java Plum	5.0
Haole Koa	3.0
Silver Oak	5.0
dicamba at 1 lb, 2,4-D at 4 lb/A	
Melastoma	3.0
Lantana	2.0
Guava	8.5
Ohia	8.0
Christmas Berry	5.0
Java Plum	5.0
Haole Koa	3.0
Silver Oak	3.0
dicamba at 1 lb, 2,4,5-T at 3 lb/A	
Melastoma	4.5
Lantana	3.0
Guava	4.0
Ohia	5.0
Christmas Berry	8.0
Java Plum	5.0
Haole Koa	3.0
Silver Oak	5.0

The interaction of penetrating agents and different fractions of isoparaffinic oils in a carrier complex for 2,4,5-T. Hull, H. M. and H. L. Morton. As a foliar application for velvet mesquite seedlings [*Prosopis juliflora* var. *velutina* (Woot.) Sarg.] we have described the use of carrier consisting of dimethyl sulfoxide (DMSO), glycerol, phytobland oil, and water (50:25:15:10, by volume) (Weed Sci. 19(1), 1971). The phytobland oil used in these investigations had a flash point (Tag closed cup) of 160 F, and 50% distillation point of 419 F. Other fractions of oils, or penetrants other than DMSO were not evaluated.

The studies of Barrentine and Warren (Weed Sci. 18(3), 1970) with ^{14}C-chlorpropham showed that penetration into the leaves of ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.] and giant foxtail (*Setaria faberii* Herrm.) was increased eightfold and fourfold, respectively, when the herbicide was carried in a phytobland isoparaffinic oil as compared to water. The oil-enhanced penetration of terbacil was even more striking. These studies likewise included a single fraction of oil.

To evaluate the possible interaction of different fractions of such isoparaffinic oils with DMSO or other penetrants in the carrier complex described above, the following experiment was devised. Greenhouse grown velvet mesquite seedlings 14 days of age and at the 3 to 4 leaf growth stage were selected, two replications of 10 plants each being used for each individual treatment. All formulations contained 1000 ppmw ae of the triethylamine salt of 2,4,5-T and 0.5% (v/v) of sorbitan monolaurate, a nonionic surfactant of slightly lipophylic character (HLB 8.6). The major constituents of the carrier included penetrant, glycerol, isoparaffinic oil, and water (50:25:15:10, by volume). The only variables, as shown in the accompanying table, were the penetrant and oil. Penetrants included DMSO, γ-butyrolactone (BLO) and N-methyl-2-pyrrolidone (M-Pyrol). Oils included the Isopar series G, H, L, and M, with flash and 50% distillation points as indicated. All formulations were applied with a micrometer-driven syringe to the upper surface of the basal leaf only, at the rate of 10 μl per plant.

M-Pyrol was the most effective penetrant in enhancing overall activity, as indicated by the relative consistency of the different physiological responses. Within this group, the percentage of plants killed was directly correlated with weight of oil; other responses showed a similar although nonsignificant trend. With BLO as a penetrant there was a highly significant positive correlation between all physiological responses and oil weight. In the case of the heaviest oil, Isopar M, responses closely resembled those resulting from the average M-Pyrol formulation. Weight of oil reacted differently in combination with DMSO. Here there was an *inverse* correlation of borderline significance between physiological responses and oil weight.

It is of interest that the carrier complex formulated with a heavy oil but without the 2,4,5-T gave only a slight and nonsignificant repression of height and dry weight when DMSO was used as the penetrant. When BLO was used instead, responses were equal in severity to formulations containing 2,4,5-T. The M-Pyrol complex without 2,4,5-T was intermediate in overall toxicity between those containing DMSO or BLO without the herbicide. (Cooperative investigation of Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, and Arizona Agri. Expt. Sta., Tucson 85719).

Physiological responses of mesquite seedlings following treatment with 2,4,5-T in a carrier complex with varying penetrants and isoparaffinic oil fractions

Penetrant (50% of carrier by volume)	Isoparaffinic oil (15% of carrier by volume)			Response 1 day after treatment[1/]		Height (cm) 29 days	Response 35 days after treatment		
	Isopar designation	Flash point °F	Point of 50% distillation °F	Apical epinasty	Injury to cotyledons		Percent kill	Shoot weight dry (g)	Root weight dry (g)
DMSO	G	103	327	5.0	0.0	6.8	0	0.25	0.10
DMSO	H	123	355	4.2	0.4	7.2	5	0.39	0.14
DMSO	L	140	378	4.2	0.4	7.6	0	0.36	0.14
DMSO	M	172	434	4.5	0.4	7.2	0	0.36	0.17
Mean				4.5	0.3	7.2	1	0.34	0.14
BLO	G	103	327	0.6	0.8	23.3	5	0.90	0.44
BLO	H	123	355	1.8	2.4	11.8	25	0.53	0.18
BLO	L	140	378	3.0	4.7	7.6	40	0.30	0.11
BLO	M	172	434	3.3	5.6	5.2	50	0.18	0.07
Mean				2.2	3.4	12.0	30	0.48	0.20
M-Pyrol	G	103	327	3.4	3.1	4.2	25	0.12	0.06
M-Pyrol	H	123	355	3.8	4.4	4.2	55	0.11	0.05
M-Pyrol	L	140	378	3.8	5.0	4.2	50	0.13	0.06
M-Pyrol	M	172	434	4.0	6.4	3.8	80	0.07	0.04
Mean				3.7	4.7	4.1	52	0.11	0.05
Control				0.0	0.0	36.2	0	1.76	0.77

1/ Degree of response on a scale of 0 to 10, where 0 = no response and 10 = maximum response.

Influence of surfactants and carriers on the responses of two mesquite varieties to a mixture of picloram and 2,4,5-T. Morton, H. L. and H. M. Hull. A carrier consisting of dimethyl sulfoxide (DMSO), ethylene glycol, phytobland oil, and water (50:25:15:10 v/v) (DMSO complex), has been used advantageously for foliar application to seedling velvet mesquite [*Prosopis juliflora* var. *velutina* (Woot.) Sarg.]. It seemed desirable to compare this carrier with water on both velvet and honey mesquite [*Prosopis juliflora* var. *glandulosa* (Torr.) Cockerell].

We utilized greenhouse-grown velvet and honey mesquite seedlings to compare responses to a mixture of triethylamine salts of picloram and 2,4,5-T applied in the DMSO complex and water carriers. We also evaluated eight ether-linked surfactants with varying hydrophile and lipophile balances (HLB).

The mixture of picloram and 2,4,5-T was formulated in water or DMSO complex carriers at a total concentration of 1000 ppmw, with each of the surfactants included at 0.5% (v/v) and at three HLB levels as shown in Tables 1 and 2. Treatments were applied with micropipette at the rate of 0.1 ml per plant to the upper surfaces of five leaves located on the central portion of the stem on each plant.

Almost without exception, the polyoxyethylene lauryl ether surfactants caused greatest enhancement of responses in both varieties of HLB 14.

The polyoxyethylene cetyl ether surfactants caused greatest apical epinasty in honey mesquite at HLB 14, but greatest injury to treated leaves and dieback of stems at HLB 10. Responses of velvet mesquite to formulations of this surfactant were not consistent.

Treatments in water carrier with the polyoxyethylene stearyl ether surfactants caused greatest apical epinasty in honey mesquite at HLB 10, but other responses, including inhibition of dry weight production and all responses of velvet mesquite were greatest at HLB 14. When treatments were applied in DMSO complex, HLB level had only slight effect on responses.

Responses of the honey mesquite seedlings to treatments in water carrier with the polyoxyethylene oleyl ether were greatest at HLB 10, with one exception, dieback of stems. Apical epinasty and effect on apical bud and leaves of velvet mesquite seedlings was greatest at HLB 8 when treatments were applied in water carrier with this surfactant, but injury to treated leaves and dieback of stems was greatest at HLB 12. HLB level had little effect on responses to treatments applied to honey and velvet mesquite seedlings in the DMSO complex with polyoxyethylene oleyl ether surfactants. Most responses of honey and velvet mesquite were similar; however, dieback of stems in velvet mesquite was significantly lower than in honey mesquite. (Cooperative investigations of Plant Science Research Division, Agricultural Research Service, U.S. Department of Agriculture, and Arizona Agricultural Experiment Station, Tucson, Arizona 85719).

Table 1. Responses of honey mesquite seedlings following treatment with a mixture of picloram and 2,4,5-T in water or DMSO complex[1] carriers with different surfactants.

Surfactant and HLB No.	Carrier	Apical epinasty[2]	Effect on apical buds and leaves[2]	Injury to treated leaves[2]	Dieback of stems[2]	Dry weight Shoots (g)	Dry weight Roots (g)
polyoxyethylene lauryl ether							
10	water	10	86	100	58	10	7
12	water	40	77	97	37	14	8
14	water	50	94	98	62	8	6
10	DMSO complex	12	98	100	23	17	9
12	DMSO complex	27	85	94	45	12	8
14	DMSO complex	40	100	100	49	14	7
polyoxyethylene cetyl ether							
10	water	30	88	93	72	9	7
12	water	30	94	56	55	8	6
14	water	60	64	54	31	11	9
10	DMSO complex	31	100	100	45	8	6
12	DMSO complex	31	100	100	29	11	6
14	DMSO complex	45	99	100	36	16	8
polyoxyethylene stearyl ether							
10	water	80	78	66	29	13	12
12	water	40	77	86	76	6	7
14	water	30	88	88	82	8	6
10	DMSO complex	40	100	100	38	8	5
12	DMSO complex	31	100	100	36	13	6
14	DMSO complex	36	99	100	38	5	3
polyoxyethylene oleyl ether							
8	water	30	55	77	21	12	13
10	water	30	73	85	11	4	5
12	water	20	35	65	23	10	10
8	DMSO complex	41	100	100	75	11	11
10	DMSO complex	38	96	100	79	11	10
12	DMSO complex	42	100	100	81	11	12

1/Complex consists of v/v mixture of dimethylsulfoxide, 50%; ethylene glycol, 25%; phytobland oil, 15%; and water, 10%.

2/Degree of response on a scale of 0 to 100, where 0 = no response and 100 = maximum response.

Table 2. Responses of velvet mesquite seedlings following treatment with a mixture of picloram and 2,4,5-T in water or DMSO complex[1] carriers with different surfactants.

Surfactant and HLB No.	Carrier	Apical epinasty[2]	Effect on apical buds and leaves[2]	Injury to treated leaves[2]	Dieback of stems[2]	Dry weight Shoots (g)	Dry weight Roots (g)
polyoxyethylene lauryl ether							
10	water	20	70	100	36	19	13
12	water	30	70	93	52	19	12
14	water	40	73	86	74	15	10
10	DMSO complex	6	70	92	19	23	11
12	DMSO complex	11	68	94	20	25	13
14	DMSO complex	17	99	100	53	12	7
polyoxyethylene cetyl ether							
10	water	50	70	94	27	13	11
12	water	30	59	68	41	17	13
14	water	30	41	56	54	23	14
10	DMSO complex	11	79	100	19	28	16
12	DMSO complex	21	98	100	25	20	11
14	DMSO complex	14	82	100	16	25	13
polyoxyethylene stearyl ether							
10	water	30	38	78	30	17	14
12	water	10	43	89	60	12	10
14	water	50	61	83	67	11	8
10	DMSO complex	16	93	100	31	16	8
12	DMSO complex	28	90	100	18	22	11
14	DMSO complex	12	97	100	22	16	8
polyoxyethylene oleyl ether							
8	water	40	47	64	28	20	16
10	water	10	45	81	23	20	19
12	water	10	35	79	54	17	15
8	DMSO complex	41	99	100	2	13	11
10	DMSO complex	49	95	100	3	21	10
12	DMSO complex	33	99	100	1	23	11

[1] Complex consists of v/v mixture of dimethylsulfoxide, 50%; ethylene glycol, 25%; phytobland oil, 15%; and water, 10%.

[2] Degree of response on a scale of 0 to 100, where 0 = no response and 100 = maximum response.

PROJECT 4. WEEDS IN HORTICULTURE CROPS

A. H. Lange, Project Chairman

SUMMARY

A total of 35 reports were submitted from California, Colorado, Texas, Washington and Wyoming. The reports included results from herbicide trials conducted on fruits, vegetables and ornamentals.

FRUITS

Grapes: Long term "cultural" tests in a California vineyard showed complete chemical weed control (non tillage) gave the highest yields for two years in a soil characteristically poor in surface infiltration.

Preemergence applications of R7465 was outstanding for annual weed control in newly planted grape cuttings. Incorporated trifluralin also gave excellent weed control and safety.

Stone fruit varieties: Two years testing in California has produced several new preemergence herbicides with greater selectivity for weed control in young newly planted *Prunus* varieties than simazine and terbacil. The outstanding new herbicides were R7465 and RP17623. Several other compounds showed promise.

Sprinkler irrigation application of terbacil and simazine were as effective as conventional spray methods.

Combination of low rates of simazine and high rates of nitralin gave safe effective weed control in a statewide testing program. Combinations of terbacil at low rates and nitralin at high rates also gave excellent weed control and generally good safety on non-bearing and young bearing trees of stone fruits and almonds.

Citrus liners: A number of new numbered chemicals showed good pre- and postemergence weed control in 6 month old Troyer citrange liners. RP17623 was outstanding giving both pre- and postemergence activity.

VEGETABLES

Asparagus: Simazine applied through sprinkler irrigation gave good weed control on seedling asparagus.

Cabbage: Trifluralin, R7465 and bensulide gave the best late season weed control in Utah cabbage trials.

Carrots: Maloran looked outstanding for weed control in Washington carrot trials.

Curcurbits: Trials conducted on watermelon in Texas showed that incorporated bensulide preplant followed by incorporated trifluralin postplant gave season long weed control.

Workers in Washington found activated charcoal could be used to protect young cucumber seedlings from the effects of diuron, fluometuron, atrazine, Tandex and SD15418 under non-irrigated conditions. Naphthalic anhydride showed some antidotal properties with SD15418.

Lettuce: California trials reaffirmed the greater selectivity of RH315 over benefin. RH315 gave better control of weeds in the family *Solanaceae* and *Cruciferae*.

Onions: Bensulide showed a high degree of selectivity for broadleaf weed control with shallow incorporation in Texas trial. DCPA also gave good weed control but caused injury when incorporated shallow.

Peas: Testing herbicides on green peas in Washington showed combinations of SD15418 and alachlor, propachlor and CP52223 controlled broadleaf weeds and grasses effectively.

Herbicides tested under tillage and non-tillage showed little difference on green peas with exception of Terbutryne which was ineffective under non-tillage.

Potatoes: A review of potato work in Kern County, California, lists six herbicides of interest to potato growers including R7465, alachlor, EL119, nitralin, EL179 and Bayer94337.

Sweet corn: Alachlor, SD15418 and butylate incorporated with a rototiller gave excellent weed control in Utah sweet corn trials without affecting a follow-up crop of oats. Atrazine and atrazine combinations caused carry-over injury to oats.

Many of several herbicides combinations gave selective weed control in Washington's large herbicide-combination trials. In general, combinations of alachlor or propachlor and the s-triazines herbicides gave good results.

Tomatoes: A number of herbicides and combinations were found to give selective weed control in California tomato trials. Diphenamid in combination with trifluralin or nitralin generally gave satisfactory control of grasses and broadleaf weeds. New herbicides showing promise included: R7465, EL179 and NIA20439.

Diphenamid applied through the sprinkler followed by one acre inch of sprinkler irrigation gave excellent weed control. This same amount of sprinkler irrigation was inadequate for the activation of granular trifluralin, nitralin and EPTC.

Heavy rainfall in Utah trials after application may have reduced phytotoxicity from diphenamid when compared with previous years results, whereas injury from DCPA was greater. Diphenamid plus trifluralin gave the best weed control and highest yields.

Trifluralin was most affected by soil moisture at the time of herbicide application in California trials. Trifluralin, pebulate, R7465 and nitrofen showed more activity when sprayed on dry surface soil than on wet surface soil.

ORNAMENTALS

Turf: Dandelions in bluegrass were controlled with Maintain nearly as well as a 2,4-D-silvex mixture in Colorado bluegrass turf tests. In bentgrass tests mixtures of 2,4-D-silvex were best.

Broadleaf weeds were effectively controlled in young alta fescue with bromoxymil when applied early in California trials. A later application showed some injury from high rates of bromoxymil but good safety with 2,4-D amine.

Crabgrass was controlled in redtop (*Agrostis alba*) turf most effectively with bensulide. Annual bluegrass and crabgrass were controlled in bermudagrass turf with oryzalin and RH315. Oryzalin gave longer residual control of crabgrass. Some early stunting occurred.

A mixture of bluegrass was least affected by bensulide and benefin, however, one variety may have been affected by benefin.

Coarse grasses in bluegrass were selectively controlled by several postemergence herbicide and fertilizer treatments in Colorado trials. Each coarse grass required a different treatment in order to selectively remove it from bluegrass. Fertilizers were as often effective as herbicides.

Ground covers: Most of the herbicides were weak on one or two weed species in a California ground cover trial. All gave initial control. All herbicides tested were safe on Algerian ivy, however, and only low rates were safe on iceplant. The high rate of RH315 and R7465 appeared to cause stunting in iceplant.

Containers grown: Nitralin, DCPA, R7465, oryzalin and the combination of simazine plus nitrofen gave excellent weed control. In young container grown liners of *Ligustrum japonicum, Raphiolepis indica, Juniperus chinesis, Buxus sempervirens* and *Euonymus japonica.* The high rate of RH315 caused moderate stunting of *Ligustrum* and *Buxus* and dieback of *Juniperus*.

Nitralin, DCPA, trifluralin and nitrofen applied through the irrigation system followed by 1/16 to 4 A in. caused no detrimental effects on container grown Oleander, pittosporum, veronica, juniper, natal plum and bottlebrush. Only chloropropham caused injury when granual chloropropham, nitrofen and EPTC were applied prior to 1/16 to 1 A in. of irrigation water.

Ornamental bulbs: Lower rates of AP920 and BAY94337 gave good annual weed control with no bulb injury in Washington trials.

Christmas tree: Scotch pine trees were resistant to a number of s-triazine herbicides including simazine, SD15418, sumatol and GS13638. All gave adequate weed control.

Methods of controlling annual weeds in grapes. Fischer, B., L. Lider, A. Lange, and L. Christensen. A number of soils in the central San Joaquin valley have low infiltration rates. Many farmers believe tillage is necessary to prevent "surface sealing", i.e. permit water movement into the soil with flood irrigation. The purpose of this study was to compare 5 cultural methods in a young Thompson Seedless grape trellised-vineyard.

The vines were planted in the spring of 1966. In the spring of 1967 the entire test area was treated with 1 lb/A trifluralin plus 0.5 lb/A simazine and harrowed into the surface 4 in. Weed control was excellent with no visible effect on the rapidly growing young vines.

The cultural-herbicide treatments were established early spring 1968. Treatment A, C, D and E received simazine at 2.4 lb ai/A plus 0.5 lb ai/A of paraquat down the vine row. In treatment A the middles were treated with trifluralin at 1.0 lb ai/A plus simazine at 0.5 lb ai/A.

In the spring of 1969 treatments A, C, D and E were treated with diuron down the vine row at 2.4 lb ai/A plus paraquat for standing ryegrass at 0.75 lb ai/A. The middles of treatment A received trifluralin at 1 lb ai/A plus simazine at 0.5 lb/A.

In the spring of 1970, A, C, D and E were again treated with diuron at 2.4 lb ai/A plus paraquat at 0.5 lb ai/A. The middles of treatment A were treated with trifluralin at 1.0 lb/A plus simazine at 0.5 lb/A.

The results of these treatments showed no detrimental effects from herbicide application or non-tillage. The average yield for two years was the highest in the complete chemical treatment (A).

From the statistical analysis it would appear that difference in yield between complete chemical treatment and herbicide down the vine row with the centers being mowed (a 10 lb/vine difference a two year average) is real. If water penetration was improved by mowed ground cover the effects were not reflected in the yield. This may have been due to a masking, competitive or nutritional effect of the mowed ground cover.

Summer disking the centers with or without French plowing for 4 years was not superior in yield to the complete chemical treatment over a two year period. (University of California Agricultural Extension, Fresno, Parlier, Agricultural Extension Station, Davis).

A comparison of 5 methods of controlling weeds in a new Thompson Seedless grape vineyard. A 4-year study in Hanford sandy loam soil[2].

Treatment	Weed control in the vine row in Dec. 1970	Average[1] 1969 lbs	1970 lbs	Two year avg lbs
A Complete chemical (non tillage)	8.9	87.93	47.56	67.78
B French plow (disked centers)	6.6	89.19	39.48	64.33
C Herbicides vine row (mowed centers)	6.8	81.12	33.56	57.34
D Herbicides vine row (winter cover crop, summer disked)	7.0	91.28	42.06	66.17
E Herbicides vine row (natural cover, summer disked)	8.8	90.75	40.18	65.46
LSO 05		6.41	6.40	
01		8.49	8.10	
C.V.		10.5%	20.2%	

[1] Average fruit weight in pounds per vine of 4 vines per plot replicated 8 times.

[2] Organic matter 0.6%, sand 67.2%, silt 24.0% and clay 8.8%.

Grape herbicide screening trial. Fischer, B, A. Lange, and L. Lider. Thompson seedless cuttings and rootings planted in late spring 1970 were treated in small 8 x 10 ft plots with herbicides on April 3 or 15. Each plot was replicated 3 times. Immediately after herbicide applications, sprinkler irrigation was applied and subsequent irrigations were accomplished by flooding. On May 29, 1970, the plots were evaluated for weed control and phytotoxicity.

Most herbicides gave excellent weed control. Even U27267, which gave only short term control, produced larger plants than the weedy check.

Even though simazine at 2 lb ai/A produced considerable foliar phytotoxicity symptoms during the entire growing season it did not appreciably affect the average wt/plant.

VCS438 gave good weed control with slightly more symptoms than simazine and appreciably less wt/plant.

R7465 gave excellent season long weed control and excellent safety applied to the soil surface (and over the dormant cuttings). However, when R7465 was preplant incorporated it produced considerable foliar phytotoxicity. The wt/plant, however, was not appreciably affected.

San6706 also produced considerable symptoms especially at high rates or when low rates were preplant incorporated, but did not seriously affect top weight.

Trifluralin gave excellent season long weed control and good top growth. (University of California, Fresno, Parlier, Davis).

Results of 1970 grape herbicide screening trial

			Average[1/]				
		Phyto.[2/]	Vigor[3/]		Weed Control[4/]		
Herbicides	lb ai/A	7/27	5/29	9/24	5/29	9/24	lb/plant
Postplant[6/]							
C-20546	1.0	2.3	6.3	8.0	10	8.0	0.25
C-20546	4.0	4.7	7.0	6.7	10	9.7	0.30
BAY-94337	1.0	5.0	6.6	5.0	9.6	3.7	0.07
BAY-94337	4.0	9.0	5.6	0.7	10	3.0	Dead
U-27267	1.5	2.7	7.0	7.2	8.3	4.0	0.28
U-27267	6.0	3.7	6.6	8.7	9.3	5.0	0.22
SAN-6706	2.0	0.7	7.6	7.0	8.6	9.0	0.12
SAN-6706	8.0	3.7	8.6	6.7	10	10.0	0.32
SAN-9789	2.0	2.7	7.3	8.0	9.3	6.3	0.17
SAN-9789	8.0	5.3	7.6	5.0	10	9.3	0.16
R-7465	2.0	1.0	9.6	9.3	9.3	7.7	0.31
R-7465	8.0	2.7	7.6	7.7	8.6	10.0	0.26
simazine	2.0	3.0	8.3	8.7	10	5.0	0.27
VCS-438	4.0	3.3	8.6	6.3	9.6	6.3	0.14
Preplant Incorporated[5/]							
R-7465	2.0	3.7	6.3	7.3	9.6	7.7	0.20
R-7465	8.0	5.3	4.6	6.7	10	9.7	0.33

(continued)

Herbicides	lb ai/A	Phyto. 7/27	Average Vigor 5/29	9/24	Weed Control 5/29	9/24	lb/plant
SAN-6706	2.0	3.7	9.6	7.7	10	10.0	0.23
SD-30187	1.0	2.0	10.0	7.7	8.6	4.0	0.15
SD-30187	4.0	1.3	8.6	7.7	8.6	9.0	0.18
trifluralin	2.0	1.5	8.0	9.0	6.6	9.5	0.28
trifluralin SAN-6706	1.0 1.0	0.7	8.6	9.0	6.6	9.5	0.32
Untreated		0.3	7.6	5.7	0	0.7	0.22

1/Average of 3 replications

2/Evaluations based on an 0 - 10 scale; 0 = no symptoms or 10 = all plants dead.

3/Vigor 10 = most vigor growth, 0 = no growth, plant dead, 5 = 50% stunted or dead.

4/Weed control 0 = no control, 10 = no Pigweed, Carpetweed, Sow thistle, Lovegrass, or Mare's Tail.

Herbicides without common names are as follows. The remainder do not have their chemistry yet disclosed.

BAY 94337 - CHEMICAL NAME: 4-amino-6-t-butyl 3-(methylthio)-as-triazin-5-(4H)-ONE

SAN 6706 - 4-chloro-5 (dimetylamino)-2-a,a,a-trifluoro-m-tolyl)-3(2H) pyridazinone. SANDOZ-WANDER, INCORPORATED

R-7465 (Stauffer) - CHEMICAL NAME: 2-(a-Napthoxy)-M,M diethyl-prpionamide

Preemergence herbicide studies in *Prunus* species. Fischer, B. and A. Lange. The response of 10 varieties of stone fruit including Texas and Nonpariel almond on Nemaguard, Fay Elberta and Halford peach on Nemaguard, Independence nectarine on Nemaguard, Queen Ann plum on Nemaguard, Santa Rosa on Marianna 2624, French prune on Myrobalan 29C, Royal Blenheim apricot on Myrobalan 29C and Bing cherry on Mazzard rootstock was similar. Most herbicides at the rates tested preemergence under basin-flood irrigation were toxic when evaluated in July and through the season.

R7465 when incorporated prior to planting caused more injury than when applied postplant preemergence and irrigated into the soil.

S-6706 and its analog San-9789 were toxic under the conditions of this experiment.

VCS438 showed considerable toxicity at 8 lb ai/A but very little at 2 lb ai/A which also gave outstanding weed control thru the season.

U27267 showed low phytotoxicity but the weed control was also somewhat less in this and later ratings.

Terbacil and simazine produced similar effects (in degree of phytotoxicity symptoms) at 2 lb ai/A. Early weed control ratings showed simazine to be more effective. The late fall readings suggested terbacil gave slightly more residual control of broadleaves and grasses. (University of California, Fresno, Parlier).

The effect of 13 herbicides on weed control and overall average foliar condition and vigor of 10 stone fruit varieties.

Herbicide	lb/A	Average[1/] Phyto.[2/]	Vigor[3/]	Broadleaf[4/] Weeds	Grass[4/]
C-20546	1.0	6.7	5.7	9.7	9.7
C-20546	4.0	10.0	0.0	10.0	10.0
Bay-94337	1.0	7.1	3.0	1.7	7.3
Bay-94337	4.0	9.4	1.3	8.0	8.3
R-7465[5/]	2.0	5.3	3.3	8.0	8.7
R-7465[5/]	8.0	6.5	1.7	9.7	9.7
R-7465	8.0	2.9	9.0	9.7	9.7
SAN-6706	2.0	2.3	8.0	4.0	9.7
SAN-6706	4.0	3.4	7.7	7.3	10.0
SAN-6706	8.0	6.6	4.0	10.0	10.0
SAN-6706	16.0	6.3	3.0	10.0	10.0
NIA-21830	2.0	8.9	2.7	7.0	9.3
NIA-21830	8.0	10.0	0.0	9.7	10.0
NIA-21800	2.0	4.7	6.7	6.7	9.0
NIA-21800	8.0	9.3	1.3	3.0	9.0
VCS-438	2.0	2.6	9.0	9.7	10.0
VCS-438	8.0	6.0	7.0	9.7	10.0
linuron	1.0	3.0	9.0	8.3	9.3
linuron	4.0	7.8	3.0	9.3	8.7
nitrofen + dinoseb	4.0 + 2.0	2.4	8.3	8.7	9.0
nitrofen + dinoseb	16.0 + 8.0	5.8	4.3	9.7	10.0
U-27267	1.5	2.2	7.3	7.0	9.7
U-27267	6.0	4.3	5.0	9.7	9.3

(continued)

Herbicide	lb/A	Phyto.	Average Vigor	Broadleaf Weeds	Grass
simazine	2.0	6.2	6.0	8.0	7.7
terbacil	2.0	5.1	7.0	9.7	9.7
SAN-9789	8.0	6.8	4.5	8.0	9.5
Untreated	-	1.7	5.7	5.3	5.7

1/ Average of three replications. The soil was a Hanford sandy loam with 0.6% organic matter, 67.2% sand, 24% silt and 8.8% clay.

2/ Phytotoxicity based on 0 = no effect, 10 = burned and dead.

3/ Vigor based on the amount of growth and foliage condition in October.

4/ Weed control rating in October where 0 = no control, 10 = no weeds.

5/ Incorporated prior to planting.

Herbicides without common names are as follows. The remainder do not have their chemistry yet disclosed.

BAY 94337 - CHEMICAL NAME: 4-amino-6-t-butyl 3-(methylthio)-as-triazin-5-(4H)-ONE

R-7465 (Stauffer) - CHEMICAL NAME: 2-(a-Napthoxy)-M, M diethyl-prpionamide

SAN 6706 - 4-chloro-5 (dimetylamino)-2-a,a,a-trifluoro-m-tolyl)-3 (2H) pyridazinone. SANDOZ-WANDER, INCORPORATED

Response of *Prunus* species to nine herbicides. Lange, A. and B. Fischer. Seven herbicides applied to eight stone fruit varieties for 2 successive years (under flood irrigation) showed several herbicides with more safety than simazine and terbacil. Even though terbacil was not reapplied at 4 and 8 lb ai/A there was excessive damage to 8 stone fruit varieties the second year after treatment. Santa Rosa plum on 29C rootstock was among the most resistant varieties to terbacil.

Most herbicides produced the same effects on different varieties of *Prunus*. The Mission (or Texas) variety was generally more susceptible to herbicides than Nonpariel.

R7465, RP17623, and San6706 gave excellent weed control with essentially four-fold safety. RH315 was safe but the weed control may be too short-lived under heavier weed pressures. VCS438 appeared safer than simazine. Nitrofen and nitralin at excessive rates showed no detrimental effects on these 8 stone fruit varieties. (University of California, Fresno, Parlier).

A comparison of several preemergence herbicides for weed control and phytotoxicity on eight stone fruit varieties (1969).

		Average[1/]	
Herbicide	lb/A	Phytotoxicity Average	Weed Control Average
terbacil*	2	3.7	8.7
terbacil	4	7.0	4.3
terbacil	8	9.0	2.0
VCS438*	4	3.0	8.3
VCS438*	16	4.3	8.3
R7465*	4	0.7	9.3
R7465*	16	0.0	9.7
RH315*	4	2.0	7.7
RH315*	16	1.0	5.7
San6706*	1	1.3	9.0
San6706*	4	1.0	9.3
RP17623*	4	1.3	9.0
RP17623*	16	1.0	10.0
nitralin*	16	2.0	10.0
simazine*	4	4.7	8.7
nitrofen*	16	0.0	9.0
Untreated	-	1.0	7.3

*Only those treatments with astericks were treated for 2 years in a row.

[1/] Average of 3 replications evaluated 10/27/70. The soil at the Kearney Field station has 0.6% organic matter, 67.2% sand, 24.0% silt and 8.8% clay.

Herbicides without common names are as follows. The remainder do not have their chemistry yet disclosed.

R-7465 - CHEMICAL NAME: 2-(a-Napthoxy)-M, M diethyl-prpionamide (Stauffer)

SAN 6706 - 4-chloro-5 (dimetylamino)-2-a,a,a-trifluoro-m-tolyl)-3(2H) pyridazinone. SANDOZ-WANDER, INCORPORATED.

RP-17623 - 2-tertiobutyl-4-(2,4-dichloro-5-isopropyloxyphenyl)-5-oxo-1,3,4-oxadiazoline. RHODIA, INCORPORATED, CHIPMAN DIVISION.

Two methods of preemergent herbicide application. Lange, A. Wettable powder forms of herbicide such as simazine and terbacil applied thru the sprinkler in the irrigation water, were as effective as when applied in 100 gpa water on the soil surface by hand spray using an 8002 E nozzle at 30 psi. The irrigation water was applied at 0.15 A in/hr. One A in. was applied over the two methods of application and subsequently irrigated by furrow irrigation as needed by the crops.

If anything, there was a trend for terbacil to be slightly better thru the sprinkler than simazine. Simazine was generally more active in this low organic matter sandy soil than terbacil. (University of California Agriculture Extension, Parlier).

A comparison of simazine and terbacil thru the sprinkler vs applied preemergence under sprinkler irrigation1/

		Average2/							
		Sugar Beets		Lettuce		Asparagus		Weeds	
Herbicide	lb/A	Hand Spray	Thru Sprink.	Hand Spray	Thru Sprink.	Hand Spray	Thru Sprink.	Hand Spray	Thru Sprink.
simazine	1/4	9.3	9.6	10	10	4.0	1.6	5.0	1.6
simazine	1	10	10	10	10	6.3	3.0	8.6	8.0
terbacil	1/4	0.3	2.3	6.6	9.0	3.3	3.6	4.3	4.3
terbacil	1	9.0	9.3	10	9.3	4.3	5.0	7.0	7.3
Average		7.2	7.8	9.1	9.6	4.5	3.3	6.2	5.3

Organic Matter 1.3%, Sand 52.5%, Silt 33% and Clay 14.5%.

