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RESEARCH PROGRESS REPORT

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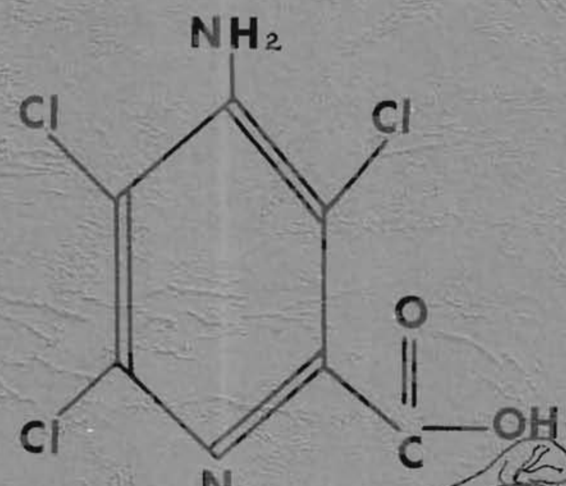

PREFACE

This is the 1970 Annual Progress Report of the Research Committee of the Western Society of Weed Science. It includes reports of the current status of progress in research in weed science conducted throughout the conference area, including the use of herbicides. It does not contain recommendations for the use of such chemicals, nor does it imply that the uses discussed have been registered under the Federal Insecticide, Fungicide, and Rodenticide Act. Some authors have used trade names in their reports. This is done for information purposes only and does not imply endorsement of commercial products by the Western Society of Weed Science nor by the institution by whom the author is employed.

The Research Committee comprises seven projects, each having a chairman. The cooperation of these chairmen in assembling and summarizing their sections and meeting all deadlines is greatly appreciated. J. LaMar Anderson, Business Manager of the Society, bore the burden of arranging for typing and printing of the Report. His help was invaluable.

Jean H. Dawson
Research Committee Chairman
Western Society of Weed Science

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PROJECT 1. PERENNIAL HERBACEOUS WEEDS

Clyde L. Elmore, Project Chairman

SUMMARY

Seven reports were submitted on six different perennial herbaceous weed species from three states. The reports are summarized as follows:

Canada thistle (Cirsium arvense). Control from picloram or combinations of picloram plus 2,4-D persisted for two years. Dormant season dichlobenil treatments controlled Canada thistle only for one season. Dicamba gave good control in Wyoming at 2 lb. per acre. Subsequent crops indicated some tolerance by wheat and sugar beets to dicamba.

Field bindweed (Convolvulus arvensis). Dichlobenil showed excellent season control when layered in a concentrated band below the surface in the spring. Formulation became important in control when only soil incorporated. Soil incorporation or surface application was least effective. Spring treatments were more effective than winter treatments.

Hoary cress (Cardaria draba). Terbacil effectively controlled this species from winter applications. Repeated applications of amitrole were somewhat less effective. Silvex, 2,4-D and diuron also gave top kill from spring applications.

Johnsongrass (Sorghum halepense). In a comparison of dalapon, dalapon plus TCA and MSMA in a non-cropped area it was found that MSMA was more effective than other treatments in reducing stands.

Purple nutsedge (Cyperus rotundus). Soil-applied bromacil in combination with foliar applications of MSMA was more effective than dichlobenil or EPTC in combination with MSMA. Herbicides disked into the soil inhibited growth more than surface application. Five applications of MSMA plus a soil-applied herbicide was the minimum treatment to kill purple nutsedge.

Russian knapweed (Centaurea repens). Picloram or picloram plus 2,4-D gave two year residual weed control of Russian knapweed. Dichlobenil showed control only for one season.

Residual control resulting from treatments of picloram, picloram + 2,4-D combinations and dichlobenil applied as dormant treatments for control of Russian knapweed (Centaurea repens L.) Alley, H. P. and G. A. Lee. A replicated series of plots was established October 27, 1967 on dormant Russian knapweed using various rates of picloram and picloram + 2,4-D combinations. Dichlobenil was applied as an early spring (dormant) treatment. All treatments were applied in 40 gpa water except the 4 percent granular dichlobenil and picloram granules which were applied as formulated granules.

The results obtained the year following the fall treatments were reported in the 1969 WSWS research reports. Residual control obtained approximately two years following application is presented in the following table.

All rates of picloram and picloram + 2,4-D combinations resulted in 100 percent control both one and two years following initial application. Dichlobenil was effective in reducing the Russian knapweed stand only during the year of application. Fifteen months after treatment the Russian knapweed had recovered and/or reinfested the dichlobenil plots to a point where no control was apparent. (Wyoming Agricultural Experiment Station, Laramie, SR-216.)

Residual control of Russian knapweed

Chemical	Rate/A[1/]	% Control 7/17/68	% Control 7/21/69	Remarks
picloram	1/2 lb	100	100	No apparent toxicity to hoary cress in any picloram treated plot
picloram	1 lb	100	100	
picloram	1 1/2 lb	100	100	
picloram + 2,4-D (Tordon-101)	1 gal	100	100	
picloram + 2,4-D (Tordon-101)	2 gal	100	100	
picloram + 2,4-D (Tordon-101)	3 gal	100	100	
picloram + 2,4-D (Tordon-212)	1/2 gal	100	100	
picloram + 2,4-D (Tordon-212)	1 gal	100	100	
picloram + 2,4-D (Tordon-212)	1 1/2 gal	100	100	
picloram (gran) (Tordon beads)	1/2 lb	100	100	

Chemical	Rate/A[1/]	% Control 7/17/68	7/21/69	Remarks
picloram (gran) (Tordon beads)	1 lb	100	100	↓
picloram (gran) (Tordon beads)	1 1/2 lb	100	100	↓
*dichlobenil (4% gran)	4 lb	95		Complete recovery and/or reinfestation of plots treated with dichlobenil
*dichlobenil (4% gran)	6 lb	95		↓
*dichlobenil (4% gran)	8 lb	95		↓
*dichlobenil (WP)	4 lb	50		↓
*dichlobenil (WP)	6 lb	90		↓
*dichlobenil (WP)	8 lb	90		↓

[1/] Rate/A expressed as lbs active except for the picloram + 2,4-D mixtures which were applied as gpa.

* Dormant spring treatments, March, 1968.

<u>Residual control resulting from treatments of picloram, picloram + 2,4-D combinations and dichlobenil applied as dormant treatments for control of Canada thistle (Cirsium arvense L.).</u> Alley, H. P. and G. A. Lee. A replicated series of plots was established October 27, 1967 on dormant Canada thistle using various rates of picloram and picloram + 2,4-D combinations. Dichlobenil was applied as an early spring (dormant) treatment. The picloram + 2,4-D treatments were applied in 40 gpa water. Dichlobenil and picloram granules were applied as the formulated granules.

The results obtained the year following the fall applications were reported in the 1969 WSWS research reports. Residual control obtained approximately two years following application is presented in the following table. All rates of picloram and picloram + 2,4-D combinations resulted in near complete elimination of Canada thistle one and two years following initial application. The dormant spring treatments of dichlobenil (gran.) at 6 and 8 lb/A resulted in 99 percent reduction in Canada thistle stand during the season of application. Fifteen months after treatment the Canada thistle had recovered and/or reinfested the dichlobenil treated plots to a point where no control was apparent. (Wyoming Agricultural Experiment Station, Laramie, SR-224.)

Residual control of Canada thistle

Chemical	Rate/A 1/	% Control 7/17/68	% Control 7/21/69	Remarks
picloram	1/2 lb	95	96	Stand of wild barley reduced in all plots treated with picloram.
picloram	1 lb	98	100	↓
picloram	1 1/2 lb	99+	100	↓
picloram + 2,4-D (Tordon-101)	1 gal	98	94	↓
picloram + 2,4-D (Tordon-101)	2 gal	99	97	↓
picloram + 2,4-D (Tordon-101)	3 gal	100	99	↓
picloram + 2,4-D (Tordon-212)	1/2 gal	99+	94	↓
picloram + 2,4-D (Tordon-212)	1 gal	99+	100	↓
picloram + 2,4-D (Tordon-212)	1 1/2 gal	100	100	↓
picloram (gran) (Tordon beads)	1/2 lb	99	93	↓
picloram (gran) (Tordon beads)	1 lb	100	100	↓
picloram (gran) (Tordon beads)	1 1/2 lb	100	100	↓
*dichlobenil (4% gran)	4 lb	75		Complete recovery and/or reinfestation of plots treated with dichlobenil

Chemical	Rate/A[1/]	% Control 7/17/68	7/21/69	Remarks
*dichlobenil (4% gran)	6 lb	99		Complete recovery and/ or reinfestation of plots treated with dichlobenil
*dichlobenil (4% gran)	8 lb	99		

1/ Rate/A expressed as lbs active except for the picloram + 2,4-D mixtures which were applied as gpa.

* Dormant spring treatments March, 1968.

Effects of herbicides plus cultivation for control of Canada thistle (Cirsium arvense (L) Scop.). Gale, A. F., H. P. Alley and G. A. Lee. Three areas heavily infested with Canada thistle were selected in the spring of 1968 to study the effectiveness and soil residual of dicamba. Each area was plowed and cultivated as needed with sub-surface tillage equipment up to August 1, 1968 allowing regrowth before chemical treatments were made. Dicambe and 2,4-D amine were applied September, 1968 at different rates of dicamba alone and in combination with 2,4-D at the Albany and Big Horn County sites. Two rates of dicamba were applied in Converse County during the latter part of August. All treatments were applied in 27 gpa water.

Evaluations made in the spring of 1969, eight months after initial treatment, are presented in the following table. Dicamba at 2 lb/A resulted in an average of 93 percent control at three locations. The treatment of dicamba at 1 lb/A plus 2,4-D amine at 3 lb/A at two locations averaged 82 percent control. Dicamba at 1 lb/A, used at only one location, gave 80 percent control. All treatments of dicamba at rates over 2 lb/A resulted in over 90 percent control. Very little Canada thistle control was obtained with 2,4-D amine treatments.

Visual injury readings on grass crops seeded in the dicamba treatments indicated winter wheat was the most tolerant followed by corn, oats, spring wheat and barley in order. Slight injury was noted on all crops in the treatment of dicamba at 1 lb/A. As the rates of dicamba were increased, injury symptoms were more severe. Visual injury estimates on broadleaved crops seeded in all dicamba treatments indicated sugar beets were most tolerant followed by alfalfa and dry beans. Sugar beets were established and growing in the treatment of dicamba at 6 lb/A. (Wyoming Agricultural Experiment Station, Laramie, SR-217).

Percent control of Canada thistle obtained with various herbicide treatments at three locations[1/]

Treatment	Rate lb/A[2/]	Percent Control Albany	Big Horn	Converse	Ave
dicamba	1	80			80
dicamba	2	90	96	95	93
dicamba	3	98			98
dicamba	4		95	98	96
dicamba	6	99			99
2,4-D amine	2	0			0
2,4-D amine	3		23		23
2,4-D amine	4		0		0
dicamba + 2,4-D amine	.75+ 1.5	71			71
dicamba + 2,4-D amine	1+ 3	90	74		82
Untreated Check		0			0

1/ Percent control is average plant counts from three replications at Laramie; average plant counts from three sub-samples at Burlington and average of three observations at Douglas.

2/ Active ingredient per acre.

Control of field bindweed (Convolvulus arvensis L.) with dichlobenil. Bayer, D. E., O. A. Leonard and R. K. Glenn. In 1968 two experiments were established on a uniform stand of field bindweed in an old vineyard. One experiment was established January 2, 1968, the second experiment was established March 27, 1968, to take advantage of different amounts of rainfall. Granular and wettable powder formulations of dichlobenil were compared with three methods of application. Rates of 3 and 6 lb/A of dichlobenil was applied to the surface, incorporated into the top 3 inches of soil with a power driven tiller and applied in a concentrated band 3 inches below the surface.

Application Concentrated band	Dichlobenil Rate/A	Ratings made 7-17-68* 1-2-68	3-27-68
Spray	3	8	9
Spray	6	9	9
Granule	3	5	8
Granule	6	6	9

Application Concentrated band	Dichlobenil Rate/A	Ratings made 7-17-68* 1-2-68	3-27-68
Incorporated			
Spray	3	2	2
Spray	6	7	6
Granule	3	3	7
Granule	6	6	7
Surface			
Granule	3	1	0
Granule	6	4	2

* Average of 4 replications -- 0 = no effect
10 = complete kill

Dichlobenil applied in a concentrated band 3 inches below the surface late in the spring just prior to spring growth of the field bindweed provided excellent control for the 1968 growing season. No difference could be noted between the wettable powder and granular formulation. However, if the application was made earlier in the year, before growth of the field bindweed, sufficient dissipation of the dichlobenil occurred before spring and summer growth occurred to reduce the control. (Botany Department, University of California, Davis).

Comparison of several herbicides for hoary cress control. (Cardaria draba). Agamalian, H. Foliage applications of several herbicides were applied to severe infestations of hoary cress in young apple orchards. Applications were made in the spring of 1967 and winter of 1968. Herbicides included in these tests were terbacil at 2 and 4 lb/A., simazine at 2 and 4 lb/A., diuron at 2 and 4 lb/A., dichlobenil at 6 and 12 lb/A., silvex at 1 and 2 lb/A., 2,4,-D at 1 and 3 lb/A., and amitrole at 4 lb/A.

Spring applications were made when the hoary cress was in the early bloom stage. Winter applications were made when the hoary cress was in the pre-bloom stage. Following spring treatments of 1967, top kill was observed on all treatments except simazine and dichlobenil. Ratings observed in the winter of 1968 resulted in excellent control with terbacil at 2 and 4 lb/A. The second most promising application was amitrole. Following winter treatment of 1968, terbacil at 2 lb/A. provided 95% control, terbacil at 4 lb/A. resulted in 100% control. Repeated treatments of amitrole resulted in 60% control of this specie.

Total amounts of water received on these experiments were 12 inches in 1967-68 and 21 inches in 1968-69. Surface soil analysis indicated the following: sand 39.2%, silt 42%, clay 18.8%, O.M. 1.5%. Phytotoxicity ratings on the apple trees show no evidence of herbicide injury with terbacil. Marginal leaf chlorosis on the apples was evident with the dichlobenil treatments at the 12 lb/A. rate.

Response of johnsongrass to dalapon, dalapon + TCA, and MSMA. McHenry, W. B., N. L. Smith and J. T. Yeager. A replicated experiment was initiated in October, 1966, on established johnsongrass located on a canalbank. The purpose of the work was to compare a proprietary formulation of dalapon + TCA (Dowpon-C ®) with dalapon and with MSMA.

Table 1. Johnsongrass control on four dates as the averages of four replications

Herbicide	Acre Rate ai	Acre Rate Formul	Control (10+100%) 11/11/66	9/4/67	11/9/67	5/14/68
MSMA	4 lb	.7 gal	8.0	9.7	9.9	9.9
Dalapon	15*	20¼ lb	5.0	1.5	4.0	4.8
Dalapon + TCA	10*	21½	3.3	1.8	2.3	4.3
Dalapon + TCA	15*	32¼	6.0	2.0	5.5	6.5
Dalapon + TCA	20*	45	6.0	1.0	4.3	3.3
Control	-	-	0.0	0.0	0.0	0.0

* Lb dalapon ae

All treatments were applied in 200 gallons per acre with ½ per cent X-77.

Table 2. Treatment dates

Treatment Dates	Treatments Included
1966--October 24	All
1967--June 21	All (late boot stage)
August 8	MSMA only
September 21	All (MSMA spot treat.)

Results from this experiment suggest that MSMA results in a more rapid stand reduction than either dalapon or dalapon + TCA using a spray volume of 200 gpa and 1/2% surfactant. (Univ. of Calif., Agric. Ext. Service, Davis).

Response of purple nutsedge to herbicide combinations. Hamilton, K. C. The responses of purple nutsedge (*Cyperus rotundus* L.) to three herbicides incorporated into the soil by two methods followed by repeated, foliar applications of MSMA was studied at Tucson, Arizona. Ninety-six plants were established from single tubers from a single purple nutsedge plant in April of 1967. Plants were spaced 10 by 15 ft apart and maintained vegetatively by mowing during the first season. Annual weeds were controlled by applications of low rates of simazine and trifluralin to the soil (sand 60%, silt 25%, and clay 15%). Plants averaged 188 aerial stems when treatments started in March of 1968. Irrigation schedules were similar to that required by cotton.

Bromacil, dichlobenil, and EPTC at 8 lb/A were applied to the soil and incorporated by disking or flood-irrigation on March 15, 1968. Where topgrowth was present, 10 lb/A of MSMA in 80 gpa of water containing 1/4% of a blended surfactant was applied every 4 weeks. Each plot contained four plants and treatments were replicated four times. The number of living aerial stems on each plant was estimated before each application and in the spring of 1969.

Herbicides disked into the soil inhibited regrowth of nutsedge more than herbicides applied to the soil surface and irrigated.

However, inhibiting regrowth reduced the number of foliar application of MSMA and resulted in less control in a single year. Bromacil was the most effective soil-applied herbicide in combination with the foliar applications of MSMA, while EPTC was the least effective (see table). At least five applications of MSMA following soil-applied herbicides were needed to kill nutsedge. Many nutsedge plants weakened by herbicide combinations did not survive the winter. (Arizona Agric. Expt. Sta., University of Arizona, Tucson.)

Nutsedge plants with topgrowth and number of stems per plant after soil applications of three herbicides and repeated foliar applications of MSMA

Treatments in 1968			Date of observation			
			1968			1969
Soil-applied herbicide	Method of incorporation	Number of MSMA treatments	March 15	June 17	Oct. 7	April 15
			Plants with topgrowth			
Bromacil	Irrigate	5	16	1	0	0
Bromacil	Disk	6	16	9	6	0
Dichlobenil	Irrigate	7	16	12	2	1
Dichlobenil	Disk	5	16	1	8	2
EPTC	Irrigate	7	16	9	12	1
EPTC	Disk	6	16	8	15	11
			Stems per plant			
Bromacil	Irrigate	5	192	1	0	0
Bromacil	Disk	6	159	7	2	0
Dichlobenil	Irrigate	7	199	21	5	1
Dichlobenil	Disk	5	172	5	13	3
EPTC	Irrigate	7	189	51	28	1
EPTC	Disk	6	215	12	30	9

PROJECT 2. HERBACEOUS RANGE WEEDS

E. H. Cronin, Project Chairman

SUMMARY

Only two reports were received concerning control of herbaceous range weeds. Both were submitted by the same researchers at the University of Wyoming. They report evaluations of rates and timing of applications of herbicides for the control of Geyer larkspur (*Delphinium geyeri* Greene).

Rates of 1 or 2 lb/A of various formulations of 2,4-D were applied at 3 stages of growth of Geyer larkspur on each of 3 successive years. Little difference was detected between the various rates and dates of application. Applications of 2,4-D on 2 successive years eliminated approximately 30-45 percent of the Geyer larkspur.

Mixtures of picloram and 2,4-D and picloram and 2,4,5-T were applied at 3 rates when the Geyer larkspur was in the 6-10 in. stage of growth. All of the treatments eliminated 97% or more of the poisonous weed one year after treatment. Two years after the treatments were made the plots contained 1 percent of less of the original population.

Larkspur (Delphinium geyeri Greene) control resulting from two successive years treatment with 2,4-D. Alley, H. P. and G. A. Lee. A time series study was initiated in the spring of 1967 to evaluate the effectiveness of 2,4-D when applied at three different stages of growth of larkspur. The original plots have been maintained and three successive treatments have been applied over a three year period. The larkspur was treated when the established plants were: (1) seedling to 3-4 in. leaf height; (2) plants 4-6 in. leaf height; and (3) plants 6-8 in. leaf height. Retreatments applied in 1968 and 1969 correspond to stages of growth of the original treatment.

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

Although no treatment, at any of the three stages of growth, resulted in satisfactory reduction in larkspur stand from one application there was an indication that treatments made at the later date were more effective than treatments made at the earlier stages of growth. Stand counts obtained in 1969, after two years treatment, show that the highest stand reduction, 46 percent, resulted from the 2 lb/A treatment of 2,4-D (PGBE) applied at the late May (6-8 in. leaf height) treatment date; however, there is very little difference between the respective rates and dates of application.

Information from this research indicates that two years of 2,4-D treatment will eliminate approximately 30-45 percent of the larkspur. (Wyoming Agricultural Experiment Station, Laramie, SR-215).

Larkspur control resulting from dates of application and two successive years of treatment with 2,4-D[1/]

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

1/ Original treatment dates and stage of growth of larkspur.

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

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

2/ Percent control determined by comparing counts obtained from plots receiving one and two successive treatments with original counts taken before the 1967 application.

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

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

The lowest rate of application (1 qt/A) of both the picloram + 2,4,5-T and picloram + 2,4-D resulted in 99-100 percent control two years following application. These rates of application would be equivalent to 1/4 lb/A picloram and 1/4 and 1/2 lb/A 2,4,5-T and 2,4-D, respectively.

The picloram + 2,4-D or 2,4,5-T combination show promise of eradicating Geyer larkspur on heavily infested ranges. However, picloram has clearance for use only on non-cropland areas and cannot be suggested as a control measure on rangelands utilized by livestock. (Wyoming Agricultural Experiment Station, Laramie, SR-213).

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

Treatment[1/]	Larkspur counts[2/] Rate/A	1967	1968	1969	% Control 1968	1969
picloram + 2,4,5-T (Tordon-225)	1 qt	312	8	1	98	99+
picloram + 2,4,5-T (Tordon-225)	2 qt	277	8	1	97	99+
picloram + 2,4,5-T (Tordon-225)	3 qt	322	2	0	99	100
picloram + 2,4-D (Tordon-212)	1 qt	324	6	0	98	100
picloram + 2,4-D (Tordon-212)	2 qt	359	4	0	99	100
picloram + 2,4-D (Tordon-212)	3 qt	336	0	1	100	99+

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

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

PROJECT 3. UNDESIRABLE WOODY PLANTS

Lisle R. Green, Project Chairman

SUMMARY

Ten progress reports were submitted by 7 authors covering work underway in 5 states.

From Washington, Dwight Peabody reported atrazine and linuron to be effective herbicides for use in Christmas tree plantations, except that the higher rates used seemed to reduce tree growth. Nitrogen fertilizer had no consistent effect on growth of shore pine. Atrazine also reduced growth of black cottonwood as compared to propazine and simazine, all at 4 pounds per acre. Within the limits of fertilizer rates used, black cottonwood growth increased with fertilizer rate.

Gratkowski in Oregon found that low volatile esters of 2,4,5-T and picloram-phenoxy herbicide mixtures failed to kill salal when applied as foliage sprays in late July. Greatest effect was a limited defoliation and slight top kill. He was more successful in controlling thimbleberry, best results being obtained with 1 pound each of picloram, 2,4-D and 2,4,5-T. However, this herbicide defoliated young Douglas-fir trees. The 2,4,5-T controlled thimbleberry almost as well, but without serious damage to trees. Gratkowski also demonstrated that heat treatments, such as might occur during wildfire, induces germination of varnishleaf ceanothus seed.

Alley and Lee reported excellent control of fringed sagebrush at all growth stages between early rosette to full-leaf, providing soil moisture was adequate. Herbicides, all about equally effective, included phenoxys and picloram - 2,4-D combination. Growth of native grass increased 4 to 8 times over controls where sagebrush was controlled.

The Bureau of Land Management in operational aerial herbicide applications of 2,4-D and 2,4-5-T esters, has consistently killed all chamise sprouts, and from 60 to 100 percent of sprouting chamise with one spray. Three successive annual sprays were necessary to kill toyon and liveoak sprouts. Mixtures containing picloram were more effective than those lacking it, on mature chamise in test plots.

Davis and Ingebo applied fenuron at 23 lbs. a.e./A along major stream channels through their Arizona test area, then determined quantities present in runoff water. Greatest concentration, 0.43 ppm, was carried off shortly after treatment by heavy rains and runoff. This gradually declined through the rainfall season to 0.06 ppm. During the second year, fenuron concentrations between .05 and .014 ppm were detected. About 2.4 percent of applied fenuron left the watershed in 27 months. Rainfall had been 27 and 50 inches during the two years.

Green and associates in southern California applied herbicides containing picloram at 1, 2, and 4 pounds per acre to mature chaparral on small watersheds. Runoff water contained 0.125, 0.50 and > 0.50 ppm picloram after the first storm. These figures were halved by 6 inches of rain, and reduced to one-fourth the original values by 3 additional inches of rain. A year later, after 40 inches of rain, runoff water from the three watersheds contained 0.002, .002, and .004 ppm of picloram. The surface soil contained considerably more picloram than depths below 6 inches throughout the period of study, and there was a continuous decline in the picloram concentration in the soil. Herbicides containing picloram were more effective in killing brush than was brushkiller (2,4-D - 2,4,5-T).

