WESTERN SOCIETY OF WEED SCIENCE

RESEARCH PROGRESS REPORT

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PREFACE

This is the 1968 Annual Progress Report of the Research Committee of the Western Society of Weed Science. It includes the progress of research in weed science conducted throughout the conference area. These reports are grouped into each of the seven projects composing the research committee.

Because of the limited time allowed for compiling and printing the Research Progress Reports, questions of conformity and context were primarily the responsibility of each respective Project Chairman.

The cooperation of the Project Chairman and research workers of the Western Society of Weed Science, in making this report possible, is greatly appreciated. Special thanks is extended to Harold P. Alley and Gary Lee for their assistance in printing and assembly of the Research Progress Report.

David E. Bayer
Secretary, Research Committee
Western Society of Weed Science

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PROJECT 1. PERENNIAL HERBACEOUS WEEDS

Allen D. Fechtig, Project Chairman

SUMMARY

Seventeen research progress reports on eleven different perennial herbaceous weeds were submitted for publication. A brief summary of each report is given in alphabetical order.

Bermuda grass (Cynadon dactylon L.). University of California research workers found TCA at 60 lb/A to be one of the most effective incorporated pre-emergence treatments. Post-emergently, from a cost-effectiveness standpoint, dalapon was found to be the superior treatment. The pre-emergence or the post-emergence treatments did not, however, eradicate the Bermuda grass.

Bracken fern (Pteridium aquilinum L.). Dicamba and picloram at 6 and 3 lb/A ai, respectively, have given at least 95 per cent control for a period of two years in Western Oregon.

A second group of researchers found a 4 lb/A ai of picloram (granule) applied from early February until April gave 100 per cent control. A 2 lb/A ai rate of picloram (K salt) and a 9 lb/A ai rate of dicamba gave complete control of the bracken fern. Hexafluoroacetone at 40 lb/A ai also gave 100 per cent control.

Canada thistle (Cirsium arvense L.). Two papers from the University of Idaho were received. One paper deals with the phenological development of Canada thistle, and the other deals with the effect of moisture, temperature, nitrogen, and subsequent herbicide treatments on two Canada thistle strains.

Dallisgrass (Paspalum dilatatum Poir.). Several herbicides showed promise for the control of dallisgrass in California, however, results were variable.

False hellebone (Veratrum californican Durad). Researchers at the University of California at Davis report 2 lb/A ai of 2,4-D to give superior control when applied prebloom to the false hellebone. At least 80 per cent control has been obtained with this treatment.

Field bindweed (Convolvulus arvensis L.). Picloram alone or in combination with phenoxy compounds has been found to be extremely effective on field bindweed by weed control workers at the University of Wyoming. Tordon 101 containing .54 lb picloram and 2 lb 2,4-D/gal gave excellent control at the rate of 1/2 and 1 gal/A. The control received at these two rates was 95 and 100 per cent respectively.

Johnson grass (Sorghum halepense L.). K. C. Hamilton at the University of Arizona reports organic arsenicals to be effective for controlling johnsongrass. From a standpoint of cost-efficiency DSMA and MSMA are comparable. Pretreating with soil active herbicides followed by 2 or 3 applications of MSMA have given 99+% control of johnsongrass.

Leafy spurge (Euphorbia esula L.). A three year study at the University of Wyoming has shown excellent control of leafy spurge with picloram alone or in combination with 2,4-D.

Nutsedge control (Cyperus esculentes and C. rotundus). Bromacil, CP-31675, dichlobenil, and Prefix all gave outstanding residual control.

Poverty weed (Franseria discolor Nutt.). Dicamba and picloram have been reported to effectively control poverty weed. Combinations of these two compounds with 2,4-D did not increase the activity.

Tansy (Tanacetum vulgare L.). Picloram at 3/4 lb/A ai was required to maintain 100 per cent control of tansy for two years.

Comparison of several herbicides for bermuda grass. Lange, A. H. and H. M. Kempen.

Preemergence Incorporated:

Nine herbicides were applied to prepared soil in a heavy bermuda grass (Cynodon dactylon) infested, non-crop area under heavy rainfall conditions on the Island of Molokai, Hawaii. Herbicides were incorporated by a power incorporator run at 4-6 inches depth immediately after herbicide application. TCA at 60 lb/A was one of the more effective treatments (Table 1). Other herbicides such as monuron, prometone, and atrazine, at rates up to 50 lb/A, gave some degree of control. Dicamba at somewhat lower rates showed a degree of control even at rates as low as five pounds. EPTC, diallate, CIPC, and Pentachlorophenol were essentially ineffective.

Postemergence Applications:

A heavily infested stand of mature bermuda grass was treated with three applications in the spring of the year over a period of three months in a field adjacent to the one in the first test. Control ratings were made at monthly intervals one month after the first treatment and continuing for seven months.

The most effective treatment was dalapon. Other herbicides showing some control were high applications of amitrole, dicamba, and linuron, none of which would compete with dalapon from a cost-effectiveness standpoint.

Incorporated and Non-incorporated Compared:

In a third test in Kern County, California under very low rainfall conditions (about 3 in.), six herbicides were applied in February. Two replications were incorporated with a disc. TCA was the only herbicide that gave satisfactory control and it did not eradicate the bermuda grass at rates up to 320 lb/A.

Pyriclor was next best, giving fair control of bermuda grass at 16 lb/A. It seemed better on saltgrass, giving excellent control at 8 lb/A.

Bromacil and Niagara 11092 were unsatisfactory here despite the fact that at 6 lb/A, excellent control has been achieved where summer sprinkling is done.

Atratol 8P (a mixture of 8% atrazine with sodium chlorate and sodium metaborate) and Pramitol 5P (a mixture of 5% prometone with sodium chlorate and sodium metaborate) were also ineffective during the season of application.

Discing after application of TCA, bromacil, Niagara 11092, and pyriclor enhanced the herbicidal effectiveness of these compounds but reduced the effectiveness of Atratol 8P and Pramitol 5P. (University of California, Riverside.)

Table 1. A comparison of several herbicides applied and then incorporated into the soil for the control of bermuda grass.

Herbicide	Lb/A	Average 1/ percent control after: 1 mo. 2/	2 mos. 2/	3 mos. 3/
TCA	20	62	64	70
	40	71	84	76
	60	100	94	88
Pentachlorophenol	100	44	29	70
	500	37	0	49
	1000	47	32	15
monuron	25	82	100	98
	50	71	87	90
prometone	5	3	8	27
	25	74	77	90
	50	35	87	90
atrazine	5	35	32	56
	25	73	71	83
	50	94	94	98
dicamba	5	79	71	64
	10	97	94	86
	20	97	97	93
EPTC	4	44	52	52
	8	15	23	15
	16	6	6	10
diallate	4	29	-3	20
	8	41	42	41
	16	32	45	47

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Table 1. (Continued)

Herbicide	Lb/A	Average[1/] percent control after: 1 mo.[2/]	2 mos.[2/]	3 mos.[3/]
CIPC - IPC	4	-3	6	17
	8	18	16	66
	16	9	19	54
Check	0	0	0	0

1/ Average of 4 replicates (5' x 5') sprayed and incorporated into the soil on October 11, 1960.
2/ Based on the number of shoots per square foot.
3/ Based on the percent of cover of weed growth.

Table 2. A comparison of several foliar-applied chemicals for bermudagrass control.

		Percent control after:						
		Months						
Herbicide	Lb/A	1	2	3	4 1/2	5 1/2	6 1/2	7 1/2
amitrole	8	100	85	58	2	0	0	0
	8+8	100	92	80	32	10	0	0
	8+8+8	100	98	92	78	48	15	12
amitrole	16	100	95	82	30	8	0	0
	16+16	100	98	100	68	40	25	20
	16+16+16	100	100	100	85	65	40	38
dicamba	20	80	18	10	0	0	0	0
	20+20	60	48	18	8	0	0	0
	20+20+20	82	62	62	62	52	38	40
dicamba	40	88	60	58	12	0	0	0
	40+40	90	70	65	62	58	30	28
	40+40+40	90	88	82	88	88	80	72
linuron	8	98	50	18	0	0	0	0
	8+8	95	85	72	18	0	0	0
	8+8+8	88	75	58	32	15	0	0
linuron	16	100	52	25	2	0	0	0
	16+16	100	88	82	35	18	0	0
	16+16+16	100	90	88	72	50	35	35
ametryne	8	98	22	8	0	0	0	0
	16	95	38	12	0	0	0	0
dalapon	10	98	85	78	28	10	0	0
	10+10	95	100	98	82	52	32	20
	10+10+10	95	95	100	92	72	55	50
Check	--------	0	0	0	0	0	0	0

Control ratings from April 10 to September 26 were based on 0 = no control to 10 = 100% or completely dead. Plots were sprayed on March 10 and at approximately monthly intervals thereafter where indicated.

Table 3. Bermudagrass control on ditchbanks in Kern County, Calif.

Treatments	Lb/A active	Lb/A product	Bermudagrass 1/ Disced 4/27	Disced 6/8	Non-disced 4/27	Non-disced 6/8
1. TCA	160	200	8.9	9.9	8.0	7.7
2. "	241	300	8.9	9.9	8.3	9.6
3. "	321	400	9.3	9.9	9.5	8.9
4. bromacil	6	7.5	2.3	5.2	3.8	2.0
5. "	8	10.0	3.0	5.0	3.5	3.7
6. "	10	12.5	3.5	5.7	3.8	5.2
7. Niag 11092	6	12	2.3	4.0	3.5	2.5
8. "	8	16	3.0	6.2	3.5	2.0
9. "	10	20	2.8	3.2	3.8	3.2
10. pyriclor	8	5.3	5.0	6.0	4.0	3.0
11. "	12	8	5.3	7.0	3.8	2.7
12. "	16	10.6	7.0	8.6	5.0	4.7
13. Atratol 8P	200	500	2.0	2.7	4.0	3.5
14. "	300	750	2.0	2.7	4.0	5.5
15. "	400	1000	3.0	3.7	5.7	6.2
16. Pramitol 5P	200	500	2.0	4.2	4.5	3.5
17. "	300	750	2.5	4.5	4.5	5.5
18. "	400	1000	3.3	5.0	4.3	5.6
19. Untreated	-	-	0.3	0.2	0.0	0.0

1/ Treated 2/7/67; rated 0 to 10; 0 = no effect; 10 = kill; averages of 2 replications each and 4 independent ratings on bermudagrass.

Chemical control of bracken fern (Pteridium aquilinum L.) in western Oregon. Fechtig, Allen D. Timing trials established during 1966 in the Coast Range in western Oregon showed dicamba, dichlobenil, and picloram to effectively control bracken fern. Maximum control was obtained with each of the herbicides when applied prior to frond emergence.

Dichlobenil effectively controlled 80% of the bracken fern through the 1966 growing season, but the plots showed essentially no control during 1967. The 4% granular formulation gave consistent results, while the control resulting from the wettable powder was extremely erratic.

The 4 lb/gal formulation of dicamba and the 10% dicamba granules at the rate of 6 lb/A ai each gave at least 95% control during 1966 and maintained this outstanding control through 1967.

Tordon bead formulation of 2% picloram and the potassium salt of picloram at 3 lb/A ai gave results comparable to the dicamba treatments. (Department of Farm Crops, Oregon State University, Corvallis, Oregon.)

Bracken fern control. Homesley, Wylie B. and W. R. Furtick. In the spring of 1967 experiments were established at three locations (about 7 miles north of Dallis in Polk County, and at Eddyville in Lincoln County and about 7 miles north of Noti in Lane County, Oregon) on stands of bracken fern (Pteridium aquilinum). The objective of the experiment was to obtain better information of the effectiveness of chemicals which show activity on bracken fern at different locations. A randomized block design was used with 4 blocks at each location.

Applications of dichlobenil (as 4% granular), dicamba and hexafluroacetone were made preemergence on March 24 to April 14. Picloram (as Tordon 22K) was applied postemergence with plants in the late hook stage to the early unfurled frond stage on May 12 to June 2. Evaluations were made from September 1 to September 5, 1967. The visual evaluation reported here was the percent kill which is the relation of the number of dead plants (current season) to those showing green color or apparent reduction in stand as compared to the checks.

Averages for the three locations revealed hexafluroacetone at 40 lb/A to be the most impressive performer giving 100% control. Dicamba also gave excellent results having averages of 92%, 100%, and 100% for 6, 9, and 12 lb/A respectively. Essentially 80% and better of the green plants remaining showed visual injury symptoms at the 6 pound rate. Dichlobenil turned in a mixed performance giving better results at the Polk County location than at the other two locations. Four, six and eight pounds gave an average control of 51%, 63% and 64% respectively. Injury to remaining green plants was good in Polk County but low at the other two locations. Picloram results were similar to dichlobenil except they were more consistent from location to location. Averages of 53%, 58%, and 65% control were obtained from picloram at 1.5, 2 and 4 lb/A respectively. Injury to remaining plants from picloram was about the same as dichlobenil in Polk County but better at the other two locations. Plots receiving the first of two annual applications had averages of 41% and 42% control for picloram at 1 and 1.5 pounds, while 4 pounds of dichlobenil gave 46% control. The poor results obtained from picloram in this experiment may be because the time of application was at the same time of the year that picloram was giving poor results in the date of application experiment. However, dicamba which was applied preemergence the last of March corresponds to the time when dicamba was turning in its best early performance in the date of application experiment. Actually results from dicamba in this experiment were superior to results obtained at the same time of application in the date of application experiment. Bracken fern on these three locations was not as dense or tall as the fern occurring on the site of the date of application experiment. (Farm Crops Dept., Oregon State Univ., Corvallis.)

Average percent kill (one season) of bracken fern.

Treatment	Application	Rate	Ave. % kill	Annual Treatments 1967 and 1968				
dichlobenil (4%)	I	4	51	picloram	1967	II	1	41
"	I	6	63	+ "	1968	II	1	--
"	I	8	64					
dicamba	I	6	92	picloram	1967	II	1.5	42
"	I	9	100	+ "	1968	II	1.5	--
"	I	12	100					
picloram	II	1.5	53	dichlobenil (4%)	1967	I	4	46
"	II	2	58	+picloram	1968	II	1	--
"	II	4	65					
hexafluroacetone	I	40	100					
check	-	0						

Evaluated 9/2/67
I = preemergence
II = erect frond
0.5% X-77 added

Bracken fern date of application experiment. Homesley, Wylie B. and W. R. Furtick. In February of 1967 an experiment was established about 7 miles west of Cheshire, Lane County, Oregon in a dense stand of bracken fern (Pteridium aquilinum) growing on a southern exposure in a red clay loam soil. The purposes of the experiment were to determine the most favorable time of year and stage of growth for applying picloram and dicamba and to compare the granular formulation of picloram as Tordon 2K with the potassium salt formulation of picloram as Tordon 22K.

A split-plot design was used with three replications. There were 14 dates of application with 7 treatments per date. The first date was February 11, 1967, and then at intervals of two weeks until frond emergence. After frond emergence treatments were made every week until full frond expansion after which treatments were reduced to two week intervals for three more dates. Several plants were emerging on the treatment date of May 6, and by May 13 most of the plants were in the late hook stage with some unfurling fronds. Final treatment date was July 15, 1967. The soil was dry on the surface by the last of May and no rainfall occurred through the remainder of the growing season; therefore, the plants were showing the effects of drouth by the time of evaluation on September 1, 1967.

The visual evaluations reported were the average of three replications based on the percent kill for the current season which was the relations of the number of dead plants (or apparent reduction in number when compared to the check) to those showing green color. Picloram (K salt) gave the best control from June 17 to July 15 when essentially 100% of the plants were brown from both the 2 and 4 pound rates. Above 92% control with the 4 pound rate was obtained from the beginning of the experiment through April 22. The 2 pound rate gave 92% control on February 25 and March 11, then dropped below 75% until June 17 after which it gave 98% or better control. Picloram granule at the 4 pound rate gave 96% to 100%

Average percent kill (one season) of bracken fern

Chemical	Rate	Dates of application 1967													
		2/11	2/25	3/11	3/25	4/8	4/22	5/6	5/13	5/20	5/27	6/3	6/17	7/1	7/15
picloram (K salt)	2	63	92	92	70	73	70	43	17	57	53	47	98	100	100
" "	4	93	98	98	96	99	92	77	27	80	63	80	100	100	100
picloram (granule)	2	85	95	92	88	83	50	30	0	10	0	7	13	0	0
" "	4	99	96	97	98	100	83	53	13	30	10	3	10	0	10
dicamba	6	50	73	50	47	43	57	50	20	47	37	60	96	100	95
"	9	73	67	70	90	85	67	50	17	50	53	90	98	100	100
Check		3	0	0	3	0	3	0	0	0	0	3	0	0	7

control from the beginning of the experiment through April 8, while the 2 pound rate gave from 83% to 95% control. The granular formulation dropped to less than 30% control after May 13. No rainfall occurred and the soil was essentially dry on the surface by May 20.

Dicamba followed a pattern similar to picloram (K salt); however, the results were less satisfactory and more erratic at the earlier dates. Control with 9 pounds of dicamba ranged between 60% and 90% during the period February 11 through May 6, while the 6 pound rate had a low of 43% and a high of 73% during the same period. On June 3, when full frond expansion was estimated to be essentially complete, 6 and 9 pounds of dicamba gave 60% and 90% control respectively. During the period June 17 through July 15, 6 pounds dicamba gave 91% to 96% control, and 9 pounds gave 98% to 99% control with the remaining plants showing 100% injury.

All applications made on May 13 resulted in 27% or less control. This is the period when most of the plants were in the late hook stage with some unfurling fronds and after rainfall was available to move the herbicides into the root zone. The late applications appeared superior to early applications of picloram (K salt) and especially of dicamba. Evaluations following another growing season will provide more conclusive evidence. Further work around July 1 with lower rates of picloram (K salt) and combinations of picloram and dicamba both as single applications and on an annual basis (two applications) should prove of value. (Dept. of Farm Crops, Oregon State Univ., Corvallis.)

Phenological development of Canada thistle (Cirsium arvense L.). Erickson, Duane H. and Lambert C. Erickson. To more thoroughly observe the phenology of this species in the environment of Moscow, Idaho, developmental data were taken at weekly intervals from May 1 to October 16. These data were obtained from plots replicated among the plots utilized for the shade-herbicide interaction study. The data involved (a) shoot emergence date and number, (b) time interval, and number involved in bud formation, (c) time interval and number of buds advanced to flowering (d) final number of plants and buds advancing to mature pappus development.

As the season progressed, dead plants and fall regrowth was disregarded. The following table shows a maximum population occuring on June 12. These data also show a 3 week interval between budding, maximum flowering and maximum plants with mature pappus.

Phenological development of Canada thistle, Moscow, Idaho 1967 (3 replications, disregarding dead plants and fall regrowth).

	Total live shoots	Flower buds 3 or more mm. in diameter	Shoots with flowers in anthesis	Live shoots with mature pappus
May 1	0	0	0	0
May 8	23.3	0	0	0
May 15	38.7	0	0	0
May 22	44.3	0	0	0
May 29	50.3	0	0	0

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Phenological development of Canada thistle, Moscow, Idaho 1967 (3 replications, disregarding dead plants and fall regrowth).

	Total live shoots	Flower buds 3 or more mm. in diameter	Shoots with flowers in anthesis	Live shoots with mature pappus
June 5	54.3	0	0	0
June 12	56.3	1.0	0	0
June 19	54.7	9.6	0	0
June 26	54.3	13.0	0	0
July 3	54.7	18.0	0.6	0
July 10	51.0	17.6	5.3	0
July 17	48.0	12.0	12.0	1.0
July 24	46.7	5.3	19.0	1.3
July 31	52.3	2.0	19.6	2.6
August 7	49.7	0.3	13.3	11.0
August 14	46.3	0.6	0.3	21.3
August 21	45.7	0.6	0	22.0
August 28	42.0	0	0	22.3
September 5	35.7	0	0	18.0
September 11	31.3	0	0	18.3
September 18	29.3	0	0	17.3
September 25	27.7	0	0	16.6
October 2	27.0	0	0	16.3
October 9	26.3	0	0	15.6
October 16	24.7	0	0	14.0

The effect of moisture, temperature, nitrogen and subsequent herbicide treatments on two Canada thistle (*Cirsium arvense* L.) strains. Erickson, Duane H., and Lambert C. Erickson. Two thistle strains, G-1 (Montana-resistant) and L1 (Idaho-unknown) were propagated under greenhouse conditions.

Root segments were taken from clonal material and propagated in asphalt coated bands. When established they were transplanted into 6x6x24 in. soil filled, zinc coated containers, requiring 96 containers for each strain.

The soil used in this study is classified "McAvoy fine sandy loam." Its moisture holding capacity is 13.9 percent and total nitrogen content 10.4 pounds per acre.

The following table gives a chronological breakdown of the total subsequent treatments and segregates.

Date	Treatment	Units
1/30	Transferred 6 in. x 6 in. x 24 in. container	
3/9	High $N(NH_4NO_3)$	50 lb N/A
	Low $N(NH_4NO_3)$	10 lb N/A

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Date	Treatment	Units
4/24	Low N (NH_4NO_3)	10 lb N/A
5/12	High N(NH_4NO_3)	100 lb N/A
5/29 to 8/2	High Moisture	18% H_2O
	Low Moisture	7% H_2O
6/26 to 8/2	High temperature	mean 72.2° F
	Low temperature	mean 66.6° F
6/29	2,4-D Amine	2.5 lb/A
	Amitrole	2.5 lb/A
	Check	-----

Each treatment on condition when once imposed was continued to the experiment's conclusion.

The application of high nitrogen was made in two aliquots to avoid possible toxicity from an excessive application.

Prior to initiating the "high" and "low" moisture segregation the containers were maintained at a moisture level approximating field capacity. To provide high and low moisture treatments, one-half the sample cans were maintained at 18% moisture and the other one-half were maintained at 7% moisture. These moisture levels were determined and maintained by weighing each container twice weekly or on alternate days according to anticipated moisture loss rates.

The herbicide applications were made with a laboratory type sprayer having an air pressure source and chain driven spray boom.

The experiment was terminated for the season on August 2. At termination the roots were washed and the samples dryed in a forage dryer set at 60° C for 24 hours. Shoot counts were then taken, and shoot and root weights were recorded for all samples.

The following statistically significant differences (1% level) were found between and among treatments:

1. The L-1 thistle strain had a greater topgrowth weight than did the G-1 strain.

2. High moisture produced more topgrowth and rootgrowth than low-moisture.

3. High nitrogen produced more rootgrowth and topgrowth than low nitrogen.

4. 2,4-D and amitrole significantly reduced both root and shoot weights vs the respective checks.

5. The G-1 strain produced a higher average shoot number per container than did the L-1 strain.

6. High nitrogen increased shoot number of both L-1 and G-1 strains at high nitrogen levels.

7. High moisture increased the shoot numbers more than low moisture.

8. Both the 2,4-D and amitrole treatments significantly reduced the shoot numbers, the root and total shoot weights of both thistle strains.

9. The two strains did not respond significantly differently to these herbicide treatments.

Control of dallisgrass with four proprietary herbicide mixtures. Jeter, R. B. and W. B. McHenry. Granular soil-applied herbicide mixtures were evaluated on a roadside borrow pit in a continuing effort to develop a recommendation for the control of dallisgrass. Next to irrigated cropland, county roadsides collect water through the summer creating a favorable environment for vigorous dallisgrass growth. Leaching pressure from nearly continuous percolation from both summer irrigation water or from winter precipitation creates an adverse condition for long residual soil phytotoxicity.

The soil-applied herbicides tested were Pramitol 5P (5.0% prometone, 40.0% sodium chlorate, 50.0% borate), Chlorea 3 (2.4% monuron, 40.0% sodium chlorate, 51.0% borate), Atratol 8P (7.0% atrazine, 40.0% sodium chlorate, 47.0% borate), Monobor Chlorate (30.0% sodium chlorate, 68.0% borate).

Herbicide	lb formulation/A	Dallisgrass control (10=100% control)
Pramitol 5P	218	2.3
Pramitol 5P	436	5.7
Pramitol 5P	872	5.7
Chlorea 3	218	4.5
Chlorea 3	436	5.3
Chlorea 3	872	5.5
Atratol 8P	218	2.5
Atratol 8P	436	8.6
Atratol 8P	872	8.6
Monobor Chlorate	218	0.8
Monobor Chlorate	436	1.3
Monobor Chlorate	872	2.3
Control	---	0

Atratol 5P provided the most successful control, but due to relatively high cost its use would be restricted to spot treatments. Most of the roadside and canalbank dallisgrass infestations are beyond controlling on a spot treatment basis. (Agricultural Extension Service, University of California).

Dallisgrass response to three soil-applied herbicides. McHenry, W. B., W. H. Brooks, R. B. Jeter, and N. L. Smith. Dallisgrass is fast becoming a weed pest in the Sacramento Valley and has spread into the northern end of the San Joaquin Valley of California. Bromacil, NIA 11092, and pyriclor were field tested on canal banks in Glenn, Mendocino, and Solano counties for the control of this perennial grass.

		Dallisgrass control (10=100% control)		
Herbicide	lb ai/A	Glenn Co.	Mendocino Co.	Solano Co.
bromacil	8	0	0	0
bromacil	12	1.5	0	0
bromacil	16	2.0	0.8	0
NIA 11092	4	0.3	0.8	0
NIA 11092	8	2.3	1.5	0
NIA 11092	12	8.1	5.0	0
NIA 11092	16	7.8	5.5	0
pyriclor	8	0.3	0	0
pyriclor	12	2.5	0	0
pyriclor	16	1.3	1.0	0
Control	--	0	0	0

The Solano County soil was a heavy clay, the Mendocino County soil a clay loam, and in Glenn County a gravely loam soil was encountered. The NIA 11092 appears to have a higher order of phytotoxicity than bromacil or pyriclor on this species. None of these herbicides offer promise on heavy soils, however. (Agricultural Extension Service, University of California).

Response of dallisgrass to foliage applications of amitrole-T, dalapon, dalapon + TCA, MSMA, and pyriclor. McHenry, W. B., W. H. Brooks, N. L. Smith, and J. T. Yeager. Two field experiments were initiated in Mendocino and Solano Counties in 1966 to develop a dallisgrass control recommendation for non-crop sites.

In Solano County, dalapon, dalapon + TCA, amitrole-T, MSMA, and pyriclor were applied July 20, and retreated August 30, October 17, 1966 and on June 21, 1967. In Mendocino County foliage treatments of dalapon, amitrole-T, and MSMA were made on June 30 and retreated September 15, 1966, and again on June 15 and in October in 1967.

		Dallisgrass control (10=100% control)	
		Mendocino Co.	Solano Co.
Herbicide	lb ai/A	11/21/67	8/16/67
Amitrole-T	4	0.3	0
Amitrole-T	8	0	0

(Continued on Page 14)

Herbicide	lb ai/A	Dallisgrass control (10=100% control) Mendocino Co. 11/21/67	Solano Co. 8/16/67
dalapon	10	5.8	-
dalapon	20	5.3	2.0
dalapon	40	---	2.8
dalapon + TCA	20 11.2	---	2.8
dalapon + TCA	40 22.4	---	3.5
MSMA	2	1.0	0
MSMA	4	4.5	1.0
MSMA	8	8.5	1.8
pyriclor	2	---	0
pyriclor	4	---	0
Control	-	0	0

Both dalapon and MSMA performed better in the Mendocino County location and with fewer retreatments than in the Solano County trial. There is no apparent explanation for the differences in response at the two locations. Further testing will be done to compare stage of growth at retreatment as a possible factor. (Agricultural Extension Service, University of California.)

Control of false hellebore (Veratrum californicum Durand). Street, J. E., D. E. Bayer and W. H. Brooks. False hellebore is a common native of meadows and moist areas of mountain grazing lands in western United States. The plant contains various related alkaloids toxic to livestock and honeybees. Although in some instances it is considered desirable forage. Ingestion of false hellebore has caused Cyclopian-type congenital malformations in lambs.

In June of 1964, 1965 and 1966 essentially monospecific stands of false hellebore were sprayed with knapsack sprayer in Mendocino County. Plots were 16.5 ft square and in three replications. Observation 12 months after initial application showed 80 and 70 percent control with 2 lb/A, ai, 2,4-D and 2,4,5-T respectively. Equivalent or greater rates of dicamba, picloram, and amitrole-T showed 20 percent or less control. 2,4-D and 2,4,5-T plots were resprayed in June 1965. A second experiment started nearby was sprayed in June of 1965 and resprayed in June 1966.

All spraying has been done in June when false hellebore was prebloom, had 8-10 leaves and was about 2 ft tall. In summary, two annual applications of 2,4-D and 2,4,5-T resulting in respectively 90 and 70 percent control.

Results were the same for both experiments. Evaluations were made one year after second application. Details of these experiments are in Research Progress Report for 1967.

Additional experiments with 25 ft x 12.5 ft plots in four replications were started in 1966 and 1967 to study the addition of diesel oil and to compare knapsack with backpack mistblower. Treatments, retreatments and interim control just prior to retreatment are shown in the table. Control with mistblower was poor and retreatment was not made. Good results with the mistblower outside the experiment and without rate control suggested a higher rate of 2,4-D in new plots established in 1967. Reports of control with picloram prompted its inclusion in 1967 initial application in combination with 2,4-D.

Four replications of five varieties of wheatgrass were planted in June 1967. Grass planting might be successful and advisable in conjunction with false hellebore control. (Agronomy Extension, University of California, Davis.)

	Lb/A ai		Diesel gpa		X-77 @ 30 oz/ 100 gal	Water gpa		Percent control
	1966	1967	1966	1967		1966	1967	1967
Mistblower 2,4-D	2		1			3.5		25
Knapsack 2,4-D	2	2	.5	.5		160	160	60
2,4-D	2	2			X	160	160	40
2,4-D		2		.5			160	
2,4-D		4		.5			160	
Combination 2,4-D and picloram		2 .5		.5			160	

Comparison of picloram and various picloram + phenoxyacetic acid combinations for control of field bindweed (Convolvulus arvensis L.). Lee, G. A. and H. P. Alley. Plots were established June 22, 1966 on a dense stand of field bindweed to compare the effectiveness of picloram and combinations of picloram + phenoxyacetic acid formulations. All treatments, except the granular formulation, were applied in 40 gpa water.

Evaluations made one year after treatment are presented in the following table. Picloram + 2,4-D (Tordon-101) at ½ and 1 gal/A and M-3060 (1 lb picolinic acid + 1 lb 2,4,5-T/gal) at ½ and 1 gal/A treatments resulted in 95 percent or better control. The picloram + 2,4-D treatment at ½ gal/A would be equivalent to ¼ lb of picolinic acid per acre. The picolinic acid in the M-2861 and M-2863 formulations is only 1/8 lb/gal and application rates were not high enough to result in effective control. (Wyoming Agricultural Experiment Station, Laramie, SR-83.)

Percent control of field bindweed from application of various picloram + phenoxyacetic acid combinations.

Formulations 1/	Rate 2/	Percent control
picloram	3/4	99+
picloram	1	100
picloram + 2,4-D (.54 lb picolinic acid + 2 lb 2,4-D/gal)	½ gal/A	95
picloram + 2,4-D	1 gal/A	100
M-3060 (1 lb picolinic acid + 1 lb 2,4,5-T/gal)	½ gal/A	95
M-3060	1 gal/A	98
M-2861 (1/8 lb picolinic acid + 2 lb 2,4-D/gal)	½ gal/A	0
M-2861	1 gal/A	0
M-2863 (1/8 lb picolinic acid + 2 lb MCPA/gal	½ gal/A	0
M-2863	1 gal/A	0
picloram gran. (Tordon Beads) (2% picolinic acid)	½ lb/sq rd	100
picloram gran. (Tordon Beads)	1 lb/sq rd	100

1/ Dow Chemical Company trademarks and formulation numbers.

2/ Rate expressed as active ingredient per acre except mixtures which are on volume basis per square rod.

Johnsongrass control with organic arsenicals and dalapon. Hamilton, K. C. Although repeat applications of organic arsenicals control johnsongrass, herbicide combinations or rotations are sometimes used where mixed weed infestations occur or when other weeds increase as treated johnsongrass becomes less competitive. A test was conducted at Tucson, Arizona, in 1967 to determine the effects on johnsongrass of combinations and rotations of dalapon with DSMA and MSMA.

Two strains of johnsongrass were established from rhizome segments in the spring of 1966. Seventy two plants of each strain were space-planted and maintained without seed production or germination. Plants averaged 90 stems when treatments started in April, 1967. Plants were wet at 4-week intervals with 200 to 400 gpa of spray solution containing the herbicide and ½% of a surfactant. Herbicide treatments were (1) dalapon 10 lb/aigh, (2) DSMA 6 lb/aigh, (3) MSMA 6 lb/aigh, (4) dalapon 5 lb/aigh and DSMA 3 lb/aigh, (5,6) dalapon 10 lb/aigh (first) alternated with DSMA or MSMA 6 lb/aigh. Each plot contained 4 plants and treatments were replicated 3 times. The number of stems per plant was estimated before each treatment and the amount of herbicide applied was determined.