1/Plots received 1 A in. of sprinkler irrigation at 0.15 A in/hr then subsequently furrow irrigated.

2/Average of 3 replications 5 ft x 5 ft plots.

Combinations for preemergence weed control in California orchards. Lange, A., C. Elmore, and B. Fischer. Simazine and diuron are recommended for annual preemergence weed control in apples, pears, walnuts, and grapes. Strip application with these herbicides has been successful, as well in some stone fruit and almond orchards of California. However, University field trials revealed moderate to severe phytotoxicity, as have commercial applications of these herbicides on stone fruit species. Symptoms occur under many growth conditions--course soil types, low organic matter, flood and sprinkler irrigation. Although furrow irrigation is safer, recommendations for the use of these chemicals by this means have not been given because of the many restrictions required for safe use.

This study was undertaken to evaluate the low rates of simazine, dichlobenil, terbacil and Sirmate with combinations of trifluralin, nitralin and DCPA for annual weed control in California tree fruits and almonds.

Forty uniform trials were conducted in as many orchard locations throughout the fruit-growing areas of California in which four broad-spectrum, preemergence herbicides and combinations of herbicides having particular preemergence effectiveness for grasses were studied in incorporated and nonincorporated treatments. At most locations the herbicides were applied as wettable powders or granular applications. Trifluralin and dichlobenil were usually applied as granulars.

In the uniform trials conducted in 40 locations in California deciduous fruit orchards, back-pack sprayers and small granular applicators were used to apply the nongranular and granular forms of simazine, terbacil, Sirmate, dichlobenil, trifluralin, nitralin, and DCPA during the winter of 1967-68. An 8 to 10 ft strip down the tree row was treated. Some applications were incorporated by a tree hoe (Northwest Equipment Company, power-driven, rotary tiller). The plots were periodically rated for weed control and phytotoxicity on a 0 to 10 rating scale (for weed control, 0 = no effect, 10 = complete control of weeds; for phytotoxicity rating, 0 = no effect on the foliage of fruit tree, 3 = definite herbicide phytotoxicity pattern, 5 = severe marginal burn, and 10 = complete kill of all foliage). Results were averaged and tabulated from 3 to 4 replicates from each experiment. Average weed control ratings below 7 were considered unacceptable; average phytotoxicity ratings of more than 2 were considered unacceptable, although there was no visible effect on growth or yield.

Most herbicides in this study gave excellent preemergence annual weed control. Simazine, dichlobenil and terbacil all gave excellent winter annual weed control. Simazine and terbacil were generally weak on summer annual grasses. Trifluralin, nitralin and DCPA were generally effective on summer grasses and some summer broadleaf annuals. Sirmate was generally weak for weed control even at the highest rate of 12 lb/A.

The combination of simazine and trifluralin applied at 1 and 2 lb/A of simazine, plus 2 lb/A of trifluralin gave weed control in 25 out of 32 orchard trials. Only one trial out of 37 showed injury at the 2 lb/A rate of simazine. A combination of simazine plus nitralin, even though nitralin was surface applied, gave the higher precentage of successful weed control trials and higher weed control ratings than comparable amounts of trifluralin.

When terbacil replaced simazine (in combinations with nitralin), control was comparable to the simazine-nitralin combination in most trials. The combination of granular dichlobenil and trifluralin produced many successful weed control trials, with only one failure at the 6 lb/A rate.

Sirmate plus trifluralin, on the other hand, was generally unsatisfactory for weed control at the 6 lb/A rate and only successful in 4 out of 7 trials at the 12 lb/A rate.

Simazine plus DCPA was usually not satisfactory for weed control except in the low organic matter soils. DCPA at 8 lb/A was generally insufficiently residual to compare satisfactorily with nitralin or trifluralin.

Terbacil and simazine appeared to be sufficiently safe at the 1 and 2 lb/A rates. The only trial producing foliar toxicity symptoms was on young trees in sandy soil. Dichlobenil combinations with trifluralin also appeared to be quite safe even under flood irrigation. Phytotoxicity symptoms, although easily apparent in a few orchards, were not excessive--rating around 3 in a scale of 0-10. Still, continued use of dichlobenil at the rates tested under the conditions of the trial could lead to tree damage and so, in soils low in organic matter with sprinkler or flood irrigation, lower rates for testing were indicated. Other instances of very slight symptoms were observed in a number of trials with dichlobenil so that further study is necessary to determine the importance of these symptoms. Dichlobenil caused a slight necrosis (burning of the leaf tip) and as the symptoms became more extensive a marginal burn appeared along the leaf edges originating at the leaf tip.

Nitralin's performance was on the whole better than that of trifluralin when combined with simazine. There were more failures with 1 lb/A of simazine plus 2 lb/A trifluralin than with 1 lb/A simazine plus 2 lb/A of nitralin. Nitralin's safety was comparable to that of trifluralin. (University of California Agricultural Extension, Parlier, Davis and Fresno).

Summary of all fruit tree field trials 1967-68. Number of satisfactory (+) and Unsatisfactory (-) weed control field trials and adequate (+) safety or injury (-)

Herbicide	Active (most often used)	Rate lb/A	Weed Control (+)	Weed Control (-)	Safety (+)	Safety (-)
simazine and [1/]	4G or 80WP	1				
trifluralin	5G	2	25	8	34	1
simazine and [1/]		2				
trifluralin [2/]		2	25	7	36	1
simazine and	80WP	1				
nitralin	75WP	2	14	1	15	0
simazine and		2				
nitralin		2	16	1	15	1
terbacil and	80WP	1				
nitralin	75WP	2	10	1	11	0
terbacil and		2				
nitralin		2	9	1	10	0

(continued)

Herbicide	Active (most often used)	Rate lb/A	Weed Control (+)	Weed Control (-)	Safety (+)	Safety (-)
dichlobenil and trifluralin	4G 5G	6 2	20	1	23	1
dichlobenil and trifluralin		12 2	17	0	16	2
Sirmate and trifluralin	4EC 5G	6 2	3	7	12	0
Sirmate and trifluralin		12 2	4	3	12	0
simazine and[3] DCPA	80WP 75WP	1 8	9	6	16	0
simazine and[3] DCPA		2 8	6	2	10	0

1/ 80WP used in most trials.

2/ 2.5G instead of 5G used in 3 trials.

3/ 4G, 5G combination used in 1 trial.

NOTE: Injury ratings 2-10 inclusive.

Winter annual grass control in citrus liners. Lange, A., and E. Stillwell. Eleven new herbicides were compared with simazine for pre and postemergence grass control in young newly established Troyer citrange liner.

The liners were planted June 18, 1970. The herbicides were applied November 27, 1970 to standing weed growth 4-12 in. The plots were evaluated December 24, 1970. The herbicides were incorporated by rainfall beginning twenty-four hours after application for a total of approximately 4 A in.

After one month there was no observable effect on the liners even though 4-5 in. of young stem was sprayed. The weed control was satisfactory at the high rates of most herbicides. The postemergence activity of RP17623 has been observed before in onion and deciduous fruit field plot work.

Further evaluation for long term weed control and safety to liners will be made at a later date. (University of California, Parlier, Riverside).

Pre and postemergence annual grass control in young citrus liners

Herbicide	lb/A	Average[1/] Grass Control[2/]	Herbicide	lb/A	Average[1/] Grass Control[2/]
simazine	1	5.3	Kerb	4	7.3
simazine	4	9.0	Kerb	16	7.3
R7465	4	7.7	RP17623	4	8.7
R7465	16	7.3	RP17623	16	10.0
simazine + R7465	2 + 2	7.7	MBR4400	4	5.7
simazine + R7465	4 + 4	9.7	MBR4400	16	9.7
MC3761	1	5.0	Orga3045	4	6.7
MC3761	4	8.3	Orga3045	16	8.7
MON 097	1	6.3	GS13638	1	6.3
MON 097	4	8.8	GS13638	4	3.0
oryzalin	4	3.7	VSC 438	4	5.5
oryzalin	16	5.0	VSC 438	16	6.7
SAN 9787	1	7.7	Check	0	5.3
SAN 9787	4	7.7			

[1/]Average volunteer barley and winter ryegrass control rating; 0 = no control, 10 = 100%; 3 replications; 5 x 5 plots.

Soil at University of California Riverside Experiment Station field #9 has 1.0% organic matter, 66.6% sand, 23.0% silt and 10.4% clay.

Herbicides without common names are as follows. The ramainder do not have their chemistry yet disclosed.

R-7465 - CHEMICAL NAME: 2-(a-Napthoxy)-M, M diethyl-prpionamide (Stauffer)

RP-17623 - 2-tertiobutyl-4-(2,4-dichloro-5-isopropyloxyphenyl)-5-oxo-1,3,4-oxadiazoline. RHODIA, INCORPORTAED, CHIPMAN DIVISION.

Kerb - N-(1,1-dimethylpropynyl)-3, 5-dichlorobenzamide. ROHM & HAAS COMPANY.

Herbicide irrigation studies in seedling asparagus. Lange, A. Direct seeded asparagus showed considerable tolerance to simazine at low rates applied in the irrigation water. Combinations of simazine or terbacil with DCPA were more toxic on weeds and sugar beets than either alone. Terbacil alone was generally less toxic on sugar beets and more toxic on asparagus than simazine. Simazine or terbacil applied through the sprinkler were equally toxic on weeds and seeded sugar beets. There was generally an increased activity with combinations on direct seeded asparagus and weeds. (University of California, Parlier).

A comparison of combinations of simazine or terbacil applied through the sprinkler with combinations of preemergence herbicides under sprinkler irrigation.

		Average[1/] phytotoxicity Herbicide thru the sprinkler			
		to asparagus			
Herbicide by hand spray	lb/A	Simazine ¼ lb/A	Simazine 1 lb/A	Terbacil ½ lb/A	Terbacil 1 lb/A
trifluralin	3/4	4.6	6.6	6.6	8.0
nitralin	3/4	8.0	8.6	9.0	8.3
DCPA	7.5	5.6	4.6	4.0	7.0
None	0	1.6	3.0	3.6	5.0
			to sugar beets		
trifluralin	3/4	9.3	10	5	9.0
nitralin	3/4	9.6	10	6.3	10.0
DCPA	7.5	10.0	10	10.0	10.0
None	0	9.6	10	2.3	9.3
			to weeds[2/]		
trifluralin	3/4	5.6	9.6	7.3	9.6
nitralin	3/4	8.0	9.6	8.6	9.6
DCPA	7.5	6.3	9.0	7.0	8.6
None	0	5.6	8.0	4.3	7.3

[1/] Average of 3 replications per treatment. Hand sprayed plots were 5 ft x 5 ft. Through-the-irrigation-system plots were 5 ft x 20 ft using an automatic 40 foot boom divided into 8 ft sections.

[2/] Weeds included primarily: London rockett, Goosefoot and Pigweed.

Preplant herbicide evaluations in transplanted cabbage. Anderson, J. LaMar. These trials were established at the request of several cabbage growers who are having difficulties with black nightshade infestations in their cabbage fields which had been treated with the recommended one-half lb/A rate of trifluralin. Herbicides were soil incorporated with a rototiller on May 21, 1970, in a sandy loom soil having a 1.1 percent organic matter. Cabbage transplants obtained from DelMonte Corporation and transplanted on May 26. All plots were furrow irrigated. None of the herbicides used at the rates indicated in the table below caused any reduction in plant vigor.

The early germinating weeds were eliminated with the mechanical incorporation of the herbicides. Very little rainfall fell following the establishment of our plots. Consequently, weed populations were low even in the untreated plots. Weed control ratings were made on July 10 and August 19, at which times all plots were hand weeded. The weeds present at the August 19 reading were primarily common lambsquarters. The 2 lb rate of alachlor and both rates of R1856 were ineffective in controlling weeds towards the end of the season. This is thought to be due to a dissipation of the chemicals rather than a relative resistance of lambsquarters to these treatments. The 1 lb trifluralin, 6 lb bensulide, and 4 lb R7465 treatments gave the best weed control in cabbage under our conditions. (Utah Agricultural Exp. Sta., Utah State University, Logan).

The effects of preplant incorporated herbicides on cabbage transplants

Herbicide	lb/A	Crop vigor	Weed control rating 7/10	Weed control rating 8/19
alachlor	2	10	4.3	3
alachlor	4	10	8.8	6
bensulide	5	10	7	6.5
bensulide	6	10	7.5	9
DCPA	8	10	7.5	7.5
nitralin	1	10	4.7	6
R 1856	4	10	8	3
R 1856	6	10	6	3
R 7465	1	10	6	8.5
R 7465	2	10	6.3	8.5
R 7465	4	10	5	9
trifluralin	1/2	10	8	8
trifluralin	1	10	9.2	10
untreated control		10	4.2	3

Selective annual weed control in carrots. Peabody, Dwight V., Jr. and W. L. Anliker. Comparisons of Maloran activity at various rates and times of application to linuron and chloroxuron showed the superiority of Maloran as a selective herbicide in carrots. In this field test carrots exhibited high tolerance to Maloran. Applied either pre or postemergently, or both, at relatively low rates of application, annual grass and broadleaved weed control was excellent and carrot injury was nil. (Northwestern Washington Research and Extension Unit, Washington State University, Mt. Vernon; CIBA Corporation, Vancouver, Washington).

Total yield, weed and grass control ratings of the 1970 herbicide field test in carrots.

Treatment	Rate		Yield	Weed Control Rating	Grass Control Rating
Herbicide	Pre-em	Post-em	Tons/Acre	7/6/70	7/6/70
Maloran	1	1	46.9 a	10.0	9.8
Maloran	2	2	45.3 ab	10.0	10.0
Maloran	-	2	44.9 ab	10.0	9.2
Maloran	2	-	43.9 ab	10.0	9.5
Maloran	-	1	38.5 ab	9.7	7.7
linuron	1	-	38.3 ab	10.0	8.3
Maloran	1	-	32.8 bc	10.0	5.8
linuron	-	1	22.2 cd	9.5	5.0
BAY 94337	1	-	19.1 d	10.0	4.0
Untreated check	-	-	17.2 de	0.0	0.0
BAY 94337	0.5	-	15.0 de	9.3	1.8
chloroxuron	-	4	5.4 e	7.2	0.3
chloroxuron	4	-	5.3 e	4.8	0.0
chloroxuron + NPO1/	-	4+2%		9.9	0.0
chloroxuron + NPO1/	-	4+4%		9.9	0.2
chloroxuron + NPO1/	-	4+1%	2/	9.1	0.0
chloroxuron + NPO1/	-	2+2%		9.4	0.0
Mean			28.83		
$SE_{\bar{x}}$			4.11		
CV			25%		

1/Non-phytotoxic oil

2/Due to severe barnyard grass infestation, these treatments were not harvested.

Effect of soil-incorporated herbicides in watermelon plantings. Menges, Robert M. and F. Luna, Jr. We studied preplanting and postemergence soil-incorporated (1 in.) applications of several herbicides on the growth of redroot pigweed (*Amaranthus retroflexus* L.), German millet (*Setaria italica* (L.) Beauv.), and 'Charleston Grey' watermelon (*Citrullus vulgaris* Schrad.) in Delfina loamy fine sand. The soil temperatures ranged from 42 to 96 F. The soil was repeatedly wetted with rainfall and sprinkler irrigation.

A combination of preplanting applications of bensulide plus postemergence applications of trifluralin gave outstanding control of weeds throughout the growing season without injuring the crop. Petroleum mulch did not affect the performance of bensulide but decreased the stand of watermelons.

Preplanting applications of isopropalin controlled weeds selectively. Although preplanting applications of 1 1/2 lb/A of nitralin selectively controlled weeds, postemergence applications of 1 lb/A of the herbicide failed to control weeds. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and Texas A&M University Agricultural Research and Extension Center at Weslaco, Texas).

Herbicide antidote test in cucumbers. Peabody, Dwight V., Jr. Three methods to protect young cucumber seedlings from the effects of herbicide activity were tested in a silt loam soil. These antidotal methods were: (1) activated charcoal applied just prior to the broadcast herbicide treatment in a two inch band directly over the planted cucumber seed, (2) cucumber seed treated with naphthalic anhydride just prior to planting and (3) a preplant incorporated application of the fungicide, Dexon. The herbicides used with these antidotal systems were those generally regarded as having high activity, i.e., diuron, fluometuron, atrazine, Tandex, Bladex, etc.

The test was carried out under non-irrigated conditions although one-quarter in. of rain fell two days after herbicide application and another one-third in. occurred ten days later.

Of the three antidotal systems tested, the activated charcoal mulch showed the most promise in protecting young cucumbers from the effects of preemergence herbicides. However, weed control was poor, most of the weed competition originating in the charcoal band.

Bladex exhibits some selectivity toward cucumbers at weed controlling rates when applied to seed which was treated with naphthalic anhydride. In this treatment weed control was adequate and cucumber injury, though present, was not enough to seriously effect yields.

All other herbicides included in this test either caused excessive cucumber injury or resulted in poor weed control--or both even though antidotal systems were used.

Preemergence applications of chloramben applied under conditions of no herbicide antidotes resulted in fair weed control with a minimum of cucumber injury. In fact, chloramben treated plots were the highest yielding in this test. (Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon).

Annual preemergence weed control in lettuce. Lange, A. and R. Brendler. Two lettuce trials conducted near Oxnard, California produced different results with benefin, known to be weak on the weed species in *Solanaceae* and *Cruciferae*. Benefin was less active on Great Lakes (Test 1) than Butterhead varieties (Test 2) when applied preemergence followed by sprinkler irrigation. The Butterhead field had been seeded 10 days prior to herbicide application whereas the Great Lake field had been applied on a newly seeded planting. Irrigation was within 4 days in Test 2 and 2 hours in Test 1.

Weed control was excellent with RH315 so the combinations were better than benefin alone but little different than RH315 was less toxic than benefin in these trials.

EL179 was similar to benefin on lettuce (Test 1) but less effective on nightshade.

Oryzalin gave excellent weed control but was too phytotoxic to lettuce (Test 1). (University of California, Parlier and Venture).

A comparison of several preemergence herbicide treatments under sprinkler irrigation for weed control and phytotoxicity to two varieties of lettuce.

		Average[1]				
			Test 1[2]		Test 2[3]	
Herbicide	lb/A	Nightshade Control	Phyto-toxicity	Lettuce Vigor	Shep.purse Control	Lettuce Vigor
benefin	1	2.8	3.3	8.8	7.0	4.2
EL179	1/2	0.2	2.2	9.5	-	-
EL179	1	0.8	2.2	8.2	-	-
oryzalin	1/2	8.5	6.0	2.8	-	-
oryzalin	1	9.2	8.3	0.7	-	-
RH315	1	8.3	1.3	8.2	10.0	8.3
RH315	2	9.8	2.2	7.8	-	-
benefin + RH315	1 + 1	8.2	2.8	7.7	10.0	4.5

(continued)

Herbicide	lb/A	Nightshade Control	Test 1 Phyto-toxicity	Average Lettuce Vigor	Test 2 Shep.purse Control	Lettuce Vigor
benefin + RH315	2 + 2	10.0	1.5	7.5	10.0	1.3
bensulide + RH315	4 + 1	8.5	3.2	6.8	-	-
bensulide + RH315	8 + 1	8.3	3.0	5.0	-	-
Check	0	0.2	2.8	8.8	0.0	9.8

1/ Average of 6 replications (1 bed x 20 ft.)

2/ Test 1 (Great Lakes lettuce) was applied to dry soil of 1.9% organic matter, 58.5% sand, 26% silt and 15.5% clay. Initial irrigation 3.4 A in.

3/ Test 2 (Butterhead lettuce) was applied to dry surface soil 3.2% organic matter, 13% sand, 52% silt and 35% clay. The irrigation was applied in two irrigations one 3 days after seeding and 3 days prior to herbicide application. The second was four days after herbicide application, i.e. 10 days after seeding.

Kerb - N-(1,1-dimethylpropynyl)-3, 5-dichlorobenzamide
ROHM & HAAS COMPANY

EL-179 (isopropalin) - 4-isopropyl-2,6-dinitro-N,N-di-(n-propyl) aniline.
ELY LILLY AND COMPANY

Soil-incorporated herbicidal treatments in onion plantings. Menges, Robert M. and Simon Tamez. We studied the effects of pre-planting and soil-incorporated (1 1/2 in.) applications and preemergence soil surface applications of several herbicides on the growth of redroot pigweed (*Amaranthus retroflexus* L.), Palmer amaranth (*Amaranthus palmeri* S. Wats.), common purslane (*Portulaca oleracea* L.), and 'Yellow Dessex' onions (*Allium cepa* L.) in a Hidalgo sandy loam. Soil temperatures ranged from 67 to 99 F, and the soil was repeatedly wetted with rainfall and furrow irrigation. Bensulide was outstanding, and selectively controlled weeds when soil-incorporated at 2 lb/A; soil surface applications of the herbicide failed to control weeds at the same rate of application.

DCPA controlled weeds at 8 lb/A but severely decreased yields when soil-incorporated. Weeds were not controlled with propachlor regardless of the method of application. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and Texas A&M University Agricultural Research and Extension Center at Weslaco, Texas).

Selective annual weed control in green peas. Peabody, Dwight V., Jr. Fifty herbicides and herbicide combinations were evaluated in order to determine: (1) their efficacy in controlling the principal annual broadleaved weed species infesting green peas, (2) their efficacy in controlling barnyard grass (*Echinochloa crusgalli*) and (3) their effect on the growth, vigor and yield of green peas.

Although several recently introduced herbicides and herbicide combinations were extremely effective in controlling both annual broadleaved weeds and barnyard grass in green peas with no crop injury or yield reduction, other factors argue against considering these safe and effective treatments as possibilities for alternates to the materials now recommended. Tandex, either alone or in combination with certain "annual grass killers", has been too erratic from year to year and place to place to engender confidence for its use as a selective herbicide in peas. Terbutryne has exhibited similar characteristics to Tandex when used as a selective herbicide in peas, i.e., erratic results. Bladex, especially when combined with an annual grass killer, shows promise, however, when two relatively new (and hence high priced) herbicides are combined, the cost to gain broad spectrum weed control becomes prohibitive, especially when compared to the standard dinoseb treatment.

The annual grass killers alachlor, propachlor and CP52223 resulted in good to excellent grass control. Further testing of these herbicides in combination with the time tested and inexpensive dinoseb should be undertaken. (Northwestern Washington Research and Extension Unit, Washington State University, Mt. Vernon).

Non-tillage field trial in green peas. Peabody, Dwight V., Jr. Six different soil residual herbicide treatments were compared under two different management systems, hereafter referred to as "tillage" and "non-tillage". Herbicides when used in the non-tillage areas were applied in combination with paraquat before planting to the rye cover crop; in the tillage (plowed, disked, harrowed) plots the soil residual herbicides were applied after planting peas but before crop emergence. In general, there did not seem to be any difference in broadleaved weed control or pea survival between tillage or non-tillage systems receiving the same herbicidal treatment. The exception was terbutryne which gave much better weed control in the tillage plots than in the non-tillage plots. This preliminary experiment indicates that the non-tillage technique might be utilized in the crop management practices of green peas. (Northwestern Washington Research and Extension Unit, Washington State University, Mt. Vernon)

Estimates of weed control and crop vigor of 1970 non-tillage vs tillage field test in processing peas

Treatment[1/]		Weed Control Rating 6/29/70		Crop Vigor Rating 6/29/70		% of Peas Surviving 6/29/70	
Herbicide	Rate	til.	non-til.	til.	non-til.	til.	non-til.
Tandex + propachlor	1+4	9.3	9.7	3.0	2.3	52	57
Tandex + alachlor	1+2	9.7	10.0	3.3	3.7	58	50
NIA 16476	1	9.7	10.0	2.3	1.7	58	57
Tandex	1	9.0	9.3	0.7	2.7	73	53
Tandex	2	9.7	10.0	6.3	8.3	17	7
Terbutryne	1	7.0	0.0	0.0	0.0	98	83

[1/] All non-tillage treatments include (1) Paraquat at 0.8 lb/A and (2) adjuvant Rhodes R-11 at 0.5% concentration by volume.

Herbicide studies in Kern County (Calif.) potatoes. Kempen, Harold M. Studies were conducted since 1964 on sandy loam soils with organic matter of 0.1 to 1.0 percent in Kern County where transpiration rates are high because of low relative humidity (to 10 percent) and high temperatures (to 41 C).

Herbicides most used commercially include EPTC and dinoseb plus oil. Trifluralin, paraquat, combinations of trifluralin plus EPTC and combinations of diphenamid plus dinoseb amine are used on lesser acreages. Herbicides investigated earlier which are not being used include prometryne, linuron, DCPA, metobromuron, 3-(4-bromo-3-chlorophenyl)-1-methoxy-1-methylurea, and dichlorobenzl methylcarbamate.

Herbicides which were promising in 1969 and 1970 studies for selective control of weeds in winter and August White Rose plantings were:

1. R7465 at 1/2 to 1 lb/A preplant or postplant incorporated.
2. R7465 at 1 to 2 lb/A postplant surface applied and sprinkler irrigated.
3. Alachlor at 2 to 4 lb/A postplant surface applied and sprinkler irrigated.
4. EL119 at 2 lb/A postplant surface applied and sprinkler irrigated.
5. Nitralin at 1/2 to 1 lb/A postplant soil incorporated.
6. EL179 at 1 to 2 lb/A preplant soil incorporated.
7. Bayer 94337 at 2 to 4 oz/A early postemergence.

Herbicides lacking selectivity in potatoes when surface applied under sprinkler irrigation in 1969-1970 studies were VCS438 at 1/2 to 3 lb/A, RP17623 at 1-1/2 to 3 lb/A, RH315 at 3/4 to 1-1/2 lb/A, dinoseb amine at 6 to 9 lb/A and R11913 at 1 lb/A. Yields were depressed by R7465 at 8 lb/A, Bayer94337 at 1/2 or 1 lb/A where surface applied under sprinklers but not when incorporated postplant into formed beds. (University of California Agricultural Extension Service, Bakersfield, California).

Weed control and residual action of preplant herbicide to sweet corn. Anderson, J. LaMar and Orlin Lusk. These trials were established primarily to obtain information for herbicide recommendations for sweet corn in a one-year rotation. Growers have asked for a chemical that gives weed control similar to that obtained by atrazine without the residual hazard of atrazine. Herbicides were soil incorporated with a rototiller on May 4, 1970, in a sandy loam soil having a 1.1 percent organic matter. Jubilee sweet corn was planted in the plots on May 6. All plots were furrow irrigated. The plots received in excess of 1 in. of rainfall within four days after establishment.

The early germinating weeds were eliminated with the mechanical incorporation of the herbicides. Consequently, weed populations were low even in the untreated plots; and therefore, nearly all treatments gave satisfactory weed control. Primaze was quite phytotoxic to seedling corn and set the plants back considerably. The atrazine-DCPA mixture also stunted the corn considerably. Following harvest the plots were disced and seeded to oats. Primaze, atrazine and the atrazine combinations all caused considerable injury to oats indicating that phytotoxic levels of these herbicides were still present in the plots. Alachlor, SD15418, and butylate each gave good weed control in the corn and yet had dissipated sufficiently that oats could be grown safely following corn harvest. These herbicides show promise and will be tested further for use in sweet corn on a one-year rotation in Utah. (Utah Agriculture Experiment Station, Utah State University, Logan).

Effects of preplant sweet corn herbicide treatments

Treatment[1/]	Rate	Weed Control	Corn Phytotoxicity	Corn[2/] Yields	Residual Effect[3/]
alachlor	3	10	±	5276	-
Amilon	1½+½	9	+	3570	+
atrazine	2	10	-	4945	+++
atrazine + alachlor	1+2	10	-	3947	+++

(continued)

Treatment	Rate	Weed Control	Corn Phytotoxicity	Corn Yields	Residual Effect
atrazine + DCPA	1+4	8.7	++	2798	+++
atrazine + butylate	1+3	10	-	4506	+++
SD15418	4	10	-	4235	-
Primaze	2	10	+++	2329	+++
propachlor	6	10	-	3720	-
R12001	2	6.7	+	4371	-
R12001	3	10	-	4673	-
butylate	4	9.3	-	5324	-
untreated control	-	5.2	-	4642	-

1/ herbicides incorporated with a rotary hoe 4 May 1970, corn planted 6 May 1970.

2/ corn yields as pounds shelled fresh weight per acre.

3/ phytotoxicity to oats planted 1 September 1970 following corn removal. Readings taken 21 October 1970.

Selective annual weed control in sweet corn. Peabody, Dwight V., Jr. One hundred different herbicides and herbicide combinations were evaluated in order to determine: (1) their efficacy in controlling the principal annual broadleaved weed species infesting sweet corn, (2) their efficacy in controlling barnyard grass (*Echinochloa crusgalli*) and (3) their effect on the growth, vigor and yield of sweet corn.

Many of the several different combinations in this field test resulted in excellent annual grass and broadleaved weed control with a minimum of sweet corn injury and yield reduction. In general, combinations of either alachlor or propachlor, with the s-triazine herbicides, atrazine, or Outfox, gave good weed control at the lower, and hance less expensive, rates. However, these combinations were not the only good selective treatments of this test: BAS2903H, Bladex, and CP52223 in various combinations also demonstrated good annual weed control with little or no sweet corn injury. In general it would seem that the sweet corn grower will have a wide selection of effective materials in various combinations to obtain annual weed control in his sweet corn planting. (Northwestern Washington Research and Extension Unit, Washington State University, Mt. Vernon).

Preemergence weed control studies in tomatoes. Lange, A., H. Agamalian, B. Fischer, and T. Tisdale. The summary of 1968-70 annual weed control trials in California tomato fields indicated a number of herbicides with sufficient selectivity for safe use. Considerable variations occurred from soil to soil and from year to year with most herbicides. Some of the variations were due to environmental factors, weed species and method of incorporation. Some were due to factors not yet explained.

In this summary of 34 tomato trials the differences in weed control between herbicide and rates were not large. Most herbicide rates gave commercial weed control.

The differences in weed control due to method of activation were again small in the overall averages. Diphenamid appeared slightly more selective applied under sprinkler irrigation than when mechanically incorporated. Diphenamid plus trifluralin and diphenamid plus nitralin appeared more selective when incorporated with furrow irrigation than under sprinkler irrigation.

R7465 appeared equally effective at 1 to 4 lb with slightly more activity when incorporated and more residual (data reported elsewhere). The selective advantages due to method of irrigation were not clear from these data.

EL179 gave slightly better weed control at 2 lb ai/A. There did not appear to be an advantage to incorporation of EL179 over sprinkler irrigation. (University of California, Parlier, Salinas, Fresno and Davis).

A comparison of the activity of 5 herbicides and combinations under sprinkler irrigation and furrow (mechanically incorporated) irrigation.

		Average[1/]				Yield[3/]
		Weed Control[2/]		Phytotoxicity		all plots
Herbicide	lb/A	Sprinkler	Furrow	Sprinkler	Furrow	% of check
diphenamid	4 to 8	7.5 (17)	7.4 (9)	0.8 (17)	1.4 (13)	106
diphenamid + trifluralin	4 + ¼	8.3 (11)	9.1 (6)	1.4 (11)	1.1 (7)	120
diphenamid + nitralin	4 + ¼	8.1 (9)	9.3 (5)	1.8 (9)	1.1 (6)	117
R7465[2/]	1	8.7 (10)	8.6 (7)	1.2 (8)	1.3 (6)	-[4/]
R7465[2/]	2	7.5 (11)	9.2 (9)	1.3 (10)	0.8 (9)	120
R7465[2/]	4	7.8 (9)	9.4 (7)	0.7 (9)	1.2 (7)	123

(continued)

Herbicide	lb/A	Average Weed Control Sprinkler	Average Weed Control Furrow	Average Phytotoxicity Sprinkler	Average Phytotoxicity Furrow	Yield all plots % of check
EL179	1	7.8 (12)	7.9 (6)	1.4 (12)	1.2 (7)	117
EL179	2	8.5 (12)	9.2 (6)	2.6 (12)	2.1 (7)	121

1/ Average rating of 3-4 replications per treatment times the number of trials in parenthesis to the right of each number ( ); 0 = no weed control or no effect on tomato plants, 10 = complete weed control or kill of tomato plants.

2/ The range in weed control rating was great in the R7465 under sprinkler, 1 lb/A rate was 4.0 - 10.0; 2 lb/A was 4.5 - 10; 4 lb/A was 5.7 - 10. When mechanically incorporated the ranges were smaller: 8 lb/A was 7.0 - 10; 2 lb/A was 8.3 - 10; 4 lb/A was 8 - 10 rating.

3/ Yield was calculated from total fruit per plot divided by the weight from the check plot. All plots averaged from 10 - 17 trials each replicated 3 - 5 times.

4/ Insufficient data to give an accurate comparison.

R-7465 (Stauffer) - CHEMICAL NAME: 2-(a-Napthoxy)-M, M diethyl-prpionamide

EL-179 (isopropalin) - 4-isopropyl-2,6-dinitro-N,N-di-(n-propyl) aniline. ELY LILLY AND COMPANY

Evaluation of herbicides in direct seeded tomatoes. Agamalian, H. Both preplant incorporated and postplant preemergence trials were conducted with R7465, BAY94337, and NIA20439. Diphenamid was used as a standard comparison.

Preplant incorporated treatments were applied to a Rincon clay loam: 26 percent clay, 32 percent silt, 42 percent sand, 1 percent O.M. The herbicides were incorporated to a depth of 3-4 in. on April 24, 1970. Variety A-1 was seeded for green-wrap harvest. Furrow irrigation was used for germination.