Leonard and associates found metham and dichlobenil to be promising herbicides for control of roots in sewer lines, with dichlobenil being most effective in suppressing root growth during laboratory tests. In actual sewer line tests, metham at 5000 ppm, or this plus dichlobenil at 100 ppm killed roots after one hour exposure, including, usually, those in the joints or a few cm beyond. Injury to trees is expected to be rare when proper concentrations and periods of treatment are fully worked out.

Combination fertilizer-herbicide test in shore pine Christmas trees. Peabody, Dwight V., Jr. Both atrazine and linuron have been shown to be effective herbicides for use in Christmas tree plantations. In the early spring of 1966 and again in 1968 these two herbicides, both alone and in various combinations, were applied to young shore pine (*Pinus contorta*) transplants in order to determine their effect on tree growth and vigor. In addition to the herbicide treatment, annual nitrogen (urea) applications were side dressed each year for three years after planting: 50 lbs. of N per acre the year of planting; 100 lbs. of N per acre the year after planting and 150 lbs. of N per acre the second year after planting. The following table summarizes the effects of the herbicidal treatments both with and without nitrogen on the growth of the trees after the third season.

Measurement of tree height and diameter of 1966 shore pine Christmas tree test

TREATMENT			TREE	
			Height 3-18-69	Diameter[1] 3-21-69
Herbicide	Rate	Fertilizer	ft.	mm
Cultivated Check	--	No Nitrogen	3.36 a	44.70 a
Linuron	2	Nitrogen	3.35 ab	38.60 bcd

TREATMENT			TREE	
Herbicide	Rate	Fertilizer	Height 3-18-69 ft.	Diameter[1] 3-21-69 mm
Cultivated Check	---	Nitrogen	3.22 ab	42.35 ab
Atrazine	4	No Nitrogen	3.22 ab	39.10 bcd
Linuron + Atrazine	2 + 4	No Nitrogen	3.18 ab	41.77 ab
Linuron	2	No Nitrogen	3.15 abc	39.02 bcd
Linuron	4	No Nitrogen	3.14 ab d	38.80 bcd
Linuron + Atrazine	2 + 4	Nitrogen	3.14 abc	37.70 cd
Atrazine	8	No Nitrogen	3.05 abcd	37.50 cd
Atrazine	8	Nitrogen	3.01 bcd	37.73 cd
Atrazine	4	Nitrogen	3.01 bcd	39.95 bc
Linuron	4	Nitrogen	2.96 bcd	35.47 de
Linuron + Atrazine	4 + 8	Nitrogen	2.94 bcd	36.50 cde
Linuron + Atrazine	4 + 8	No Nitrogen	2.84 cd	33.17 ef
Non-cultivated Check	---	Nitrogen	2.76 d	25.93 g
Non-cultivated Check	---	No Nitrogen	2.76 d	26.18 g
Mean			3.07	37.15
$SE_{\bar{x}}$			0.097	1.25
CV			7%	8%

[1] Measurement taken just above root collar.

In general these results indicate that (1) the higher rates of linuron and atrazine either alone or in combination seem to cause a growth reduction in shore pine, and (2) nitrogen fertilization has no consistent effect on shore pine growth. (Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon).

Fertilizer-herbicide-spacing field test in black cottonwood. Peabody, Dwight V., Jr. In early spring of 1967, black cottonwood (*Populus trichocarpa*) whips were planted at three different spacings in a silt loam soil which had received three fertilizer treatments. Two weeks later atrazine, propazine and simazine each at 4 lbs. active ingredient per acre were applied to the different spacings and fertilizer treatments. The following table lists the treatment combinations and summarizes the green matter yields harvested from each combination treatment two growing seasons after planting.

The following general conclusions can be made from this experiment after the first cutting: (1) as spacing was increased, green weight yields per unit area decreased; (2) atrazine reduced tree growth as compared to the other two herbicide applications; and (3) usually within any given spacing and herbicide treatment, the more fertilizer used, the greater the yield. (Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon).

Treatment schedule and green matter yield from first cuttings of 1967 cottonwood planting

Herbicide 4# ai/A	Spacing ft.	Fertilizer lbs./Acre	Green Yield based on Trees Present lbs./Acre
Atrazine	1 x 1	0-0-0	30,451 abcde
Atrazine	1 x 1	400-0-0	31,581 abcd
Atrazine	1 x 1	400-400-400	40,878 a
Atrazine	2 x 2	0-0-0	16,335 g---k
Atrazine	2 x 2	400-0-0	22,556 d---i
Atrazine	2 x 2	400-400-400	22,964 d---i
Atrazine	4 x 4	0-0-0	10,577 jk
Atrazine	4 x 4	400-0-0	5,990 k
Atrazine	4 x 4	400-400-400	9,760 jk
Simazine	1 x 1	0-0-0	29,035 b---f
Simazine	1 x 1	400-0-0	39,027 ab
Simazine	1 x 1	400-400-400	36,345 abc
Simazine	2 x 2	0-0-0	29,090 b---f
Simazine	2 x 2	400-0-0	28,042 b---f
Simazine	2 x 2	400-400-400	26,449 c---g
Simazine	4 x 4	0-0-0	9,488 jk
Simazine	4 x 4	400-0-0	11,571 ijk
Simazine	4 x 4	400-400-400	17,601 f---k
Propazine	1 x 1	0-0-0	22,869 d---i
Propazine	1 x 1	400-0-0	33,800 abcd
Propazine	1 x 1	400-400-400	35,760 abc
Propazine	2 x 2	0-0-0	12,115 ijk
Propazine	2 x 2	400-0-0	19,915 e---j
Propazine	2 x 2	400-400-400	24,053 d---h
Propazine	4 x 4	0-0-0	8,208 k
Propazine	4 x 4	400-0-0	11,748 ijk
Propazine	4 x 4	400-400-400	13,245 hijk
Mean			22,201
$SE_{\bar{x}}$			3,467
CV			27%

Foliage sprays fail on salal. Gratkowski, H. Amitrole-T, low volatile esters of 2,4,5-T, and mixtures of picloram with phenoxy herbicides did not kill salal (Gaultheria shallon) when applied as foliage sprays during late July. These herbicides were tested on a dense, 2-foot-tall stand of this resistant shrub in the Coast Ranges in southwestern Oregon.

Treatments included: (1) amitrole-T (21 percent active ingredient) at 1½ gal per acre; (2) a low volatile ester of 2,4,5-T at 3 lb ae per acre; (3) a mixture containing ½ lb ae of picloram and 2 lb ae of 2,4,5-T as triisopropanolamine salts applied at a rate of 1½ gal per acre; and (4) a mixture containing 1 lb each of picloram, 2,4-D, and 2,4,5-T applied at 1½ gal per acre. An oil-in-water emulsion was used as a carrier for the 2,4,5-T. Amitrole-T and the picloram mixtures were applied in water carriers.

When examined 15 months later, none of the herbicides had killed salal. The greatest effect on any plot consisted of a limited defoliation and slight top kill--an unacceptable degree of control for site preparation or release of small coniferous trees. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon.)

Screening tests on thimbleberry. Gratkowski, H. Thimbleberry (Rubus parviflorus) is a troublesome brush species on forest land in the Pacific Northwest. It is a major component of most Coast Ranges brushfields and rapidly dominates sites after aerial spraying to release conifers from taller brush and weed trees.

On July 23, 1966, two formulations of picloram (M-2951 and M-3083) were applied as foliage sprays on thimbleberry in the Oregon Coast Ranges. M-2951 contains ½ lb ae of picloram plus 2 lb ae of 2,4,5-T per gallon; M-3083 contains 1 lb each of picloram, 2,4-D, and 2,4,5-T per gallon in the form of triisopropanolamine salts. Amitrole-T (21% active ingredient) at a rate of 1½ gal per acre and a low volatile ester of 2,4,5-T were included for comparison. A 2-percent oil-in-water emulsion was used as the carrier for 2,4,5-T; other herbicides listed above were applied in water carriers. Tordon 10K, containing 10 percent ae as the potassium salt, was also tested at rates of 10 and 30 lb of pellets per acre.

Response to treatment was rated 15 months later using the Dow Rating System based on 10 observations per plot.

Herbicide	Treatment Rate/acre	Carrier	Degree of control [1]
Amitrole-T	1½ gal	Water	2
Tordon 10K	10 lb	None	2
Tordon 10K	30 lb	None	2
M-2951	1½ gal	Water	2
2,4,5-T	3 lb	Emulsion	4
M-3083	1½ gal	Water	4.5

1/ A rating of 1 indicates little or no effect; a rating of 5 indicates shrub or tree is dead.

Low volatile esters of 2,4,5-T at a rate of 3 lb ae per acre produced a degree of control almost equal to that obtained with 1½ gallons of M-3083 per acre. In addition, 2,4,5-T had almost no effect on young Douglas-firs in this late July treatment; M-3083 defoliated and damaged the trees.

Where conifers are to be released from thimbleberry, low volatile esters of 2,4,5-T would be preferable to the mixture of herbicides in M-3083. For site preparation where no conifers are present, the 2,4,5-T treatment should produce as good control of thimbleberry at lower cost than would M-3083. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon.)

Heat-induced germination of varnishleaf ceanothus seeds. Gratkowski, H. Varnishleaf ceanothus (*Ceanothus velutinus* var. *laevigatus*) is one of the most widespread and abundant brush species on forest land in western Oregon. Each year, the shrubs produce large amounts of seed that are incorporated in the soil. A high percentage of this is hard seed that evidently lies dormant but viable in the soil for years after dissemination. A laboratory experiment has shown that high soil temperatures during wildfires or burning of logging debris will induce germination of these dormant ceanothus seeds in the soil.

Varnishleaf seeds were buried for periods of 4, 13, 22, 31, or 40 minutes in fine sand preheated and maintained at soil temperatures of 30°, 60°, 75°, 90°, 105°, or 120° Centigrade. Each treatment was replicated four times in a 5 x 8 factorial experiment in a randomized block design. Thermocouples and a recording potentiometer were used to control soil temperatures during treatment period. All seeds were stratified for 3 months after heat treatment.

Soil temperatures of 60°C or less did not cause the seeds to germinate. Approximately 1/3 of the seeds germinated after exposure to 75°C soil temperatures, but maximum germination was obtained from seeds exposed to soil temperatures of 90° and 105°C. A 120°C soil temperature was evidently in the lethal range for these seeds. Germination decreased with increasing duration of exposure to a soil temperature of 120°. Additional exposure beyond 4 minutes had no further effect on germination at soil temperatures up to and including 105°C. Although the seeds became permeable within 4 minutes, continued exposure even to soil temperatures of 105°C had no effect on viability of the seeds. (Pacific N.W. Forest and Range Expt. Sta., Forest Service, U.S. Dept. of Agric., Roseburg, Oregon.)

Evaluation of a time series study and various herbicides for the control of fringed sagebrush (*Artemisia frigida* Willd.). Alley, H. P. and G. A. Lee. Fringed sagebrush is becoming more prevalent on many thousands of acres of rangeland. Control from use of phenoxy herbicides has been somewhat erratic between years. Information needed to determine whether moisture conditions or stage of growth at time of application might cause the variation in control is not available.

A time series study was established in 1968 in hopes of determining if stage of growth had any effect on the control obtained. Plots were 1/2 acre in size; all treatments were applied in 25 gpa water with a truck mounted spray rig. Applications were made at three stages of growth of the fringed sagebrush (1) early rosette, (2) 3 1/2 - 4 in. plant height, and (3) 4-5 in. plant height. The experimental area was a heavily infested rangeland pasture, soil type was a sandy loam and precipitation during the months treatments were made was above normal and adequate for vigorous plant growth.

All treatments resulted in near complete elimination of the fringed sagebrush regardless of stage of growth, and clipping measurements showed a 400 to 700 lb/A increase of native grass species. The unsprayed area produced only 140 lb/A air-dry grass forage and 996 lb/A air-dry fringed sagebrush.

Results from this study indicate that outstanding control can be obtained any time between the early rosette stage of growth to when the fringed sagebrush plant is fully leafed when soil moisture is adequate. (Wyoming Agricultural Experiment Station, Laramie, SR-214).

Control of fringed sagebrush and increase in native forage production resulting from control of fringed sagebrush

Treatment[1/]	Rate/A	Percent control[2/]	Production lb/A[3/] Native grass	Fringed sagebrush
2,4-D (LVE)	1 lb	99+	611	14
2,4-D (LVE)	2 lb	99+	633	10
2,4,5-TP	1 lb	99+	562	-
2,4,5-TP	2 lb	99+	697	-
picloram + 2,4-D (Tordon-212)	1 qt	99+	842	-
picloram + 2,4-D (Tordon-212)	2 qt	100	822	
picloram + 2,4-D (Tordon-101)	1 qt	99+	802	
Check			140	996

1/ Plots established:

1) 5/29/68 - early rosette
2) 6/12/68 - 4¼-4 in. plant height
3) 7/01/68 - 4-5 in. plant height

2/ Percent control an average of all three dates of application.

3/ Air-dry weight.

Using herbicides to control sprouting and mature chaparral species. Burma, George. Since 1958 the Bureau of Land Management has sprayed to kill brush seedlings and sprouts the spring following burning the brush and subsequent fall seeding. The mixture used has been 2 pounds, 2,4-D, 1 pound of 2,4,5-T, 2 to 3 quarts of diesel fuel and enough water to make up five gallons of spray material applied at the rate of 5 gallons per acre. The herbicides used have been the low volatile ester of Iso-Octyl Ester, Propylene Glycol Butyl Ether Ester and Butoxyethanol Ester. The first three years application was made by aeroplanes but since 1961 application has been limited to helicopters because of the rough terrain. Time of application has been from April 15 to May 31, more often from May 1 to May 15. The results have been a 100% kill of Chamise seedlings and from 60% to 100% kill of Chamise sprouts. We have no explanation as to the varying results in kill of chamise sprouts. To kill toyon and liveoak sprouts it has been necessary to spray 3 years in succession.

In cooperation with UC, Davis, plots have been sprayed by helicopter using low volatile ester mixtures of 2,4-DP and 2,4-D, 1 lb. each of Tordon 2,4-D and 2,4,5-T, and amine mixture of 1 lb. Tordon and 2 lbs. 2,4-D. Preliminary data indicates that the 2,4-DP and 2,4-D mixture is less effective on chamise than the regular BLM mixture. Mixtures including Tordon are more effective, especially on old growth chamise, than the regular BLM mixture. (Folsom District, Bureau of Land Management, Folsom, California).

Fenuron contamination of stream water from a chaparral watershed in Arizona. Davis, E. A. and P. A. Ingebo. Fenuron is proving to be an effective herbicide for reducing brush density on experimental watersheds in Arizona. Amount and duration of stream water contamination are important considerations if fenuron is to be used widely on watershed lands. Results from a partially treated chaparral watershed in central Arizona show that relatively low concentrations of fenuron persist in the stream water for as long as 2 years after treatment.

Pelleted fenuron (884 pounds active material) was applied in March 1967 to 38 acres of mixed chaparral along the major stream channels of a 246-acre watershed (Whitespar B). The rate of application on the channel strips was 23 pounds active fenuron per acre. The pellets were applied by hand to the soil surface beneath shrubs; intershrub areas were not treated. The soil is a fine gravelly sandy loam of granitic origin.

Water samples were collected from streamflow at the gaging station, and were analyzed by the standard colorimetric procedure in which fenuron is hydrolyzed to aniline. By this method, breakdown products of fenuron which yield aniline on hydrolysis are also measured as fenuron.

Fenuron was detected in the stream water before rain fell, probably due to direct contamination of localized channel flowers during treatment of shrubs in the channel bottoms. The highest concentration detected in the stream water, 0.43 ppm, was measured 33 days after treatment following heavy rains. Subsequent concentrations during the first year ranged from 0.06 to 0.28 ppm; the higher concentrations generally were associated with periods of rainfall. As time passed, however, periods of heavy rainfall produced lower fenuron concentrations.

One year after treatment, cumulative rainfall at the streamgage was 27.2 inches, cumulative streamflow was 2.2 inches, and the fenuron concentration was 0.06 ppm. During the second year, the fenuron concentration ranged from 0.014 to 0.05 ppm. Cumulative rainfall for the 2-year period was 49.9 inches, and streamflow was 4.4 inches. Trace amounts of fenuron, its breakdown products, or both were still present in the stream water 27 months after treatment. These levels of stream water contamination resulted from treating only 15 percent of the watershed.

Actual fenuron loss from the water shed measured on 49 sampling dates was 2.6 pounds. From this sample, it is estimated that 21 pounds, or 2.4 percent, of the applied fenuron left the watershed via stream water during the 27 months after treatment. This probably represents a maximum loss figure, since the sampling dates on which the estimate was based included a disproportionate number of days with high fenuron losses (days of high streamflow). A single high streamflow day produced 58 percent of the measured loss; 6 days accounted for 82 percent.

The relatively small amount of fenuron which left the watershed in stream water indicates that the chemical was highly retained by the watershed. One measure of an herbicide's contamination potential is the extent to which it is retained within the treated area. On this basis it appears that fenuron has a low contamination potential. Before fenuron is considered for widespread use on watershed lands, however, studies are needed to determine the effects of low contamination levels on the food chain in streams and lakes, fish, wildlife, and domestic animals, and the suitability of such water for drinking purposes. (Rocky Mountain Forest and Range Experiment Station, Forest Service, USDA, Forest Hydrology Laboratory, Arizona State University, Tempe, Arizona.)

Effect of picloram and phenoxy herbicides in small chaparral watersheds. Green, Lisle R. In June 1967, several combinations of 2,4-D, 2,4,5-T, and picloram were broadcast sprayed by helicopter onto mature chamise chaparral in samll southern California watersheds. We monitored the picloram in runoff water and in the soil, and recorded effects of the herbicides on several brush species.

The first runoff following spraying was in August 1967, and water samples collected at the lower end of watersheds that received 1, 2, and 4 pounds of picloram per acre contained 0.125, 0.50, and > 0.50 ppm picloram, respectively. After four inches of rainfall in September and two more in November, about half as much picloram was detected by bio-assay as following the first storm. In January, after a 3-inch storm, picloram in the runoff was about one-fourth the original values. Rainfall of about 2½ inches in March and April (approximately 15 inches total following spray application) reduced picloram still farther, to 0.008, 0.03, and 0.03 ppm in runoff water from the same three watersheds. One year later, in March 1969, after 40 inches of rainfall, the values were 0.002, 0.002, and 0.004 ppm. Picloram was never detected in a small reservoir about 5 miles downstream from the study site.

Soil samples were collected in July 1968, but were contaminated during storage. Samples taken after one year (15 inches rainfall) and two years (40 inches rainfall) contained picloram as ppm of soil as follows:

Collection date	Soil depth (in.)	Picloram application rate per acre 2	4
April 1968	0-6	.06	.06
	6-12	.04	.04
	12-18	.03	.05
May 1969	0-6	.003	.003
	6-12	.0008	.0012
	12-18	.0005	.0005

All of the herbicide combinations defoliated the dominant shrub, chamise, in varying degrees, and there was stem sprouting and stem dieback throughout the first year. In July 1968 the apparent chamise kill with picloram at 2 pounds per acre was better than with heavier or lighter picloram, or with picloram - 2,4-D - 2,4,5-T combinations, but there was stem sprouting on scattered plants. In the watershed sprayed with 4 pounds picloram, an estimated 80 percent of chamise plants had vigorous stem sprouts. The 2,4-D - 2,4,5-T ester treatment defoliated faster than other treatments, but by July had more stem sprouting than with any treatment containing picloram.

Vegetation was observed again in August 1969, and results expressed as percent of plants that were dead:

Herbicide			Shrub species				
Picloram	2,4-D	2,4,5-T	Chamise	Red shank	Manzanita	Sugar bush	Scrub oak
(lbs.	per	acre)					
1	2	2	1	0	0	40	0
1/2	2	2	70	0	75	50	0
1	2	0	30	0	10	45	0
1	4	0	25	0	30	45	-
2	0	0	75	0	40	90	65
4	0	0	20	-	-	60	-
0	2	2	10	7	5	50	-

(Cooperative investigations of U.S.D.A., Forest Service, Pacific Southwest Forest and Range Experiment Station, Riverside, Calif., Agronomy Dept., University of California, Riverside, and California Division of Forestry, Riverside.)

Studies related to control of tree roots in sewer lines. Leonard, O. A., J. F. Ahrens, and Neal Townley. These studies were undertaken because of the economic importance of root problems in sewer lines of urban areas.

Eucalyptus (*E. camaldulensis*), willow (*Salix* sp.), and grape (*Vitis vinifera*) were grown in 15-cm diameter pots containing a sand-peat mix. A hole, 2.5 to 4.0 cm in diameter, was made in the bottom of each pot to enable the roots to grow into the moist air beneath them; the latter was possible because the pots were placed on 1500 ml-capacity cans having vermiculite at the base, but with holes to prevent the accumulation of free water. The trees were fertilized to promote vigorous shoot and root growth. When root growth had developed abundantly in the cans, the herbicide treatments were made for periods of 1 minute to 24 hours, with most of the treatments being for 1 hour. This was done by placing the roots in similar cans containing 1000 ml of herbicide solution, thus soaking all roots 4.8 cm and further from the base of the pots. After being treated the roots were either washed with tap water to remove unabsorbed herbicide or were allowed to drain without washing. The pots containing the plants were then placed on the original cans. Records were kept on injury to roots and shoots for six weeks, at which time the plants were harvested for obtaining more detailed information on the nature and extent of injury to the plant.

Although several herbicides were employed in these trials, the most promising results were with metham and dichlobenil (wettable powder), or a combination of the two. Some comments on results are (1) roots could be killed by a 1 minute dip with metham under some conditions and root killing extended from 0 to 13 cm above the point treated, (2) killing was related to the concentration of metham used, being greater at 5000 ppm than at 2000 ppm and being greater with a combination of metham and dichlobenil than by either herbicide alone, (3) killing was reduced by reducing water uptake by transpiration (by removing the leaves), (4) upward kill of roots above the point treated was related to the percentage of the whole root system that was treated, (5) shoot injury could be encountered by extended treatment with metham but not with dichlobenil, (6) one hour of treatment seemed desirable when using dichlobenil alone, with 100 ppm being superior to 10 ppm, (7) dichlobenil was more effective in suppressing root regrowth than metham, (8) washing the roots following treatment reduced the kill.

A replicated trial in the sewer lines of Sacramento County produced some promising results. Briefly stated it appears that root in sewer lines flooded for one hour were killed by metham at 5000 ppm or by metham at 5000 ppm plus dichlobenil at 100 ppm; dichlobenil at 100 ppm appeared promising but further observations are needed. In addition to killing roots in the lines, roots were usually killed in the joints, and even outside of the joints for 3 to 15 cm. In one instance, a mulberry was injured. In lathhouse trials it was noted that metham was transported in the wood and did not always kill the overlying bark. When not killed, rather rapid recovery appears to take place. It is hoped that by reducing the concentration of metham in the lines and the period of treatment that injury to trees will be rare. (Botany Department, University of California, Davis, California; The Connecticut Agricultural Experimental Experiment Station, Windsor, Connecticut; Utilities Division of Sacramento County, Sacramento, California.)

PROJECT 4. WEEDS IN HORTICULTURAL CROPS

James McKinley, Project Chairman

SUMMARY

A total of 22 reports were submitted from Washington, Oregon, Utah, California, Colorado and Texas. The reports included results from herbicide trials conducted on vegetables, fruits and ornamentals.

FRUITS

Deciduous: California workers have screened a number of new herbicides on prunes and have found several to have more safety than simazine or terbacil. These are R-7465, SD-15179, RH-315, S-6706, RP-17623, CP-44939, nitralin and nitrofen and combinations of linuron and amitrole. In this year's work, unlike previous trials at the same location, simazine under flood irrigation was safer than terbacil on a pound-for-pound basis on prunes.

Herbicide tolerance on figs showed several herbicides to be safer than simazine. These were dichlobenil, R-7465 and nitralin. On black walnuts, R-7465 and SD-15179 showed excellent safety.

An Oregon research worker reported testing eleven new herbicides and found none of these to be superior to terbacil on apples. On newly planted apple, pear, cherry and prune trees, good selectivity was obtained from S-6115, AP-920 and BAY-88410, also good weed control was obtained but some crop injury was observed on cherries and prunes. On young filbert plantings, best overall performance was obtained with dichlobenil, S-6115 and SD-15418.

Trials were established in Utah on young sweet and sour cherries to compare present weed control recommendations with several new materials and combinations. Terbacil was impressive in its ability to retard growth of white top and field bindweed, but was too phytotoxic for use in young cherries. GS-14254 had considerable foliar activity and was the most promising of the numbered compounds tested.