All treatments except dalapon destroyed the topgrowth of johnsongrass. The table summarizes plant kill, stems per surviving plants, and herbicide cost in November, 1967. By July good control was achieved with DSMA and

MSMA but combinations and rotations of dalapon with organic arsenicals gave little control. The only treatments giving complete kill were 6 applications of DSMA and 5 applications of MSMA. The least control was achieved with dalapon. Combinations and rotations of dalapon with the organic arsenicals were intermediate in effectiveness and cost. When only johnsongrass control was considered, repeat applications of DSMA and MSMA were the fastest, most economical treatments. (Arizona Agric. Expt. Sta., University of Arizona, Tucson.)

Johnsongrass kill, stems per surviving plants, and herbicide cost after 8 applications of herbicides at 4-week intervals.

Treatments Herbicide	lb/A	Percent plants dead[1]	Stems per surviving plant	Herbicide cost[2] per acre
dalapon	10	42	47	$271
DSMA	6	100	0	52
MSMA	6	100	0	50
dalapon-5 with DSMA-3		67	5	163
dalapon-10 rotate with DSMA-6		54	25	142
dalapon-10 rotate with MSMA-6		96	1	131

[1] Based on 24 plants.

[2] Based on dalapon $1.35/lb, DSMA and MSMA $.80/lb, and surfactant $5.00/gal.

Johnsongrass response to MSMA when pre-treated with soil-applied herbicides. McHenry, W. B., B. B. Fischer, R. B. Jeter, N. L. Smith, and J. T. Yeager. Work was continued following promising results in 1966 to screen additional soil-applied herbicides. It appears that established stands of Johnsongrass on canalbanks can be controlled 99%-100% with two to three MSMA applications each at 4 lb ai/A when the plots are pre-treated the winter before with relatively low rates of soil-active compounds.

Pre-treatments of atrazine, bromacil, diuron, diphenamid, monuron, and NIA 11092 at 4 lb ai/A markedly reduced the number of MSMA treatments required in 1967 to effect apparent eradication. The same herbicides at 8 lb ai/A with no foliage treatments had no effect on Johnsongrass. More certain evaluation of results will be made during the 1968 growing season. (Agricultural Extension Service, University of California.)

The persistance of several compounds over a three-year period, as indicated by the control of leafy spurge (Euphorbia esula L.). Alley, H. P., G. A. Lee and A. F. Gale. Plots were established May 15, 1964 on a heavily infested railroad right-of-way to evaluate the persistence and longevity of several compounds used for leafy spurge control. Readings have been made the past three years and are presented in the following table.

All treatments of picloram, granule, liquid and the mixture with 2,4-D, were highly residual as indicated by outstanding control 3 years following the treatments. Fenac, 2,3,6-TBA and Benzabor showed longevity of control but was more damaging to the associated grass vegetation than the picloram treatments. Dicamba, even at the high rates of application, was dissipated from the soil at the end of the second year following treatment as indicated by reinfestation of the treated areas. (Wyoming Agricultural Experiment Station, Laramie, SR-87.)

Control of leafy spurge one, two and three years following treatment.

Treatment	Rate 1/	Percent control 6/65	5/66	8/67	Remarks 1967
dicamba	5	97	77	20	
dicamba	10	100	90	20	
dicamba	15	100	96	50	Moderate grass damage
2,3,6 TBA	10	100	96	70	
2,3,6 TBA	15	100	98	98	Grass thinned
2,3,6 TBA	20	99	100	90	Grass thinned
fenac liq.	5	75	50	0	
fenac liq.	10	98	90	60	
fenac liq.	15	100	99	98	Moderate grass damage
fenac gran.	½ lb/sq rd	98	97	95	
fenac gran.	1 lb/sq rd	100	100	95	Grass damaged
fenac gran.	1½ lb/sq rd	100	100	100	Grass damaged
Tritac-D	8	78	50	70	
Tritac-D	12	99	94	65	
Tritac-D	16	99	98	90	
Benzabor	3/4 lb/sq rd	100	90	90	
Benzabor	1½ lb/sq rd	100	98	100	Grass damaged
picloram	1	96	83	55	
picloram	2	100	99	98	
picloram	3	100	100	100	
picloram	4	100	100	100	
picloram + 2,4-D (Tordon-101)	1.3 gal/A	99	90	100	
picloram + 2,4-D (Tordon-101)	2.6 gal/A	99	96	100	
picloram + 2,4-D (Tordon-101)	3.9 gal/A	100	99	100	Grass damaged
picloram + 2,4-D (Tordon-101)	5.2 gal/A	100	100	100	Grass damaged
picloram gran. (Tordon-2K)	.3 lb/sq rd	97	99	100	
picloram gran. (Tordon-2K)	.6 lb/sq rd	100	100	95	
picloram gran. (Tordon-2K)	.9 lb/sq rd	100	100	100	
picloram gran. (Tordon-2K)	1.25 lb/sq rd	100	100	100	
amitrole-T	8	50	15	25	Grass damaged

1/ Rate is expressed as pound active per acre except for the granular and mixtures which are actual formulations per unit area.

Nutsedge control. Lange, A., G. Morehead, N. Welch, and H. Ford. Heavily infested nutsedge locations were treated with herbicides in four vastly different locations--Hawaii, San Bernardino County, Imperial County, and in the delta of Sacramento County, California. Herbicides were applied to small replicated plots at 2 rates in 100 gallons of water per acre and incorporated immediately by power tiller to a depth of 4 to 6 inches. Plots were then rated when the first regrowth occurred and 4-11 months after this point in time.

The Sacramento trial differs from the others in that the application was made in mid-summer during dry soil conditions and the regrowth read the following spring, that is nine months later. The nutsedge was dormant first from lack of moisture and then during the winter from low temperature. The Sacramento and San Bernardino tests were predominantly *Cyperus esculentes*, whereas the Hawaii and Imperial trials were in infestation of purple nutsedge (*Cyperus rotundus*).

Results

EPTC and its analogs, R-1910 and R-2007, gave excellent initial nutsedge control in most tests. R-2007 performed better in Hawaii and San Bernardino than it did in Imperial and Sacramento. R-1910 was somewhat more variable than EPTC, although in some instances gave slightly better nutsedge control.

Dichlobenil and the related compound R-7961 (Prefix) gave good initial and residual nutsedge control except in the Sacramento trial where the organic matter content was very high. CP-31675 gave good control in most trials initially, and good residual control in Hawaii and Sacramento trials. The San Bernardino and Imperial soils were very sandy soils, low in organic matter. They would also be warmer soils part of the year than the Hawaii and Sacramento soils.

Bromacil in contrast to the other herbicides in this was weaker initially and more effective toward the end of the experiments. These results are consistent with other field results in California. Bromacil, a long residual herbicide, kills germinating tubers over a long period of time.

Trifluralin, although an excellent herbicide for grasses generally, is weak on nutsedge. In other trials not reported here, increased vigor of nutsedge has been observed in trifluralin plots, probably as the result of annual grass control. (University of California, Riverside.)

Average percent nutsedge control 3/.

Herbicide	Approx. Rate	Hawaii 1/ 1 mo.	Hawaii 1/ 9 mo.	S. Bdno. 2/ 1 mo.	S. Bdno. 2/ 8 mo.	Imperial 1/ 1 mo.	Imperial 1/ 4 mo.	Sacramento 2/ 9 mo.	Sacramento 2/ 11 mo.
EPTC	low 4/	100	42	96	12	63	17	45	52
EPTC	high 5/	100	40	100	39	87	20	92	57

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Herbicide	Approx. Rate	Hawaii 1/ 1 mo.	9 mo.	S. Bdno. 2/ 1 mo.	8 mo.	Imperial 1/ 1 mo.	4 mo.	Sacramento 2/ 9 mo.	11 mo.
R 1910	Low	100	65	80	0	77	33	45	42
R 1910	High	100	72	85	21	93	37	80	67
R 2007	Low	92	25	76	37	3	7	18	32
R 2007	High	100	68	80	25	40	23	10	30
trifluralin	Low	-	-	-	-	40	13	20	42
trifluralin	High	-	-	-	-	63	17	37	32
dichlobenil	Low	100	72	99	63	100	77	28	35
dichlobenil	High	100	82	100	87	100	80	30	45
CP 31675	Low	100	60	72	31	57	20	87	52
CP 31675	High	100	78	79	0	93	17	100	87
bromacil	Low	48	58	-	-	57	53	28	65
bromacil	High	10	70	-	-	67	80	55	80
Prefix	Low	-	-	94	50	-	-	-	-
Prefix	High	100	72	100	97	-	-	-	-
Check	---	0	0	0	0	27	20	22	47
% organic matter		2.6%		1.2%		1		21%	

1/ *Cyperus rotundus*
2/ *Cyperus esculentus*
3/ Based on 0-10 control rating where 0 = no control and 10 = 100% control
4/ Low rates refer to 3-6 lb/A
5/ High rates refer to 6-12 lb/A

Comparison of dicamba and picloram for poverty weed control in Colorado drylands. Hepworth, H. M., J. W. May and J. L. Fults. White leafed poverty weed (*Franseria discolor* Nutt.) has become such a severe problem in some dryland wheat areas of Colorado that acreages have been abandoned for further fall wheat cultivation. At Kelim, Colorado a series of plots was established to compare picloram, dicamba and combinations of these chemicals with 2,4-D and to determine their usefulness in controlling or eradicating the white leafed poverty weed. Two applications were made in the fall of 1966 (Aug. 11 and Sept. 16) and one in the spring (May 9), after observation of fall tests had given further indication of desirable rates of chemical. Plots were 10 x 50 ft. Chemicals were applied in 32 gal of water per acre with a pressure tank and hand spray boom.

Fall wheat and barley were seeded across the fall applied plots 13 and 26 days after treatments were applied. Oats, wheat and barley were seeded across all plots including the spring chemical applications on May 16, 1967.

In all cases oats appeared to be least susceptible to damage from the herbicides with barley intermediate and wheat most affected.

Moisture was a factor in these trials. The fall was extremely dry which would allow dicamba to persist longer than usual. Greater than normal spring rainfall may have affected the dissipation of the spring applied treatments. Weed control appeared very satisfactory at several rates.

Conclusions. It appears that either dicamba or picloram can be successfully used to control poverty weed under these conditions. All rates above and including two pounds of dicamba and ¼ pound picloram gave 100 percent control of poverty weed in fall applications. In spring applications 1 pound of dicamba appeared to be sufficient. Addition of 2,4-D at 1 and 2 pounds per acre did not increase the effectiveness of picloram or dicamba in these trials.

Cereal grains were more tolerant to picloram than to dicamba but unusual weather conditions preclude definite conclusions as to time required for dissipation of chemicals below toxic levels. Oats appeared more tolerant than barley or wheat. Further observations will be made. (Botany & Plant Pathology Section, Colorado Agric. Exp. Sta., Colo. State University, Fort Collins.).

Rates of dicamba, picloram and combinations with 2,4-D applied to white leaf poverty weed.

August 16, 1966	September 11, 1966	May 9, 1967
picloram ¼ lb/A	picloram ¼ lb/A	Picloram ¼ lb/A
picloram ½ lb/A	picloram ½ lb/A	picloram ½ lb/A
picloram 1 lb/A	picloram 1 lb/A	picloram 1/8 lb/A
picloram + 2,4-D 1/8 + 2 lb/A	picloram + 2,4-D 1/8 + 2 lb/A	picloram + 2,4-D 1/8 + 1 lb/A
picloram + 2,4-D ¼ + 2 lb/A	picloram + 2,4-D ¼ + 1 lb/A	picloram + 2,4-D ¼ + 1 lb/A
picloram + 2,4-D ½ + 2 lb/A	picloram + 2,4-D ½ + 1 lb/A	picloram + 2,4-D ½ + 1 lb/A
picloram + 2,4-D 1 + 2 lb/A	picloram + 2,4-D 1 + 1 lb/A	picloram + 2,4-D 1/16 + 1 lb/A
dicamba 2 lb/A	dicamba 2 lb/A	dicamba 2 lb/A
dicamba 3 lb/A	dicamba 3 lb/A	dicamba 3 lb/A
dicamba 5 lb/A	dicamba 5 lb/A	dicamba ½ lb/A
dicamba + 2,4-D 1 + 2 lb/A	dicamba + 2,4-D 1 + 1 lb/A	dicamba + 2,4-D 1 + 1 lb/A
dicamba + 2,4-D 2 + 2 lb/A	dicamba + 2,4-D 2 + 1 lb/A	dicamba + 2,4-D 2 + 1 lb/A
dicamba + 2,4-D 2 + 3 lb/A	dicamba + 2,4-D 3 + 1 lb/A	dicamba + 2,4-D ½ + 1 lb/A
control	control	control

Chemical control of tansy (Tanacetum vulgare L.) in Wyoming. Alley, H. P., G. A. Lee and A. F. Gale. Initial treatments made in 1964 showed that the lowest rate of picloram (2 lb/A) applied in the early evaluation plots was high enough to maintain 100 percent control over a two-year period. Additional applications were made in 1965 to determine if lower rates of application of picloram were feasible.

Evaluations made one and two years following application are presented in the following table. Picloram at a minimum of 3/4 lb/A was required to obtain 100 percent control of tansy and maintain this control over a two-year period. The ½ lb/A treatment showed increased control the second year after application, but did not eliminate the stand. (Wyoming Agricultural Experiment Station, Laramie, SR-86.)

Tansy control - one and two years after treatment.

Chemical	Rate 1/	Percent control 1966	Percent control 1967
picloram	1/4	50	50
picloram	1/2	80	90
picloram	3/4	100	100
picloram	1	100	100
picloram	1-1/2	100	100
picloram gran. (Tordon Beads)	1/2 lb/sq rod	100	100
picloram gran. (Tordon Beads)	3/4 lb/sq rod	100	100
2,4-D amine (Dacamine)	6	0	0
2,4-D LVE (PGBE)	6	0	0
2,4-D Emulsifiable acid (Weedone-638)	6	0	0

1/ Rate is expressed as pound active ingredient per acre except for granular materials.

PROJECT 2. HERBACEOUS RANGE WEEDS

J. A. Young, Project Chairman

SUMMARY

There was a drastic reduction in the number of abstracts submitted to this project. Although few in number the abstracts submitted report interesting progress in herbaceous range weed control.

Evaluations of the potentials of several combination treatments of picolinic acid, phenoxyacetic acid and propionic acid for control of plains larkspur (*Delphinium geyeri* Greene). Alley, H. P., G. A. Lee and D. W. Smith. The outstanding control obtained with previous combinations of picolinic acid + 2,4-D prompted a more extensive evaluation of other mixtures. All of the combinations, except picloram + 2,4-D (Tordon-101), were made up by the research personnel.

A replicated series of plots were established May 12, 1966. The larkspur plants were in the leaf-rozette (2-6 in. growth) stage of growth at time of treatment. All chemicals were applied in 40 gpa water. All plots originally treated with phenoxyacetic and propionic acid formulations were retreated June 9, 1967.

Percent control was determined by comparing quadrate counts taken before treatment to those taken one year following treatment.

Several of the mixtures showed considerable promise. The lowest rates of the mixtures giving 100 percent control were: (1) picloram + 2,4-D (Tordon-101) at 6 pt/A; (2) picloram + 2,4,5-T_e (¼ + 2) at 6 pt/A; (3) picloram + 2,4,5-T_e (½ + 2) at 4 pt/A; (4) picloram + 2,4,5-T_e (1 + 2) at 4 pt/A; and (5) picloram + 2,4,5-TP_e (½ + 2) at 6 pt/A. The figures in parentheses refer to the active ingredient per gallon as mixed by the research personnel. All retreated plots (1967) showed rapid burn down of the larkspur. Further evaluations will be made in 1968 to determine the retreatment effects upon larkspur stand. (Wyoming Agricultural Experiment Station, Laramie, SR-88.)

Percent control of plains larkspur one year following treatment.

Treatment	Rate/A	Percent Control[1/]
picloram	1/8	34
picloram	1/4	55
picloram	1/2	100
picloram	1	100
picloram + 2,4-D (Tordon-101) (1/2 + 2)	2 pt	50
picloram + 2,4-D (Tordon-101) (1/2 + 2)	4 pt	96
picloram + 2,4-D (Tordon-101) (1/2 + 2)	6 pt	100

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Treatment	Rate/A	Percent Control[1/]
picloram + 2,4-D (1/4 + 2)[3]a	2 pt	0
picloram + 2,4-D (1/4 + 2)[3]a	4 pt	68
picloram + 2,4-D (1/4 + 2)[3]a	6 pt	70
picloram + 2,4-D (1/2 + 2)[3]a	2 pt	41
picloram + 2,4-D (1/2 + 2)[3]a	4 pt	50
picloram + 2,4-D (1/2 + 2)[3]a	6 pt	82
picloram + 2,4-D (1 + 2)[3]a	2 pt	14
picloram + 2,4-D (1 + 2)[3]a	4 pt	93
picloram + 2,4-D (1 + 2)[3]a	6 pt	94
picloram + 2,4,5-T (1/4 + 2)[3]e	2 pt	56
picloram + 2,4,5-T (1/4 + 2)[3]e	4 pt	73
picloram + 2,4,5-T (1/4 + 2)[3]e	6 pt	100
picloram + 2,4,5-T (1/2 + 2)[3]e	2 pt	97
picloram + 2,4,5-T (1/2 + 2)[3]e	4 pt	100
picloram + 2,4,5-T (1/2 + 2)[3]e	6 pt	95
picloram + 2,4,5-T (1 + 2)[3]e	2 pt	96
picloram + 2,4,5-T (1 + 2)[3]e	4 pt	100
picloram + 2,4,5-T (1 + 2)[3]e	6 pt	100
picloram + 2,4,5-TP (1/4 + 2)[3]e	2 pt	69
picloram + 2,4,5-TP (1/4 + 2)[3]e	4 pt	94
picloram + 2,4,5-TP (1/4 + 2)[3]e	6 pt	94
picloram + 2,4,5-TP (1/2 + 2)[3]e	2 pt	91
picloram + 2,4,5-TP (1/2 + 2)[3]e	4 pt	93
picloram + 2,4,5-TP (1/2 + 2)[3]e	6 pt	100
picloram + 2,4,5-TP (1 + 2)[3]e	2 pt	89
picloram + 2,4,5-TP (1 + 2)[3]e	4 pt	98
picloram + 2,4,5-TP (1 + 2)[3]e	6 pt	74
* Dacamine	1 lb	74
* Dacamine	2 lb	28
* Emulsamine	1 lb	22
* Emulsamine	2 lb	19
* Weedone 638	1 lb	0
* Weedone 638	2 lb	53
* Butyl Ester	1 lb	44
* Butyl Ester	2 lb	25
* PGBE Ester	1 lb	38
* PGBE Ester	2 lb	57
* Butyl Ester + X-77	1 lb	41
* Butyl Ester + X-77	2 lb	0
* PGBE Ester + X-77	1 lb	50
* PGBE Ester + X-77	2 lb	70
* 2,4,5-TP (Silvex)	1 lb	51
* 2,4,5-TP (Silvex)	2 lb	0
* 2,4,5-TP + X-77	1 lb	39
* 2,4,5-TP + X-77	2 lb	82
* 2,4,5-T	1 lb	83
* 2,4,5-T	2 lb	72

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Treatment	Rate/A	Percent Control 1/
* 2,4,5-T + X-77	1 lb	18
* 2,4,5-T + X-77	2 lb	62
dicamba + 2,4-D (2 + 2)	1/4 gal	43
dicamba + 2,4-D (2 + 2)	1/2 gal	75
dicamba + 2,4-D (2 + 2)	1 gal	0
Check		0

3 - mixed by researchers.
a - amine formulation of phenoxyacetic or propionic acid.
e - ester formulation of phenoxyacetic or propionic acid.
* - retreated 6/9/67. Larkspur 6-10" - no seed head elongation.
1/- four 1' x 2' quadrates within each square rod plot.

Residual control of plains larkspur (Delphinium geyeri Greene) with various rates of picolinic acid and picolinic acid-2,4-D combinations. Lee, G. A. and H. P. Alley. A replicated series of plots were established in 1964 to evaluate the rate of picolinic acid necessary for effective control of plains larkspur and the longevity of control obtained from the various treatments. The plots have been maintained over a three-year period and the control obtained is presented in the following table.

Outstanding control of plains larkspur has been maintained over a three-year period with all picolinic acid and picolinic acid + 2,4-D treatments. The ¼ gal/A treatment of picloram + 2,4-D (Tordon-101) has maintained 98 percent control over a 3-year period and appears to be as effective as twice the rate of picolinic acid when applied alone. The native blue grama was stunted by all treatments of picolinic acid up to 1 lb/A, rates above this reduced the stand considerably and 2 lb/A killed the blue grama. The mixtures of picolinic acid + 2,4-D caused stunting and prostrate growth of the associated blue grama but did not reduce the stand. (Wyoming Agricultural Experiment Station, Laramie, SR-84)

Control of plains larkspur over a three-year period.

Treatment	Rate/A 1/	Percent Control 1965	1966	1967	Remarks
picloram	¼	98	99+	100	Blue grama stunted
picloram	½	100	100	100	Blue grama stunted
picloram	1	100	100	100	Blue grama stunted
picloram	1½	100	100	100	Blue grama thinned
picloram	2	100	100	100	Blue grama killed - Fringed sage invading
picloram + 2,4-D (Tordon-101)	¼ gal	96	98	98	Blue grama stunted - healthy

(Continued on Page 26)

Treatment	Rate/A 1/	Percent Control 1965	1966	1967	Remarks
picloram + 2,4-D (Tordon-101)	½ gal	98	98	99	Blue grama stunted - healthy
picloram + 2,4-D (Tordon-101)	1 gal	100	100	100	Blue grama stunted - healthy
dicamba	½	50	10	0	
dicamba	2	65	40	0	
Silvex + X-77	2	55	50	0	
2,4-D LVE (PGBE) + X-77	2	55	50	0	

1/ Rate expressed as active ingredient per acre except mixtures which are on a volume basis.

Paraquat to increase rose clover seed production on the range. Kay, Burgess L., James E. Street, and Carl M. Wick. Rose clover (*Trifolium hirtum* All.) is a winter growing annual commonly planted for range improvement in cismontane California. It is generally grown in a mixed sward with resident annual grasses and forbs. Under proper grazing management the clovers will flourish and an abundance of nitrogen will be fixed. The nitrogen will in turn stimulate the non-legumes which may be extremely competitive and reduce clover seed production. Paraquat was tested to remove this competition.

An established rose clover pasture on the east side of the Sacramento Valley was selected for these experiments. The vegetation germinated in mid-November and was grazed by sheep until late December. Paraquat was applied to the sward late in the afternoon of December 21, 1966 in a logarithmic application at rates from 0.5 to 0.05 lb/A in 64 gpa total voluem. The surfactant X-77 was added at the rate of 0.05%. The rose clover was mostly 1.5 trifoliate leaves with some at the 2.5 leaf stage. Slender oat (*Avena barbata* Brot.) had 3 leaves, 3 inches long and foxtail fescue (*Festuca megalura* Nutt.) 3 leaves 1 inch long. Filaree (*Erodium* sp.) was a rosette 2.5-3 inches diameter, with 5-6 leaves.

Ratings two weeks after spraying showed all associated plants were killed at rates above 0.25 lb/A and most plants above 0.125 lb/A. Some rose clover was killed at rates above 0.25 lb/A. Much of the ground remained bare until the period of rapid growth began in early April. Some new weeds germinated during this period. Ground cover measurements of rose clover on April 29 showed a considerable increase in rose clover where sprayed with paraquat at rates between 3/64 and 3/16 lb/A. Ground cover of rose clover at 3/8 lb/A was similar to the non-sprayed area. However, the sprayed area had very few weeds, while the non-sprayed area was 44% weeds. On April 29 there was considerable bare ground at the highest rate of paraquat, but by cessation of growth in June the ground covered by vegetation approached 100% throughout.

Total vegetation was harvested in late June by clipping four square feet to ground level. The seed was subsequently threshed in a hammermill and the seed separated on a Clipper cleaner. Dry forage yields were not affected by any of the spray treatments.

Seed yields were increased significantly by all rates from 3/32 - 3/8 lb/A. The highest seed yields were from the plots sprayed with the highest rate of paraquat (see table). Seed weight and germination were unaffected by paraquat.

Clover seed harvested directly from the pasture can be a valuable cash crop. A paraquat application may increase seed production considerably. The yields reported here were measured in a season with above normal late spring moisture. Similar experiments are continuing to test other spraying dates, years and rate of surfactant. (Dept. of Agronomy, Univ. of California, Davis, California.)

Effects of paraquat on ground cover, forage yield, and rose clover seed yield in a rose clover sward.

Treatment paraquat lb/A	Percent grd. cover rose cl. Apr. 29	Forage lb/A all species*	Rose cl. seed lb/A **	.05	.01	Grams per 500 seeds*	Germination percent* #
0	56	6,200	510	a	a	1.58	94
3/64	87	7,070	600	ab	ab	1.59	89
3/32	98	6,080	760	bc	ab	1.56	91
3/16	92	6,010	800	bc	ab	1.59	90
3/8	55	5,830	960	c	b	1.57	94

* No significant difference.
** Values followed by the same letter are not significantly different at the level indicated.
\# Mean of 100 seeds per replication. Germinated 7 days at 68° F in Jan. 1968. Includes hard seed.

<u>A test of picloram and dicamba for control of certain range weeds in northwestern Colorado.</u> May, J. W., H. M. Hepworth and J. L. Fults. Thirteen range weeds were treated with picloram and dicamba in range land near Steamboat Springs in northwestern Colorado. Herbicide applications were made June 14, 1966 and plots were visually evaluated on July 28, 1966 and July 18, 1967. Observations are listed in the following table. (Botany & Plant Pathology Section, Colo. Agric. Expt. Sta., Colo. State University, Fort Collins.)

Weed	Herbicide & rate (ai/A)	Percent weed reduction 1966	1967
1. Milk vetch (*Astragalus haydenianus*)	picloram 1 lb	100	100
	dicamba 3 lb	75	50
	dicamba 5 lb	100	85
2. Canada thistle (*Cirsium arvense*)	picloram 1 lb	95	98
	picloram 1½ lb	100	100
	dicamba 3 lb	95	75
	dicamba 5 lb	99	90
3. White lupine (*Lupinus argentus*)	picloram 1 lb	100	98
	dicamba 5 lb	100	95
4. Yarrow (*Achillea lanulosa*)	picloram 1 lb	10	50
5. Russian knapweed (*Centurea repens*)	picloram 1 lb	100	100
	dicamba 5 lb	100	100
6. Poverty weed (*Franseria discolor*)	picloram 1½ lb	100	100
	dicamba 1 lb	50	0
	dicamba 3 lb	100	0
	dicamba 5 lb	100	0
7. Whitetop (*Cardaria draba*)	picloram 1 lb	0	0
	dicamba 3 lb	10	0
	amitrole 8 lb	100	95
8. Stinging nettle (*Urtica dioicaprocera*)	picloram 1 lb	100	100
	dicamba 2 lb	100	95
9. Bluebell (*Campanula rapunculoides*)	picloram 2 lb	100	100
	dicamba 4 lb	100	100
10. Bindweed (*Convolvulus arvensis*)	picloram 1 lb	15	100
	dicamba 3 lb	100	50
	dicamba 5 lb	100	95
11. Wild licorice (*Glycyrrhiza lepidota*)	picloram 1 lb	5	0
	dicamba 2 lb	60	10
	dicamba 5 lb	80	50
12. Skunk cabbage (*Veratrum californicum*)	picloram 1 lb	5	0
	dicamba 1 lb	0	0
	dicamba 2 lb	15	0

PROJECT 3. UNDESIRABLE WOODY PLANTS

Herbert M. Hull, Project Chairman

SUMMARY

Six reports from the same number of authors were received from only four states in the western region. Nevertheless, these reports represent a fairly wide diversification of interest, ranging from the broad spectrum control of plants on non-crop lands, through the fate of amitrole in forest litter and of phenoxy herbicides as monitored in mountain streams, to the control of various oaks, digger pine, saltcedar, and red alder by various techniques and herbicides.

Good control of a great many woody plants and trees on roadsides, fuel breaks, waterways, and other non-crop areas in the three Pacific Coast states, has been achieved with Tordon 101 (a 1:4 mixture of picloram and 2,4-D. Rates of 1 to 3 gpa (approx. 2.5 to 7.5 lb ae/A) in water at a volume of 25 to 75 gpa (depending upon species) gave good results. Drift was minimized when herbicides were formulated with Norbak particulating agent. Treatment during May and early June generally gave better results than late June or July treatments, when growth was less vigorous.

Studies in Oregon demonstrated that the degradation of amitrole (alone or in combination with NH_4SCN or 2,4-D) in forest floor litter maintained under controlled conditions proceeds at a rapid rate the first five days, and is apparently not influenced by the presence of other chemicals. An equivalent rate of disappearance in sterile and non-sterile litter suggests loss by adsorption, chemical degradation, or complexing with metal ions, rather than biological degradation. Additional studies, in which forested watersheds were sprayed by helicopter with 1 lb rates of both 2,4-D and 2,4,5-T in 10 gal of oil per acre, demonstrated that fall rains do not cause detectable contamination of streams flowing through areas which received spring or early summer spray treatments.

Studies in California have shown that winter application of a half gram of 2,4-D or picloram to trunk cuts 6 inches apart will give complete kill of interior live oak and California black oak. With digger pine, 2,4-D was more effective than picloram, but against tan oak this relationship was reversed. Two ml doses of hexafluoroacetone applied in this manner gave complete top kill of interior live oak and blue oak, and a partial top kill of tan oak. Other compounds were less effective.

Research on saltcedar in New Mexico has demonstrated that mowing in August or September, followed by a spray of 2 lb/A silvex ester the following May, will reduce the stand by 89% as compared to 24% on sprayed but unmowed areas. This effect may have been associated with the 37% lower quantity of root carbohydrates observed in plants which had been previously mowed. Mowing in March, followed by treatment as above in both May and August was also very effective. Polypropylenediol, added to the final silvex mixture at 1 or 2%, has significantly increased kill over silvex alone - applied by aerial spray either during dormancy or in June.

Although the market for red alder is expanding, a report from Washington indicates that it still must be controlled on sites that are better suited for conifers. When too scattered for economical aerial spraying, red alder may be controlled by individual treatment. Studies have shown that 2,4-D and 2,4,5-T amines, dicamba, and picloram (either Tordon 22K or 101) will all give satisfactory kill (100% in the case of picloram) any month of the year when 2 ml of undiluted chemical is applied to each of the cuts spaced at 2-in. intervals around the trunk.

An integrated system for application of thickened mixtures of Tordon(R) and 2,4-D herbicides to control woody plants on roadsides and other non-crop areas. Warren, L. E. Woody plants present serious maintenance problems on the sides of roads for access to restricted areas for lumbering, fire control or for normal traffic on powerline roads, fuel breaks, waterways, and other non-crop areas. Treatments are needed to provide control of a broad range of species including conifers, using more efficient application procedures and in some areas positive drift control. Reports and experience have indicated that a combination of picloram plus 2,4-D herbicides in a ratio of 1:4 controls a wide spectrum of problem species. Picloram + 2,4-D (Tordon(R) 101 Mixture containing 0.54 lb picolinic acid and 2 lb 2,4-D per gallon as the triisopropanolamine salts) is registered for use at 2 to 4 gpa along with Norbak(R) particulating agent to control drift and has been applied aerially for several years to control brush along powerline rights-of-way. This system has been adapted to truck mounting for treatment of roadside brush and weeds with considerable improvement in plant control as well as efficiency of application compared to previous systems.

In May to July, 1966, several experiments were established in northern California and western Oregon and Washington to determine the efficacy of picloram + 2,4-D (Tordon 101 Mixture) at 1 to 3 gpa with Norbak agent under varying degrees of moisture stress and seasonal growth. The volume rate was usually 25 gpa but varied at some locations up to 37.5, 50 and 75 gpa. The spray was pressurized with a Roper 1-1/4 in. gear pump. Spraying Systems' 3/4 OC-80 plus a U0520 and a 3/4 DOC-48 or DOC-72 nozzle at 20 to 30 psi were mounted about 5 ft high on a vertical standard at the edge of the sprayer traveling at 5 to 10 mph. Plots were 12 to 20 ft wide and 150 to 400 ft long. Sprays were directed to fall onto the tops of the plants as much as possible. Drift was minimized and good placement of sprays was possible in winds up to 6 to 8 mph.