Preemergence applications were made on May 19, 1970 to UFM Bush Variety, grown for green harvest. The soil analysis was 31.2 percent sand, 42 percent silt, 26.8 percent clay, and 2.4 percent O.M. Sprinkler irrigation was used for germination. At rates tested, R7465 provided effective weed control on lambsquarters, common groundsel, barnyard grass, and sow thistle. NIA20439 was effective on shepherds purse, sow thistle, barnyard grass, and common groundsel. It was less effective on lambsquarters. Isopropalin at 1 and 2 lb/A controlled lambsquarters and barnyard grass. No control was evident on sow thistle, common groundsel, or mustard. BAY94337 at 1 and 2 lb/A resulted in excellent control of shepherds purse, lambsquarters, pigweed, and hariy nightshade. When applied as preplant incorporated treatments, crop tolerance of R7465, NIA20439, and isopropalin are acceptable at effective weed control rates. Selectivity of BAY94337 appears to marginal at rates tested. NIA at 6 lb/A as a preemergence treatment indicated less crop tolerance than when compared to preplant incorporation. The following tables give mean weed control, crop phytotoxicity and total yield per acre. (Univ. of Calif. Agr. Ext., Salinas).

Table 1. Preplant incorporated tomatoes

Herbicide	lb/A	Weed Control	Crop 6/4 Injury	Crop 7/22 Injury	Yield T/A
NIA20439	2	8.5	0	0	45.4
NIA20439	4	8.5	1.3	0	50.3
NIA20439	6	8.5	1.0	1.0	43.7
R7465	1	8.5	0	0.5	42.6
R7465	2	8.3	0	0.8	40.2
R7465	4	8.5	0	0	53.5
EL179	1	7.0	0.7	0	43.2
EL179	2	8.0	2.0	1.0	41.2
diphenamid	6	7.8	1.8	1.5	40.0
control	0	0	0	0	43.1

Table 2. Preemergence tomatoes

Herbicide	lb/A	Weed Control	Crop 6/4 Injury	Crop 6/15 Injury	Yield T/A
NIA20439	2	9.1	2.8	1.5	42.5
NIA20439	4	9.1	1.3	0.8	47.0
NIA20439	6	9.5	3.0	2.5	37.0
BAY94337	1	9.9	5.0	4.0	41.8
BAY94337	2	10.0	8.0	8.5	38.6
EL179	1	5.5	0.8	0.8	40.9
EL179	2	8.6	1.5	0.8	43.1
R7465	2	5.3	2.0	0.5	44.6
R7465	4	7.3	2.0	0.5	46.7
diphenamid	6	8.3	1.0	0.3	44.1
control	0	0	0	0	43.1

Studies with diphenamid in sprinkler irrigation. Lange, A. With the increasing use of sprinkler irrigation a great many herbicides require individual detailed study. The objective of this experiment was to compare diphenamid applied through the sprinkler with sprinkler activated granular herbicides and combinations of these two methods of applications.

Diphenamid applied through the sprinkler was very effective in the low organic matter sandy soil of the Citrus Experiment Station, Riverside, California (organic matter 1.3 percent, sand 52.5 percent, silt 33 percent and clay 14.5 percent). A total of approximately 1 A in. of sprinkler irrigation was applied following the application of diphenamid through the irrigation system (in .05 of water). A one pound rate of granular trifluralin, nitralin and EPTC was virtually ineffective, followed by only 1 A in. of sprinkler irrigation. Subsequent irrigation was accomplished by furrow so no additional sprinkler or rainfall occurred after the original 1 A in. was applied. Early control was fair with granular trifluralin and nitralin but was short lived probably because of insufficient movement of the herbicide into the surface of the soil. (University of California, Parlier).

A comparison of diphenamid (wp) applied through the sprinkler with granular formulation of three herbicides and their combinations with diphenamid as measured by seeded barley and volunteer weeds.

			Average[1/]		
Herbicide through the sprinkler	lb/A	No granular	Trifluralin 1 lb/A (5%)	Nitralin 1 lb/A (5%)	EPTC 1 lb/A (5%)
				Barley control at 3 mo.	
diphenamid	2	9.5	8.2	9.2	8.2
diphenamid	4	9.5	9.5	9.5	8.5
diphenamid	8	10.0	10.0	9.8	10.0
Water only	0	2.2	2.5	4.0	5.2
				Weed[2/] control at 3 mo.	
diphenamid	2	6.8	7.0	7.0	6.8
diphenamid	4	7.0	7.5	6.0	6.5
diphenamid	8	7.5	8.8	7.5	7.0
Water only	0	3.0	7.0	6.0	2.2
				Barley control at 4 mo.	
diphenamid	2	9.7	9.0	9.7	8.5
diphanamid	4	10.0	9.7	10.0	9.2
diphanamid	8	10.0	10.0	9.7	10.0
Water only	0	1.5	0.5	2.2	3.7

(continued)

Herbicide through the sprinkler	lb/A	No granular	Average: Trifluralin 1 lb/A (5%)	Average: Nitralin 1 lb/A (5%)	Average: EPTC 1 lb/A (5%)
			Weed[2] control at 4 mo.		
diphenamid	2	3.7	4.7	4.7	4.2
diphenamid	4	5.0	5.2	4.0	3.7
diphenamid	8	5.5	6.5	5.5	4.7
Water only	0	2.5	1.0	2.5	3.0

1/Average of 4 replications; 5x5 ft. plots for granular and 5x20 plots for diphenamid.

2/Weeds in addition to seeded barley were: London rockett, Goosefoot and Pigweed.

Evaluation of several herbicides for weed control in direct seeded and transplant tomatoes. Anderson, J. LaMar and Orlin Lusk. These trials were established primarily to obtain information for herbicide recommendations for direct seeded tomato plantings. All herbicides, with the exception of amiben, were soil incorporated with a rototiller on April 24, 1970, in a sandy loam soil, having 1.2 percent of organic matter. The VF-99 tomatoes were direct-seeded with a Stanhay Precision Planter on April 24th. DelMonte 71-24 transplants were planted in the plots on May 18. Amiben plots were treated following transplanting on May 18. All plots were furrow irrigated.

The direct-seeded plots received 2.11 in. of rainfall during the week following plot establishment and 3.63 in. in the first two weeks after the plots were established. This amount of rainfall is unusual for Utah conditions and affected the weed control obtained by diphenamid. The amount of phytotoxicity to germinating seedlings was less severe during 1970 than it had been in previous years. Only DCPA gave considerable injury to emerging seedlings. No treatment was significantly phytotoxic to tomato transplants. Yields in the untreated plots are quite low due to the fact that hand weeding did not occur until July 2. Commercially, tomatoes would be weeded much earlier than this, thereby eliminating the weed competition and greatly increasing the yields in the untreated plots. (Utah Agricultural Experiment Station, Utah State University, Logan).

Herbicide effects on tomato weed control[1]

Treatment	lb/A	July 2, 1970: Weed control rating	July 2, 1970: Weeding time	Aug. 18, 1970: Weed control rating	Aug. 18, 1970: Weeding time
amiben	3	3.5	4:44	7.5	1:12
DCPA	8	7.5	2:28	8.5	:52
diphenamid	5	5.5	4:50	7	1:40

(continued)

Treatment	lb/A	July 2, 1970 Weed control rating	July 2, 1970 Weeding time	Aug. 18, 1970 Weed control rating	Aug. 18, 1970 Weeding time
diphenamid + trifluralin	4 + ¼	8.8	2:07	9.5	:39
EL179	1	6	3:38	9	:47
pebulate	4	7	3:07	7.5	1:22
nitralin	½	7	3:28	9	:49
trifluralin	½	6	3:44	9.5	:39
trifluralin + amiben	½ + ½	7	3:50	9	:45
untreated control		0.7	9:24	4	2:10

1/ Average of 4 replications

Tomato response to herbicide treatment1/

Treatment	rate	Phytotoxicity	Yield (tons/A)2/ Transplants	Yield (tons/A)2/ Direct seeded
amiben	3	4.2	15.36	4.25
DCPA	8	6.3	18.84	5.04
diphenamid	5	1.2	14.96	7.84
diphenamid + trifluralin	4 + ¼	1.5	21.17	12.85
EL179	1	2.7	15.56	9.51
pebulate	4	2.7	16.12	7.17
nitralin	½	3.2	17.89	7.44
trifluralin	½	3.2	17.53	7.95
trifluralin + amiben	½ + 1½	3.7	17.32	5.95
untreated control		0	10.56	4.97

1/ Average of 4 replications

2/ Tonage is the average total yield of 8 hand pickings of transplants and 5 hand pickings of direct seeded plots.

Soil moisture effects on herbicide activity. Lange, A., W. Humphrey, and L. Francis. Seven herbicides sprayed on the wet surface of a sandy loam soil were less active than when applied to a dry soil surface. Trifluralin showed the most effect of soil moisture, followed by pebulate, R7465 and nitrofen. Nitralin although closely related to trifluralin responded less to differences in soil moisture. DCPA showed the least effect of soil moisture at the time of herbicide application but was extremely toxic to sugar beets, pigweed, and dichondra and tomato. However, carrots indicated DCPA was also more active on dry soil. Diphenamid was also more active on dry soil than wet, as shown by the response of sugar beets, tomatoes and dichondra. (University of California Agricultural Extension, Parlier, Anaheim).

The effect of soil moisture at the time of herbicide application on stand and vigor. Rated at two months for vigor where 0 = no growth and 10 is most vigorous growth.

Herbicide	lb/A	Sugar beets wet[2]	Sugar beets dry[3]	Alfalfa wet	Alfalfa dry	Pigweed wet	Pigweed dry	Average[1] Dichondra wet	Average[1] Dichondra dry	Tomato wet	Tomato dry	Carrots wet	Carrots dry
trifluralin	1	10.0	5.0	9.5	9.5	6.0	1.0	9.5	1.5	4.5	3.0	7.5	4.5
nitralin	1	7.0	5.0	8.5	8.5	3.5	1.0	0.0	1.0	2.0	0.5	2.5	4.0
DCPA	8	0.5	0.5	10.0	9.5	0.5	0.0	1.5	0.0	0.0	0.0	7.5	0.5
R7465	4	7.5	6.0	9.5	9.5	4.0	2.0	8.0	6.0	7.0	4.5	1.0	1.0
pebulate	4	9.0	4.5	9.0	8.0	7.5	4.5	2.5	0.0	1.0	2.5	3.5	2.0
nitrofen	2	8.0	7.5	10.0	9.5	5.0	0.5	8.5	2.0	3.0	1.5	6.5	3.0
diphenamid	4	8.0	4.0	8.5	8.5	2.5	2.0	7.0	5.5	4.0	0.2	0.0	0.0
Check	0	8.0	10.0	9.0	9.0	8.5	9.5	5.5	4.5	3.5	5.5	2.5	8.0

1/ Average two replications vigor where 10 = best stand and growth, 0 = no plants, 5 = 1/2 stand or 1/2 size plants.

2/ Wet = 1/8 A in. irrigation prior to herbicide application. All plots irrigated 2½ hours after herbicide application.

3/ Dry = air dry in field. Organic matter 1.0%, sand 58.5%, silt 22.5% and clay 19.0%

Comparison of some new and old herbicides for control of dandelions in bluegrass and bentgrass turf. Fults, Jess. At present, there is a distinct possibility that several of the long used turf herbicides may be removed from approved use around the home. In the face of this situation it would seem important to investigate promising substitute materials.

During the summer of 1970, in cooperation with the Chevron Chemical Co., Fresno, California, a series of tests were made on the Colorado State University's Bay Farm at Fort Collins, Colorado. Tests involved three main experiments.

Experiment #1 was conducted on dandelion infested bluegrass turf. Sprays, at two rates, were applied twice to dry leaves on July 29 and August 3. Evaluation was on September 21, 1970. Weed counts were made on June 29, August 1 and September 21.

Experiment #2 was conducted on dandelion infested bluegrass turf. Dry formulations of herbicides plus fertilizer (22-4-4) were applied

A comparison of some new and old herbicides for control of dandelions in bluegrass and bentgrass turf. Bay Farm, Colorado State University, Fort Collins, Colorado, 1970.

EXPERIMENT #1 - Bluegrass turf, treated twice, sprays

Plot No.	Chemical	Rate/gal per 200 sq ft^2 x rate	2x rate	Dandelions[1/] June 29	Aug. 1	Sept. 21	Control	Toxicity to turf	Remarks
				per ft^2	per ft^2	per ft^2			
1	.58 lb/gal Maintain CF112[2/]	1 Tbs	-	27.7	18.7	9.0	Good	None	Very few dandelions
2	.58 lb/gal Maintain CF112[2/]	-	2 Tbs	15.0	12.7	1.0	Excel.	None	Almost no dandelions
3	.87 lb/gal Maintain CF112[2/]	2 tsp	-	29.7	15.0	3.3	Good	None	Few dandelions
4	.87 lb/gal Maintain CF112[2/]	-	4 tsp	32.0	13.7	1.3	V. Good	None	Very few dandelions
5	1.32% MCPP[3/]	2 tsp	-	36.7	46.7	17.3	Poor	None	Many dandelions
6	1.32% MCPP[3/]	-	4 tsp	31.3	26.0	5.7	Poor	None	Many dandelions
7	1.75% MCPP[3/]	4 tsp	-	23.7	19.7	7.3	Poor	None	Many dandelions
8	1.75% MCPP[3/]	-	8 tsp	22.3	14.7	6.7	Poor	None	Many dandelions
9	.4 lb/gal cation[3/] morformquat	3 Tbs	-	12.0	10.7	9.7	Poor	None	Many dandelions
10	.4 lb/gal cation[3/] morformquat	-	6 Tbs	9.7	0.3	3.0	Poor	None	Many dandelions
11	.88 lb/gal 2,4-D acid ester + .44 lb/gal Silvex ester	4 tsp	-	12.7	0.3	2.7	Good	None	Some dandelions
12	.88 lb/gal 2,4-D acid ester + .44 lb/gal Silvex ester	-	8 tsp	23.0	0.0	1.7	Excel.	None	Almost no dandelions

(continued)

EXPERIMENT #2 - Bluegrass turf, treated once, dry formulations

Plot No.	Chemical	Rate/gal per 200 sq ft² x rate	2x rate	Dandelions June 29	Aug. 1	Sept. 21	Control	Toxicity to turf	Remarks
		per 1000 ft²		per ft²	per ft²	per ft²			
13	.83% Maintain on 22-4-4 fertilizer[2/]	5-1/2 lbs		14.7	9.0	8.3	Poor	None	
14	.83% Maintain on 22-4-4 fertilizer	11 lbs		9.3	6.0	4.7	Fair	None	
15	.83% MCPP on 22-4-4 fertilizer[3/]	5-1/2 lbs		25.3	41.7	11.0	Poor	None	Many dandelions + fertilizer effect
16	.83% MCPP on 22-4-4 fertilizer	11 lbs		18.0	8.0	5.3	Poor	None	Many dandelions + fertilizer effect
	.64% 2,4-D acid ester + .32% Silvex acid ester on 22-4-4 fertilizer	5-1/2 lbs		9.7	4.0	2.3	Poor	None	Many dandelions
18	.64% 2,4-D acid ester + .32% Silvex acid ester on 22-4-4 fertilizer	11 lbs		9.7	0.7	2.7	F. to P.	Some turf burn	Some dandelions

EXPERIMENT #3 - Bentgrass turf, treated once, sprays

Plot No.	Chemical	x rate (per 200 sq ft²)	2x rate	June 29	Aug. 1	Sept. 21	Control	Toxicity to turf	Remarks
19	1 lb 2,4-D + 1-1/2 lb MCPP/A[3/]	4 tsp	-	7.0	6.3	5.7	Poor	None	Many dandelions
20	1 lb 2,4-D + 1 lb MCPP/A[3/]	4 tsp	-	20.3	4.7	9.7	Poor	None	Many dandelions
21	1 lb MCPP[3/] + 1 lb MCPA/A	4 tsp	-	18.7	9.0	9.0	Poor	None	Many dandelions
22	1 lb 2,4-D + 1/2 lb Silvex/A	4 tsp	-	24.7	3.3	0.7	Good	None	Few dandelions
23	1 lb 2,4-D + 1-1/2 lb MCPA/A	-	8 tsp	9.7	3.3	1.0	Good	None	Few dandelions
24	1 lb 2,4-D + 1 lb MCPP/A[3/]	-	8 tsp	15.3	1.0	3.0	Good	None	Few dandelions
25	1 lb MCPP[3/] + 1 lb MCPA/A	-	8 tsp	33.7	7.7	3.7	F. to P.	None	Some dandelions
26	1 lb 2,4-D + 1/2 lb Silvex/A	-	8 tsp	25.7	0.0	3.3	Good	None	Some dandelions

1/ Each value shown is the average of 3-one foot² quadrat samples.
2/ Maintain CF112 = 12.5% chlorflurenol-i.e. 8.8% methyl-2-chloro-9-hydroxyfluorene-9-carboxylate plus 2.1% methyl-9-hydroxyfluorene-9-carboxylate plus 1.6% methyl 2,7-dichloro-9-hydroxyfluorene-9-carboxylate U.S. Borax Res. Corp.
3/ Morformquat cation - not disclosed; Chevron Chemical Co.

once to wet leaves on July 6. Evaluations and weed counts were made on August 11 and September 21, 1970.

Experiment #3 was conducted on dandelion infested bentgrass turf. Sprays were applied once at two rates to dry leaves on June 29. Evaluations and weed counts were made July 21, August 1 and September 21. Results are summarized for all three experiments in the attached table. (Weed Research Laboratory, Botany Department, Colorado State University, Fort Collins, Colorado 80521).

Postemergence control of broadleaf weeds in young alta fescue turf. McHenry, W. B., C. L. Elmore and N. L. Smith. A comparison of bromoxynil and the dimethylamine salt of 2,4-D was made on young alta fescue turf applied at two growth stages. All treatments included 1/4 percent surfactant (Surfax) and were applied in 100 gpa. The grass was planted October 30, 1969, and treated on November 20 (2 in. in ht.) and December 30, 1969 (5 in. in ht.). Weed species present were yellow starthistle (*Centaurea solstitialis* L.), common chickweed (*Stellaria media*), milk thistle (*Silybum marianun* Goertn.), fiddleneck (*Amsinckia douglasiana* DC), and hedge mustard (*Sisymbrium officinale* (L.) Scop.). Visual evaluations were made on weed control and injury to the turf.

		Treated 11/20/69 (2 in.)			Treated 12/30/69 (5 in.)	
		Weed control		Phyto-toxicity	Weed control	Phyto-toxicity
Herbicide	lb/A	12/29/69	5/20/70	5/20/70	5/20/70	5/20/70
bromoxynil	0.5	9.1	8.1	0	7.2	0
bromoxynil	0.75	9.4	9.3	0	7.8	0
bromoxynil	1.0	9.4	9.1	0	8.2	0.8
bromoxynil	2.0	9.5	9.1	0	9.0	4.5
2,4-D amine	0.5	7.8	9.0	0	9.0	0.2
2,4-D amine	0.75	8.3	8.9	0	9.0	0
Control	--	0	0.5	0	0.8	0

All data are means of 4 replications
Weed control: 0 = no effect, 10 = complete control
Phytotoxicity: 0 = no injury, 10 = dead turf

All rates of bromoxynil gave excellent control of the broadleaf species particularly at the younger stage (2 in.). When applied to older weeds a higher rate was required to give similar control. The daily maximum temperatures for the treatment dates and the three succeeding days ranged from 65 - 68 F in November and 51 - 59 F in December. The younger weeds and higher temperatures in November may account for the increased activity of bromoxynil.

Weed control was good with 2,4-D amine at either 0.5 or 0.75 lb/A at both stages of growth.

No turf injury from either herbicide was observed when applied on the earlier date. However at the 2 lb rate of bromoxynil on older turf there was injury 6 months after application. The injury appeared in an area where the turf was somewhat drier due to poor sprinkler distribution. No apparent turf injury was noted with 2,4-D amine at either rate. (University of California, Agric. Ext. Serv., Davis).

Early postemergence control of hairy crabgrass in a redtop (*Agrostis alba*) turf. Elmore, C. L. Several herbicides were evaluated for their postemergence control of hairy crabgrass (*Digitaria sanquinalis* (L.) Scop.) in a mixed turf (principally *Agrostis alba*, redtop). Postemergence applications were made on March 12, 1970, (1-2 leaf stage). Plots were replicated four times. All plots were irrigated for 15 minutes beginning 5 hours after application.

Bensulide gave outstanding crabgrass control for seven months at 15 lb/A. Although somewhat less control was observed for 10 lb/A it was commercially acceptable.

Although benefin gave good early control residual control was poor. Since the turf was not watered immediately after application some of this material may have been lost, and the effective rate reduced.

Oryzalin gave control similar to benefin requiring 6 lb for full season control. Injury was observed at this rate.

BASF2903H did not give satisfactory control of crabgrass when applied postemergence.

DCPA gave good control at two months (new germinating crabgrass), however because of the existing population poorer control than normal was observed. (University of California, Agric. Ext. Serv., Davis).

Effects of several herbicides on hairy crabgrass in redtop turf

Treatment	Rate	Crabgrass control[1/] Months after application			Phytotoxicity[2/] Months after application	
(1-2 leaf stage)	lb/A	2	4	7	2	7
bensulide	10	7.9	7.5	8.0	0	0
bensulide	15	9.1	9.2	9.4	0	0
benefin	3	7.5	2.2	4.0	0.7	0

(continued)

Treatment (1-2 leaf stage)	Rate lb/A	Crabgrass control Months after application 2	4	7	Phytotoxicity Months after application 2	7
benefin	4	8.8	2.0	3.5	1.0	0
oryzalin	2	8.5	4.2	5.5	0	0
oryzalin	4	9.9	5.0	6.8	0.5	0
oryzalin	6	10.0	7.2	8.6	1.0	0
BASF2903	4	5.0	1.5	1.8	0	0
BASF2903	8	3.5	0	0.8	0	0
DCPA	10	8.4	4.0	5.0	1.2	0
Control	-	2.2	1.0	0.8	0	0

1/Weed control - 0 = no control; 10 = complete control

2/Phytotoxicity - 0 = no injury; 10 = dead turf

Annual bluegrass and crabgrass control in bermudagrass turf. Van Dam, John, H. Williams, and C. L. Elmore. Five herbicides were evaluated and compared to two standards, benefin and bensulide, for control of crabgrass (*Digitaria sanquinalis* and *D. ischemum*) in Tifgreen bermudagrass turf. Treatments were hand sprayed on February 25, on plots replicated four times. The initial evaluations were made on annual bluegrass (*Poa annua* L.) and subsequent evaluations on crabgrass. Phytotoxicity evaluations were made periodically throughout the growing season.

Oryzalin and Kerb gave early control of annual bluegrass with oryzalin giving good residual crabgrass control. Residual crabgrass control with Kerb did not last the full season. BASF2903 did not injure turf but neither did it give effective control. Early injury was evident on the bermudagrass with oryzalin at all rates. Kerb and benefin also showed early stunting of the turf. At five months after application no visual effects could be observed with any treatment. (University of California, Agric. Ext. Serv., Los Angeles County, Los Angeles State and County Arboretum, and Agric. Ext. Serv., Davis).

Control of annual bluegrass and carbgrass in Tifgreen bermudagrass turf

Treatment	Rate lb/A	Weed control[1] Months after application 2(a)	3(a)	3(c)	6(c)	9(c)	Phytotoxicity[2] Months after application 2	5
oryzalin	2	7.3	5.6	10.0	8.6	7.2	3.0	0
oryzalin	3	8.5	7.6	9.9	8.4	6.5	5.0	0

(continued)

Treatment	Rate lb/A	Weed control Months after application 2(a)	3(a)	3(c)	6(c)	9(c)	Phytotoxicity Months after application 2	5
oryzalin	6	9.5	9.0	10.0	9.8	9.4	7.5	0
Kerb	2	8.8	7.3	7.8	5.5	4.1	3.2	0
Kerb	4	9.8	9.6	8.8	7.4	4.4	3.5	0
BASF2903	4	3.0	4.0	5.3	4.4	1.9	0.7	0
BASF2903	8	3.3	4.0	5.4	5.0	2.6	1.0	0
bensulide	15	4.0	4.0	9.0	8.6	7.1	0.7	0
benefin	3	5.3	5.4	8.8	7.7	5.7	2.5	0
Control	-	3.3	4.0	6.0	5.0	2.1	0.5	0

1/ Weed control - 0 = no effect, 10 = complete control
(a) annual bluegrass evaluations
(c) crabgrass evaluations

2/ Phytotoxicity - 0 = no injury, 10 = dead turf

Tolerance of several herbicides on bluegrass sod. Elmore, C. L. H. B. Collins. This trial reflects the tolerance of a mixed bluegrass sod (six months old) to several herbicides. The bluegrass mixture was 1/3 Merion, 1/3 Newport, and 1/3 Windsor. Treatments were made April 23, 1970, and irrigation followed in 6 hours. Soil was a Metz sandy loam.

The herbicides NC5461, NC8438, and oryzalin produced severe stunting with no appreciable new growth one month after application. At three months after application the turf treated with NC5461 and NC8438 regrew without observable indication of damage, however, severe thinning of the turf occurred with oryzalin. Benefin at 6 lb/A appeared to reduce stand selectively giving a coarser textured turf. This appeared to be a reduction in Windsor population. (University of California, Agric. Ext. Serv., Davis and San Benito County).

Phytotoxicity of several herbicides to mixed bluegrass

Herbicide	Rate lb/A	Phytotoxicity1/ 5/21/70	7/7/70
bensulide	15	0	0
benefin	3	0.8	0.2
benefin	6	2.5	2.0
AN56477	1.5	1.0	0

(continued)

Herbicide	Rate lb/A	Phytotoxicity 5/21/70	7/7/70
AN56477	3	0.8	0.2
NC5651	6	0.5	0
NC5651	12	4.0	0.8
NC8438	2.4	6.5	0.2
NC8438	4.8	7.0	0
ER5461	1.5	0	0
ER5461	3.0	0.2	0.5
EL119	3.0	7.0	8.2
EL119	6.0	7.5	9.2
BASF2903H	8.0	0	0
Control	-	0	0

All data and means of 4 replications

1/Phytotoxicity evaluations: 0 = no effect, 10 = dead turf

Control of coarse-leaved grasses in bluegrass turf. Fults, Jess L. The selective control of coarse-leaved grasses in bluegrass turf is an important but relatively unsolved weed problem. Three years of field testing have indicated that the selective removal of coarse-leaved bunch grasses such as coarse fescue (*Festuca arundinacea* (Schreb.), orchard grass (*Dactylis glomerata* L.) red top (*Agrostis alba* L.), timothy (*Phleum pratense* L.) and perennial ryegrass (*Lolium perenne* L.) is actually probably more difficult than the selective removal of sod-forming grasses such as smooth brome grass (*Bromus inermis* Leyss) or quack grass (*Agropyron repens* (L) Beauv.).

Plots containing a single coarse grass mixed with Windsor Kentucky bluegrass were established from seed in March 1968. Each plot received one lb/1000 ft^2 of bluegrass seed plus two lb of coarse grass seed. Plots were ready for herbicide treatment by September 8, 1969. Two experiments were conducted in each of the 6 coarse-grass plots. In Experiment #1 the objective was to study the relative merit of 7 different herbicides plus a non-herbicide control when the herbicides were used in all possible paired combinations; this included single (x) and double (2x) rates of each herbicide. In Experiment #2 the same 7 herbicides were used at single rates but combined with the interaction of nitrogen fertilization (ammonum sulfate) used at 2, 4, 8 and 12 lb N/1000 ft^2. In Experiment #1 384 subplots (6 grasses x 64 subplots) were used. In Experiment #2 192 subplots (6 grasses x 32 subplots) were involved. In each subplot 3-one-ft^2 square quadrats were used to obtain quantitative data when results were first evaluated on August 4, 1970.

Herbicides used were cacodylic acid, amitrole at 8 lb/87 gal water/acre; paraquat at 1 lb ai/87 gpa water; potassium cyanate at 30 lb formulation/87 gpa water; dalapon at 6 lb ai/87 gpa water; picloram at 8 lb ai/87 gpa water; and MSMA at 5.4 pt commercial formulation/218 gpa water.

Results from Experiment #1 (Paired herbicides) indicated that the "best" treatment differed for each coarse grass-bluegrass mixture. The "best" treatment for perennial ryegrass was cacodylic acid plus MSMA; for orchard grass cacodylic acid plus potassium cyanate; for smooth brome was cacodylic acid double rate, picloram plus amitrole or plus paraquat or plus dalapon or plus MSMA; for coarse fescue picloram plus paraquat; for timothy picloram double rate; for redtop cacodylic acid plus potassium cyanate etc.

Results from Experiment #2 (single rates of herbicides interacting with 2, 4, 8 and 12 lb N/1000 ft^2) indicated that the "best" treatment for perennial ryegrass was no herbicide plus 8 lb/N/1000 ft^2; for orchard grass cacodylic acid plus 4 lb/N; for smooth brome no herbicide plus 2 lb/N; for coarse fescue no herbicide plus 12 lb/N; for timothy MSMA plus 8 lb of N and for redtop picloram plus 8 lb of N. (Weed Research Laboratory, Colorado Agricultural Experiment Station, Colorado State University, Fort Collins, Colorado 80521).

Weed control and phytotoxicity of several herbicides to two ground cover species. Elmore, C. L., D. Hamilton, E. Johnson, and E. Roncoroni. Rooted cuttings of *Hedera canariencis*, Algerian Ivy, and unrooted cuttings of *Carpobrotus edule*, large leaf iceplant, were planted in rows with 9 other species of ground covers. The trials were planted in a coastal climate (Santa Clara) and a valley climate (Davis) on May 12 and May 18, respectively. Each 10 ft x 20 ft plot was replicated 4 times and the ground cover species randomized in each replication. Treatments were made May 18 at Santa Clara and 22 at Davis and followed by sprinkler irrigation. Fertilization and sprinkler irrigation was applied as needed. The soil analysis for the Santa Clara location was: organic matter, 4.5; sand, 26.4; silt, 55.6; clay, 18.0; and at Davis was organic matter, 4.3; sand, 25.2; silt, 60.0; and clay, 14.8.

Most herbicides gave excellent weed control at one month after application. However, at two months when the plots were hand weeded, control was not as apparent with Kerb at 2 lb/A, Soil Serv 463 at 6 lb/A, and GS13638 at 2 lb/A. At Davis where the principal weed was *Amaranthus deflexus*, prostrate pigweed, R7465 at 4 lb/A was not effective. R7465 did not control *Lambium amplexicaule*, henbit, in Santa Clara trial. Kerb failed to control *Sonchus oleraceus*, common sowthistle, or *Senecio vulgaris*, common groundsel, at either location.

All herbicides appeared to be safe for use on *Hedera canariensis* (algerian ivy) in these two locations. Kerb at 8 lb/A and R7465 at

8 lb/A appeared to stunt the *Carpobrotus edule* although the 2 and 4 lb rates of the two herbicides, respectively, appeared safe. Slight chlorosis was apparent on *Carpobrotus edule* with 8 lb/A of GS13638. (University of California, Agric. Ext. Serv., Davis, Alameda County, San Mateo County, Davis).

Effects of several herbicides on weed control, phytotoxicity, and weeding costs in ground covers

Herbicide	Rate lb/A	Weed control[2/] 1 mo.	Cost (dollars/A)[3/] @$2.00/hr 2 mo.	Average[1/] Average phytotoxicity[4/] *Carpobrotus edule* 1 mo.	*Carpobrotus edule* 3 mo.	*Hedera canariensis* 1 mo.	*Hedera canariensis* 3 mo.
Kerb	2	7.9	$1,083	0.2	1.1	0.5	1.2
Kerb	8	9.5	324	1.0	4.5	0	1.1
Nitrofen	4	9.6	377	0	0.5	0.2	1.1
Nitrofen	8	9.9	96	0	1.0	0.6	1.0
Nitralin	2	8.5	399	0	0.7	0.7	1.0
DCPA	8	8.8	281	0	0.5	0.8	0.6
Soil Serv 463	6	9.3	816	0	0.4	0.5	0.9
Soil Serv 463	12	9.9	245	0	0.9	0.5	1.9
R7465	4	8.4	1,173	0.4	1.4	1.0	1.1
R7465	8	9.5	456	0.4	2.2	0.5	1.4
Simazine + nitralin	½+2	9.9	84	0.1	1.0	0.1	0.9
Simazine + trifluralin	½+2	10.0	126	0.1	1.0	1.0	0.7
Simazine + R7465	½+4	9.7	325	0.1	0.7	0.6	1.0
GS13638	2	9.0	880	0.1	0.9	0.4	0.7
GS13638	8	9.9	133	1.9	1.5	0.4	1.0
Control	-	1.3	2,941	0	0.7	0	1.0

1/ Average of 4 replications each at 2 locations.

2/ Weed control - 0 = no control, 10 = complete control.

3/ Plots were hand weeded and a time recorded. These were converted to a cost/A figure.

4/ Phytotoxicity was a visual observation: 0 = no injury, 10 = dead plants.

The effects of several herbicides on five container grown ornamentals. Elmore, C. L., L. Frey, and E. Roncoroni. Young liners of *Ligustrum japonicum*, privet; *Raphiolepis indica, Juniperus chinensis* 'Torulosa', *Buxus sempervirens* and *Euonymus japonica* 'aurea-variegata' were planted in a modified U.C. potting mix and were allowed to become established for approximately 2 months. Six single containers of each species were placed in a 5 ft x 5 ft square to be broadcast sprayed April 29, 1970. All containers were sprayed lightly with water immediately after application. Weed control was evaluated by weed counts and figured as percent reducation from the untreated containers. Phytotoxicity was visually evaluated on a 0-10 scale.