Paraquat combination trials were conducted on an established cherry orchard. Paraquat alone allowed considerable regrowth of puncturevine and field bindweed. Paraquat applied over the top of GS-14254 and terbacil gave the best weed control of any combination tested.

Grapes: Herbicide screening trials on grapes in California showed that several new compounds gave as much or more safety for the weed control than simazine. These herbicides included OCS-438, R-7465, S-6706, CP-44939, RP-17623, nitralin and diphenamid plus dinitro.

Cranberries: In three years of trials with cranberries in Western Oregon, it has been found that certain weed species can best be controlled by delaying herbicide applications until after dormancy is ended in the cranberry plant. The later these applications are made the greater the yield loss may be due to injury.

VEGETABLES

Cucurbits: Trials conducted in Oregon showed the best performance and greatest crop safety was obtained on cucumbers with combinations of amiben plus bensulide or amiben plus naptalam.

Weed control and crop tolerance in canteloupe, cucumbers and watermelon was studied by a Colorado research worker. A number of the treatments provide acceptable weed control. However, the major differences between treatments was crop tolerance. Amiben plus naptalam was best in the series. DCPA, bensulide and amiben ester also provided good weed control with adequate crop tolerance.

Research workers in Washington showed by combining both a fungicide dexon and "pop-up" fertilizer with the herbicide SD 15418, little or no cucumber yield reduction or plant injury occurred. However, when dexon alone or "pop-up" fertilizer with the herbicide SD 15418 treatment, cucumber injury and yield reductions were severe and definite.

Onions: Three papers on onion weed control were submitted from California, Oregon and Texas. Work conducted in California indicated that weed control was enhanced with the application of surfactants and non-phytotoxic oil with chloroxuron. Two pounds of chloroxuron plus adjavent-T was comparable to 6 lbs/A of chloroxuron considering weed control, crop injury and yield. In two years trials on peat soils in Oregon, none of the new herbicides or herbicide combinations have shown significantly better weed control than current commercial practices of repeated applications of chlorpropham and CDAA. Research work conducted in Texas indicated chloroxuron and H_2SO_4 controlled London rocket and nitrogen controlled common purselane.

Tomatoes: One paper from Utah presented evaluation of preplant herbicides in direct seeded and transplant tomatoes. None of the herbicides or herbicide combinations injured transplanted tomatoes. Recorded weeding time and injury ratings on direct seeded tomatoes indicated trifluralin plus diphenamid to be most promising. Thirty one trials on direct seeded tomatoes and one on transplants from California indicated that the effective herbicide rates for EL 179 are 1 lb/A on sand and sandy loam, 1.5 lb/A on loam, silt loam and silt and 2 lb/A on clay loam, silty clay and clay soils. EL 179 is reported to control a number of annual grass and broadleaf weed species.

Asparagus: One paper from California was submitted pertaining to evaluation of several preemergence herbicides for the control of nutsedge in established asparagus. Terbacil and R-7465 appear to be most promising for yellow nutsedge control.

Peas: One paper on weed control in green peas was submitted from Washington. GS 14260 alone and in combination with dinoseb, low rates of terbacil, trifluralin, NIA 11092, and NIA 16476 were effective on many different annual weed species with little or no effect on pea vigor and yield.

Celery: A comparative study of several herbicides for the control of groundsel in celery was reported from California. The addition of non-phytotoxic oil and surfactant to chloroxuron enhanced weed control without increasing crop injury. The addition of these two materials to prometryne and C-6313 enhanced weed control but caused increased crop injury.

ORNAMENTALS

Tulips: A Washington research worker evaluated 10 different herbicides on six different tulip varieties. Of these herbicides only NIA 16476 showed selectivity toward tulips equivalent to the current recommended chlorprofam. In addition NIA 16476 gave considerably better annual weed control than did chlorprofam.

Rhododendrons: A three year study from Oregon of combinations of herbicides and mulches in Rhododendrons concluded that: 1) the mulches used in the trial were more effective for controlling weeds than simazine and dichlobenil, 2) there was no important differences between the two herbicides or between the types of mulch, 3) there was a slight advantage from a weed control standpoint to apply the herbicide before the mulch is put down.

Herbicide screening trials in prunes. Lange, A. H., and B. B. Fischer. Young trees in the genus *Prunus* were planted on March 25, 1969, and treated with 18 herbicides on April 15, 1969, in small replicated plots. Immediately after herbicide application 2½ - 3 A" of sprinkler irrigation were applied. Subsequent irrigation were made by flood basin irrigation. The trees were evaluated for phytotoxicity on May 16 and September 16, 1969. The soil analysis was: organic matter 0.6%, sand 67.2%, silt 24%, clay 8.8%.

A number of new herbicides were more phytotoxic than terbacil or simazine. These herbicides included S-6115, ACP 68-72, B-88410 (Table 1).

Those herbicides showing considerably more safety than simazine or terbacil were R-7465, SD-15179, RH-315, S-6706, RP-17623, CP-44939, nitralin and nitrofen. The combination of linuron and amitrole also showed considerable safety, particularly in the September evaluation. The addition of ametryne to simazine appeared only to increase the phytotoxicity and did not give more weed control.

One of the outstanding differences in this work when compared to earlier testing at the same location is that simazine under flood irrigation was safer than terbacil on a pound-for-pound basis. Inasmuch as terbacil is a much more soluble compound, the flood irrigation may have moved herbicides relative to their solubilities into the rootzone of the trees. This reversal of earlier results may have been due to less water being applied over the herbicide in the earlier work.

VCS-438 showed increasing injury through the season finally suggesting a margin of safety closer to simazine and terbacil than was shown in earlier tests.

R-7465 continues to be the outstanding herbicide in these trials. Although this herbicide was excellent on most weed species, it was weak on ground cherry, as could be expected, since it is a potential tomato herbicide. S-6706 and RP-17623 warrant further evaluation because of their excellent margin of safety and good residual weed control.

Ametryne did not appear to have more safety than simazine and gave less weed control even at much higher rates.

Nitrofen, although applied at an exceedingly high rate (16 lb/A), showed outstanding safety and should be further evaluated particularly for use around young trees during the growing season. (University of California, Agricultural Extension Service, Fresno and Riverside.)

Table 1. The results of 1969 deciduous fruit herbicide screening trial on a Hanford sandy loam soil.

		Average[1/]									
		Phytotoxicity								Weeds	
Herbicides	lb ai/A	Almond Texas	Almond Non-pareil	Peach Halford	Plum Santa Rosa	Apricot Royal Blenheim	Prune French	Cherry Bing	Apricot Tilton	Control	Species[2/] Present
Terbacil	2.0	1.3	1.6	1.3	2.0	2.6	6.0	7.0	4.3	9.3	L,C
Terbacil	4.0	8.6	7.3	7.6	8.6	9.0	9.3	10.0	9.0	9.0	L,A,S
Terbacil	8.0	9.3	9.6	9.3	8.0	9.6	9.6	10.0	9.6	9.6	C,A
VCS-438	4.0	3.3	1.6	2.6	2.3	1.6	2.3	1.6	0.6	9.6	A,L
VCS-438	16.0	6.6	7.0	5.3	8.6	8.6	6.3	7.6	6.0	9.6	S,D
R-7465	4.0	0	1.0	1.0	0	0	2.0	0.6	0	9.3	G
R-7465	16.0	0.6	1.6	1.0	0	0	0	0.6	0	9.6	G
SD-15179	4.0	1.3	1.0	2.3	0.6	0	0.6	2.0	2.0	9.3	L,C,A
SD-15179	16.0	6.6	6.3	3.6	2.3	4.0	5.3	4.0	4.6	9.6	L,A
RH-315	4.0	0.6	0.6	0.6	0	0	1.3	0.6	0	8.6	C,S,A,G,L
RH-315	16.0	0.6	1.3	1.6	0.6	0	1.3	0.6	0.3	6.6	A,L,B,C,G
S-6706	1.0	3.3	0.6	0.6	0.6	0	0	0.3	0	8.0	A,C,S
S-6706	4.0	0	3.6	1.0	0.3	0.6	2.6	3.6	0.3	9.3	A,C
RP-17623	4.0	1.6	1.0	1.3	2.3	1.3	2.0	0.6	0	8.6	B,L,M,S
RP-17623	16.0	0	0	1.0	0.6	0	1.0	0	0	10.0	---
CP-44939	4.0	4.3	2.0	2.3	0.6	0	1.6	4.0	1.6	8.6	A,L,S,C
CP-44939	16.0	6.0	6.0	5.0	5.3	4.0	6.0	5.3	4.0	9.3	L,A,P
S-6115	4.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	9.3	---
S-6115	16.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	---
ACP 68-72	2.0	7.0	5.0	3.6	8.6	4.3	8.3	10.0	5.3	10.0	---
ACP 68-72	8.0	9.0	9.3	9.0	10.0	9.3	10.0	10.0	9.3	10.0	---
B-88410	4.0	8.3	5.3	7.3	9.3	9.0	10.0	10.0	7.3	6.6	L,A,C
B-88410	16.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	9.3	P,L
Ametryne	4.0	1.6	2.0	1.0	1.3	3.3	2.0	1.6	0	6.0	L,A,C,S,U
Ametryne	16.0	7.0	4.0	4.6	6.3	10.0	8.3	4.6	8.0	8.3	L,A,C
AC-78126	2.0	0	3.3	1.0	1.0	0	2.0	3.3	0	5.0	C,S,L,G,U
AC-78126	8.0	6.6	6.6	6.6	4.0	4.0	4.3	4.3	4.0	7.3	C,L,S,G,A

		Average 1/									
		Phytotoxicity								Weeds	
Herbicides	lb ai/A	Almond Texas	Almond Non-pareil	Peach Halford	Plum Santa Rosa	Apricot Royal Blenheim	Prune French	Cherry Bing	Apricot Tilton	Control	Species Present 2/
Nitralin	16.0	0	3.3	3.3	0.6	0	2.3	3.3	0.6	10.0	
Simazine	4.0	6.3	5.0	5.3	4.6	5.3	6.0	5.3	6.0	10.0	
Simazine +	4.0	8.0	5.3	6.3	5.3	6.3	9.3	6.3	7.0	9.0	L,G,A
Ametryne	1.0										
Linuron +	2.0	0	2.3	0.6	0	0	0.6	1.6	0	9.3	L
Amitrole-T	2.0										
Nitrofen	16.0	0.6	0	0.6	0	0	0.3	0	0	9.6	A,S,U
Untreated	--	0.6	1.3	2.0	0.6	0.6	0.3	1.3	0	5.0	A,S,U,C,G

1/ Evaluation based on a 0 to 10 scale. 0 = no injury, 10 = dead trees. Average of three replications.

2/ Weed code: A = pigweed, C = carpetweed, B = Cupgrass, D =Crabgrass, L = Lovegrass, U = Purslane, G = Groundcherry, S = Sowthistle, M = Maresta.

Second year application - Screening trial - Stone fruits. Fischer, B., and A. Lange. Seven varieties in the genus Prunus were planted on March 20, 1968, and treated on March 29, 1968. The results of this work were reported last year (WWCC Rept. 1969). These same trees were retreated on February 13, 1969, and basin flood irrigated throughout the season and evaluated on September 16, 1969. The soil analysis was: organic matter 0.6%, sand 67.2%, silt 24.0%, and clay 8.8%.

Trees established for one year before treatment showed varying degrees of phytotoxicity by the summer of 1969. The evaluation made on September 16, 1969, showed a number of herbicides safer for weed control in stone fruits than simazine.

Herbicides safer than simazine after two years' application included bensulide, R-7465, SD-15179, and RP-17623. Those herbicides showing toxicities higher than simazine included terbacil, particularly for the almond and apricot species; GS 14254 (which was not retreated in 1969) for all species and the combination of terbacil plus diuron. This combination appeared to be more toxic than either terbacil alone or simazine alone. However, the combination did not appear to be as toxic as diuron alone, although these differences are probably not significant.

Those herbicides suggesting further tests include R-7465, SD-15179, VCS-438, and RP-17623. RH-315 also looked safe but did not have residual weed control competitive with other herbicides in this test. (University of California, Agricultural Extension Service, Fresno and Riverside.)

The results of a stone fruit herbicide screening trial on Hanford sandy loam soil, Kearney Horticultural Field Station

Herbicide	lb ai/A	Average [1/] Phytotoxicity						
		Peach Fortuna	Almond Peerless	Plum Laroda	Peach Starn	Apricot Blenheim	Peach Red Top	Plum Santa Rosa
Simazine	2.0	0	0	0	0	0	0	-
Simazine	4.0	1.3	1.0	.5	0	0	1.4	3.0
Terbacil	2.0	0	0	0	0	0	0	0
Terbacil	4.0	0	2.3	0	0	9.0	1.7	0
Dichlobenil	4.0	0	0	0	0	0	0	0
Dichlobenil	16.0	1.3	1.3	0	1.0	4.0	2.4	3.0
Bensulide	4.0	0	0	0	0	0	0	0
Bensulide	16.0	0	0	0	0	0	0.4	0
R-7465	4.0	0	0	0	0	0	0	0
R-7465	16.0	0	0	0	0	0	0	0

Herbicide	lb ai/A	Average[1] Phytotoxicity Peach Fortuna	Almond Peer-less	Plum Laroda	Peach Starn	Apricot Blen-heim	Peach Red Top	Plum Santa Rosa
R-11913	4.0	1.0	0	0	0	0	.7	0
R-11913	16.0	1.6	3.3	1.6	2.3	0	2.7	-
SD-15179	2.0	0	0	0	0	0	0	0
SD-15179	8.0	0	0	0	0	0	0	0
VCS 438	2.0	0	0.3	0	0	0	0	0
VCS 438	8.0	2.3	2.0	0	2.6	0	3.7	7.0
GS-14254 [2]	2.0	3.0	3.3	1.0	3.3	3.3	3.7	9.0
GS-14254 [2]	8.0	7.3	8.3	9.0	6.6	9.0	7.4	7.3
RP-17623	4.0	0	0	0	0	0	0	-
RP-17623	16.0	0	0	0	0	0	0	-
RH-315	4.0	0	0	-	0	0	0	0
RH-315	16.0	0	0	0	0	0	0	1.0
Sinbar & Diuron[3]	1.0 + 1.0	0	0	0	0	0	0	-
Sinbar & Diuron[3]	2.0 + 2.0	3.6	1.0	-	7.5	7.3	-	5.6
Diuron[4]	2.0	0	0	1.0	0	1.5	0	0
Untreated	---	0	0	0	0	0	0	-

[1]Evaluation based on a 0 to 10 scale, minus untreated rating. 0 = no injury, 10 = death of plant; average of 3 replications per treatment.

[2]Not treated 13 February 1969

[3]Treated with B-80890 in 1968

[4]Treated with DNPB in 1968

Phytotoxicity studies on black walnut seedlings. Lange, A. H. and Humphrey, W. A. Simazine and diuron control most weeds in California orchards; however, certain difficult species persist, particularly several perennial weed pests. A large number of new herbicides have shown longterm weed control and some have shown selectivity in tests with stone fruits.

A greenhouse experiment was conducted at the South Coast Field Station, Tustin, comparing several new herbicides with simazine, using young black walnut seedlings as the test plant. Black walnut seeds were germinated in flats of sand and peat and later transferred to the same soil mixture with one tree per 46 oz. container. Ten weeks after transplanting, herbicides were applied on 4/10/69, at 1, 10, and 100 ppm in water to the soil mixture in which the seedlings were growing. A nutrient solution was applied biweekly. On 5/21/69, the trees were cut back to a height of five inches and all the remaining leaves were removed. The condition of the foliage was evaluated on 7/11/69. The phytotoxicity rating used: 0 = no effect, 3 = distinguishable toxicity pattern, 4 = pattern plus slight burn, 5-9 = increasing chlorosis and burn, 10 = all foliage dead. Those treatments showing only low readings and which did not increase with the higher treatment rates should be considered only slight or doubtful injury.

R-11913 showed the most injury. ACP 68-72 also showed increasing injury with increasing rate. R-7465 was outstandingly safe as was SD-15179. EL 119 was as safe as simazine. The remaining herbicides were generally as toxic as simazine under the conditions of the experiment which included considerable organic matter in the soil mix. Both formulations of ametryne, an analogue of simazine, were generally more toxic than wettable powder simazine. (University of California, Agricultural Extension Service.)

The effect of aqueous suspensions of several new herbicides applied to the roots of young black walnut seedlings growing in nutrient fed sand-peat culture

Herbicide	Act.	Average[1]		
		1	10	100
		7/11/69 (ppm)		
Simazine	80 W	1.0	0.3	1.0
R 7465	50 W	0	0	0
AC 6872	70 W	1.0	2.8	5.0
VCS 438	1 EC	0	0.7	3.0
Sandoz 6706	80 W	2.7	1.5	2.7
Linuron	50 W	0.7	2.3	1.3
Ametryne	80 W	2.0	1.7	3.0
Ametryne	2 EC	0.7	0	3.3

Herbicide	Act.	Average 1/ 1	+ 10	100
			7/11/69 (ppm)	
R 11913	75 W	3.0	3.3	5.3
SD 15179	80 W	0.7	0.7	0.7
EL 119	75	1.3	1.0	0.7
Check	0	0.3	1.0	0.3

1/ Average phytotoxicity rating from 3 single tree pots where 0 = no effect, 3 = typical symptoms, 4 = symptoms with burned margins, 10 = all foliage dead.

Fig herbicide tolerance study. Fischer, B. B. and Lange, A. H. Herbicides in 100 cc/can aqueous suspension were applied 4/16/69 to recently rooted calymyrna fig rootings growing in washed river sand. Concentrations were calculated on the basis of oven dried weight of sand per 46 oz. can. Following the application of herbicides, the cans were watered twice weekly with 6 oz. of tap water.

Phytotoxicity ratings made 5/2/69 and 5/16/69 showed most herbicides tested to be safer than simazine except ACP 68-72 and B-88410. Dichlobenil showed considerably more safety than simazine. R-7465 and nitralin showed the least injury and should be tested further, possibly in combination with other herbicides to obtain broader spectrum of weed control. VCS-438 and S 6706 were intermediate, showing less injury than simazine. (University of California, Agricultural Extension Service, Fresno and Riverside.)

Tolerance of fig rootings to eight herbicides

Variety: Calymyrna--rootings

Herbicide	Concentration in ppm	Phytotoxicity Ratings 1/ 5/2/69	5/16/69
A Simazine	.001	0	2.5
B Simazine	.01	0	4.75
C Simazine	.1	0.75	3.5

Herbicide		Concentration in ppm	Phytotoxicity Ratings 1/ 5/2/69	5/16/69
D	Simazine	1.0	2.5	7.5
E	Dichlobenil	.01	0	0.25
F	Dichlobenil	.1	0	1.5
G	Dichlobenil	1.0	0.25	2.0
H	VCS-438	.01	0.25	2.5
I	VCS-438	.1	0	3.5
J	VCS-438	1.0	0.25	3.75
K	R-7465	.01	0.25	0.75
L	R-7465	.1	0	0.5
M	R-7465	1.0	0	0.5
N	Nitralin	.01	0	1.25
O	Nitralin	.1	0	0.5
P	Nitralin	1.0	0.25	1.25
Q	S 6706	.01	0.5	0.5
R	S 6706	.1	0	1.0
S	S 6706	1.0	0.5	4.5
T	ACP-6872	.01	0.5	0.25
U	ACP-6872	.1	3.0	6.5
V	ACP-6872	1.0	3.0	8.25
W	B-88410	.01	1.0	3.75
Y	B-88410	.1	0.5	4.0
Z	B-88410	1.0	4.0	8.25
X	Untreated	---	0	0

1/ Injury ratings based on a 0 to 10 scale: 0 = no injury, 10 = death of plants. Values represent the average of four replications

Herbicide screening trials in orchard crops. Crabtree, Garvin. A number of candidate herbicides were evaluated for selective control of weeds in several orchard crops during 1968 and 1969. Materials were evaluated for control of established weeds (mostly annuals) as well as for residual control. When 11 new herbicides were compared with standards in apples none were superior to terbacil in these trials. In a test of herbicides applied to newly planted apple, pear, cherry and prune trees, where crop tolerance evaluations are most critical, good selective control was observed with S-6115. Compounds AP 920 and Bay 88410 gave good weed control but some crop injury was observed in the cherry and prune plantings. When a number of herbicides were screened on a young filbert planting, best overall performance was observed with dichlobenil, S-6115 and SD 15418. Nitralim and trifluralin were particularly effective for controlling grasses but were difficult to incorporate satisfactorily around the base of the trees. (Horticulture Dept., Oregon State University, Corvallis.)

Weed control in young orchards. Anderson, J. LaMar. These trials were established to compare the present weed control recommendations with several new materials and combinations. Herbicides were surface applied to a five foot strip beneath 3 year old Top Red apples, Bing cherries and Redglobe peaches. Soil was a sandy loam in which the organic matter ranged from 1.8 - 2.2%. The orchard was sprinkler irrigated.

Considerable white top and field bindweed were growing beneath the young sweet cherry trees. Terbacil was impressive in its ability to reduce the growth of these perennial weeds, but was too phytotoxic for use in young cherries. GS 14254 had considerable foliar activity and was most promising of the numbered compounds tested. The non-incorporation of trifluralin could account for its poor performance in this trial. (Utah State University Agr. Exp. Sta.)

Effects of Herbicide Treatment on Weed Control and Fruit Tree Phytotoxicity

Treatment	lb/A	Weed Control		Phytotoxicity		
		9 May '69	10 July '69	apples	peaches	sweet cherries
diuron	1	1.5	3.5	-	0	0
	2	2	5	0	1	0
	4	3.5	6	0	5	1
simazine	1	2	5	-	0	0
	2	3.5	6	0	2	0
	4	4	8	0	4.5	2
GS 13529	2	1	3.5	0	0	-
	4	1	5	0	2	-
GS 14254	2	4	4	0	1	-
	4	5	6	0	2.5	-
GS 17893	2	4.5	4.5	0	2.5	-
	4	6	6.5	0	5	-
terbacil	1	6	5	-	1	1
	2	7.5	6	0	1.5	3.5
	4	9	8.5	0	3	6.5
terbacil + diuron	1/2+1/2	3.5	3.5	-	0	0
	1+1	5	5.5	0	1	1
	1 1/2+1 1/2	6	6	-	1.5	2
	2+2	8.5	6.5	0	3	3.5
trifluralin	1	1	1	0	0	-
	2	1	1.5	0	0	-
control	-	0	0	0	0	0

Paraquat combinations for orchard weed control. Anderson, J. LaMar. These trials were set up to study the effects of combinations of paraquat and various residual herbicides to control established weeds in an orchard. We were looking for a combination that would kill existing weeds and prevent others from emerging. Treatments were applied July 18, 1969, to a mature sour cherry orchard shortly after harvest of the fruit. The soil was a sandy loam having an organic matter content of 2.21%. The orchard was furrow-irrigated. Weeds present at the time of treatment included puncture vine, sunflower, cocklebur, field bindweed and some annual grasses. X-77 surfactant was used with all combination treatments.

The greatest increase in weed control due to paraquat over the residual herbicide alone occurred in the simazine and nitralin treatments; this was expected as these herbicide essentially have no foliar activity. Paraquat alone allowed considerable regrowth of puncture vine and field bindweed. Regrowth of these weeds was considerably restructed by paraquat combinations with the high rates of terbacil, GS 13529 and GS 14254. GS 14254 and terbacil treatments were comparable and gave the best weed control. No phytotoxicity to the sour cherries by any treatment was observed. (Utah State University Agr. Exp. Sta.)

Effect of paraquat in combination with residual herbicides for control of established weeds in sour cherries

		Combination Treatment 1)				
Treatment	lb/A	--	paraquat 1/2 lb.	paraquat 1 lb.	dinoseb 1 1/2 lb.	amitrole 2 lb.
control	0	0	2	4	2	5
diuron	4	1.5	3.5	5	-	-
simazine	2	0	2	4	1	5
	4	1	2	4	1.5	5
GS 13529	2	4	6	6.5	-	-
	4	5.5	6.5	8.5	-	-
GS 14254	2	4	7	8	-	-
	4	8	8	8.5	-	-
GS 17893	2	2.5	3.5	4	-	-
	4	4	5	8	-	-
nitralin	2	0	2	4	-	-
	4	0	2	4	-	-
terbacil	2	4	7	8	-	-
	4	8	8	8.5	-	-

1) Weed control 60 days after mid summer treatment.

The results of 1969, a grape herbicide screening trial. Lange, A. H., B. B. Fischer, and L. Lider. Thompson seedless cuttings and rootings planted in late spring 1969 were treated in small 8 x 10 ft. plots with herbicides on April 11. Each plot was replicated three times. Immediately after herbicide applications, sprinkler irrigation was applied. Subsequent irrigations were accomplished by basin flood. On September 16, 1969, the plots were evaluated for weed control and phytotoxicity where 0 = no effect, 10 = complete weed control or death of grape cutting. The soil analysis was: organic matter 0.6%, sand 67.2%, silt 24.0%, clay 8.8%.