Following are examples of responses to these treatments. Untreated growth in May and early June was vigorous and by late July had usually ceased. At Eureka, California; Winston, Springfield, Seaside and Tillamook, Oregon; and Chehalis, Ft. Lewis and Bangor Island, Washington, picloram + 2,4-D (Tordon 101 Mixture) applied at 1 to 2 gpa in late May and early June gave good to excellent control of Douglas fir, incense and western red cedars, western hemlock, ponderosa pine, Sitka spruce, vine and bigleaf maples, poplars, willows, madrone, alder, blackberries, salmonberry, thimbleberry, poison oak, wild rose, yerba santa, locust, tree of heaven,

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manzanita, Canada thistle, St. Johnswort, and a number of other species. Grass growth invariably was encouraged. On larger trees (12 to 20 ft), volume rates of over 25 gpa seemed to improve control sometimes, but not consistently. Two to 3 gpa of picloram + 2,4-D (Tordon 101 Mixture) were required for good control of Oregon ash, Oregon oak, live oak, and tan oak in sizes less than 8 to 10 ft high. Control of many species was sometimes poorer with applications in late June to July after growth had slowed down.

One advantage of this treatment is the slow and less drastic cosmetic effect compared to the phenoxy compounds. In areas of public awareness, several possibilities exist now of containing the brush and weeds with economical chemical treatments that will not elicit undue objections.

The particulated spray must be mixed properly for best results. The equipment and procedures developed to mix this spray are simple and inexpensive. The spraying system should include a positive displacement pump and a helical ribbon agitator in a rounded bottom tank. The boomless nozzle system enables much faster application with fewer problems than with the usual booms. (Plant Science Research and Development, The Dow Chemical Company, Davis, California.)

Recovery of amitrole from forest litter. Norris, Logan A. In continuing studies of chemical pollution of the forest environment, the fate of amitrole in forest litter is being investigated. The purpose of this study is to determine the persistence characteristics of amitrole as an environmental contaminant.

Forest floor litter was collected from a red alder, *Alnus rubra* Bong., stand in western Oregon. The litter was mechanically chopped and preconditioned for three weeks under a 15 hr day with 60 degree F night and 75 degree F day temperature regime in a growth chamber. Twenty-five g (oven dry weight) samples were weighed into four ounce waxed paper cups and returned to the growth chamber after treatment with amitrole. Samples were watered daily to maintain a moisture content of 54%. The environmental conditions during the test period were the same as those used during the preconditioning period.

In a second part of the study, preconditioned litter was weighed into 500 ml erlenmeyer flasks which were stoppered with cotton plugs. These samples were autoclaved at 15 lb pressure for 30 min and cooled to room temperature prior to treatment with a sterile solution of amitrole. Following treatment these samples were maintained in sterile culture in the growth chamber.

At intervals cups were removed from the growth chamber and frozen until analyzed. The analytical procedure involved soxhlet extraction with 70% methanol followed by removal of the amitrole from the methanol with Dowex-50 ion exchange resin. After several clean up steps, the amitrole was eluted from the column with NH_4OH and concentrated by boiling. After a final clean up with activated charcoal, the amitrole was diazotized and determined colorimetrically. The complete procedure is available on request.

The following treatments were included in the first series of tests: (1) amitrole at 2 or 4 lb/A, (2) amitrole at 2 lb/A in combination with 1.8 lb/A NH_4SCN or 2 lb/A 2,4-D potassium salt, or (3) amitrole at 2 lb/A three weeks after the litter had been treated with 2 lb/A 2,4-D potassium salt. Treatments were made by applying the indicated chemicals in a total of 5 ml to the surface of the litter.

Table 1. Precent recovery of amitrole from litter.

Treatment	Days after treatment			
	5	10	20	35
amitrole 2 lb/A	47	42	28	20
amitrole 4 lb/A	54	39	29	21
amitrole 2 lb/A plus 1.8 lb/A NH_4SCN	51	48	31	20
amitrole 2 lb/A plus 2 lb/A 2,4-D	57	43	26	21
amitrole 2 lb/A 21 days after 2 lb/A 2,4-D	56	50	25	24

It is apparent from the data in Table 1 that the recovery of amitrole falls rapidly the first five days after application, and the presence of other chemicals does not influence the rate of the reaction. The comparable behavior of the 2 and 4 lb/A application rates suggests first order kinetics.

The pattern of amitrole recovery in sterile and normal litter the first ten days after treatment with 4 lb/A of herbicide was determined in a second part of the study. The results of this study are expressed as before in Table 2.

Table 2. Percent recovery of amitrole from sterile and normal litter.

Treatment	Days after treatment						
	½	1	2	3	5	7	10
Normal litter		76	71	61	62	49	41
Sterile litter	93	77	67		54		39

When the data in tables 1 and 2 are compared graphically it is clear that biological degradation was not an important factor in the apparent loss of amitrole in these tests. Had there been appreciable biological degradation the percent recovery in normal and sterile litter would not have paralleled one another so closely.

The loss of amitrole or the inability to recover it may be due to chemical degradation, complexing with metal ions, adsorption or any combination of these three. The mechanism of this loss is under investigation.

This research was supported in part by Research Grant WP 00477 from the Federal Water Pollution Control Administration, and in part by Supplements 39 and 49 to the Master Memorandum of Understanding between Oregon State University and the U. S. Forest Service. (Oregon Agricultural Experiment Station, Oregon State University, Corvallis.)

Stream contamination by herbicides after fall rains on forest land. Norris, Logan A. Previous studies have shown that in some cases fall rains do not introduce measurable quantities of herbicides into streams flowing by or through forest areas treated with herbicides. As part of a continuing study of this aspect of environmental contamination, two streams were monitored for herbicide residues in western Oregon in the fall of 1967.

Cape Creek Watershed. This study area is located 13 miles south of Yachats, Oregon in the Siuslaw National Forest. It is a 7,850 acre watershed covering portions of townships 16 and 17 S and ranges 11 and 12 W. W.M. One pound each of 2,4-D and 2,4,5-T in 10 gal of oil per acre was applied to 476 acres by helicopter. One spray unit containing 423 acres is adjacent to the stream for 2.3 miles and extends from 200 to 400 yards up slope from the stream. The remaining acreage is scattered in four small units. Water samples were collected by U. S. Forest Service personnel just downstream from the lower edge of the large unit.

Green Creek Watershed. This watershed is located in the Mapleton Ranger District of the Siuslaw National Forest and covers parts of townships 16 and 17 S and range 9 W W. M. One pound each of 2,4-D and 2,4,5-T in 10 gal of oil was applied by helicopter in late March to a total of 407 acres in 25 treatment units in this 2880 acre watershed. Treatment units are scattered over most of the watershed. Water samples were collected by Forest Service personnel in Green creek about one mile upstream from the confluence with Lake Creek.

Water samples were collected and stored in gallon glass jugs which contained 75 grams of sodium hydroxide to prevent microbial degradation and to aid in hydrolysis of the ester. The herbicide was removed from the water after acidification by liquid-liquid extraction with benzene. After esterification with 10% BF_3 methanol, the herbicide was determined by gas chromatography using the Dohrmann detection system. The analytical method is quantitative to 1 part per billion acid equivalent of herbicide in the water.

Measurements of rainfall were made near Yachats about nine miles north of the Cape creek watershed, and at Mapleton which is about four miles southwest of the Green creek watershed. The following table shows the rainfall pattern and the dates water samples were collected in the study areas.

Rainfall pattern and sample collection dates

	Cape Creek Watershed		Green Creek Watershed	
Date	Rainfall (inches)	Sample collected	Rainfall (inches)	Sample collected
9/29	0.52	no	0.57	no
9/30	0.43	no	0.43	yes
10/1	0.64	no	0.97	yes
10/2	0.68	no	0.56	yes
10/3	1.18	yes	3.12	yes
10/4	0.06	yes	0.05	no
10/5	0.17	yes		
10/6	----	yes		
10/9	----	yes		

Measurable concentrations of 2,4-D and or 2,4,5-T were not found in any of the samples collected in this study. In earlier studies with both phenoxy and amitrole herbicides, fall rains did not introduce measurable herbicide into streams flowing through small scattered treatment units. The present study has expanded the scope of this concept to include cases where a fairly large portion of a watershed is treated and where the treatment unit is oriented for a considerable distance along the stream. On the basis of this and previous studies it is concluded that fall rains will not result in appreciable contamination of streams flowing through forest areas treated with phenoxy or amitrole herbicides in spring or early summer. Unless heavy application is made directly to the stream, the major potential for stream contamination is from heavy rain or land movement resulting in heavy overland (surface) flow of water and sediment shortly after application.

This research was supported in part by Supplements 39 and 49 to the Master Memorandum of Understanding between Oregon State University and the Forest Service. Additional support as fees and services were received from the Siuslaw National Forest. (Oregon Agricultural Experiment Station, Oregon State University, Corvallis.)

Effect of several herbicides on trees following their application to cuts in trunks. Leonard, O. A. and R. K. Glenn. The objective of these tests was to compare the herbicidal effect of several herbicides on trees by the cut-surface method of application. Herbicides employed in these studies were the following: alkanolamine salt of 2,4-D, K salt of picloram, paraquat, cacodylic acid, and hexafluoroacetone.

One-half gram ae of either 2,4-D or picloram applied to cuts 6 in. apart in the winter gave complete kills of interior live oak (Quercus wislizenii) and California black oak (Q. kelloggii). This same treatment was effective against digger pine (Pinus sabiniana) with 2,4-D but not completely so with picloram. Picloram was more effective than 2,4-D against tan oak (Lithocarpus densiflora) with the tops being killed, but 40% developed a few basal sprouts. Plant kills were greater with winter applications than with those made in the late spring or summer. Although plant kills decreased as the spacings were increased, the decrease was most marked with 2,4-D. Also, dosage was more critical with 2,4-D than it was with picloram.

Hexafluoroacetone (undiluted), cacodylic acid (40% w/v in water), and paraquat (2 lb/gal) were applied to cuts in trunks every 6 inches. A dosage of 2 ml per cut resulted in a complete top kill with hexafluoroacetone on interior live oak and blue oak (Q. douglasii), and a partial top kill of tan oak. Results with paraquat were less complete, while those with cacodylic acid were poorest. All treatments with these herbicides which were effective in achieving a marked effect on the tops, resulted in an abundance of vigorous basal and root sprouts. (Botany Department, University of California, Davis, California.)

Recent developments in saltcedar control. Hughes, Eugene E. Two ground-applied treatments developed in 1966 look promising for control of saltcedar (Tamarix pentandra Pall.), a problem phreatophyte in Western

United States. The first treatment involved mowing plants in August and September, 1965, then spraying them with 2 lb/A of the propylene glycol butyl ether (PGBE) ester of 2-(2,4,5-trichlorophenoxy)-propionic acid (silvex) in May, 1966. The stand of saltcedar on mowed plots was reduced 89% compared to 24% on plots with unmowed plants similarly sprayed. During 1967, carbohydrate analyses of plants mowed in August and September, 1966, showed the plants mowed in August to have 37% lower root carbohydrates than non-treated plants at the May, 1967, spraying date. This undoubtedly influenced the enhanced reduction of stands on mowed plots noted in the 1965-66 treatments.

A second promising treatment included mowing saltcedar plants in March, then spraying in May with 2 lb/A of the PGBE ester of silvex, and spraying again in August with the same rate. This treatment resulted in a 97% stand reduction. Spraying unmowed plants twice reduced the stand only 24%.

In addition to the ground-applied treatments, two aerial-applied treatments also looked promising. An aerial spray treatment of 8 lb/A of the PGBE ester of silvex in 20 gal of diesel oil containing 1% polypropylenediol, applied in March of 1966, killed 75% of dormant saltcedar plants on experimental plots near Ashland, Kansas. On adjacent plots, an aerial foliage spray treatment of 2 lb/A of silvex plus 2% polypropylenediol in 5 gal of water, applied in June, reduced the stand 43%, compared to 12% with 2 lb/A of silvex alone. Although it is relatively expensive, the former treatment is very safe and could be used adjacent to areas that will be growing susceptible crops later in the year. Both treatments indicate that polypropylenediol may be effective as an additive to silvex ester for control of saltcedar. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Los Lunas, New Mexico.)

A test of five chemicals to control scrub red alder (*Alnus rubra* Bong.) each month of the year. Finnis, J. M. The market for red alder is expanding but it frequently occurs on sites more suited for conifers and where alder control is necessary. Aerial spraying of alder is a common practice in the Pacific Northwest, but there are many occasions when the alder is too scattered or the area too small to justify aerial spraying, and ground control is consequently required. The "Hack and Squirt" method, also know as trunk or stem injection, is a convenient technique for situations such as this because it is effective, requires a minimum of equipment, and can be carried out by any type of crew with a minimum of training. Earlier work (Finnis and Wolfe, unpublished) had shown 2,4-D amine to be effective in the summer and dicamba to be effective in the winter; however, dicamba is expensive, and we were looking for a cheaper alternative for winter use. Five chemicals were tested on the 15th of each month from August 1966 through July 1967. The treatments were:

1. 2,4-D amine
2. 2,4,5-T amine
3. dicamba
4. picloram + 2,4-D (Tordon 101)
5. picloram (Tordon 22K)

Five trees were treated per chemical per month. The number of hacks per tree was not constant but varied with tree diameter, being spaced two in. apart edge to edge. Two ml of undiluted chemical was applied per hack, using a Vacco syringe. Average diameter of the test trees was 3.6 in. All trees were examined in September 1967 and assigned a rating of 1-5, with 1 signifying no effect and 5 indicating tree dead. The results are shown in the following table.

Chemical	No. of trees in each rating class 1	2	3	4	5	Total No. of trees
2,4-D amine	0	2	0	1	57	60
2,4,5-T amine	0	0	2	5	53	60
dicamba	0	0	0	1	59	60
picloram + 2,4-D (Tordon 101)	0	0	0	0	60	60
picloram	0	0	0	0	60	60

These results show that both picloram formulations produced complete kill and the other three chemicals produced kills that for all practical purposes were successful. The relatively small size of the test trees is believed to account for the successful results, as previous work had shown that 2,4-D amine and 2,4,5-T amine were not effective on larger trees in the winter. Based on effectiveness and cost, picloram + 2,4-D (Tordon 101) appears to be a promising winter treatment. (Silviculturist, Department of Natural Resources, Route 4, Box 490, Olympia, Washington 98501.)

PROJECT 4. WEEDS IN HORTICULTURAL CROPS

Harry Agamalian, Project Chairman

SUMMARY

Weed workers from California, Colorado, and New Mexico, submitted 16 reports with fruits, turf, ornamentals and vegetables.

Turf

Nine preemergence herbicides were evaluated by Colorado Agricultural Experiment Station workers for barnyardgrass control on three species of established bluegrass. Results from DCPA, Planavin, bensulide, Sindone, Bandane, and benefin indicated less than two barnyardgrass plants per 25 square feet. Initial injury from benefin and Sirmate was not apparent by mid-summer.

Dandelion and mallow control with six postemergence treatments was also reported from the Colorado Agricultural Experiment Station. Results from these workers indicated 80% or better dandelion control with 2,4-D and dicamba mixture and 2,4-D + silvex + dicamba mixture. Mallow control with dicamba and combination of 2,4-D + silvex + dicamba gave 80% or better control. In all treatments combinations of 2,4-D with dicamba and/or silvex resulted in better weed control than 2,4-D alone.

Vegetables

Cantaloupe: Preplant and preemergence experiments of NPA and bensulide were studied under furrow and sprinkler irrigation by California workers. The use of sprinkler irrigation with NPA caused severe crop injury when compared to similar treatments under furrow irrigation. Bensulide caused no crop injury with the use of sprinkler or furrow irrigation.

Peas: Preemergence and postemergence treatments were evaluated by Colorado Agricultural Experiment Station and Extension workers. Of the several chemicals tested benefin and Sindone-B resulted in excellent weed control and good crop tolerance. Postemergence treatment with bromoxynil resulted in excellent black nightshade control without damage to the peas.

Onions: One test from Colorado indicated that early postemergence treatments of bromoxynil and subsequent bromoxynil applications provided excellent weed control and increased yields over the hand weeded check.

Peppers (direct seeded): Two papers on pepper weed control were submitted from New Mexico and California. New Mexico workers indicated effective weed control from preplant incorporated treatments of benefin, bensulide, DCPA, and D-497, resulting in a significant reduction of hand weeding cost. Yield data indicated no significant differences from the hand weeded check. Preplant trials from California indicated effective weed control with diphenamid and DCPA. Poor weed control was reported with bensulide. Treatments of trifluarlin was injurious to the stand. Combinations of DNPB and diphenamid applied post to the weeds and preemergence to

the peppers, provided good weed control and with slight crop injury. Results from trifluralin and amiben applied as lay-by treatments warrent further testing.

Potatoes: Results from California indicated that preemergence treatments of linuron, C-6313 and prometryne can cause injury under sprinkler irrigation, when treatment occurs on soils of low clay and organic matter content. Preplant incorporation treatments of EPTC, diphenamid, DCPA, trifluralin, and SD 11831, resulted in good crop tolerance. Preemergence application of UC 22463 resulted in good weed control and no crop injury.

Spinach: One California test with preplant incorporated herbicides indicated some crop phytotoxicity from R-2063, CP-31393, norea, and CP 50144, throughout the growing season. Subsequent yield data, indicated a significant reduction with CP 50144. Excellent weed control was obtained with all treatments.

Ornamentals

Carnations: California workers reported effective weed control with TOK at 2, 4, and 8 lb/A as postemergence treatments to transplanted carnations. Initial harvest data indicated a slight reduction in fancy grade flowers. Total yields were comparable or slightly higher than the hand weeded control.

Azalea: Weed control trials in shade-grown azaleas indicated excellent weed control with diuron over an eight month period. Similar weed control for five months was obtained with bensulide, trifluralin, diphenamid, simazine, and prometryne. Early leaf chlorosis was not apparent at harvest, causing no affect on plant quality.

Chrysanthemums: Herbicide treatments with varying rates of TOK, CIPC and combinations were reported to be effective in groundbed plantings. Single treatments of TOK at 3 and 6 lb/A and CIPC at 2 lb/A indicated no reduction in fancy flowers. Combination of TOK and CIPC indicated crop phytotoxicity, which reduced percent fancy flowers.

Fruits

Deciduous: Three papers submitted by California workers covered various phases of weed control in this discipline. Peach and plum rootstock tolerances were studied with eight herbicides indicating translocation to be a factor in crop tolerance with dalapon and MSMA. Postemergence weed control is evaluated with all treatments.

Studies on established orchards indicate a strong correlation between the time of herbicide application, method of irrigation and soil type and organic matter, when using diuron and simazine. Flood irrigation caused more tree phytotoxicity than when the treatments were furrow irrigated.

A comparison study with several new triazine compounds, simazine, and Cotoran indicated more effective weed control with the triazines. Crop tolerances are indicated for plum, peach, and citrus rootstock.

Grapes: Preplant and postplant treatments of several herbicides on field cutting were studied by workers in California. Mechanical incorporation of dichlobenil, EPTC, R-11914, and trifluralin were evaluated for crop phytotoxicity. Sprinkler incorporation was used for dichlobenil, Cotoran, simazine, Sirmate and GS 14254. Initial crop injury was more severe when dichlobenil was mechanically incorporated. Crop phytotoxicity was evaluated over a three month period.

Performance of nine preemergence herbicides for control of barnyardgrass in three varieties of Kentucky bluegrass. May, J. W., H. M. Hepworth and J. L. Fults. On April 24, 1967, nine preemergence annual grass herbicides were applied to year-old common, Merion and Windsor bluegrass turf heavily infested with barnyardgrass (*Echinochloa crusgalli*) and bristlegrass (*Setaria* spp.).

On August 2 plots were evaluated and quantitative data secured by using a 5 x 5 ft transect divided into nine equal 400 sq in. subunits. Nine readings were taken for each transect and eight transects were evaluated for each treatment on each of the three turf varieties and the data averaged. Comparisons have been made on the basis that 0 = no weedy grasses; 1 = 1 or 2 plants; 2 = 3-10; 3 = 11-25; and 4 = 25^{+} per 400 sq in. Performance comparisons are shown in the following table for the nine herbicides.

Planavin, at the rate used in this experiment, resulted in severe thinning of Merion with moderate injury in both common and Windsor bluegrass. A slight reduction in tillering was observed in both common and Meriod bluegrass as a result of treatment with benefin; and Sirmate produced pronounced chlorosis in all three turf types shortly after treatment. Injury caused by both benefin and Sirmate was overcome by mid-summer. (Botany and Plant Pathology Section, Colo. Agri. Expt. Sta., Colo. State Univ., Fort Collins.)

Herbicide performance rating

Chemical treatment	Rate lb ai/A	Performance rating on each turf variety: Common Kentucky	Merion bluegrass	Windsor bluegrass	Average variety rating
DCPA	12	0.01	0.01	0.00	0.01
Planavin	3	0.07	0.17	0.01	0.08
bensulide	15	0.18	0.06	0.00	0.08
Sindone	8.3	0.32	0.03	0.04	0.13
Bandane	35	0.32	0.19	0.15	0.22
benefin	2	0.72	1.67	0.28	0.89
terbutol	12	1.40	1.66	0.51	1.19
siduron	12	2.26	3.61	2.38	2.78
Sirmate	8	2.31	2.34	1.78	2.14
Control	0	1.45	2.21	2.52	2.06

Evaluation of six chemical treatments for controlling dandelions and mallow in three Kentucky bluegrass varieties. May, J. W., H. M. Hepworth and J. L. Fults. Dicamba and 2,4-D amine each applied alone at the rate of 1 lb ai/A were compared with four formulations containing mixtures of 2,4-D plus dicamba, 2,4-D plus MCPP and dicamba, and 2,4-D plus dicamba and 2,4,5-TP at the rates suggested by the manufacturers to control dandelion (*Taraxicum officinalis*) and common mallow (*Malva neglecta*) in year-old turf of common Kentucky, Merion, and Windsor bluegrass (*Poa pratensis*).

Postemergence treatments were on May 8, 1967, using a volume of spray of 1 gal/1000 sq ft of turf. On June 15, evaluation of weed control and turf damage was made. Quantitative data were obtained by using a 5 x 5 ft quadrat divided equally into nine 400 sq in. subunits. Actual plants were counted in each subunit and an average for each transect determined. Ninety six quadrats were read on each turf variety; 12 for each of the six chemical treatments and for the control plots.

No apparent turf damage resulted from any of the six chemical formulations. Weed control performance is shown in the accompanying table. (Botany and Plant Pathology Section, Colo. Agri. Expt. Sta., Colo. State Univ., Fort Collins.)

Chemical control of dandelion and mallow on three turf varieties

Chemical formulation	Amt. formulation per 1000 sq ft	Bluegrass variety	Dandelions	Mallow	Combined
Amchem 66-303 (2,4-D + dicamba)	65 ml	Common	80	21	33
		Merion	86	59	68
		Windsor	80	30	55
		ave.	82%	37%	52%
Amchem 66-304 (2,4-D + MCPP and dicamba)	65 ml	Common	80	63	67
		Merion	86	67	74
		Windsor	70	70	70
		ave.	79%	67%	70%
Amchem 66-306 (2,4-D + 2,4,5-TP and dicamba)	65 ml	Common	80	84	83
		Merion	86	76	79
		Windsor	100	80	90
		ave.	89%	80%	84%
Banvel-D (dicamba)		Common	60	89	83
		Merion	29	75	57
		Windsor	60	80	70
		ave.	50%	81%	70%
Ortho CS-5986 (2,4-D + dicamba on fertilizer base)	5 lb	Common	60	57	50
		Merion	71	59	63
		Windsor	80	90	85
		ave.	70%	65%	66%
2,4-D amine	23 ml	Common	40	37	38
		Merion	14	17	16
		Windsor	20	60	40
		ave.	25%	38%	31%

<u>Tolerance of cantaloupe to NPA and bensulide with sprinkler and furrow irrigation.</u> Tisdell, T. F., W. B. Fischer and F. M. Ashton. This trial at the West Side Field Station in Fresno County was established to investigate

some of the problems associated with utilizing herbicides in cantaloupe production. NPA was applied to shaped beds at 5 and 10 lb/A. The bensulide treatments were at the rates of 4 and 8 lb/A. These were applied by the following two methods: (1) pre-plant and incorporated into the soil to a depth of 2 inches with a power tiller, (2) preemergence treatments to the soil surface after the crop had been seeded. One block of four replicates of each treatment was furrow irrigated and another sprinkler irrigated.

Cantaloupe plant counts and vigor ratings made 23 days after planting showed severe crop injury, when the NPA applications were followed by sprinkler irrigation. However, the NPA treatments which were furrow irrigated did not produce any apparent loss in stand or plant vigor. The results were essentially the same whether the NPA was applied to the soil surface or incorporated into the soil.

Bensulide did not cause any observable injury to the crop under any of the above conditions. (California Agri. Exp. Sta., Davis, Calif., Agri. Ext. Ser. Fresno, and Calif. Agri. Exp. Sta. Davis.)

<u>Pre and postemergence chemical weed control in canning peas.</u> May, J. W., and P. E. Heikes. Eight preemergence herbicides were tested on canning peas in the Ft. Lupton area of northeastern Colorado during the 1967 season. All treatments were applied postplant, preemergence on May 10, just prior to emergence of pea seedlings. Application of all formulations was broadcast with an Amchem "Metermizer" using 1 gal of water per 1000 sq ft of plot followed by very mild incorporation. Principle weeds in the area included barnyardgrass, setaria, pigweed, lambsquarters, purslane, toothed spurge, ground cherry and kochia. Results of May 25 and July 3 evaluations are shown in Table 1.

Three postemergence compounds were investigated on peas in the same area. In this case application was on May 25 when peas were 15 day old and approximately 4 in. high. Chemicals were applied broadcast with a metermizer using 1 gal of water per 1000 sq ft. Peas had been underseeded with alfalfa which had emerged at treatment time and the principle weed was black nightshade; other weeds included setaria, barnyardgrass, witchgrass, Russian thistle, pigweed, lambsquarters, ragweed and kochia.

Plots were evaluated on July 3 just prior to pea harvest and the results are listed in Table 2.

Since fruits of black nightshade are difficult to separate from peas and present a serious problem, control of this weed is of primary importance. Low rates of bromoxynil appeared very promising. (Botany & Plant Pathology Section, Colo. Agri. Expt. Sta. and Colo. Cooperative Extension Service, C.S.U., Fort Collins, Colo.)

Table 1. Preemergence herbicides for peas

Chemical	Rate	Comments
Sirmate	8 lb ai/A	inhibited chlorophyll formation in pea seedlings, very good control of both grass and dicot weeds

Table 1. (Continued)

Chemical	Rate	Comments
trifluralin	3/4 lb ai/A	No adverse effect on peas, excellent weed control except for ground cherry.
benefin	1½ lb ai/A	Outstanding with respect to both crop tolerance and weed control.
DCPA	10 lb ai/A	Good grass weed control, some retardation in pea plants.
Sindone-B	1½ lb ai/A	Excellent weed control with no apparent adverse effect on peas.
EPTC	3 lb ai/A	Weed control fell short, also peas suffered retardation.
Planavin	1 lb ai/A	Excellent weed control, peas slightly set back.
OCS-21799	3 lb ai/A	Poor weed control, peas severely reduced.

Table 2. Postemergence herbicides for peas

Chemical	Rate	Comments
bromoxynil	¼ lb ai/A	Excellent control of nightshade without damage to peas or alfalfa.
bromoxynil	3/8 lb ai/A	Excellent nightshade control as well as other broad-leaved weeds, little reduction in grasses;
bromoxynil	½ lb ai/A	very slight indication of retardation in peas; similar results for both 3/8 and ½ lb ai/A rates.
OCS-21799	2 lb ai/A	Good grass control, poor control of nightshade; moderate pea injury.
2,4-DB	1 lb ai/A	Considerable epanasty in peas, very good broadleaf weed control including nightshade; no grass weed control; peas somewhat retarded in development.

Response of onions to repeated bromoxynil treatment. Dunster, K. W. At the Arkansas Valley Experiment Station, Rocky Ford, Colorado, yellow Spanish onions (Colorado #6) were treated with the octanoic acid ester formulation of bromoxynil at rates of ¼, 3/8, ½ and 1 lb/A. Onions were in the late flag leaf stage with true leaves emerging at time of initial treatment. All plots were retreated with bromoxynil ester at 3/8 lb/A 39 days later. Plots were replicated 3 times and consisted of 6 rows 30 feet in length. The cooperation of Jerre Swink, Station Superintendent, is gratefully acknowledged.

The variable weed population in the plot area prevented accurate control evaluation. It was noted that hand weeding costs were reduced 50% in the general plot area compared to an adjacent untreated area. Weed species consisted of Kochia scoparia, Salsola kali and Hibiscus trionum. Bromoxynil ester applied at ¼ + ¼ lb/A with a 14-day spray interval provided satisfactory control of the above species and Amaranthus retroflexus in field strip trials established the same place.

The trial area was damaged by hail before the second spray application. Subsequent bromoxynil treatments, particularly at the higher application rates, burned leaves considerably. Perhaps environmental factors which weaken the onion cuticle increase sensitivity to bromoxynil.

None of the treatments reduced onion stand or total yield. No treatment increased the occurrence of doubles. All treatments appeared to increase the incidence of rots. Results are presented in the tables which follow. (Amchem Products, Inc., Fremont, California.)

Effect of bromoxynil on onion stand, vigor and yield.

Herbicide	Rate lb/A 4/28/67	Rate lb/A 6/6/67	Percent onion* (5/16/67) Stand	Percent onion* (5/16/67) Vigor reduction	Yield** (9/11/67) lb (fresh wt.)
bromoxynil	1/4 +	3/8	99	3	36.2
bromoxynil	3/8 +	3/8	102	7	36.1
bromoxynil	1/2 +	3/8	105	10	38.1
bromoxynil	1 +	3/8	94	23	38.1
bromoxynil	---	3/8	---	--	37.2
Check	---	---	100	0	32.6

* Average of 3 replications
** Average of 3 replications; 32 feet of row sampled per replication
--- Hand weeded

Effect of bromoxynil on onion grade classification.

Herbicide	Rate lb/A 4/28/67	Rate lb/A 6/6/67	Numbers Jumbo	Numbers Medium	Numbers Rots	Numbers Culls	Weight (lb) Jumbo	Weight (lb) Medium	Weight (lb) Rots	Weight (lb) Culls
			Onion grade classification (11/2/67)*							
bromoxynil	1/4 +	3/8	10.3	86.7	5.0	20.0	5.8	24.1	1.7	1.9
bromoxynil	3/8 +	3/8	11.0	81.7	7.0	28.7	6.3	21.6	2.1	3.2
bromoxynil	1/2 +	3/8	6.0	105.0	7.0	22.0	3.3	27.6	2.1	2.2
bromoxynil	1 +	3/8	11.0	86.0	6.0	25.3	6.4	24.1	2.3	2.7
bromoxynil	-	3/8	9.7	87.3	7.0	21.7	5.7	24.1	2.5	2.2
Check			5.3	90.0	0.7	19.3	3.0	24.6	0.2	2.1

* Average of 3 replications; 32 feet of row sampled per replication

Classification (diameter)	
Jumbo	over 3 in.
Medium	2-3 in.
Cull	under 1-3/4 in.

<u>Weed control in chili peppers.</u> Whitworth, J. W., P. M. Trujillo, and W. P. Anderson. Six herbicides were applied preplant for weed control in seeded chili peppers in northern New Mexico. Amiben, benefin, bensulide,

DCPA, diphenamid, and D-497 (Sindone B) were each applied at two dosages and 5 replications of each dosage to preformed seedbeds and soil-incorporated by discing twice parallel to the beds. A randomized block design was used, and individual plots were 9 x 30 ft in size, containing 3 30-in. beds. After incorporating the herbicides, applied in aqueous sprays, the beds were reformed and chili pepper, var. Espanola #1, was seeded into the beds, one row per bed, by hand to obtain a stand of one plant per ft of row. Immediately after planting, the first irrigation was applied, and additional irrigations were made as needed. Weed counts were made in a 6-in. band located along the middle bed of each 3-bed plot. After making the counts, all plots were hoed to free them of weeds and, for the center bed of each plot only, records were kept of the hoe-time for each plot. The first picking of green chili was made August 25, 1967, and the second and final picking on September 18, 1967. Weed counts, hoeing time, and yields are recorded in the table. Yields are based on the weight of green chili harvested from the center 30-ft row of each plot.

The stands of chili were not adversely affected by any of the treatments. Yields of green chili, for both the first and second picking, from the herbicide treated plots were statistically equal to those of the hoed checks that received no herbicides. Four herbicides, benefin, bensulide, DCPA, and D-497, were very effective in reducing the stand of weeds and hoeing-time required to maintain weed-free plots. Savings in hoeing time ranged from 45% for DCPA at 6 lb/A to 66% for benefin and D-497 at 1.5 and 4 lb/A, respectively. Two herbicides, amiben and diphenamid, were ineffective. Assuming a cost of $1/hr for hand labor, a net saving of about $18/A was realized from the use of DCPA for weed control. Similarly, costs could be determined for the other treatments.