Kerb phytotoxicity was observed as moderate stunting of *Ligustrum* and *Buxus* and stunting and dieback on *Juniperus* at the 8 lb rate. No effects were noted at the 2 lb rate. Veinal chlorotic symptoms with S6706 were observed on *Raphiolepis, Euonymus,* and *Buxus* at the 8 lb rate. At 2 lb per acre rate the *Euonymus* showed slight leaf symptoms.

Injury was not observed with any other compound or combination of compounds.

The herbicides nitralin, DCPA, R7465, oryzalin and the combination of simazine-nitralin gave excellent weed control in this experiment. Oryzalin, S6706, and R7465 gave good control of groundsel. Nitralin, R7465, oryzalin, Kerb, and the combinations, simazine-nitralin and simazine-R7465 gave excellent grass control. Trifluralin did not give good grass control in this experiment. A possible reason for this is that the herbicides were applied to moist soil and not irrigated for approximately 26 hours; thus, volatility loss may have occurred. AN56477 gave commercial weed control at both rates with safety, but primarily not controlling groundsel.

ER5461 gave somewhat less than commercial weed control at the 2 lb rate but gave good control and did not injure plants at the 8 lb rate.

GS13638 gave commercial control at both the 2 and 8 lb rates without observable injury to the plants.

Weeds present: common groundsel (*Senecio vulgaris*), Kentucky bluegrass (*Poa pratensis*) (seeded), prostrate spotted spurge (*Euphorbia maculata*), and few-seeded bittercress (*Cardamine oligosperma*). (University of California, Agric. Ext. Serv., Davis and Sacramento County).

Irrigation and formulation studies in the pot culture of ornamentals. Lange, A., W. Humphrey and C. Elmore. Trifluralin, nitralin, DCPA, and nitrofen thru the irrigation system followed by 1/16 to 4 A in. of irrigation caused no detrimental effects to gallon containers of newly planted oleander, pittosporum, veronica, juniper, natal plum and bottlebrush. Only chloropropham caused injury when granular chloropropham, nitrofen and EPTC was applied prior to 1/16 to 1 A in. of irrigation water. (University of California Agric. Ext., Parlier, Anaheim and Davis).

Weed control with several herbicides in 5 container grown ornamentals

Herbicide	Rate lb/A	Weed control: 6/3/70 percent reduction[1]	Weed control: 7/6/70 percent reduction	Phytotoxicity[2] 3 months after treatment: *Raphiolepis*	*Juniperus*	*Ligustrum*	*Euonymus*	*Buxus*
Trifluralin	2	51	38	1	0	0	0	0
Nitralin	2	90	95	0	0	0	0	1
ER5461	2	69	64	0	0	0	0	0
ER5461	8	81	83	0	0	0	0	0
AN56477	2	82	86	0	0	0	0	1
AN56477	8	83	96	0	0	0	0	1
S6706	2	82	52	0	0	0	0	0
S6706	8	99	99	1	0	0	0	1
R7465	4	98	95	0	0	1	0	0
R7465	16	99	99	0	0	0	0	1
GS13638	2	74	86	0	0	0	0	2
GS13638	8	85	96	0	0	0	0	2
DCPA	10	80	88	0	0	0	0	1
Oryzalin	2	98	95	0	0	0	0	1
Oryzalin	8	99	99	0	0	0	0	2
Kerb	2	75	91	0	0	0	0	1
Kerb	8	77	93	1	4	3	1	3
Simazine + R7465	½+4	99	98	0	0	0	0	1
Simazine + Nitralin	½+2	97	95	0	0	0	0	1
Control	-	0	0	0	0	0	0	0
Control	Hand weeded	0	0	0	0	0	0	1

1/Weeds were counted and removed at each.

2/Means of 6 replications.

Selective herbicide field test in ornamental bulbs (iris, tulips, and narcissi). Peabody, Dwight V., Jr. Present recommendations call for a preemergence diuron treatment in fall plus a postemergence chloropropham or monuron application in the early spring to maintain iris, tulips, and narcissi weed free the entire growing season. Principal objective in this year's field test in ornamental bulbs was to find a preemergence herbicide which could be applied in the fall and would then presist for the following eight months until harvest time the following summer, making it unnecessary to use a late spring postemergence herbicide.

Although the candidate herbicide NIA16476 applied prior to emergence at very low rates of application resulted in excellent, season long weed control, there was good evidence that bulb yields were reduced except at the very lowest rates (one-half pound per acre preemergence plus one-half pound per acre postemergence). Two other numbered candidate herbicides, AP920 and BAY94337 also gave good weed control for the eight month growing season and at their lower rates caused no bulb yield reduction in iris or narcissi. (Northwestern Washington Research and Extension Unit, Washington State University, Mt. Vernon).

Weed control in three year-old Christmas trees in Wyoming. Lee, G. A. and H. P. Alley. Studies were initiated to evaluate several herbicides for control of annual weed species in three year-old Scotch pine (*Pinus sylvestris* L.). Plots were established after a light rain on May 13, 1970 at Torrington, Wyoming. The location consisted of a sandy loam soil. Plots were 4.5 x 30 ft and replicated three times. The herbicides were applied directly over the trees in 40 gpa of water carrier on a full coverage basis. Visual observations were made on June 26. The weed population consisted of kochia (*Kochia scoparia* (L.) Roth) in the 4-leaf stage, common dandelion seedlings (*Taraxicum officinale*) in the 4-6 leaf stage, common lambsquarter (*Chenopodium album* L.) in the 2-leaf stage, tansy mustard (*Descurainia pinnata* (Walt.) Britt.) in the 6-leaf stage and green foxtail (*Setaria viridis* (L.) Beauv.) which was starting to emerge.

Simazine at 2.0 lb/A eliminated all annual weed species present. No visible phytotoxicity was detected on the Scotch pine trees. Bladex at 1.0 lb/A controlled all the broadleaved weeds and 95 percent of the green foxtail. There were sufficient green foxtail remaining to provide ground cover as protection against sand blasting damage to the small trees. The 2 lb/A rate of Bladex resulted in 100 percent control of all weed species. No visual herbicide damage was apparent on the trees. Sumatol (2-sec. butylamino-4-ethylamino-6-methoxy-s-triazine) at 1.0 and 2.0 lb/A eliminated all weed species present with no phytotoxicity to the Scotch pine. GS13638 (name unavailable) at 1.0 lb/A was not a sufficient rate to control the weed species present. Results obtained with the 2.0 lb/A rate of GS13638 was equivalent to Bladex at 1.0 lb/A. GS13638 at 4.0 lb/A controlled all broadleaved weeds and 98 percent of the green foxtail. High tolerance of Scotch pine to GS13638 at 4.0 lb/A was evident.

Although most of the herbicide treatments gave excellent control of the annual weed species, the desire of the commercial tree growers is to reduce the competition of the unwanted plants to a minimum without completely eliminating the vegetative ground cover. Trees grown in sandy soil are quite susceptible to sand and wind damage. (Wyoming Agriculture Experiment Station, Laramie SR-295).

PROJECT 5. WEEDS IN AGRONOMIC CROPS

C. H. Slater, Project Chairman

SUMMARY

Thirty progress reports were submitted from Arizona, California, Colorado, Nevada, New Mexico, Oregon, Washington, Wyoming and Utah, concerning herbicide evaluation in small grains, corn, sugar beets, beans, cotton, peppermint, alfalfa, potatoes. Other papers discuss activated charcoal and individual weed species.

Small Grains. There were eleven papers submitted on weed control in small grains from Arizona, California, Oregon and Wyoming.

Two reports, one from California and the other from Colorado, present data on postemergence control of wild oats (*Avena fatua* L.) with triallate granules, barban, BAY94337, haloxydine, and SD30053.

Preemergence and postemergence weed control in furrow irrigated barley is discussed by two investigators in Arizona.

Blue mustard (*Chorispora tenella*) control in winter wheat is reported by Colorado researchers. Control of several annual broadleaf weed species in winter wheat is controlled postemergence by dicamba in trials established at Walla Walla, Washington.

Two papers report on annual grass control in winter wheat. Annual ryegrass (*Lolium multiflorum*) was controlled with CP52223 and combinations of CP52223 + diuron in Western Oregon. Downybrome (*Bromus tectorum*) control in winter wheat was reported by Colorado investigators. A total of eight different herbicides were evaluated.

Weed control in summer fallow in Washington and Wyoming was investigated in 1970. The Washington paper reported on dicamba applied in late summer to control perennial weeds, then fall seeded to winter wheat. Wyoming investigators tested nine herbicides and combinations to control downy bromegrass (*Bromus tectorum* L.) and annual broadleaf weeds in wheat summer fallow.

Tolerance of four winter wheat varieties to diuron was reported by investigators in Western Oregon.

Corn. Four papers were submitted on weed control in corn from California, Oregon and Wyoming.

Shallow incorporation and irrigation three days after application of alachlor enhanced Japanese millet (*Echinochloa frumentaceae*) control in sweet corn at two experiments in Western Oregon.

Wyoming investigators reported nine herbicides and combinations were tested on field corn at two different locations in Wyoming.

Six annual broadleaf weed species and green foxtail were the predominant weed in these trials. Bladex gave best control in one trial whereas Bladex + Alachlor was best in the other trial.

One investigator presents data on soil residual activity of eight herbicides used on corn and milo in California. The bioassay crops were kidney beans, radish, tomato, sugar beets and wheat.

Sugar Beets. Five progress reports were submitted on sugar beets from California, Colorado, Washington and Utah.

Preplant incorporated treatments were superior to preemergence treatments at two experiment locations in the Sacramento Valley. CP52223 and NC8438 gave 4.5 weeks weed control in sugar beets. Postemergence weed control was evaluated when the sugar beets were in the 2 to 4 leaf stage and weed species 2 to 4 leaf stage. Phenmedipham resulted in the best postemergence weed control with the best crop tolerance.

Eight herbicides and combinations applied preemergence to sugar beets were evaluated by investigators in Colorado and Kansas. These researchers report that preemergence application in furrow irrigated regions offers much promise for reliable chemical weeding in the absence of soil incorporation.

Data from Washington indicates that cycloate applied preplant, phenmedipham applied early postemergence to weeds and beets, with trifluralin being applied 2 days after thinning gave season long weed control in sugar beets.

Beans. Progress reports from Wyoming and California present data on control of black nightshade (*Solanum nigrum* L.) and hairy nightshade (*Solanum sarachoides* Sendt.) in lima beans and field beans. Wyoming data indicates that a tread mulcher and power driven incorporator was superior to the springtine harrow and tandom disc for preplant incorporated herbicides.

Cotton. The continued use of selective herbicides in cotton has encouraged increased infestations of resistant weed species reports New Mexico investigator.

Linuron + trifluralin applied before planting controlled all weed species early in the season in tests conducted at Marana and Phoenix, Arizona.

Potatoes. Fifteen potato herbicides were applied postplant incorporated, preemergence, at emergence and postemergence in trials conducted in Eastern Oregon.

Peppermint. Peppermint treated with terbacil in Western, Central and Eastern Oregon was bioassayed using annual ryegrass (*Lolium multiflorum*) as the indicator crop. Terbacil was present in the surface layer (Top four inches of soil) in sufficient quantities to be damaging to sensitive crops. Plowing reduced injury from terbacil soil residue.

Seedling Alfalfa. Kerb controlled four annual weed species in seedling alfalfa with less alfalfa injury than five other herbicides as reported by an investigator in Southern Nevada.

Activated Charcoal. Thirty-one preemergence herbicides were tested on fourteen crops to determine if activated charcoal increased selectivity. In general the activated charcoal gave protection to all crops from one or more herbicides that would otherwise been nonselective.

Annual Weeds. Two progress reports were submitted on Russian thistle (*Salsola iberica* Sennen & Pau.) and one report on Hillman's panicum (*Panicum hillmanii* Chase.).

Wild oat (*Avena fatua* L.) control in barley. Thiele, Gerald H. and Robert L. Zimdahl. These experiments were conducted at several locations to determine the optimum rate and time of application of selected herbicides for control of wild oats in barley. Moravian malting barley was planted on all locations with a standard farm drill. Granular applications were applied on 8 ft x 30 ft plots with a four ft Grandy applicator. All liquids were applied broadcast with a bicycle type plot sprayer in 20-30 gpa of water on 6 ft x 30 ft plots. We studied fall applications of granular Triallate at different rates with and without incorporation. The fall incorporated treatments gave good control of wild oats while the spring surface applied treatments did not give good control. Incorporation enhances control at any time of application. Rates over 1.5 lb did not give added control and may have lowered yields. We feel that post applications with granular Triallate is better than no treatment at all if the barley cannot be treated in the two leaf stage with barban.

BAY94337 showed definite promise preemergence at 1 to 1.5 lb. Post applications severely injured barley at rates of 1.0 to 1.5 lb. Haloxydine at 1/2 lb preemergence also gave good control. Postemergence application caused marginal yellowing and white leaf tips. These symptoms disappeared and did not lower yield.

Experimentation with different rates and stages of application of alanine, SD30053 with and without nonphytotoxic oil shows that treatment at the five leaf stage with oil gave good control but some degree of safety was lost. At the rate used, this compound was not an effective wild oat killer but did suppress growth and eliminate much of the wild oat competition. However, it is questionable if suppression alone is a sufficient criterion for a wild oat herbicide. Most competition studies show that the elimination of early season competition is essential and SD30053 may not be adequate in this respect.

A method for wild oat control with paraquat was tried. Wild oats were induced to germinate by tillage, then treated paraquat and the barley planted a few days later. The prescribed space tillage and planting intervals could not be scheduled so hand tillage and spaced applications were used. The technique used was unsuccessful. Wild oat control was poor and barley was injured even at the coleoptile stage. The most important disadvantage is that wild oats germinate over several weeks and one application of paraquat does not kill later germinating wild oats.

MSMA did not show the control obtained in 1969. Late applications (barley 6-12 in.) were not included and might have been effective.

C20546 does not injure barley but is not effective for wild oat control. (Weed Research Laboratory, Department of Botany and Plant Pathology, Colorado State University, Fort Collins).

Postemergence wild oat control in barley. Agamalian, H. Postemergence application of triallate and barban were compared in barley for the control of wildoats (*Avena fatua* L.). Triallate granules at 1.25 lb/A ai and barban E.C. at .33 lb/A ai were applied when the wild oats were in the 1 to 2 leaf stage. The California Mariout barley was in the 3 to 4 leaf stage and growing under stress conditions, having been subjected to minimal moisture and low ambient temperatures of 22 F.

The first nine days following treatment ambient temperatures were 57.9 to 28.3 F. Initial rainfall recorded ten days post treatment was 0.93 in. Twenty days following herbicide application 3 in. of rainfall was recorded.

Wild oat symptoms were quite similar with both compounds. Initial stunting of oats and a bluish-green color is evident. Increased barley growth providing competition appear to enhance control. The following data indicates degree of control and corresponding yield results.

Wild oat control in barley

Treatment	lb/A	Formulation	Wild oat control[1/]	Crop injury	Yield lb/A
barban	0.33	E.C.	10.0	1	3142**
triallate	1.25	granules	8.6	0	3018**
control	0		0.8	0	2271

[1/]Rated 3/13/70.

LSD 0.01 = 36.6

Preemergence application of herbicides in row-planted, furrow-irrigated barley. Hamilton, K. C. and H. F. Arle. Interest in chemical weed control in small grains has increased because of new herbicides and row plantings of barley on shaped beds at reduced seeding rates. During the past winter, a test was conducted at Mesa, Arizona to determine the effects preemergence applications of linuron, terbutryn, C6313, and VCS438 on barley planted on shaped beds. Mustard (*Brassica japonica* (Thunb.) Sieb.) was seeded on the test area. Two rows of barley (hybrid Hembar) were planted on vegetable beds on 40 in. centers at the rate of 20 lb/A. Herbicides were applied to the soil (sand 44 percent, silt 36 percent, clay 20 percent, organic matter 1 percent) on November 19, 1969. Treatments were replicated four times on two-bed plots 32 ft long. Treatment was followed by a germination irrigation and rainfall. Development of barley and mustard was observed every few weeks and plots were harvested by combine in May, 1970.

Barley seedlings were severely injured by 0.5 and 1.0 lb/A of linuron and 1.0 lb/A of terbutryn (see table). All herbicide treatments were effective in the initial control of mustard but terbutryn failed to maintain control. Vigorous barley growth controlled weeds late in the growing season. Treatments that injured barley delayed maturity and reduced lodging prior to harvest. Yield data were highly variable and none of the differences were significant although the higher rates of linuron, terbutryn, and C6313 tended to lower yields. (Cooperative investigations of Arizona Agric. Expt. Sta., University of Arizona, Tucson, and Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Phoenix).

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

Treatments		Percent crop injury and weed control estimated 12/24/69		Yield of grain[1/]
Herbicide	lb/A	Barley	Mustard	lb/A
Linuron	1.00	52	100	4,080a
Linuron	0.50	32	100	4,490a
Linuron	0.25	12	100	4,810a
Terbutryn	1.00	34	99	4,790a
Terbutryn	0.50	14	92	4,910a
Terbutryn	0.25	6	56	5,120a
C6313	1.00	22	100	4,610a
C6313	0.50	4	100	5,100a
C6313	0.25	1	100	5,400a
VCS438	1.00	11	100	4,810a
VCS438	0.50	6	94	4,590a
Untreated check		0	0	4,690a

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

Blue mustard (*Chorispora tenella* (Willd.) D.C.) control in winter wheat. Hyzak, D. L. and R. L. Zimdahl. A field experiment was established to evaluate various potential herbicides and herbicide combinations for control of broadleaf weeds in winter wheat. In the location of a test plot area, blue mustard was the predominant species present in a fairly thick, uniform stand. It was selected as a test species to represent many of the typical broadleaf weeds which occur naturally in winter wheat in Colorado.

All treatments were applied broadcast with water as the carrier at 24 gpa, and as postemergence treatments in a randomized block design with four replications per treatment. The herbicides were applied at one or more rates, with or without a surfactant (X77 or Dow Corning), and as herbicide combinations. Plot size was 6 ft x 30 ft. The soil texture was a loamy sand.

Winter wheat was grown under dryland farming conditions. It was in the 4- to 5-leaf tillering stage and was healthy and vigorous. The blue mustard were in the prebloom and bloom stage. Three visual ratings of blue mustard control and wheat injury were made following treatment. Wheat plots were harvested to provide a quantitative measure of herbicide performance.

The data (see table) shows that Tordon-22K (picloram) at .25 lb/A severely stunted the wheat, delayed its maturity, and resulted in the lowest yield. Tordon 202 (picloram + 2,4-D) also exhibited injury to wheat. Evidently picloram was the principle cause of wheat injury, since 2,4-D amine and dicamba alone did not show wheat injury visually. The growth regulators (picloram, dicamba, and 2,4-D), in general, gave poor blue mustard control. A possible explanation for this is that blue mustard was in fairly mature stage at the time of treatment and may have been tolerant to these herbicides.

BAY94337 at 1.5 lb/A provided excellent blue mustard control; however, it was extremely injurious to wheat as indicated by wheat injury and yield data. BAY94337 at .75 lb/A rate, with or without a surfactant, reduced wheat significantly, but blue mustard control was reduced almost in half compared to the 1.5 lb/A treatment. This herbicide provides good weed control but its low margin of tolerance may restrict its use in wheat. Bromoxynil plus Dow Corning surfactant at .25 lb/A doubled blue mustard control with similar wheat injury compared to bromoxynil alone. Of the bromoxynil-herbicide combinations the bromoxynil-diuron combinations provided better weed control with similar wheat injury than bromoxynil-linuron combinations. Many of the bromoxynil treatments were more effective compared to the other treatments. Bromoxynil due to its contact action, showed a rapid phytotoxic response on blue mustard.

Of the three urea herbicides, linuron at 2.0 lb/A gave better weed control and similar wheat injury compared to diuron and chlorobromuron.

Uran applied alone or in herbicide combinations did show a nitrogen response compared to the check. The foliage of wheat was a darker green and it appeared to have more vegetative growth. Uran alone did increase the yield of wheat compared to the check. The check was neither weeded or treated.

A couple of points in this study need to be clarified. Even though the majority of herbicides or herbicide combinations exhibited wheat injury according to the observation data, the wheat plant, in many cases overcomes this injury stress. The wheat injury is thereby not always reflected in the yield data. Another point is that blue mustard was treated at a fairly mature stage. It would be safe to assume that the majority of the treatments would have given better weed control had they been applied at an earlier date, since young weeds are usually more susceptible to herbices.

This study will be continued in 1971. Some of the more promising treatments will be reevaluated in greater detail. (Weed Research Laboratory, Department of Botany and Plant Pathology, Colorado State University, Fort Collins).

Effects of herbicide treatments on wheat injury, blue mustard control, and wheat yields

Herbicide[1/]	Rate lb ai/A	Wheat[2/] injury	Blue mustard[3/] control	Wheat yield bu/A
Tordon-22K (picloram)	0.25	3.0	2.9	8.6
2,4-D amine	0.50	0.0	1.7	41.6
dicamba	0.25	0.0	1.0	31.7
Tordon-202 (picloram + 2,4-D)	0.016 + 0.25	0.6	2.9	28.6
Tordon-202 (picloram + 2,4-D)	0.023 + 0.375	1.8	2.1	33.5
BAY94337	0.75	0.7	4.9	35.6
BAY94337 + .5% X77	0.75	1.0	4.7	30.4
BAY94337	1.50	4.2	9.5	23.4
bromoxynil	0.25	0.2	3.4	38.7
bromoxynil + .5% Dow Corning	0.25	0.3	6.7	37.8
bromoxynil + linuron (tank mix)	0.125 + 0.125	0.6	4.1	40.8
bromoxynil + linuron (ACP-69-219)	0.125 + 0.125	0.0	2.8	42.1
bromoxynil + linuron (ACP-69-219) + .5% Dow Corning	0.125 + 0.125	0.4	3.0	37.7

(continued)

Herbicide	Rate lb ai/A	Wheat injury	Blue mustard control	Wheat yield bu/A
bromoxynin + linuron (ACP-69-219 + uran[4]/	0.125 + 0.125	0.1	2.2	35.9
bromoxynil + diuron (tank mix)	0.25 + 0.333	0.8	7.2	44.1
bromoxynil + diuron (ACP-69-386)	0.25 + 0.333	0.8	6.0	48.1
bromoxynil + diuron (ACP-69-386) + 5% Dow Corning	0.25 + 0.333	2.1	7.2	26.4
bromoxynil + diuron (ACP-69-386) + uran	0.25 + 0.333	0.5	7.9	47.6
diuron	2.00	1.9	6.6	40.5
linuron	2.00	2.0	7.8	36.2
chlorobromuron	1.50	1.0	5.1	41.6
Uran	0.00	0.0	0.0	43.7
Check	0.00	0.0	0.0	30.5

1/ Chemical company code letters: BAY = Chemagro Corp., ACP = Amchem Products, Inc.

2/ 0 = no injury, 10 = complete kill of wheat.

3/ 0 = no control, 10 = complete control of blue mustard.

4/ uran (32% N) was applied at 6 gpa in stated treatments.

Evaluation of VCS438 for selective use in winter wheat. Collins, R. L. VCS438 (2-(3,4-Dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3, 5-dione) and combinations with dicamba were evaluated for postemergence selectivity in wheat and broadleaf weed control.

The two principal weeds were fiddleneck (*Amsinckia intermedia*) and henbit (*Lamium amplexicaule*). Other weeds were jimhill mustard (*Sisymbrium altissimum*), common chickweed (*Stellaria media*), blue mustard (*Chorispora tenella*), umbellate chickweed (*Holosteum umbellatum*), and bur chervil (*Anthriscus vulgaris*).

Herbicides were applied postemergence to gaines winter wheat, on two application dates, in Walla Walla, Washington, early date, November 26, 1969 (wheat 2-4 leaves, weeds 2 in. diameter and 2-5 leaves), late date, February 10, 1970 (wheat one tiller, weeds 3 in. diameter and 5-7 leaves). The soil type was a Walla Walla silt loam. The plot area received approximately 15 in. of rainfall. Each treatment was one sq. rod in size, replicated three times. Herbicides applied in 40 gal. water/A. Wheat was seeded October 10, 1969. Weed control evaluations were made on March 31, 1970. Wheat was harvested on July 14, 1970.

Results (following table) show that 2 lb/A VCS438 gave satisfactory control of fiddleneck, henbit, and all other weeds except bur chervil. VCS438 1 lb/A and VCS438 1/2 lb/A plus dicamba 1/8 lb/A applied at the early date gave fair results. All other treatments gave less than satisfactory results. Two lb/A of VCS438 appears to be necessary to give season long broadleaf weed control in wheat. (Research and Development Department Velsicol Chemical Corp. Hillsboro, Oregon).

Treatment	Rate lb/A	Average Weed Control[1/]			Average yields lb/A
		Fiddleneck	Henbit	Others	
Applied November 26, 1969					
VCS438	1	8.3	9.5	8.3	4803
VCS438	2	9.0	9.8	9.0	4491
VCS438 ≠ dicamba	1/2 ≠ 1/8	7.5	8.5	8.5	4896
VCS438 ≠ dicamba	3/8 ≠ 1/8	7.0	7.6	6.6	4555
VCS438 ≠ dicamba	3/8 ≠ 1/16	6.0	5.0	5.6	4140
Check	-	.0	.0	.0	2913
Applied February 10, 1970					
VCS438 ≠ dicamba	1/2 ≠ 1/8	6.3	6.0	7.0	5268
VCS438 ≠ dicamba	3/8 ≠ 1/8	6.3	4.6	5.6	5078
VCS438 ≠ dicamba	3/8 ≠ 1/16	5.3	5.0	5.6	4783

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

Control of annual ryegrass in winter wheat in Western Oregon. Aldridge, J. C. Phillip D. Olson and Arnold P. Appleby. Annual ryegrass (*Lolium multiflorum*) is one of the most damaging weeds to profitable winter wheat production in Western Oregon. Experiments were established in the fall of 1969 at various sites in the Willamette Valley to ascertain the effectiveness of several herbicide treatments in controlling annual ryegrass. Yields, visual evaluations of weed control, and crop injury were recorded.

One experiment conducted at four different locations included preemergence treatments of CP52223 and diuron alone and in combination. These trials were established on growers' fields. Soil types were loam or clay loams with organic matter content ranging from 3.6 to 4.3 percent. Large strip plots were used to enable a more accurate appraisal of the treatments.

Data summarized in the accompanying table would indicate that the combinations of diuron and CP52223 gave superior results over the other treatments. Little difference was noted between the 0.8 lb. ai/A diuron plus 1.0 lb ai/A CP52223 treatment and the 1.5 lb ai/A diuron plus 1.6 lb ai/A CP52223 treatment. At the one location where a 3 lb ai rate of CP52223 was used, this treatment resulted in the highest yield although there was some early crop injury.

Four multi-herbicide yield trials were also conducted at various locations to compare a number of promising herbicide treatments. Treatments with the highest yields include CP52223 at 1.5 lb ai/A preemergence, CP52223 1.2 lb ai/A plus diuron 1.0 lb ai/A preemergence, diuron at 1.6 lb ai/A either pre or postemergence and norea at 1.6 lb ai/A postemergence. As in the preceding experiment, the combinations of CP52223 and diuron gave increased yields over either compound alone. (Farm Crops Department, Oregon State University, Corvallis).

Diuron - CP52223 comparisons (Western Oregon)

Location	Treatment	Material lbs ai/A	Percent wheat injury	Percent ryegrass control	Average yield bu/A
McMinnville, Oregon	CP52223	0.8	0	97.0	53.4
Yamhill County	CP52223	1.6	0	98.5	53.9
	CP52223 + diuron	1.0 + 0.8	0	98.5	66.9
	CP52223 + diuron	1.5 + 1.6	5	98.5	55.1
	diuron	1.6	0	97.0	56.9
	Check	-	-	-	15.7
Corvallis, Oregon	CP52223	0.8	0	77.5	47.1
Benton County	CP52223	1.6	2.5	92.5	71.7
	CP52223 + diuron	1.0 + 0.8	0	97.5	75.3
	CP52223 + diuron	1.5 + 1.6	2.5	98.5	74.3
	diuron	1.6	0	65.0	27.5
	Check	-	-	-	1.8
Salem, Oregon	CP52223	0.8	0	68.5	59.5
Marion County	CP52223	1.6	0	81.5	78.6
	CP52223 + diuron	1.0 + 0.8	0	91.0	100.4
	CP52223 + diuron	1.5 + 1.6	0	97.0	105.8
	diuron	1.6	0	51.0	66.5
	Check	-	-	-	12.6

(continued)

Location	Treatment	Material lbs ai/A	Percent wheat injury	Percent ryegrass control	Average Yield bu/A
Dallas, Oregon	CP52223	0.8	0	87.5	50.7
Polk County	CP52223	1.6	0	92.5	63.7
	CP52223	3.0	7.5	99.5	65.2
	CP52223 + diuron	1.0 + 0.8	0	97.0	58.8
	CP52223 + diuron	1.5 + 1.6	0	97.0	56.9
	diuron	1.6	0	67.5	45.9
	Check	-	-	-	21.8

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

Downy brome (*Bromus tectorum* L.) control in winter wheat. Hyzak, D. L. and R. L. Zimdahl. Two field experiments were established on two different dates to evaluate the effectiveness of eight herbicides for control of downy brome in winter wheat. The eight herbicides were BAY94337 (4-amino-6-t-butyl-3-(methylthio)-as-triazin-5-(4H)-one), MBR4400 (Fluroalkanesulfonanilide derivative), BAS2440 (5-amino-4-bromo-2-phenyl-3-(2H)-pyridazinone), diuron, chlorobromuron, linuron, Ansar 529 (MSMA), and terbutryn. The herbicides were applied at two rates, with or without a surfactant (X77), and as postemergence treatments in a randomized block design with four replications per treatment. All treatments were applied broadcast with water as the carrier at 20 gpa. Plot size was 6 x 30 ft. The soil texture was a loamy sand with 1.1 percent O.M., and ph of 6.8.

On the first treatment date (3/27/70), winter wheat was breaking winter dormancy, and downy brome appeared dormant with a purplish color and was 1 to 2 in. high. On the second treatment date (4/25/70), winter wheat was in the 3- to 4-leaf tillering stage and downy brome was 1 to 3 in. high. Two visual ratings of downy brome control and wheat injury were made following each application date. Wheat yield data were taken as an added measure of herbicide effectiveness.

Of the eight herbicides evaluated after the first treatment date, only BAY94337 and BAS2440 exhibited a significant response on wheat and downy brome. BAY94337 at 1.0 and 2.0 lb/A gave 100 percent downy brome control; however, it was extremely injurious to wheat resulting in a yield of 0 and 0.8 bu/A respectively. BAS2440 at 2.0 lb/A rate provided good weed control with slight wheat injury. Of all treatments from the first experiment date, BAS2440 at 2.0 lb/A rate looked most promising.

On the second treatment date, it was decided that BAY94337 at 1.0 and 2.0 lb/A rate was excessive for use as postemergence treatments in winter wheat. The rates were reduced to 0.75 and 1.5 lb/A with all other treatments remaining the same. Again, BAY94337 at 0.75 and 1.50 lb/A showed excellent downy brome control, but moderate to severe injury to wheat. Evidently the tolerance range of BAY94337 to wheat is narrow.

The wheat was more tolerant to BAY94337 after the second treatment date than after the first treatment date. This is probably due to larger and more vigorous wheat at the more mature stage. BAY94337 at 0.75 lb/A rate looked most promising.

Ansar 529 (MSMA) at 3.0 lb/A, MBR4400 at 4.0 lb/A, BAS2440 at 2.0 lb/A and linuron at 2.0 lb/A gave from 10 to 25 percent downy brome control with little or no injury to wheat. The majority of the postemergence treatments were rather ineffective. It seems very difficult to control downy brome selectively in winter wheat with postemergence herbicides. (Weed Research Laboratory, Dept. of Botany and Plant Pathology, Colo. State University, Fort Collins).

Herbicide weed control in wheat fallow in Wyoming. Lee, G. A. and H. P. Alley. Studies were conducted at the Archer Agricultural Experimental Substation at Cheyenne, Wyoming in 1970. The location consisted of predominately sandy loam soil in the A horizon and a well developed clay loam in the B horizon. The annual precipitation is 12-14 in. with the greatest amounts received in the winter months and early spring. Plots were established May 5, 1970. All treatments were replicated three times. Herbicides were applied to the soil surface in 40 gpa of water carrier on a full coverage basis. The major weed population consisted of downy bromegrass (*Bromus tectorum* L.), prostrate knotweed (*Polygonum aviculare* L.), tansy mustard (*Descurainia pinnata* (Walt.) Britt.), common lambsquarter (*Chenopodium album* L.), Russian thistle (*Salsola kali* L.) and redroot pigweed (*Amaranthus retroflexus* L.), with a lesser infestation of platte thistle (*Cirsium canescens* Nutt.), skeleton weed (*Lygodesmia juncea* (Pursh) D. Don.) and tumblegrass (*Schedonnardus paniculatus* Nutt.). Volunteer wheat was prevalent in the study area. Visual estimates of control for individual weed species were made July 24, 1970. Downy bromegrass was in the .75 to 1 in. stage of growth and tansy mustard and platte thistle were in the rosette stage at the time of herbicidal application. All other species had not emerged.