From the data in the table, a number of herbicides gave excellent weed control including simazine, VCS-438, R-7465, SD-15179, B-88410, ametryne, RP-17623, and S-6115.

A number of the herbicides were too toxic for grape cuttings including B-88410 and S-6115. Several gave as much or more safety for the weed control than simazine; these herbicides included VCS-438, R-7465, S-6706, CP-44939, RP-17623, nitralin and diphenamid (plus dinitro).

The herbicides showing the largest apparent margin of safety were R-7465, SD-15179, S-6706, RP-17623 and nitralin. These herbicides, particularly R-7465, should be studied further for weed control in young grapes. (University of California, Agricultural Extension Service, Fresno and Riverside.)

The results of a herbicide screening trial on Thompson seedless cuttings and rootings in a Hanford sandy loam. Kearney Horticultural Field Station

		Average[1]		
Herbicide	lb ai/A	Phytotoxicity	Weed Control	Weeds Present[2]
Simazine	2.0	1.3	8.3	L, C
Simazine	4.0	6.6	8.3	L
VCS-438	4.0	0	10.0	---
VCS-438	16.0	8.3	10.0	---
R-7465	4.0	0	9.6	L, A
R-7465	16.0	1.0	10.0	
SD-15179	4.0	0.6	7.3	D, L, C
SD-15179	16.0	3.3	9.3	L
RH-315	4.0	0.6	4.3	L, A, C
RH-315	16.0	1.0	6.6	L, A, B

Herbicide	lb ai/A	Average[1/] Phytotoxicity	Average[1/] Weed Control	Average[1/] Weeds Present[2/]
S-6706	1.0	1.3	6.0	A, C, L
S-6706	4.0	0.3	7.0	A, C, L
CP-44939	4.0	2.0	5.0	A, L, C
CP-44939	16.0	4.0	10.0	A, L, B
ACP-6872	2.0	0	4.3	A, L, B
ACP-6872	8.0	10.0	10.0	---
B-88410	4.0	9.3	9.3	B, L, A
B-88410	16.0	10.0	9.6	L
Ametryne	4.0	4.3	8.6	A, L
Ametryne	16.0	7.3	7.6	A, C, L
AC-78126	2.0	0.6	3.6	A, L, C, B
AC-78126	8.0	4.0	5.3	A, L, B, C
RP-17623	4.0	0.6	6.6	A, L, C
RP-17623	16.0	4.3	10.0	
S-6115	4.0	9.0	9.3	A, L, C
S-6115	16.0	10.0	9.3	
Nitralin	16.0	1.0	6.6	L
Diphenamid + Dinitro	8.0	0	7.6	L, A, C
Untreated	--	0.6	0	L, A, C, B

1/ Average of 3 replications. The grape cuttings and rootings were planted one foot apart--alternating. Following planting, the soil was harrowed, herbicides applied, and the area sprinkler irrigated. Subsequent irrigations were by basin flooding. Evaluation based on a 0 to 10 scale. 0 = no injury, 10 = death of plant. Sept. 16, 1969.

2/ Species code: L = Lovegrass, A = Pigweed, B = Cupgrass, C = Carpetweed, D = Crabgrass.

Timing of herbicide applications for cranberries. Crabtree, Garvin. In three years of trials with cranberries in Western Oregon, it has been found that late applications of herbicides can severely reduce crop yield. Certain weed species can best be controlled by delaying herbicide applications until after dormancy is ended in the cranberry plants but the later these applications are made the greater the yield loss may be. Dichlobenil, chlorpropham, 2,4-D and combinations of chlorpropham and 2,4-D were applied at intervals starting in early March when the cranberry plants were still relatively dormant. The date at which yield reductions began to occur varied from year to year due to differences in crop development associated with seasonal changes. This was as early as mid-April in 1967 and 1968 but not until early May in 1969. This timing was correlated with the "rough-neck" stage of flower shoot development. (Horticulture Dept., Oregon State University, Corvallis.)

Herbicides and herbicide combination treatments for cucumbers. Crabtree, Garvin. In an attempt to find an improved weed control program for cucumbers a number of screening trials have been established on various soil types during the past few years. In 1969 most treatments were based on various combinations of amiben, bensulide, naptalam, nitralin and EL 179. Many of the treatments resulted in good selective control in certain trials but consistency of weed control or crop safety were not evident when all trials were considered. Of these combination treatments probably the best performance was obtained with amiben plus bensulide or amiben plus naptalam. In a trial including treatments applied to a stale seedbed very good selective control was obtained with amiben plus naptalam used with either dinoseb (amine) or paraquat. In some applications of dinoseb (amine) with unfavorable weather conditions, crop injury has resulted, although this did not occur in this trial. These treatments were applied approximately two weeks after soil preparation and three days after planting. (Horticulture Department, Oregon State University, Corvallis.)

Evaluation of herbicides for weed control in cucurbits. Heikes, P. E. This experiment was conducted on the Experiment Station at Rocky Ford, Colorado; weed control and crop tolerance in cantaloupe, cucumbers, and watermelon were studied. Plots were 1000 sq. ft., cross seeded to each of the three crops. There were 17 different treatments; all herbicides were applied with a plot sprayer in 40 gallons of water per acre - 2 reps.

Bensulide (Prefar), trifluralin (Treflan) and benefin (Balan) were soil incorporated with a tandem disk, twice over. This incorporated the herbicides 2½ to 3 inches deep. Other materials were soil incorporated with a spike-tooth harrow, twice over. The crops were planted two days after herbicides were applied and irrigated the following day.

Major weeds in this field were redroot pigweed (Amaranthus retroflexus) (L.), venice mallow (Hibiscus trionum) (L.), light stand of grass, mainly Setaria sps., some barnyardgrass (Echinochloa crusgalli) (L.), kochia (Kochia scoparia) (L.) Schrad, buffalobur (Solanum rostratum Dunal), Russian thistle (Salsola kali) (L.), and puncturevine (Tribulus terrestris (L).

HERBICIDES EVALUATED: Bensulide (Prefar) 4, 6 and 8 lbs per acre; trifluralin (Treflan) ½ and 3/4 lb per acre; nitralin (Planavin) 1 and 1½ lbs per acre; DCPA (Dacthal) 8 and 10 lbs per acre; benefin (Balan) 1 and 1½ lbs per acre; amiben (Amiben ester) 2 and 3 lbs per acre; amiben/naptalam (Amiben ester/Alanap) 1½ + 3 lbs per acre and naptalam (Alanap) 5 lbs per acre.

SUMMARY: Several materials were effective and should provide acceptable weed control; the major difference between materials was crop tolerance. The amiben/naptalam combination was best in the series, DCPA, bensulide and amiben also provided acceptable weed control. DCPA showed good crop tolerance but was weak on venice mallow and buffalobur. Bensulide was effective at 6 and 8 lbs per acre and showed good crop tolerance. Amiben ester was effective at the 2 lb rate but caused some crop injury at 3 lbs; however, 2 lbs was high enough for good weed control - there was little difference between the 2 and 3 lb rates. Results of this series of herbicide evaluations are shown in the table.

None of the materials affected maturity and none affected germination of seed harvested from treated plots. (Extension Weed Specialist, Botany Department, Colorado State University, Fort Collins, Colorado.)

Cucurbit herbicide evaluations
Colorado-1969

Treatment	Rate per Acre	Percent Stand Reduction					
		Cucumbers	Cantaloupe	Watermelon	Pigweed	Setaria	Others[1/]
bensulide (Prefar)	4 lbs	0	0	0	85	98	0
bensulide	4 lbs	0	0	0	90	97	65

Treatment	Rate per Acre	Percent Stand Reduction Cucumbers	Cantaloupe	Watermelon	Pigweed	Setaria	Others[1/]
bensulide	8 lbs	0	0	0	94	98	50
trifluralin (Treflan)	½ lb	0	0	13	97	97	16
trifluralin	3/4 lb	48	41	32	99	99	34
nitralin (Planavin)	1 lb	17	19	0	97	95	66
nitralin	1½ lb	24	20	18	95	94	100
DCPA (Dacthal)	8 lbs	0	0	0	85	98	44
DCPA	10 lbs	0	0	0	93	96	50
benefin (Balan)	1 lb	10	10	0	85	98	20
benefin	1½ lb	10	20	20	98	97	66
amiben salt	2 lbs	0	0	0	90	88	50
amiben ester	3 lbs	0	12	25	95	91	66
amiben/naptalam (Amiben ester Alanap)	1½ + 3 lbs	0	0	0	100	98	100
naptalam (Alanap)	5 lbs	5	15	20	95	70	33

1/ Composite of venice mallow, buffalobur, puncturevine and Russian thistle.

<u>Combination pesticide fertilizer field test in cucumbers</u>. Peabody, D. V. Jr, Gabrielson, Richard L., Haglund, W. A., Heilman, Paul E. To evaluate the combined effects of "pop-up" fertilizer, a soil fungicide and a herbicide on crop yield and vigor as well as on annual weed control, cucumbers were planted in late May in soil that had received several of these pesticide and herbicide combinations. The fungicide (dexon) treatments were sprayed on the surface in a 12 inch band and rotovated to a depth

of four inches immediately before planting. "Pop-up" (with the seed) fertilizer treatment consisted of treble superphosphate at 30 lbs/acre plus potassium nitrate at 10 lbs/acre. The herbicide treatment was SD 15418 at 1 lb. active ingredient per acre applied pre-emergence immediately after planting but before the petroleum soil mulch was applied.

By combining both dexon and "pop-up" fertilizer with the herbicide SD 15418, little or no cucumber yield reduction or plant injury occurred. However, when dexon alone or "pop-up" fertilizer alone was combined with SD 15418 treatment, cucumber injury and yield reductions were severe and definite.

Table 1. Gross yields and stand counts of cucumbers in combination pesticide-fertilizer field test

Treatment[1]	Yield of 6 pickings T/A	Stand Count Number of plants/15 feet 6/7/69	6/11/69	6/20/69
Check (Petroleum Soil Mulch)	12.54	65	72	66
Dexon + "Pop-up" fertilizer	12.20	79	88	87
"Pop-up" fertilizer	11.99	73	80	75
Dexon + SD 15418 + "Pop-up" fertilizer	11.94	71	73	65
Dexon [2]	11.78	67	75	71
Dexon	11.33	67	78	70
Check (No petroleum soil mulch)	10.64	52	67	55
SD 15418 + "Pop-up" fertilizer	8.99	76	29	9
SD 15418	8.25	56	22	19
Dexon + SD 15418	7.26	67	34	32

[1] All treatments (with one exception) received petroleum soil mulch.

[2] Dexon applied at 15 lbs. active ingredient/acre in this treatment only.

Table 2 shows that this three-way combination (dexon-"pop-up" fertilizer-SD 15418) resulted in the best annual weed control of the several treatments tried. (Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon.)

Table 2. Weed counts and estimates of weed control and crop vigor of cucumbers in combination pesticide-fertilizer field test.

Treatment[1]	Weed count No. per sq. ft. 6-27-69	Weed control rating 6-25-69	Crop vigor rating 6-25-69
Dexon + SD 15418 + "pop-up" fertilizer	0.07	10.0	2.5
SD 15418	0.10	9.8	7.4
Dexon + SD 15418	0.19	9.6	5.0
SD 15418 + "pop-up" fertilizer	0.33	9.5	6.3
"Pop-up" fertilizer	4.87	0.4	0.0
Check (petroleum soil mulch)	5.72	0.9	0.4
Dexon[2]	5.80	0.3	0.4
Dexon	6.10	0.8	0.3
Check (no petroleum soil mulch)	6.50	0.8	2.0
Dexon + "pop-up" fertilizer	7.00	0.1	0.1

[1] All treatments (with one exception) received petroelum soil mulch.

[2] Dexon applied at 15 lbs. active ingredient/acre in this treatment.

<u>The effects of surfactant and nonphytotoxic oils with post-emergence herbicides on onions.</u> Agamalian, H. Applications of chloroxuron and nitrofen at 2,4, and 6 lb/A. were applied with nonphytotoxic oil and adjavant-T. All post-emergence treatments received pre-emergence applications of DCPA at the rate of 10 lb/A. Applications were made to the variety Southport White Globe at the 1 to 2 leaf stage of growth. The nonphytotoxic oil was used at 1 and 2% by volume. The adjavant-T was applied at 1/2% by volume. Nonphytotoxic oil had a U.S.R. rating of 96.

All applications were applied at the rate of 100 gal./A. Crop phytotoxicity and weed control was evaluated and crop yields obtained.

Weed control was enhanced with the applications of surfactants and nonphytotoxic oil with chloroxuron. This was especially true with <u>Senacio</u> <u>vulgaris</u> (common groundsel). Harvested data indicated a significant yield reduction when chloroxuron was applied at 6 lb/A. with adjavant-T and nonphytotoxic oil.

Table one indicates herbicide treatments, crop vigor, and weed control. Data in table two represents fresh plant weight and bulb yields. Herbicide interactions and surfactants may be summarized as follows:

(1) Chloroxuron at 6 lb/A. is comparable to chloroxuron plus adjavant-T at 2 lb/A. when one considers weed control, crop injury, and yield.

(2) Chloroxuron rates of 4 and 6 lb/A. plus adjavant reduce crop vigor and yield.

(3) Chloroxuron at 4 lb/A. with nonphytotoxic oil caused no more onion injury than 4 lbs. alone.

(4) Nitrofen at 6 lb/A. plus adjavant-T reduced yields when compared to all other nitrofen treatments.

(5) R.P. 2929 provided good crop tolerance at both rates applied.

(6) Combinations of chloroxuron and nitrofen indicated no severe crop phytotoxicity.

(University of California Agriculture Extension, Salinas.)

Table 1. Pre and post emergence applications of several herbicides to Southport White Globe onions in the 1-2 leaf stage.

Herbicide	lb/A.	Surfactant	Crop Vigor	Weed Control[4]
DCPA[1]	10	none	0.7	2.3
DCPA[2]	10	none	3.2	5.1
chloroxuron[3]	2	none	1.8	7.4
chloroxuron	4	none	3.8	9.2
chloroxuron	6	none	4.5	9.9
chloroxuron	2	Adj.-T	4.5	10.
chloroxuron	4	Adj.-T	5.8	10.
chloroxuron	6	Adj.-T	6.8	10.
chloroxuron	2	oil	2.3	7.8
chloroxuron	4	oil	3.5	9.5
chloroxuron	6	oil	5.5	9.9
nitrofen	2	none	1.5	6.6
nitrofen	4	none	0.8	7.6
nitrofen	6	none	0.8	7.1
nitrofen	2	Adj.-T	1.0	6.6
nitrofen	4	Adj.-T	1.8	7.1
nitrofen	6	Adj.-T	1.8	7.4
nitrofen	2	oil	0.5	8.0
nitrofen	4	oil	1.0	7.1
nitrofen	6	oil	1.0	7.1
nitrofen+chloroxuron	2+4	none	1.5	7.5
nitrofen+chloroxuron	2+4	Adj.-T	2.0	9.6

Herbicide	lb/A.	Surfactant	Crop Vigor	Weed Control[4]
nitrofen+chloroxuron	4+4	none	3.3	8.0
R.P. 2929	2	none	2.5	7.8
R.P. 2929	4	none	2.5	9.7

(1)Preplant incorporated only

(2)Post plant, pre-emergence only

(3)All post-emergence treatment received DCPA 10 lb/A. pre-emergence

(4)Mean evaluations of common groundsel, shephardspurse and pigweed.

Table 2. Crop phytotoxicity, evaluated on fresh plant weights 40 days post treatments. Harvested yield data taken on September 26, 1969

Herbicide	lb/A.	Surfactant	Fresh Wts. 6/13/69 gm/50 Plants	Harvest bulb lb/Plot
DCPA	10	none	905.8	758.2 b
DCPA	10	none	800.0	680.7a
chloroxuron	2	none	1047.7	829.2 bc
chloroxuron	4	none	934.8	710.2a
chloroxuron	6	none	956.3	737.5 b
chloroxuron	2	Adj.-T	790.5	790.5 b
chloroxuron	4	Adj.-T	726.5	722.5a
chloroxuron	6	Adj.-T	680.0	705.5a
chloroxuron	2	oil	1150.0	787.2 b
chloroxuron	4	oil	875.3	725.7 b
chloroxuron	6	oil	887.8	703.2a
nitrofen	2	none	1175.5	800.5 bc
nitrofen	4	none	1067.3	746.0 b
nitrofen	6	none	1003.5	795.5 bc
nitrofen	2	Adj.-T	1002.0	791.5 bc
nitrofen	4	Adj.-T	960.3	802.2 bc
nitrofen	6	Adj.-T	1064.3	719.7a
nitrofen	2	oil	1072.8	825.0 bc
nitrofen	4	oil	1068.5	746.0 b
nitrofen	6	oil	1045.5	783.2 b
nitrofen+chloroxuron	2+4	none	1042.8	710.7a
nitrofen+chloroxuron	2+4	Adj.-T	981.3	825.2 b
nitrofen+chloroxuron	4+4	none	1088.8	751.2 b
R.P. 2929	2	none	1046.0	756.7 b
R.P. 2929	4	none	945.8	765.0 b

Herbicides for onions on peat soils. Crabtree, Garvin. In two years of trials of onions grown on peat soil, none of the new herbicides or herbicide combinations have shown significantly better weed control than the current commercial practice of repeated applications of chlorpropham and CDAA. In 1968, many of the combinations included alachlor or propachlor which had been outstanding treatments in trials on mineral soils, but resulted in excessive crop damage in these trials on peat soil. In 1969, there was less damage with propachlor on peat soil. A post-emergence application of chloroxuron following a pre-emergence treatment of chlorpropham and CDAA resulted in good residual weed control without injury to the onion crop. If a post-emergence application of chloroxuron was used without prior weed control this treatment was not able to satisfactorily control established weeds. Additional control from post-emergence applications of chloroxuron resulted from the use of surfactant in the spray but considerable crop injury was observed. RP17623 also showed promise in these trials as a post-emergence herbicide with both contact and residual herbicidal activity. (Horticulture Dept., Oregon State University, Corvallis.)

Postemergence applications of herbicides in onions. Menges, Robert M. and Simon Tamez. We studied the effects of sprays of 3-[p(p-chlorophenoxyl)phenyl]-1,1-dimethylurea (chloroxuron), H_2SO_4, monosodium methanearsonate (MSMA), 2,4-dichlorophenyl p-nitrophenyl ether (nitrofen), and dimethyl amino-4-thiocyanobenzene (RP-2929), on the growth of Palmer amaranth (*Amaranthus palmeri* S. Wats.), common purslane (*Portulaca oleracea* L.), London rocket (*Sisymbrium irio* L.), and 'Yellow Granex" onions. Most of the weeds were small and succulent at time of treatment. Ambient temperatures ranged from 70 to 96°F and evaporimeter measurements indicated that 0.17 inches of water evaporated from a free water surface on the day of treatment. No rain occurred for 3 days after treatment.

Postemergence applications of chloroxuron and H_2SO_4 controlled London rocket and nitrofen controlled common purslane. Neither herbicide controlled Palmer amaranth that was 4 to 8 inches tall. None of the weed species were controlled by RP-2929 or MSMA. None of the herbicide sprays affected onions 2 to 4 inches tall with 2 true leaves where a canopy of Palmer amaranth covered approximately 50% of the onion plants. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and the Texas Agricultural Experiment Station, Weslaco, Texas.)

Preplant herbicide evaluations in direct seeded and transplant tomatoes. Anderson, J. L. These trials were established to compare present weed control recommendations with several new materials and combinations. Herbicides were soil incorporated with a rototiller on April 21, 1969 in a sandy loam soil having 1.2% organic matter. Two varieties of tomatoes, VF 99 and UP 25, were direct seeded with a Stanhay Precision planter April 28th. UP 25 transplants were planted in the plots May 16th. All plots were furrow irrigated.

Grasses, lambsquarters and pigweed were satisfactorily controlled by all herbicide treatments. Differences in weed control ratings were due to the amounts of nightshade, shepherd's purse and pursland remaining in the plots. Phytotoxicity ratings are given for the direct seeded tomatoes only. No treatment was significantly phytotoxic to tomato transplants. The trifluralin, trifluralin + pebulate and diphenamid + pebulate treatments showed excessive injury to direct seeded tomatoes. (Utah State Univ. Agr. Exp. Sta.)

The effects of preplant incorporated herbicides on direct seeded tomatoes[1]

		5/23		7/1		
Herbicide	lb/A	weed control	weeding time	weed control	weeding time	Phyto-toxicity
diphenamid	5	8.0	3-1/2 min.	7.3	7-3/4 min.	2.3
diphenamid + pebulate	4 + 3	9.7	1-3/4 min.	9.5	6-1/2 min.	6.7
trifluralin	1/2	8.0	4-3/4 min.	7.5	3-1/2 min.	5.7
trifluralin + diphenamid	1/4+4	8.7	2-3/4 min.	9.0	4 min.	2.8
trifluralin + pebulate	1/4+3	9.7	2-1/2 min.	9.5	5-1/4 min.	4.7
EL 179[2]	1-1/2	8.0	4 min.	7.3	3-1/2 min.	4.0
EL 179[2]	3/4	6.8	5-1/2 min.	6.0	5-3/4 min.	3.3
Control		0	24-1/2 min.	0	11-1/2 min.	0

[1] average of 6 replications

[2] average of 3 replications

EL-179: A promising new soil incorporated herbicide for direct-seeded and transplant tomatoes and peppers. Massy, G. D. and P. L. Steenwyk. EL-179, 4-isopropyl-2, 6-dinitro-N,N- (dipropyl) aniline, is a new selective preplant soil incorporated herbicide for control of weeds in tomatoes, peppers, and other Solanaceae crops, such as white potatoes and tobacco. Numerous experiments were conducted with this herbicide in the major tomato and pepper growing regions of the Western United States during 1968 and 1969. Research included thirty-one trials on direct-seeded tomatoes and one on transplants. Three experiments were conducted on direct-seeded peppers and one on transplants. Data from these experiments indicate that the effective herbicidal rates for EL-179 are 1 lb/A on sand and sandy loam (light); 1.5 lb/A on loam, silt loam and silt (medium); and 2 lb/A on clay loam, silty clay and clay (heavy) soils. EL-179 has provided effective control of the following weeds: Grasses - *Echinochloa crusgalli* (barnyardgrass), *Digitaria* sp. (crabgrasses), *Eleusine indica* (goosegrass); *Setaria* sp. (foxtails), *Sorghum halapense* (johnsongrass from seed), *Lolium* sp. (ryegrasses). Broadleaf weeds - *Chenopodium album* (common lambsquarters), *Amaranthus* sp. (pigweeds), and *Portulaca oleracea* (common purslane).

Crop tolerance, yield, and fruit maturity of transplant tomatoes or peppers were not adversely effected at the recommended rates of EL-179. Slight to moderate early-season stunting of direct-seeded tomatoes has been noted in some trials with rates of 2 lb/A and above. No delay in fruit maturity or yield reduction of direct-seeded tomatoes and peppers has been observed at the recommended rate of EL-179.

Laboratory studies have shown that in a submerged or anaerobic condition EL-179 rapidly disappears when mixed with soil. Under field conditions, EL-179 appears to degrade to non-phytotoxic levels during the growing season. (Eli Lilly and Company, Fresno, California.)

Evaluation of several pre-emergence herbicides for the control of nutsedge (*Cyperus esculentes*) in establishing asparagus. Agamalian, H. Initial applications of several thio-carbanates, terbacil, dichlobenil, and R-7465 were made on established asparagus crowns on July 5, 1968 at the completion of spring harvest. Treatments were soil incorporated at the depth of 4 inches followed by furrow irrigation. Surface soil (0-6") contained 52% sand, 32% silt, 16% clay, and 1.7% organic matter. Nutsedge evaluations were made during the fern growing period and the following spring. All plots were re-treated on April 22, 1969 and evaluated during the current crop year. Yield data was obtained for the 1969 harvest year.

Data presented in the following table indicates excellent nutsedge control with terbacil, R-7465, and dichlobenil. Thio-carbanates expressing excellent nutsedge inhibition were cycloate, butylate, and EPTC. Yield data obtained from multiple harvests during the spring of 1969. Terbacil at 2 and 4 lbs. active and R-7465 at 4 and 8 lbs. appear to be most promising for yellow nutsedge control. Acceptable crop tolerances were excellent with both of these compounds at rates treated. (University of California Extension Service, Salinas.)