Predominant weeds in the plot-area were annual grasses, pigweeds, and lambsquarter. Other weed species present were cocklebur, puncturevine (goathead), purslane, Russian thistle, sunflower, sweet clover, and white horse nettle. (New Mexico Agricultural Experiment Station, New Mexico State University, University Park, New Mexico 88001.)

Performance of preplant herbicides in chili peppers, Espanola Valley Branch Station, Alcalde, New Mexico, 1967.

Treatment		Weeds			Chili		
		1st hoeing		Total time (hr/A) (3 hoeings)	Stand/30ft row at harvest	Yields (lb/A)[a]	
Herbicide	lb/A	stand/ft^2	time (hr/A)			1st pick	total
amiben	2.0	158	29	62	28	8,930	19,844
	4.0	128	35	73	29	10,914	18,455
benefin	0.75	16	11	27	28	7,342	18,455
	1.50	13	10	22	28	8,136	17,860
bensulide	6.0	14	8	25	31	10,914	20,241
	8.0	21	11	25	29	9,724	17,860
DCPA	6.0	44	14	36	29	9,327	22,821
	10.5	15	10	25	28	8,930	18,447

(Continued on Page 45)

Herbicide	lb/A	Weeds: 1st hoeing stand/ft²	Weeds: 1st hoeing (hr/A)	Weeds: Total time (3 hoeings)	Chili: Stand/30 ft of row at harvest	Chili: Yields (lb/A)[a] 1st pick	Chili: Yields (lb/A)[a] total
diphenamid	5.0	73	26	69	26	8,136	15,478
	8.0	103	24	49	26	12,502	17,860
D-497	2.0	18	11	27	26	5,358	17,860
	4.0	18	8	22	24	6,152	17,463
Checks (hoed)		126	30	65	29	8,325	19,844
LSD @ 5% for herbicides vs check =		44	7	16		3,867	4,898
Coeff. of variance		56	29	30	13	36	21

[a] Harvested as green chili.

Preplant and postemergence herbicide evaluations with peppers. Agamalian, H., G. E. May and T. F. Tisdell. This is a report of trials conducted in Monterey and Stanislaus counties during 1967. Preplant applications of diphenamid at 4, 6 and 8 lb/A produced acceptable levels of weed control in both trials. There also was no noticeable loss in pepper stand or vigor. The 4 and 8 lb/A rates of bensulide applied preplant gave no weed control. The preplant treatments of trifluarlin at ½ and 1 lb/A and DCPA at 8 and 16 lb/A severely reduced the stand and vigor of the bell peppers, although the weed control was excellent. The effect of preplant applications of DCPA at 5 and 10 lb/A on the chili peppers was slight. A combination of diphenamid and DNBP at 4 and 3 lb/A applied preemergence to the peppers and post to the weeds, provided excellent weed control, with a very slight amount of phytotoxicity to the chili peppers.

The postemergence applications of 1 lb/A trifluralin produced satisfactory weed control in bell peppers with or without a 4 or 6 lb/A preplant treatment of diphenamid. The postemergence application of 3 lb/A of amiben provided a higher level of control, when it was preceeded by a preplant application of diphenamid at 4 or 6 lb/A. Trifluralin and amiben require further testing as postemergence or lay-by treatments for peppers. (Calif. Agri. Ext. Ser., Monterey and Stanislaus counties and Calif. Agri. Exp. Sta., Davis.)

Results of herbicide trials in California potatoes. Kempen, Harold M. Many trials were conducted with various herbicides during 1963-1967 on Kern County soils characteristically low in organic matter and clay content. Herbicides included in two or more trials were DCPA, diphenamid, linuron, prometryne, trifluralin, the amine salt of DNBP, DNBP plus diesel oil, EPTC, metobromuron, 3,4-dichlorobenzyl methylcarbamate (UC 22463), 4-(methylsulfonyl)-2,6-dinitro-N,N-dipropyl aniline (SD 11831) and N-(4-bromo-3-chlorophenyl)-N-methoxy-N'-methyl urea (C-6313).

Our results showed that at indicated rates preemergence applications of linuron (1 lb/A), metobromuron (1),C-6313 (1), and prometryne (2) occassionally caused injury symptoms. Symptoms were noted primarily where irrigation was by sprinklers. In two trials linuron reduced yields. DNBP amine at 3 lb/A or more caused injury in two 1967 trials.

Herbicides which appeared harmless to potatoes and were effective against many weed species at the rates indicated were preemergence incorporated treatments of EPTC (3-6 lb/A), diphenamid (4-8), DCPA (6-12), trifluralin (½-1), and SD 11831 (3/4-1½). No effect on yield or quality was noted. Two preemergence non-incorporated trials with UC 22463 in 1967 only, resulted in good weed control without apparent injury to the potatoes.

More detailed information is given in three county publications published in January, 1966; January, 1967; and September, 1967. (University of California Agricultural Extension Service, P. O. Box 2509, Bakersfield, California.)

Evaluation of several preplant incorporated herbicides on spinach. Agamalian, H. Herbicides were applied and incorporated with a power driven L-shaped tooth equipment, at a depth of 2 in. The variety Hy #44 was planted immediately following treatment. This study was conducted under furrow irrigation on a Salinas sandy clay loam. A complete randomized block design was used with 5 replications. Excellent control of burning nettle (*Urtica urens*) and shepherd's purse (*Capsella bursa-pastoris*) was obtained with R-2063, CP 31393, norea, and CP 50144 at all rates tested. Varying degrees of crop phytotoxicity occurred throughout the growing season. Subsequent yield data indicated significant yield reductions with CP 50144; whereas yield reductions with R-2063, CP 31393 and norea suggest a minimal crop tolerance under these conditions. (University of California Agriculture Extension, Salinas.)

Summary of evaluations (spinach weed control). Preplant soil incorporated, 2 in. depth, December 21, 1966, Soledad, California. Variety: Hybrid #44

Treatment	Lb/A	$\bar{X}$ Weed control[a] 2/11	3/3	3/29	$\bar{X}$ Crop Phytotoxicity 2/11	3/3	3/29	Harvest green wt. lb/83 sq ft
R-2063	4	9	9.6	9.0	0	0.2	1.0	35.2
R-2063	6	9	9.8	9.0	1.0	0.6	1.6	33.6
R-2063	8	9	9.8	9.5	1.4	0.6	1.0	34.6
CP 31393	4	9	7.8	8.6	0.6	1.0	0.6	33.2
CP 31393	8	9.6	9.0	9.4	1.6	2.0	2.0	33.6
CP 50144	2	10	10	10	2.2	2.8	2.4	30.9**
CP 50144	4	10	10	10	3.6	5.2	4.0	24.0**
norea	4	9.6	9.2	9.0	0	0.5	1.0	36.6
norea	8	9.9	9.6	9.2	0.6	1.0	1.0	34.2
Control	0	1.4	1.2	1.0	0	0.5	0	38.6
L.S.D. (Among Means) .05								5.7
.01								7.7

[a] Major weed species: stinging nettle, shepherd's purse

Postemergence control of weeds in greenhouse carnations. Agamalian, H., D. S. Farnham, and C. Elmore. Two trials were established on groundbeds in a Watsonville plastic greenhouse during 1967. Trial S. C. #1 and S. C. #2 were established to measure levels of crop tolerance, and trial S. C. #3 has been harvested to measure yield responses. The carnation plants in trial S. C. #1 were planted July 15, 1967, and treated August 1, 1967, while plants in trial S. C. #2 were planted August 15, 1967, and treated August 24, 1967. Plants in S. C. #3 were planted July 15, 1967, and treated September 15, 1967. Each treatment was applied to the carnation variety Improved White Sim. Three replications of each treatment were arranged in a randomized block experimental design. Weeds varied from the cotyledon stage to 2" tall at the time of treatment.

Weed species consisted of hairy nightshade (*Solanum sarachoides*), red root pigweed (*Amaranthus retroflexus*), annual bluegrass (*Poa annua*), and redstem filaree (*Erodium cicutarium*). Visual weed and crop ratings were taken and excellent weed control obtained on above species at all rates tested. No apparent plant injury was observed from prebloom readings. Flowers were harvested and graded throughout a 60 day period.

Initial harvest data indicated a 25% reduction of fancy grade at all TOK treatments. Subsequent harvest periods with the 2 lb/A rate resulted in a higher percent harvest of fancy grade when compared to the hand weeded control. TOK treatments at 4 lb/A resulted in a reduced harvest of fancy grade throughout the season. Total harvest yields from the 8 lb/A treatment resulted in a slightly higher fancy grade than the control.

It would appear from these data that an initial delay in maturity may be evident at all rates. Total yield of fancy grade was greater at the 2 and 8 lb/A treatments. Although the 4 lb/A rate indicated a reduction in fancy grade over the control, the probability of this being attributed to the herbicide treatment is questionable. (Agriculture Extension, University of California.)

Weed control ratings for carnations in groundbeds

		S. C. Carnation #1			S. C. Carnation #2				
Treatment	Rate	Solanum sarachoides	Amaranthus retroflexus	Crop vigor	Solanum sarachoides	Amaranthus retroflexus	Erodium cicutarium	Poa annua	Crop vigor
TOK-25	2 lb/A	9.5	10.0	0	8.3	9.0	9.3	9.0	0
TOK-25	4 lb/A	9.7	10.0	0	9.3	10.0	10.0	10.0	0
TOK-25	6 lb/A	10.0	10.0	0	10.0	10.0	9.6	10.0	0
Untreated check	0	0	0	0	0	0	0	8.0	2

Mean % accumulated harvest by grade of carnations as compared to the control.

Treatment	lb/A	Grade	Dates of harvest 11/12-11/20	11/21-12/1	12/2-12/15	11/16-12/31	1/1-1/10
TOK-25	2	Fancy	75.6	103.8	105.2	100.5	108.6
		Standard	82.2	85.1	80.0	75.6	75.6
TOK-25	4	Fancy	76.9	86.8	87.2	95.6	94.5
		Standard	95.1	100.9	93.1	90.0	90.0
TOK-25	8	Fancy	74.3	89.9	103.4	109.1	121.0
		Standard	93.5	105.5	96.5	92.5	92.5
Control	0	Fancy	100	100	100	100	100
		Standard	100	100	100	100	100

Preemergence weed control in azalea cultivar madona. Bivins, J. L., C. L. Elmore and A. H. Lange. Earlier, neburon was found effective at low rates and was non-toxic to azaleas. An experiment was established in a commercial planting of azaleas, cv. Madona, in 1964-65 to find a herbicide comparable to neburon. The soil mix used is the commercial range is 90% German or Canadian peat and 10% wood shavings. The azaleas were planted in raised beds filled to a depth of six inches. The underlying soil is a Baywood sandy loam which has good drainage.

Azaleas were one and one-half to two years old from cuttings on their own roots, when set in rows eight in. apart. The grower's regular cultural program under a lath covering affording approximately 50% shade was used.

Herbicides were applied as a suspension in water with a two gallon X-pert Hudson sprayer which maintained a constant pressure of 25 psi. The nozzle was a T-jet #32. The herbicides bensulide, DCPA, trifluralin, and diphenamid were incorporated by kneading the peat by hand prior to setting plants in place. The herbicides simazine, diuron, and prometryne were sprayed over the plants with no attempt to keep the suspension off the foliage, and not incorporated. Treatment rates are recorded in Table 1.

Four time replicated plots were hand weeded four times and each time all weeds in the 2.5 by 5 foot area were recorded (see Table 1). Weed species included annual bluegrass and yellow oxalis.

The control of weeds was excellent over a period of five months at both rates of bensulide, trifluralin and diuron and at the high rates of diphenamid, simazine, and prometryne. At the end of six months there was no weed control at the low rate of bensulide, trifluralin, diphenamid, simazine and prometryne. The 3 lb simazine and prometryne and 5 lb/A rate of trifluralin had lost much of their effectiveness at the end of six months. The 3 lb/A rate of diuron gave excellent weed control for the entire crop season of eight months.

There was slight visible symptoms of toxicity to the azaleas at both rates of diuron, prometryne, and simazine. The symptoms appeared as chlorosis or yellowing of leaves. The 3 lb/A rate caused more severe chlorosis and a greater drop of leaves. The symptoms had disappeared by harvest and by actual measurement at harvest and grading there was no size difference of plants among the treatments. (University of California, Agricultural Extension Service, Santa Barbara, Davis, Riverside.)

Table 1. Average number of weeds in four replications.

Treatment	Lb/A	3/18	5/14	7/8	8/17
bensulide	10	0.5	3.0	13.0	38.8
bensulide	20	2.0	3.5	2.2	133.0
DCPA	10	18.0	26.0	16.5	32.5
DCPA	20	5.8	14.2	17.5	47.5
trifluralin	1	0.5	6.5	13.0	50.0
trifluralin	5	1.5	4.5	4.8	117.8
diphenamid	5	7.0	13.8	11.8	62.8
diphenamid	10	0.0	5.8	3.0	37.5
simazine	1	4.5	9.8	13.0	59.5
simazine	3	1.2	3.0	8.0	30.8
diuron	1	0.2	3.2	2.2	63.8
diuron	3	0.2	0.2	0.2	0.2
prometryne	1	16.0	24.2	15.0	78.8
prometryne	3	3.8	5.0	6.5	28.5
control		20.8	30.2	12.5	46.5

The predominant weed species were annual bluegrass and yellow oxalis and are the only species reported in Table 1.

Table 2. Crop toxicity rating and yield.

Treatment	Lb/A	Phytotoxicity Rating		Grade size
		3/3*	6/21*	9/22**
bensulide	10	0	0	4.8
bensulide	20	0	0	4.5
DCPA	10	0	0	4.5
DCPA	20	0	0	4.6
trifluralin	1	0	0	4.7
trifluralin	5	0	0	4.2
diphenamid	5	0	0	5.1
diphenamid	10	0	0	4.9
simazine	1	0	0	5.1
simazine	3	1	1	4.7
diuron	1	0	0	4.9
diuron	3	0	1	4.6

(Continued on Page 50)

Table 2. (Continued)

Treatment	Lb/A	Phytotoxicity Rating 3/3*	6/21*	Grade size 9/22**
prometryne	1	0	0	5.2
prometryne	3	3	3	4.7
control				5.2

* Rating 0 - 10
0 = Vigorous or no visible symptoms.
10 = Crop dead. The figures are averages of four replications. Only whole numbers are reported.

** Each plant was graded according to size. Each size was assigned a number and the numbers averaged. The average number is the figure reported in this column.

Chemical control of weeds in groundbeds planted to greenhouse chrysanthemums. Agamalian, H., D. S. Farnham, and C. Elmore. TOK-25 and CIPC alone and in combination were evaluated for preemergence postplant weed control in a plastic greenhouse at Watsonville, California, during 1967.

Chemicals were applied postplant to rooted White Albatros chrysanthemum cuttings in August, 1967, one day after the cuttings were transferred to the groundbed from the cutting bench. Materials were applied to 3 ft x 5 ft (15 sq ft) plots with a constant pressure CO_2 sprayer. Three replications of each treatment were arranged in a randomized block experimental design. Treatments were flood irrigated immediately after application. Flowers were harvested on December 1, 1967, and the percent harvested as fancy grade or above are reported.

Weed species consisted of *Amaranthus retroflexus*, *Solanum sarachoides*, *Poa annua* and *Stellaria media*. Single rate treatments of TOK-25, CIPC and combinations were applied to establish flower tolerance and their efficacy on *Stellaria media* which limits its use as a single applied compound. Initial crop injury ratings indicated some phytotoxic effects with CIPC at the 4 lb/A rate in single and combination treatments with TOK-25. Yield data correlated this early suppression by reducing percent fancy flowers harvested from CIPC treatments at the 4 lb/A rate. (Agriculture Ext., Univ. of California.)

Chemical control of weeds in greenhouse groundbed chrysanthemums.

Treatment	Lb/A	Weed control - rated 9/12/67: Amaranthus retroflexus	Solanum sarachoides	Poa annua	Stellaria media	Plant injury 9/12/67	% Fancy flowers 12/1/67
TOK-25	3	9.7	9.3	10.0	10.0	.3	86.1
TOK-25	6	10.0	9.7	10.0	10.0	.3	80.1
CIPC	2	9.7	9.0	10.0	9.7	1.3	81.9
CIPC	4	10.0	9.3	10.0	10.0	3.6	54.4
TOK-25 + CIPC	3 + 2	10.0	9.0	10.0	10.0	1.0	74.4
TOK-25 + CIPC	6 + 4	9.7	10.0	10.0	10.0	4.0	42.3
Control		7.7	6.0	7.3	8.0	1.0	79.1

Phytotoxicity of eight herbicides as foliar sprays and peach and plum rootstock. Lange, A. H. The lower one-third of the foliage of rapidly growing S-37 and Nemagard peach seedlings and Marianna 2624 plum cuttings in their second year (first year after heading back) were sprayed on May 24, 1967. The foliage was rated for damage at about one week and two months after application for total effect on each tree.

The results showed that all herbicides produced good initial weed burn at the high rates even though the weeds were large except dalapon, Sirmate and FW-925.

The early phytotoxicity was moderate to severe on the total appearance of the tree. After two months the new growth had obscured much of the early burn except in the MSMA and dalapon plots. Here the untreated one third (top) of the young trees were showing consistent phytotoxicity symptoms.

MSMA symptoms were a general chlorosis and reduction in leaf size and leaf drop.

Dalapon symptoms had the typical "salt type" marginal burn and curling. Both herbicides appeared to have translocated better than 2,4-D as determined by the degree of phytotoxicity in the new foliage. (University of California, Riverside.)

Phytotoxicity studies on young peach and plum rootstock foliage (2/3 of each tree sprayed May 24, 1967). 0 = no effect; 10 = killed.

		Average[1]			
		Weed control		Phytoxicity	
Herbicide	lb/A	1 wk.	2 mo.	1 wk. (old)	2 mo. (new & old)
paraquat	1	7.3	7.0	3.7	0
paraquat	4	6.3	5.7	4.0	0.7
2,4-D	4	5.7	6.7	4.7	1.3
2,4-D	16	6.3	8.3	5.3	3.0
MSMA	4	4.3	4.7	3.3	3.7[2]
MSMA	16	7.3	6.3	6.0	7.0[2]
cacodylic acid	4	7.0	6.3	5.3	2.3
cacodylic acid	16	8.0	7.0	8.3	3.0
dalapon	4	0.3	0.7	0.3	4.0
dalapon	16	4.7	3.3	4.0	7.7[2]
bromoxynil	1	3.7	6.0	4.0	1.0
bromoxynil	4	7.0	6.7	5.0	1.7
Sirmate	4	1.7	1.0	2.3	-
Sirmate	16	3.3	4.0	4.3	1.7
TOK-E-25 (FW-925)	16	1.3	0	2.0	1.3
Check	-	-	0	-	0.7

[1] Average of three replications of 6 trees (4 peach and 2 plum).

[2] New growth (not sprayed) showing severe symptoms suggesting injury due to translocation of herbicides.

Orchard weed control, irrigation, and phytotoxicity from simazine and diuron. Fischer, B. B. and A. H. Lange. Considerable orchard to orchard variations in phytotoxic responses of fruit trees to soil persistent herbicides have been observed. More injury has been experienced in light soils under sprinkler and flood irrigation than with furrow irrigation. A series of irrigation-herbicide studies were started in 1963 with two tests at the Kearney Field Station near Fresno, California.

The first and second tests were conducted on twenty-year-old Elberta peach trees growing in a sandy soil (organic matter 0.6%, sand 67.2%, silt 24% and clay 8.8%). In the first test, simazine and diuron were applied at 4, 8 and 16 lb/A on May 6 and June 4, 1963 and irrigated two days after application.

In the second test conducted in the same location, but with different trees, the herbicides were applied February 5, 1964 at rates of 2, 4, 8 and 16 lb/A in plots laid up for flood and furrow irrigation in a split plot design. Each treatment was replicated four times except for the 16 lb application which was replicated only once and only with furrow irrigation.

The third test was conducted at the Geigy Research Field Station, east of Fresno, in a soil containing 2.1% organic matter, 49.6% sand, 32.6% silt and 16.8% clay. Young peach trees (Lovell rootstocks) were planted in the early spring of 1966 and grown for one year under furrow irrigation. In the spring of 1967, flood basins and furrows were laid up. Shortly after the herbicides were applied on March 3, 1967. Weed control and phytotoxicity ratings were made on March 30 and July 6, 1967.

Results:

First Test (1963): Twenty-year-old bearing Elberta peach trees were severely injured from high rates of simazine and diuron applied in the late spring, and flood irrigated with 20 acre inches of water in two months. Rates of simazine above 4 lb/A were excessively toxic causing severe chlorosis and burn on the foliage over most of the trees. Three lbs caused considerable chlorosis and simazine pattern. No simazine residue was found in the fruit up to the highest rates, i.e., 16 lb/A.

Diuron was more erratic in its phytotoxicity and showed symptoms of a similar intensity but with a different pattern. Usually the diuron symptoms on leaves were of a lighter yellow with the veins turning chlorotic early, followed by a blotchy burning of the margin of the leaves. With simazine the veins remained green and the inner veinal areas turned yellow with increasing yellowing margins and burn with increasing herbicide rate and time.

Second Test (1964): In the second trial at the Kearney Field Station, the herbicides were applied during the winter and caused considerably less injury the following summer than in the first test, even with flood irrigation. With furrow irrigation very little injury was observed up to, and including, 8 lb/A rates. In the furrow plots the water was not allowed to cover the treated area, whereas in the flood basin irrigation, water was applied over the treated area and apparently carried the herbicide into the root zone causing typical simazine and diuron injury at the higher rates.

The intensity of symptoms was considerably less with winter-applied herbicides than summer-applied as seen in the results of the drastic treatment in Test 1 (Table 2). Winter application gave more safety as did furrow irrigation over flood irrigation. The rainfall after February was insufficient to cause sufficient leaching of the herbicide into the root zone. By the time irrigation was begun in the flood basin, enough of the herbicide had become unavailable as to minimize the amount of simazine or diuron reaching the root zone of the peach trees, hence less damage was observed in Test 2 than in Test 1.

Third Test (1967): In the third test conducted on a somewhat heavier soil with young (one-year-old) peach trees, excellent weed control was obtained from all the herbicides with the exception of C-6989. Cotoran showed excellent weed control but showed considerably more injury than equivalent rates of simazine or terbacil under flood irrigation. Less injury from Cotoran was observed under furrow irrigation; however, even here the ratings were above those of simazine or terbacil. The phytotoxicity from simazine although fairly slight on this heavier soil was greater under flood irrigation than furrow. These data were consistent with the earlier two experiments on older trees. The phytotoxicity symptoms from terbacil were comparable in intensity to those of simazine. The pattern was completely different. Terbacil caused a severe chlorosis with the veins turning yellow down to the small veinlets giving a lacy pattern of yellow veins. Under the same soil conditions, considerably more injury is observed on young trees than older trees. However, even the high rates of simazine (4 lb/A) gave only slight symptoms in this somewhat heavier soil type. These results again illustrate the large differences brought about by location effects which apparently relate to soil type and probably, more specifically, to the level of organic matter. (University of California, Agricultural Extension Service, Fresno and Riverside.)

Table 1. The effect of spring applied simazine and diuron on the foliar condition of 20 year old Elberta peach trees growing in sandy soil[1] with heavy basin (flood) irrigation[6].

		Date applied[3]		Average[2]	
Herbicide	lb/A	5-6-63	6-4-63	Ave.	ppm herbicide in fruit at harvest
simazine	4	3.0	3.0	3.0	0[4]
simazine	8	5.0	6.5	5.8	0[4]
simazine	16	8.5	7.0	7.8	0[4]
diuron	4	1.0	1.0	1.0	-[5]
diuron	8	1.5	8.0	4.7	-[5]
diuron	16	8.5	5.0	6.8	-[5]
check	0	0	0	0	0

[1]Organic matter 0.6%, sand 67.2%, silt 24.0% and clay 8.8%.
[2]Average of rating made 7-17-63. 0 = no effect, 3 = definite pattern of chlorosis, 5 = chlorosis with marginal burn, 10 = all foliage burned brown and dead.
[3]Herbicides were applied to single tree plots, four replications per treatment, half of the replications were treated 5-6-63, and half on 6-4-63.
[4]Fruit analyzed by the Geigy Chemical Company.
[5]Fruit samples submitted but never analyzed.
[6]Trees irrigated with 4 acre inches on 5-8-63, 5-20-63, and 6 acre inches on 6-5-63 and 7-10-63 for a total of 20 acre inches.

Table 2. The effect of winter applied simazine and diuron on foliar condition of 20 year old Elberta peach trees growing in a sandy soil with basin (flood) and furrow irrigation.

Herbicide	lb/A	Average[1] Weed control[2] Flood	Furrow	Phytotoxicity[3] Flood	Furrow
simazine	2	7.7	5.3	0	0
simazine	4	9.0	7.0	3	0
simazine	8	9.3	10.0	4	0
simazine	16[4]	-	10.0	-	2
diuron	2	6.7	5.0	0	0
diuron	4	9.3	8.7	2	0.3
diuron	8	9.7	10.0	2	0
diuron	16[4]	-	10.0	-	3
check	0	0	0	0	0

Herbicides applied 2/5/64 and evaluated 4/28/64 and 6/4/64. Soil analysis showed 0.6% organic matter; 67.2% sand; 24% silt; and 8.8% clay.
[1]Average of 3 replication.
[2]Average weed control rating where 0 = no effect and 10 = complete control of annual weeds.
[3]Average phytotoxicity where 0 = no effect on foliage, 3 = definite chlorosis pattern, 5 = chlorosis pattern with marginal burn and 10 = all foliage burned or dead.
[4]Replicated only once in the furrow irrigation portion of the test.

Table 3. The effect of irrigation on weed control and phytotoxicity of four herbicides to young Lovell peach rootstocks.

Herbicide[4]	lb/A	Average[1] Weed control[2] 1 month Flood	1 month Furrow	3 months Flood	3 months Furrow	Phytotoxicity[3] 3 months Flood	3 months Furrow
simazine	2	9.0	9.2	10.0	10.0	0.7	0
simazine	4	8.0	9.2	10.0	10.0	1.2	0
terbacil	1	10.0	10.0	10.0	9.5	0.2	0
terbacil	2	10.0	10.0	10.0	9.7	1.0	0
terbacil	4	10.0	10.0	10.0	10.0	1.2	0.3
Cotoran	2	9.7	10.0	9.5	9.5	3.0	1.5
Cotoran	4	10.0	10.0	10.0	9.5	7.0	3.0
C 6989	2	6.5	8.0	2.7	8.7	0.7	0
C 6989	4	8.0	8.2	3.5	5.2	0.2	0
check	0	0.7	2.5	2.7	6.0	0	0

[1]Average of four trees per replication times 4 replications.
[2]Weed control rated using 0 = no control and 10 = 100% annual weed control.
[3]Phytotoxicity rating using 0 = no effect, 3 = chlorosis pattern, 5 = chlorosis plus marginal burn, 10 = all leaves burned or defoliated.
[4]Herbicide applied to loose soil March 3, 1967 (organic matter 2.1%, sand 49.6%, silt 32.6%, and clay 16.8%).

The effect of several soil persistent herbicides on young orchard rootstocks. Lange, A. H. and Ragsdale, D. Dormant 1 year old rootstock cuttings of Marianna 2624 plums and seedlings of S-37 peaches were planted on February 4, 1966 and sprayed with herbicides in 100 gpa of water on February 24, 1967. Observations were made on 5-23-67, 7-17-67, and 11-2-67.

The results clearly demonstrated the superiority of the triazine herbicides over Cotoran at equivalent rates. Neither of the new triazines were superior to simazine on general annual weeds.

GS 14259 was considerably safer on citrus than simazine or GS 14254.

Both of the numbered triazines were more toxic than simazine on plum and peach rootstocks. Both tended to increase in toxicity whereas simizine did not. (University of California, Riverside and Geigy Agricultural Chemicals, Riverside.)

The effect of several herbicides on the foliar condition of troyer citrange, Marianna 2624, and S-37 peach rootstocks. Soil sprayed 2-24-67 one year after planting; sprinkler irrigation (Organic Matter 1.0%, Sand 66.6%, Silt 23.0%, Clay 10.4%) rated 7-17-67 and 11-2-67.

		Average[1] Weed Control[3]			Average[1] Phytotoxicity[2]								
					Citrus			Plum			Peach		
Herbicide	lb/A	5-23	7-17	11-2	5-23	7-17	11-2	5-23	7-17	11-2	5-23	7-17	11-2
simazine	2	10	9.0	6.8	1	2	2	4	5	0	3	3	5
simazine	4	10	10.0	9.7	2	1	3	6	4	1	4	3	2
simazine	8	10	10.0	8.3	4	6	3	8	6	0	2	5	0
GS 14254	2	10	8.0	7.0	4	2	0	4	5	3	5	6	3
GS 14254	4	10	7.0	3.3	3	3.1	2	5	10	10	8	9	5
GS 14254	8	10	8.0	6.8	5	6	3	8	10	10	9	10	10
GS 14259	2	9.7	8.0	6.0	0	0	1	4	4	5	4	2	3
GS 14259	4	9.7	7.0	8.3	2	0	0	4	4	3	4	6	3
GS 14259	8	10	9.0	7.6	2.0	0	0	7	10	10	6	10	10
Cotoran	2	7.3	3.7	1.3	0	0	0	1	0	0	3	1	2
Cotoran	4	8.0	4.0	3	0	0	0	4	2	0	0	9	3
Cotoran	8	8.5	5.7	2.3	1	0	2	8	10	9	7	8	8
Check	0	5.3	3.3	3.0	0	0	0	1	0	0	0	0	0

[1] Average of 3 replications, 2 trees per replication.
[2] Phytotoxicity rating was 0 = no effect, 3 = distinct chlorosis pattern, 5 = severe chlorosis with marginal burn, 10 = all foliage dead.
[3] Weed control rating was where 0 = no effect, 7 = commercially acceptable weed control, and 10 = completely free of weeds.

Phytotoxicity studies in Thompson Seedless field cuttings. Fischer, B. B. and A. H. Lange. Four preplant and five postplant herbicides were applied on 5-11-67. Herbicides for the preplant were sprayed on and incorporated immediately after application by power tiller. Rooted cuttings were planted to a 6 in. depth while the preemergence, postplant herbicides were being applied to just planted rooted cuttings. Excessive herbicide rates were used to determine relative phytotoxicity. The whole area was sprinkler irrigated immediately thereafter and subsequently flood irrigated. The soil contained 0.6% organic matter, 65% sand, 28% silt, and 7% clay. At monthly intervals after application the plots were rated for phytotoxicity on the basis of 0 = no effect, 10 = complete kill. On August 18, 1967, 3 months after application, the old and new growth were visually rated separately.

No phytotoxicity was apparent in the trifluralin treated plot as determined by visual symptoms or growth pattern (Table 1). Dichlobenil showed severe symptoms when incorporated, but at the low rate the new growth appeared to be growing out of the injury by August. R 11914 showed no injury symptoms up to 16 lb. EPTC showed no detrimental symptoms at 4 lb, however, severe injury was apparent at the 16 lb rate.

Simazine showed severe injury with only partial recovery at the 4 lb/A rate (Table 2). This substantiates earlier work in this same low organic matter soil where earlier 1 and 2 lb also showed considerable injury. Cotoran (C-2059) showed severe injury at both rates. UC 22463 (Sirmate) showed virtually no injury up to 16 lb. Only very slight symptoms were observed as a chlorosis on the margin of the leaf in the older leaves. Chlorosis was apparent in the earlier ratings. Dichlobenil applied on the surface showed some symptoms on the older leaves, but the new leaves had completely recovered by late summer. GS 14254 appeared slightly less toxic than simazine.

Considerably more injury resulted when grape cuttings were planted into incorporated dichlobenil than when sprayed on the surface and irrigated into the soil. (University of California, Agricultural Extension Service, Fresno and Riverside.)

Table 1. The effect of several herbicides on the foliar condition of Thompson Seedless grape seedlings rated 2 and 3 months after application (5-11-67). The herbicides were incorporated to a depth of 3-5 in. immediately after application.

			Average Phytotoxicity[1]			
			1 month	2 months	3 months	
Herbicide	Act.	lb/A[2]	all foliage	all foliage	Old leaves	New growth
trifluralin	4 lb/gal	1	0.7	1.0	0.7	1.3
trifluralin		4	1.3	0	0	0
dichlobenil	50 W	4	4.7	5.7	5.3	0.3
dichlobenil		16	8.7	8.7	8.0	5.0
R 11914	75 W	4	1.7	1.7	0	0
R 11914		16	0.7	0.7	0	0
EPTC	6 lb/gal	4	2.0	2.3	0	0
EPTC		16	7.3	8.4	6.3	3.3
Check		0	0.7	0.7	0	0

[1] Average of 3 replications per treated 3 vine plots with readings made from center vine only.

[2] Pounds of active ingredient per acre.

Table 2. The effect of several postplant surface applied herbicides on the foliar condition of Thompson Seedless grape cuttings. Incorporation by overhead sprinkler irrigation.