All herbicide treatments resulted in excellent control of downy bromegrass except Igran at 1.0 lb/A and atrazine + Bladex at .5 + 1.0 lb/A (table). Sumatol at 1.0 lb/A, terbacil at .75 lb/A and atrazine + dalapon at 1.0 + 3.0 lb/A did not give adequate control of prostrate knotweed; however, the higher rates of the herbicide treatments were sufficient to result in acceptable control. Atrazine + dalapon at 1.0 + 3.0 lb/A was the only treatment which did not result in 90 percent or better control of tansy mustard and common lambsquarter. BAY94337 at 1.0 lb/A and both rates of atrazine + dalapon resulted in 80 and 85 percent, respectively, of redroot pigweed present. Although Russian thistle was one of the more difficult species to control, 11 of the herbicide treatments gave 100 percent control. Platte thistle was eliminated by Tandex at 1.5 and 2.5 lb/A and BAY94337 at 4.0 lb/A. Volunteer wheat was eradicated by six of the 23 treatments. This is desirable since volunteer plants harbor disease and insects. (Wyoming Agricultural Experiment Station, Laramie, SR-288).

Percent control of weed species present on wheat fallow land, Archer Experimental Substation, Cheyenne.

Treatment	Rate lb/A	Percent Control: Downy brome-grass	Pros-trate K. weed	Tansy Must.	Lambs-quarter	Pig-weed	Russ. Thist.	Kochia	Platte Thist.	Skel-eton weed	Tumble grass	Volun-teer wheat
atrazine	.75	90	90	100	90	90	80	90	20	80	0	0
atrazine	1.0	95	95	100	95	90	85	95	30	85	10	0*
Igran[1]	1.0	85	100	100	100	100	85	90	20	85	10	0
Igran	3.0	95	100	100	100	100	90	95	25	90	20	0*
Sumatol[2]	1.0	100	80*	100	100	100	100	100	10	70*	0	20*
Sumatol	3.0	100	100	100	100	100	100	100	40	80*	10	25*
GS13529[3]	1.0	100	100	100	100	100	100	90	20	50	0	80*
GS13529	3.0	100	100	100	100	100	100	95	30	60	0	95*
terbacil	.75	100	70	100	100	100	0	0	10	40	0	98*
terbacil	1.5	100	100	100	100	100	0	80	10	20	0	100
Tandex[4]	1.5	100	100	100	100	100	100	100	100	100	100	100
Tandex	2.5	100	100	100	100	100	100	100	100	100	100	100
Bladex[5]	2.0	100	100	100	100	100	20	100	25	30	0	100
Bladex	4.0	100	100	100	100	100	100	100	55	100	10	100
BAY94337[6]	1.0	100	100	100	100	80	75	80	50	100	0	0
BAY94337	2.0	100	100	100	100	100	80	100	50	100	20	90
BAY94337	4.0	100	100	100	100	100	100	100	100	100	100	100
atrazine + Bladex	.5 + 1.0	50	90	98	95	95	90	95	80	95	15	50
atrazine + Bladex	1.0 + 1.0	98	98	100	100	100	100	100	90	95	20	90
atrazine + Igran	1.0 + 2.0	95	100	100	100	100	100	100	40	50	0	70
atrazine + Igran	1.0 + 3.0	98	100	100	100	100	100	100	50	60	0	80
atrazine + dalapon	1.0 + 3.0	98	70	80	85	85	50	85	25	40	0	60
atrazine + dalapon	1.0 + 4.0	99+	90	95	90	85	60	90	40	80	30	85

* Plants remained stunted.
1/ 2-tert-butylamino-4-ethylamino-6-methylthio-s-triazine.
2/ 2-sec.-butylamino-4-ethylamino-6-methoxy-s-triazine.
3/ 2-tert-butylamino-4-chloro-6-ethylamino-s-triazine.
4/ m-(3,3-dimethylureido) phenyl tert-butylcarbamate.
5/ 2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrite.
6/ 4-amino-6-t-bytyl-3-(methylthio)-as-triazin-5-(4H)-one.

Tolerance of four winter wheat varieties to diuron. Guneyli, E., Phillip D. Olson and Arnold P. Appleby. Four winter varieties (Druchamp, Nugaines, Yamhill, and Hyslop) were subjected to several rates of diuron at the Hyslop Research Farm, Corvallis, Oregon during 1969-1970 growth season. The objective of the experiment was to compare the tolerance of the four varieties to five rates of diuron (0, 2.4, 3.2, 4.8, and 6.0 lb ai/A).

Wheat varieties were planted at 7-in. row spacing on October 21, 1969 at 100 lb/A seeding rate. The experimental design was a split-plot with four replications. The trial received 120 lb/A fertilizer (16-20-0) at planting time. Diuron was applied preemergence on October 23, 1969. Herbicide injury on wheat and percent weed control was determined on March 23, 1970. Annual bluegrass (*Poa annua* L.), dogfennel (*Anthemis cotula* L.), common chickweed (*Stellaria media* (L.) Cyrillo), and *Brassica* spp. were the dominant weed species present during the herbicide evaluation. Wheat yields were taken on July 13, 1970 from 130 sq ft harvesting area. A bulk sample of wheat was taken from each plot to determine 1,000 seed weight. See included table for a summary of wheat injury, weed control, 1,000 seed weights, and yields.

Yamhill was more tolerant than Hyslop, Nugaines, and Druchamp to diuron at 4.8 and 6.0 lb/A. There was no significant damage to wheat at 3.2 lb/A of diuron rate. Nugaines was the most sensitive wheat variety at 6.0 lb/A diuron rate. Bluegrass, common chickweed, and mouseear chickweed (*Cerastium vulgatum* L.) were effectively controlled by 2.4 lb/A of diuron. There was an average of 21 percent yield increase at 2.4 lb/A of diuron compared to the weedy check plots.

Statistical analysis of the data indicated that there was a significant (0.05 level of probability) interaction between herbicide rates and varieties. Variety response at the same level of diuron also was highly significant (0.01 level of probability). (Farm Crops Department, Oregon State University, Corvallis).

Summary of four winter wheat varieties treated with five rates of diuron.

Variety	lb ai/A	Percent Wheat Injury	Percent Bluegrass Control	% Common Chickweed Control	1,000 Seed Weight	Yield (lb/130 sq ft)	Average Yield bu/A	Percent Yield Increase
Druchamp	0	0	0	0	42.7	13.7	76.4	0.0
	2.4	0	96	96	41.7	13.5	75.3	-1.4
	3.2	3	100	100	42.5	14.5	80.9	5.9
	4.8	19	100	100	42.9	10.6	59.1	-23.7
	6.0	32	100	100	42.5	9.1	50.7	-36.0
Nugaines	0	0	0	0	39.4	13.6	75.9	0.0
	2.4	0	96	95	38.2	16.8	93.7	23.4
	3.2	4	100	98	37.2	14.3	79.8	5.1
	4.8	57	100	100	37.2	9.4	52.4	-31.0
	6.0	67	100	100	35.7	7.8	43.5	-42.7

(continued)

Variety	lb ai/A	Percent Wheat Injury	Percent Bluegrass Control	% Common Chickweed Control	1,000 Seed Weight	Yield (lb/130 sq ft)	Average Yield bu/A	Percent Yield Increase
Yamhill	0	0	0	0	44.6	16.3	90.9	0.0
	2.4	0	97	98	45.2	19.9	111.0	22.1
	3.2	0	99	100	45.3	18.1	101.0	11.1
	4.8	10	100	100	44.8	14.0	78.1	-14.1
	6.0	20	100	100	43.8	14.0	78.1	-14.1
Hyslop	0	0	0	0	41.2	16.0	89.3	0.0
	2.4	0	98	97	40.5	19.4	108.2	21.1
	3.2	0	100	100	39.7	18.4	102.7	15.0
	4.8	16	100	100	39.8	15.9	88.7	-0.7
	6.0	51	100	100	39.4	9.4	52.4	-41.3

Planting Date: October 21, 1969
Evaluation Date: March 23, 1970
Irrigation: (30-40 inches of rainfall)
Fertilizer: 120 lb at planting (16-20-0)
Soil Type: clay loam
Organic Matter: 3.25%
C.V.= 16%

Effects on wheat rotated to dicamba treated cropland. Collins, R. L. This study was initiated to determine the effects of dicamba on subsequent crops. Application was at a time when dicamba would normally be used for perennial weed control and during the fallow periods between crops.

Treatments were applied to the soil, previously planted to potatoes, on October 22, 1969, at Moses Lake, Washington. Soil type was Ritzville silt loam. Treatments were replicated three times and were four sq rods in size. Dicamba was applied in 40 gal water per acre. Nugaines winter wheat was seeded December 15, 1969. The plot area was sprinkler irrigated. The wheat showed no apparent injury symptoms on April 1 and 29, 1970. Injury symptoms noted on June 9, 1970 were principally reduced plant height, decumbancy, and some thinning of stand at the highest rate. Wheat was harvested on August 11, 1970. (Research and Development Dept. Velsicol Chemical Corp. Hillsboro, Oregon).

Treatment	Rate lb/A	Average[1/] Visual Effects	Average Yield lb/A
dicamba	2	1.0	11,030
dicamba	4	1.8	10,060
dicamba	6	2.3	7,350
Check	--	1.0	11,060

[1/]Visual effects June 9, 1970, 1 = no effect, 10 = complete elimination

Preventing a break at thinning time in full-season weed control in sugar beets. Dawson, J. H. Cycloate, introduced into the soil before planting sugar beets, usually controls 95 to 100 percent of barnyardgrass (*Echinochloa crusgalli* (L.) Beauv.), and 70 to 90 percent of common lambsquarters (*Chenopodium album* L.), nightshade (*Solanum* spp.), and certain other broadleaf weeds. Phenmedipham, applied to foliage after weeds and sugar beets have emerged, kills many broadleaf weeds. Excellent weed control from planting to thinning of sugar beets (Period I) results when both cycloate and phenmedipham are used.

Phenmedipham only kills emerged weeds; it has essentially no residual activity in the soil. If any cycloate remains in the soil at thinning time, the thinning operation terminates its effect by dispersing the treated soil and exposing untreated soil in the rows. Consequently, the cycloate-phenmedipham program does not control weeds from seeds that germinate after thinning.

Weeds that emerge from thinning to layby of sugar beets (Period II) can be controlled by incorporating trifluralin into the soil with a flex-tine harrow and by additional flex-tine harrowings after application.

Trifluralin and the flex-tine harrow do not control emerged weeds effectively. Consequently, if too much time elapses between the application of phenmedipham and the application of trifluralin, weeds may emerge and survive. During this interval, the sugar beets are normally cultivated between the rows, the crop is thinned, and irrigation water is applied. The time required for these operations may delay the application of trifluralin, and a break in full-season weed control may result.

An experiment was conducted at Prosser, Washington in 1970 to evaluate several treatment schedules in an effect to prevent a gap in weed control between Periods I and II.

In all schedules, cycloate at 3 lb/A was injected into the soil when the sugar beets were planted to form a treated band 4½ inches wide and a band of phenmedipham was applied postemergence at 1 lb/A. Trifluralin was broadcast at 1/2 lb/A and incorporated with a power driven flex-tine harrow near thinning time. The soil was harrowed 2 or 3 additional times during the 2 to 4 weeks after trifluralin was applied.

In all schedules, the herbicides controlled weeds effectively. When 10 to 20 days passed between applications of phenmedipham and trifluralin, some weeds emerged during the interim and escaped control. When the sugar beets were thinned within 7 days after application of phenmedipham, and when trifluralin was applied within 2 days after thinning, all weeds were controlled.

The treatments were most effective when trifluralin was applied before the sugar beets were thinned. In such schedules, control measures for Period I and Period II overlapped, and a break in weed control could not occur. Flexibility in timing all operations was increased. Thinning, inter-row cultivation, and irrigation could be scheduled efficiently and conveniently without concern for weeds within the rows, because they were always under control. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and Washington State University College of Agriculture cooperating. Irrigated Agriculture Research and Extension Center, Prosser, Washington).

Preemergence herbicides on sugar beets, 1969-70. Sullivan, E. F. and L. T. Fagala. Logarithmic evaluations of preemergence herbicides on sugar beets were made at three locations in Colorado and Kansas. The sprayer had a 23.5 ft half-dosage distance. Delivery was 14.1 gpa in a 7-inch band. Soil (silty clay to clay loam), moisture conditions, and infestants varied somewhat among locations and years. Precipitation was supplemented with irrigation to promote germination and chemical activity. Plant counts were made five to six weeks after treatment which occurred in April. Standard methods were used in application, observation and analysis of results. Average data for selected treatments are reported herein as percentages of the untreated controls (Tables 1 and 2). In general, these results reveal performance to be equal to or better than results obtained from preplanting herbicides. Preemergence application in furrow irrigated regions offers much promise for reliable chemical weeding in the absence of soil incorporation. Additional investigations are needed particularly with new compounds and combinations including sequence application. (Contribution of the Great Western Sugar Company, Research Division, Agricultural Experiment Station, Longmont, Colorado. Published with the approval of the Director as Abstract No. 12-H, Journal Series).

Evaluation of postemergence herbicides for weed control in sugar beets. Orr, Jack P. and Robert F. Norris. A postemergence trial was established in Sacramento County, California to study the effectiveness of a late spring application of several herbicides for weed control in sugar beets. Treatments consisted of three rows 20 feet in length and were replicated four times. The herbicides were applied in 30 gpa of water carrier, except for one 90 gpa treatment, on a full coverage basis. The treatments were made May 4, 1970 on cycloate treated sugar beets in the 2-4 leaf stage. The weed species were in the 2 to 4 leaf stage and consisted of prostrate knotweed (*Polygonum aviculare* L.), redroot pigweed (*Amaranthus retroflexus* L.), barnyardgrass (*Echinochloa crusgalli* L.), mustard (*Brassica* spp.). and dogfennel (*Anthemis cotula* L.). Temperatures the day of the application and days following were in the 80-85^{o} range.

Phenmedipham at 0.75 lb/A resulted in the best weed control and crop tolerance. Higher rates of phenmedipham, although giving better weed control, was increasingly toxic to the sugar beets. Increased weed control was obtained, without increased crop injury when 90 gpa of carrier was used instead of 30 gpa at the 1.5 lb/A rate. Under

Table 1. Abridged summary of the average effects of preemergence herbicides applied at a variable rate at Goodland, Kansas and Longmont, Colorado, spring, 1969 (Experiment 4, 2 replications each site)

Herbicide[1/]	lb/A active variable	Pt. pt. ft.	Beet retard. %	Beet stand %	Weed Control: Pigweed %	Kochia %	Lambs-quarters %	Other %	Brdlv. %	Grass %	Avg. %
BAS2430 + CP52223	8 + 6	53	17	80	99	91	94	86	95	95	95
BAS2430 + TCA	12 + 8	62	14	75	100	98	100	73	96	90	93
CP52223	12	65	42	75	95	64	64	80	83	99	91
BAS2430	12	62	16	90	88	89	77	100	88	91	89
BAS2430 + endothall-283	12 + 8	53	14	81	82	94	96	84	93	80	87
Pyrazon	12	47	17	81	88	79	87	90	84	80	82
R11913	6	64	30	80	97	94	85	81	92	36	64
Plant counts/sq ft, untreated				4.6	11.7	3.7	4.1	3.3	23.5	16.8	40.3

[1/] Chemical names for coded compounds are: 1-phenyl-4-(a-hydroxy-B,B,B-trichloroethylamino)-5-bromo-pyridazone-6, BAS-2430; 2-chloro-N-(isobutoxymethyl)-2',6'-acetoxylidide, CP52223; and 3-hydroxy-propionanilide isopropyl carbamate, R11913.

Table 2. Abridged summary of the average effects of preemergence herbicides applied at a variable rate at Ovid and Longmont, Colorado, spring, 1970 (Experiment 204, 2 replications each site)

Herbicide[1]	lb/A active variable	Opt. pt. ft.	Beet retard %	Beet stand %	Weed Control: Pigweed %	Kochia %	Lambs-quarters %	Other %	Brdlv. %	Grass %	Avg. %
Pyrazon + NC8438	12 + 8	75	5	105	94	83	91	100	92	100	96
Pyrazon + CP52223	12 + 4	33	11	80	94	81	89	73	89	95	92
Pyrazon + TCA	12 + 15	30	9	90	95	66	93	97	91	91	91
CP52223 + R11913	6 + 3	47	17	85	96	70	89	88	90	92	91
Pyrazon + TCA + CP52223	10 + 8 + 2	40	12	94	93	71	74	91	87	88	88
Pyrazon + M3447	12 + 12	41	13	90	76	47	92	91	75	64	70
Pyrazon + endothall-283	12 + 8	37	16	101	79	46	84	100	77	38	58
Plant counts/sq ft, untreated				7.7	29.4	7.5	6.4	5.5	50.1	27.0	77.1

[1]Chemical names for coded compounds are: X-(2,2,2-trichloroethyl)styrene, M3447; and 2-ethoxy-2,3-dihydro-3,3-dimethyl-5-dimethyl-5-benzofuranyl methanesulphonate, NC8438. Pyrazon + NC8438 applied at Ovid only.

conditions of this trial phenmedipham provided considerably better control of barnyardgrass than dalapon which gave poor control at 2.2 lb/A. Adding 2.2 lb/A dalapon to phenmedipham at 0.75 lb/A increased weed control slightly, however sugar beet injury was increased. The plants tended to grow out of this initial injury. Pyramin-plus, although not injuring the sugar beets, provided inadequate weed control. The tank-mix of pyrazon and dalapon gave slightly better control of knotweed and mustard, but was poor on redroot pigweed, dogfennel and barnyardgrass. The use of phytobland oil, Orchex N795, as a spray adjuvant for pyrazon plus dalapon improved the weed control, particularly of mustard and dogfennel, however the sugar beet stand was reduced severely. EP475 in this trial, although providing better pigweed and mustard control, would appear overall no better than phenmedipham. In many treatments where there was an early vigor reduction to sugar beets, they out-grew this and there was no significant difference in yields. (Cooperative investigations of University of California Agricultural Extension Service, Sacramento County and the Botany Department, University of California, Davis).

Evaluation of new herbicides for weed control in furrow irrigated sugar beets. Norris, Robert F. Several good herbicides are currently used in sugar beets in California, but due to the wide variation in cropping conditions there are still many situations for which no satisfactory herbicide(s) exist. A program is therefore maintained to assess new herbicides for selectivity and weed control in this crop.

Two logarithmic screening trials were conducted in 1970. One in a sandy loam soil at Woodland, started on May 13 and 14, and one at Tracy in a clay soil, and started on July 16. Both were applied preplant incorporated (John Deere curved tooth tiller set 2.5 in. deep) and preemergence using a tractor mounted power sprayer, applying 100 gpa. Chemicals, starting rates, and weed species controlled are shown in the accompanying table.

The following discussion summarizes some of the more important findings. Unless otherwise noted, all discussion is for the preplant incorporated treatments due to their being much more effective, in general, than the preemergence treatments.

NC8438 was the most promising new compound. Commercially acceptable beet stands grew at 10.0 lb/A or less, and no injury could be detected at rates of less than 5.6 lb/A in the sandy loam, and at 10.0 lb/A in the clay. Barnyardgrass control was good, equalling that of cycloate, but was not as good as CP52223 or cycloate/EPTC. Broadleaf weed control was generally good, being 95 percent or better at rates of from 1.5 to 2.5 lb/A. This compound, in these and other tests, appears particularly active on redroot pigweed.

Postemergence weed control in sugar beets

Treatment	6/12/70 Sugar beet Stand	6/12/70 Sugar beet Vigor	10/30/70 Sugar beet Stand	10/30/70 Sugar beet Vigor	Percent Control: Knot-weed	Mustard	Redroot Pigweed	Dog-fennel	Barnyard-grass	Yield[1/] (T/A)	Plants per acre
Pyramin plus 80W 12 lb product/A	10.0	8.0	9.0	9.5	5.3	5.8	7.3	8.0	5.8	21.1	25,454
Pyrazon 80W 4 + Dalapon 2.2 85% Salt	9.8	8.5	10.0	10.0	7.5	7.3	6.3	6.5	4.3	33.6	29,090
Pyrazon 80W 4 + Dalapon 2.2 + Orchex 1.5 gpa	8.8	5.4	7.0	8.6	6.5	8.8	7.3	8.5	5.3	19.0	20,000
phenmedipham 1.3E 0.75	9.3	8.3	10.0	10.0	7.8	6.8	7.3	9.8	7.5	31.0	34,090
phenmedipham 1.3E 1.5	7.3	4.3	6.4	9.1	8.1	8.8	7.6	9.8	8.5	21.0	18,181
phenmedipham 1.3E 3.0	5.8	2.8	7.9	8.8	8.8	9.8	8.1	10.0	7.5	20.0	22,272
phenmedipham 1.3E 0.75 + Dalapon 2.0 85% Salt	7.8	6.0	8.8	9.3	7.5	9.3	7.5	9.8	8.3	22.0	25,000
EP475 1.3E 0.75	9.2	7.7	10.0	10.0	7.0	8.7	8.7	7.2	6.5	26.0	32,727
EP475 1.3E 1.5	8.2	4.7	7.7	9.3	7.8	9.7	8.2	9.5	7.2	23.0	28,636
phenmedipham 1.3E 1.5 90 gpa	7.2	6.2	7.7	9.0	8.3	9.2	8.5	10.0	9.2	25.0	21,818
Check	10.0	10.0	10.0	10.0	0	0	0	0	0	25.0	28,181

[1/] No significant difference in yield at the 5% level.

M3447 needed incorporation to produce any useful effect. It was fairly selective on the sugar beets, but did not provide particularly good weed control. It definitely appeared weaker on broadleaved weeds.

CP52223, as in previous years, gave excellent barnyardgrass control and good broadleaf control, except for purslane in the clay soil. It was injurious to sugar beets at the higher rates, but due to the low rates required for good weed control would be selective on sugar beets. It was the only chemical that showed appreciable activity used pre-emergence under the conditions of these trials. Mixing pyrazon with CP52223 1:1 reduced the overall effectiveness of the latter. Sugar beet injury was less, but so was weed control. No explanation can be given for this.

Cycloate provided good grass control at 2.5 lb/A in the light soil, but required 4.5 to 5.0 lb/A in the clay soil. Sugar beet injury was not severe. Using a 2:1 package mix of cycloate:EPTC markedly increased sugar beet injury; it also improved weed control.

Pyrazon gave essentially no grass control, but at the 4.0 lb/A rate did provide good broadleaf weed control. Sugar beet injury was not excessive. BAS3501 did not appear to offer any advantage over pyrazon in these trials.

RH315 and BAS3870 were not selective on sugar beets. IMC3950 gave only weak weed control, and appeared to be better preemergence than preplant incorporated.

Ratings were made at both 3 and 4½ weeks from treating at Tracy. Cycloate ratings declined slightly during this period. Weed control with CP52223 and NC8438 remained constant or improved. (Department of Botany, University of California, Davis).

Logarithmic screening trials - sugar beets

			Woodland trial 6/10/70 95% control			Tracy trial 8/17/70 95% control			
Herbicide	Rate		Beet stand.	Barnyard grass	Pigweed	Beet stand.	Barnyard grass	Pigweed	Purslane
Pyrazon	16	PE	14.6	14.6	10.0	16.0	16.0	16.0	13.3
		PP	9.0	12.0	-	16.0	16.0	2.3	3.2
Cycloate	16	PE	14.0	7.6	4.5	16.0	15.3	6.6	9.6
		PP	11.5	2.4	-	13.3	5.3	3.5	7.6
Cycloate/ EPTC	16/ 8	PE	15.0	5.1	6.5	16.0	11.5	10.6	11.5
		PP	4.3	1.0	-	3.8	1.2	1.2	2.2
CP52223	16	PE	5.8	2.6	3.0	16.0	11.8	5.9	15.5
		PP	3.3	1.0	1.5	11.1	0.5	3.2	10.0

(continued)

Herbicide	Rate		Woodland trial 6/10/70 95% control Beet stand.	Barn yard grass	Pig-weed	Tracy trial 8/17/70 95% control Beet stand.	Barn yard grass	Pig-weed	Purs-lane
CP52223/	16/	PE	9.5	5.3	3.0	16.0	12.6	10.0	8.6
pyrazon	16	PP	5.0	1.8	1.8	11.5	5.3	6.5	4.8
M3447	16	PE	16.0	15.6	11.0	16.0	15.3	13.3	16.0
		PP	6.6	3.8	2.2	15.3	2.5	13.3	16.0
M3447/	16/	PE	13.6	13.4	13.0	16.0	15.6	10.3	13.3
pyrazon	16	PP	9.6	10.6	3.6	13.3	4.0	4.5	4.3
BAS3501 H	16	PE	16.0	16.0	7.5	16.0	16.0	11.0	10.3
		PP	6.5	7.3	-	16.0	13.3	7.7	4.0
BAS3870	16	PE	6.6	10.0	2.7	15.0	9.6	10.0	8.4
		PP	1.5	1.3	1.5	8.0	2.6	5.0	3.5
BAS3870/	4/	PE	15.3	16.0	7.0	16.0	15.3	15.3	13.0
pyrazon	16	PP	9.0	9.0	-	11.3	8.6	4.0	5.1
NC8438	16	PE	14.0	11.0	2.6	14.3	12.0	3.6	3.0
		PP	9.6	2.8	1.0	12.6	5.6	2.6	1.8
RH315	16	PE	5.0	12.0	1.5	-	-	-	-
		PP	1.2	2.6	-	-	-	-	-
IMC3950	16	PE	-	-	-	16.0	10.6	5.8	9.5
		PP	-	-	-	15.3	15.6	13.6	14.0
Untreated		PE	16.0	16.0	9.0	16.0	16.0	14.6	16.0
Check		PP	16.0	16.0	15.0	16.0	16.0	14.6	16.0

All data are mean of 3 replications.
PE - preemergence application; PP - preplant incorporated application.
Beet stand is lb/A below which stand was commercially acceptable
95% weed control is lb/A above which weed control was 95% or better.
Rate - is lb/A starting rate.

<u>Soil bioassays for soil residual activity of herbicides used for weed control in corn and milo.</u> Norris, Robert F. The types of rotations used in California result in crops such as cereal grains, sugar beets, tomatoes, etc. following a crop of corn or milo. The longer persistent herbicides commonly used in these crops in other parts of the country can result in injury to these succeeding crops. This necessitates that the possibility of soil residual activity of corn or milo herbicides be investigated. Bioassays provide one method of obtaining this needed information.

Soil was collected from field trial sites at the end of the cropping season; after harvest, but before discing or ploughing. The Stanislaus trial was applied postemergence to a milo crop on a heavy clay soil. Irrigation was by furrow. Samples were 2 in. deep from the top of the bed; the point considered most likely to contain residues under furrow irrigated conditions. The Contra Costa trials was applied preplant incorporated (3 in. deep) to corn in a clay soil; again furrow irrigated. Soil samples were similar to those from the Stanislaus trial. The Sutter trial was applied postemergence to milo on an alluvial silty soil, which was never surface irrigated; the soil surface remained dry between treatment and harvest except for one very light shower. The surface 2 in. of soil were collected for bioassay. A delay for 2 to 6 weeks occurred between sample collection and greenhouse bioassay. The soil was screened to remove debris and placed in 4 in. deep metal flats. Subirrigation was employed to minimize leaching. The test plants were allowed to grow for four weeks.

Atrazine, at the rates tested, showed sufficient residual activity in the soil at the end of the crop season to injure all test species, except wheat which was only significantly reduced after 3.0 lb/A treatments. X77 of Orchex N795 in the original spray mix did not seem to influence atrazine soil persistence.

GS14260 did not show significant residual effects except on sugar beets at 3.0 and 4.0 lb/A. This was considered particularly significant for soil from the Sutter trial with its lack of soil moisture at the surface during the cropping season.

Alachlor, butylate and SD15418, at the rates tested, did not show any residual effects at the time of sampling. S6115 did show definite activity remaining, although not quite equal to that of atrazine.

Bioassay plants in several of the herbicide treated soils grew significantly (0.05 level) better than those in the nontreated checks. This increased growth was easily detected by eye when the plants were growing, in addition to being reflected in the data for fresh weight per plant. Examples of this were seen for tomatoes in GS14260 from Stanislaus; tomatoes, in alachlor, butylate, SD15418 and GS14260 from Contra Costa, and sugar beets in alachlor, butylate and SD15418 treated soil from Contra Costa. No attempt has been made to determine the cause(s) for such an increase. (Department of Botany, University of California, Davis).

Evaluation of herbicide combinations in field corn in Wyoming. Lee, G. A., H. P. Alley, and R. D. Kukas. A corn herbicide trial was established to evaluate several combinations of herbicides under Wyoming climatic conditions. Preemergence treatments were replicated three times and applied on May 11, 1970. All treatments, unless specified, were incorporated to a depth of 1 to 1½ in. by going over the treated area twice with a flextine harrow. Herbicides were applied in 40 gpa of water.

Soil residual bioassay

Herbicide	Rate lb/A	Kidney beans Plant no.	Kidney beans Fr wt /plant.	Radish Plant no.	Radish Fr wt /plant.	Tomato Plant no.	Tomato Fr wt /plant.	Sugar beet Plant no.	Sugar beet Fr wt /plant.	Wheat Plant no.	Wheat Fr wt /plant.
Stanislaun - 1968. Treated 7/5/68, soil samples collected 11/1/68 (3 replications).											
atrazine	3.0	18	2.64a	4	0.03a	0	0.00a	0	0.00a	16	0.07a
atrazine - 0.5% X77	3.0	18	2.37a	0	0.00a	0	0.00a	0	0.00a	17	0.04a
atrazine - Orchex[1]	3.0	17	1.74a	0	0.00a	0	0.00a	0	0.00a	17	0.02a
GA244	3.0	17	2.43a	4	0.05a	0	0.00a	0	0.00a	16	0.07a
GS14260	3.0	20	5.47b	17	0.84b	20	0.31c	2	0.12b	17	0.53b
Untreated check	-	18	4.84b	19	0.76b	20	0.19b	10	0.34c	18	0.49b
Contra Costa - 1969. Treated 6/19/69, soil samples collected 10/18/69 (3 replications).											
atrazine	2.0	12	7.04a	24	0.27a	29	0.08a	6	0.10a	30	0.40a
alachlor	4.0	12	8.67abc	37	1.03b	36	0.21cd	36	0.31bc	26	0.51a
butylate	4.0	12	10.96c	37	1.39b	35	0.26d	43	0.32bc	33	0.54a
SD15418	4.0	12	9.03abc	36	1.20b	40	0.22cd	39	0.35c	25	0.56a
GS14260	2.0	12	9.62bc	41	1.09b	35	0.19cd	37	0.24abc	30	0.51a
S6115	2.0	13	7.20ab	25	0.45a	32	0.13ab	17	0.10a	24	0.39a
Untreated check	--	12	7.59abc	39	1.00b	38	0.15ab	39	0.19ab	25	0.35a
Sutter - 1969. Treated 7/9/69, soil samples collected 10/29/69 (4 replications).											
atrazine	1.0	12	8.62a	26	0.52a	21	0.12a	13	0.10a	30	0.40a
GS14260	2.0	12	9.83b	35	1.89b	38	0.29b	33	0.31b	28	0.56a
GS14260	4.0	12	9.35b	38	1.53b	35	0.28b	22	0.16a	26	0.57a
Untreated check	-	12	10.00b	36	1.78b	33	0.35b	29	0.30b	35	0.51a

[1]/Orchex N795 used at 1.5 gpa

All data are means of the indicated number of replications. Data within a column and date followed by different letters are significantly different at the 0.05 level.

carrier on a full coverage basis. The study site consisted of a sandy loam soil containing 70.8 percent sand, 10.5 percent silt, 18.7 percent clay and 1.26 percent organic matter. The weed population was black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.), kochia (*Kochia scoparia* (L.) Roth), purslane (*Portulaca oleracea* L.) and green foxtail (*Setaria viridis* (L.) Beauv.). Percent weed control was obtained by actual counts of individual weed species and compared to the number of plant present in the nontreated check.

Bladex + butylate at 2.0 + 3.0 lb/A and Bladex + alachlor at 1.5 + 2.0 lb/A resulted in 99.9 percent total average control; however, the Bladex + alachlor at 1.5 + 2.0 lb/A treatment reduced the corn stand to 87.8 percent of the check (table). There were eight additional combination treatments which resulted in 99.0 percent or better total average control of the weed species present. Although the 10 treatments which gave 99.0 percent or better total average control eliminated nearly all of the broadleaf weed spectrum, none of these 10 combination achieved 100 percent control of green foxtail. GS13529 + alachlor at .75 + 1.5 lb/A was the only combination which eliminated all the grassy weeds present. All treatments except atrazine + simazine at .37 + .37 lb/A gave 90.6 percent or better control of green foxtail. Corn stands were reduced to 87.8 percent, 84.6 percent and 86.3 percent by Bladex + alachlor at 1.5 + 2.0 lb/A, atrazine + simazine .37 + .27 lb/A and GS13529 + alachlor at .75 + 1.5 lb/A, respectively.

This study illustrates the effectiveness of herbicide combinations for weed control in field corn. The reduced rates of individual residual herbicides decreased the potential of phytotoxic damage to subsequent susceptible crops while effectively controlling a broad spectrum of weed species. (Wyoming Agricultural Experiment Station, Laramie, SR-285).

Weed control in corn in Wyoming. Lee, G. A., H. P. Alley and R. D. Kukas. Studies were conducted at the Torrington Agricultural Substation to determine the performance of individual herbicides in field corn under Wyoming climatic conditions. The preemergent treatments were established on May 11, 1970. Each treatment was replicated three times and incorporated to a depth of 1 to 1½ in. with a flextine harrow unless otherwise specified. The herbicides were applied in 40 gpa of water carrier. The weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), kochia (*Kochia scoparia* (L.) Roth), common lambsquarter (*Chenopodium album* L.), purslane (*Portulaca aleraceae* L.) and green foxtail (*Setaria viridis* (L.) Beauv.). Weed control was determined by counting individual weed species in an area 5 ft. x 6 in. over the corn row and comparing to numbers of weeds in the nontreated check plots.