Summary of nutsedge control in established asparagus and yield following split applications of several herbicides

Herbicide	lb/A.	Nutsedge Control 7/19/68	Nutsedge Control 4/21/69	Nutsedge Control 5/26/69	Crop Injury 7/19/68	Harvest[1] 1969 lbs/Plot[2]
EPTC	3	9.2	2.2	6.5	0.25	301.5**
EPTC	6	9.7	1.5	8.8	2.5	273.0
butylate	4	6.7	3.0	5.2	1	303.5**
butylate	8	7.	2.2	8.8	0	316.5**
pebulate	4	5.7	0.5	5.0	1	275.5
pebulate	8	7.2	2.2	6.7	1.5	290.8**
terbacil	2	3.2	1.2	7.5	0	340.5**
terbacil	4	6.2	4.2	7.7	0.7	283.0**
R-7465	4	6.2	5.2	9.0	0.2	285.5**
R-7465	8	6.5	8.2	9.2	0.5	305.0**
dichlobenil	1	10.	3.0	9.7	6	215.5**
dichlobenil	2	10.	3.0	9.9	8.7	93.3**
R-1856	4	3	0	1.2	0.7	294.5**
cycloate	4	9.5	3.2	7.0	3	253.0
cycloate	8	7.0	3.0	9.2	1	262.5
control	0	1.7	0	0	1.7	261.3

(1) 14 cuttings spring 1969
(2) LSD @ 0.5-21.52 lb/Plot

** LSD @ 0.1-16.1 lb/Plot

Pre-emergence herbicides and herbicide combinations in green peas. Peabody, Dwight V. Jr. Thirty-two different herbicides and herbicide combinations were applied to Darkskin Perfection peas prior to emergence in order to assess their activity on pea growth and yield and on the annual broadleaved and grassy weed population present. Peas were planted in early May and all treatments were applied within the next three days after planting.

GS 14260 (Igran) alone and in combination with dinoseb resulted in good control of both annual grass and broadleaved weed species with no reduction in yield of processing peas. Low rates of terbacil, as in field tests of past years, also demonstrated good overall activity on many different annual weed species with little or no effect on pea vigor and yield. Trifluralin, NIA 11092 (Tandex) and NIA 16476 were also effective and selective in this test. (Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon.)

A comparative study of several herbicides for the control of common groundsel (Senacio vulgaris) in celery. Agamalian, H. The lack of effective control for common groundsel in celery production has resulted in this specie becoming a serious weed. Applications of chloroxuron at 2 and 4 lb/A., prometryne at 1 and 2 lb/A., and C-6313 at 1 and 2 lb/A. were made to celery in the 3 true leaf stage on July 22, 1969.

Common groundsel varied in sizing from 1 to 6 inches in height. The above treatments were applied with the addition of nonphytotoxic oil (U.S.R. 95) at 2% by volume and tronic at 1/2% by volume. The additive effects of nonphytotoxic oil and surfactant enhanced groundsel kill with all herbicides.

Comparative weed control ratings, phytotoxicity and yield data obtained from this experiment are presented in the table. The interactions of crop selectivity and weed control appear to be the most significant factors of this experiment. The influence of non-phytotoxic oil and tronic to chloroxuron enhance weed control without negating crop safety. The additive effects of nonphytotoxic oil and tronic to prometryne and C-6313 enhanced weed control but caused increased crop injury. (University of California Extension Service, Salinas.)

The effect of three herbicides and surfactants for the control of common groundsel in direct seeded celery

Herbicide	lb/A	Surfactant	Rated 8/1/69 Weed Control(1)	Rated 8/1/69 Crop Injury	Harvest 11/28/69 lb/Stalk	Harvest 11/28/69 lbs/Plot
chloroxuron	2	none	1	0	1.7	90.2
chloroxuron	4	none	6.5	1	1.9	99.7
chloroxuron	2	oil	9.8	2.8	2.2	133.2
chloroxuron	4	oil	10.0	3.5	1.9	108.6
chloroxuron	2	tronic	9.0	2.5	2.1	111.1
prometryne	1	none	3.5	1	2.0	119.7
prometryne	2	none	6.8	4.5	2.0	109.2

Herbicide	lb/A	Surfactant	Rated 8/1/69 Weed Control[1]	Crop Injury	Harvest 11/28/69 lb/Stalk	lbs/Plot
prometryne	1	oil	9.5	5.3	2.0	113.5
prometryne	2	oil	9.8	5.8	1.8	80.5
prometryne	1	tronic	9.0	5.5	2.2	88.6
C-6313	1	none	3.3	1.8	1.7	92.2
C-6313	2	none	4.8	3.0	1.6	76.9
C-6313	1	oil	7.0	3.8	1.7	104.1
C-6313	2	oil	8.3	4.5	1.6	87.4
C-6313	1	tronic	7.0	4.5	1.7	86.9
Control	-	----	0	0	1.7	86.8

(1) Common groundsel

Postemergence herbicide test in tulips. Peabody, Dwight V., Jr. On November 21, 1968 six different tulip varieties (Olaf, Emmy Peeke, Fantasy, Rose Copeland, Tulipe Noire, Sundew) were planted in a silt loam soil and hilled 4 to 6 inches high. After emergence in early March, ten different herbicides were applied each at two rates to evaluate the activities of these compounds on tulip growth, vigor and yield as well as on the annual weed population present. Of these herbicides only NIA 16476 showed selectivity toward tulips equivalent to the currently recommended chlorprofam. In addition, NIA 16476 gave considerably better annual weed control than chlorprofam.

Bulb yields and weed control estimates of 1968-69 post-emergence herbicide tests in Sundew tulips.

Treatment Herbicide	Rate	Weed control estimates Count 5/10/69 No./sq.ft.	Rating 6/17/69	Bulb yields 10 cm. and larger No/plot	Gm/plot
VCS 438	4.0	0.7	10.0	25.0	550.0
NIA 16476	1.0	1.4	10.0	45.3	1094.3
NIA 16476	2.0	1.7	10.0	34.3	826.3
SD 15418	2.0	1.7	10.0	35.3	782.7
SD 15418	4.0	1.8	10.0	15.7	343.3
VCS 438	2.0	2.6	8.7	33.7	766.0
GS 14260	2.0	3.2	8.0	23.7	569.0
RH-315	2.0	3.2	7.0	30.3	684.0
RH-315	1.0	5.5	4.7	35.3	806.0
Granular Trifluralin	8.0	6.5	6.7	29.3	673.3
Chlorpropham	2.0	6.7	6.0	47.7	1143.0

Treatment Herbicide	Rate	Weed control estimates Count 5/10/69 No./sq. ft.	Rating 6/17/69	Bulb yields 10 cm. and larger No/plot	Gm/plot
C-6989	4.0	11.0	2.7	16.0	346.3
GS 14260	1.0	12.2	4.0	32.2	762.7
Granular Trifluralin	4.0	13.8	5.7	36.3	857.3
C-6989	8.0	15.4	2.7	2.0	40.3
Phenmedipham	4.0	23.9	2.7	33.3	773.7
Phenmedipham	2.0	32.1	1.7	34.0	762.7
Hoed - untreated check[1]	---	61.8	10.0	35.3	782.7
Chlorpropham + PPG 124E	2.0	62.8	1.0	28.0	608.3
Chlorpropham + PPG 124E	4.0	69.7	0.3	28.7	622.0

[1] Hoed and handweeded June 11, 1969

(Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon.)

Combinations of herbicides and mulches in rhododendrons. Crabtree, Garvin. Ornamental plantings that are mulched for appearance, ease of maintenance and good crop growth may need additional weed control measures. A trial was started in 1966 to study interactions between mulches and herbicides in combination. Field plantings of the rhododendron cultivars Cynthia and Pink Pearl were treated with granular applications of simazine or dichlobenil in various combinations with mulches of fir sawdust or finely ground fir bark. Weed control and crop response evaluations were made over a three year period. It was concluded that the mulches used in this trial were more effective than the herbicide treatments for controlling weeds, particularly when evaluated more than a year after time of application. There were no important differences between the two herbicides or between the types of mulch, however, there was a slight advantage from the standpoint of weed control to apply the herbicide before the mulch is put down. Analysis of the plant response data shows that none of the herbicide and mulch treatments affected the average number of flowers per plant. Plant size was significantly influenced by mulching but not by the herbicide treatments. Larger plants were produced in mulched plots with no difference being exhibited between sawdust or bark mulch. (Horticulture Dept., Oregon State University, Corvallis.)

PROJECT 5. WEEDS IN AGRONOMIC CROPS

Gary A. Lee, Project Chairman

SUMMARY

The number and diversity of agronomic crop research reports submitted attests to the multiformity of agriculture of the Western United States. The excellent response of 28 papers in 11 areas of research are summarized as:

Alfalfa. Results of studies conducted in Colorado on new seeded alfalfa indicate that DCPA and EPTC gave acceptable control of most species present. Bromoxynil caused alfalfa stand reduction as a result of high temperatures at the time of and following application. Terbacil and GS-14254 applied to dormant alfalfa gave promising results at several locations under irrigated and dryland conditions in Utah. Studies conducted in Wyoming on irrigated soils showed atrazine, bromacil, GS-14254 and terbacil effectively controlled annual weed when applied to dormant alfalfa. Dodder was effectively controlled over a longer period of time by utilizing chlorpropham + PCMC or RH-315 when compared to the standard treatment of chlorpropham in alfalfa seed production fields in Washington.

Mixed Forages. When compared to dinoseb, bromoxymil alone and in combination with 2,4-DB caused increased injury to various legumes growing with Climax timothy. However, alfalfa did show tolerance to bromoxynil.

Small Grains. Extensive studies conducted in winter wheat production areas of Utah indicate that various preemergence and postemergence treatments resulted in excellent weed control without sustained damage to the crop. Minimum tillage barley production utilizing a specially designed grain drill and a contact herbicide has resulted in a promising new cultural practice. California researchers obtained excellent wild oat control in barley and wheat with emulsifiable concentrate of triallate, but erratic control resulted with the granular formulation. Greenhouse studies show that barley has high tolerance when triallate is sprayed on exposed seeds and then both barley seed and herbicide incorporated into the soil in one operation. Increased nitrogen fertilizer rates complimented by growth regulators at various stages of barley growth, to reduce lodging effects, has resulted in some yield increase in Oregon trials.

Field Beans. Studies conducted in Colorado on effect of incorporation versus nonincorporation on weed control obtained with various herbicidal treatments showed only slight differences due to extensive rains following applications. However, DCPA, nitralin + EPTC, nitralin + amiben, alachlor, and alachlor + linuron resulted in excellent

control of broadleaf and grassy weeds. Nitralin + EPTC, nitralin and alachlor gave outstanding weed control in Wyoming. SD-15418 and EPTC + R-11913 resulted in severe bean stand reductions.

Corn. Non-tillage corn production in old pasture swards using atrazine + amitrole and atrazine + paraquat provided several advantages over traditional cultural practices in Washington studies. Logarithmic screening trials in California showed that several herbicides gave excellent barnyardgrass control and established rate of application tolerances. Extensive studies in Colorado indicated several new herbicides gave better grass control than atrazine, but few were superior to atrazine for broadleaf weed control. Under Wyoming climatic conditions, SD-15418 resulted in outstanding season long weed control when comparing herbicides alone and in combination. Oregon scientists concluded that although there are several good herbicides available for use in corn, adequate incorporation, timing and amount of overhead moisture and stage of growth of weeds at time of herbicide application greatly influence the resulting weed control.

Cotton. Severe cotton stand reductions which are encountered with diuron at 1.5 to 2.0 lb/A can be eliminated by including trifluralin as a combination treatment. Trifluralin inhibits secondary root growth in cotton seedlings which reduces the uptake of diruon allowing the plants to develop normally.

Peppermint. Surfactants and nonphytotoxic oils increased terbacil weed control activity when applied postemergence. Liquid fertilizer at 20% of total volume sprayed increased the phytotoxic activity of terbacil; however, surfactants and nonphytotoxic oils were superior additives. Greater weed control was obtained when applications were made one week after weed seedlings emergence.

Potatoes. Studies conducted at two locations in Oregon indicated that several new herbicides showed promise as preplant, preemergence and postemergence treatments for weed control in potatoes.

Sugar Beets. Oregon studies showed that cycloate preplant plus phenmedipham postemergence resulted in outstanding weed control. Cycloate + R-11913 gave acceptable sugar beet tolerance in the Pacific Northwest. However, cycloate + R-11913 at 2 + 2 lb/A resulted in the greatest sugar beet stand reduction in Colorado trials. Excellent weed control was reported with various herbicide combinations at both locations. Investigators found that the addition of nonphytotoxic oils to postemergence treatments increased sugar beet damage. EP-474 and EP-475 resulted in greater redroot pigweed control when compared to phenmedipham which is in agreement with results from Oregon. Phenmedipham gave acceptable weed control and less sugar beet damage when applied during the winter months in California.

Chemical Fallow. Excellent weed control was obtained with paraquat + surfactant in winter wheat fallow in Wyoming. However, three applications were necessary through the summer to maintain relatively weed-free conditions.

Residue Studies. Various incorporation methods and irrigation practices effected the residual life of many herbicides in Panoche clay loam soil in California. Residual damage to subsequent crops may be averted by management practices.

Evaluation of herbicides in new seedling alfalfa. Heikes, P. E. This work was done on the Experiment Station at Rocky Ford, Colorado. Preplant herbicides were applied May 20 and postemergence herbicides June 18. Plots were 1000 sq. ft.; herbicides were applied in 40 gpa of water. EPTC and benefin were soil incorporated immediately after application with a tandem disk going twice over. This incorporated the materials 2½ to 3 in. deep. All other preplant herbicides were incorporated with a spike-tooth harrow going twice over. Alfalfa was seeded the following week and immediately irrigated.

The soil on this farm is a sandy clay loam; it was analyzed as follows: pH 7.8, 1.3% O. M., 45% sand, 32% silt, and 23% clay. The mean temperature for June and July was 79.8 and 77.8°F respectively. There was 1.3 and 1.89 in. of rainfall these months. The daytime temperature June 18 when postemergence herbicides were applied was 72°F - maximum 79°F. Daytime temperatures were lower than this prior to June 18 (70 and 71°F the two days previous), and continued to rise the following week with 88 and 95°F the next three days - 100°F, June 28th.

The major weeds in this field were puncturevine (*Tribulus terrestris* L.), redroot pigweed (*Amaranthus retroflexus* L.), Venice mallow (*Hibiscus trionum* L.), purslane (*Portulaca oleracea* L.), and some buffalobur (*Solanum rostratum* Dunal). There was a thin stand of grass weeds - *Setaria* spp., barnyardgrass (*Echinochloa crusgalli* L.), and nutgrass (*Cyperus esculentus* L.).

Results of this series of herbicide evaluations are presented in the accompanying table.

SUMMARY: DCPA was best of the preplant herbicides; there was no crop injury at either rate. Dacthal controlled all weeds except venice mallow. EPTC was effective on grasses and most broadleaf weeds but did not control puncturevine. Benefin was weak on broadleaf weeds and had little effect on venice mallow. SD-15418 and nitralin lacked crop tolerance. In this series, bromoxynil did not show the selectivity expected but weather conditions before and after application may have contributed to the crop injury. 2,4-DB was fairly good on broadleaf weeds but had no effect on grasses and caused some crop stunting, but later the crop appeared to recover.
(Botany Department, Colorado State University, Ft. Collins, Colorado.)

Herbicide evaluations in new seeding alfalfa

Colorado - 1969

Herbicide	Rate per Acre	Percent Stand Reduction[1/] Broadleaf Weeds	Grass Weeds	Puncture Vine	Venice Mallow	Alfalfa
EPTC	3 lbs	46	87	0	97	0
EPTC	4 lbs	53	100	10	99	0
benefin	½ lbs	26	88	20	0	0
benefin	3/4 lbs	23	99	10	10	0
DCPA	7½ lbs	88	100	92	0	0
DCPA	10 lbs	90	100	97	0	0
nitralin	1 lb	89	100	80	0	25
nitralin	2 lbs	92	100	90	0	75
SD-15418	2 lbs	74	88	65	35	100
SD-15418	4 lbs	92	99	92	75	100
bromoxynil	¼ lb	93	0	97	99	75
bromoxynil	3/8 lb	94	0	99	100	100
2,4-DB ester	½ lb	51	0	40	35	20[2/]
2,4-DB ester	3/4 lb	52	0	90	93	37[2/]

1/ Percent stand reduction based on plant counts made July 1.

2/ Percent stunted, no stand reduction.

Herbicide evaluation studies with irrigated alfalfa in Utah. Evans, J. O., and C. R. Woods. Three experiments were established for the control of shepherdspurse (*Capsella bursa-pastoris* (L.) Medic.) and downy brome (*Bromus tectorum* L.) in irrigated alfalfa. Irrigation was either by boarder or by furrow. Treatments were applied with bicycle sprayer in early April before alfalfa broke dormancy.

Of the herbicides tested (following table), only terbacil and GS-14254 gave satisfactory control of both weeds. GS-14260 gave good control of shepherdspurse but failed to give satisfactory control of downy brome. Several compounds gave excellent control at some locations but failed to provide consistent weed control. Although all treatments showed some initial injury to the alfalfa crop, none of the materials caused significant damage in any of the cuttings. At the second and third cutting all treatments were equal to or better in general appearance than the controls. (Utah State University Exp. Station, Logan.)

Evaluation of herbicides to control sheperdspurse mustard and downy brome in irrigated alfalfa

Treatment	Rate (lb/A)	Alfalfa Injury Inj. Ind.	Shepherdspurse[1] Control (%)			Downy Brome[2] Control (%)	
			Benson	Smith-field	Wells-ville	Benson	Wells-ville
4-(2,4-DB)	1.0	.66	27	40	13	10	0
Simazine	1.0	.66	85	33	98	80	78
Simazine	1.5	1.0	88	35	75	85	70
GS-14260	.75	.33	87	91	100	40	86
GS-14260	1.5	.66	83	95	100	60	91
GS-14254	.75	.75	87	98	100	90	93
GS-14254	1.5	1.0	87	98	100	90	98
GS-14254	2.0	1.0	90	95	100	98	100
bromoxynil	.75	.66	80	88	55	45	3
bromoxynil	1.0	--	83	--	--	40	--
plus R-11913	.50 + 1.0	.66	83	88	--	60	78
RP-17623	1.0	3.0	70	42	97	30	78
RP-17623	2.0	4.0	63	33	80	35	87
terbacil	.50	.66	--	95	100	--	100
terbacil	.75	1.0	85	98	100	95	100
terbacil	1.0	1.0	88	98	100	98	100
R-11913	1.0	.66	78	25	70	65	75
R-11913	2.0	.33	85	50	100	80	68
R-11913	1.0	--	--	--	--	--	--
plus GS-14254	1.0	--	87	--	--	95	--
dichlobenil	1.0	2.0	13	18	10	25	43
dichlobenil	2.0	3.0	--	12	40	--	40
Check	---	0	0	0	0	0	0

[1] Shepherdspurse (<u>Capsella bursa-pastoris</u> (L.) Medic.)

[2] Downy Brome (<u>Bromus tectorum</u> L.)

Applications of herbicides for weed control in dormant established dryland alfalfa. Evans, J. O., and C. R. Woods. Studies to determine the effectiveness of promising herbicides for the control of annual weeds in established dryland alfalfa were conducted at three locations in Utah in 1969.

Weed populations consisted of bur buttercup (*Ranunculus testiculatus* Crantz), shepherdspurse (*Capsella bursa-pastoris* (L.) Medic.), snoweed (*Veronica campylopoda* Boiss), and downy brome (*Bromus tectorum* L.).

Herbicides were applied in the spring before the alfalfa broke dormancy (April 2-21). Each treatment was replicated three times in 180 sq. ft. plots. Herbicides were applied with a bicycle sprayer in 16 gpa water on a broadcast basis.

Results (following table) show that only GS-14254 gave satisfactory control of both broadleafed and grass weeds at all locations. Terbacil gave good control of all species at two of the three locations. GS-14260 gave good broadleafed weed control at all locations but appeared weak on grasses.

GS-14254 and terbacil were the most promising compounds tested based on crop safety and longevity for full season weed control. (Utah State University Exp. Station, Logan.)

Control of annual weeds in established dryland alfalfa with herbicides - 1969

Treatment	Rate lbs/A	Broadleaf Control (%)				Grass Control (%)[5]	
		Hyrum[1]	Mendon[2]	Clarkston		Hyrum	Clarkston
				Snoweed[3]	Mustard[4]		
4-(2,4-DB)	1.0	13	33	8	77	0	0
simazine	1.0	80	92	13	5	43	10
simazine	1.5	87	100	20	40	40	48
GS-14260	.75	90	100	88	88	3	27
GS-14260	1.5	92	100	93	92	68	40
GS-14254	.75	93	100	92	87	83	85
GS-14254	1.5	95	100	95	95	95	95
GS-14254	2.0	95	100	96	95	95	93
bromoxynil	.75	88	100	92	85	2	53
bromoxynil	.50	--	--	--	--	--	--
plus R-11913	1.0	92	100	88	88	13	17
RP-17623	1.0	83	63	87	62	17	22
RP-17623	2.0	87	57	--	--	23	--
linuron	1.0	--	--	83	42	--	18
terbacil	.50	7	77	90	92	95	95

Treatment	Rate lbs/A	Broadleaf Control (%)				Grass Control (%)[5]	
		Hyrum[1]	Mendon[2]	Clarkston		Hyrum	Clarkston
				Snoweed[3]	Mustard[4]		
terbacil	.75	18	97	87	62	95	90
terbacil	1.0	45	100	93	93	98	95
R-11913	1.0	35	--	--	--	0	--
R-11913	2.0	53	99	80	57	17	55
R-11913	3.0	--	100	77	65	--	58
dichlobenil	1.0	7	10	17	7	5	13
dichlobenil	2.0	3	12	--	--	0	--
Check	00	0	0	0	0	0	0

1 & 2 Bur buttercup (Ranunculus testiculatus Crantz)
3 Snoweed (Veronica campylopoda Goiss)
4 Mustard (Brassica Sp.)
5 Downy brome (Bromus tectorum L.)

Weed control in irrigated alfalfa. Lee, G. A., Ogg, P. J., and Alley, J. P. Weed control in established alfalfa is beneficial in several respects. Increased quality of hay and decreasing potential weed infestations in subsequent crops are among the advantages.

Plots were established April 1, 1969 when the alfalfa was in a dormant stage. The study location consisted predominately of a sandy loam soil. Treatments were replicated three times and were two sq. rods in size. The herbicides were applied in 40 gpa of water carrier on a full coverage basis.

Weed population consisted of tansy mustard (Descurainia pinnata (Walt.) Britt.), kochia (Kochia scoparia (L.) Roth) and green foxtail (Setaria viridis L. Beauv.). Yield of alfalfa, percent weeds by weight of alfalfa were obtained by clipping two subsamples from each plot. Protein levels were determined by the micro-Kjeldahl method.

Atrazine at 1.0 lb/A and bromacil at 1.0 lb/A resulted in .62 and .60 Tons/A alfalfa, respectively, with complete elimination of weeds for three cuttings. Alfalfa hay treated with bromacil at 1.0 lb/A contained .9% more protein than hay from the atrazine at 1.0 lb/A treatment. GS-14254 at 1.0 and 3.0 lb/A, terbacil at 1.0 lb/A and simazine at 2.0 lb/A gave season long weed control. Areas treated with bromacil at .5 lb/A and atrazine at 2.0 lb/A were reinfested with weeds as the growing season progressed. CP-44939 at 2.0 and 4.0 lb/A gave good control of green foxtail but had little effect on the broadleaved weeds. Terbacil at .25 lb/A gave excellent weed control at the time of the first cutting but weeds reinfested

Effect of herbicides applied at dormant spring treatments on alfalfa yield, percent weeds by weight, and percent protein of alfalfa

		First Cutting			Second Cutting		Third Cutting		Average	
Treatment*	Rate lbs/A	Tons/A Alfalfa	% Weeds	% Protein	Tons/A Alfalfa	% Weeds	Tons/A Alfalfa	% Weeds	Tons/A Alfalfa	% Weeds
atrazine	1.0	.71	0.0	16.4	.64	0.0	.50	0.0	.62	0.0
bromacil	1.0	.79	0.0	17.3	.59	0.0	.43	0.0	.60	0.0
GS-14254[1/]	3.0	.71	0.0	18.5	.56	0.0	.44	0.0	.57	0.0
terbacil	0.5	.88	0.15	16.8	.65	0.0	.45	0.3	.66	0.2
simazine	2.0	.68	0.0	17.3	.64	0.0	.37	0.0	.56	0.0
terbacil	1.0	.71	0.0	16.6	.58	0.0	.38	0.0	.56	0.0
GS-14254	1.0	.78	0.0	16.0	.52	0.0	.44	0.0	.58	0.0
R-11913[2/]	4.0	.78	0.0	16.5	.63	0.1	.45	0.3	.62	0.1
terbacil	0.25	.73	0.0	16.4	.67	0.0	.34	1.2	.58	0.4
bromacil	0.5	.97	0.0	16.5	.60	0.7	.46	3.8	.68	1.5
R-11913	2.0	.66	0.0	17.4	.58	0.2	.51	0.3	.58	0.2
R-11913	3.0	.86	0.0	16.3	.64	0.1	.31	5.4	.60	1.8
simazine	3.0	.62**	0.0	18.4	.48	0.3	.36	0.0	.49	0.2
CP-44939[3/]	4.0	.67	8.9	15.7	.64	0.0	.42	0.3	.58	3.1
RH-315[4/]	3.0	.72	9.2	17.0	.53	0.1	.50	0.8	.58	3.5
CP-44939	2.0	.81	2.9	16.8	.51	0.6	.40	0.7	.57	1.4
RH-315	1.0	.81	4.5	16.4	.60	0.3	.39	1.2	.60	2.1
atrazine	2.0	.53**	0.0	17.4	.49	0.7	.34	4.4	.45	1.6
Check		.64	7.3	16.5	.54	0.6	.37	1.26	.52	3.0

* Treatments listed in order of total performance.