Herbicide	Act.	lb/A[2]	Average Phytotoxicity[1] 1 month all foliage	2 months all foliage	3 months Old leaves	New growth
simazine	80 W	4	3.7	7.0	7.3	4.7
dichlobenil	50 W	4	0	1.7	1.7	0
dichlobenil		16	0.7	3.3	3.7	2.0
Sirmate	4 lb/gal	4	0	0.7	0.7	0
Sirmate		16	0	0.7	0.7	0
Cotoran	80 W	2	3.0	6.3	6.0	6.7
Cotoran		4	4.3	5.7	6.3	3.3
GS 14254	25 W	2	0	1.7	5.7	3.3
GS 14254		4	0	3.0	6.3	3.3
Check		0	0.7	0.7	0	0

[1] Average of 3 replications per treatment.
[2] Pounds of active ingredient per acre.

PROJECT 5. WEEDS IN AGRONOMIC CROPS

Dwight V. Peabody, Jr., Project Chairman

SUMMARY

A total of 26 reports were submitted on 12 crops from the following states: Wyoming, Colorado, Arizona, Montana, Oregon, New Mexico, California, and Washington.

Alfalfa

In alfalfa establishment in Wyoming, none of the herbicides tested gave satisfactory control of all weed species present at all locations (dryland and irrigated). However, in established alfalfa under dormant conditions, terbacil and bromacil resulted in consistently excellent weed control at both dryland and irrigated locations. In Utah, both bromoxynil and ACP-66-130 provided good weed (mallow) control at rates tolerated by alfalfa.

Beans

In a Colorado primary field screening test which included 21 different herbicides and herbicide combinations, the best weed control with the least damage to pinto beans was obtained with SD-15179, not incorporated, and amiben with shallow incorporation.

Sugar Beets

Of the several treatments tried in Arizona, a combination of IPC and pyrazon at relatively low rates resulted in excellent winter annual weed control and the highest sugar beet yield despite early stunting and stand reductions. In Montana, TD 283, either alone or in combination, gave the most effective weed control with negligible sugar beet injury.

Corn

S-6115, either alone or in combination with propachlor, pre or post-emergence, was better than all other treatments tested and equivalent to the preemergence atrazine-propachlor combination when evaluated as a selective herbicide in an Oregon field test.

Cotton

Trifluralin and diuron, alone and in combination, were applied to cotton in an Arizona field test carried out over a 3-year period. Principal results were (1) no treatment affected cotton yields or fiber properties, and (2) effect of the various herbicide treatments on the weed population present varied over the 3-year period. A comparison of nitralin and trifluralin was made on a New Mexico field test under "non-normal" conditions: certain treatments gave indication of yield reductions although none of the differences in yield were statistically significant from the untreated controls, with one exception. In other New Mexico tests *Anoda* spp. have shown high resistance to the activity of the substituted urea and toluidine herbicides. Consequently, as an aid to field and greenhouse experimentation, a method has been devised to promote reliable germination of *Anoda* spp. seed.

Legumes

Of the several herbicides and herbicide combinations tested in Montana, ACP 66-130 applied postemergence at low rates gave the best selective weed control in a seeding of sainfoin.

Field tests undertaken in established California ladino clover seed fields have shown the effectiveness of dichlobenil on many different weed species as well as high tolerance of ladino clover to this herbicide.

Mint

At Montana, terbacil has been shown to be an effective herbicide in mint.

Washington research tests have shown that under many conditions terbacil results in excellent annual weed control with no concomitant spearmint or peppermint injury. However, preliminary observations indicate that terbacil activity does persist in the soil at least one year after application in amounts high enough to cause alfalfa and wheat injury.

Peas, (et al.)

"A series of experiments conducted over a 3-year period in Idaho, Oregon, and Washington provides data demonstrating that trifluralin may be safely applied as a preplant soil incorporated herbicide on green peas, dry peas, and lentils grown under dryland conditions." In addition, "trifluralin adequately controls certain troublesome annual weeds found in these crops."

Potatoes

In Oregon field tests, several herbicides have shown promise as effective and selective herbicides in potatoes.

Safflower

In Arizona, directed postemergence applications of certain substituted urea and s-triazine herbicides at weed-killing rates caused much less injury to safflower than when applied broadcast.

Sorghum

Results from a field test in Arizona indicated that trifluralin killed sorghum only when placed so that the germinating seed or seedling contacted the herbicide.

Cereal Grains

In an Oregon field test several herbicides of different chemistry resulted in good wild oat control with a minimum of injury to barley. In Wyoming control of several different annual weed species growing in winter wheat was obtained with different herbicides, although no treatment gave satisfactory control of all weed species. Of the 11 different herbicides and herbicide combinations included in a selective weed control test in Montana, ioxynil ester provided the best weed control; yields were equal to the hand-weeded check.

Evaluation of the potential of herbicides for weed control in establishing alfalfa. Lee, G. A., H. P. Alley and A. F. Gale. Studies on the effect of various herbicides for establishment of alfalfa were conducted at three locations in Wyoming in 1967. Experiments are being conducted to determine the feasibility of using herbicides to reduce weed competition thus reducing the amount of seed needed to obtain a vigorous stand of alfalfa.

Weed populations at Sheridan (dryland) consisted of common mallow (*Malva rotundifolia* L.), rough pigweed (*Amaranthus retroflexus* L.), tansy mustard (*Descurainia pinnata* (Walt.) Britt.), wild sunflower (*Helianthus annus* L.), Russian thistle (*Salsola kali* L.) and monolepis (*Monolepis nuttalliana* (R. & S.) Green). Species present at the Torrington location (irrigated) were rough pigweed, lambsquarters (*Chemopodium album* L.), black nightshade (*Solanum nigrum* L.), buffalobur (*Solanum rostratum* Dunal), purslane (*Portulaca oleracea* L.) and green foxtail (*Setaria viridis* (L.) Beauv.). Major weed species at the Laramie location (irrigated) were rough pigweed, lambsquarters, shepard's purse (*Capsella bursa-pastoris* (L.) Medic.), tansy mustard and volunteer barley (*Hordeum vulgare* L.).

Visual estimates of weed control, alfalfa stand, and the phytotoxicity to alfalfa were made during the growing season.

Results (following table) show that no herbicide gave satisfactory control of both broadleafed and grass weeds at all locations. However, EPTC gave excellent control of all species present at the Torrington location. Bromoxynil (3,5-dibromo-4-hydroxybenzonitrile) at 4 oz and 6 oz/A, ACP 66-130 (bromoxynil formulation) at 4 oz and 6 oz/A, ACP 65-180 (bromoxynil + 2,4-DB) at 4 oz/A and ACP 66-71B (Oxynil formulation) at 6 oz/A gave excellent control of broadleafed weeds at Torrington and Laramie locations. Benefin (N-butyl-N-ethyl-a,a,a-trifluiro-2,6-dinitro-p-toluidine) and trifluralin (a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine), Planavin (4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline), and EPTC showed considerable activity on the grass species at Torrington and Laramie. No treatment gave outstanding control of broadleafed weeds at the Sheridan location. (Wyoming Agricultural Experiment Station, Laramie, SR-82.)

Evaluation of herbicides used for weed control in establishing alfalfa.

Treatment	Rate	Broadleaved Weeds			Grass Weeds	
		Sheridan	Torrington	Laramie	Torrington	Laramie
EPTC*	3 lb/A	poor	good	fair	fair	poor
EPTC*	5 lb/A	poor	excellent	good	excellent	good
bromoxynil**	4 oz/A		excellent	excellent	poor	poor
bromoxynil**	6 oz/A		excellent	excellent	poor	poor
ACP 66-130**	4 oz/A		excellent	good	poor	poor
ACP 66-130**	6 oz/A		excellent	excellent	poor	poor
benefin*	¼ lb/A	poor	fair	poor	excellent	excellent
benefin*	½ lb/A	fair	fair	poor	excellent	excellent
trifluralin*	1 pt/A	fair	poor	poor	excellent	good
trifluralin*	2 pt/A	good	good	good	excellent	excellent

(Continued on Page 61)

Treatment	Rate	Broadleaved Weeds Sheridan	Broadleaved Weeds Torrington	Broadleaved Weeds Laramie	Grass Weeds Torrington	Grass Weeds Laramie
Planavin*	1 lb/A	fair	fair	fair	good	good
Planavin*	3 lb/A	good	good	good	excellent	excellent
ACP 65-180**	4 oz/A		excellent	excellent	none	poor
ACP 65-180**	6 oz/A		excellent	excellent	none	poor
ACP 66-71B**	6 oz/A		excellent	excellent	none	poor
2,4-DB**	2 lb/A	poor				
2,4-DB**	4 lb/A	fair				
2,4-DB (Ester)	¼ lb/A	good				
2,4-DB (Ester)	½ lb/A	good				

* Mechanically incorporated into the soil.

** Applied as a postemergence treatment when weeds were in the 2 to 4 leaf stage of growth.

Weed control in established alfalfa in Wyoming. Lee, G. A., H. P. Alley and A. F. Gale. The purpose of the study was to determine the potential of several herbicides as effective treatments for weed control in dormant alfalfa under varied climatic and cultural conditions in Wyoming.

Herbicides were applied before the alfalfa broke dormancy in the spring. Each treatment consisted of square rod plots replicated three times. The herbicides were applied in 40 gpa of water on a broadcast basis. Chemicals which required incorporation were mixed into the top 1 to 1½ in. of the soil with a spring-tine harrow. An area four feet square was clipped in each plot to obtain yields and ratio of alfalfa to weeds. Samples were oven dried at 80^{o} C for 36 hours before weights were determined.

Weed populations at the Torrington location (irrigated) consisted of dandelion (Taraxacum officinale Weber), kochia (Kochia scoparia (L.) Schrad.), tansy mustard (Descurainia pinnata (Walt.) Britt.), green foxtail (Setaria viridis (L.) Beauv.) and downy bromegrass (Bromus tectorum L.). The dryland location at Sheridan was heavily infested with downy bromegrass, tansy mustard, and Russian thistle (Salsola kali L.). There also was a lesser infestation of purple mustard (Chorispora tenella (Willd.) D.C.), goatsbeard (Tragopogon pratensis L.) and prickly lettuce (Lactuca serriola L.).

Data from the Torrington location (following table) showed that 16 of the 34 treatments reduced the weed infestation to less than two percent weeds, by weight, in the alfalfa hay. Bromacil at 1 lb/A and terbacil at 2 lb/A gave excellent control, reducing the weed infestation to .71 percent and .66 percent weeds, respectively. Terbacil at both rates was the only chemical which controlled dandelion. Alfalfa from the dalapon and atrazine plots showed slight phytotoxic symptoms at the first cutting but exhibited no symptoms at the time of the second cutting. Tenoran at 1 lb/A and diphenamid at 1 lb/A treatments reduced the alfalfa yields below 1 ton per acre.

Because of the obvious lack of control by several treatments at the Sheridan location, only the plots which visually exhibited herbicidal activity were harvested. Six treatments reduced the weed infestations to less than two percent weeds by weight in the alfalfa hay as compared to 49.7 percent weeds for the untreated check. Alfalfa hay harvested from plots treated with atrazine at 1 lb/A and 2 lb/A, terbacil at 2 lb/A contained only .78 percent, .74 percent and .74 percent, respectively. Terbacil at 4 lb/A and bromacil at 1 lb/A gave complete control of all weeds in the plots.

A comparison of data from both locations shows that terbacil at 2 lb/A and 4 lb/A and bromacil at 1 lb/A gave consistently excellent weed control. Trifluralin and GS-14260 (2-<u>tert</u>. butylamino-4-ethylamino-6-methylthio-S-triazine) at both rates gave satisfactory control under irrigated conditions but failed to give control under dryland conditions. (Wyoming Agricultural Experiment Station, Laramie, SR-80.)

Effect of herbicides on yields and percent weeds by weight in alfalfa.

		Yield tons/A Alfalfa		Yield tons/A Alfalfa + Weeds		Percent weeds by weight	
Treatment	Rate	Torrington	Sheridan	Torrington	Sheridan	Torrington	Sheridan
EPTC	3 lb/A	1.38	.29	1.44	.33	4.17	14.39
EPTC	5 lb/A	1.24	.25	1.30	.29	4.64	15.57
Cotoran	.75 lb/A	.80		.82		3.64	
Cotoran	1.5 lb/A	.83		.88		5.15	
dalapon	6 lb/A	1.38		1.40		1.78	
dalapon	8 lb/A	1.20		1.30		7.33	
diphenamid	1 lb/A	.88	.21	.94	.36	6.35	41.76
diphenamid	3 lb/A	1.22	.28	1.30	.35	6.90	21.59
GS-14260	1 lb/A	1.68		1.70		1.18	
GS-14260	2 lb/A	1.78		1.80		1.39	
benefin	2 pt/A	1.68	.31	1.72	.42	1.75	25.00
benefin	4 pt/A	1.77	.25	1.80	.45	1.40	44.64
GS-36393	1 lb/A	1.60		1.62		1.24	
GS-36393	3 lb/A	1.52		1.56		2.25	
atrazine	1 lb/A	1.52	.30	1.54	.31	1.63	.78
atrazine	2 lb/A	1.34	.32	1.36	.32	2.20	.74
simazine	1 lb/A	1.50	.28	1.54	.28	2.27	2.54
simazine	3 lb/A	1.49	.33	1.54	.33	2.93	1.44
terbacil	2 lb/A	1.51	.32	1.52	.32	.66	.74
terbacil	4 lb/A	1.26	.28	1.28	.28	1.56	0
dichlobenil	2 lb/A	1.44	.31	1.54	.34	6.80	7.14
dichlobenil	4 lb/A	1.43	.29	1.52	.35	5.62	18.18
Planavin	1 lb/A	1.74	.30	1.76	.49	1.14	37.70
Planavin	3 lb/A	1.77	.28	1.80	.37	1.40	16.67
trifluralin	1 pt/A	1.56		1.59		1.57	
trifluralin	2 pt/A	1.38		1.39		1.08	
GS-17891	2 lb/A	1.29		1.38		6.53	
GS-17891	4 lb/A	1.26		1.30		3.46	
diuron	2 lb/A	1.60	.33	1.64	.39	2.14	14.91
diuron	4 lb/A	1.48	.23	1.50	.24	1.34	3.00
bromacil	½ lb/A	1.37	.34	1.38	.35	1.08	2.08
bromacil	1 lb/A	1.42	.33	1.42	.33	.71	0
Tenoran	1 lb/A	.99		1.04		5.26	
Tenoran	3 lb/A	1.54		1.59		2.83	
Check		1.70	.21	1.84	.42	7.42	49.72

Grass control trials in established alfalfa. Rydrych, Donald J. Perennial ryegrass (Lolium perenne) and mouse barley (Hordium murinum) are often jointly responsible for severe yield losses in established alfalfa in eastern Oregon. Trials were located on fields which were heavily infested with both perennial ryegrass and mouse barley. Herbicides were applied postemergence on the grassy weeds when the alfalfa was semi-dormant. Flood irrigation was used throughout the growing season.

Compounds which were most effective included RP 11561 (3-6 lb/A) at 100% grass control, R 11913 (4 lb/A) at 60% control, DP 327 (1.6 lb/A) at 70% control. All materials were compared with terbacil at (.8-1.6 lb/A) at 90-100% grass control.

Alfalfa forage yields from the treated areas averaged at least 1.5 tons/A from the first cutting. The non-treated control produced only .89 tons/A of clean alfalfa. Additional testing is needed to determine residual characteristics following alfalfa plow-out. (Oregon Agricultural Experiment Station, Pendleton.)

Evaluation of bromoxynil and chloroxynil for the control of mallow (Malva rotundifolia) in seedling alfalfa. Dunster, K. W. Postemergence treatments were established in a pure stand of seedling alfalfa growing under dryland conditions near Newton, Utah. A solid infestation of Malva rotundifolia was present in the trial area. Octanoic acid ester formulations of bromoxynil, chloroxynil and Amchem 66-130 (a special oil formulation of bromoxynil) were compared for alfalfa tolerance and herbicidal effect. Alfalfa was in the 2- to 3-trifoliate leaf stage and mallow was 1½ to 2 in. tall at time of treatment.

The commercial bromoxynil formulation and Amchem 66-130 provided equivalent weed control and alfalfa tolerance. Mallow control was promising at selective rates. Alfalfa leaf burn was observed at rates above 3/8 lb/A with both bromoxynil formulations. Injury symptoms disappeared within 3 weeks of treatment.

Chloroxynil produced less alfalfa injury and weed control than the bromoxynil formulations at equivalent rates.

The ester of 2,4-DB failed to provide satisfactory weed control at ½ lb/A. Combinations of 2,4-DB with bromoxynil failed to demonstrate a weed control advantage. Bromoxynil ester applied at 3/8 lb/A one week later at the same location did not control weeds satisfactorily. This demonstrates the importance of treatment when weeds are small. (Amchem Products, Inc., Fremont, California.)

Mallow control in seedling alfalfa.

Herbicide	Rate (lb/A)	Mallow	Visual rating* Alfalfa Stand	Vigor
bromoxynil	1/8	5.2	0	0.7
bromoxynil	1/4	8.0	2.0	2.7
bromoxynil	3/8	8.7	2.3	3.3

(Continued on Page 64)

Herbicide	Rate (lb/A)	Mallow	Visual rating* Alfalfa Stand	Vigor
bromoxynil	1/2	9.5	3.3	3.7
bromoxynil	3/4	9.7	5.0	4.3
Chloroxynil	1/4	3.8	0	0
Chloroxynil	3/8	5.3	1.0	0.7
Chloroxynil	3/4	7.8	1.3	1.3
Amchem 66-130	1/4	8.2	2.3	2.0
Amchem 66-130	3/8	9.0	3.0	2.7
Amchem 66-130	3/4	9.7	5.3	5.3
2,4-DB ester	1/2	2.9	0	0
bromoxynil + 2,4-DB	1/8 + 1/4	4.3	1.0	2.0
bromoxynil + 2,4-DB	1/4 + 1/4	6.3	2.7	3.0

* Average of 3 replications -- 0 = no effect
10 = complete kill or stand reduction

Preemergence weed control in pinto beans. May, J. W., H. M. Hepworth and J. L. Fults. Evaluation was made of 21 preemergence herbicide treatments in Idaho #111 field beans. A randomized complete block experiment employing 5.5 x 50 ft plots replicated three times was used in the tests located at the Botany Research Farm, C.S.U., Ft. Collins, Colorado. Chemicals were applied broadcast in 40 gpa of water postplanting, preemergence on June 22, 1967, and were evaluated on July 20.

A mixture of weed seed which included setaria, pigweed, lambsquarter, kochia, purslane and wild buckwheat was broadcast on the area and raked in following bean planting. Light rain between planting and the time of chemical application left the field in a condition of high soil moisture. Herbicides requiring incorporation were only lightly mixed into the upper 1½ surface inches so as not to disturb the germinating bean seed.

Data on percent weed control and toxicity to beans is summarized in the following table. No yield data were taken as this was a primary field screening test.

Under the conditions of this experiment, the best weed control with the least crop damage came with SD-15179 at 1½ lb/A, no incorporation and amiben at 3 lb/A with incorporation. The relatively poor performance of some of the herbicides in this experiment may be largely attributed to the high soil moisture at the time of application and shallow incorporation. (Botany & Plant Pathology Section, Colo. Agri. Expt. Sta., Colorado State University, Fort Collins.)

Postplant, preemergence herbicide trial in field beans, 1967 season, Ft. Collins, Colorado.

		Weed control in % weed reduction			
Chemical	Rate/A	Grass weeds	Brd. lf. weeds	All weeds	Toxicity Comments
SD-15179	1½ lb, no incorp.	100%	100%	100%	no crop damage
LR-12	5 lb, incorp.	100%	100%	100%	some bean reduc.
amiben	3 lb, incorp.	100%	98%	99%	no crop damage
OCS-21799	1½ lb, no incorp.	97%	98%	98%	serious bean reduction
VCS-438	2½ lb, no incorp.	89%	100%	94%	moderate bean damage
Sindone-B + amiben	1 lb, incorp. 2 lb	96%	88%	93%	no crop damage
Planavin WP	1½ lb, incorp.	100%	77%	90%	slight bean stand reduction
Sirmate	6 lb, no incorp.	88%	94%	90%	chlorosis in bean seedlings
trifluralin	3/4 lb, incorp.	97%	79%	90%	no crop damage
Planavin liq.	1½ lb, incorp.	86%	79%	89%	some bean stand reduction
trifluralin + EPTC	1½ lb, incorp. 2 lb	85%	79%	88%	no crop damage
Planavin liq.	1 lb, incorp.	93%	81%	85%	no crop damage
SD-15179	1 lb, no incorp.	85%	90%	87%	no crop damage
Planavin WP	1 lb, incorp.	97%	67%	85%	no crop damage
EPTC + Thimet	5 lb, incorp. 1 lb	86%	65%	78%	slt. primary leaf burn
Sindone-B	2 lb, incorp.	91%	50%	74%	slight stand reduction
EPTC + Disyston	5 lb, incorp. 1 lb	80%	48%	67%	slt. marginal burn on prm. lvs.
EPTC	3 lb, incorp.	72%	58%	66%	no crop injury
EPTC + Disyston	3 lb, incorp. 1 lb	72%	56%	65%	no crop injury
EPTC + Thimet	3 lb, incorp. 1 lb	81%	21%	56%	no crop injury
VCS-478	1 lb, no incorp.	0%	35%	12%	some reduction of bean stand

<u>Preplanting applications of herbicides in sugar beets.</u> Hamilton, K. C. and H. F. Arle. Evaluation of preplanting applications of herbicides for control of winter annual weeds in sugar beets was continued at Mesa, Arizona, in 1967. Soil of the test area contained 40% sand, 40% silt, 20% clay and 1% organic matter. Barley and mustard were seeded as weeds. IPC, pyrazon, and <u>S</u>-ethyl ethylcyclohexylthiocarbamate (R-2063) were applied to the soil alone or in combination and disked 4 in. deep on September 30, 1966. Two rows of Spreckels 301-H sugar beets were planted in dry soil on vegetable beds and germinated by a postplanting irrigation. Plots were 4 beds, 32 ft

long and treatments were replicated 4 times. The control of barley and mustard on top of the beds was estimated before thinning. Sugar beets were thinned and the area cultivated once. Sugar beets were harvested in July. Rates of herbicide application, effect on weeds and sugar beets, and yields of sugar beets are summarized in the table.

All herbicides caused some injury of sugar beets. Treatments containing pyrazon caused stunting and stand reduction ranging from 30 to 50. Weeds were controlled best with treatments containing pyrazon. Yield of beets from treatments including pyrazon was higher than yields from other treatments despite the injury to seedling sugar beets. Herbicide treatments did not affect sugar content of sugar beets.

At Mesa, pyrazon was also applied as a preemergence treatment and early as a postemergence treatment alone or combined with preplanting applications of IPC or R-2063. Preemergence applications of pyrazon injured sugar beets and were less effective in controlling weeds than preplanting treatments. Postemergence applications of pyrazon did not injure sugar beets but control of weeds initially was poor.

Similar treatments were made at Yuma, Arizona on a heavier soil containing 4% sand, 54% silt, 42% clay, and 1.5% organic matter. Rates of herbicides were 1 to 2 lb/A higher than at Mesa. No herbicide treatment injured sugar beets. Treatments which controlled weeds satisfactorily contained 3 lb/A of IPC applied preplanting and 6.4 lb/A pyrazon applied preplanting, preemergence, or postemergence. (Cooperative investigations of Crops Research Division, Agricultural Research Service, U. S. Dept. of Agriculture, Phoenix, and Arizona Agric. Expt. Sta., University of Arizona, Tucson.)

Effect of preplanting applications of herbicides on weeds and sugar beets at thinning and sugar beet yields at harvest.

Treatment				Percent control estimated October 19		Sugar beet injury[1] October 19	Yield* of sugar beets lb/A
Herbicide	lb/A	Herbicide	lb/A	Mustard	Barley		
IPC	3			35	92	12	13,600b
R-2063	2			75	86	10	20,400b
pyrazon	6.4			97	95	50	51,500a
pyrazon	4.8 +	R-2063	1	98	97	42	48,800a
IPC	2 +	R-2063	1	50	91	12	23,100b
IPC	2 +	pyrazon	3.6	97	95	42	46,100a
IPC	2 +	pyrazon	4.8	96	97	32	56,610a
Cultivated check				0	0	0	11,200b

[1] 0 = No injury; 100 = All plants dead.
* Values followed by the same letter are not significantly different.

<u>Chemical control of weeds in sugar beets.</u> Stewart, Vern R. Nine herbicides alone and in combination were used to determine what herbicides will effectively control weeds in sugar beets and to measure the effect on the sugar beet plant. Weed species occurring naturally in the plots were;

pigweed (Amaranthus retroflexus L.), lambsquarter (Chenopodium album L.), and black nightshade (Solanum nigrum L.). Plots were 10 ft x 60 ft, replicated 3 times. All herbicides were applied in 44.5 gpa volume, preplant. Incorporation was done with a tandem disk. Weed and sugar beet counts were made when the beets were in the 4-6 leaf stage. Eight counts were made in each plot, using a quadrant 3 in. x 48 in. Results are recorded on this basis, and as percent weed control.

TD 283 alone and in combination gave the most effective weed control of all species. Above 2 lb/A of TD 283, some injury to beets occurred. However, as the season progressed the affected beet plants seemed to recover. Ro-Neet at 3 lb/A plus TD 283 at 2 lb/A gave excellent control and caused very slight injury to the sugar beet plant. Ramrod was the least effective on black nightshade of any of the herbicides used. (Northwestern Montana Branch Station, Agriculture Experiment Station, Montana State University, Kalispell, Montana.)

Summary of weed control data from sugar beet study conducted on the Homer Bailey farm, Corvallis, Montana, 1967.

Treatment	Rate lb/A	Plant Counts Sugar beets	Pig-weed	Lambs-quarter	Night-shade	Other	% control of all weeds	Beet injury 0-10
Check	0	8.5	4.1	1.4	17.4	.88	0	0
Ramrod	3	9.5	1.8	.04	11.1	.17	45.1	1.33
Ro-Neet + diallate	2.5 + .75	8.9	1.8	.20	5.9	.33	65.3	2.00
Amchem 66-28	5	9.6	1.9	.33	5.3	0	68.4	0
pebulate	4	9.9	1.3	.13	5.0	.08	72.5	1.00
pebulate	3	10.2	1.8	.42	3.8	.17	74.2	.67
pebulate + diallate	3.25 + 1.75	9.7	1.0	.20	3.5	1.1	75.4	1.67
pyrazon + Ramrod	3 + 2	9.8	1.6	.08	3.8	.04	76.7	1.00
pyrazon + TCA	4 + 5	8.8	1.7	.13	3.1	0	79.1	4.00
pyrazon	4	8.9	1.3	.20	3.1	0	80.5	1.00
No-Neet	3	9.9	1.4	.25	2.7	.17	80.9	.33
pyrazon + Sindone	4 + 1.5	8.7	.79	.04	3.3	.04	82.6	2.00
pyrazon + Ro-neet	3 + 2	9.3	1.0	.17	2.0	0	86.3	1.00
Ro-neet + diallate	2.5 + .75	10.0	.50	.17	2.3	.17	87.4	2.33
pyrazon+TCA	3.75 + 1.25	8.5	1.0	.08	1.3	0	88.9	2.00
Ro-Neet + Ramrod	3 + 3	8.7	.42	0	2.3	.08	89.8	2.67
Ro-Neet	4	9.9	.63	.29	1.5	.08	89.8	1.67
pyrazon + Ramrod	3 + 3	7.8	.38	.04	1.9	0	90.5	2.33
Ro-Neet + diallate	3.25 + 1.75	9.2	.58	.04	1.1	.13	92.3	2.00
pyrazon + Na-endothall	3 + 2	8.1	.92	.17	.33	.04	93.9	2.00

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Treatment	Rate lb/A	Plant Counts Sugar beets	Pig-weed	Lambs-quarter	Night-shade	Other	% control of all weeds	Beet injury 0-10
pyrazon + TD 283	4 + 3	8.7	.63	.29	.42	0	94.4	3.33
TD 283	2	9.5	.54	.04	.67	0	94.7	3.67
pyrazon + TD 283	3 + 2	8.8	.29	0	.50	0	96.7	3.67
Ro-Neet + TD 283	3 + 2	9.3	.29	.25	.21	0	96.8	1.67
TD 283	3	9.1	.38	.20	0	0	97.5	3.67

[1] 0-10 = 0 - no injury; 10 - plants dead.

Weed control in sugar beets. Olson, Phillip. Trials were established in the fall of 1966 and summer and spring of 1967 at Corvallis, Salem, and Hermiston, Oregon. Treatments consisted mainly of herbicide combinations and new chemicals in fall and spring-planted sugar beets using a monogerm variety. Soil types were as follows: Corvallis, clay loam; Salem and Hermiston, sandy loam. Sprinkler irrigation was used in all cases. Germination of sugar beets at Hermiston was not adequate to make injury readings. Yields were not taken at any of the locations. Primary weed species in the fall trials were wild mustard (Brassica campestris), dogfennel (Anthemis cotula), annual ryegrass (Lolium multiflorum), and annual bluegrass (Poa annua). Primary weeds in the summer trials were barnyardgrass (Echinochloa crusgalli), redroot pigweed (Amaranthus retroflexus), and nightshade (Solanium sp.). Principle results of visual evaluations are summarized in the following tables.

Combinations of Ro-Neet with R-11913, pyrazon or ACP 65-223 were most outstanding in controlling all weeds present. In most cases beet injury did not occur. R 11913 alone gave excellent weed control at Salem in 1966, but failed to duplicate this activity in the Corvallis and 1967 Salem trial. CP 52223 showed good activity on grasses. BAS 2572 showed promise in both sugar beet selectivity and weed control.

Here again the Ro-Neet combinations were most active in controlling weeds. It should be pointed out that some injury occurred in the Ro-Neet, R 11913, and R 11914 combinations. Ro-Neet plus pyrazon was the most outstanding treatment in both weed control and selectivity. Other treatments that showed promise were pyrazon plus Sindone and CP 52223 applied preemergence.

The most outstanding treatments at Hermiston were Ro-Neet at 4 lb/A + pyrazon at 4 lb/A, ACP 66-28B at 4 and 8 lb/A, CP 52223 at 2 and 3 lb/A, Ramrod at 3 lb/A + pyrazon at 3 lb/A, and BAS 2572 at 5 and 6 lb/A. (Farm Crops Department, Oregon State University, Corvallis.)

Table 1. Fall sugar beets.

Treatment	Rate lb/A ai	Sugar beets % injury	Wild mustard % control	Dogfennel % control	Annual ryegrass % control	Annual bluegrass % control
Salem - 1966						
PREPLANT INC. - (tilled 4 in.)						
EPTC	3	11	30	6	100	91
Ro-Neet	4	0	100	55	96	100
pyrazon	4	3	100	97	99	91
Ro-Neet + pyrazon	4+4	0	100	93	100	100
PREPLANT INC. + EARLY POSTEMERGENCE						
Ro-Neet + R11913	4+3	0	100	100	100	100
Ro-Neet + R11913	4+6	0	100	100	100	100
EARLY POSTEMERGENCE						
IPC + Endothal	4+2	0	10	99	50	70
R11913	3	0	100	100	75	100
Corvallis - 1966						
EARLY POSTEMERGENCE						
R11913	2	0	0	0	0	30
R11913	4	0	10	60	0	90
R11913	8	30	99	100	20	99
Salem - 1967						
PREPLANT INC. - (tilled 4 in.)						
Ro-Neet	4	0	52	20	100	100
PREPLANT INC. + EARLY POSTEMERGENCE						
Ro-Neet + R11913	3+3	0	85	100	100	100
Ro-Neet + ACP 65-223	3+12 product	10	95	100	100	100
PREPLANT INC. + EARLY PREEMERGENCE						
Ro-Neet + pyrazon	3+4	2	95	95	100	100
PREEMERGENCE						
pyrazon	4	0	70	100	40	75
CP 52223	2	5	62	95	95	97
CP 52223	3	40	56	100	100	100
BAS 2572	4	0	95	95	80	62
PREEMERGENCE + EARLY POSTEMERGENCE						
pyrazon + R11913	3+3	5	97	100	95	87
EARLY POSTEMERGENCE						
R11913	3	0	7	0	0	0
ACP 65-223	12 product	2	10	47	15	45

Scale - 0-100%   0 = no effect
100 = complete kill

Table 2. Spring sugar beets.