Bladex at 3.0 lb/A, Outfox at 1.0 lb/A and atrazine flowable formulation at .75 lb/A resulted in 99.2 percent, 99.1 percent and 98.6 percent total average control of weed species present, respectively (table).

Percent control of weed species with herbicide combinations in field corn

Treatment	Rate lb/A	Corn % stand	Percent Control: Night shade	Redroot pigweed	Lambs-quarter	Kochia	Purslane	Green foxtail	Total average	Ranking
Bladex[2] + butylate	1.5 + 3.0	97.4a[1]	98.2a	100.0a	100.0a	100.0a	100.0a	99.7a	99.7	5
Bladex + butylate	2.0 + 3.0	100.0a	100.0a	100.0a	100.0a	100.0a	100.0a	99.3a	99.9	2
Bladex + alachlor	1.5 + 2.0	87.8b	100.0a	100.0a	100.0a	100.0a	100.0a	99.7a	99.9	1
Bladex + alachlor	2.0 + 2.0	94.3a	98.5a	97.6a	100.0a	100.0a	100.0a	95.0a	98.5	12
Bladex + atrazine	1.5 + .5	94.4a	100.0a	100.0a	100.0a	100.0a	100.0a	98.3a	99.7	4
Bladex + propachlore	1.5 + 3.0	93.6a	100.0a	100.0a	100.0a	100.0a	100.0a	94.7a	99.1	9
alachlor + atrazine	1.5 + .75	97.4a	100.0a	100.0a	100.0a	100.0a	100.0a	99.0a	99.8	3
propachlor + atrazine	2.4 + 1.0	94.9a	99.1a	100.0a	100.0a	100.0a	100.0a	91.0a	98.3	14
propachlor + atrazine	2.4 + .75	94.9a	100.0a	100.0a	100.0a	100.0a	100.0a	90.6a	98.4	13
atrazine + simazine	.37 + .37	84.6b	91.5a	97.6a	100.0a	100.0a	100.0a	72.5b	93.6	17
atrazine + simazine	.5 + .5	91.0a	99.7a	100.0a	100.0a	100.0a	100.0a	94.5a	99.0	10
GS13529[3] + propachlor	.75 + 2.4	91.7a	93.7a	86.5a	100.0a	100.0a	100.0a	91.1a	95.2	16
GS13529 + alachlor	.75 + 1.5	86.3b	94.6a	97.6a	100.0a	100.0a	100.0a	100.0a	98.7	11
Outfox[4] + butylate	.5 + 3.0	95.9a	100.0a	100.0a	100.0a	100.0a	100.0a	97.3a	99.5	7
Outfox + butylate	1.0 + 2.0	92.3a	100.0a	100.0a	100.0a	100.0a	100.0a	96.4a	99.4	8
Outfox + alachlor	.5 + 2.5	93.6a	96.7a	88.9a	100.0a	100.0a	100.0a	93.9a	96.6	15
Outfox + alachlor	1.0 + 2.0	92.0a	100.0a	100.0a	100.0a	100.0a	100.0a	97.9a	99.7	6

1/ Means with the same letter are not significantly different at the .05 level.

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

3/ 2-test-butylamino-4-chloro-6-ethylamino-s-triazine.

4/ 2-chloro-4-cyclopropylamino-6-isopropylamino-1,3,5-triazine.

Bladex at 3.0 lb/A, the three formulations of atrazine at .75 lb/A and Outfox at .5 lb/A and 1.0 lb/A eliminated all broadleaf weed species present. Comparisons of atrazine formulations indicates that the flowable formulation designated as blue top resulted in slightly better total average weed control than either the flowable formulation designated as white top or the standard wettable powder. The blue top formulation was the only atrazine treatment which gave acceptable control of green foxtail. Bladex at 1.5 lb/A, 2.0 lb/A and 3.0 lb/A gave 97.7 percent, 98.2 percent and 99.2 percent total average control of the weed species, respectively. The insignificant differences existing between the 1.5 lb/A and 3.0 lb/A rates indicate that the higher rate is not necessary for effective weed control on sandy loam soils in Wyoming. Although both rates of Outfox were effective on the broadleafed weed spectrum, the 1.0 lb/A rate was required to give above 90 percent control of green foxtail. Propachlor at 5.0 lb/A did not effectively control black nightshade, redroot pigweed, common lambsquarter, or purslane. Alachlor at 2.5 lb/A did not result in acceptable control of common lambsquarter. GS13529 at 1.5 lb/A was required to give effective total average control of the weed species present. Butylate at 4.0 lb/A was weak on black nightshade, redroot pigweed and green foxtail. Bay88410 at .25 lb/A, .50 lb/A, and 1.0 lb/A resulted in progressively severe phytotoxic symptoms to the corn plants. Plots treated with the 1.0 lb/A rate contained only a 56.3 percent stand of corn and the remaining plants were severely necrotic and stunted. (Wyoming Agricultural Experiment Station, Laramie, SR-287).

Activation of alachlor for annual grass control in corn. Colbert, D. R., Floyd O. Colbert and Arnold P. Appleby. In 1970 two sweet corn experiments were established in Western Oregon to evaluate the effectiveness of alachlor for control of annual grasses using Japanese millet (*Echinochloa frumentacea*) as the test species. Alachlor was applied in both experiments at three rates 1, 2, and 3 lb ai/A.

In the first experiment alachlor was applied under the following conditions: (1) application on a wet soil surface versus a dry soil surface, and (2) two methods of application (preemergence versus incorporation). Approximately 0.33 in. of water was applied by a garden sprinkler to the soil surface in the wet treatments prior to the application of alachlor. Two methods of incorporation were used. Shallow incorporation was accomplished with a spiketooth harrow to a depth of one in. A rototiller was used for incorporation to a depth of three in. Approximately 1½ in. of sprinkler irrigation was applied three days after the herbicide application.

Summary of Results

Dry Soil Surface - Incorporation of alachlor at the 1 and 2 lb ai/A rate by harrowing was slightly better than rototilling to a depth of three in. At the 3 lb ai/A rate they were comparable. When applied preemergence, the 2 lb ai/A rate gave satisfactory millet control with excellent control at the 3 lb ai/A rate.

Percent control of weed species with herbicides in field corn

Treatment	Rate lb/A	Corn % stand	Percent Control: Night-shade	Redroot pigweed	Lambs-quarter	Kochia	Purslane	Green foxtail	Total average	Ranking
butylate	4.0	93.6a[1]	78.1a	77.8a	91.1a	100.0a	100.0a	87.7a	89.3	11
Bladex[2]	1.5	94.6a	98.2a	97.6a	100.0a	100.0a	100.0a	90.6a	97.7	6
Bladex	2.0	98.7a	99.1a	97.6a	100.0a	100.0a	93.3a	98.9a	98.2	4
Bladex	3.0	95.5a	100.0a	100.0a	100.0a	100.0a	100.0a	95.4a	99.2	1
propachlor	5.0	93.6a	65.4b	50.0b	29.2c	100.0a	60.0b	95.2a	66.6	18
alachlor	2.5	91.0a	95.2a	100.0a	83.3a	100.0a	100.0a	97.1a	95.9	9
atrazine (Blue top flowable)	.75	92.3a	100.0a	100.0a	100.0a	100.0a	100.0a	91.4a	98.6	3
atrazine (White top flowable)	.75	96.2a	100.0a	100.0a	100.0a	100.0a	100.0a	79.7b	96.6	7
atrazine (W.P. Form.)	.75	94.9a	100.0a	100.0a	100.0a	100.0a	100.0a	72.1c	95.4	10
GS13529[3]	.75	91.0a	63.0b	64.3b	66.7b	100.0a	66.7b	73.3c	72.2	16
GS13529	1.5	96.2a	99.7a	86.5a	100.0a	100.0a	100.0a	91.9a	96.4	8
AC78126[4]	1.0	90.3a	85.8a	59.5b	66.7b	66.7b	66.7b	83.9b	71.5	17
AC78126	2.0	89.5a	93.5a	64.3b	95.2a	93.3a	100.0a	80.9b	87.9	12
Outfox[5]	.5	94.9a	100.0a	100.0a	100.0a	100.0a	100.0a	88.9a	98.2	5
Outfox	1.0	92.1a	100.0a	100.0a	100.0a	100.0a	100.0a	94.7a	99.1	2
BAY88410[6]	.25	86.5a	63.5b	61.9b	100.0a	100.0a	100.0a	93.2a	86.4	14
BAY88410	.50	76.9b	54.1b	57.1b	100.0a	100.0a	66.7b	93.6a	78.6	15
BAY88410	1.0	56.3c	74.3a	65.1b	100.0a	100.0a	100.0a	87.8a	87.9	13

[1] Means with the same letter are not significantly different at the .05 level.
[2] 2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrite.
[3] 2-tert-butylamino-4-chloro-6-ethylamino-s-triazine.
[4] Name unavailable.
[5] 2-chloro-4-cyclopropylamino-6-isopropylamino-1,3,5-triazine.
[6] 4-amino-6-isopropyl-3-(methylthio-as-triazin-5-(4H)-one.

Wet Soil Surface - At the 1 lb ai/A rate, alachlor applied preemergence or incorporated by harrowing gave good millet control. Excellent control was obtained from the 2 and 3 lb ai/A rate of alachlor when applied either as a preemergence treatment or incorporated.

In the second experiment alachlor was evaluated under these conditions (1) preemergence versus incorporation by rototilling to a depth of 2 in., and (2) timing of first irrigation after herbicide application. Sprinkler irrigation was applied three days versus twenty days after herbicide application. The amount of moisture applied was 1½ in.

Summary of Results

Irrigation three days after alachlor application - Preemergence applications of alachlor at the 1 lb ai/A rate gave satisfactory millet control with the 2 and 3 lb ai/A rate giving excellent control. Incorporation by rototilling to a depth of two in. gave excellent millet control with the 2 and 3 lb ai/A rate. While the 1 lb ai/A rate gave poor control.

Irrigation twenty days after alachlor application - Because of late herbicide activation, all preemergence applications of alachlor resulted in poor millet control. Incorporation of alachlor at the 2 and 3 lb ai/A rate by rototilling to a depth of two in. gave excellent millet control. (Farm Crops Department, Oregon State University, Corvallis).

Effect of various mechanical incorporation methods on the activity of field bean herbicides. Lee, G. A., H. P. Alley and G. A. Stephenson. A study was initiated at the Torrington Agricultural Substation to determine the most effective mechanical incorporation method and/or methods for the herbicide or combination of herbicides being utilized for weed control in field beans. The location consisted of a sandy loam soil (70.8 percent sand, 10.5 percent silt, 18.7 percent clay and 1.25 percent organic matter). Herbicide treatments were applied with a truck mounted sprayer which delivered 18 gpa of water carrier. The experiment was arranged in a split plot design with the herbicide treatments as whole plots and the incorporation methods as split plots. Incorporation methods were: springtine harrow, spiketooth harrow, tandom disc, tread mulcher and power incorporator. All tools were operated at four mph except the power incorporator unit which was a rototiller mounted on a small garden tractor. All plots were incorporated twice in a parallel direction. Herbicides were applied May 19 and field beans were planted May 20, 1970. All implements incorporated the herbicide to a depth of 1½ to 2 in. except the disc which incorporated the herbicide 3 to 4 in. deep. Depth and placement of herbicide was checked with fluorescent dye. Herbicide treatments were: trifluralin at 0.5 lb/A, nitralin 0.75 lb/A, ACP 70-25 at 1.0 and 2.0 lb/A, EPTC at 3.0 lb/A, ACP 70-25 + EPTC 1.0 + 2.0 lb/A, nitralin + EPTC 0.75 + 2.0 lb/A, trifluralin + EPTC at 0.5 + 2.0 lb/A. Weed control evaluations were made by counting four quadrats 5 ft. x 6 in. in each plot on June 25, 1970. Late visual observations were made July 28. Yields were taken on August 27, 1970. The weed population consisted of black nightshade (*Solanum nigrum* L.), red-root pigweed (*Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.), green foxtail (*Setaria viridis* (L.) Beauv.) and others which were a lesser population of kochia (*Kochia scoparia* (L.) Roth), wild buckwheat (*Polygonum convolvulus* L.) and common purslane (*Portulaca aleracea* L.).

The tread mulcher and power incorporation of trifluralin at 0.5 lb/A resulted in the best total weed control (table). The springtine harrow and tandom disc were the least satisfactory methods of incorporation as reflected in the total weed control. The best weed control obtained with nitralin at 0.75 lb/A was in plots incorporated with the tread mulcher. The springtine harrow and power incorporation gave nearly the same results with 85.6 and 83.4 percent total weed control. The disc was the least acceptable method of incorporating nitralin. All methods of incorporating ACP 70-25 at 2.0 lb/A gave satisfactory total weed control. The herbicide was applied at a sufficient rate so that the dilution effect from the disc or shallow placement by the springtine harrow and spiketooth harrow were not a critical factor in total weed control. However, ACP 70-25 at 1.0 lb/A incorporated with the tread mulcher or springtine harrow gave 95.7 percent or better total weed control. The other methods of incorporation resulted in appreciably less total control of the weed species present. Excellent overall control was obtained with EPTC at 3.0 lb/A, nitralin + EPTC at 0.75 lb/A and trifluralin + EPTC at 0.5 + 2.0 lb/A with all methods in incorporation. The tandom disc incorporation of ACP 70-25 at 1.0 + 2.0 lb/A resulted in practically no control of black nightshade which is reflected in the total weed control. However, all other methods of incorporation of ACP 70-25 + EPTC at 1.0 + 2.0 lb/A gave 95.4 percent or better total weed control. (Wyoming Agricultural Experiment Station, Laramie, SR-286).

Effect of eight herbicide treatments and five incorporation methods on field bean stands and percent weed control

Treatment	Rate lb/A	Bean stand	Night-shade	Pig-weed	Lambs quarters	Others	Green foxtail	Total Avg. control
trifluralin	0.5							
springtine		88.0	31.9	95.0	96.4	78.3	53.3	71.0
disc		98.4	22.0	93.4	99.2	80.8	37.8	73.7
spiketooth		98.4	26.6	97.8	99.4	98.0	65.9	77.5
power		100.0	39.3	99.0	100.0	100.0	96.8	88.4
tread mulcher		94.6	33.2	96.6	98.8	95.0	99.7	85.0
nitralin	0.75							
springtine		100.0	31.3	100.0	99.4	82.9	96.0	85.6
disc		89.0	12.3	96.3	99.7	82.9	88.8	71.0
spiketooth		98.4	19.9	98.8	99.0	95.0	77.4	78.8
power		92.2	17.4	100.0	100.0	100.0	99.4	83.4
tread mulcher		100.0	45.6	98.8	100.0	94.8	99.9	88.0

(continued)

Treatment	Rate lb/A	Bean stand	Night-shade	Pig-weed	Lambs quarters	Others	Green foxtail	Total Avg. control
ACP 70-25[1/]	1.0							
springtine		100.0	81.2	97.7	100.0	100.0	97.6	95.7
disc		96.9	21.2	98.7	100.0	100.0	95.3	83.5
spiketooth		93.8	75.7	96.4	100.0	88.8	48.6	81.9
power		96.6	47.3	97.5	100.0	93.8	90.7	85.8
tread mulcher		100.0	91.9	97.9	100.0	100.0	97.3	97.4
ACP 70-25	2.0							
springtine		96.9	92.3	100.0	100.0	100.0	98.0	98.1
disc		98.4	66.4	100.0	100.0	100.0	98.8	93.0
spiketooth		96.9	91.7	97.8	100.0	100.0	93.9	96.7
power		85.8	80.8	98.2	98.8	93.8	100.0	94.1
tread mulcher		93.3	92.3	96.7	100.0	100.0	96.3	96.6
ACP 70-25 + EPTC	1.0 + 2.0							
springtine		95.3	80.3	98.4	99.2	100.0	99.0	95.4
disc		93.5	6.3	96.2	98.2	99.7	90.8	78.2
spiketooth		90.6	97.6	97.4	98.8	100.0	96.2	98.0
power		100.0	84.1	99.2	100.0	98.8	99.7	96.3
tread mulcher		86.2	96.8	100.0	100.0	100.0	100.0	99.4
nitralin + EPTC	.75 + 2.0							
springtine		89.1	100.0	100.0	100.0	95.0	100.0	99.0
disc		96.9	96.9	99.1	100.0	100.0	99.7	98.2
spiketooth		98.5	100.0	100.0	100.0	100.0	100.0	100.0
power		100.0	100.0	100.0	100.0	100.0	100.0	100.0
tread mulcher		93.4	100.0	100.0	100.0	100.0	97.4	99.5
trifluralin + EPTC	.5 + 2.0							
springtine		96.9	100.0	100.0	100.0	100.0	100.0	100.0
disc		92.2	95.4	100.0	100.0	90.0	100.0	97.1
spiketooth		100.0	100.0	100.0	100.0	93.8	100.0	98.8
power		92.2	98.4	100.0	100.0	79.0	100.0	95.8
tread mulcher		88.6	98.7	100.0	100.0	100.0	100.0	99.7
EPTC	3.0							
springtine		96.9	100.0	100.0	100.0	100.0	100.0	100.0
disc		98.4	96.8	98.8	98.0	97.9	99.4	98.4
spiketooth		100.0	100.0	99.0	98.9	100.0	98.5	99.3
power		96.9	95.1	98.8	100.0	100.0	100.0	98.8
tread mulcher		100.0	99.0	100.0	100.0	100.0	99.3	99.7

[1/] Name unavailable.

Nightshade control in lima beans. Agamalian, H. Continuous application of currently registered herbicides for lima beans have resulted in serious hairy nightshade (*Solanum sarachoides* Sendt.) population.

Preplant incorporation experiments with several herbicides have shown considerable promise in the control of this weed. The two experiments were applied to a Lockwood clay loam: 35 percent sand, 45 percent silt, 20 percent clay, and 1.5 percent O.M. The herbicides were incorporated to a depth of 2-3 in. and the fordhook lima beans planted to soil moisture, approximately 3 in. in depth. The beans germinated from the field moisture and were furrow irrigated three weeks post germination.

Principle weeds in this study were hairy nightshade, pigweed, and mustard.

Efficiency of RH315, N-(1,1-dimethylpropynl)-3,5-dichlorobenzamide, alachlor, and chloropropham resulted in a high degree in the control of hairy nightshade.

Acceptable lima bean selectivity was evident at rates and methods used in these experiments. Combinations of trifluralin plus RH315, trifluralin plus alachlor, and trifluralin plus chloropropham offer promise for a wide spectrum weed control in lima beans. The following data indicates hairy nightshade control, crop injury, and harvested yields. (University of California, Agr. Ext. Service, Salinas).

Table 1. Evaluation of preplant incorporated herbicides for the control of nightshade in lima beans

Herbicide	lb/A	Yield green ton/A	Yield white ton/A	Weed 7/22/70	Crop 7/22/70
1. Treflan	3/4	1.98	1.51	6.0	0
2. Furloe	4	2.22	1.60	8.5	0
3. Furloe + Treflan	3/4 + 4	2.18	1.49	8.5	0
4. Furloe	8	2.35	1.51	9.0	0
5. Lasso	2	2.22	1.57	7.0	0
6. Lasso	4	2.41	1.58	9.2	0
7. Lasso	8	2.14	1.43	8.5	0
8. Lasso + Treflan	2 + 3/4	2.12	1.64	8.5	0
9. Lasso + Treflan	4 + 3/4	2.32	1.56	7.5	0
10. R7465	2	2.15	1.54	3.5	0
11. KERB	4	2.07	1.52	9.0	0
12. R7465	4	2.23	1.50	2.5	0
13. KERB	2	2.18	1.59	9.0	0
14. Preforan	2	2.18	1.54	6.5	0

(continued)

Herbicide	lb/A	Yield green ton/A	Yield white ton/A	Weed 7/22/70	Crop 7/22/70
15. Preforan	4	2.02	1.43	7.5	0
16. Planavin	3/4	2.20	1.67	1.0	0
17. Lasso + Planavan	2 + 3/4	2.52	1.66	7.5	0
18. Control	0	1.80	1.51	5.0	0

Major weeds: Hairy nightshade, pigweed, lambsquarters

Table 2. Evaluation of preplant incorporated herbicides for the control of nightshade in lima beans

Herbicide	lb/A	Yield 11/17/70 ton/A	Weed 7/22/70	Crop 7/22/70
1. BAS3870	1	1.90	6.1	0.8
2. BAS3870	2	1.97	7.8	0
3. AC78100	1	1.90	4.0	0
4. AC78100	2	2.00	6.3	0
5. AC78126	1	1.82	7.6	0
6. AC78126	2	1.91	8.0	0.3
7. AH56477	1	1.90	7.0	0
8. AH56577	2	1.98	5.0	0
9. RH892	1	1.78	7.0	0
10. RH892	2	1.63	6.3	0
11. NIA20439	2	1.76	4.1	0.3
12. NIA20439	4	1.69	5.1	1.8
13. RH892 + Treflan	1 + 1	1.89	8.1	0
14. RH892 + Treflan	2 + 1	1.78	8.0	0
15. VCS438	2	1.86	5.3	0
16. VCS438	4	1.92	8.0	0.5
17. Treflan	1	1.90	7.5	0
18. Treflan + KERB	1 + 1	1.94	9.5	0
19. Treflan + KERB	1 + 2	2.03	9.8	-
20. KERB	2	2.03	9.8	0
21. Control	0	1.80	1.8	0

$L.S.D._{5\%}$ = .200 ton/A $L.S.D._{1\%}$ = .270 ton/A

Weed problems resulting from herbicide use. Whitworth, J. Wayne and John Norris. The continued use of selective herbicides in cotton has encouraged increased infestations of resistant weed species such as purple nutsedge (*Cyrpus rotundus*), cottonweed (*Anoda cristata*), ironweed (*Flaveria repanda*), etc. Even the somewhat susceptible annual morning glory (*Ipomea* spp.) continues to be a problem. Rotation experiments on cotton and sorghum were initiated in the spring of 1970 to determine what herbicides or combinations of herbicides, old or new, would help solve this problem and what effects respective applications would have on plant communities. As measured by persistent effects on natural infestation of annual morning glory and on cucumber and cupgrass (*Erichloa gracilis*) seeded onto the cottonfield, some of the commercially approved herbicides might affect crops of spring onions and fall lettuce which will follow the 1970 cotton plots (Tables 1 and 2). Experimental herbicides (pyrazone related Sandoz 6706 and 9789) while promising in other trials for controlling all of the resistant species, including nutsedge, showed very high soil residual in those experiments. None of the herbicides or herbicide combinations adversely affected yields of cotton, Tables 1 and 2, or sorghum (not shown). While band application might prove useful in reducing herbicide carryover in the soil, this method of application was less effective for weed control as compared to broadcast. Whereas, combinations of herbicides tended to improve the spectrum of weed control when both herbicides were included in the mixture of full strength, lesser amounts were not effective. Therefore, it is doubtful that combinations will prove useful in reducing the soil residual of herbicides.

Fiber properties were taken and are being subjected to statistical analysis, but like yield, there were no apparent differences due to treatment. (Agronomy Department, New Mexico State University, Las Cruces).

Table 1. Herbicide residual and yield of cotton as measured by percentage of untreated control following preplant, soil-incorporated applications. Mayfield Farm, New Mexico State University (avg. of 4 replications)1/

Broadcast Application

Treatment Number and Herbicide	Rate lb/A (active)	Cotton yield % of check	Annual Morning Glory 6/17	Annual Morning Glory 7/8	Annual Morning Glory 8/3	Cucumber 7/8	Cucumber 8/3	Cupgrass 7/8	Cupgrass 8/3
			Date Counted / % of Control						
16. Sandoz 9789	4	105	56	98	91	100	42	100	100
15. Sandoz 6706	4	97	0	97	91	93	19	100	100
11. Treflan + Caparol	1 + 2	95	67	97	91	93	81	100	100
17. Caparol	2	101	28	96	86	100	37	100	18
1-2. Treflan + Caparol	3/4 + 1-1/2	98	14	71	0	97	18	100	91
6-7. Dacthal + Caparol	6 + 1-1/2	98	6	66	60	98	35	100	78
12. Dacthal + Caparol	8 + 2	101	56	97	74	100	21	100	100
18. Dacthal + Sandoz 6706	4 + 2	101	11	71	80	14	16	100	73
13. Planavin + Caparol	1 + 2	101	17	84	40	93	2	100	73
14. Prefar + Caparol	2 + 2	106	0	92	89	100	77	100	91

(continued)

Table 2. 12 inch band applications

Treatment Number and Herbicide		Rate lb/A (active)	Cotton yield % of check	Annual Morning Glory 6/17	Annual Morning Glory 7/8	Annual Morning Glory 8/3	Cucumber 7/8	Cucumber 8/3	Cupgrass 7/8	Cupgrass 8/3
				% of Control						
16.	Sandoz 9789	4	109	61	77	80	50	0	100	18
15.	Sandoz 6706	4	107	17	92	80	57	46	100	73
11.	Treflan + Caparol	1 + 2	105	78	84	74	100	25	100	100
17.	Caparol	2	92	56	78	57	100	0	95	27
1-2.	Treflan + Caparol	3/4 + 1-1/2	106	0	0	0	61	8	98	23
6-7.	Dacthal + Caparol	6 + 1-1/2	97	25	44	39	61	6	100	9
12.	Dacthal + Caparol	8 + 2	93	0	68	31	100	14	100	64
18.	Dacthal + Sandoz 6706	4 + 2	95	50	85	83	7	18	86	82
13.	Planavin + Caparol	1 + 2	102	28	53	0	86	0	95	9
14.	Prefar + Caparol	2 + 2	96	0	36	0	100	16	100	45

[1]/Herbicides applied on 6 May 1970 onto pre-irrigated beds and incorporated with Lilliston rolling cultivator prior to planting on 7 May. Silty clay loam to clay loam soil with 1.1 to 1.7% O.M. Three in-crop irrigations of 4 inches each. Rainfall negligible. Annual morning glory was a natural infestation, cucumbers and cupgrass were seeded prior to each of the last two irrigations. Cotton yields on the check plots were from 2.09 to 2.11 bales of lint/A.

Linuron-trifluralin combinations in cotton. Hamilton, K. C. and H. F. Arle. Interest in linuron was revived when it was used in combination with a herbicide effective on grass weeds and because of its relatively short soil residue. In 1969, tests were conducted at Marana and Phoenix, Arizona, to compare three methods of applying linuron-trifluralin combinations in irrigated cotton. All combinations included .5 lb/A of trifluralin and .75, 1.5, or 2.25 lb/A of linuron. After the preplanting irrigation, combinations of trifluralin and the three rates of linuron were applied to the soil before harrowing (preharrow) in the final seedbed preparation. Preharrow applications of trifluralin were also combined with directed postemergence applications of the three rates of linuron covering the entire furrow and base of cotton when plants were 18 in. tall. Combinations of trifluralin and the lower rates of linuron were also applied directed postemergence. Herbicides applied postemergence were incorporated by cultivation. Treatments were replicated four times on 4-row plots at least 41 ft. long.

Deltapine 16 cotton was planted in moist soil under a dry mulch in early April. Soil contained 39 percent sand, 35 percent silt, 36 percent clay, and 1 percent organic matter at Marana and 36 percent sand, 40 percent silt, 24 percent clay, and 1 percent organic matter at Phoenix. Weeds present at Marana included browntop panicum (*Panicum fasciculatum* Swartz), woolly morningglory (*Ipomoea hirsutula* Jacq. f.), and Wright groundcherry (*Physalis wrightii* Gray) and at Phoenix, browntop panicum, Wright groundcherry, and Palmer amaranth (*Amaranthus palmeri* S. Wats.). Tests areas received two or three cultivations. Broadleaf and grass weed control were estimated before harvest. The center rows of each plot were machine-picked.

Preharrow applications of trifluralin and linuron-trifluralin combinations had no effect on cotton emergence and development. Linuron-trifluralin combinations applied before planting controlled all weeds early in the season. Small weeds were present after midseason on plots treated with the lower rates of linuron but were controlled by crop competition later in the season. Trifluralin alone applied before planting controlled early season grass weeds but broadleaf weed emerged and were controlled by postemergence applications of linuron. Numerous grass and broadleaf weeds were established where postemergence combinations of linuron and trifluralin were applied. Postemergence applications containing linuron killed all weeds. Lower leaves of cotton contacted by linuron became yellow or brown but cotton growth was not affected. At harvest weed control with all treatments was 97 to 100 percent. Cotton yields did not differ significantly between treatments at either location. (Cooperative investigations of Arizona Agric. Expt. Sta., University of Arizona, Tucson, and Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Phoenix, Arizona).

Weed control in potatoes grown in a soil with the potential to allow loss of herbicide selectivity. Radosevich, S. R., J. C. Aldridge and Phillip D. Olson. In the spring of 1970, an experiment was established in the Hermiston area of Umatilla County on Russet potatoes. The purpose of this experiment was to test herbicides which are registered or close to registration in a soil with potential to allow loss of herbicide selectivity. The herbicides listed in the following table were applied to a Quincy sandy loam which has 0.54 percent organic matter. Lambsquarters (*Chenopodium album*) was found to be the predominant weed of the experiment and two visual evaluations of weed control and potato injury were made. To determine the effect of weed competition and herbicide toxicity to the crop, potato yields were also taken and samples were categorized into No. 1, No. 2, and cull grades.

Most herbicide treatments gave good or excellent control of lambsquarters. Only RP17623, RH892, and the lowest rates of norea (Herban), VSC438, and Maloran failed to give acceptable control of this weed species.

Foliage injury and stand reduction of the crop was apparent with linuron, norea, and HOE2933 when applied at 3 lb ai/A 74 days after application. However, in 133 days after application these treatments did not show the previous injury.

Based on yield data it was determined that all treatments except linuron and norea at 3 lb ai/A and RH892 at 1.5 lb ai/A improved total potato yields when compared to a weedy control. However, when each herbicide treatment was compared to a handweeded control the following treatments were found to significantly reduce yields.

trifluralin	.75 lb ai/A
linuron	1.5 and 3.0 lb ai/A
Maloran	1.5 and 3.0 lb ai/A
RH892	
norea	1.5 and 3.0 lb ai/A
RP17623	.9 and 1.8 lb ai/A
VSC438	1.0 and 2.0 lb ai/A
HOE2933	3.0 lb ai/A
diphenamide + paraquat (Enide + Paraquat)	2.0 + .75 lb ai/A

When yields of No. 1 grade potatoes of each herbicide treatment were subjected to the same comparisons, similar results were found. Reduction in the yield of the No. 1 grade was sometimes caused by an increased amount of No. 2 or cull potatoes.

From these data it is concluded that promising herbicide treatments in this soil type are as follows:

<u>Postplant Incorporated</u>

EPTC - 3.0 lb ai/A

<u>Preemergence</u>

metobromuron (Patoran) - 1.5 to 3.0 lb ai/A

Sencor (BAY94337) - .5 to 2.0 lb ai/A

metobromuron + DCPA (Patoran + Dacthal) - 1.0 + 6.0 lb ai/A

linuron + DCPA (Lorox + Dacthal) - .75 + 6.0 lb ai/A

<u>At Emergence</u>

diphenamide + dinoseb - 2.0 + 1.5 lb ai/A

metobromuron + paraquat - (Patoran + Paraquat) - 2.0 + .75 lb ai/A

Maloran + paraquat - .5 + .75 lb ai/A

<u>Postemergence</u>

Sencor - .5 to 1.0 lb ai/A

(Farm Crops Department, Oregon State University, Corvallis).

Herbicide treatments applied to potatoes grown in a soil with the potential to allow loss of selectivity (Hermiston, Oregon)

Treatment	Time of Application	Rate lb ai/A
EPTC	Pre Inc	3.0
trifluralin	Pre Inc	.75
metobromuron	Pre	1.5
metobromuron	Pre	3.0
linuron	Pre	1.5
linuron	Pre	3.0
Maloran	Pre	1.5
Maloran	Pre	3.0
norea	Pre	1.5
norea	Pre	3.0
RP17623	Pre	.9
RP17623	Pre	1.8
Sencor (BAY94337)	Pre	.5
Sencor (BAY94337)	Pre	1.0
Sencor (BAY94337)	Pre	2.0
VSC438	Pre	1.0
VSC438	Pre	2.0
metobromuron + DCPA	Pre	1.0 + 6.0
linuron + DCPA	Pre	.75 + 6.0
HOE2933	Pre	3.0
diphenamid + dinoseb	10% emerged	2.0 + 1.5
metobromuron + paraquat	10% emerged	2.0 + .75
diphenamide + paraquat	10% emerged	2.0 + .75
Maloran + paraquat	10% emerged	.5 + .75
RH892	10% emerged	1.5
Sencor	Post	.5
Sencor	Post	1.0
Sencor	Post	2.0
Check (weedy)	-	-
Check (handweeded)	-	-

Weed control research in peppermint. Colbert, D. R. and Arnold P. Appleby. Weed control research in peppermint at Oregon State University has been focused on a solution to problems arising from the persistence of terbacil in the soil. Trials were conducted in three major areas of interest: (1) less persistent herbicides, (2) studies on terbacil movement is soil, and (3) tillage management following previous terbacil applications.

Since terbacil has caused some problems in rotation of crops with mint, trials were established to search for short residual herbicides selective to peppermint. Herbicides were applied at three locations in the spring of 1970. The major weed species were lambsquarters (*Chenopodium album*), nightshade (*Solanum* spp.), pigweed (*Amaranthus retroflexus*), and Russian thistle (*Salsola kali*). See the accompanying table for visual observations on percent weed control and peppermint injury. Three herbicides, norea, linuron, and Maloran were more selective to peppermint than diuron and are less persistent in the soil than either diuron or terbacil. Of the three herbicides, norea can be used at the highest rate with slight injury but is less effective at the lower rate. Linuron may be slightly more damaging to mint at rates equal to those of Maloran but linuron could be used at slightly lower rates for comparable weed control. A weakness of these three herbicides is poor control of Russian thistle.