** Alfalfa chlorotic during early growth stage.

1/ 2-sec. butylamino-4-ethylamino-6-methoxy-s-triazine

2/ Name unavailable.

3/ 6'-tert.-Butyl-2-chloro-N-(methoxymethyl)-s-acetotoluidide.

4/ Name unavailable.

the area later in the growing season. No herbicide caused a significant decrease in protein levels of the hay. However, GS-14254 at 3.0 lb/A and simazine at 3.0 lb/A increased percent protein 2.0 and 1.9, respectively. Atrazine at 2.0 lb/A and simazine at 3.0 lb/A moderate chlorosis to alfalfa plants early in the growing season. However, no symptoms were evident at the time of the second and third cuttings. (Wyoming Agriculture Experiment Station, Laramie, SR-225.)

Herbicides for dodder control in alfalfa. Dawson, J. H. Isopropyl *m*-chlorocarbanilate (chlorpropham) applied to the soil at 6 lb/A is the standard treatment for controlling dodder (*Cuscuta* spp.) in alfalfa seed fields. Although chlorpropham controls dodder consistently, its short residual activity in the soil (about 4 weeks) limits its effectiveness. For improved dodder control, we need herbicides that kill dodder and persist in the soil longer than chlorpropham. In greenhouse and field experiments, chlorpropham plus *p*-chlorophenyl *N*-methylcarbamate (PCMC), a non-phytotoxic microbial inhibitor, and *N*-(1,1-dimethylpropynyl-3,5-dichlorobenzamide (RH-315), a new herbicide, controlled dodder for several weeks longer than chlorpropham alone. In the greenhouse, dodder was controlled for 4 weeks by chlorpropham alone at 6 lb/A; 9 weeks by chlorpropham at 6 lb/A + PCMC at 1.5 lb/A; and 12 weeks by RH-315 at 1½ lb/A.

In a field experiment, RH-315, chlorpropham + PCMC, and chlorpropham alone were applied March 13 and April 14, 1969. All were applied both on the soil surface and mechanically incorporated to a depth of 1 inch in the soil. Abundant dodder emerged in late April and early May. Emergence stopped in the middle of May because the surface soil became dry. Dodder control was measured by counting seedlings attached to host plants in treated and untreated plots on May 21. Irrigation on May 22 stimulated emergence of additional dodder, control of which was evaluated by counting attached seedlings again on June 12. Not enough dodder emerged after June 12 to allow further measurement of control. Control of dodder was considered satisfactory when the number of attached dodder was reduced 95% or more.

Satisfactory control of the early-emerging dodder resulted from chlorpropham at 6 lb/A incorporated March 13 or applied April 14 on the soil surface or incorporated (see Table). No application of chlorpropham alone controlled dodder satisfactorily during the second emergence.

RH-315 at 1½ lb/A applied on the soil surface or incorporated mechanically on March 13 or April 14 controlled 96 to 100% of the dodder at both dates of evaluation. These results demonstrated its effectiveness against dodder in the field, and its persistence in soil for periods longer than that of chlorpropham.

Chlorpropham at 6 lb/A plus PCMC at 1½ lb/A applied on the soil surface or incorporated on March 13, or incorporated on April 14, controlled 97 to 100% of the dodder at both dates of evaluation. As in the greenhouse, the addition of PCMC to chlorpropham under field conditions increased the persistence of the herbicide in the soil and prolonged the period of effective dodder control. (Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, and Washington State University College of Agriculture cooperating. Irrigated Agriculture Research and Extension Center, Prosser, Washington.)

Control of dodder in the field from certain soil-applied herbicides

Herbicide	Date applied	Application method	Percent control* May 21	Percent control* June 12
Chlorpropham, 6 lb/A	March 13	Surface	90	64
		Incorporated	98	75
	April 14	Surface	97	71
		Incorporated	99	91
Chlorpropham, 6 lb/A + PCMC, 1½ lb/A	March 13	Surface	98	98
		Incorporated	100	97
	April 14	Surface	98	92
		Incorporated	100	100
RH-315, 1½ lb/A	March 13	Surface	97	97
		Incorporated	96	97
	April 14	Surface	96	99
		Incorporated	100	97

* Based on numbers of attached dodder. Untreated checks averaged 288 per 18 sq ft on May 21 and 1428 on June 12.

Postemergence herbicide applications on new seedings of ten different pasture legumes. Peabody, Dwight V., Jr. On April 10, 1969, each of ten different pasture legumes: Ladino clover, red clover, alsike clover, bigleaved birdsfoot trefoil, narrow-leaved birdsfoot trefoil, subclover, New Zealand white clover, white Dutch clover, DuPuit alfalfa, and crimson clover were seeded with Climax timothy. Five weeks later three herbicidal treatments were applied to these mixed stands of forage in order to assess their effect on growth and stand in comparison to the standard procedure of clipping for annual weed control. The herbicidal treatments tested were: (1) dinoseb (amine salt) at 1.5 lbs/acre; (2) bromoxynil at 0.5 lbs/acre; (3) bromoxynil at .5 lbs/acre plus 2,4-DB amine at 1 lb/acre.

Based on a series of ratings and visual estimates of crop stand and vigor, it was concluded that (1) bromoxynil either alone or in combination with 2,4-DB caused more injury on more different legume species than the presently recommended dinoseb, and (2) alfalfa was the only forage legume that showed consistent tolerance of bromoxynil activity. (Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon.)

Control of annual weeds in winter wheat. Evans, J. O., and C. R. Woods. Experiments were established to test promising herbicides for the control of snoweed (*Veronica campylopoda* Boiss), and bur buttercup (*Ranunculus testiculatus* Crantz) in dryland winter wheat in Northern Utah.

Of the herbicides tested, GS-14260 and GS-14254 gave over 90% control of snoweed. GS-14260, GS-14254, and linuron at all rates gave excellent control of bur buttercup. Crop injury that was evident shortly after application of GS-14254 and linuron was not evident when the wheat reached the boot stage.

This and other experiments conducted in Utah during 1968-69 show GS-14260 to be the most promising herbicide for the control of nearly all broadleafed annual weeds. Linuron shows promise for control of annual grasses and some annual broadleaf weeds. (Utah State University Exp. Station, Logan.)

Control of snoweed and bur buttercup in dryland winter wheat - 1969

Treatment	Rate lb/A	Wheat Inj. Ind.	Snoweed[1] % Control	Bur Buttercup[2] % Control
GS-14260	.50	0	92	93
GS-14260	.75	0	93	91
GS-14260	1.0	0	100	100
GS-14254	.50	0	92	93
GS-14254	1.0	.66	100	97
Check	-	0	0	0
bromoxynil	.50	0	73	51
bromoxynil	.75	0	83	58
CP-52223	1.0	0	68	81
CP-52223	2.0	.33	77	78
linuron	.75	.33	11	95
linuron	1.25	1.66	18	96
VCS-438F	1.0	0	9	43
VCS-438F	1.5	0	5	54

1 Snoweed (*Veronica campylopoda* Boiss)
2 Bur Buttercup (*Ranunculus testiculatus* Crantz)

Preemergence and postemergence weed control in winter wheat. Evans, J. O., and C. R. Woods. Several herbicides were evaluated for their preemergence and postemergence control of prickly lettuce (*Lactuca scariola* L.) and downy brome (*Bromus tectorum* L.) in dryland winter wheat in Utah. Preemergence applications were made on November 18, 1968, and postemergence treatments made on April 4, 1969.

GS-14260 at 1.5 lb/A and CP-52223 at 1.5 and 2 lb/A gave excellent control of prickly lettuce when the chemicals were applied in the fall. Spring treatments of GS-14260 at 2 lb/A were required to give 90% prickly lettuce control and CP-52223 proved to be less effective when the weed was established. VCS-438 shows considerable promise as a postemergence treatment for several broadleaf weeds in wheat. Downy brome was more effectively controlled with preemergence treatments, with CP-52223 giving satisfactory control at 2.5 lb/A. At the higher rates, R-11913 gives satisfactory grass control and shows excellent crop safety. (Utah State University Exp. Station, Logan.)

Control of prickly lettuce and downy brome in winter wheat - 1969

Treatment	Rate lb/A	Wheat Inj. Ind.	Prickly lettuce[1] % Control	Downy Brome[2] % Control
Preemergence - applied November 15, 1968				
GS-14260	1.0	0	72	18
GS-14260	1.5	0	92	42
GS-14254	1.0	0	87	82
linuron	1.0	0	58	78
linuron	1.5	0	62	83
R-11913	1.75	0	32	80
R-11913	1.0	-	--	--
Plus bromoxynil	.38	0	63	43
HOE-2990	1.0	0	47	18
HOE-2933	1.0	0	47	13
VCS-438	1.0	0	74	68
CP-52223	1.50	0	90	82
CP-52223	2.50	0	93	90
C-9122	1.25	0	70	70
RP-11561	1.0	0	32	31
Check	---	0	0	0
Postemergence - applied April 4, 1969				
GS-14260	1.0	0	80	8
GS-14260	2.0	.33	91	40
GS-14254	1.5	1.66	90	67
linuron	.75	--	--	--
Plus R-11913	1.0	.33	27	63

Treatment	Rate lb/A	Wheat Inj. Ind	Prickly lettuce[1] % Control	Downy Brome[2] % Control
R-11913	1.0	.66	33	42
R-11913	1.5	0	42	43
R-11913	2.0	1.0	50	77
VCS-438	2.0	.33	83	5
VCS-438F	2.0	0	40	0
CP-52223	1.5	0	63	42
CP-52223	2.5	0	67	60
RP-11755	2.0	.33	41	47
RP-11755	2.5	.66	73	58
linuron	1.0	2.33	58	22
linuron	2.0	3.66	77	42
Check	--	0	0	0

1. Prickly lettuce (Lactuca scariola L.)

2. Downy brome (Bromus tectorum L.)

Minimum tillage for spring barley production. Colbert, Floyd O. and Appleby, Arnold P. The weed project at Oregon State University has been working with different types of minimum tillage for several years. So for clarification the following definitions are included.

1. Minimum tillage is a general term referring to all practices in which mechanical tillage is reduced or eliminated.

2. Chemical seedbed, as used by Oregon State University personnel, refers specifically to a program involving mechanical seedbed preparation in the fall, chemical control of weeds prior to planting, and seeding in the spring without further mechanical tillage.

3. Stubble-planting refers to the practice of chemical weed control in the stubble followed by seeding without any prior mechanical tillage.

In 1969 spring barley was tested under chemical seedbed and stubble planting minimum tillage technique. The main objectives were to obtain yield data for comparison to the conventional seedbed method, observe biological differences between treatments and evaluate the performance of Allis-Chalmers prototype minimum tillage grain drill. Four locations for each method was selected. A summary of the yield and weed control readings are presented in the following table. Paraquat gave good weed control for existing vegetation at planting. However, at chemical seedbed location I henbit (Lamium amplexicaule L.) was not controlled. At stubble planting site I annual ryegrass (Lolium multiflorum Lam.) emerged through the stubble after paraquat application and was not controlled. For both techniques yields were comparable to the conventional method. However, further investigations are needed for biological problems such as weeds, slugs, and seed germination in non-degraded stubble. These data will aid in predicting under what conditions success for these new techniques can be expected. With most conditions tested adequate plant establishment was obtained with the Allis-Chalmers drill, although more work is needed to improve its performance under field conditions.

Studies are presently underway to obtain additional information for production of spring barley and winter wheat employing both minimum tillage techniques. (Farm Crops Department, Oregon State University, Corvallis.)

Weed control ratings and yield for minimum tillage spring barley production 1969

Location and treatment	Weed control[1/] (%)	Yield (lbs/A)
Chemical Seedbed		
I. Conventional	-	2178
AC2" + paraquat[2/]	75	2139
II. Conventional	-	1407
AC2" + paraquat	90	1041
III. Conventional	-	1342
AC2" + paraquat	95	928
IV. Conventional	-	1768
AC2" + paraquat	95	1803
Stubble Planting		
I. Conventional	-	1660
AC0" + paraquat	90	1289
AC2" + paraquat	90	1185
II. Conventional	-	2683
AC0" + paraquat	95	2230
AC2" + paraquat	95	2052

Location and treatment		Weed Control[1/] (%)	Yield (lbs/A)
III.	Conventional	-	2448
	ACO" + paraquat	95	2618
	AC2" + paraquat	95	2609
IV.	Conventional	-	1479
	AC2" + paraquat	95	1933

1/ 0% indicates no injury; 100% indicates complete kill of vegetation.

2/ ACO" designates Allis-Chalmers rippled edge rolling coulter. AC2" designates Allis-Chalmers 2-inch fluted rolling coulter. Tradename No-Til Coulter.

Triallate for wild oat control in California. Norris, Robert F., Robert L. Sailsbery, and Orris W. Gibson. Triallate provided outstanding wild oat (*Avena fatua* L.) control in barley when applied preemergence incorporated. Barley was aerially seeded and harrowed in prior to application of treatments, and the chemical was incorporated with a further double spike-tooth harrowing. Trials established in both Glenn and Yolo counties showed 1.25 lb/A a.i. of EC triallate providing high levels of wild oat control throughout the season. Substantial increases in barley yield were realized at both locations (see table). The granular formulation of triallate proved erratic, giving moderate wild oat control in Glenn County, but virtually no activity in Yolo county.

One trial conducted on wheat indicated a narrow margin of tolerance to triallate by this crop. No wild oats emerged in this experiment, and the data presented in the accompanying table reflect only effects of triallate on the wheat.

The method of application of triallate outlined in the table required two additional field operations. This is undesirable in a low profit-margin crop. Attempts have therefore been made to determine if other sequences of seeding and treating might be feasible. A greenhouse and a small plot field trial have shown complete safety when barley was broadcast on the soil surface and the chemical then sprayed on the exposed grain, followed by a single harrowing to cover the seed and to incorporate the triallate. Such a method would reduce the number of field operations required to use the chemical. This possibility is being investigated further.

A single trial to investigate the possibility of using triallate granules postemergence indicated that tillered wild oats could be controlled by 1.25 lb/A of chemical using this method. The treatment was at an advanced stage of crop and weed growth and no changes in barley yield were obtained. As a final note, where rain fell within two days of applying triallate EC preemergence it was observed that wild oat control was equal between areas receiving only rainfall and those which were mechanically incorporated. (Department of Botany, Davis; and Agricultural Extension Service, University of California).

Effects of triallate on barley and wheat, and on wild oat control

Treatment	Glenn county Barley Treated 10/22/69		Yolo county Barley Treated 10/31/68		Sutter county Wheat Treated 11/27/68	
	Wild oat control 5/22/69	Yield lbs/A	Wild oat control 6/11/69	Yield lbs/A	Wheat stand 4/17/69	Yield lbs/A
Triallate EC 0.625 lb/A	5.9	995	8.6	2,580	8.8	2,350
Triallate 1.25 lb/A	8.1	1,187	9.4	2,790	8.0	1,935
Triallate 2.50 lb/A	9.0	1,266	9.7	2,910	5.8	1,010
Triallate 10G 1.25 lb/A	6.2	1,025	0.0	1,890	8.7	2,140
Untreated control	0.0	655	0.0	1,680	9.3	2,230

All data are mean of 4 replications.

Control: 0 - none, 10 - complete; Stand: 0 - none, 10 - normal.

Growth regulators in barley. Stanger, C. E. and Appleby, Arnold P. The objective of this experiment was to determine if barley yields could be increased with higher nitrogen rates if lodging could be prevented by addition of growth regulators. Two growth regulators (Ethrel and RH 531) and two nitrogen rates (150 and 230 lbs/A) were used. The growth regulators were applied during different stages of barley growth at 1.0 and 2.0 lbs/A. The RH 531 treatments were applied at the 1 to 2-leaf, 3 to 4-leaf, or early tillering stage of growth and Ethrel was applied during tillering, early boot, or late boot stage of growth. Both lodging and grain yield data were obtained and are included in the following table.

The untreated check plots at the high fertility levels yielded 23% less than the lower fertility check plots, primarily because of more rapid and more extensive lodging at the high N rates. Higher yields were obtained from the low nitrogen check treatments than from any of the high nitrogen plots treated with growth regulators.

RH 531 at 1.0 lb/A applied at the tillering stage and Ethrel at 1.0 lb/A applied at the early boot stage gave slightly higher yields than the untreated check at the lower nitrogen rates.

In the high nitrogen plots eight of the growth regulator treatments resulted in higher yields than the untreated check, although RH 531 at 2.0 lb/A applied at early tillering was the only treatment that was significantly higher than the check at the 5% level. Ethrel at 2.0 lb/A applied during late boot in both the low and high nitrogen treatments resulted in yields significantly lower than the check plots because of plant injury.

RH 531 applied at the 3 to 4-leaf or early tillering stage delayed lodging in the high nitrogen treatments by as much as 30 days when compared to check treatments. Ethrel also had this same effect when applied during the early and late boot stages of growth.

Injury to the developing seed heads and a 10 to 14 day delay in maturity was noted with Ethrel treatments when applied in the late boot stage of growth. (Farm Crops Department, Oregon State University, Corvallis, Oregon.)

Growth Regulators on Spring Barley

Treatment	Rate lb/A	Stage growth	Avg. yield lb/A	% lodging
150 lbs N/A				
RH 531	1	Early tillering	3433	48
Ethrel	1	Early boot	3392	2
Check	-	---	3316	70
RH 531	2	Early tillering	3293	38
RH 531	2	3 to 4-leaf	3147	48
Ethrel	2	Early boot	3133	1
RH 531	1	1 to 2-leaf	3119	43
RH 531	2	1 to 2-leaf	2979	28
Ethrel	1	Tillering	2936	45
RH 531	1	3 to 4-leaf	2908	50
Ethrel	2	Tillering	2852	70
Ethrel	1	Late boot	2773	5
Ethrel	2	Late boot	2346	1

Treatment	Rate lb/A	Stage growth	Avg. yield lb/A	% lodging
230 lbs N/A				
RH 531	2	Early tillering	3147	95
RH 531	1	1 to 2-leaf	3125	88
RH 531	2	1 to 2-leaf	3049	85
RH 531	1	3 to 4-leaf	3001	90
RH 531	1	Early tillering	2880	93
Ethrel	1	Early boot	2866	13
Ethrel	2	Tillering	2796	95
Ethrel	1	Tillering	2655	100
RH 531	2	3 to 4-leaf	2627	90
Check	-	---	2627	85
Ethrel	2	Early boot	2276	10
Ethrel	1	Late boot	2183	10
Ethrel	2	Late boot	1649	8

Evaluation of herbicides for weed control in dry beans. Heikes, P. I. This work was done on the Experiment Station at Fort Collins. Herbicides were applied broadcast with a plot sprayer in 40 gpa of water. Plots were 500 sq. ft., 2 replications. EPTC, trifluralin and EPTC + trifluralin combinations were soil incorporated immediately after application with a tandem disk twice over. This incorporated the herbicides about 2½ to 3 in. deep. Half of other plots were soil incorporated with a spike-tooth harrow one time over; the other half was not incorporated. Pinto bean variety 114 was seeded June 4 about 1½ in. deep at approximately 75 lb of seed per acre with a 4-row planter. The area was seeded with lambsquarters (Chenopodium album L.), kochia (Kochia scoparia (L.) Schrad), redroot pigweed (Amaranthus retroflexus L.), Setaria spp., and nightshade (Solanum nigrum L.).

Weed counts were made July 25; visual observations were made July 18 and August 25. There were four 2 ft. x 4 ft. quadrat counts made in each plot - 2 in the incorporated area and 2 in the non-incorporated area. Two rows, 20 ft. long were harvested in each plot September 20; moisture comparisons of the beans and vines were made at harvest time. Several treatments appeared to delay maturity. Most herbicides did not show significant differences in weed control where incorporated and not incorporated; however, there were light showers almost every day for the next several weeks after the beans were seeded which may have evened out differences.

Results of this experiment are shown in the following table. Botany Department, Colorado State University, Fort Collins, Colorado.)

Weed control in dry beans

Common Name	Rate lb per Acre	Percent Weed Control: Brdlf Weeds	Grass Weeds	Pigweed	Purslane	Night Shade	Yield lbs/A
EPTC	3	83	99	81	80	94	1933
trifluralin	3/4	89	94	92	86	50	2023
EPTC/ trifluralin	2 + ½	82	99	80	80	91	2010
C-6989	3	90	63	94	97	75	1600
C-6989	3	94	81	94	98	82	1852
DCPA	10	92	100	89	90	97	1985
DCPA	12	96	99	88	87	100	2070
DCPA/ nitralin	6 + ½	89	95	91	88	88	1980
DCPA/ linuron	6 + ½	93	96	93	90	90	2043
DCPA/ dinoseb	6 + 3	79	97	72	76	95	1067
nitralin	3/4	70	91	69	67	37	1011
nitralin	1	86	96	93	85	62	1740
nitralin	1½	89	100	90	92	57	2059
nitralin EPTC	½ + 2	92	100	92	92	92	2040
nitralin/ amiben	½ + 1½	90	91	88	91	44	1775
propachlor	6	79	99	92	66	35	1635
propachlor	8	81	100	92	78	60	1765
alachlor	4	83	99	86	67	75	1930
alachlor	4	96	100	99	97	95	1955
linuron	3/4	55	80	56	47	49	914
linuron/ amiben	3/4 1½	92	92	97	95	54	1878
linuron propachlor	4 pkg.mix	62	93	58	62	91	884
amiben (salt)	3	97	86	97	98	89	2230
amiben (ester)	3	93	88	94	94	82	2095
alachlor/ linuron	1.33 + .66	88	99	95	92	81	1899
alachlor/ linuron	2 + 1	99	100	99	98	99	2080
amiben dinoseb	2.0 + 3.0	67	54	61	77	38	916
Check							296

Weed control in field beans in Wyoming. Lee, G. A. and Alley, H. P. Screening trials were conducted at Torrington, Wyoming, on a sandy loam soil (70.8% sand, 10.5% silt, 18.7% clay and 1.26% organic matter). Treatments were applied in 40 gpa of water carrier. Each treatment was replicated three times. Chemical treatments were applied and incorporated with a spring tooth harrow on May 14, 1969 and planted May 16, 1969. Weed control evaluations were made July 9 and September 5, 1969. The natural weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), green foxtail (*Setaria viridis* (L.) Beauv.) and others which were a grouping of kochia (*Kochia scoparia* L. Roth), wild buckwheat (*Polygonum convolvulus* L.), common purslane (*Portulaca oleracea* L.), and common lambsquarters (*Chenopodium album* L.).

The data indicates that 16 of the 24 herbicide treatments resulted in 90% or better total control of all weed species present (attached table). EPTC + R-11913 at 2.0 + 2.0 lb/A controlled 100% of the weeds; however, the bean stand was reduced to 5.0% of the nontreated check. EPTC + R-11913 at 2.0 + 1.0 lb/A, Lasso at 4.0 lb/A, and nitralin + EPTC at .75 + 1.5 lb/A ranked second in the study with 99+% total weed control. The two latter treatments resulted in little or no bean stand reduction and no visual phytotoxicity to the crop. Nitralin at 1.0 lb/A and SD-15418 at 4.0 lb/A gave 99% total weed control. However, SD-15418 at 2.0 and 4.0 lb/A severely reduced the bean stand. Alachlor at 2.0 lb/A ranked fourth in total weed control with 97%. Nitralin + EPTC at .75 + 2.0 lb/A gave 96% total weed control with a slight reduction in bean stand. At the time of the late visual evaluation on September 5, nitralin + EPTC at .75 + 1.5 lb/A and .76 = 2.0 lb/A and trifluralin + EPTC at .5 + 2.0 lb/A treatments were nearly void of any weed growth. The bean plants in these plots were more mature that plots containing weeds. All weed species emerged extremely late in the spring which may account for the poor results obtained with the short residual herbicides. Alachlor at 2.0 lb/A, trifluralin + EPTC at .5 + 2.0 lb/A and nitralin + EPTC at .75 + 1.5 lb/A yielded 2118, 2086 and 2038 pounds of dry beans per acre, respectively. Although DCPA at 6.0 lb/A resulted in acceptable weed control, the bean plants did not mature. The bean seed contained 22.9% moisture at the time of harvest. (Wyoming Agriculture Experiment Station, Laramie, SR-219.)