Treatment	Rate lb/A ai	Sugar beet % injury	Pigweed % control	Nightshade % control	Barnyardgrass % control
Salem - 1967					
PREPLANT INC. - (tilled 4 in.)					
EPTC	3	0	62	50	93
Ro-Neet	4	0	78	88	75
ACP 28-B	4	3	45	90	60
Ro-Neet + pyrazon	4+4	0	85	95	95
pyrazon + R11914	3+2	6	58	90	66
pyrazon + Sindone	4+1½	0	77	90	75
PREPLANT INC. + EARLY POSTEMERGENCE					
pyrazon + R11913	2+3	6	93	100	63
Ro-Neet + R11913	4+3	3	97	-	95
CP 52223	1	0	68	40	13
CP 52223	2	0	82	43	55
CP 52223	3	0	80	40	56
BAS 2572	6	0	13	30	20
Bayer 60618	2	0	6	0	23
Bayer 60618	4	0	6	0	23
EARLY POSTEMERGENCE					
CP 52223	1	10	45	10	35
R 11913	3	13	97	98	13

Scale - 0-100% 0 = no effect
100 = complete kill

Promising herbicides in corn. Coulston, L. and P. Olson. An early summer screening trial at Corvallis, Oregon in a clay loam soil on Sugar King sweet corn indicated S-6115 and NC-4780 as herbicides with high margins of safety and good weed control. A late summer trial in the same location and same soil with these herbicides was established on July 28, 1967. Preemergence treatments were applied on August 1 and postemergence on September 1, 1967. Major weed species present were barnyardgrass (*Echinochloa crus-galli*), green foxtail (*Setaria viridis*), pigweed (*Amaranthus retroflexus*), and wild mustard (*Brassica kaber*).

S-6115, NC-4780, and atrazine gave comparable broadleaf control preemergence. S-6115 was more effective on pigweed postemergence. S-6115 was more effective on grass species than the other herbicides. S-6115 gave comparable control as the atrazine + propachlor combinations. Postemergence S-6115 was better than atrazine + X-77. NC 4780 + X-77 gave considerable injury. Propachlor in combination with NC 4780 increased control on grass species.

An irrigation study with preemergence and postemergence applications of NC 4780 and NC 6627 was established on July 28, 1967 with treatments applied on August 1 and August 26, 1967. The location and soil type were the same as the foregoing trials. The trial was set up in two blocks, minimum and maximum irrigation. The objective was to study the loss of herbicide effectiveness under high moisture conditions. From July 29 to September 2, a total of 4.75 and 9.25 inches sprinkler irrigation was applied in the minimum and maximum blocks respectively.

Visual evaluations on September 15, 1967 indicated no apparent difference in weed control between blocks. (Farm Crops Department, Oregon State University, Corvallis.)

Percent corn injury and weed control by visual estimate.

Treatment	Rate lb/A ai	Injury %	Wild mustard	Barnyard-grass	Pigweed	Foxtail
PREEMERGENCE						
S-6115	2	0	99	94	100	95
S-6115	3	0	100	98	100	99
atrazine	2	0	100	77	100	10
atrazine	3	0	100	85	100	60
NC-4780	2	0	100	20	100	95
NC-4780	3	0	100	37	100	87
S-6115 + propachlor	1½ + 3	0	100	85	100	96
S-6115 + propachlor	2 + 3	0	100	87	100	99
atrazine + propachlor	1½ + 3	0	100	94	100	97
atrazine + propachlor	2 + 3	0	100	99	100	100
NC-4780 + propachlor	1½ + 3	0	100	99	100	95
NC-4780 + propachlor	2 + 3	0	100	99	100	96
POSTEMERGENCE						
S-6115	2	0	100	90	100	87
S-6115	3	0	100	100	100	99
S-6115	8	7	100	100	100	100
atrazine	2	0	99	5	87	20
atrazine	3	0	100	35	99	0
NC-4780	2	10	100	37	62	92
NC-4780	3	15	100	37	65	94
S-6115 + propachlor (pre)	½ + 3	0	100	99	100	100
S-6115 + propachlor (pre)	1 + 3	0	100	100	100	100
S-6115 + X-77	2 + 1%	0	100	65	100	75
NC-4780 + X-77	2 + 1%	50	100	50	75	87
atrazine + X-77	2 + 1%	0	100	45	99	5
S-6115 + oil	2 + 2 gal/A	0	100	85	100	90
NC 4780 + oil	2 + 2 gal/A	25	100	85	100	95

Annual applications of herbicides in irrigated cotton. Arle, H. F. and K. C. Hamilton. Four herbicide programs were continued for 3 years on the same plots at the Cotton Research Center, Phoenix, Arizona to determine their affects on cotton and annual weeds. The herbicide programs were: (a) 1 lb/A of trifluralin applied to the flat soil surface before furrowing for the preplanting irrigation; (b) 2 lb/A of diuron applied at layby as a directed spray covering the entire furrow and base of cotton plants; (c) 3/4 lb/A of trifluralin as in (a) and 1¼ lb/A of diuron as in (b); and (d) 1¼ lb/A of diuron applied after the preplanting irrigation prior to the final seedbed preparation and 3/4 lb/A of trifluralin applied at layby. Herbicides applied at layby were incorporated by a sectioned, rolling cultivator. Treatments were replicated 8 times on plots 4 rows wide and 43 ft long. Each year the cotton received 2 to 3 cultivations. Deltapine Smooth Leaf cotton was planted in moist soil under a dry mulch in 1965 and 1966. In 1967 Hopicala cotton was planted.

The surface soil contained 32% sand, 42% silt, 26% clay and 1% organic matter. Weeds present included Panicum fasciculatum Swartz, Echinochloa colonum (L.) Link, E. crusgalli (L.) Beauv., Leptochloa filiformis (Lam.) Beauv., Physalis wrightii Gray, and Amaranthus palmeri S. Wats. Prior to harvest, weed control was estimated and boll samples obtained for analyses of fiber properties and boll components. Control of broad-leaved and grassy weeds and cotton yields during the test are summarized in the table.

Preplanting applications of trifluralin caused temporary stunting of cotton each year and reduced stands in 1966. Other treatments did not affect cotton development. During the first year, diuron controlled broad-leaved weeds well and trifluralin controlled grasses fairly well. The best control was obtained with the combination of diuron preplanting and trifluralin at layby. During the second year, all programs except the preplanting trifluralin controlled weeds. During the last year all programs gave excellent weed control, but control of Physalis wrightii was only 95% with trifluralin. The weeds which survived a given program offered less, rather than more, competition in the following years.

Cotton yields, fiber properties, and boll components were not affected by any of the herbicide programs. Herbicide persistence or accumulation were not evident from observations of weed and cotton growth. (Cooperative investigations of Crops Research Division, Agricultural Research Service, U. S. Dept. of Agriculture, Phoenix, and Arizona Agric. Expt. Sta., University of Arizona, Tucson.)

Weed control and cotton yield during 3 years of four herbicide programs.

Treatment		Weed control percent estimated at harvest						Yield of seed cotton in lb/A		
		Broadleaved			Grasses					
Preplant	Layby	1965	1966	1967	1965	1966	1967	1965	1966	1967
trifluralin	---	27	21	95	79	84	100	2620	3030	2320
---	diuron	100	100	100	46	99	99	2390	3090	2370
trifluralin	diuron	96	100	100	64	97	100	2460	3090	2230
diuron	trifluralin	85	100	100	89	99	100	2650	3150	2350

Effect of nitralin and trifluralin on cotton yields. Anderson, W. P. and J. W. Whitworth. Greenhouse experiments have shown that nitralin (formerly identified as SD-11831) will prevent the growth of the primary root of cotton seedlings growing through treated soil when it is freshly incorporated. If planting was delayed one week or more after nitralin was incorporated into moist soil, the primary root grew through the treated soil with no apparent inhibition of its elongation. However, as with the closely related herbicide trifluralin, lateral root development was prevented along the primary root in the zone of treated soil, but not above or below it. This paper presents the results of a field experiment conducted in 1967 to compare the effect of nitralin and trifluralin on cotton yields when each was soil-incorporated either 10 days prior to seeding or just before seeding.

On April 21, nitralin and trifluralin were each applied to 3 row plots, 9.5 x 35.0 ft in size, at dosages of 0.5, 0.75, and 1.0 lb/A, and soil-incorporated about 3 in. deep with a power-driven rototiller. On May 1st, these herbicides were similarly applied and incorporated into adjacent plots. Raised seedbeds were formed and cotton was seeded in all plots on May 1st. All treatments were replicated 10 times, and untreated plots served as controls. Prior to applying the herbicides, the soil was dry and full of clods about the size of large baseballs due to a complete lack of winter moisture following fall plowing. An unsuccessful effort was made to break down these clods by repeated discing and then by rototilling; finally, the field was flood irrigated and allowed to partially dry prior to the herbicide applications on April 21. After planting the cotton on May 1st, the plots were watered by furrow irrigation. The severe crusting that followed was broken with a rotary hoe. The cotton emerged under very adverse conditions but stands were good. Certified cotton seed, var. Acala 1517V, treated with Ceresan and Demosan was planted.

During the growing season, the plots were watered as needed by furrow irrigation and occasionally hoed to control annual morning glory and the growth of johnsongrass and purple nutsedge. The cotton was harvested on November 10, 1967, by hand picking, and the yields are shown in the table and are the average of 10 replications.

The results of this experiment were completely contrary to expectations. Nitralin reduced cotton yields when applied and soil-incorporated 10 days prior to seeding than when applied and incorporated just before seeding. Trifluralin treatments showed yield reductions when applied just prior to seeding, but there was no reduction when these treatments were applied 10 days prior to seeding. Other than with the 1 lb/A dosage of Nitralin applied on April 21, none of the differences in yield were statistically significant from the untreated controls, at the 5% level.

When reviewing these results, it must be borne in mind that the moisture and seedbed conditions were not "normal," and that the cotton was planted late due to efforts to improve the condition of the seedbed. However, these conditions were common on most farms in this area at this time. (New Mexico Agri. Expt. Sta., New Mexico State University, University Park, New Mexico 88001.)

Effect of nitralin and trifluralin on cotton yields when applied preplant, soil-incorporated, at two intervals prior to seeding.

Treatment			Yield - lint cotton[b]
Herbicide	lb/A	Applied[a]	(bales/A)
nitralin	0.5	April 21	1.69
	0.75	April 21	1.35[c]
	1.0	April 21	1.31[d]
nitralin	0.5	May 1	1.46
	0.75	May 1	1.46
	1.0	May 1	1.47
trifluralin	0.5	April 21	1.91
	0.75	April 21	2.07
	1.0	April 21	1.83
trifluralin	0.5	May 1	1.78
	0.75	May 1	1.55
	1.0	May 1	1.48
Untreated control		--	1.86
		--	1.85

a Cotton seeded May 1, 1967. University Park, New Mexico.
b Harvested November 10, 1967; average of 10 replications.
c Nearly a significant difference from control at 5% level, Duncan's Multiple Range Test.
d Significantly different from control at 5% level, Duncan's Multiple Range Test.

The cottonweed problem. Whitworth, J. W. and W. P. Anderson. Cottonweed (*Anoda* sp.) was never a serious problem in the cotton fields of New Mexico until selective herbicides replaced the hoe. Starting with the heavy use of the substituted urea herbicides (monuron and diuron) in 1956, the population density of this thinly present weed began to increase. In more recent years, the extensive use of the toluidine type herbicides has selectively killed other weed species and permitted the buildup of the resistant cottonweed to the point where it has taken over many fields.

In the early 1960's, dichlobenil proved effective as a preemergence herbicide against cottonweed, but it was too hazardous to use on cotton. A heavy, natural infestation of cottonweed in our 1964 screening trials was successfully controlled by prometryne at 2 lb/A and 1,1-dimethyl-3-(a,a,a-trifluoro-m-tolyl)urea (C-2059) or chloroxuron at 3 lb/A. Adjacent plots treated with 1 lb/A of trifluralin, 2 lb/A of diuron, 8 lb/A of bensulide or DCPA showed dense stands of cottonweed. All treatments were sprayed onto the surface of flat plots and watered in by flood irrigations.

Longevity studies in 1960-63 indicated that cottonweed possessed enough dormancy to cause it to persist in the soil for at least three years even when the seed was buried at shallow depths and kept moist by repeated irrigations. This same type of dormancy was apparently responsible for the failure to emerge of a direct seeding of this species in our 1967 fall screening trials. This and other seed lots collected at this time were taken into the laboratory to develop methods for breaking the dormancy. The results are shown in the following table. (New Mexico Agri. Expt. Sta., Las Cruces, New Mexico.)

Percentage germination of cottonweed (Anoda cristata and reticulata) six days after treating with conc. H_2SO_4.[a]

Minutes in conc. H_2SO_4	Percentage germination		
	A. cristata	A. reticulata	Average
0	1	0	1
10	4	8	6
20	56	32	44
30	92	46	69
60	97	86	92

[a] Germinated at a temperature of 72° F.

Herbicides for control of broadleaf weeds in new legume seeding. Stewart, Vern R. Eight herbicides were used alone and several in combination to find an effective means of controlling broadleaf weeds in sainfoin (*Onobrychis vicaefolia* Scap). The effect of these herbicides on sainfoin was also measured. The predominate weed species were shepherds purse, (*Capsella Bursa-pastoris* L. Medic); fanweed, (*Thaspi arvense* L.); lambsquarter, (*Chenopodium album* L.); and redroot pigweed, (*Amaranthus retroflexus* L.). Plots were 20 ft x 10 ft or 200 square feet. Application dates and rates of herbicide used are found in the table that follows. Postemergence treatments were made when the sainfoin was in approximately the five leaf stage. Forty-four and one-half gpa volume was used for application of all herbicides. Weed counts were made mid-July, with eight counts being made per plot.

ACP 66-130 was the most effective herbicide for weed control, but rates above four ounces were quite injurious to sainfoin plants. The four ounce rate reduced the plant population and the vigor of sainfoin, however the plant recovered by the end of the growing season. Bromoxynil and ACP 66-71B were similar in weed control and effect on sainfoin.

The herbicides applied preplant and preemergence did not give effective weed control. No significant damage to the sainfoin plant was noted. (Northwestern Montana Branch Station, Montana Agricultural Experiment Station, Montana State University, Kalispell, Montana.)

Data from herbicide study on a new seeding of sainfoin. Northwestern Montana Branch Station 1967, Kalispell, Montana.

Treatment	Application time	Rate/A ounces	Plant counts[1] sainfoin	Plant counts[1] weeds	Sainfoin plant vigor 0-10[2]	% weed control
EPTC	preplant[3]	16	2.6	1.96ab[4]	9	0.0
EPTC	preplant	32	4.2	1.25ab	10	25.0
benefin	preplant	12	3.7	2.25ab	10	0.0
benefin	preplant	16	4.3	1.54ab	9	7.5
benefin	preplant	24	4.1	1.88ab	10	0.0
Dacthal	preemerg.	128	3.7	1.29ab	9	22.5
Dacthal	preemerg.	192	4.5	1.42ab	9	15.0
Sindone-B	preplant[3]	24	4.1	2.46a	9	0.0
Sindone-B	preplant	48	4.2	1.83ab	8	0.0
bromoxynil	postemerg.	4	3.8	.58ab	7	65.0
bromoxynil	postemerg.	6	1.5	.54ab	6	67.5
bromoxynil	postemerg.	12	.33	.54ab	2	67.5
ACP 66-71-B[a]	postemerg.	4	3.8	.54ab	9	67.5
ACP 66-71-B	postemerg.	6	3.6	.54ab	7	67.5
ACP 66-71-B	postemerg.	12	2.4	.29ab	5	82.5
ACP 66-130[b]	postemerg.	4	2.8	.13ab	3	92.5
ACP 66-130	postemerg.	6	1.4	.00	2	100.0
ACP 66-130	postemerg.	12	.54	.04ab	1	97.5
bromoxynil + 2,4-DB ester	postemerg.	4 + 4	1.7	.33ab	4	80.0
bromoxynil + 2,4-DB ester	postemerg.	4 + 8	2.2	.54ab	5	67.5
bromoxynil + dalapon	postemerg.	4 + 32	2.6	.29ab	4	82.5
bromoxynil + dalapon	postemerg.	6 + 32	1.4	.17ab	2	90.0
2,4-DB ester	postemerg.	8	4.5	2.04ab	8	0.0
2,4-DB ester	postemerg.	12	2.9	1.58ab	6	60.0
ACP 63-57	postemerg.	16	2.4	.46ab	6	72.5
ACP 63-57 + bromoxynil	postemerg.	8 + 4	1.3	.00	2	100.0
ACP 63-57 + bromoxynil	postemerg.	8 + 6	.75	.04ab	1	97.5
Check			4.2	1.67ab	10	0.0

[1]Plant counts based on 8 counts in a 3 in. x 48 in. quadrant, 3 replications.
[2]0 = plants dead; 10 = vigorous normal plants.
[3]Preplant incorporated with double disk.
[4]Multiple range test (items having common letter are not significant one from another).
[a]ACP 66-71-B (bromoxynil formulation - octanoic acid ester).
[b]ACP 66-130 (3,5-dichloro-4-hydroxybenzonitrile).

Application dates:		
	Preplant incorporate	May 29, 1967
	Preemergence	June 12, 1967
	Postemergence	June 29, 1967

Control of mixed annual and perennial weeds in established ladino clover seed fields with dichlobenil. Ashton, Floyd M., Orris W. Gibson, Theodore S. Torngren, and Roy B. Jeter. Several herbicides are currently in use for controlling mixed annual and perennial weeds in established ladino clover grown for seed in California. Each of these herbicides is especially weak or ineffective on several weed species such as buckhorn plantain (Plantago lanceolata L.) and bristly oxtongue thistle (Picris echioides L.) which reduce clover stands and cause premature removal of fields from seed production. Weed control costs often exceed $60.00 per acre, including hand labor, to remove prickly oxtongue thistle before the field can be certified for seed production.

Dichlobenil was initially determined to be a promising herbicide in established ladino clover in our research in 1964. It has since been tested in fourteen field trials in Glenn and Sacramento Counties, the principal ladino clover seed growing areas in California. Rates of application, time of application and combinations of rates and times were tested under both wet and dry spring conditions to evaluate weed control and safety of each treatment under these conditions. Forage and seed samples were collected for residue analysis and seed samples were tested for germination. Seed yields were compared with those of standard herbicide treatments.

Dichlobenil (4-G granules) was shown to require some rainfall to be effective. When six weeks elapsed without rainfall following application, initial weed control was good but of a shorter duration. Excessive rainfall immediately following granular application moved much of the herbicide laterally on the surface to the lower end of the field. Lateral transport of the herbicide was also observed where the granules were applied to flood irrigated checks after the water had been shut off and the flow had nearly ceased.

The initial herbicidal symptom of dichlobenil was an immediate burn back of the clover plant with the exception of the mature stolons. This period of dieback was very brief, and recovery was almost immediate with only a trace of temporary stunting and chlorosis as secondary symptoms. By midseason the clover had completely recovered and usually surpassed the non-treated checks in vigor. Seed yields were substantially increased by most dichlobenil treatments although other factors (drought, insects, etc.) reduced the amount of viable seed in our harvested trials to near normal yields.

The best times and rates of application were dependent upon the amount and timing of precipitation. November through January treatments have been the most outstanding. Split applications of 1½ lb/A have given more prolonged weed control than a single 2 lb/A rate which was the maximum rate ladino clover could tolerate at one time without sustaining serious injury. The treated areas usually remained weed free until harvest except where the clover stand was sparse. In these instances, dense stands of late emerging barnyardgrass and crabgrass developed. Principal weed species controlled by dichlobenil include annual ryegrass, buckhorn plantain, prickly oxtongue thistle, prickly lettuce, common sow thistle, prickly sow thistle, several mustard species, wild radish, shepherds purse, windmill pink, pineapple weed, common chickweed, mouse ear chickweed, and annual bluegrass. Species showing intermediate susceptibility were common dandelion, smooth cats ear, yellow nutsedge, and curly dock. The most resistant species were filaree and corn cockle.

The broad spectrum control of annual and perennial weed species by dichlobenil is an additional tool for weed control in established ladino clover grown for seed. Problems still exist in the even distribution of the granules and mobility of the herbicide with excessive water. (Department of Botany, Davis, and Agricultural Extension Service, University of California.)

Weed control in mint using certain herbicides. Stewart, Vern R. Three herbicides were used in a study to control weeds in mint (*Mentha piperita*). The predominant weed species in the study were; cheatgrass (*Bromus tectorum*), shepherds purse (*Caspella bursa-pastoris*), Canada thistle (*Cirsium arvense*), and dog fennel (*Anthemis cotula*). Observation of the plots were made throughout the growing season until harvest. Data are recorded as a weed control score 0-10. 0 indicates no control, 10 indicates complete control.

Linuron was not effective on cheatgrass in this study. Diuron provided very limited weed control. Terbacil was relatively effective at all three rates used, however the 3.2 lb/A ai gave 100% control of all weeds present in the study. (Northwestern Montana Branch, Agricultural Experiment Station, Montana State University, Kalispell, Montana.)

Data from herbicide study on mint (*Mentha piperita*) conducted on the Robert Stonebrook farm, Plains, Montana, 1967.

Herbicide	Rate lb/A ai	Replications 1	2	3	$\bar{x}$
		0-10[1]			
terbacil	.8	9	6	8	7.7
terbacil	1.6	9	10	9	9.3
terbacil	3.2	10	10	10	10.0
linuron	1.0	5	0	7	4.0
linuron	2.0	5	7	3	5.0
linuron	4.0	4	3	4	3.7
diuron	2.0	3	5	2	3.3
Check	0	0	0	0	0.0

[1] 0-10 0 = no weed control; 10 = complete control.

Application date: April 21, 1967
Relative humidity: 30%
Wind Velocity: calm
Temperature: 58°F

Peppermint and spearmint weed control. Brown, Dean A. Lack of adequate weed control in mint fields results in reduced yields, poor oil quality, and shorter life of the planting. Research in other mint-producing areas has shown terbacil to be an effective herbicide with high tolerance to peppermint. Field tests were undertaken in the Yakima Valley to substantiate this research as well as to evaluate activity of terbacil and trifluralin on spearmint.

In general, terbacil at rates of 1½ to 2 lb/A was required to obtain consistent annual weed control under conditions of rill irrigation. However, evan at rates as high as 6 lb/A, weed control with terbacil was always poor in the furrow under rill irrigation. Under sprinkler irrigation, adequate control of annual weeds was obtained with terbacil at the rate of 1 lb/A. Trifluralin always gave good annual grass control; however, annual broadleaved control was not satisfactory at any test location.

At all locations, and at rates of application as high as 6 lb/A, terbacil caused no permanent injury to peppermint or spearmint. Similar activity was observed in trifluralin treatments at rates up to 2 lb/A.

Better weed control with terbacil treatments was usually obtained with spring applications, and harrowing following terbacil application enhanced weed control under conditions of no rainfall.

Preliminary observations show that terbacil at the rate of 2 lb/A was still present in the soil one year after application in sufficient quantity to prevent alfalfa and wheat from becoming established. These soil persistence studies are being continued. (Washington State University, Cooperative Extension Service, Yakima.)

<u>Trifluralin as a selective preplant soil incorporated herbicide for green peas, dry peas, and lentils.</u> Chamberlain, H. E. and C. H. Starker. Trifluralin has been established as an effective preplant soil incorporated herbicide on several crops for the control of annual grasses and certain broadleaf weeds. This research was conducted to determine the crop safety and effectiveness of trifluralin as a herbicide for annual weeds commonly found in green peas, dry peas, and lentils grown under dryland conditions in Idaho, Oregon, and Washington.

Trifluralin was originally tested on peas and lentils in 1965. The results were encouraging and additional research was conducted in 1966 with continuing favorable results. An extensive research program was carried out in 1967 to include climatic, soil, and cultural differences encountered in the pea and lentil producing areas of the Pacific Northwest.

Trifluralin was soil incorporated throughout the three year study with equipment commonly used in pea and lentil culture, e.g., modified spring tooth harrows such as the Vibra-Shank or Glenco (modified field cultivators) stirring the soil to a depth of 1½-2 in. This type of soil incorporation was compared to a double disc set to cut to a depth of 4-5 in. and PTO driven rotary tiller set at a 2-3 in. depth. The disc and PTO driven rotary tiller were used to compare the effectiveness of incorporation tools not yet recommended and the crop tolerance of peas and lentils with deep and thorough soil incorporation of trifluralin.

Effective weed control was obtained with trifluralin at rates of 0.5 and 0.75 lb/A when soil incorporated with a tandem disc operated over plots twice in opposite directions, with a Vibra-Shank cultivator operated over plots twice in opposite directions, or with a PTO driven rotary tiller operated over plots in one direction. Weed species present in the studies and effectively controlled included wild oats (Avena fatua), redroot pigweed (Amaranthus retroflexus), and lambsquarters (Chenopodium album). Dry and green peas were slightly more tolerant to trifluralin than lentils. The three crops have sufficient tolerance to trifluralin for commercial usage (table).

This series of experiments conducted over a three year period in Idaho, Oregon, and Washington provides data demonstrating that trifluralin may be safely applied as a preplant soil incorporated herbicide on green peas, dry peas, and lentils grown under dryland conditions. It was further demonstrated that trifluralin adequately controls certain troublesome annual weeds found in these crops. (Eli Lilly and Company and Elanco Products Company, Oregon Research Station, Rt. 2, Box 111 A, Canby, Oregon.)

Summary of weed control, crop tolerance and yield when trifluralin is applied preplant to green peas, dry peas and lentils

		Weed control rating[a]					Crop injury rating[e]			Yield (lb/A)		
		Wild oats		Broadleaf[d]								
Chemical	Rate (lb/A)	B[b]	C	A	B	C	A	B	C	A	B[f]	C[g]
trifluralin 4EC	0.5 PPI[c]	9.2	9.2	9.8	9.7	9.1	0	0	0	3224	1939**	1323**
	0.75 PPI	9.5	9.7	9.9	9.8	9.6	0	0	0	3016	1885**	1258**
	1 PPI	9.7	9.8	10.0	9.8	9.7	0	0.3	0.5	3295	1795**	1102
	1.5 PPI	9.8	9.9	10.0	9.9	9.8	0.8	0.9	1.7	2719	1744**	1227**
	2 PPI	9.8	9.9	10.0	9.9	9.9	2.0	1.9	3.2	2340	1707**	908
triallate	1	8.9	9.2	-	6.8	7.3	-	0.3	0	-	1768**	1089
Control	0	0	0	0	0	0	0	0	0	2900	1504	1004

[a] Weed control rating 0-10: 0 = no control; 10 = 100 percent control.
[b] A = green peas: 2 locations: varieties, Green Grant 430 and Perfection Freezer;
B = dry peas: 3 locations: varieties, First and Best, and Alaskan;
C = Lentils: 2 locations: variety, Chilean
[c] PPI is preplant soil incorporated simultaneously with or immediately after (5-15 min.) herbicide application.
[d] Broadleaf weeds were lambsquarters and redroot pigweed.
[e] Crop injury rating 0-10: 0 = no injury; 1-3 = slight; 4-6 = moderate; 7-9 = severe; 10 = death.
[f] LSD @ 0.5 = 111 lb/A*; LDS @ 0.01 = 148** lb/A.
[g] LSD @ 0.5 = 141 lb/A*; LSD @ 0.01 = 190** lb/A.

Preemergence weed control in green peas. Rydrych, Donald J. Several new compounds were tested on peas in eastern Oregon during the 1967 season. All materials were applied preemergence in April on non-irrigated land. Weed species in the area included Russian thistle (Salsola kali), lambsquarters (Chenopodium album), prostrate knotweed (Polygonum aviculare), and occasional sparse patches of catchweed (Asperugo procumbens).

Linuron (1 lb/A), Ciba 6313 (1 - 1.6 lb/A), and terbacil (.25 lb/A) were effective on all weed species except Russian thistle with fair crop safety.

GS 14260 (2 lb/A) gave 100% control of all weed species and crop safety was moderate. R 11914 (2 - 3 lb/A) gave excellent weed control on all weed species except Russian thistle although thistle control averaged above 50%. R 11914 had excellent crop safety.

The 1967 results show that further testing with GS 14260 and R 11914 are necessary. Further tests are planned in 1968. (Oregon Agricultural Experiment Station, Pendleton.)

Weed control research in potatoes - 1967. Zimdahl, R. L., P. D. Olson, and W. R. Furtick. Experiments were designed to determine the efficacy of several promising herbicides for weed control in potatoes at four locations in Oregon. Two screening trials were established to evaluate new herbicides.

The standard weed control recommendation for potatoes in Oregon is EPTC, incorporated at 4 lb/A. EPTC was widely used on potatoes in 1967 and, as in other years, results have been both good and poor. Linuron is questionable as a selective potato herbicide in Oregon because of the injury danger. CIBA's Patoran (metobromuron) and C-6313 (a-4-bromo-3-chlorophenyl urea) gave good weed control in all trials with no injury at any location. These compounds provided season-long weed control at an optimal rate of 2 lb/A. Three pounds was no more effective at any location. Dacthal at 9 lb/A did not give satisfactory weed control when applied preemergence. Prometryne was expected to cause some injury under these conditions, but it gave no injury and excellent weed control at all locations. Monsanto's CP-31675 incorporated at 1 and 2 lb/A did not give satisfactory weed control and caused injury.

The following compounds showed sufficient promise in the screening trials to be included in future work: Monsanto's CP-52223 and CP-52665: 3M Company's MBR-3957; Chipman's RP-17623 at ½ and 1 lb; and Shell's SD-15179 at 4 lb. (Farm Crops Department, Oregon State University, Corvallis.)

Postemergence applications of herbicides in irrigated safflower. Arle, H. F. and K. C. Hamilton. Summer-annual weeds that germinate after the crop is established are a major problem in safflower in the Southwest. In 1967 we applied herbicides postemergence at Mesa, Arizona, to determine their effects on safflower.

Frio safflower was planted in rows in December. Soil of the area contained 49% sand, 29% silt, 22% clay, and 1% organic matter. In March, when the safflower plants were 22 in. high, herbicides were applied as directed sprays covering the base of the plants and the entire furrow. Diuron, linuron, metobromuron, and prometryne were applied at .75 and 1.5 lb/A and chloroxuron was applied at 1.5 lb/A. Diuron, linuron, and prometryne were also applied broadcast over safflower on the same date. Herbicides were applied in 40 gpa of water containing ½% surfactant. Treatments were replicated 4 times on 4-row plots 32 ft long. Safflower was harvested for seed in July and untreated checks yielded 3,500 lb/A.

Directed applications of herbicides caused a slight chlorosis of lower foliage and epinasty of flower stems. Applications of herbicides to the foliage of safflower caused severe browning of foliage and epinasty of the entire plant, and also delayed maturity. All applications of herbicides to the foliage of safflower reduced yields; however linuron was less injurious than diuron or prometryne. Directed applications of herbicides did not cause significant yield reductions; however yields from the 1.5 lb/A treatments averaged 8% less than those from the .75 lb/A treatments. (Cooperative investigations of Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Phoenix and Arizona Agric. Expt. Sta., University of Arizona, Tucson.)

Soil applications of trifluralin in irrigated sorghum. Hamilton, K. C. and H. F. Arle. Various methods of applying trifluralin to the soil in sorghum were evaluated at Mesa, Arizona to determine: (1) if this herbicide could be used safely for weed control in irrigated sorghum; and (2) the best methods of applying trifluralin for the control of volunteer sorghum in other crops.

The soil of the test area contained 46% sand, 36% silt, 18% clay and 1% organic matter. In April the area was furrowed (sometimes called listing), irrigated, and harrowed to prepare the final seedbed for planting. Georgia 615 sorghum was planted in moist soil and covered by a mulch of dry soil. The area received one cultivation after emergence of the sorghum. Herbicide treatments, replicated 4 times, included 3/4 lb/A of trifluralin applied: (1) broadcast before furrowing; (2 & 3) broadcast or as a 26-in. band in the furrow before harrowing in the final seedbed preparation; (4 & 5) broadcast or as a band in the furrow but not incorporated; (6 & 7) broadcast or as a band in the furrow when sorghum was 8 in. high and incorporated by cultivation. Yield from the plots harvested for grain in August averaged 5,000 lb/A.

Applications of trifluralin to the soil before furrowing reduced sorghum stands 99% and sorghum yields 92%. No other treatment affected sorghum emergence, growth or yield. Fibrous and brace roots were not affected by treatments after furrowing.

The results indicated that trifluralin could be used in sorghum, or sorghum grown in soil treated with this herbicide, if the seed or herbicide are placed to prevent crop injury. Trifluralin killed sorghum only when placed so that the germinating seed or seedling contacted the herbicide. (Cooperative investigations of Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Phoenix, and Arizona Agric. Expt. Sta., University of Arizona, Tucson.)

Preemergence control of wild oats (Avena fatua) in barley. Agamalian, H. Preplant and postplant treatments of triallate with and without incorporation were made to Atlas barley. All triallate applications were at 1.25 lb/A. Treatments were applied to a 20 x 100 ft area, with four replications in a complete randomized block design. Treatments were made in November 1967. Initial rainfall fell 45 days post treatment. Total rainfall over the five month season was 14 in.

Triallate was applied as a preplant non-incorporated treatment, preplant incorporated, postplant incorporated, and postplant non-incorporated. Preplant treatments provided better wild oat control than postplant treatments.