A soil residue study was initiated in the spring of 1970 to help determine the depth to which terbacil had penetrated at various locations. Soil samples were collected from growers fields in Eastern, Central, and Western Oregon. All locations had received recommended rates of terbacil in the spring of 1969. Samples were taken from both furrow and sprinkler irrigated mint fields at three depths, 0-4, 4-8, and 8-12 in. The soil samples were bioassayed in the greenhouse using annual ryegrass (*Lolium multiflorum*) as the indicator crop. In nearly all cases there was more terbacil in the top four inches than at any other depth. Terbacil was present in the surface layer at most locations in sufficient quantities to be damaging to sensitive crops. Some terbacil moved downward in the soil, particularly in the lighter soils, but results indicate that plowing would minimize injury from terbacil residue.

To gain further information on tillage methods on land containing terbacil residue, an experiment was established at Corvallis, Oregon using three tillage methods. A plot of land was selected that had been used during the summer of 1969 for surfactant studies with terbacil applied at 0.5 lb/A. Three seedbeds were prepared for spring wheat as follows: (1) plowing 10 in., (2) discing 4-5 in., and (3) rototilling 1½ in. Wheat sown in areas that had been plowed 10 in. deep was injured considerably less than in the rototilled areas and somewhat less than in the disced areas. These results agree with conclusions drawn from the soil sampling studies. (Farm Crops Department, Oregon State University, Corvallis).

Visual observations on percent weed control and peppermint injury for spring applied herbicides on established peppermint

Treatment[1/]	Rate lb ai/A	Percent Control[2/] Lambs-quarters	Russian thistle	Night-shade	Pigweed	Percent Mint Injury
norea	2	85	15	60	25	0
	4	98	15	90	90	0
	6	93	40	93	93	20

(continued)

Treatment	Rate lb ai/A	Percent Control: Lambs-quarters	Russian thistle	Night-shade	Pigweed	Percent Mint Injury
diuron	2	100	35	95	99	5
	4	98	80	100	100	33
	6	-	-	100	100	55
linuron	2	90	0	100	97	5
	4	93	0	100	100	13
	6	95	15	100	100	27
maloran	2	-	-	70	98	0
	4	-	-	100	100	5
	6	-	-	100	100	10
terbacil	1	100	85	90	73	0
	2	100	90	95	100	0
Check	-	0	0	0	0	0

1/ All treatments were applied preemergence to mint and weeds.

2/ Average of three locations. 0 = no control, 100 = complete kill.

Evaluation of herbicides in new seedling alfalfa in Southern Nevada. Reeve, T. A. Several herbicides were evaluated in trials for control of weeds in spring-seeded alfalfa. Benefin, DCPA and EPTC were applied preplant on May 6, 1970 and bromoxynil, Kerb and 2,4-DB amine were applied as emergence herbicides on May 22, 1970 when alfalfa was in three leaf stage of growth. Preplant herbicides were incorporated with a rotivator. The field was corrugated before irrigation.

The major weed populations in this trial were cocklebur (*Xanthium italicum* Mor.), redroot pigweed (*Amaranthus retroloxus* L.), lambsquarter (*Chenopodium album* L.), and barnyardgrass (*Echinochloa crusgalli* L.).

Evaluation of herbicides in spring-seeded alfalfa 1970

Treatment	Rate lb ai/A	Percent weed control	Percent alfalfa stand reduction
2,4-DB amine	1.00	76	82
Bromoxynil	.25	85	91
	.50	80	24
DCPA	5.00	85	21
	8.00	82	22
EPTC	2.00	70	41
	3.00	81	63

(continued)

Treatment	Rate lb ai/A	Percent weed control	Percent alfalfa stand reduction
Benefin	1.00	85	68
	1.50	85	70
Kerb[1/]	.75	66	0
	1.25	81	1
Check	-	0	0

[1/]N-(1,1-dimethylpropynyl)-3,5-dichlorobenzamide

Summary: Kerb controlled the weeds with less stand reduction of alfalfa than the other herbicides. DCPA showed promise as preplant for all weeds except cocklebur. The reduction in alfalfa stands by 2,4-DB amine and bromoxynil was probably due to high temperatures following application. Bromoxynil and 2,4-DB amine did not control barnyardgrass. (Cooperative Extension Service, Max C. Fleischmann College of Agriculture, University of Nevada, Reno).

The use of activated charcoal to establish crops with various preemergence herbicides. Olson, Phillip D. and Arnold P. Appleby. Preliminary research at Oregon State University indicates that activated charcoal may be a useful tool in establishing several crops with soil-active herbicides. The use of activated charcoal to establish grass seed crops has been successfully adapted in Oregon. Diuron has recently been registered for use with charcoal in the grass seed industry.

To determine the feasibility of using the activated charcoal technique on other crops, a trial was established at Corvallis, Oregon in the summer of 1970. In the trial thirty-one preemergence herbicides were tested on fourteen crops. At least one representative herbicide from each group of soil-active herbicides was included in the experiment. The crops included in the trial were white clover (*Trifolium repens*), alfalfa (*Medicago sativa*), carrots (*Daucus carota*), lettuce (*Lactuca sativa*), cucumbers (*Cucumis sativus*), sugar beets (*Beta vulgaris*), cotton (*Gossypium hirsutum*), soybeans (*Glycine max*), green beans (*Phaseolus vulgaris*), annual ryegrass (*Lolium multiflorum*), wheat (*Triticum aestivum*), peas (*Pisum sativum*), corn (*Zea mays*), and rice (*Oryza sativa*).

Four rows of each crop were treated as follows: one row untreated (check), one row treated with 150 lb/A activated charcoal (Aqua Nuchar), one row treated with 300 lb/A activated charcoal (Aqua Nuchar), and one row with the seed treated with Gulf's anhydride (1,8-naphthalic anhydride). The activated charcoal was applied in a one-inch band on the soil surface over the seeded row. The charcoal application was made at the time of seeding in the same operation. The Gulf antidote was mixed with the seed just prior to planting on a basis of 1/2 percent by weight of seed. The herbicides were sprayed as a broadcast spray over the seed rows and charcoal bands. The herbicide applications were made within twenty-four hours after planting. Sprinkler irrigation (3/4 in.) was applied within forty-eight hours of herbicide application.

In general the activated charcoal gave protection to all of the crops from one or more herbicides that would have otherwise been nonselective. The charcoal gave better protection to all of the crops than the Gulf antidote. The only crop in the trial that the antidote gave a significant increase in crop tolerance was soybeans. This increase (30-40 percent) was with alachlor at 2 and 4 lb ai/A and CP52223 at 2 and 4 lb ai/A. The following table gives some of the herbicides with their respective crops that were given acceptable tolerance due to the protection of activated charcoal and warrant further research. In each case reported there was severe injury in the untreated (check) row. It should be noted that the charcoal was giving some protection to the germinating weeds in the charcoal bands. The degree of protection varied with herbicides and rate. (Farm Crops Department, Oregon State University, Corvallis).

List of crops by herbicides which were given protection by activated charcoal

alachlor 2 lb ai/A
- carrots
- lettuce
- cucumbers
- sugar beets
- cotton
- soybeans
- green beans
- annual ryegrass
- wheat
- peas

atrazine 2 lb ai/A
- carrots
- cotton
- soybeans
- wheat
- rice[1]/

fluometuron 2 lb ai/A
- carrots
- sugar beets
- cotton
- soybeans
- green beans
- corn
- rice[1]/

amiben 4 lb ai/A
- carrots
- cotton
- soybeans
- wheat
- rice[1]/

Bladex (SD15418) 2 lb ai/A
- alfalfa
- carrots
- cucumbers
- soybeans
- green beans
- wheat
- peas
- rice[1]/

DCPA 9 lb ai/A
- carrots
- lettuce
- cucumbers
- sugar beets
- soybeans
- annual ryegrass
- rice[1]/

(continued)

dichlobenil 3 lb ai/A
alfalfa
carrots
lettuce
cucumbers
sugar beets
soybeans
annual ryegrass
wheat
corn

Kerb (RH315) 2 lb ai/A
cucumbers
sugar beets
cotton
wheat
corn
rice[1/]

linuron 2 lb ai/A
peas
corn
rice[1/]

maloran 2 lb ai/A
cucumbers
annual ryegrass
rice[1/]

metabromuron 2 lb ai/A
alfalfa
carrots
sugar beets
cotton
soybeans
green beans
annual ryegrass
wheat
peas
rice[1/]

Outfox (S6115) 2 lb ai/A
carrots
cotton
annual ryegrass
wheat

propachlor 2 lb ai/A
alfalfa
carrots
annual ryegrass
peas
rice[1/]

diphenamid 6 lb ai/A
white clover
carrots
cotton
annual ryegrass
peas
corn
rice[1/]

diuron 2 lb ai/A
alfalfa
carrots
sugar beets
cotton
soybeans
green beans
annual ryegrass
wheat
peas
rice[1/]

norea 2 lb ai/A
carrots
sugar beets
soybeans
green beans
annual ryegrass
wheat
peas
rice[1/]

prometryne 2 lb ai/A
alfalfa
cucumbers
sugar beets
peas

pyrazon 3 lb ai/A
lettuce
cucumbers
green beans

Tandex (NIA11092) 1 lb ai/A
carrots
cotton
soybeans
green beans
wheat
corn

(continued)

simazine 2 lb ai/A
alfalfa
cucumbers
rice[1]

terbacil 1/2 lb ai/A
alfalfa
cucumbers

chloroxuron 2 lb ai/A
alfalfa
cucumbers
sugar beets
annual ryegrass

nitrofen 3 lb ai/A
white clover
alfalfa
lettuce
cucumbers
sugar beets
cotton
peas

[1] Rice was direct seeded.

Herbicide evaluation for the control of Hillman's panicum (*Panicum hillmanii* Chase.). McHenry, W. B., N. L. Smith and J. T. Yeager. In the Sacramento Valley over recent years irrigation districts and road departments have expressed concern over population increases of annual panicum grass on sites treated with soil-applied herbicides. The population escapes appeared to be associated with the use of atrazine or simazine.

Eleven soil-active herbicides were applied on February 6, 1970, at two or three rates on a Solano County roadside with a history of a relatively high panicum population. Paraquat at 1 lb ai/A with 1/4 percent surfactant was included in all treatments to control existing winter annual species. Three replications were employed. Aproximately 5 in. of precipitation fell on the test location following application and prior to the evaluations. Initial evidence of panicum germination was noted on February 26, 1970. Evaluations were made on general over-all control of annuals as well as on Hillman's panicum. On the May evaluation it was practical only to note the appearance or absence of panicum; by September sufficient topgrowth was present to evaluate the degree of panicum control. Evaluations included the control of other general annual species present, e.g. wild oat (*Avena fatua* L.), Italian ryegrass (*Lolium multiflorum* Lam.), yellow starthistle (*Centaurea solstitialis* L.), and turkey mullein (*Eremocarpus setigerus* Benth.).

Control of general annual weeds (G) and Hillman's panicum (P) with 11 soil-applied herbicides. Treatments with panicum present on the May evaluation date are indicated by +.

	Acre Rate		Control (10=100%)			
			5/18/70		9/10/70	
Herbicide	A.I.	Formul.	G	P	G	P
atrazine	4 lb	5 lb	7.0	+	6.3	4.7
atrazine	8	10	6.7	+	5.3	3.0
atrazine	12	15	7.7	+	6.3	4.7

(continued)

Herbicide	Acre Rate A.I.	Acre Rate Formul.	Control (10=100%) 5/18/70 G	5/18/70 P	9/10/70 G	9/10/70 P
bromacil	2	2.5	9.9	+	9.9	9.9
bromacil	4	5	9.9		9.3	10
bromacil	6	7.5	10		9.8	10
diuron	2	2.5	9.0	+	6.0	8.2
diuron	4	5	8.6	+	5.7	9.0
diuron	6	7.5	9.3	+	7.0	9.0
linuron	2	4	8.3	+	7.3	9.2
linuron	4	8	8.5	+	8.0	9.6
monuron	2	2.5	8.8	+	5.3	8.5
monuron	4	5	9.3	+	6.7	9.8
monuron	6	7.5	9.0		6.7	9.6
nitralin	2	0.5 gal	8.7	+	6.0	8.5
nitralin	4	1	8.3	+	7.3	8.5
prometone	4	2	8.3	+	7.5	10
prometone	8	4	9.3		8.0	9.6
prometone	12	6	8.8	+	7.7	9.0
simazine	4	5 lb	8.3	+	7.7	6.0
simazine	8	10	7.0	+	6.0	4.7
simazine	12	15	8.7	+	6.7	6.7
SAN6706	2	2.5	9.3	+	7.3	9.7
SAN6706	4	5	8.0	+	7.3	9.8
Tandex	2	2.5	9.6	+	8.3	8.2
Tandex	4	5	9.3	+	8.8	9.7
Tandex	6	7.5	9.6	+	9.3	9.3
VCS438	4	5.3	8.8	+	7.3	8.3
VCS438	8	10.7	9.0	+	7.0	9.1
Control	-	-	0	+	0	0

General annual vegetation control was reduced in nearly all treatments from May to September due to the appearance of turkey mullein. Atrazine and simazine provided the lowest degree of panicum control of the herbicides tested. Bromacil was notably effective on turkey mullein as well as on Hillman's panicum. Italian ryegrass exhibited appreciable resistance to prometone particularly at 4 and 8 lb ai/A. (University of California, Agr. Ext. Serv., Davis).

Summary of soil-applied herbicide experiments for the control of Russian thistle (*Salsola iberica* Sennen & Pau.). McHenry, W. B.[1], B. B. Fischer[2], L. L. Buschmann[3], W. V. Johnson[4], H. S. Agamalian[5], and N. L. Smith[1]. Russian thistle is often tolerant of low-rate herbicide treatments used on non-crop or industrial sites where complete annual weed control is desired. In some instances land managers seek selective soil-applied treatments to eradicate Russian thistle and maintain a grass stand for erosion control. Several field experiments were conducted to derive both selective and non-selective Russian thistle control recommendations. Plot size was consistent within each experiment and among experiments varied from 200 sq ft (10 ft x 20 ft, roadside) to 420 sq ft (15 ft x 28 ft railroad right-of-way). Four replications were employed in Merced, Monterey, and Sutter counties, three in Fresno county (nitrofen and R7465, 2-(OC Naphthoxy)-N,N-diethylpropionamide, data are from single observational plots). Soils at the test locations varied from medium texture to coarse texture types (Fresno County - 68 percent sand, 23 percent silt, 9 percent clay, 0.3 percent organic matter; Monterey County - 72 percent sand, 19 percent silt, 9 percent clay, 0.85 percent organic matter).

For non-selective control of Russian thistle on non-crop sites, the results of these experiments suggest that atrazine, bromacil, S6115, SAN6706, and Tandex are effective herbicides at from 2-4 lb ai/A on relatively light textured soils. Where annual grass is to be preserved for erosion control or where total annual vegetation control is not required, fenac at 6 lb ai/A appeared to provide the most consistently effective control followed by 2,3,6-TBA at 6 lb ai/A. With the exception of the 1967 experiment in Merced county, picloram rates tested were too low. Although limited to two test locations, dicamba results were too dissimilar to suggest an optimum rate. From these and other experiments, linuron applied preemergent has been consistently weak on Russian thistle.

Three experimental sites supported sufficient annual grass to evaluate stand effects by the selective herbicides (dicamba, fenac, picloram, 2,3,6-TBA). Fenac and 2,3,6-TBA reduced red brome (*Bromus rubens* L.) by approximately 50 percent at 6 lb ai/A. Rattail fescue (*Festuca myuros* L.) was thinned by all herbicide treatments; wild oats (*Avena fatua* L.) was least effected of the selective herbicide group and was moderately stimulated by picloram at all rates in the 1967 Modesto County trial. (University of California, Agr. Ext. Serv., Davis[1], Agr. Ext. Serv., Fresno[2], Agr. Ext. Serv., Sutter County, Yuba City[3], Agr. Ext. Serv., Monterey County, Salinas[5], and W. V. Johnson, Calif. Dept. Water Resources, Sacramento [4].

<u>Response of Russian thistle (*Salsola iberica* Sennen & Pau.) to single applications of foliage-applied herbicides.</u> McHenry, W. B.[1], B. B. Fischer[2], L. L. Buschmann[3], and N. L. Smith[1]. Four Russian thistle control experiments were conducted in 1969 to compare selective and non-selective foliage-applied herbicides at different growth stages or heights. While it is apparent that retreatments of foliage-applied herbicides are required for complete control of Russian thistle in field-scale programs, estimates of control in these studies were based on effects from single treatments. Spray volumes and surfactant concentrations used

Summary of selective and non-selective Russian thistle control experiments on non-crop sites with soil-applied herbicides

Herbicide	Acre Rate A.I.	Acre Rate Formul.	Merced Co. 12/21/67: 11/25/68 4.8 in[1]	Merced Co. 12/21/67: 6/5/69 14.7 in[1]	Merced Co. 11/14/68: 5/21/69 10.3 in[1]	Merced Co. 11/14/68: 6/5/69 10.3 in[1]	Sutter Co. 2/26/69: 10/1/69 2.3 in[1]	Monterey Co. 1/13/70: 6/14/70 5.1 in[1]	Fresno Co. 2/18/70: 4/23/70 2.47 in[1]	Fresno Co. 2/18/70: 11/5/70 2.60 in[1]
atrazine	4 lb	5 lb	–	–	–	–	9.3	10	10	10
atrazine	6	7.5	–	–	–	–	–	10	–	–
atrazine	8	10	–	–	–	–	10	10	10	10
bromacil	2	2.5	–	–	–	–	10	9.9	10	10
bromacil	4	5	–	–	–	–	10	10	10	10
bromacil	6	7.5	–	–	–	–	–	9.9	–	–
dicamba	1	0.25 gal	–	–	9.3	9.7	0	–	–	–
dicamba	2	0.5	–	–	10	9.9	0	–	–	–
dicamba	4	1	–	–	10	9.7	0.8	–	–	–
dicamba	6	1.5	–	–	9.8	9.9	–	–	–	–
diuron	4	5 lb	–	–	–	–	4.7	–	9.2	1.7
diuron	8	10	–	–	–	–	10	–	9.9	8.7
dichlobenil	4	100	–	–	–	–	0	–	–	–
dichlobenil	8	200	–	–	–	–	4.2	–	–	–
fenac	2	1.3 gal	9.0	9.0	6.0	7.4	8.8	–	–	–
fenac	4	2.6	8.5	9.7	7.8	9.5	8.8	10	9.9	9.0
fenac	6	4	9.3	9.9	8.3	9.3	10	10	10	10
fenac	8	5.3	–	–	–	–	–	10	10	10
linuron	2	4 lb	–	–	–	–	0	–	–	–
linuron	4	8	–	–	–	–	0	–	–	–
nitrofen	6	3 gal	–	–	–	–	–		0	0
picloram	1 oz	4 fl oz	9.8	4.5	2.8	4.3	0	–	–	–
picloram	2	8	10	7.7	4.0	6.6	0.8	9.3	–	–
picloram	3	12	10	7.7	9.0	9.2	9.3	–	–	–
picloram	4	16	10	7.8	8.8	9.3	7.7	9.0	–	–
picloram	6	24	–	–	–	–	–	9.3	–	–
prometone	2 lb	1 gal	–	–	–	–	–	–	–	–
prometone	4	2	–	–	–	–	3.7	–	–	–
prometone	8	4	–	–	–	–	8.8	–	–	–

(continued)

Herbicide	Acre Rate A.I.	Acre Rate Formul.	Merced Co. 12/21/67 11/25/68 4.8 in.	Merced Co. 12/21/67 6/5/69 14.7 in.	Merced Co. 11/14/68 5/21/69 10.3 in.	Merced Co. 11/14/68 6/5/69 10.3 in.	Sutter Co. 2/26/69 10/1/69 2.3 in.	Monterey Co. 1/13/70 6/14/70 5.1 in.	Fresno Co. 2/18/70 4/23/70 2.47 in.	Fresno Co. 2/18/70 11/5/70 2.60 in.
R7465	4	8 lb	-	-	-	-	-	-	0	0
R7465	8	16	-	-	-	-	-	0	0	0
S6115	2	2 gal	-	-	-	-	-	10	-	-
S6115	4	4	-	-	-	-	-	10	-	-
SAN6706	2	2.5 lb	-	-	-	-	-	7.4	-	-
SAN6706	4	5	-	-	-	-	-	10	-	-
simazine	4	5	-	-	-	-	2.3	-	9.9	8.0
simazine	8	10	-	-	-	-	7.7	-	9.9	8.7
Tandex	2	2.5	-	-	-	-	4.7	10	10	10
Tandex	4	5	-	-	-	-	9.3	10	10	10
Tandex	6	7.5	-	-	-	-	-	10	-	-
2,3,6-TBA	2	1 gal	10	9.4	3.0	4.0	-	-	-	-
2,3,6-TBA	4	2	10	8.7	4.8	8.0	-	9.9	9.7	8.7
2,3,6-TBA	6	3	10	9.0	7.3	9.7	-	8.3	10	9.0
2,3,6-TBA	8	4	-	-	-	-	-	10	9.9	9.8
VCS438	1	.25	-	-	-	-	0	-	-	-
VCS438	2	.5	-	-	-	-	0	-	-	-
VCS438	4	1	-	-	-	-	4.7	-	-	-
Control	-		7.3	0	0	0	0	4.5	0	0

1/ Precipitation data

R7465, 2-(αNaphthoxy)-N,N-diethylpropionamide
S6115, 2-chloro-4-cyclopropylamino-6-isopropylamino-s-triazine
SAN6706, 4-chloro-5-(dimethylamino)-2-a,a,a-trifluro-m-tolyl-3(2H)-pyridazinone
Tandex, m-(3,3-dimethylureido)phenyl tert-butylcarbamate
VCS438, 2-(3,4-Dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione

were 100 gpa with 0.25 percent Colloidal X77[R] in the 5 in. and 12 in. growth stages (Fresno County, 4 replications), 200 gpa and 0.25 percent at the 20-30 in. stage (Fresno County, 2 replications), and 200 gpa and 0.5 percent Surfax[R] in the fourth experiment at approximately the 18-24 in. height (Sutter County, 3 replications).

From these studies it appears that application rates of 2,4-D amine in excess of 2 lb ai/A are required to control Russian thistle that has attained a height of 5 in., however subsequent retreatments would be expected to increase control. Low volatile ester 2,4-D was generally more effective than the water soluble amine. The addition of MSMA to 2,4-D amine in June markedly increased control over either 2,4-D or MSMA alone. In October cooler temperatures presumably slowed effects of 2,4-D and MSMA alone and in combination as well as bromoxynil. The daily maximum and minimum temperature range for the treatment date and the 3 consecutive days thereafter were 87-93 F, maximum and 57-62 F, minimum in June (Fresno County) and 69-85 F, maximum and 43-53 F, minimum in October (Sutter County). Paraquat at 0.75 to 1 lb in May, June, and October and bromoxynil at 1 lb ai/A applied in June were the most effective treatments followed by cacodylic acid at 4 lb plus MSMA at 4 lb ai/A applied in June. Amitrol-T, cacodylic acid, and dicamba were not sufficiently active at the rates tested. (University of California, Agr. Ext. Serv., Davis[1/]; Agr. Ext. Serv., Fresno County, Fresno[2/], Agr. Ext. Serv., Sutter County, Yuba City[3/]).

<u>Importance of soil incorporation of the triazine herbicides under arid conditions</u>. Williams, David and J. Wayne Whitworth. For the past six years, weed control experiments have been conducted on the control of weeds in irrigated grain sorghum produced under arid conditions. The soil type was sandy loam and sandbur (*Cenchrus* spp.) was the primary weed species. Weed control with the triazine herbicides has been very erratic and ranged from very poor to excellent.

Over the years, the most effective way to apply the herbicides was as a preplant, soil incorporated treatment, as compared to preemergence soil applications. The differences between the two methods were even more pronounced this year than in the past--acceptable weed control as compared to no weed control (table).

Yields were not taken on the preemergence plots due to the high density of sandbur. The yields on the preplant, soil-incorporated plots showed yields, when expressed as a percentage of the untreated and unhoed check, of 170, 145, 144, 110, 110, 100 for GS14260 at 1.5 and 3.0 lb/A, C19355 at 1.5 lb/A, propazine at 1.5 lb/A, C20546 at 0.5 lb/A, and atrazine at 1.5 lb/A, respectively. Yields from the other treatments were below the untreated (and unhoed) check plots. (Northeastern Branch Station, Tucumcari, New Mexico).

Summary of Russian thistle control experiments with selective and non-selective foliage-applied contact and translocated herbicides

			Control (10=100%)							
			Treated: 4/30/69 (5 in.)			6/16/69 (12 in.)		6/18/69 (30 in.)		10/22/69 (24 in.)
	Acre Rate									
Herbicide	A.I.	Formul.	6/3/69	7/28/69	10/7/69	7/28/69	10/7/69	7/28/69	10/7/69	11/4/69
Amitrole-T	1	0.5 gal	0	0	0	1.3	1.8	-	-	-
Amitrole-T	2	1	0.5	0.3	0	0.8	1.0	-	-	-
bromoxynil	0.5	0.25	-	-	-	-	-	8.0	4.0	1.7
bromoxynil	0.75	0.38	-	-	-	-	-	-	-	3.0
bromoxynil	1	0.5	-	-	-	-	-	9.9	7.0	4.0
cacodylic acid	4	1.2	1.8	0.8	1.0	2.0	1.8	3.5	0.5	-
cacodylic acid	8	2.4	5.3	0.8	2.3	4.0	2.3	6.0	2.5	-
cacodylic acid + MSMA	4 +4	1.2 +0.6	-	-	-	-	-	9.3	7.5	-
dicamba	0.5	0.13	6.5	3.0	6.5	2.3	4.3	2.0	7.0	-
dicamba	1	0.25	7.0	2.8	4.0	2.3	2.3	2.5	8.5	-
MSMA	4	0.6	-	-	-	-	-	5.0	5.5	0.3
paraquat	0.5	0.25	6.3	2.5	2.8	6.5	4.3	8.8	6.0	-
paraquat	0.75	0.38	-	-	-	-	-	-	-	9.9
paraquat	1	0.5	9.3	8.0	6.3	10	9.6	10	9.9	9.9
2,4-D,dimethyl amine salt	1	0.25	7.5	4.5	5.8	6.0	5.0	5.0	7.5	0
2,4-D,dimethyl amine salt	2	0.5	8.0	6.0	6.3	6.3	6.8	5.0	8.5	-
2,4-D,dimethyl amine salt + MSMA	1 +2	0.25 +0.3	-	-	-	-	-	-	-	0.3
2,4-D,dimethyl amine salt + MSMA	1 +4	0.25 +0.6	-	-	-	-	-	9.3	9.9	0.7
2,4-D,butoxy ethanol ester	1	0.25	7.9	6.0	6.3	4.3	3.5	5.0	9.5	0
2,4-D,butoxy ethanol ester	2	0.5	8.3	8.9	8.8	6.3	6.3	5.0	9.5	-
2,4-D,butoxy ethanol ester + MSMA	1 +4	0.25 +0.6	-	-	-	-	-	-	-	1.3
Control	-	-	0	0	0	0.3	1.3	0	0	0

Response of sandbur and sorghum to herbicides applied 27 May 1970, readings taken 11 September 1970 (Average of 4 replications), Tucumcari, New Mexico[1/]

Herbicide	Rate lb/A	Sandbur Preplant Incorp.	Sandbur Preemerge Surface	Sorghum Preplant Incorp.	Sorghum Preemerge Surface
propazine	1.5	7	0	3	5
	3.0	9	0	4	0
atrazine	1.5	7	1	3	0
	3.0	10	0	10	0
GS14260	1.5	4	0	1	0
(Igran)	3.0	5	0	0	1
C19355	1.5	8	0	1	0
	3.0	9	1	8	0
C20546	0.5	4	0	2	0
	1.0	4	0	4	0
Sandoz 6706	2.0	5	0	8	0
	4.0	10	0	10	1
Check	0	2	0	1	0

1/ 0 = no injury
10 = complete kill

PROJECT 6. AQUATIC AND DITCHBANK WEEDS

R. D. Comes, Project Chairman

SUMMARY

Six reports were received from five authors located in California, Colorado, Idaho, and Washington. The reports are summarized as follows:

In laboratory studies at Denver, Colorado, adjustment of bicarbonate ion through the addition of carbon dioxide to tapwater or mineral nutrient solution resulted in increased biomass productivity of sago pondweed. The studies indicated that carbon availability may be a limiting chemical factor to pondweed productivity.

A triethanolamine copper complex, a citric acid-copper sulfate chelating mixture and copper sulfate were evaluated in California for the control of *Chlorella* sp. cultured in water that contained 3.42 me/l CO_3 plus 4.79 me/l HCO_3. None of the compounds were effective at rates up to 4 ppm copper ion.

Biweekly applications of emulsified xylene at 4 to 5 gallons per cubic foot per second of flow suppressed all aquatic plant growth in irrigation laterals and prevented extensive silt deposits. Success of the practice was largely dependent on the proper timing of the initial application.

The calculated annual cost of herbicide spraying, mowing and debris removal, or a combination of burning and mowing for weed control on the estimated 80,000 acres of rights-of-way along irrigation channels in Bureau of Reclamation Region 1 was $7.50, $36.00, and $32.66/A, respectively. There are approximately 21,000 miles of irrigation channel and 3,000,000 irrigable acres in the region.

In California, six repeated applications of DSMA or MSMA at 8 to 12 lb/A, or four repeated applications of dalapon at 20 lb/A controlled 95 to 100 percent of the dallisgrass along a canal. MSMA and DSMA were appreciably less effective when the retreatment interval was extended beyond 5 weeks. Combinations of MSMA with dicamba or picloram were no more effective than MSMA alone.

Amitrole-T at 4 lb/A, applied 3 to 7 weeks after emergence of three grass species and again 4 months later, reduced the stand of reed canarygrass and creeping red fescue 93 to 99 percent, but it did not reduce the stand of redtop.

<u>Effects of mineral enrichment and carbon availability on pondweed productivity</u>. Otto, N. E. Laboratory tests were conducted under controlled environmental conditions to determine the effects of mineral

nutrient enrichment on the vegetative productivity of sago pondweed (*Potamogeton pectinatus* L.) and American pondweed (*P. nodosus* Poir). Vegetative pondweed propagules were cultured in sand-filled pots placed in 20-liter culture aquaria. The culture vessels were maintained at a temperature of 21 C with a 14-hour light period in growth chambers. Biomass productivity was determined by ovendry weight of individual plants, less the original propagule, at 20, 30, and 60 days of age.

Previously reported studies (1969 Research Progress Report WSWS) showed that enrichment of culture waters with complete mineral nutrients and/or various levels of phosphorus and nitrogen did not enhance the growth of pondweeds. Results of subsequent tests suggested that pondweeds require mineral nutrients at much lower levels than were provided in these studies and any excess was insignificant to furthering the growth of the plants.

Concluding from these studies that excessive aquatic plant growths are not solely related to large amounts of mineral nutrients (i.e. phosphorus and nitrogen) in water, the influence of carbon availability to pondweed production was studied as a possible limiting factor.

Amounts of available carbon for aquatic plant growth were introduced by the adjustment of bicarbonate ion through the addition of carbon dioxide to tapwater or enriched mineral nutrient solutions used for plant culture. Progress of replicated studies with sago pondweed show that increased levels of available carbon resulted in increased biomass productivity, regardless of the culture solution, as shown in the accompanying table. These laboratory studies indicate that carbon availability may be a limiting chemical factor to pondweed productivity. Investigations are continuing to study the relationship of organic loading in water and subsequent microorganism production and release of carbon dioxide into the aquatic environment. (Cooperative investigations of the Division of General Research, Bureau of Reclamation, U.S. Department of the Interior, and Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Denver, Colorado).

Effects of carbon availability on the vegetative productivity of sago pondweed (30-day-old plants)

Culture medium	HCO_3^{-1} alkalinity, ppm[1/]	Mean ovendry weight/plant, mg
	Study 1	
Tapwater	52	88
Tapwater + CO_2	150	198
Total nutrient solution, Chu #10	44	82
Total nutrient solution, Chu #10 + CO_2	200	188

(continued)

Culture medium	HCO_3-1 alkalinity, ppm	Mean ovendry weight/plant, mg
	Study 2	
Tapwater	40	160
Tapwater + CO_2	120	269
Total nutrient solution, Chu #10	52	164
Total nutrient solution, Ch #10 + CO_2	156	224

1/Averages of two replications per culture medium as determined by potentiometric methods of analysis.

Response of *Chlorella* sp. to three proprietary forms of copper. McHenry, W. B. and N. L. Smith. Much of the irrigation water derived from aquafers in the Central Valley of California are relatively high to very high in carbonate and biocarbonate ion. Consequently copper, the principal algaecide in use (copper sulfate), is readily precipitated and thus rendered inefficient or often completely ineffective used at or below the current registered maximum of 2 ppm copper sulfate pentahydrate (1/2 ppm elemental copper).