Percent bean stand, percent weed control, yield and moisture content of beans

Treatment	Rate lb/A	% Stand Beans	Percent Control: Night-shade	Redroot Pigweed	Others	Green Foxtail	Average Total	Ranking 1/	Dry Wt. Yield lb/A	% Moist. 2/ at Harvest
EPTC	3	79	72	55	90	99	79	16	1543	12.5
trifluralin	.5	87	62	93	87	94	84	14	1621	12.5
trifluralin + EPTC	.5 + 2.0	95	88	98	90	100	94	8	2086	16.7
DCPA	6.0	90	90	93	95	100	94	7	1851	22.9
nitralin	.75	100	83	98	100	94	94	8	1592	12.0
nitralin	1.0	94	99	100	97	99	99	3	1975	11.7
AC-72986 3/	.75	86	24	0	66	5	24	20	820	14.9
AC-72986	1.5	83	32	0	71	40	36	18	843	16.5
AC-78126 4/	.75	82	55	0	66	0	30	19	801	13.4
AC-78126	1.5	100	37	0	68	38	36	17	828	14.1
nitralin + EPTC	.75 + 2.0	90	99	100	87	100	96	5	1888	10.2
RP-17623 5/	1.0	94	90	91	87	81	87	13	1379	12.4
RP-17623	2.0	73	82	100	95	90	92	9	1703	14.2
alachlor	2.0	100	99	100	90	98	97	4	2118	11.3
alachlor	4.0	98	99	100	100	100	99+	2	1758	13.5
BAY-94337 6/	1.0	3	65	100	97	100	91	11	*	
BAY-94337	.5	21	66	100	100	96	90	12	743	13.8
nitralin + EPTC	.75 + 1.5	100	99	100	100	100	99+	2	2038	7.5
SD-15418 7/	2.0	30	98	91	100	92	95	6	*	
SD-15418	4.0	20	100	98	97	99	99	3	*	
EPTC + R-11913 8/	2.0 + 2.0	5	100	100	100	100	100	1	*	
EPTC + R-11913	2.0 + 1.0	49	99	100	100	100	99+	2	*	
HOE-2933 9/	.75	89	79	83	95	76	83	15	1138	14.2
HOE-2933	1.5	80	84	91	100	90	91	10	1175	13.2
Check		100							755	13.8

1/ Ranking is based only on average percent control of all species present.
2/ Percent moisture was determined seven days after cutting.
3/ Name unavailable.
4/ Name unavailable.
5/ 2-tertiobutyl-4-)2,4-dichloro-5-isopropyloxyphenyl)-5 oxo-1,3,4-oxadiazoline.
6/ Name unavailable.
7/ 2-(4-chloro-6-ethylamino-5-triazin-2-ylamino)-2-methylpropionitrile.
8/ Name unavailable.
9/ Name unavailable.
* Not sufficient bean plants in plots to obtain harvest data.

Non-tillage corn trials. Peabody, Dwight V. Jr. Five dairy farms in different areas in western Washington were sites to determine the feasibility of planting and growing corn in undisturbed sod with no subsequent tillage. Two different herbicide combinations (atrazine + amitrole and atrazine + paraquat) were applied to old pasture swards before corn was planted. Corn variety and type of fertilizer used at each site was the same as the farmer's. (Rate of fertilizer was approximately the same.) Test areas were located within or adjacent to corn managed the usual way - the "field check". A special planter was used for seeding in the killed sod and a greater seeding rate was used to offset poor germination due to the possibility of inadequate furrow closure.

Planting corn in sod that was killed with a combination herbicide treatment was shown to be practical and resulted in certain advantages not usually obtained with the traditional tillage methods of seed bed preparation and subsequent production management practices. Some of these advantages are:

1. An extra early utilization of the old pasture sod can be obtained prior to corn planting.

2. Expensive and lengthy tillage practices are eliminated.

3. Erosion, if a factor on side hills, is reduced.

4. Sometimes yield increases are obtained.

5. Firm footing for equipment is present under late (and wet) harvest conditions.

6. Improved control of both annual and perennial weeds for a smaller cost.

Summary yield information of 1969 non-tillage corn planting trials

Herbicide[1]	Stalks 1000/A	Green Weight T/A	Dry Matter yields: Weight %	Total T/A	Ears T/A	Stalks T/A	% in Ears
Atrazine+Amitrole	44.1	33.0	19.4	6.4	2.9	3.5	45
Atrazine+Paraquat	45.2	32.5	21.2	6.9	3.2	3.7	46
Field Check	35.1	31.1	19.9	6.2	2.6	3.6	42

[1] Rates of application of atrazine: 4 lbs ai/A; amitrole: 4 lbs. ai/A; paraquat: 1 lb. ai/A. Adjuvant (spreader-activator) was added, at a concentration equivalent to 1 quart per 38 gallons of spray mix to all treatments.

(Northwestern Washington Research & Extension Unit, Washington State University, Mt. Vernon.)

Logarithmic screening trials in corn. Norris, Robert F. and Orris W. Gibson. Preplant and preemergence logarithmic bands of the following chemicals were applied to preshaped beds of clay soil at two locations. All logarithmic rates started at 16 lb/A and reduced to 1/4 lb/A. Results of both trials were very similar, chemicals, effective rates and results of one trial are shown below.

S-6115 (incorporated) was the most outstanding herbicide from the standpoint of weed control combined with crop safety. The ratings indicate slight loss of stand above the 12 lb/A rate, however, it was not established that this injury was entirely due to the herbicide. Barnyard grass (Echinochloa crus-galli (L.) Beauv.) was completely controlled at 1 lb/A, nearly complete at 3/4 lb/A, and though not eliminated, was very stunted and chlorotic at 1/4 lb/A. The herbicide, cultivation, and subsequent rapid growth of the corn provided season long barnyard grass control in this experiment.

Bay-86791 (incorporated) also gave excellent barnyard grass control but caused severe injury to the corn down to 2 lb/A and there was a trace of corn injury at 3/4 lb/A.

Atrazine, alachlor and SD-15418 (incorporated) all gave good barnyard grass control at 2 lb/A. Atrazine gave a trace of corn injury at 6 lb/A, alachlor 4 lb/A and SD-15418 at 5 lb/A. SD-15418, however, caused severe injury at 7 lb/A which did not occur until the 10 to 12 lb rate for the other two chemicals. Atrazine and alachlor also gave good barnyardgrass control non-incorporated at 3 lb/A, providing considerably more safety to the crop. This safety was also found with the preemergence treatment of SD-15418; however, 6 lb of this material was required to give the same degree of barnyard grass control.

Butylate and GS-14260 (incorporated) were also effective in controlling barnyard grass at 3 lb/A. Butylate gave a trace of injury at 3 lb/A and severe injury above 6 lb/A. Butylate was not effective when unincorporated and GS-14260 required about twice the incorporated rate to achieve comparable results. Soil samples were collected on 10/29/69 from the incorporated row for bioassay of residual chemical activity.

No residual activity data are available at the writing of this report. (Department of Botany, University of California, David, California).

Contra Costa County corn trial
Treated 6/19/69 - Rated 7/9/69

Chemical		Corn First Emerg.	Corn Full Stand	Barnyard Grass First Emerg.	Barnyard Grass 95% Control
atrazine	PE	16	13	7	3
"	PP	16	10	3	2

Chemical		Corn First Emerg.	Corn Full Stand	Barnyard Grass First Emerg.	Barnyard Grass 95% Control
propachlor	PE	16	11	15	13
"	PP	16	8	14	11
atrazine-propachlor	PE	16	15	14	9
" "	PP	16	12	8	5
alachlor	PE	16	13	6	3
"	PP	16	9	3	2
butylate	PE	16	15	15	10
"	PP	16	10	5	3
SD-15418	PE	16	14	13	7
"	PP	16	8	4	2
alachlor	PE	16	13	6	3
"	PP	16	9	3	2
butylate	PE	16	15	15	10
"	PP	16	10	5	3
SD-15418	PE	16	14	13	7
"	PP	16	8	4	2
CP-53619	PE	16	8	4	2
"	PP	16	7	8	5
GS-14260	PE	16	15	10	6
"	PP	16	5	5	3
S-6115	PE	16	12	6	3½
"	PP	16	9	1	3/4
Preforan	PE	16	14	16	15
"	PP	16	11	14	14
BAS-2903	PE	16	12	16	13
"	PP	6	2	2	1
BAY-86791	PE	16	10	9	6
"	PP	5	2	2	1
Untreated Check	PE	16	16	16	16
" "	PP	16	15	16	16

All data are mean of 3 replications, and are lb a.i./A.

Evaluation of preemergence herbicides in field corn. Heikes, P. E. Herbicides were evaluated at six locations with soil types ranging from sand to clay loam and organic matter from 0.4 to 2.0 percent. The major weed species were sandbur (*Cenchrus pauciflorus* Benth), kochia (*Kochia scoparia* (L.) Roth), pigweed (*Amaranthus retroflexus* L.), lambsquarters (*Chenopodium album* L.), purslane (*Portulaca oleracea* L.), nightshade (*Solanum nigrum* L.), and foxtail species (*Setaria* spp.).

All materials were applied broadcast with a plot sprayer in 40 gpa of water. Herbicides were applied before the corn was seeded and half of all plots were soil incorporated; the other half was not incorporated. Butylate was soil incorporated with a tandem disk, twice over. Plots were 1000 sq. ft. - 8 rows spaced 30" apart, 60 ft. long. 6, 2 ft. x 4 ft. weed counts were made in each plot. Results of this series of corn herbicide evaluations are shown in the following table. (Botany Department, Colorado State University, Fort Collins, Colorado.)

Preemergence corn herbicides evaluations
Colorado - 1969

Common Name	Rate lb per acre	Percent Weed Control Average 6 Locations Grasses	Brdlf Weeds	Total	% Crop Thinning[1]
atrazine	1½	84	93	89	
atrazine	2	89	97	93	
SD-15418	1½	76	75	76	
SD-15418	2	87	87	87	
SD-15418	4	92	89	91	
EPTC/2,4-D	2 qts	90	85	88	
butylate	4	89	84	87	
butylate/ atrazine	2 + 1	69	85	77	
butylate/ atrazine	3 + 1	76	93	85	
atrazine/ prometryne	3/4 + 3/4	78	87	83	
atrazine/ prometryne	1 + 1	82	90	86	15/1
linuron/ propachlor	5 lb pkg mix	73	77	75	
DCPA/2,4-D	6 + 1½	83	75	79	18/6
DCPA/2,4-D	7.2 + 1.8	87	84	86	26/6
DCPA	8	83	62	73	27/6
DCPA/atrazine	4 + 1	92	97	95	13/2
propachlor	6	69	50	60	
alachlor	2	88	84	86	
alachlor	3	88	87	88	
alachlor	4	91	84	88	

Common Name	Rate lb per acre	Percent Weed Control Average 6 Locations Grasses	Brdlf Weeds	Total	% Crop Thinning[1/]
alachlor/ atrazine	1½ + 1	88	88	88	
alachlor/ atrazine	2 + 1	92	91	92	
Propachlor/ atrazine	5 lb pkg mix	79	92	86	
propachlor atrazine	6 lb pkg mix	80	97	89	
C-6313	4	77	94	86	40/6
C-6989	4	66	69	68	
S-6115	1½	93	97	95	
S-6115	2	97	99	98	
BAS-2903	4	78	86	82	
alachlor/ linuron	1.33 + .66	82	86	84	
alachlor/ linuron	2 + 1	87	94	91	22/3

1/ Crop thinning and number of locations where thinning occurred.

Weed control in corn in Wyoming. Lee, G. A. and Alley, H. P. An executive corn herbicide trial was established to evaluate individual herbicide performance under Wyoming climatic conditions. Preemergence treatments were made on May 9, 1969. All treatments, unless specified, were incorporated to a depth of 1 to 1½ in. by going over the treated areas twice with a flextine harrow. Herbicides were applied in 40 gpa of water on a full coverage basis. The location consisted of a sandy loam soil (70.8% sand, 10.5% silt, 18.7% clay and 1.25% organic matter). The weed population was black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), and green foxtail (*Setaria viridis* (L.) Beauv.). Lesser populations of kochia (*Kochia scoparia* L. Roth), wild buckwheat (*Polygonum convolvulus* L.), common lambsquarters (*Chenopodium album* L.) and common purslane (*Portulaca oleracea* L.) were grouped together into a category labeled "Others". Percent weed control was obtained by actual counts of each species and compared to the number of plants present in the nontreated check. A severe frost on June 13 caused erratic loss of corn plants in the plots.

The data show that 7 of the 39 treatments resulted in 90% or better total weed control. SD-15418 (W.P.) at 4.0 lb/A, nonincorporated, gave 100% control of all weed species present. The flowable formulation of SD-15418 at 2.0 and 4.0 lb/A rated second and third in the study with 98 and 97% total control, respectively. Incorpora-

Treatment	Rate lb per acre	% Stand Corn	Percent Control: Black Nightshade	Redroot Pigweed	Others	Green Foxtail	Total Control	Ranking
butylate	4.0	79	67	100	2	64	58	18
butylate	6.0	85	81	100	63	87	83	8
2,4-D amine	1.0	74	1	67	22	0	22	28
R-15431[1/]	3.0	35	100	100	95	87	95	4
R-15431	6.0	23	100	96	100	86	95	4
AC-72986[2/]	.5	97	0	0	40	0	10	32
AC-72986	1.5	88	0	50	35	0	21	29
AC-78126[3/]	.5	71	34	46	30	8	32	26
AC-78126	1.5	74	31	54	30	0	29	27
atrazine	.75	88	100	100	93	29	80	10
atrazine	1.0	76	82	96	91	69	84	7
SD-15418[4/] (W.P.)	2.0	88	99	79	77	47	75	11
SD-15418 (W.P.)	4.0	85	100	92	98	84	94	5
SD-15418 (W.P.)	2.0	82	73	46	72	11	51	20
SD-15418 (W.P.)	4.0	71	100	100	100	100	100	1
VCS-438[5/]	1.5	91	92	92	84	55	81	9
VCS-438	2.5	68	100	96	88	47	83	8
Preforan[6/]	2.0	82	13	75	83	24	36	25
Preforan	4.0	74	83	96	54	61	73	13
propachlor	4.0	76	0	40	40	71	38	24
propachlor	6.0	88	0	12	0	56	18	31
dicamba	.5	74	74	4	2	0	20	30
dicamba	1.0	71	0	46	24	0	18	31
alachlor	2.0	94	70	92	5	95	65	16
alachlor	3.0	100	84	75	68	97	81	9
BAY-86791[7/]	0.5	44	0	96	63	84	61	17
BAY-86791	1.0	35	97	100	70	94	90	6
BAY-94337[8/]	.5	44	7	92	98	81	69	14
BAY-94337	1.0	44	0	96	91	82	67	15
primaze[9/]	.75	88	0	92	51	32	44	22
primaze	1.0	62	47	92	68	0	52	19
GS-14260[10/]	.75	100	87	83	74	53	74	12
GS-14260	1.0	100	84	88	91	73	84	7
GS-13529[11/]	.75	91	25	92	63	2	45	21
GS-13529	1.0	97	98	100	98	36	83	8
SD-15418 (WDL)	2.0	100	100	100	98	94	98	2
SD-15418 (WDL)	4.0	100	99	100	95	95	97	3
HOE-2933[12/]	.75	85	45	88	33	0	41	23
HOE-2933	1.5	88	0	92	35	39	41	23

tion decreased the activity of SD-15418 at the 4.0 lb/A rate of application. Alachlor at 2.0 and 3.0 lb/A resulted in excellent control of green foxtail but was weak on the broadleaved weeds. Although BAY-86791 at 1.0 lb/A gave good overall weed control, excessive corn damage resulted. Atrazine resulted in commercially acceptable control of the broadleaved weeds but did not give sufficient control of green foxtail. GS-13529 at 1.0 lb/A performed similarly to atrazine with the broadleaved weeds showing more susceptibility than the grasses. SD-15418 was the only herbicide that resulted in excellent control of the entire weed spectrum present. (Wyoming Agriculture Experiment Station, Laramie, SR-220).

Key to Footnotes for previous table.

* Treatments nonincorporated
1/ Name unavailable
2/ Name unavailable
3/ Name unavailable
4/ 2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrite
5/ Name unavailable
6/ p-Nitrophenyl α, α, α,-trifluoro-2-nitro-p-tolyl ether
7/ Name unavailable
8/ Name unavailable
9/ Atrazine + 2,4-bis (isopropylamino) -6-methylthio-s-triazine
10/ 2-tert-butylamino-4-ethylamino-6-methylthio-s-triazine
11/ 2-tert-butylamino-4-chloro-6-ethylamino-s-triazine
12/ Name unavailable

Herbicide combinations for weed control in corn. Lee, G. A. and Alley, H. P. Various herbicide combinations were evaluated for weed control in corn under Wyoming climatic conditions. Combinations were applied preemergence and incorporated 1 to 1½ in. deep by going over the plots twice with a flextine harrow. Herbicides were applied in 40 gpa of water carrier on a full coverage basis. The location consisted of a sandy loam soil (70.8% sand, 10.5% silt, 18.7% clay and 1.25% organic matter). The plots were established on May 9, 1969. The weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), green foxtail (*Setaria viridis* (L.) Beauv.), and others which were a grouping of kochia (*Kochia scoparia* L. Roth), wild buckwheat (*Polygonum convolvulus* L.), common purslane (*Portulaca oleracea* L.) and common lambsquarters (*Chenopodium album* L.). Percent weed control was obtained by actual counts of each species and compared to the number of plants present in the nontreated check. A frost on June 13 caused severe damage to the young corn plants.

Results show that 12 of the 24 combination treatments gave 90% or better total weed control. Alachlor + atrazine at 1.5 + .75 lb/A resulted in 99% control of all weed species present. GS-15260 + GS-13529 at .5 + .5 lb/A ranked second with 98 percent total control. The light rate GS-14260 + GS-13529 did not satisfactorily control green foxtail. Atrazine + simazine at .5 + .5 lb/A gave 97% total weed control. Propachlor + atrazine at 2.0 + .75 lb/A gave 97% total weed control but exhibited greater activity towards green foxtail than the atrazine + simazine combination. Butylate + R-11913 at 3.0 + 2.0 lb/A was somewhat weak on the group of weed species labeled others. DCPA + 2,4-D amine and 2,4-D amine + dicamba did not result in satisfactory total weed control. Combination of the two triazines generally gave excellent broadleaf weed control but tended to be weak on green foxtail. (Wyoming Agriculture Experiment Station, Laramie, SR-221).

Effectiveness of herbicide combinations for weed control in corn. Akhavein, A. A., Pollak, T., Olson, P. D., and Appleby, A. P. In 1969, five trials at five locations in Oregon were established to investigate the effectiveness of 24 combination herbicidal treatments and a few single treatments for season-long control of weeds in sweet corn and field corn. Four herbicides primarily effective on grasses (1) EPTC preplant incorporated; (2) butylate, preplant incorporated; (3) propachlor, preemergence; and (4) alachlor, preemergence were used in combination with six herbicides primarily effective on broadleaves ((1) atrazine, preemergence; (2) atrazine + oil, postemergence; (3) S-6115 (2-chloro-4-cyclopropylamino-6-isopropylamino-s-triazine), postemergence; (4) S-6115, preemergence; (5) amine salt of dinoseb, spike stage or early postemergence; and (6) 2,4-D amine salt, postemergence). One rate of each herbicide and all 24 combinations were included in each of the five trials. SD 15418 [2-(4-chloro-6-ethylamino-s-triazine-2-ylamino)-2-methylpropionitrile] applied preemergence, was tested at one location. Visual estimates of the percent weed control and the percent corn injury were made twice during the growing season. A few general conclusions can be drawn from the experiments.

1. EPTC and butylate gave reasonably good grass control at most locations, regardless of soil type or irrigation. EPTC at 3 lb/A was sometimes slightly more effective on grasses than butylate at 4 lb/A. EPTC also contributed to broadleaf control whereas butylate had very little effect on most broadleaves. However, butylate was less damaging to corn than EPTC.

2. In general, performance of propachlor and alachlor did not meet expectations based on results in previous years. Both products were nearly always inferior to EPTC and butylate for grass control. Clearly, overhead moisture is more

Effect of herbicide combinations on percent corn stand and percent weed control
(Lee, G. A. and Alley, H. P.)

Treatment	Rate lb per Acre	% Stand Corn	Percent Control: Black Nightshade	Redroot Pigweed	Others	Green Foxtail	Total Control	Ranking
butylate + R-11913[1/]	3.0 + 1.0	74	0	83	49	41	43	18
butylate + R-11913	3.0 + 2.0	68	97	100	86	95	95	5
butylate + R-15431[2/]	3.0 + 1.0	79	86	92	63	71	78	13
butylate + R-15431	3.0 + 2.0	71	100	88	93	84	91	8
butylate + atrazine	3.0 + 1.0	76	100	96	100	59	89	10
butylate + atrazine	4.0 + .5	88	87	92	86	55	80	12
2,4-D amine + dicamba	1.0 + .5	85	62	62	61	27	53	17
alachlor + atrazine	1.25+ .75	82	94	75	65	61	74	14
alachlor + atrazine	1.5 + .75	94	100	100	98	98	99	1
GS-14260[3/] + GS-13529[4/]	.37+ .37	85	96	100	91	81	92	7
GS-14260 + GS-13529	.5 + .5	91	100	100	98	92	98	2
GS-13529 + Primaze[5/]	.37+ .37	91	100	100	100	63	91	8
GS-13529 + Primaze	.5 + .5	91	77	96	77	32	70	16
atrazine + simazine	.37+ .37	88	99	96	81	6	71	15
atrazine + simazine	.5 + .5	97	100	100	98	90	97	3
GS-14260 + atrazine	.37+ .37	97	99	100	98	64	90	9
GS-14260 + atrazine	.5 + .5	100	100	100	93	79	93	6
linuron + propachlor	1.0 + 1.0	74	99	96	95	94	96	4
linuron + propachlor	1.0 + 2.0	100	98	92	86	95	93	6
DCPA + 2,4-D amine	4.0 + 1.0	100	44	100	63	79	71	15
DCPA + 2,4-D amine	6.0 + 1.0	88	87	100	60	97	86	11
propachlor + atrazine	2.0 + .75	94	100	100	91	97	97	3
propachlor + atrazine	2.5 + 1.0	100	100	96	95	64	89	10

1/ Name unavailable.
2/ Name unavailable.
3/ 2-tert-butylamino-4-ethylamino-6-methylthio-s-triazine
4/ 2-tert-butylamino-4-chloro-6-ethylamino-s-triazine
5/ Atrazine + prometone

critical with alachlor than with propachlor and more critical with both materials than with EPTC and butylate.

3. Atrazine or S-6115 were effective on broadleaves when applied preemergence only if adequate overhead moisture was received. Both materials generally gave good broadleaf control when applied postemergence, atrazine in oil and S-6115 as formulated. Rates of either material could be reduced to 3/4 lb/A when applied postemergence to broadleaves.

4. Atrazine in oil or S-6115 were effective applied postemergence on annual grasses but only when applied when grasses were small. When treatments were delayed beyond the 2-in. stage, control was very poor.

5. SD 15418 was obviously weak on pigweed. Also, combination with a grass-killer would probably be necessary. Because of its short persistence in the soil and its effectiveness on other species, further work is suggested. Possibly combinations with alachlor may be effective.

In summary, a number of good herbicides are available for use in corn. Since all of them have weaknesses, combinations of materials are generally necessary. This has resulted in lower levels of persistent residues in the soil and more effective, broad spectrum weed control. However, attention to such factors as adequate incorporation, timing and amount of overhead moisture, and timing of application to weeds will be necessary to obtain maximum benefits from these materials. (Farm Crops Department, Oregon State University, Corvallis.)