Preplant non-incorporated treatments indicated less barley tolerance than the other method used in this experiment. Significant yield increases were obtained with all treatments over the non-weeded control. (University of California Agricultural Extension, Salinas.)

Summary of evaluations (M. Barley #1-67), wild oat control. Preemergence treatment. Date Treated: November 2. Seeded: November 3, 1967. Variety: Atlas. San Lucas, California.

Treatment	(Method)	lb/A	Wild oat control 12/21	1/19(a)	Crop injury 12/21	Mean gram wt. wild oats per 5 lb sample	Mean yield lb/A
triallate	Post Seeding Non-incorp.	1¼	6.75	15	0.75	12.5**	2456.9**
triallate	Post Seeding Incorporated	1¼	7.0	11	0.5	3.2**	2526.9**
triallate	Pre-Seeded Non-incorp.	1¼	8.75	7.5	1.0	5.8**	2379.2*
triallate	Pre-Seeded Incorporated	1¼	9.0	5.7	0.5	2.4**	2659.0**
Control	--	0	2.0	39.2	0.25	21.5	2122.6

(a) - denotes wild oat count/4 sq ft

L.S.D. (Among Means)	.05	5.6	214.7
	.01	7.9	302.6

<u>Evaluation of several herbicides for wild oat control in spring barley. Wiedman, Steve.</u> Various herbicides were applied to Hannchen spring barley to control wild oats. Wild oat seed was broadcast over all plots except weed-free ones. A sheet of plastic was placed over the weed-free plots while the remainder of the experimental area was sown. After the covering was removed the barley was sown. Visual observations of wild oat control and barley height reduction were taken in addition to yield data. Lack of summer rain contributed to the generally low yields as irrigation was not used.

In general, most of the compounds tested gave significant increase in yield over the untreated check. Bay 70533 applied at tillering of the barley at 3 and 4 lb/A gave the best yields even though slight reductions in plant height were observed. Barban QS at 1/16 lb/A also gave good results as did barban QT at 1/4 lb/A. These are different formulations of the parent compound, barban. MSMA, formulated as Daconate, at 4 lb/A gave good results. A new herbicide developed specifically for wild oat control, BH 1455, gave good control and yield at 4 lb/A, but showed slight height reduction at 6 lb/A. See the following table. (Farm Crops Department, Oregon State University, Corvallis.)

Evaluation of several herbicides for wild oat control, plant height reduction, and yield of barley.

Treatment	Rate lb/A	Bu/A avg. - 4 reps.	*Wild oat control avg - 4 reps.	*Barley injury avg. - 4 reps.
RH 315 (pre)	1	13.9	30	45
	2	12.6	20	50
	4	9.6	20	70
barban QS (post)	1/16	25.0	80	0
	1/8	22.8	70	0
	1/4	23.0	70	0
barban QT	1/16	22.7	70	0
	1/8	22.9	60	0
	1/4	24.1	75	0
barban	1/16	21.5	50	0
	1/8	22.9	60	0
Bay 70533 (3-4 leaf)	2	21.9	60	0
	3	23.0	70	20
Bay 70533 (tillering)	3	24.3	50	0
	4	24.6	70	10
BH 1455	2	21.2	50	0
	4	23.3	90	5
	6	20.8	65	20
MSMA (Daconate)	2	20.4	50	0
	4	22.4	75	10
DSMA	4	20.6	55	10
	8	19.6	60	25
Check (no treat.)		20.4		
Check (weed-free)		25.2		

* Rating: 0 - 100   0 = no control or injury
100 = complete control, kill

Weed control in winter wheat in Wyoming. Lee, G. A. and H. P. Alley. The purpose of this experiment was to determine the potential of several new herbicides for annual weed control in winter wheat. Amine and low volatile ester formulations of 2,4-D were included in the study for comparison.

Herbicidal treatments were made when the wheat was in 6 to 8 tiller stage of growth. Each treatment consisted of square rod plots replicated three times. The chemicals were applied in 40 gpa of water on a broadcast basis. A portion of each plot was harvested and the weight sample computed to an acre basis. Bushels per acre was determined by using a 60 lb test weight for winter wheat. Visual estimates of weed control were made when the wheat was in the late boot stage.

The experimental area was heavily infested with tansy mustard (Descurainia pinnata (Walt.) Britt.), Russian thistle (Salsola kali L.) and downy bromegrass (Bromus tectorum L.). Sparsely encountered species were rough pigweed (Amaranthus retroflexus L.), wild buckwheat (Polygonum convolvulus L.) and bull thistle (Cirsium vulgare (Saui) Airy Shaw). Although no treatment gave satisfactory control of all species, all formulations of Chlorflurazole (4,5-dichlor-2-trifluoromethyl benzimidazole) and amine and LV ester of 2,4-D resulted in excellent control of tansy mustard and good control of Russian thistle (following table). Diuron at 2 lb/A, linuron at 1 lb/A and 2 lb/A, GS-14260 at 1 lb/A and 2 lb/A resulted in good control of downy bromegrass. The Chlorflurazole formulations at all rates showed some activity on downy bromegrass but did not give satisfactory control.

Comparisons of harvest data show that 12 of 25 chemically treated plots had yields higher than the weedy check. Plots treated with Chlorflurazole-W at 1 lb/A and Chlorflurazole-LB at 1 lb/A resulted in yields greater than the weed-free check. 2,4-D amine and LV ester treated plots resulted in yields of 1.19 and 1.01 bu/A, respectively, lower than the weedy check. Yields from plots treated with diuron at 1 lb/A and 2 lb/A were the lowest in the experiment.

Chlorflurazole-LB at 3 lb/A, diuron at 2 lb/A and linuron at 2 lb/A caused visible stunting of the winter wheat. (Wyoming Agricultural Experiment Station, Laramie, SR-81.)

Evaluation of herbicides used for weed control in winter wheat.

Treatment	Rate/A	Weed control			Yield/A
		Tansy mustard	Russian thistle	Downy bromegrass	
Chlorflurazole-W	1 lb	E	G	S	30.75
Chlorflurazole-W	2 lb	E	G	S	28.11
Chlorflurazole-W	3 lb	E	G	S	23.74
Chlorflurazole-LB (Chlorflurazole + MCPA + wetting agent)	1 lb	E	G	S	31.72
Chlorflurazole-LB	2 lb	E	G	S	26.08
Chlorflurazole-LB	3 lb	E	G	S	25.90
Chlorflurazole-LD (Chlorflurazole + CMPP + wetting agent)	1 lb	E	G	S	29.46
Chlorflurazole-LD	2 lb	E	G	S	26.62
Chlorflurazole-LD	3 lb	E	G	S	29.74
diuron	1 lb	O	G	S	21.41
diuron	2 lb	O	G	G	18.03
linuron	1 lb	O	S	G	27.07
linuron	2 lb	O	S	G	24.64
ioxynil	6 oz	O	S	S	24.58
ioxynil	12 oz	O	S	S	22.10
bromoxynil	6 oz	O	S	S	29.18
bromoxynil	12 oz	O	S	S	27.70
dicamba	1/8 lb	S	G	O	23.06
dicamba	1/4 lb	S	G	S	24.79
2,4-D amine	3/4 lb	E	G	O	24.56
2,4-D LVE (PGBE)	3/4 lb	E	G	O	24.74
dicamba + 2,4-D amine	1/8 + 1/4 lb	G	S	S	25.86
dicamba + 2,4-D amine	1/4 + 1/2 lb	G	S	S	25.04

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Treatment	Rate/A	Weed control Tansy mustard	Russian thistle	Downy bromegrass	Yield/A
GS-14260	1 lb	S	G	G	24.45
GS-14260	2 lb	S	G	G	25.24
Weedy check					25.75
Weed-free check					30.60

0 = no apparent herbicidal activity
S = some weed control
G = good weed control
E = excellent weed control

Chemical control of field gromwell (Lithospermum arvense). Stewart, Vern R. Eight herbicides at various rates and in combination were used in a study for the control of field gromwell (Lithospermum arvense) in Delmar winter wheat. Rates and combinations are seen in the following table. Hand weeded check plots were included in this study, primarily to measure the effects of weeds when removed in the fall vs removal in the spring. All herbicides were applied November 17, 1966, except one spring application of 2,4-D.

Plots hand weeded in the fall resulted in a 10.7 bushel per acre increase over plots hand weeded in the spring. These plots were kept weed free during the entire growing season.

Bromoxynil at 4, 6 and 8 oz/A were about equal for weed control, giving 80 to 90% control. Yields were slightly higher than the weedy check and somewhat below the fall hand weeded check.

Ioxynil ester at 8 oz/A provided the best weed control in the study. Yields were equal to the check plot hand weeded in the fall. The yield being 69.3 bu/A.

The application of LV 2,4-D in the fall decreased yields and delayed maturity at all rates. Early spring application also depressed yields. The combination of MCP and picloram delayed maturity, caused head distortion and decreased the yield of Delmar winter wheat. This combination was less effective than ioxynil or bromoxynil in weed control. (Northwestern Montana Branch, Agricultural Experiment Station, Montana State University, Kalispell, Montana.)

Summary of yield from herbicide study, fall application, on winter wheat at Northwestern Montana Branch Station, Kalispell, Montana, 1966-67.

Treatment	Rate oz/A	Yield bu/A	Weed score 0-10[1]
Check	0	62.5	0
Check (hand weeded, fall)	0	69.8	10

Treatment	Rate oz/A	Yield bu/A	Weed score 0-10[1]
bromoxynil ester	4	62.6	9
bromoxynil ester	6	65.5	8
bromoxynil ester	8	66.9	9
picloram	.5	65.8	5
ioxynil ester	6	63.0	9
ioxynil ester	8	69.3	10
OCS 21799	16	65.9	3
OCS 21799	24	65.6	5
OCS 21799	48	50.6	5
diuron	12	60.5	5
diuron	24	60.7	9
2,4-D LV	4	57.4	4
2,4-D LV	8	53.1	8
MCP	8	61.6	6
Chlorflurazole + MCPA	16 + 8	68.6	5
Chlorflurazole + MCPA	12 + 8	63.9	3
Chlorflurazole	16	55.9	2
picloram + MCP (M)	¼ + 4	57.5	3
picloram + MCP (M)	½ + 8	53.2	7
2,4-D LV (spr. applied[2])	1	56.0	4
Check (hand weeded spr.)	0	58.9	10

Date applied: November 17, 1966.
[1] 0 - no control; 10 - complete control.
[2] Applied May 4, 1967.

Weed control in winter wheat. Rydrych, Donald J. Research on weed control in winter wheat was conducted under a wide variety of conditions in eastern Oregon during the 1967 season. Linuron (.8 - 1.6 lb/A), GS 14260 (.8 - 1.6 lb/A), and ACP 65-96 (2 - 4 lb/A) were compared with diuron (.8 - 1.6 lb/A) for crop safety and weed activity.

Weed species in the areas included fiddleneck (*Amsinckia intermedia*), Jim Hill mustard (*Sysimbrium altissimum*), tansy mustard (*Descurania sophia*), and jagged chickweed (*Holesteum umbellatum*), and downy brome (*Bromus tectorum*).

Treatments were applied early postemergence (November) and late postemergence (March) to both wheat and weeds. Good broadleaved weed control was obtained from all chemical treatments. Only ACP 65-96 gave adequate downy brome control. Yield responses were generally higher when treatments were applied early. All compounds except ACP 65-96 had good crop safety at the rates tested. ACP 65-96 is apparently safer on well established wheat. (Oregon Agricultural Experiment Station, Pendleton.)

Weed control in hops. Olson, Phillip, C. E. Zimmermann and W. R. Furtick. Two trials in hops were established east of Corvallis, Oregon in a silt loam soil. The first trial was conducted in a four-year old hop yard. Diuron and simazine were tested at 2 and 4 lb/A. Terbacil was tested at 2 lb/A. The compounds were applied as a single winter treatment, split winter and spring treatments and/or a combination winter and spring treatment. The winter treatments were applied December 29, 1966 and the spring treatments April 13, 1967. Evaluations were made August 24, 1967. Principal weeds present at the time of evaluations were annual ryegrass (Lolium multiflorum), redroot pigweed (Amaranthus retroflexus), and common groundsel (Senecio vulgaris). The following table is a summary of the results.

Table 1

Treatment and time of application	Rate lb ai/A	Hops % injury	Pigweed % control	Groundsel % control	Annual ryegrass % control
terbacil-winter	2	20	30	50	93
diuron-winter	4	0	94	87	100
simazine-winter	4	0	80	100	93
diuron-winter + diuron-spring	2 2	0	94	100	100
terbacil-winter + terbacil-spring	2	70	100	100	100
simazine-winter + simazine-spring	2 2	0	100	100	62
diuron-winter + simazine-spring	2 2	0	97	100	100
Check-mechanical		0	95	100	100

Evaluation scale (0 = no effect; 100 = complete kill)

All of the treatments proved to be effective in controlling all weeds present. Both terbacil treatments seriously injured the hops. Injury appeared as a burning effect on the leaves approximately four months after treatment. The split or combination treatments of diuron and simazine at 2 lb/A appear to be very effective in controlling the weeds present and caused no visible crop injury.

In the second trial, 24 herbicides were screened on four varieties of newly planted 'baby' hops. Varieties used were Fuggle, Brewers Gold, Yakima cluster and L-8. The hops were planted February 3, 1967. Preemergence treatments were applied February 6, 1967. Postemergence treatments were applied when the hops were in the emerging to 10 leaf stage. Visual injury evaluations were made August 24, 1967. Evaluation results are summarized in Table 2.

Dichlobenil at 2 lb/A, simazine at 2 lb/A, CP 50144 at 3 lb/A, and CIBA 6313 at 4 lb/A were the most selective on all four varieties of hops. There were several other treatments that appeared to be safe on one or two of the varieties. They were trifluralin at ½ and 3/4 lb/A, simazine at 4 lb/A, CP 50144 at 6 lb/A, sesone at 4 lb/A, paraquat at ¼ lb/A, 2,4-D at 1 lb/A, CIPC at 4 lb/A, diuron at 2 and 4 lb/A, CIBA 6313 at 8 lb/A, and OCS 21799 at 4 lb/A. (Oregon State College, Corvallis.)

Table 2

Treatment	Rate lb ai/A	Fuggle % injury	Brewers gold % injury	Yakima cluster % injury	L-8 % injury
PREPLANT INC. (6 in. disk)					
trifluralin	1/2	10	15	0	0
trifluralin	3/4	15	15	10	40
PREEMERGENCE					
dichlobenil	2	0	2	15	2
dichlobenil	4	70	30	5	95
CIPC	4	100	77	5	37
CIPC	8	100	80	100	100
diuron	2	10	5	80	20
diuron	4	10	97	95	10
simazine	2	0	5	20	10
simazine	4	15	10	95	0
terbacil	1	100	100	100	100
terbacil	2	100	100	100	100
CP 50144	3	0	0	5	5
CP 50144	6	10	0	77	30
sesone	4	100	0	0	87
dicamba	4	100	100	100	100
picloram	2	100	100	100	100
diphenamid	6	100	100	100	100
diphenamid	12	100	100	100	100
RP 11755	4	100	100	100	100
RP 11755	8	100	100	100	100
Nia 11092	2	100	100	100	100
Nia 11092	4	100	100	100	100
CIBA 6313	4	0	10	10	0
CIBA 6313	8	45	100	10	15
OCS 21799	4	15	10	55	0
OCS 21799	8	30	27	40	83
SD 11831	2	100	85	100	100
SD 11831	4	100	95	100	100
POSTEMERGENCE					
CIPC + DNBP	4+3	75	35	15	50
paraquat	1/2	0	80	35	5
paraquat	1	80	85	40	100

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Treatment	Rate lb ai/A	Fuggle % injury	Brewers gold % injury	Yakima cluster % injury	L-8 % injury
dalapon	5	75	83	80	95
dalapon	10	97	95	100	100
2,4-D	1	5	0	0	90
2,4-D	2	100	100	100	100
bromoxynil	1/2	90	90	10	95
bromoxynil	1	97	91	100	90
dicamba	1/2	100	100	100	100
dicamba	1	100	100	100	100
Check		0	0	0	0

Evaluation scale (0 = no effect; 100 = complete kill)

PROJECT 6. AQUATIC AND DITCHBANK WEEDS

E. J. Bowles, Project Chairman

SUMMARY

Hardstem bulrush was controlled satisfactorily with MSMA in California.

Granular dichlobenil at 7.5 and 15 lb/A ai provided 99+ percent control of waterlilies in the Pacific Northwest for an entire season. Necrotic plant tissue did not surface, and submersed species did not invade the treated areas.

Alligatorweed appeared to be difficult to control in a trial conducted in California.

Acrylaldehyde (acrolein) volatilized rapidly in aqueous solutions at 2 ppmw or lower in laboratory jars. In a canal at 0.6 ppmw the cumulative calculated loss exceeded 98 percent at mile 19.

Copper sulfate at 1 lb/cfs was 95 percent sorbed in a 23-mile canal, mostly by suspended sediment.

The LD_{50} for fingerling trout was 3¼ hours in 0.47 ppmw of acrolein; they were not killed by copper sulfate.

The concentration of amitrole found in water, after ditchbank treatment of 6 lb/A of amitrole-T, was reduced from 16 ppb of amitrole at a sampling station 250 yards below the treated plot to only 1 ppb one mile down stream.

<u>The seasonal response of hardstem bulrush to methanearsonate herbicides.</u> Kempen, Harold M. The standard recommendation for controlling bulrush in California has been the application of 2,4-D ester at the early flowering stage. Normally one or two retreatments are required to effect eradication. However, this herbicide cannot be used in areas where 2,4-D sensitive crops are grown.

An experiment was conducted in 1965 and was repeated in 1966 to measure the response of hardstem bulrush (*Scirpus acutus*) to MSMA at 2.2 and 4.4 lb aihg, applied in the spring, mid-summer and fall. Spring treatments of DSMA were included. Wetting agent was included in treatment sprays applied at 435 gpa. The experiments were conducted in a drain canal supporting a dense stand near Bakersfield, California.

With all treatment dates and rates, our evaluations indicated apical browning of the 5 to 7-foot stems began about one week following application but complete necrosis of the topgrowth was not completed until more than a month elapsed.

Where spring treatments were made sparse regrowth which was stunted and chlorotic was noted later in the growing season. Regrowth the second year was less than 10% of the untreated controls. Control resulting from the mid-summer treatments was 50 to 90% whereas from fall treatments it was 20 to 30%.

Our observations of stand reduction and symptoms under field conditions suggest that the methanearsonates translocate into the rhizome system of hardstem bulrush and destroy the terminal bud. These compounds apparently remain in overwintering dormant rhizomes and then move upward into regrowth developing from the remaining healthy tissue.

MSMA and DSMA offer significant advantages over 2,4-D where susceptible crops are grown. Possible water contamination must be evaluated before they can be widely utilized. (University of California Agricultural Extension Service, P. O. Box 2509, Bakersfield, California.)

Seasonal response of hardstem bulrush to MSMA, pyriclor, 2,4-D and dalapon + TCA. McHenry, W. B., L. L. Buschmann, and N. L. Smith. A time series susceptibility trial was conducted in 1966 with several foliar herbicides in an effort to find a substitute recommendation for 2,4-D. Too many hardstem bulrush problems occur near 2,4-D sensitive broadleaf crops in California.

Evaluation for July 5, 1966, foliage treatments

Herbicide	lb aihg	Bulrush control (10 = 100% control) 5/8/67
MSMA	1	8.0
MSMA	2	8.3
MSMA	4	9.0
pyriclor	1	4.7
pyriclor	2	7.3
pyriclor	4	7.0
dalapon + TCA	4.7 + 2.6	1.0
2,4-D LV ester	2	9.5
Control	-	

An application volume of 300 gpa was used on all treatment dates, i.e., May 24, July 5, August 15, and October 3, 1966. The July application was superior to the remaining treatment dates. Late summer and fall treatments were appreciably less effective. MSMA was second only to the low volatile ester form of 2,4-D in bulrush control. (Agricultural Extension Service, University of California.)

Control of white waterlily (Nymphaea tetragona) with dichlobenil granules. Comes, R. D. and L. A. Morrow. White waterlily infests the shallow areas of many lakes and ponds in the Pacific Northwest. Repeated treatments with phenoxy herbicides are currently used to control this species. However, the floating mats of necrotic leaves, petioles, and rhizomes that ensue are unsightly and odoriferous, and may create dissolved oxygen deficiencies in heavily infested areas. We evaluated dichlobenil, an herbicide known to be effective on several species of submersed aquatic weeds, at 7.5 and 15 lb/A ai for control of white waterlily in a south-central Washington lake.

Treatments were replicated three times on open water plots, each 50 ft square, and separated by 50-ft untreated borders. Water depth in the plot area averaged 4.5 ft, and the hydrosoil was a black muck. A granular formulation of dichlobenil was applied with a centrifugal spreader from a slow moving boat on April 10, 1967. At that time, only 10 to 12 waterlily leaves per sq rod had emerged from the water surface.

Leaves ceased to emerge from the water after the herbicide was applied. By mid-July, 99+ percent control of waterlilies was evident on all plots. This degree of control existed throughout the season. Margins of plots were very distinct, which indicated the herbicide had not moved laterally from the treated plots in phytotoxic concentrations. Moreover, necrotic plant tissue did not surface, and submersed species did not invade the treated areas. (Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and the Washington Agriculture Experiment Station, Prosser.)

Alligatorweed response to nine soil-applied herbicides. McHenry, W. B. and V. H. Schweers. Field studies initiated in 1966 in Tulare County were evaluated in 1967 for suggested leads in the control of alligatorweed (*Alternanthera philoxeroides*). Two previously unknown infestations of this perennial species were discovered in California in 1965. The California Department of Agriculture, the Tulare County Department of Agriculture, and the University of California Agricultural Extension Service have since conducted a field testing program to derive an eradication procedure.

Soil active herbicides were applied November 15, 1967, on two heavily infested canals that had been drained for the winter season. A dense mat of alligatorweed stems 6-8 in. deep covered most of the soil surface. Portions of the soil surface in the test area were covered with approximately 1 in. of ash resulting from attempts to burn the vegetative mat in the fall. These conditions plus several periods of flooding during the remainder of the precipitation season following treatment probably created adverse conditions for optimum leaching into the root zone. Approximately 4-6 in. of rain fell prior to the first flooding period.

Herbicide	Formulation	lb ai/A	Control (10 = 100%)
atrazine	80% WP	20	0.5
atrazine	80% WP	30	0
atrazine	80% WP	40	0
bromacil	80% WP	20	1.0
bromacil	80% WP	30	0
bromacil	80% WP	40	1.5
dicamba	4 lb ae/gal	4	4.0
dicamba	4 lb ae/gal	6	2.5
dicamba	4 lb ae/gal	8	1.0
dichlobenil	4% gran (AQ)	5	4.5
dichlobenil	4% gran (AQ)	10	6.0
dichlobenil	4% gran (AQ)	15	8.0

(Continued on Page 94)

Herbicide	Formulation	lb ai/A	Control (10 = 100%)
diuron	80% WP	20	0.3
diuron	80% WP	30	1.0
diuron	80% WP	40	2.3
fenac	1.5 lb ae/gal	10	1.5
fenac	1.5 lb ae/gal	15	1.3
fenac	1.5 lb ae/gal	20	2.8
picloram	2 lb ae/gal	1	1.8
picloram	2 lb ae/gal	2	3.0
simazine	80% WP	20	0.5
simazine	80% WP	30	1.5
simazine	80% WP	40	0
sodium chlorate*	30% gran.	200	6.3
sodium chlorate*	30% gran.	300	4.5
sodium chlorate*	30% gran.	400	6.2
Control	-----	-	0.5

* Monobor-Chlorate R

Under the experimental conditions encountered, none of the herbicides approached eradication. Dichlobenil treatments attained the highest degree of stand reduction; Monobor-Chlorate ranked second. To prevent further spread of this aggressive weed in California, high cost treatments will be acceptable to achieve eradication. (Agricultural Extension Service, University of California.)

Behavior, reactions, and effects of acrolein and copper sulfate in irrigation water. Bruns, V. F., J. L. Nelson, and C. C. Coutant. Acrylaldehyde (acrolein) at 2 ppmw or lower in aqueous solutions in laboratory jars and bottles volatilized rapidly. Microbial degradation and chemical decomposition or alteration were also evidenced.

In treatment of a canal at .6 ppmw for 8 hours, acrolein volatilized as the treated water moved downstream. The cumulative calculated losses of acrolein were 22, 53, and 98+ percent at miles 1, 3, and 19 (end of canal), respectively. The greatly reduced concentration at mile 19 still injured submersed aquatic weeds. At mile 1, the acrolein concentration dropped sharply to undetectable levels as soon as the treated body of water passed. Apparently, little or no acrolein was retained in the canal bed for later release.

In laboratory tests, the loss of acrolein was more rapid from moist soil than from still water. At 8 ppmw and at room temperatures, 90% of the acrolein was lost from soil in about 11 hours and 99% in 48 hours.

The LD_{50} for fingerling rainbow trout was 3¼ or 4¼ hours exposure to a calculated concentration of .47 or .14 ppmw of acrolein, respectively. The proliferation of periphyton was retarded only temporarily (about 4 days) after exposure to approximately .5 ppmw of acrolein for 8 hours.

Four hundred and eleven pounds of copper sulfate crystals were poured simultaneously into a canal with a waterflow of 411 cfs. This rate of 1 lb/cfs is the one most commonly recommended for control of algae in canals. Ninety-five percent of the added copper was sorbed from the water in the 23-mile reach of canal. Most of the sorption was by suspended sediment which gradually settled to the canal bottom. Copper then was slowly re-released into the water over a period of several days. Apparently, no marked accumulation of copper is developing in soils irrigated with treated water in this area.

Fingerling rainbow trout were not killed by the copper sulfate treatment. (Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Prosser, Washington, and Battelle-Northwest Laboratories, Richland, Washington.)

Amitrole in irrigation water after ditchbank treatment. Demint, Robert J. and Peter A. Frank. A typical ditchbank treatment of six pounds of amitrole-T per acre was made to ditchbank weeds for one-quarter mile upstream on one side of a canal carrying approximately four cubic feet per second of irrigation water. Sample collection sites were located 250 yards below the treatment and one mile downstream. At the time of treatment the canal contained a heavy growth of weeds which contributed to channeling and entrapment of water. This condition resulted initially in dilution of the herbicide in the leading mass of water, followed by an enrichment of the water farther upstream as it flowed by the herbicide sinks formed by the weed growth. Flow characteristics of the water were confirmed by visual observation of dye added to the water before and after the herbicide treatment. The first water to receive amitrole from the bank treatment contained 16 ppb of amitrole when it reached the sampling site 250 yards below the treated plot. Midway through and at the end of the treated blanket of water the herbicide concentrations were 24 and 10 ppb, respectively. After traveling one mile downstream the water receiving amitrole at the beginning of the treatment contained only 1 ppb of the herbicide while the middle and end portions of the one-quarter mile blanket of water contained 5 and 11 ppb, respectively. Water flowing past the upstream and the one mile sampling stations thirty minutes after passage of the final dye marker had herbicide concentrations of 6 and 8 ppb, indicating the extent of the dilution and lengthening of the blanket of herbicide bearing water. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Denver, Colorado.)

PROJECT 7. CHEMICAL AND PHYSIOLOGICAL STUDIES

J. W. Whitworth, Project Chairman

SUMMARY

Ten research progress reports were received from seven states. A brief summary of each follows in the order in which they are assembled in this section. The report on:

Herbicide breakdown as influenced by the amount of irrigation water showed a "trend toward decreasing activity of herbicides with increased irrigation rate."

Picloram + phenoxy combinations on the yield, quality and germination of barley and effectiveness in controlling Canada thistle showed that all combinations caused reductions in the germination, yield, and quality of barley. None of the treatments killed all the Canada thistle but seed formation was prevented.

Picloram degradation in dry as compared to moist or saturated soils showed a more rapid breakdown within 6 weeks in the moist and saturated soils.

CIPC and IPC longevity studies indicated that the residual life of these herbicides could be increased by applying them in combination with the carbaryl insecticide (Sevin).

Root uptake of 2,4-D by Canada thistle plants with the tops removed at various intervals indicated that root uptake and release of this herbicide was essentially independent of the foliage.

Quantity of light and toxicity of 2,4-D on Canada thistle foliage indicated greatest toxicity in full sunlight and the addition of glucose increased toxicity under partial shade.

Charcoal protection against herbicide injury on crops indicated good protection on sugar beets and grasses for most herbicides tested but poorer for the carbamate herbicides. The herbicides gave equivalent weed control in the sugar beet experiment on both charcoal and non-charcoal areas, but in the grass experiments, the charcoal protected the weeds as well as the grass plants.

Charcoal for overcoming persistent herbicides indicated that a 200 lb/A application of charcoal was nearly sufficient to overcome the residues of 4.8 lb/A of atrazine but this was not true for diuron and bromacil.

Herbicides on soil fungi comparing paper assay disks vs. fiber glass disks showed fiber glass more reliable as they contain no carbon to serve as food source for the fungi.

Pyrazon and soil microorganisms using 40 species showed that none of the 40 used pyrazon as a food source when it was suspended in agar. When pyrazon was available to *Rhizoctonia solani* and *Fusarium solani* on fiber glass disks, it appeared to serve as a food source for the fungi.

The effect of irrigation on herbicide breakdown. Lange, A. H. and B. Fischer. Herbicides were sprayed to the soil surface in aqueous solution on May 12, 1967, bedded up to 30 in. beds, and flooded at 1, 2 and 4 X rates of irrigation water. Herbicides studied were atrazine, trifluralin, DCPA, and pyrazon.

The weed growth resulting from the irrigation indicated herbicide activity directly related to amount of moisture applied (Table 1).

Crops planted 4 months later generally showed decreased herbicide residue with increased irrigation (Table 2). At the lower rate of the herbicides tested, there was a decrease in residual activity with an increase in soil moisture during the 4 month period. Some of the high rates showed similar trends; this was particularly true with DCPA. The differences in phytotoxicity shown by the higher rates of these other herbicides may not be significant because of the extreme toxicity observed.

The only trend with atrazine at the rather high rate of 4 lb is in the grain sorghum which is somewhat resistant to atrazine.

Trifluralin at 1 lb on barley showed only a slight trend which may not be significant. Barley is intermediate in its susceptibility to trifluralin at this rate. Safflower which is resistant to trifluralin showed no difference. On the other hand, canarygrass, a species susceptible to trifluralin, showed a pronounced reduction in trifluralin residue indicating reduced phytotoxicity with increasing moisture. Although grain sorghum is also susceptible to this rate of trifluralin, it did not show an effect. The 4 lb/A rate of trifluralin was excessively toxic on all crops except safflower.

DCPA at 8 lb, generally not excessively toxic on barley or safflower, showed no trend due to soil moisture, but there may have been a trend at 32 lb. The more susceptible canarygrass and sorghum showed a trend at the lower rate.

Barley and safflower show a partial trend at the low rate of pyrazon. Canarygrass and sorghum, which are resistant, showed no phytotoxicity at the low rate. Sorghum showed a partial trend at the high rate.

While these results are far from consistent, they do show a general trend toward decreasing activity of herbicides with increased irrigation rate. (Agricultural Extension Service, University of California.)

Table 1. The effect of the amount of moisture applied by flood irrigation on herbicide activation as measured by weed control (0-10)[1] ratings (8-18-67).

	Average[1] Annual Weed Control			
Herbicides	lb/A ai	1x Irrigation	2x Irrigation	4x Irrigation
atrazine	4	3.3	5.4	8.2
trifluralin	1	2.3	4.2	5.9
trifluralin	4	3.9	5.3	8.6
DCPA	8	2.8	2.7	5.0
DCPA	32	2.4	4.7	6.2
pyrazon	4	1.8	3.5	5.3
pyrazon	16	3.1	5.2	6.9
Check	0	0	0	0

[1]Weed control ratings were made using a 0-10 rating where 0 = no effect, and 10 = 100% or weed free. Average increase control over untreated check 3 replications.

Table 2. The effect of amount of moisture by furrow irrigation on herbicide breakdown at 4 months after treatment.

Herbicides	Act	lb/A ai	Barley Irrigation[3] 1 X	2 X	4 X	Safflower Irrigation[3] 1 X	2 X	4 X	Canarygrass Irrigation[3] 1 X	2 X	4 X	Grain sorghum Irrigation[3] 1 X	2 X	4 X
			Average[1] Stand and Injury Ratings[2]											
atrazine	80 WP	4	-	9.6	10.0	5.5	6.0	6.0	10.0	9.0	8.6	3.0	0	0
trifluralin	4 EC	1	5.5	5.3	3.6	0	3.3	1.6	9.6	6.0	1.6	4.6	7.0	6.6
trifluralin	4 EC	4	9.5	8.5	9.3	0	3.0	2.3	9.6	9.6	10.0	10.0	6.6	10.0
DCPA	75 WP	8	5.6	2.0	4.0	3.0	1.0	1.3	3.0	3.3	0	5.3	2.6	1.0
DCPA	75 WP	32	10.0	9.3	5.0	5.0	.6	1.3	6.0	10.0	10.0	8.6	10.0	10.0
pyrazon	80 WP	4	9.0	5.6	6.0	2.6	1.3	.6	0	0	1.3	0	0	0
pyrazon	80 WP	16	9.0	10.0	9.6	3.0	6.0	7.3	3.3	5.0	5.6	3.6	4.3	.6
Untreated	-	-	3.0	2.3	0	0	0	0	0	0	0	0	0	0

[1] Average of 3 replications.