An experiment was conducted to compare standard copper sulfate pentahydrate, a triethanolamine copper complex (Cutrine[R]), and a citric acid-copper sulfate chelating mixture (Cuprose[R]) in jar cultures with water containing 3.42 me/1 CO_3 plus 4.79 me/1 HCO_3 (395 ppm total CO_3 and HCO_3). The water was collected in quart jars (800 ml) in September, 1970, from a local campus arboretum waterway containing a heavy algal bloom of predominantly *Chlorella* sp. The jars were placed on a laboratory bench under 540 foot-candles of continuous light derived from a mixture of cool white and warm white fluorescent lights. Water temperatures held close to 82 F. Algaecidal effects were measured as light transmittance at 660 mμ using a model M4 Q11 Zeiss spectrometer.

Initial comparisons were at concentration of 1/4, 1/2, and 1 ppm computed as elemental copper employing 4 replications.

Table 1. Response of *Chlorella* sp. in jar cultures to three proprietary forms of copper at 3 calculated concentrations

Algaecide	Calculated copper concentration	Percent light transmittance (average of 4 replications) at 660 mμ. Treated 8/31/70			
		9/1/70	9/2/70	9/3/70	9/4/70
Copper sulfate	1/4 ppm	48	51	53.5	57.0
Copper sulfate	1/2	49	51.5	54.5	58.5
Copper sulfate	1	50	50	55	58

(continued)

Algaecide	Calculated copper concentration	Percent light transmittance (average of 4 replications) at 660 mμ. Treated 8/31/70			
		9/1/70	9/2/70	9/3/70	9/4/70
Cu complex	1/4	48	51	55	58
Cu complex	1/2	48	51	56	59.5
Cu complex	1	49	51	56	60
Cu chelate	1/4	48	51.5	55	59
Cu chelate	1/2	49	52	57	60.5
Cu chelate	1	54.5	57	60.5	64
Control	-	50	54	59.5	64.5

By the fifth day following treatment no significant control had been evident and a second comparison was made in a new series using concentrations of 1, 2, and 4 ppm as elemental copper (8 times the registered maximum).

Table 2. Response of *Chlorella* sp. in jar cultures to three proprietary forms of copper at 3 calculated concentrations

Algaecide	Calculated copper concentration	Percent light transmittance (average of 4 replications) at 660 mμ. Treated 9/8/70		
		9/10/70	9/11/70	9/14/70
Copper sulfate	1 ppm	64	68	75
Copper sulfate	2	65	68	76
Copper sulfate	4	66	68	76
Cu complex	1	64	67.5	75
Cu complex	2	64	66.5	74
Cu complex	4	64	66	73
Cu chelate	1	64	67.5	75.5
Cu chelate	2	70	73	78.5
Cu chelate	4	71	73	79
Control	-	67	69	82

The second experiment was terminated after 6 days with no significant departure from the untreated controls. No attempt was made to measure the residual ionized copper but it must be presumed that under the conditions of these experiments that copper was unavailable in sufficient amounts for adequate uptake and algal phytotoxicity. (University of California, Davis).

Improved practice culminates dream of managing laterals completely free of pondweeds and algae. Boyle, W. Dean. Managers of irrigation districts and canal companies have long dreamed of maintaining laterals continuously free of algae and pondweeds. They have anticipated dribbling a chemical into these channels which would completely suppress all aquatic plant growth. The practice of biweekly applications of small quantities of xylene has brought these dreams into reality. Applications are begun when pondweeds are 4 in. to 6 in. long and while the filamentous algae are immature and still attached to the bottom or sides of the channel. For each cubic foot per second of flow, 4 to 5 gallons of xylene, premixed with 1½ percent emulsifier, is applied over a period of 30 to 45 minutes.

The degree of success with this practice is largely dependent on the proper timing of the initial treatment. Delay of the initial application until the pondweeds are longer than 6 in. may result in poor suppression of the pondweed and failure of the practice.

As might be expected, these suppressive treatments prevent the formation of seed and maturation of the pondweeds which result in a reduction of plant food storage in underground tubers and buds. These cumulative effects result in reduced pondweed vigor and thinning of stands. This reduction in stands and size of pondweed causes an extensive reduction in the deposition of silt. Some managers of irrigation districts report that savings in the cost of silt removal more than offset any increase in the additional xylene as compared to the conventional method of treatment wherein 8 to 10 gallons of xylene is applied 2 to 3 times per season. (Bureau of Reclamation, Region 1, Boise, Idaho).

Weed control on irrigation systems - cost of mowing and burning compared to spraying. Oliver, Floyd. In January, 1970 data was collected from several agencies to compare the costs of mowing and burning practices with herbicidal spraying for control of weeds on irrigation rights-of-way. Information was collected from the State Highway Department, the Sunnyside Valley Irrigation District and the Columbia Basin Project Irrigation Districts in Washington State. The A. & B. Irrigation District at Rupert, Idaho supplied cost data on propane burning for suppression of wild barley (*Hordeum jubatum*). Information on practices and costs was also supplied by Regions 6, 7 and 5 of the Bureau of Reclamation at Billings, Montana; Denver, Colorado and Amarillo, Texas for programs operated by the Bureau or irrigation districts. Representative costs for these activities were summarized to obtain average costs that could be used to estimate how ditchbank weed control expenditures would be effected if use of herbicides was curtailed on irrigation system rights-of-way in the area within Region 1 of the Bureau of Reclamation--the States of Washington, Oregon, Idaho and Western Montana.

The average cost of mowing in 1968 was $16.75/A. Frequency of the practice per growing season varied from 2 times in Washington, Montana and N. Dakota to 3 to 5 times in Colorado, Kansas and Texas. Sparse data indicated that the mowed widths on irrigation channels vary from 8 to 16 ft. on each bank. The longest sickle bar reported in use was 92 in. Objections to mowing included lack of access preventing reaching all the right-of-way, uneven terrain, obstacles on the rights-of-way, safety hazards and the debris produced. Considerable maintenance requirement on machinery was reported for both sickle bar and rotary methods. The hazard of flying objects was cited as a safety problem with the latter method, particularly in rocky terrain. Mowing is not a common practice and a trend of diminishing use in favor of spraying was evident in the reports and interviews. Density and proximity of herbicide susceptible crops was the principle reason for its use.

Costs of burning with diesel oil or propane varied from $9.00 to $20.00/A with an average of $14.65. Number of applications varied from one in Idaho and Montana to 3 to 7 in Colorado, Kansas, New Mexico and Texas. Burning costs were lower in the Southwest compared to the Northwest. Objections to burning included the fire hazard to irrigation system structures and adjacent crops, rangeland and buildings and the consequent limitation on the period it could be used, destruction of desirable protective grass stands and increasing restrictions on burning as a source of air pollution.

Based on data available from the Columbia Basin Irrigation Districts, Washington a cost estimate was prepared for removal and disposal of mowed debris that would fall or be blown into the irrigation channel. Removal of the debris produced from two mowings on a four ft. strip adjacent to each waterline of a ditch, or one acre per mile, would cost $12.50.

In Region 1 of the Bureau of Reclamation there are approximately 21,000 miles of irrigation channel right-of-way in which there is an estimated 80,000 acres in need of and susceptible to weed control. This system serves approximately 3,000,000 acres of farmland. Weed spraying costs in this Region vary from $2.25 to over $5.00/A. If this 80,000 acres of right-of-way is sprayed once and half of it is sprayed twice each year at a cost of $5.00 per treatment, the average annual cost per irrigable acre is 20 cents. Results of this inquiry indicate that mowing or a combination of mowing and burning would be considerably more expensive than herbicide spraying. Mowing and debris removal on a like acreage would increase costs by 76 cents per irrigable acre; a combination of burning and mowing would increase costs by 67 cents. Tables 1, 2 and 3 give the derivation of these estimates. (Col. Basin Irrigation Districts, P. O. Box 96, Mesa, Wa. 99343).

Table 1. Estimated cost of mowing and debris removal

Mowing	
80,000 acres @ $16.75 = $1,340,000 x 2 mowings per season	= $2,680,000

(continued)

Debris removal 1 acre per mile or 1/5 of right-of-way (4-foot strip waterline) @ 1/2-tone dry debris = 8,000 tons @ $25 per ton (1/2 ton of dry debris produced from 2 mowings would be equivalent to a very light hay cutting. In wet condition the weight would be increased several times)	$ 200,000
Total cost	$2,880,000

Table 2. Estimated cost of burning-mowing combination

Burn inside slopes Average of 4 ft. strip each side or 1 acre per mile; 16,000 acres (1/5 of 80,000 acres) @ $14.65 per burning	$ 234,400
Mow top and outside bank Average of 16 ft. strip each side or 4 acres per mile; 64,000 acres (4/5 of 80,000 acres) @ $16.75 per mowing	$1,072,000 $1,306,400
Two treatments per season	x 2
	$2,612,800

Table 3. Alternatives compared to spraying

Spray 80,000 acres 1-1/2 times per season at $5 per acre	$ 600,000
Mowing and debris removal	$2,880,000
Spraying	- 600,000
Savings from use of herbicidal sprays	$2,280,000
Burning-mowing combination	$2,612,800
Spraying	- 600,000
Saving from the use of herbicidal sprays	$2,012,800

Control of dallisgrass with foliage-applied herbicides. McHenry, W. B. and N. L. Smith. Dallisgrass has proven to be a difficult weed of moist roadside sites and more particularly of canal banks along the saturated soil at the waterline. Although the species lacks the extensive rhizome development of johnsongrass, untilled stands of dallisgrass are in many respects more difficult to control with either soil-applied or foliage-applied herbicides.

An experiment employing 4 replications was initiated in July, 1968, on a Solano County canal bank to compare retreatment intervals and application rates of DSMA and MSMA (compared on equal arsenic basis), combinations of MSMA (8 lb ai/A) with dicamba (50 and 100 ppm) and with picloram (5 and 10 ppm). The grass was at full bloom stage. Herbicide combinations offered no advantage over MSMA alone, and retreatment intervals of 10 and 15 weeks were appreciably less effective than a 5-week interval.

Table 1. Dallisgrass control with DSMA and MSMA applied to 200 gpa with ½ percent Surfax on a 5-week retreatment interval, experssed as the average of 4 replications. Number of treatments given are cumulative.

			Control (10=100%)		
	Acre Rate		8/28/69	10/8/69	4/21/70
Herbicide	A.I.	Formul.	(4 treats)	(6 treats)	(6 treats)
DSMA	9 lb	14.3 lb	7.3	8.6	9.9
MSMA	8	1.2 gal	4.8	8.5	9.9
MSMA	12	1.8	8.5	9.7	10.0
Control	-	-	0.0	0.0	0.0

A second experiment was initiated on the same canal in July, 1969, to compare MSMA, dalapon, dalapon + MSMA, ethylene glycol-bis-(trichloroacetate) (Glytac), and methyl-4-aminobenzene sulfonylcarbamate (ARD 13-02). In contrast to other experiments here, the dallisgrass was at a peak of vegetative vigor with only a few short inflorenscences present.

The highest degree of control was obtained with either dalapon alone or in combination with MSMA. It appears from this trial and earlier testing that dallisgrass is more responsive to dalapon at a very early flowering stage in contrast to a later stage following extensive flower stem elongation. Orchex (emulsifiable non-phytotoxic oil) at 1 percent was comparable to the surfactant Surfax at 1/4 percent. A slight improvement in stand reduction was observed where dalapon was combined with MSMA. MSMA appears to require applications rates above 4 lb ai/A and many additional retreatments to achieve acceptable stand reduction. Glytac and ARD 13-02 at the rates tested provided a lower order of control and were discontinued after 3 applications. (University of California, Davis).

Table 2. Dallisgrass control with foliage-applied herbicides and varying penetrants applied in 200 gpa, expressed as the average of 3 replications. Number of treatments given are cumulative; retreatment interval ca. 5 weeks.

	Acre Rate			Control (10=100%)				
Herbicide	A.I.	Formul.	Penetrant	8/28/69 (1 treat)	10/8/69 (2 treats)	11/18/69 (3 treats)	7/29/70 (3 treats)	10/23/70 (4 treats)
MSMA	4 lb	0.6 gal	¼% Surfax	0.3	2.0	1.3	3.0	4.7
MSMA	4	0.6 gal	1% Orchex	1.0	2.0	3.0	5.0	6.3
Dalapon	20	27 lb	¼% Surfax	1.0	4.3	9.1	7.0	9.7
Dalapon	20	27	1% Orchex	0.7	4.0	8.7	6.2	9.5
Dalapon + MSMA	20 +4	27 +0.6 gal	¼% Surfax -	1.0	5.0	9.3	6.6	9.9
Glytac	1/	14.5	100% diesel	0.3	1.3	8.0	2.7	(discontinued)
Glytac	1/	14.5	None	0.0	0.7	6.3	0.0	(discontinued)
Control	-	-	-	0.0	0.0	0.0	0.0	0.0

1/ Analysis not supplied.

Response of seedlings of three perennial ditchbank grasses to four herbicides. Comes, R. D. Reed canarygrass (*Phalaris arundinacea* L.), redtop (*Agrostis alba* L.) and creeping red fescue (*Festuca rubra* L.) are well adapted to the area along the waterline of canals and ditches in the Pacific Northwest. Generally, reed canarygrass is a troublesome weed on such sites. The other two species are desirable for erosion control and as competition against annual weeds. Reed canarygrass seedlings frequently are present and prevent the establishment of redtop or creeping red fescue when seeded on such sites.

Seedlings of the above species emerged on May 9, 1969, from seeds planted in rows spaced 24 inches apart. The following herbicide treatments were applied 3, 5, 7, or 10 weeks after emergence of the seedlings: amitrole-T at 1, 2, and 4 lb/A, paraquat at 0.5 and 1.0 lb/A, cacodylic acid at 2 and 4 lb/A, and dalapon at 4 and 8 lb/A. The amitrole-T treatments at 2 and 4 lb/A were repeated on the same plots on September 9, 1969. All herbicides were mixed with water and applied as sprays at 60 gpa. Measurement of susceptibility was based on stand reduction and not on initial injury symptoms.

The lowest rate of each herbicide did not reduce the stand of any species more than 23 percent. Paraquat and cocodylic acid applied at 1 and 4 lb/A, respectively, 3 weeks after emergence of the grasses nearly eliminated all species. However, such treatments applied 5, 7, and 10 weeks after emergence did not reduce the stand of reed canarygrass or creeping red fescue more than 35 percent. Paraquat at 1 lb/A, applied to redtop 5 weeks after emergence, reduced the stand 66 percent but did not reduce the stand when applied 7 and 10 weeks after emergence.

None of the applications of amitrole-T at 2 and 4 lb/A or dalapon at 8 lb/A reduced the stand of redtop on any treatment date. Reed canarygrass was slightly more susceptible than creeping red fescue to such treatments, but a single treatment did not reduce the stand of either grass more than 58 percent.

The second application of amitrole-T at 4 lb/A reduced the stand of creeping red fescue and reed canarygrass 93 to 99 percent, but it did not affect the stand of redtop. These results indicate that reed canarygrass seedlings can be selectively controlled in a reed canarygrass-redtop seedling community with amitrole-T applied at 4 lb/A 3 to 7 weeks after emergence of the grasses and again in the fall of the year of establishment. (Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and the Washington Agricultural Experiment Station, Prosser, Washington).

PROJECT 7. CHEMICAL AND PHYSIOLOGICAL STUDIES

E. E. Schweizer, Project Chairman

SUMMARY

Six progress reports were submitted. They reported that:

Dichlobenil interferred with the transport of $^{14}CO_2$ assimilates from cotton leaves by causing callose depositions on the sieve plates and border pits of sieve elements. Callose deposition appeared to be related to concentration of dichlobenil included in the nutrient solution and the period of time the roots were kept in a solution containing dichlobenil.

Three new furocoumarins were isolated from spring parsley. One furocoumarin was not phototoxic and the other two were phototoxic to one-week-old chicks when administered orally.

Plants stress produced by different herbicides was not distinguished by either infrared or color film photography. Infrared color images produced in drought stress cultures of bluegrass turf were distinctly different than those produced by insect attack or a growth regulating chemical.

Infrared spectrophotometry did not aid in identifying dicamba and picloram injury in pinto beans. Refinement or alterations of this technique will be required to make this method useful for diagnosing specific herbicide injury.

A two-year study on the persistence of S-6115, SD-15418, and atrazine in soil showed that S-6115 was as persistent as atrazine at equivalent rates. SD-15418 was definitely less persistent than atrazine or S-6115. In a one-year study, BAY-94337 appeared to be less persistent than any of the triazines.

Five months after dicamba was applied at rates from 1 to 6 lb/A, barley was injured at rates higher than 1 lb/A, spring wheat at rates higher than 2 lb/A, and oats at rates higher than 4 lb/A. Twenty months after 2 lb/A of dicamba or 1 lb/A of dicamba plus 3 lb/A of 2,4-D amine was applied, the yield of alfalfa from the second year's growth in these treated plots was more than double the yield obtained from the non-treated plots which were infested with Canada thistle.

<u>Some effects of dichlobenil on transport of assimilates in cotton.</u> Glenn, R. K., O. A. Leonard and D. E. Bayer. Cotton seedlings, var. Acala, were germinated in moist sand for 7 days and then transferred to jars containing half strength Hoagland solution. The plants were then placed in a greenhouse maintained at 80 C and grown until the third

and fourth true leaves were about two thirds expanded at which time the plants were ready for treatment.

In the initial experiment roots of cotton plants were treated with solutions containing 0, 0.2, 2.0, and 20 ppm of dichlobenil for varying periods of time (0, 5, 25, and 125 hr), exposed to $^{14}CO_2$ and following a 24 hr transport period were freeze-dried. The plants were then divided into leaves, stem and root, ground and counted.

Plants treated with 0.2 ppm dichlobenil showed a slight reduction in transport of assimilates to the roots after 25 hr treatment and about the same results after 125 hr. Plants treated with 2.0 or 20 ppm showed little reduction in transport to the roots until they had been exposed to dichlobenil for 25 hr and then at both 25 and 125 hr exposure transport was almost completely blocked.

Plants in this study were also autographed and it was noticed that accumulation of labeled assimilates by both the apical and axial buds was almost completely blocked even before any reduction in transport to the roots had occurred so in the following studies the plants were sectioned into leaf, apical bud, stem, and roots. Culturing, treatment and counting methods were the same as in the previous study for all subsequent studies.

In the next experiment the roots were treated with a solution containing 20 ppm dichlobenil for 1, 5 and 25 hr, removed from the treatment solution, washed in water, and returned to half strength Hoagland solution for 0, 1, 7, and 14 days. At the end of these respective times the plants were labeled with $^{14}CO_2$ and after a 24 hr transport period harvested, freeze-dried, ground and counted.

Transport to the apical bud was almost completely stopped by simply exposing the plants to $^{14}CO_2$ and placing the roots in dichlobenil solution during the 24 hr transport time.

Transport to the roots on the other hand was only slightly reduced after 1 day exposure to dichlobenil and not until 7 days following exposure for either 1, 5 or 25 hr was transport almost completely blocked. At the longer periods following exposure to dichlobenil there was no apparent recovery of assimilate transport.

A third experiment was designed as a repeat of some of the previous data and also to show the effect of dichlobenil on CO_2 fixation. The roots were treated with a 20 ppm solution of dichlobenil for 24 hr, returned to half strength Hoagland solution for 0, 1 and 7 days, and then processed as in the previous experiment except that half the plants from each experiment were harvested immediately after exposure to $^{14}CO_2$ and the other half after a 24 hr transport period. Results in the table again show the rapidity dichlobenil displays in reducing transport to the apical bud although in this study blockage was not achieved until 1 day after exposure to dichlobenil. Transport to the roots was reduced by two thirds 1 day after exposure to dichlobenil and after 7 days almost 100 percent.

In a further study utilizing detached leaves, plants were exposed to a solution containing 20 ppm dichlobenil for 24 hr and returned to half strength Hoagland solution for 2 days. At this time the plants were exposed to $^{14}CO_2$ and immediately following exposure two fully expanded leaves were excised from one half the plants and placed in a moist container during the 24 hr transport period. At the end of the transport period comparable leaves on the remaining plants were excised and all the leaves were freeze-dried and autographed. When compared with control leaves both the attached and detached leaves showed almost complete blockage of movement of labeled assimilates out of the mesophyll tissue into the veins.

In another experiment an attempt was made to determine if dichlobenil had reduced the levels of ATP in various portions of the plants. No detectable differences were found between treated and untreated portions of any of the plants.

In a final experiment the authors used analine blue and fluorescent microscopy to study whether dichlobenil caused an accumulation of callose above normal levels anywhere in the transport system. Plants harvested one day after exposure to solutions of 20 ppm dichlobenil showed considerable increase in the callose deposited on both the sieve plates and border pits of sieve elements as compared to control plants. Seven days after exposure, the callose deposits on both the sieve plates and the border pits had not diminished and in many cases had increased and quite severe disruption of the sieve elements was apparent. The authors have assumed that this reaction is not reversible and could possibly contribute to the reduction in assimilate transport in the earlier stages and that in the later stages a combination of the increased callose deposition plus the disruption of the sieve elements results in nearly 100 percent reduction of assimilate transport. (Department of Botany, University of California, Davis).

Percent distribution of labeled assimilates in cotton after 0 and 24 hr transport periods. Based on s.a. (c/m/mg).

Days following 24 hr root treatment with 20 ppm dichlobenil solution	Leaves		Apical Buds		Stems		Roots	
	0 hr	24 hr	0 hr	24 hr	0 hr	24 hr	0 hr	24 hr
Control	96.0	32.7	0.3	18.7	3.4	20.1	0.3	28.5
0 day	97.0	40.5	0.2	19.0	2.3	16.3	0.5	24.2
1 day	98.2	83.9	1.4	1.5	0.3	4.9	0.1	9.7
7 days	94.1	83.6	4.0	11.1	1.6	4.7	0.2	0.6

Isolation of three new furocoumarins from spring parsley. Williams, M. Coburn. Spring parsley (*Cymopterus watsonii* (Coult. & Rose) Jones) is a perennial species of the Umbelliferae which causes photosensitization in sheep on desert ranges in southwestern Utah and southeastern Nevada. The species contains several phototoxic furocoumarins.

Bergapten and xanthotoxin were previously identified as the principal furocoumarins responsible for photosensitization of sheep. Three additional furocoumarins have been isolated. One appears to be isopimpinellin. Although widely distributed in the Umbelliferae, this furocoumarin is not phototoxic. Two other yellow-fluorescing furocoumarins were isolated by column chromatography. Both have low Rf values and occur in low concentrations in the plant. They were phototoxic to one-week-old chicks when administered orally. Further purification and identification studies are in progress.

Cymopterus longipes S. Wats., a closely related species which occurs widely in the Intermountain West, has not been reported to cause photosensitization in livestock under field conditions. Examination of this species indicates that it contains the same furocoumarins as spring parsley but the concentrations are much lower. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and the Utah Agricultural Experiment Station, Logan).

The use of infrared color photography in the detection of plant stress. Fults, Jess L. and Bert L. Bohmont. Infrared color photography has been used for several years for detection of camouflage, vegetation mapping and land use surveys. Its use by plant pathologists to detect the specific locations of plants under the stress of disease has been well established. Its use for the evaluation of the herbicidal control of range weeds, rabbitbrush (*Chrysothamnus viscidiflorus* (Hook.) Nutt) and medusa head (*Taeniatherum asperum* (Sim.) Nevski), has been pioneered by Young, Evans and Tueller working in Nevada. Since infrared color photography has been applied to the detection of specific clinical diseases of animals that could not be detected by other forms of photography, this suggested that certain kinds of stress in plants might be more specifically detected by infrared color photography than by ordinary color photography. The investigations reported here have explored this question. The kinds of stress explored include that produced by insect injury, moisture stress and herbicide damage. The color film used was 35 mm Kodachrome II; the infrared color film used was Kodak Ektachrome Infrared Aero film 8443. The camera used was a Canon equipped with a macro-lens FL 50 mm, 1:35. A No. 12 K light yellow filter was used with the infrared film--development was by Eastman Kodak Process E-3. Plants used for comparisons "in the field" included corn, sugarbeets, barley, potatoes, beans and several kinds of turf grasses--particularly Kentucky bluegrass, bentgrass, perennial ryegrass and mixed bluegrass-buffalo grass.

Results of aerial photography comparisons - scale 1:2880 to 1:5000. Each crop could be identified by their specific color in the infrared films--the color differences were somewhat more specific than with ordinary color (Kodachrome II). Stress produced by different herbicides was not distinguished by either infrared or color film. Different kinds of turf grasses produced characteristic colors with both infrared and color film; the size of the differences between kinds was perhaps a little greater in the case of the infrared film.

When the amount of injury produced by certain herbicides on bluegrass turf was compared in infrared vs Kodachrome II, it was found that the differences were about equal. Evaluation of the several plots using either type of film showed specific differences between the stress produced by different herbicides. The information was well correlated with ground based photography and vegetation evaluation.

Results of greenhouse and laboratory comparisons. Stress symptoms produced in cultures of bluegrass turf produced by drought, insects and growth inhibition by a growth regulating chemical were somewhat more apparent with infrared photography than with color photography. Drought stress produced on infrared color images were distinctly different than those produced by insect attack or growth regulating chemical.

Varigated leaves (those lacking chlorophyll in certain areas) produced distinctly greater color differences with infrared film than color film but basically did not add much specifically to biological interpretation.

Leaves of bean plants grown under phytotoxic levels of herbicides produced specific images on both infrared and color film. However the differences between control and herbicide treatments seemed definitely better with simple color film compared to the infrared. (Weed Research Laboratory, Colorado Agricultural Experiment Station and Colorado Cooperative Extension Service, Colorado State University, Fort Collins).

Infrared spectrophotometry as a tool for identification of herbicides involved in crop injury. Bohmont, Bert L. This study was initiated to evaluate the infrared spectrophotometer as a possible tool to aid in identifying herbicide injury in crop plants. The intent was not to measure the actual herbicide, but rather to measure the molecular changes that might be brought about in the plant constituents as a result of the action of the herbicide.

Pinto beans were grown in the field in soil treated with dicamba at rates of 1/2, 1, 2 and 4 lb/A and in picloram treatment of 1/2, 1, 2 and 4 oz/A. Portions of the top growth were harvested when the plants were 8 weeks old.

Extracts of the dried, ground plant materials were made using a series of increasingly polar solvents. Solvents used were hexan, carbon disulfide, ether, and ethyl alcohol.

Potassium bromide was mixed with a portion of the residue remaining from the evaporated extracts. The resulting KBr-residue material was thoroughly mixed in a ball mill. The mixed material was then made into a pellet which was inserted into the infrared spectrophotometer and scanned from 2 to 15 microns wavelength using a NaCl prism.

Examination of the spectra revealed only minor differences between the spectra for the two herbicides when extracted in ether and ethyl alcohol. The spectra of the two herbicide extracts did deviate from that of the control at 5.9 microns wavelength and at 11.5 - 12.5 microns wavelength. The deviation at 5.9 microns wavelength, although minor, would indicate increased activity of carbonyl groups. At 11.5 - 12.5 microns wavelength there was a definite difference between the spectra for the herbicides and the control spectra. The two herbicide treatments were remarkably similar in their pattern. The activity indicated in this region was most probably due to $N-H_2$ out-of-plane bending vibrations.

Additional studies and refinement or alterations of the technique will be required in order to make this method useful for specific herbicide injury diagnosis. (Colorado Cooperative Extension Service and Botany and Plant Pathology Department, Colo. State Univ., Fort Collins).

Small grain and alfalfa yields as affected by application of dicamba. Gale, A. F., H. P. Alley and G. A. Lee. The results of a study using dicamba in conjunction with cultivation for control of Canada thistle (*Cirsium arvense* (L.) Scop.) were reported in the 1970 Research Progress Report. The study reported herein is a continuation of that study and was established to evaluate the soil residual effects of dicamba on small grains and alfalfa.

A replicated series of plots were established on land which had been cropped during the 1969 growing season. Dicamba at rates ranging from 1 to 6 lb/A was applied December 3, 1969, and small grains planted across all treatments May 2, 1970, approximately 5 months after the applications were made.

The yields of small grains presented in the attached table are from plots treated 5 months prior to seeding and the alfalfa yields from the initial evaluation program which was established in 1968 and seeded in 1969.

There was apparently no effect on yield of spring wheat up to the 2 lb/A application and no effect on yield of oats at even higher rates up to 3 to 4 lb/A of dicamba.

The susceptibility of barley to dicamba residues has been documented in previous studies and is again indicated in this study. All treatments higher than the 1 lb/A rate caused serious yield reduction and poor quality seed.

The yield of alfalfa is indicative of the Canada thistle control obtained from the combination of mechanical + herbicide treatments (1969 Research Progress Report) and alfalfa establishment on plots treated in 1968 and seeded in 1969.

Alfalfa yields, one cutting, from all chemical treated plots were equal to or higher than from the non-treated plots. Yields from two treatments, dicamba at 2 lb/A and the combination of dicamba + 2,4-D amine at 1 + 3 lb/A, were more than double the yield obtained from the non-treated plots. These two treatments resulted in an original 90 percent reduction in Canada thistle stand. (Wyoming Agriculture Experiment Station, Laramie, SR-289).

Small grain and alfalfa yields from dicamba-treated plots

		Yields			
		Bu. Per Acre			lb/A
Treatment[1/]	Rate lb/A	Spring wheat	Oats	Barley	Air-dry Alfalfa
dicamba	1	22.2	88.2	40.9	4486
dicamba	2	20.4	85.0	24.6	6026
dicamba	3	16.8	71.4	16.2	4886
dicamba	4	12.9	69.9	8.9	
dicamba	6	14.2	64.7	3.3	3420
2,4-D amine	2				3697
dicamba + 2,4-D amine	3/4 + 1.5				3067
dicamba + 2,4-D amine	1 + 3				6046
Check		21.6	72.4	39.2	2972 + 3600 lb Canada thistle

[1/] Treatments for the small grain study were established 12/3/69 and seeded 5/2/70. The treatments from which the alfalfa yields were obtained were established 9/16/68, and seeded the spring of 1969; therefore, yields are from second year's growth.

<u>Herbicide residues in soil</u>. Zimdahl, Robert L. This is the second year of a study first reported in 1970. We have compared the field persistence of two of the newer triazine herbicides, 2-(4-chloro-6-ethylamino-<u>s</u>-triazine-2-ylamino)-2-methylpropionitrile (SD-15418) at 2 and 4 lb/A, 2-chloro-4-cyclopropylamino-6-isopropylamino-1,3,5-triazine (S-6115) at 1, 2, and 4 lb/A with atrazine. This year we also included 4-amino-6-t-butyl-3-(methylthio)-<u>as</u>-triazin-5-(4H)-one (BAY-94337) at 1, 2, and 4 lb/A. One location with two replicates was established on

a loam soil with 1.7 percent O.M., 46 percent sand, 35 percent silt, and 19 percent clay. Two applications (approx. May 15 and June 15) were made each year. After the second application one row of field beans, sugarbeets, Moravian barley, and Scout wheat was planted in each 10 by 10 ft plot. Additional plantings were made in mid July, August, and September. The final planting will be made in the spring of 1971. The plots were furrow irrigated which created some problems in obtaining sufficient moisture for germination at the later planting dates.

Data from each year show that S-6115 is as persistent as atrazine at equivalent rates. These compounds will remain to injure sugarbeets and field beans the succeeding year. The tolerance of wheat and barley is greater but they should not immediately follow an application of 2 lb/A of either compound. The residues did seem to dissipate more rapidly in 1970 as a wetter spring and summer exerted their influence. We are not sure if this will be expressed in the spring 1971 planting. It is interesting to note that the injury level rose from the late summer to the spring plantings in the experiment begun in 1969. We had doubts about the validity of a field bioassay when these crops were planted with poor moisture and irregular irrigation late in the summer. The differential injury observed, emphasizes the problems with a field bioassay when crops are planted at other than normal times.

SD-15418 is definitely less persistent than atrazine or S-6115 and causes only minimal injury to the four crops in the second year when applied at 4 lb/A. Sugarbeets remain sensitive throughout the first year but field beans were less sensitive. Barley and wheat should not be planted as alternative crops if a corn crop failure occurs in the year of use.

BAY-94337 appears to be less persistent than any of the triazines. The sugarbeet and field bean data indicate that the phytotoxic effect of 1 lb/A may be gone in 2 months and 2 lb/A in a slightly longer time. We believe BAY-94337 will prove to be a compound with few problems of injury to succeeding crops. (Weed Research Laboratory, Dept. of Botany and Plant Pathology, Colorado State University, Fort Collins).

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 Herbicides[1/]

Common name	Chemical name[2/]
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
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-ethyl-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
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-dimethyl=urea
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-2H-1,3,5-thiadiazine-2-thione
DCPA	dimethyl tetrachloroterephthalate
DCU	1,3-bis(2,2,2-trichloro-1-hydroxyethyl)urea
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]pyrazinedi=ium 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(trichloro=acetate)
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-trazine

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

Common name	Chemical name
IPC (see propham)	
isocil	5-brome-3-isopropyl-6-methyluracil
isopropalin	2,6-dinitro-N,N-dipropylcumidine
K	
KOCN	potassium cyanate
L	
lenacil	3-cyclohexyl-6,7-dihydro-1H-cyclopentapyrimidine-2,4(3H,5H)-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-1H-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(trichloroacetate)
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-4,7-methanoindan-5-yl)-1,1-dimethylurea
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-methylcar= banilate

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(2H)-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[3]	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]Herbicides no longer in use in USA are omitted. Complete listing, including these, is in WEEDS 14(4), 1966.

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

2/ 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.

3/ This herbicide usually is available as mixed isomers. When possible, the isomers should be identified, the amount of each isomer is the mixture specified and the source of the experimental chemicals given.

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 minutes
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

AUTHOR INDEX

CROP INDEX

Page No.

Page No.

WOODY PLANT INDEX

HERBACEOUS WEED INDEX

Page No.