[2] Rating 0 - 10 visual phytotoxicity rating where 0 = no effect, excellent stand, and 10 = complete kill of crop or no stand.

[3] Relative amount of irrigation as determined by length of run of one setting.

The effect of several picloram + phenoxyacetic acid combinations on yield and germination of barley. Alley, H. P., R. Parker and G. A. Lee. The purpose of the experiment was to determine the effect mixtures of picloram + 2,4-D would have upon barley yield and germination along with evaluation for Canada thistle control.

Five combinations of picloram + 2,4-D were compared, at equivalent rates of picolinic acid ai/A, to picloram (Tordon-22K). The five combinations and the active ingredients of each are presented in the following table.

The barley (Trebi) was in the tiller to early jointing stage of growth and the Canada thistle in the pre-bud to early bud stage of growth at time of treatment. All treatments were applied at the rate of 1/16 and 1/8 lb/A ai of picolinic acid in a total volume of 40 gpa water.

None of the treatments killed all the Canada thistle; however, all treatments prevented seed formation. Annual weeds, kochia (Kochia scoparia L.) and lambsquarters (Chenopodium album L.) were common in the treated plots at harvest time.

The quality of the barley was lowered by all chemical treatments as indicated by germination percentage and bushel weight. The M-2861 (1/8 lb picolinic acid + 2 lb 2,4-D/gal) at 1 gal/A and Tordon-101 (1/2 lb picolinic acid + 2 lb 2,4-D/gal) at 1 qt/A treatments resulted in the greatest yield reduction and lowest germination percentage. It is interesting to note that with the M-2861 and Tordon-101 formulations the amount of picolinic acid in relation to 2,4-D was lower than the other formulations. This resulted in considerably more 2,4-D/A to obtain the equivalent rates of picolinic acid. (Wyoming Agricultural Experiment Station, Laramie, SR-85.)

The effect of the various picolinic acid + phenoxyacetic acid formulations on yield and germination of treated barley.

Chemical[1]	Rate/A[2]	Average yield bu/A	Average test wgt/bu	% Germination
M-2861 (1/8 lb picolinic acid + 2 lb 2,4-D/gal)	2 qt	40.7	38.9	95
M-2861	1 gal	15.5	29.3	69
M-2863 (1/8 lb picolinic acid + 2 lb MCPA/gal)	2 qt	30.1	41.3	92
M-2863	1 gal	24.3	35.4	93
M-3060 (1 lb picolinic acid + 1 lb 2,4,5-T/gal)	1/2 pt	35.1	38.7	93
M-3060	1 pt	28.4	36.0	94
M-3061 (1 lb picolinic acid + 2 lb 2,4-D/gal)	1/2 pt	33.5	36.8	91
M-3061	1 pt	36.6	37.8	89
Tordon-101 (.54 lb picolinic acid + 2 lb 2,4-D/gal)	1 pt	31.4	38.8	94
Tordon-101	1 qt	14.3	34.2	82
picloram	1/16 lb	19.5	43.4	96
picloram	1/8 lb	26.2	39.5	92
Check		42	44.1	99

[1]Dow registered trademarks and formulation numbers.
[2]Rate/A of the mixtures is the rate required to give 1/16 and 1/8 lb/A of picolinic acid.

A test of picloram degradation under three soil moisture treatments. Bohmont, Bert L. and J. L. Fults. A concentration series of picloram herbicide was incorporated in greenhouse soil at rates from 1/8 lb/A (62.50 ppbw) to 1/4096 lb/A (0.122 ppbw). One replication was kept completely dry for six weeks. A second replication was given 50 cc water daily for six weeks. The third replication was kept saturated for six weeks. Norland variety potatoes were planted in all replications and grown for four weeks.

Visual observation would indicate that dry soils do not lose picloram as rapidly as moist or saturated soils and more severe symptoms were produced in the test plants. Little difference was noted between moist or saturated soils.

It was believed that anaerobic bacteria might degrade the picloram in saturated soils. This was not observed, however the six weeks saturation period might not have been sufficient to allow anaerobic breakdown.

A visual rating was made of the picloram symptoms in the potato plants on the basis of 0 = no symptom; 1 = light symptoms; 2 = moderate symptoms; 3 = severe symptoms; 4 = only slight growth; and 5 = no growth. The accompanying table summarizes the results.

Beans are being tested under similar conditions. (Colo. Cooperative Extension Service and Botany & Plant Pathology Department, Colo. Agri. Expt. Sta. C.S.U., Fort Collins, Colo.)

Visual response rating of potato plants grown in picloram concentration series under three soil moisture conditions.[a]

Treatment rate	Dry soil 6 weeks	50cc H_2O daily 6 weeks	Saturated 6 weeks
1/8 lb (62.50 ppbw)	5	5	4
1/16 lb (31.25 ppbw)	4	4	4
1/32 lb (15.62 ppbw)	4	4	4
1/64 lb (7.81 ppbw)	4	4	3
1/128 lb (3.91 ppbw)	3	3	3
1/256 lb (1.95 ppbw)	4	3	2
1/512 lb (0.98 ppbw)	4	3	1
1/1024 lb (0.49 ppbw)	2	2	2
1/2048 lb (0.24 ppbw)	4	3	2
1/4096 lb (0.12 ppbw)	2	1	1
Control	0	0	0

[a] Picloram symptoms: 1 = light, 2 = moderate, 3 = severe, 4 = slight growth, and 5 = no growth.

Combinations for increasing longevity of CIPC and IPC. Vesecky, John F. and Arnold P. Appleby. A trial was established on June 7, 1967 near Corvallis, Oregon to determine if the residual life of CIPC and IPC could be increased by applying in combination with the insecticide carbaryl (Sevin).

Sevin was applied separately and all applications were surface-applied to dry soil in 34 gpa water. Annual ryegrass was then planted at 30 lb/A across the plots in a 10-ft strip as soon as the spraying was completed and again at 2, 4, and 6 weeks. Water was applied 4 days after application and periodically thereafter.

Percent ryegrass control for the first 4 plantings, i.e., 0, 2, 4, and 6 weeks after application was evaluated visually on September 26. At that time it was decided to make a fifth planting due to the continued activity of CIPC at the 3 lb/A rate. On September 30 the first planting of ryegrass was sprayed with paraquat at 0.5 lb/A. On October 4 the fifth planting of ryegrass was made into the area previously occupied by the first planting due to lack of plot space. Visual evaluations of this planting were made on November 22.

Application of the insecticide Sevin with CIPC and IPC resulted in better control of ryegrass than did either herbicide alone. Sevin, even at the zero date, resulted in small but consistent increases in activity. With few exceptions slightly better ryegrass control resulted when Seven was applied at the 2 lb/A rate over the 1 lb/A rate. In general, almost twice as much ryegrass control resulted at the 6 week planting date in the plots receiving 2 lb/A of Sevin over those receiving no Sevin. (Farm Crops Department, Oregon State University, Corvallis.)

Combinations for increasing longevity of CIPC and IPC.

Treatment	Pounds active material/A	Planting dates (weeks after application) 0	2	4	6	17
		% ryegrass control				
IPC	2	63	28	7	7	0
IPC + Sevin	2 + 1	71	35	13	11	0
IPC + Sevin	2 + 2	73	40	10	8	0
IPC	4	84	33	15	17	0
IPC + Sevin	4 + 1	90	57	38	30	0
IPC + Sevin	4 + 2	89	63	42	32	0
CIPC	1	65	38	17	16	0
CIPC + Sevin	1 + 1	75	47	32	29	0
CIPC + Sevin	1 + 2	78	55	38	30	0
CIPC	3	90	74	69	43	0
CIPC + Sevin	3 + 1	93	87	83	75	10
CIPC + Sevin	3 + 2	95	88	85	81	15
Check		0	0	0	0	0
Sevin	1	0	0	0	0	0
Sevin	2	0	0	0	0	0

Root uptake of 2,4-D-1-C^{14} by Canada thistle plants as influenced by excision of tops. Whitworth, J. W. and Kathy Tolman. An experiment was carried out to determine the effect of excision of tops of plants on the uptake and exudation of 2,4-D by roots of Canada thistle. Plants that were 5 months old were brought from the greenhouse to the laboratory, washed free of potting material, and allowed to establish themselves in a complete nutrient solution in one quart glass jars. After 7 days, 2,4-D-1-C^{14} (2,4-D*) was introduced into each jar to bring the solution to a cencentration of 1 ppm of 2,4-D. Four jars were used with 1 plant per jar. The tops of plant I were removed just before the 2,4-D* was introduced into the solution. The tops of plant II were cut off 1 hour after exposure of the roots to 2,4-D*, plant III at 2 hours after, and plant IV was left intact. The nutrient solutions were sampled for 2,4-D* every half hour for 2 days during the normal working day and every hour on the third day.

Excision of the tops did not reduce the capacity of the roots to remove 2,4-D* from the nutrient solution nor to release or exude it back into the solution. The uptake and release followed a cyclic pattern that has been described in previous WWCC reports. The magnitude of the cycling was affected very little by the removal of the tops, but the time of its occurrence was delayed when the tops were removed at the time of treatment. At a time when the trend for each plant was in the direction of either rapid uptake or loss back into the solution, removal of the tops of the plants did not alter the direction of movement of the 2,4-D*. Apparently the uptake of 2,4-D by roots of Canada thistle plants is essentially independent of the foliage or tops. (New Mexico Agri. Exp. Sta., New Mexico State University, University Park, N. M., 88001.)

<u>The effects of four light quantities on the response of Canada thistle (Cirsium arvense L.) to 2,4-D.</u> Erickson, Duane H., and Lambert C. Erickson. Lath cages 4 x 4 x 4 ft were constructed to provide approximately 50, 25 and 12.5 percent (exclusive of framing) light exposure versus full (100%) sunlight, to determine what influences these degrees of shade would have on the toxicity of 2,4-D on Canada thistle; and if glucose applied with the 2,4-D might enhance toxicity as the quantity of shade increased. The cages, replicated in triplicate, were placed in a uniform Canada thistle field infestation on May 8, the 2,4-D and 2,4-D + glucose treatments applied June 28, and data were gathered until October 16.

Light quantities in these cages were found to be 39, 22, and 9% respectively of full sunlight by Uranyl Oxalate Actinometer measurements. Each of these light quantities thereby contained two treatments; 2,4-D at 2 lb/A, and 2 lb of 2,4-D + 20 lb/A glucose in 40 gallons of water/A.

Just prior to the herbicide applications, vegetation samples were taken by removing the terminal 6 in. of growth from each thistle shoot for samples to determine the simple sugar and protein contents per shade treatment.

Population counts were recorded for comparisons with next season's regrowth per treated areas. The major interest regarding this perennial weed will center on regrowth rather than immediate plant death, but in order to have data available this season, percentages of dead topgrowth tissue were recorded at weekly intervals from July 5 through October 16.

The following statistically significant differences, based on percentages of necrotic topgrowth tissue following herbicide treatments, prevailed between treatments at the 1% level:

1. There was significantly greater dead topgrowth tissue in the 100% full sun as compared to any shade treatment.

2. Herbicide effects were significantly different among the shade treatments. 2,4-D + glucose gave the greatest quantity of dead topgrowth tissue, the check gave the least.

(Idaho Agricultural Experiment Station, University of Idaho, Moscow.)

The application of charcoal on seed rows for crop protection. Brenchley, Ronald G. An experiment was established September 13, 1967, to determine the effectiveness of charcoal in reducing herbicide injury to sugar beets. Spray attachments were connected to a seeder so that a saturated charcoal suspension equal to a rate of 189 lb/A charcoal could be applied either in the furrow directly on the seed or in a 1 in. band on the soil surface directly over sugar beet seeds. Herbicides (pyrazon, 6.0 and 12 lb active/A; R-11913, 3.0 and 6.0 lb active/A; bromacil, 1.5 and 3.0 lb active/A; and propachlor, 4.0 and 8.0 lb active/A) were applied the day following the seeding date. Excess herbicide was used so as to make certain injury would occur on the sugar beets. Beets were sprinkler irrigated the same day as herbicide application with 1 in. of water and periodically from then on as the necessity for water arose.

Results of this experiment are given in the following table. The charcoal definitely gave added protection to sugar beets, depending somewhat on the herbicide used. Charcoal was much more active in deactivating the 3.0 and 6.0 lb/A rates of R-11913 than any of the other herbicides used. At the 6 lb/A rate of R-11913 with 189 lb/A of charcoal there were approximately 20 times more sugar beets than on plots treated at the same rate without charcoal. Charcoal increased beet counts on the 12 lb/A pyrazon and 8 lb/A propachlor plots by one third. Bromacil rates were much too high giving nearly complete sterilization of the plots. However, charcoal applied to the soil surface did increase beet counts on the 1.5 lb/A bromacil plot from 5 to 24 plants per 3 ft of row space. It appears that weed control within the row treated with charcoal was just as good as weed control between the rows where no charcoal was added.

Similar results were obtained in other work conducted at Oregon State University by Dr. Orvid Lee using activated charcoal to protect 3 different grass species, ryegrass (*Lolium multiflorum* Lam.), creeping red fescue (*Festuca rubra* L.), and Kentucky bluegrass (*Poa pratensis*), from herbicide treatments. The charcoal was applied as a spray at the time the crop plants were being seeded. The rate of charcoal application was approximately 187 lb/A of treat area. The charcoal treatments were no charcoal, charcoal sprayed on the seed as it dropped from the seed tube so that it was incorporated with the seed, and charcoal sprayed in a band 1 in. wide over the seeded row after the seed had been covered. Herbicide plots were laid out perpendicular to the planted rows and extended over all charcoal treatments and crop species. Each herbicide plot was divided and one half of the plot was treated before the crops were seeded and the other half after seeding. Bromacil, terbacil, simazine, atrazine, diuron, IPC and CIPC were compared at two rates each.

The charcoal treatment was most effective in protecting the crop plants when it was applied as a 1 in. band over the seeded row. Less injury occurred when the herbicide was applied after planting than when applied before planting. On most plots the grasses were eliminated when no charcoal was used or when the charcoal was sprayed directly in the row. Where the charcoal was sprayed over the row after seeding, 100% stand of vigorous grass resulted following many of the herbicide treatments. The charcoal band was effective in protecting the grasses against diuron and simazine at rates of 3.0 lb ai/A, atrazine at 1.5 lb ai/A and bromacil and terbacil at 1.0 lb ai/A. The charcoal was less effective in protecting the plants against IPC and CIPC. Weeds within the charcoal-treated area were protected along with the crop plants. (Department of Farm Crops, Oregon State University, Corvallis.)

The use of charcoal for protecting sugar beet seedlings.

			Ave. plant counts per 3 ft of row space				
Treatment	Active material lb/A	% injury on beets	Sugar beets	Broadleaf weed within row	Broadleaf weed between row	Grassy weed within row	Grassy weed between row
pyrazon	6.0	7	76	0	0	5.0	6.0
pyrazon	12.0	63	44	0	0	.5	.8
pyrazon + charcoal in furrow	12.0	0	65	0	0	3.0	.7
pyrazon + charcoal on surface	12.0	10	66	0	0	2.7	1.0
R-11913	3.0	73	32	0	0	4.5	6.0
R-11913	6.0	95	3	0	0	0.0	.3
R-11913 + charcoal in furrow	3.0	0	65	0	0	6.0	5.0
R-11913 + charcoal in furrow	6.0	22	54	0	0	1.1	.1
R-11913 + charcoal on surface	3.0	3	65	.1	0	7.0	5.7
R-11913 + charcoal on surface	6.0	33	57	0	0	2.1	.3
bromacil	1.5	100	5	0	0	0.0	0.0
bromacil + charcoal on surface	1.5	82	24	0	0	0.0	0.0
propachlor	4.0	45	56	4.2	4.3	.7	.3
propachlor	8.0	77	38	3.3	3.3	0.0	0.0
propachlor + charcoal on surface	8.0	52	59	2.3	2.0	.5	0.0
Check		0	76	4.5	5.1	15.0	19.3

<u>The use of charcoal to overcome persistent herbicides.</u> Brenchley, Ronald G. and L. C. Burrill. An experiment was established in 1966-67 to determine the feasibility of using activated charcoal as a means of protecting crops from damaging rates of herbicides. Three persistent herbicides (atrazine, bromacil, and diuron) were applied on plots (10 ft x 20 ft) at rates of 1.6 and 4.8 lb/A active material every 15 days starting August 15,

1966 and continuing through March 15, 1967. A 200 lb/A rate of charcoal (Aqua Nuchar A) was applied on June 6, 1967, to one-half of each plot leaving the other half with no charcoal. Following charcoal application, the entire plot was rototilled in at a 4 in. depth. Oats were then drilled across both the charcoal treated and untreated areas. Visual oat injury on selected plots was evaluated on August 10, 1967. Percent pigweed control was also included since a uniform stand of volunteer pigweed was available for evaluation.

Results of this experiment are given in the following table. Charcoal treatment was sufficient to overcome the residue from the 1.6 lb/A rate of bromacil applied on August 15, 1966. However, 200 lb of charcoal per acre was not adequate to overcome the residue left over from 1.6 lb/A bromacil applied after the December 15, 1966 application date. The 200 lb/A rate of charcoal was insufficient to prevent 100% injury to oats at all application dates of 4.8 lb/A bromacil. It appeared that the 200 lb/A charcoal rate was at least adequate to overcome the 1.6 lb/A rate of atrazine and nearly sufficient to overcome the residues from the 4.8 lb/A atrazine rate when the herbicide was applied before December 15, 1966. The charcoal rate used in this experiment was not high enough to overcome the residue from 4.8 lb/A diuron. Fifteen to 20% visual oat injury was observed for all dates of application for this herbicide. (Farm Crops Department, Oregon State University, Corvallis.)

The use of charcoal (Aqua Nuchar A) to overcome herbicide residues.

Treatment	lb active per acre	Date of herb. application	Charcoal-lb/A applied 6/17/67	% oat injury	% pigweed control
bromacil	1.6	8/15/66		100	85
bromacil	1.6	8/15/66	200	10	0
bromacil	1.6	12/15/66		100	70
bromacil	1.6	12/15/66	200	60	20
bromacil	1.6	3/15/67		100	100
bromacil	1.6	3/15/67	200	80	50
atrazine	1.6	8/15/66		30	0
atrazine	1.6	8/15/66	200	0	0
atrazine	1.6	12/15/66		30	0
atrazine	1.6	12/15/66	200	0	0
atrazine	1.6	3/15/67		80	0
atrazine	1.6	3/15/67	200	0	0
atrazine	4.8	8/15/66		95	25
atrazine	4.8	8/15/66	200	20	0
atrazine	4.8	12/15/66		100	100
atrazine	4.8	12/15/66	200	10	0
atrazine	4.8	3/15/67		100	100
atrazine	4.8	3/15/67	200	60	0
diuron	4.8	8/15/66		60	20
diuron	4.8	8/15/66	200	20	0
diuron	4.8	12/15/66		70	20
diuron	4.8	12/15/66	200	20	0
diuron	4.8	3/15/67		85	10
diuron	4.8	3/15/67	200	15	0

A comparison of paper assay disks versus fiber glass assay disks in laboratory testing of herbicides against soil fungi. Bohmont, Bert L., and J. L. Fults. Standard 1 cm paper assay disks (No. 740-E, Schleicher and Schuell) were compared with sterilized thick (No. 24) and thin (No. 27) fiber glass disks (Schleicher and Schuell Co., Keene, New Hampshire). The disks were soaked in pyrazon at 0 ppm and 5,000 ppm and placed on each of three kinds of media: Czapeks minus sucrose with Noble agar; Noble water agar; and Czapeks complete with Noble agar. *Gibberella* and *Helminthosporium sativum* were used as test organisms.

In all cases except one, fungi on paper assay disks without pyrazon equaled or exceeded the growth of the fungi on the fiber glass disks with or without pyrazon. This would indicate that the fungi do derive carbon from the paper assay disks as a food source.

Fiber glass assay disks can be considered to give more reliable results when exclusion of an outside food source is critical in the evaluation of herbicides against fungi. (Colo. Cooperative Extension Service and Botany & Plant Pathology Department, Colo. Agri. Expt. Sta., C.S.U., Fort Collins, Colo.)

A test of pyrazon against known soil micro-organisms. Bohmont, Bert L., and J. L. Fults. The mode of action of pyrazon (5 amino-4-chloro-2-phenyl-3(2H) - pyridazone) appears to be somewhat different than other herbicides used for weed control in sugar beets, but its exact mechanism of action is not known. Likewise, it is not known how pyrazon is decomposed and dissipated in the soil.

Thirty-five species of fungi and 5 *Streptomyces* species were tested against pyrazon using various combinations of agar and rates of pyrazon.

One test involved pyrazon suspended in crystaline form in Czapeks agar (minus sucrose). None of the 40 species appeared to use pyrazon as a food source. It is doubtful if the test is critical enough due to the possible inaccessibility of the pyrazon to the fungi when suspended in agar.

A concentration series of pyrazon at rates from 0 ppm to 5,000 ppm were impregnated on paper assay disks and placed on Czapeks complete agar. Pyrazon did not appear to be toxic to any of the fungi at any concentration and it was questioned whether the fungi were using the pyrazon as a carbon source or possibly getting carbon from the paper assay disks.

Fiber glass disks dipped in 5,000 ppm pyrazon were used in another test. It was felt that the elimination of a carbon source, such as might be available in the paper assay disks, would give a more reliable reading. *Alternaria sp.*, *Chaetomium sp.*, *Helminthosporium sativum*, *Phoma betae* and *Rhizopus nigricans* showed less growth, and toxicity of pyrazon to these species was indicated. *Rhizoctonia solani* and *Fusarium solani* showed considerably more mycelial growth than the controls and could indicate that they were able to use pyrazon as a source of carbon. (Colo. Cooperative Extension Service and Botany & Plant Pathology Department, Colo. Agri. Expt. Sta., C.S.U., Fort Collins, Colo.)

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NOMENCLATURE AND ABBREVIATIONS

Tables 1 and 2 below are nomenclature and abbreviation lists of the Weed Society of America (Nomenclature Weeds 15(3), 1967). Authors are urged to use this terminology and abbreviation wherever applicable.

Table 1. Common and Chemical Names of Herbicides[a]

Common name	Other designation(s)	Chemical name[b]
A		
acroleine		acrylaldehyde
ametryne		2-ethylamino-4-isopropylamino-6-methylmer = capto-s-triazine
amiben		3-amino-2,5-dichlorobenzoic acid
amitrole		3-amino-1,2,4-triazole
	AMS	ammonium sulfamate
atratone		2-methoxy-4-ethylamino-6-isopropylamino-s-triazine
atrazine		2-chloro-4-ethylamino-6-isopropylamino-s-triazine
B		
barban		4-chloro-2-butynyl m-chlorocarbanilate
benefin		N-butyl-N-ethyl-alpha, alpha, alpha-trifluro-2,6-dinitro-p-toluidine
bensulide	R-4461	N-(2-mercaptoethyl)benzenesulfonamide S-(O, O-diisopropyl phosphorodithioate)
	BCPC	sec-butyl N-(3-chlorophenyl)carbamate
bromacil		5-bromo-3-sec-butyl-6-methyluracil
bromoxynil		3,5-dibromo-4-hydroxybenzonitrile
buturon	H-95-1	3-(p-chlorophenyl)-1-methyl-1-(1-methyl-2-propynyl)urea
C		
cacodylic acid		dimethylarsinic acid
	CDAA	2-chloro-N,N-diallylacetamide
	CDEA	2-chloro-N,N-diethylacetamide
	CDEC	2-chloroallyl diethyldithiocarbamate
	CEPC	2-chloroethyl N-(3-chlorophenyl)carbamate
chlorazine		2-chloro-4,6-bis(diethylamino)-s-triazine
chloroxuron		N'-4-(4-chlorophenoxy)phenyl-N,N-dimethylurea
	CIPC	isopropyl N-(3-chlorophenyl)carbamate
	CMA	calcium acid methanearsonate
	CPMF	1-chloro-N-(3,4-dichlorophenyl)-N,N-dimethyl = formamidine
	CPPC	1-chloro-2-propyl N-(3-chlorophenyl)carbamate
cycluron	OMU	3-cyclooctyl-1,1-dimethylurea
cycpromid	S-6000	3,4-dichlorocyclopropanecarboxanilide

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

Common name	Other designation(s)	Chemical name[b]
D		
dalapon		2,2-dichloropropionic acid
	DCB	o-dichlorobenzene
	DCPA, DAC893	dimethyl 2,3,5,6-tetrachloroterephthalate
	DCU	dichloral urea
desmetryne		2-isopropylamino-4-methylamino-6-methyl = mercapto-s-triazine
diallate	DATC, CP15336	S-2,3-dichloroallyl N,N-diisopropylthiol = carbamate
dicamba		2-methoxy-3,6-dichlorobenzoic acid
dichlobenil		2,6-dichlorobenzonitrile
dichlorprop	2,4-DP	2-(2,4-dichlorophenoxy)propionic acid
dichlone		2,3-dichloro-1,4-naphthoquinone
dicryl dicryl	N-4556	3'4'-dichloro-2-methacrylamide
		P,P-dibutyl-N,N-diisopropylphosphinic amide
diphenamid		N,N-dimethyl-2,2-diphenylacetamide
diphenatrile		diphenylacetonitrile
dipropalin		N,N-dipropyl-2,6-dinitro-p-toluidine
diquat		6,7-dihydrodipyrido/1,2-a:2',1'-c/pyrazidi = inium salt
diuron		3-(3,4-dichlorophenyl)-1,1-dimethylurea
	DMPA	O-(2,4-dichlorophenyl) O-methyl isopropyl = phosphoramidothioate
	DMTT	3,5-dimethyltetrahydro-1,3,5,2H-thiadiazine-2-thione
	DNAP	4,6-dinitro-o-sec-amylphenol
	DNBP	4,6-dinitro-o-sec-butylphenol
	DNC	3,5-dinitro-o-cresol
	DSMA	disodium methanearsonate
E		
	EBEP	ethyl bis(2-ethylhexyl)phosphinate
endothall		7-oxabicyclo/2.2.1/heptane-2,3-dicarboxylic acid
	EPTC	ethyl N,N-dipropylthiocarbamate
erbon		2-(2,4,5-trichlorophenoxy)ethyl-2,2-dichloro = propionate
	EXD	ethyl xanthogen disulfide
F		
fenac		2,3,6-trichlorophenylacetic acid
fenuron		3-phenyl-1,1-dimethylurea
fenuronTCA		3-phenyl-1,1-dimethylurea trichloroacetate
	4-CPA	4-chlorophenoxyacetic acid
	4-CPB	4-(4-chlorophenoxy)butyric acid
	4-CPP	2-(4-chlorophenoxy)propionic acid
fluometuron		3-(m-trifluoromethylphenyl)-1,1-dimethylurea

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

Common name	Other designation(s)	Chemical name[b]
H		
	HCA	hexachloroacetone
I		
ioxynil		3,5-diiodo-4-hydroxybenzonitrile
ipazine		2-chloro-4-diethylamino-6-isopropylamino-s-triazine
	IPC	isopropyl N-phenylcarbamate
isocil		5-bromo-3-isopropyl-6-methyluracil
K		
	KOCN	potassium cyanate
L		
lenacil		3-chlorohexyl-5,6-trimethyleneuracil
linuron		3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea
M		
	MAA	methanearsonic acid
	MAMA	monoammonium methanearsonate
	MCPA	2-methyl-4-chlorophenoxyacetic acid
	MCPB	4-(2-methyl-4-chlorophenoxy)butyric acid
	MCPES	sodium 2-methyl-4-chlorophenoxyethyl sulfate
mecoprop	MCPP	2-(2-methyl-4-chlorophenoxy)propionic acid
	MH	1,2-dihydropyridazine-3,6-dione (maleic hydrazide)
metobromuron		N-(p-bromophenyl)-N'-methyl-N'-methoxyurea
molinate	R-4572	S-ethyl hexahydro-1 H-azepine-1-carbothioate
monolinuron		3-(4-chlorophenyl)-1-methoxy-1-methyl-urea
monuron		3-(p-chlorophenyl)-1,1-dimethylurea
monuronTCA		3-(p-chlorophenyl)-1,1-dimethylurea trichloro = acetate
	MSMA	monosodium acid methanearsonate
N		
neburon		1-butyl-3-(3,4-dichlorophenyl)-1-methylurea
norea		3-(hexahydro-4,7-methanoindan-5-yl)-1,1-dimethylurea
	NPA	N-1-naphthylpthalamic acid
P		
paraquat		1,1'-dimethyl-4,4'-bipyridinium salt
	PBA	polychlorobenzoic acid
	PCP	pentachlorophenol
pebulate	PEBC,R-2061	S-propyl butylethylthiocarbamate
picloram		4-amino-3,5,6-trichloropicolinic acid
	PMA	phenylmercuric acetate
prometone		2-methoxy-4,6-bis(isopropylamino)-s-triazine
prometryne		2,4-bis(isopropylamino)-6-methylmercapto-s-triazine

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

Common name	Other designation(s)	Chemical name[b]
propachlor		2-chloro-N-isopropylacetanilide
propanil	DPA	3',4'-dichloropropionanilide
propazine		2-chloro-4,6-bis(isopropylamino)-s-triazine
pyrazon	PCA,H-119-1	5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone
pyriclor		2,3,5-trichloro-4-pyridinol.
S		
sesone		sodium 2,4-dichlorophenoxyethyl sulfate
siduron	H-1318	1-(2-methylcyclohexyl)-3-phenylurea
silvex		2-(2,4,5-trichlorophenoxy)propionic acid
simazine		2-chloro-4,6-bis(ethylamino)-s-triazine
simetone		2-methoxy-4,6-bis(ethylamino)-s-triazine
simetryne		2,4-bis(ethylamino)-6-methylmercapto-s-triazine
	SMDC	sodium N-methyldithiocarbamate
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
	TCA	trichloroacetic acid
triallate		S-2,3,3-trichloroallyl N,N-diisopropylthiol = carbamate
tricamba		2-methoxy-3,5,6-trichlorobenzoic acid
trietazine		2-chloro-4-diethylamino-6-ethylaminol-s-triazine
trifluralin		a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine
trimeturon		1-(p-chlorophenyl)-2,3,3-trimethylpseudourea or N-(p-chlorophenyl)-0,N',N'-trimethylisourea
	2,3,5,6-TBA[c]	2,3,5,6-tetrachlorobenzoic acid
	2,3,6-TBA[c]	2,3,6-trichlorobenzoic acid
	2,4-D	2,4-dichlorophenoxyacetic acid
	2,4-DB	4-(2,4-dichlorophenoxy)butyric acid
	2,4-DEB	2,4-dichlorophenoxyethyl benzoate
	2,4-DEP	tris(2,4-dichlorophenoxyethyl) phosphite
	2,4,5-T	2,4,5-trichlorophenoxyacetic acid
	2,4,5-TES	sodium 2,4,5-trichlorophenoxyethyl sulfate
V		
vernolate	R-1607	S-propyl dipropylthiocarbamate

[a]Herbicides no longer in use in USA are omitted. Complete listing, including these, is in Weeds 14 (4), 1966.

[b]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.

[c]These herbicides usually are available as mixed isomers. When possible the isomers should be identified, the amount of each isomer in 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 minute
hr	hour(s)
ht	height
in	inch(es)
L	liter(s)
lb	pound(s)
mg	milligram(s)
mi	mile(s)
min	minute(s)
ml	milliliter(s)
mm	millimeter(s)
mp	melting point
mph	miles per hour
oz	ounce(s)
ppmv	parts per million by volume
ppmw	parts per million by weight
ppt	precipitate
psi	pounds per square inch
pt	pint(s)
qt	quart(s)
rd	rod(s)
rpm	revolutions per minute
sp gr	specific gravity
sq	square
T	ton(s)
tech	technical
temp	temperature
wt	weight
w/v	weight per volume. Do not use this abbreviation. Instead give specific units (examples: g/L or lb/gal)

Table 2. Abbreviations of terms used in weed control

Abbreviations	Definitions
NCWCC	North Central Weed Control Conference
NEWCC	Northeastern Weed Control Conference
SWC	Southern Weed Conference
WSA	Weed Society of America
WSWS	Western Society of Weed Science (formally Western Weed Control Conference)

HERBACEOUS WEED INDEX

HERBACEOUS WEED INDEX (Continued)

WOODY PLANT INDEX

CROP INDEX