Preplanting applications of trifluralin to reduce diuron injury in cotton. Arle, H. F. and K. C. Hamilton. In experiments during 1967 and 1968 we observed that when herbicide combinations were applied preplanting, diuron symptoms on cotton were reduced when trifluralin was included in the combination. In 1969, a test was conducted at the Cotton Research Center in Phoenix, Arizona, to determine the amount of diuron cotton would tolerate in diuron-trifluralin combinations. On February 26, trifluralin at 0.75 lb/A, diuron at 1, 1.5, and 2 lb/A, and combinations of 0.75 lb/A of trifluralin with 1, 1.5, 2, and 2.5 lb/A of diuron were applied to the soil and incorporated by disking before furrowing (listing) for the preplanting irrigation. Treatments were replicated four times on 4-row plots 41 ft long. The soil contained 36% sand, 42% silt, 22% clay, and 1% organic matter. Deltapine 16 cotton was planted in moist soil under a dry mulch on March 31. After emergence, 10-ft sections of row were marked in each plot and the number of living cotton plants were counted each week until thinning. The center rows of each plot were machine-picked in October.

Cotton emergence appeared normal with all treatments. Trifluralin caused temporary stunting of cotton seedlings. Within 3 weeks after emergence 1.5 and 2 lb/A of diuron reduced cotton stands by 50%. Stands were not reduced by these rates of diuron in combination with trifluralin. There was no significant difference between treatments in yield of seed cotton, although cotton treated with 2 lb/A of diuron averaged 2,970 lb/A and that treated with the same rate combined with trifluralin averaged 3,570 lb/A. The inhibition of secondary roots of cotton by trifluralin where the combination was applied reduced apparently the uptake of diuron allowing the cotton to develop normally. (Cooperative investigations of Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Phoenix, and Arizona Agric. Expt. Sta., University of Arizona, Tucson.)

Foliage applications of terbacil to peppermint and various weed species. Radosevich, Steven R. and Appleby, Arnold P. Postemergence applications of terbacil at .5 lb/A (active) in combination with several surfactants, nonphytotoxic crop oils, and a liquid fertilizer has given very good selective weed control in peppermint (*Mentha piperita*) under the proper conditions. Weed species tested included: redroot pigweed (*Amaranthus retroflexus* L.), lambsquarters (*Chenopodium album* L.) common mustard (*Brassica* sp.), prickly lettuce (*Lactuca scariola* L.), barnyardgrass (*Echinochloa crusgalli* (L.) Beauv.) and green foxtail (*Setaria viridis* (L.) Beauv.). Broadleaf weeds appear to be more susceptible to foliage treatments of terbacil than grass species. However, excellent weed control of both broadleaf weeds and grasses have been obtained when postemergence applications of terbacil with various spray solution additives were made within one week after weed emergence. Decreases in grass control always resulted when treatments were applied two or three weeks after emergence.

Addition of various surfactants, nonphytotoxic crop oils, or liquid fertilizer to spray solutions containing .5 lb/A (active) of terbacil usually resulted in greater phytotoxicity to the weeds. Similar treatments applied to peppermint about six in. high caused no significant reduction in peppermint hay production.

Surfactants used in combination with terbacil include Tronic, X-77, and Activate-Plus. Only small differences in weed control were observed when these substances plus terbacil were compared to each other. However, when compared to a treatment without surfactant added to the sprayed solution, treatments of terbacil plus surfactant were generally superior. It was also found that when different rates of surfactant added to the herbicide solution were compared, rates of any surfactant greater than .5% of the total volume sprayed were excessive, and sometimes resulted in less weed control activity. Rates of .1% surfactant of the total volume of sprayed solution plus terbacil usually gave about as good weed control as terbacil plus .5% surfactant.

Terbacil at .5 lb/A (active) plus nonphytotoxic crop oil at 10% of the final volume sprayed gave excellent control of all broadleaf and grass weeds when applied to very young plants. It was also usually observed that terbacil plus nonphytotoxic oil combinations were usually more effective against older weeds than terbacil plus surfactant combinations. Oils tested include Savol Oil, Superior Spray Oil, and Superior Spray Emulsion. Generally, little differences were found when comparing different oil plus terbacil combinations, however, greater control always resulted when comparing such treatments to applications of terbacil without oils added to the spray solution.

Solution 32, a liquid fertilizer containing 32 percent nitrogen, was also tested at several rates with .5 lb/A (active) of terbacil. The highest rate tested, 20% of total volume sprayed, gave better control of both broadleaf and grass weeds than lower rates. However, treatments of terbacil plus either surfactants or nonphytotoxic crop oils usually gave better results than similar treatments of terbacil plus Solution 32.

It can be concluded that under the proper conditions, postemergence treatments of .5 lb/A (active) of terbacil can be used selectively in peppermint and give excellent control of many accual broadleaf weeds and grasses. It is also evident that treatments of terbacil plus surfactants or nonphytotoxic crop oils usually give better weed control than treatments of terbacil without such additives. In addition, early timing of application is necessary for best control of both types of weeds, especially grass species. Greatest control always was obtained within one week after weed emergence. (Farm Crops Dept., Oregon State University, Corvallis.)

Weed control research in potatoes in Oregon. Kirkland, K., Groenwold, B. E., Olson, P. D., and Appleby, A. P. EPTC is the primary herbicide used in potatoes in Oregon. However, other herbicides with better late-season activity and better control of perennial broadleaves are needed.

Potato trials were established at Madras and Klamath Falls in order to determine the effectiveness of several newer herbicides when compared with established materials.

A screening trial was included at the Madras site in order to evaluate several new compounds for their safety and weed control effectiveness in comparison with some standard treatments.

Weed seeds of several species were broadcast on the experimental areas at the time of applying the preemergence treatments. Weeds seeded were redroot pigweed (*Amaranthus retroflexus* L.), lambsquarters (*Chenopodium album* L.), green foxtail (*Setaria viridis* (L.) Beauv.), barnyardgrass (*Echinochloa crusgalli* (L.) Beauv.), and wild oats (*Avena fatua* L.).

Promising treatments are listed below. (All rates are in terms of the active ingredients.

Klamath Falls Yield Trial

Preplant incorporated

EL 179 at 1, 1.5, and 3.5 lbs/A

Preemergence

RP 17623 at 1, 2, and 3 lbs/A
VCS 438 at 2 lbs/A
Maloran at 1.5 and 2 lbs/A
Patoran at 1.5 lb/A
dinoseb at 3 lbs/A
diphenamid and dinoseb at 2 + 1.5 lbs/A

Postemergence

diphenamid + dinoseb at 4 + 3 lbs/A

Madras Field Trial

Preemergence

RP 17623 at 1 lb/A
Patoran at 2 lbs/A

Postemergence

diphenamid + dinoseb at 4 + 3 lbs/A

Madras Screening Trial

Preemergence

Maloran, linuron, HOE 2933, nitrofen, and VCS 438 all at 3 lbs/A
Patoran and tenoran at 4 lbs/A
DCPA + linuron at 4 + 2 lbs/A

Generally the same herbicide showed more activity against weeds and less injury to the crop at the Klamath Falls site than at Madras.

There were no perennial weeds of importance at any of the experiments. (Department of Farm Crops, Oregon State University, Corvallis.)

Weed control research in sugar beets. Olson, Phillip D. and Appleby, A . P. The research emphasis in sugar beets at Oregon State University over the past few years has been with herbicide combinations. The combinations consisted mainly of cycloate (S-ethyl N-ethylthio-cyclohexanecarbamate) with various postemergence herbicides. For the past two years combinations of cycloate plus phenmedipham (3-methoxycarbonylaminophenyl-N-[3'-methylphenyl] carbamate) have been the most outstanding of the combinations tested. Rates that show good sugar beet tolerance and satisfactory control of annual weeds such as redroot pigweed (Amaranthus retroflexus L.), lambsquarters (Chenopodium album L.), nightshade (Solanum sp.), and barnyardgrass (Echinochloa crusgalli (L.) Beauv. are cycloate at either 2, 3, or 4 lb ai/A plus phenmedipham at 1, 1.5 or 2 lb ai/A. These rates are dependent on various factors such as the type of weed population, soil type, soil moisture, and air temperature. In these combinations cycloate is applied as a preplant incorporation treatment and can be applied either as a broadcast or band treatment. The use of fin-injectors has been a popular method of band incorporation of cycloate in the Northwest. Phenmedipham is applied when the sugar beets have two true leaves.

In addition to the cycloate-phenmedipham work, research was conducted near Salem, Oregon in the summer of 1969 to investigate new herbicides and new combinations. The trial was established on a sandy loam soil type. Sprinkler irrigation was used. Weed species present in the experiment were redroot pigweed, lambsquarters, and barnyardgrass.

Results from the Salem trial show that EP 474 postemergence, EP 475 postemergence, CP 52223 at 3 lb ai/A preemergence, and a preplant combination of cycloate plus R 11913 gave satisfactory control of the weed species present and acceptable sugar beet tolerance. Both EP 474 and EP 475 were comparable to phenmedipham in their postemergence weed control activity except that the experimental compounds were more active on pigweed than phenmedipham. Each material displayed some preemergence activity with EP 475 being slightly better on barnyardgrass than EP 474. The tolerance of sugar beets to EP 474 at 4 lb ai/A postemergence was slightly less than to phenmedipham at the same rate. At 2 lb ai/A the sugar beet tolerance of the two compounds was the same. EP 475 at 4 lb ai/A postemergence had sugar beet tolerance equal to that of phenmedipham.

Cycloate plus R 11913 was tested at 2 + 1, 3 + 1, and 2 + 2 lb ai/A. Weed control from these combinations increased as the rate of R 11913 was increased. The 2 + 2 lb ai/A treatment was the best weed control treatment of the cycloate + R 11913 combinations. (Farm Crops Department, Oregon State University, Corvallis.)

Chemical weed control in sugarbeets. Schweizer, E. E. We evaluated several herbicides to control foxtail millet (Setaria italica (L.) Beauv.), kochia (Kochia scoparia (L.) Schrad.), and redroot pigweed (Amaranthus retroflexus L.) in sugarbeets. The herbicides were applied on the university Bay Farm at Fort Collins as preplanting, postemergence, or combination treatments (preplanting plus postemergence).

On April 8, immediately before planting, we sprayed the herbicides on a 7-inch band over the row in 19.1 gpa (60 gpa broadcast) aqueous mixture. The herbicides were incorporated 1½ inches deep with a frontmounted, four-row, power-driven, hooded incorporator. Sugarbeet seed were planted simultaneously with the application of the herbicides. The experimental area received over 3¼ inches of moisture within 7 days of planting from sprinkler irrigation and natural percipitation. On May 12, herbicides applied as postemergence treatments were sprayed on an 11-inch band over the row in 30 gpa (60 gpa broadcast) aqueous mixture. Sugarbeets had four true leaves. Foxtail and pigweed had four true leaves, 1/8 to 3/4 inch tall. Kochia had 12 to 14 leaves and was 1/2 to 1 inch in diameter. The plots were four rows wide and 60 ft long. Rows were 22 inches wide. A randomized complete block design with four replications was used.

Weed control was assessed May 28 by counting the number of weeds. The stand of weeds present has been expressed as a percentage reduction from the weedy, cultivated plots which were not treated with herbicides. Sugarbeets were evaluated visually June 3 for injury from herbicides.

Six treatments reduced the stand of kochia by 90% or more (see table). The most effective and selective preplanting treatment for control of kochia was a mixture of 3 lb/A of cycloate plus 1 lb/A of R 11913 [3-methoxycarbonylaminophenyl-N-(3'-methylphenyl)carbamate] to sugarbeets growing in soil previously treated with 3 lb/A of cycloate plus 1 lb/A of R 11913. The average control of foxtail, kochia, and pigweed was consistently greater in plots where herbicides were applied both preplanting and postemergence as compared to plots treated only before planting or after the weeds had emerged.

The mixture of 2 lb/A each of cycloate plus R 11913 reduced the stand of sugarbeets the most (36%). This mixture also severely retarded the growth of sugarbeet tops. Since the mixture of 3 lb/A of cycloate plus 1 lb/A of R 11913 did not injure sugarbeets, the range for selective weed control with R 11913 in sugarbeets appears narrow. Cycloate and CP 52223 [2-chloro-N-(isobutoxymethyl)-2',6'-acetoxylidide], applied before planting, also had retarded the growth of sugarbeets when evaluated 5 weeks after emergence. However, within 8 weeks the tops appeared to recover completely. (Cooperative investigations of Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, and Colorado Agri. Exp. Sta., Colo. State University, Fort Collins.)

Response of sugarbeets and weeds to herbicides applied preplanting and postemergence

Treatments				Sugarbeets[a]		Weeds[a]			
				Stand red. (%)	Injury rating (%)	Stand reduction (%)			
Preplanting	Rate lb/A	Postemergence	Rate lb/A			Foxtail	Kochia	Pigweed	Avg
CP 52223	2	none	0	5	2	97	49	99	82
CP 52223	2	S 4075	2	-	20	99	78	98	92
CP 52223	2	pyrazon + S 4075	3 + 1.5	-	6	99	46	97	81
cycloate	4	none	0	3	4	99	23	92	71
cycloate	4	S 4075	2	-	12	100	91	99	97
cycloate	4	pyrazon + S 4075	3 + 1.5	-	7	100	57	99	85
cycloate + R 11913	3 + 1	none	0	1	5	95	80	93	89
cycloate + R 11913	3 + 1	S 4075	2	-	20	100	98	99	99
cycloate + R 11913	3 + 1	pyrazon + S 4075	3 + 1.5	-	19	99	100	99	99
cycloate + R 11913	2 + 2	none	0	36	49	95	95	92	94
cycloate + R 11913	2 + 2	S 4075	2	-	60	99	100	95	98
cycloate + R 11913	2 + 2	pyrazon + S 4075	3 + 1.5	-	55	100	98	99	99
none	0	S 4075	2	-	7	99	58	75	77
none	0	pyrazon + S 4075	3 + 1.5	-	0	94	15	74	61
Weeds and sugarbeets/ft in untreated check[b]				5.6		7.6	1.5	3.0	

[a]Plant stands counted May 28 and injury ratings made June 3.

[b]Number of plants per linear ft of row as determined by counting sugarbeets and weeds in six random quadrats, 4 inches by 3 ft, per treatment.

Postemergence weed control in sugarbeets. Lee, G. A., Alley, H. P., and Gale, A. F. Screening trials were established at Torrington, Wyoming to study the effectiveness of postemergence application of several herbicides for weed control in sugarbeets. Treatments consisted of four rows 100 ft. in length and were replicated three times. The herbicides were applied in 40 gpa of water carrier on a full coverage basis. The treatments were made May 17, 1969, when the weed species were in the 2 to 4 leaf stage. The weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), and green foxtail (*Setaria viridis* (L.) Beauv.). A lesser infestation of kochia (*Kochia scoparia* L. Roth), common lambsquarters (*Chenopodium* album L.) and common purslane (*Portulaca oleracea* L.) were categorized as others.

BASF-2430 + phenmedipham + oil at 3.0 + 1.5 lb/A + 1.5 gal/A gave 100% control of the broadleafed weeds and 97% control of the grasses (attached table). However, the addition of the nonphytotoxic oil resulted in severe sugarbeet stand reduction. BASF-2430 + phenmedipham at 3.0 + 1.5 lb/A resulted in excellent weed control without any apparent effect on the sugar beet plants. Pyrazon + phenmedipham + oil at 3.0 + 1.5 lb/A + 1.5 gal/A gave outstanding control of the entire weed spectrum with slight reductions in stand. Pyrazon + phenmedipham at 3.0 + 1.5 lb/A did not give satisfactory control of redroot pigweed and green foxtail. Pyramin Plus + phenmedipham at 9 lb formulation + 1.5 lb/A did not give commercially acceptable control of green foxtail. However, the addition of phenmedipham did increase the phytotoxic activity towards all weed species when compared to Pyramin Plus at 12 lb formulation/A. No precipitation was received from time of herbicide application until evaluation which accounts for the poor performance of Pyramin Plus. EP 474 and and EP 475 gave excellent broadleaved weed control at the 1.0 lb/A rate. However, the green foxtail control was not satisfactory. EP 474 at 2.0 lb/A gave excellent broad spectrum weed control but severely reduced the sugar beet stand. EP 475 at 2.0 lb/A showed greater safety towards sugar beet seedlings than EP 474 at 2.0 lb/A but did not give acceptable control of green foxtail. As indicated by the data, phenmedipham is weak on redroot pigweed. The analogs of phenmedipham (EP 474 and EP 475) are excellent for redroot pigweed control but exhibit less sugar beet tolerance and reduced activity on grasses.

There was little or no late weed infestations after the thinning operation at the experimental location in 1969. Plots treated with Pyramin Plus at 12 lb formulation/A yielded 35.4 tons/A. EP 474 at 2.0 lb/A and EP 475 at 2.0 lb/A yielded 27.9 and 28.4 tons/A, respectively, which may be attributed to excessive phytotoxicity to the sugar beet seedlings early in the growing season. Comparison of pyrazon + phenmedipham at 3.0 + 1.5 lb/A and BASF-2430 + phenmedipham at 3.0 + 1.5 lb/A with and without nonphytotoxic oil shows that the addition of oil resulted in sufficient damage to the sugar beets to decrease the tonnage yields. (Wyoming Agriculture Experiment Station, Laramie, SR-222.)

Postemergence weed control in sugar beets

Treatment	Sugar Beet Stand (%)	Percent Control: Black Nightshade	Redroot Pigweed	Others	Green Foxtail	Yield (T/A)	Percent Sucrose
Pyrazon + phenmedipham + oil 2/ 3.0 + 1.5 + 1.5 gal	90^{bcd} 1/	93^{a}	100^{a}	100^{a}	94^{a}	32.5^{abc}	14.8^{a}
Pyrazon + phenmedipahm 3.0 + 1.5	100^{abc}	90^{a}	85^{a}	95^{a}	65^{a}	31.8^{abc}	15.8^{a}
BASF-2430 3/ + phenmedipham + oil 3.0 + 1.5 + 1.5 gal	51^{e}	100^{a}	100^{a}	100^{a}	97^{a}	29.9^{abc}	14.6^{a}
BASF-2430 + phenmedipham 3.0 + 1.5	100^{abc}	99^{a}	98^{a}	97^{a}	96^{a}	35.0^{ab}	15.3^{a}
Pyramin Plus 4/ + phenmedipham 9# form. + 1.5	100^{abc}	90^{a}	90^{a}	100^{a}	81^{a}	29.4^{bc}	14.6^{a}
Phenmedipham	98^{abcd}	89^{a}	48^{b}	87^{a}	80^{a}	32.3^{abc}	15.0^{a}
EP 474 5/ 1.0	97^{bcd}	94^{a}	100^{a}	97^{a}	84^{a}	30.4^{abc}	14.8^{a}
EP 474 2.0	35^{e}	100^{a}	100^{a}	100^{a}	98^{a}	27.9^{c}	15.0^{a}
EP 475 6/ 1.0	100^{abc}	97^{a}	100^{a}	95^{a}	72^{a}	33.7^{abc}	15.2^{a}
EP 475 2.0	79^{d}	99^{a}	98^{a}	100^{a}	85^{a}	28.4^{c}	15.1^{a}
Pyramin Plus 12# form.	100^{abc}	9^{g}	12^{c}	87^{a}	18^{b}	35.4^{a}	14.8^{a}
Check	100^{abc}	0^{b}	0^{c}	0^{b}	0^{b}	31.8^{abc}	14.9^{a}

1/ Means with the same letter are not significantly different at the .05 level.
2/ Nonphytotoxic oil (Sun oil).
3/ 1-phenyl-4-amino-5-bromo-pyridazone-(6).
4/ Pyrazon + dalapon + wetting agent.
5/ Analog of phenmedipham.
6/ Analog of phenmedipham.

Evaluation of phenmedipham when applied to sugar beets in different planting seasons in California. Norris, Robert F. and Orris W. Gibson. Two years of field testing of phenmedipham for control of mixed annual broadleaves and grasses in sugar beets has shown it to be very safe and effective as well as an unsafe and ineffective herbicide. This depends on the season of application. Seventeen postemergence trials were applied by hand sprayer or tractor mounted power sprayer depending primarily on the soil condition at the time when the weeds were ready for spraying. Testing ranged from the Imperial Valley region to Tehama County in the north Sacramento Valley.

The most successful results were obtained in those areas where the sugar beets and weeds emerged during the months of November through March. These months were associated with cool, moist, short day length conditions. No sugar beet injury was observed when treated at the rates of 1/2 to 2 lb ai/A, at stages ranging from cotyledons to 6 to 8 leaves. Susceptible weed species at these rates included chickweed, mustards, wild radish, shepherds purse, henbit, sow thistle, pineapple weed, seedling purslane, curley dock, prickly lettuce, bull thistle, oxtongue thistle, milk thistle, fiddleneck, silver sheath knotweed, annual rye grass, lambs quarters, goosefoot, stringing nettle, and London rocket. Resistant species included red maids, miners lettuce and common knotweed. Several species were controlled only in early season treatment and later were inadequately controlled. These included annual bluegrass, barnyard grass, young volunteer barley, filleree and pigweed.

Generally weeds were most susceptable in the cotyledon to 4 true leaf stage. Resistance to the herbicide advanced rapidly with the maturity of the weeds. Activity was primarily a foliar burn except in one experiment when applications of 1.0 and 2.0 lb/A gave a short period of preemergence weed control after application to cotyledon beets. One half lb/A did not show this preemergence activity. Yields obtained from this trial were increased considerably by the phenmedipham treatments.

The poorest results with phenmedipham were obtained in the late spring, summer, and early fall when conditions were warm, relatively dry, and of longer day length. Sugar beets were often severely injured at 1/2 lb ai/A and the stand almost eliminated by the 2 lb ai rate. Many weed species which were susceptable during winter or early spring became highly resistant. In some cases the sugar beets were injured less and were able to outgrow the badly stunted weeds.

Preliminary testing of phenmedipham used in conjunction with other herbicides or additives has been largely unsuccessful. Most have caused excessive injury to the sugar beets without greatly increasing the weed control. There was a very short period of time in the spring while temperatures were rising when the addition of 1.5 gpa of non-phytotoxic oil to phenmedipham enhanced the weed control without causing excessive sugar beet injury. There was no advantage to adding oil in the winter and there was a point later in the spring where the oil increased the phenmedipham damage to the sugar beets. (Department of Botany, University of California, Davis, California.)

Treated February 27, 1969 Cotyledon stage

	Crop* Vigor	% weed stand Reduction	Yield Tons/A
Phenmedipham 1/2	10	99	37
" 1	10	99	36
" 2	10	99	37
Untreated Check	10	0	23

*10 = Full vigor; 0 = All plants dead

Chemical fallow with paraquat. Lee, G. A. and Alley, H.P. A study was conducted to determine the feasibility of using paraquat for chemical fallow of wheat land in Wyoming. The objectives were to: 1) determine the effectiveness of a contact herbicide for removing weeds from fallow ground and 2) determine the number of treatments required to keep the fallow area weed free for the growing season. Plots were established at the Archer Agriculture Experimental Substation which receives approximately 14 in. of annual precipitation. Paraquat was applied at .5 and 1.0 lb/A + X-77. Treatments were applied in 25 gpa of water carrier on a full coverage basis. Plots were 1 acre in size. When reinfestation of weeds was sufficient, retreatments were made in the same manner as original treatments. The natural weed population consisted of prostrate knotweed (Polygonum aviculare L.), tansy mustard (Descurainia pinnata (Walt.) Britt.) and downy bromegrass (Bromus tectorum L.).

In order to effectively control weeds through the growing season, three treatments of paraquat were applied on April 11, June 6 and July 17. The first treatment eliminated tansy mustard for the growing season. On the June 6 evaluation date, downy bromegrass had reinfested the area and showed 2 to 2½ in. growth in plots treated with both the .5 and 1.0 lb/A rate of paraquat. Plants in the non-treated check had reached maximum growth. Prostrate knotweed had emerged and reached maximum growth between the second and third treatment. A small infestation of downy bromegrass, approximately 20% of the original infestation, was present at the time of the third treatment. Final evaluation in mid-August revealed that downy bromegrass had been completely eliminated by 3 applications of paraquat at 1.0 lb/A + X-77. The paraquat at .5 lb/A + X-77 treatment was 95% effective on downy bromegrass. Neither the .5 or 1.0 lb/A rate of paraquat visibly reduced the prostrate knotweed infestation. (Wyoming Agriculture Experiment Station, Laramie, SR-223.)

Herbicide residue studies under different cultural practices. Lange, A. H. and Fischer, B. B. Herbicides were applied on December 17, 1968, and treatments were incorporated with a straight-tooth, power driven, rotary tiller or left on the surface and sprinkler irrigated. Some treatments received mechanical incorporation and sprinkler irrigation. Four months after herbicide application, six crops were planted and evaluated on July 13, 1969. Four months later, six crops were planted again and four evaluated on September 9, 1969, (only the eight-month reading is included here). The soil contained 2.8% organic matter. Phytotoxicity ratings showed a wide difference between residual characteristics of herbicides tested. Some herbicides evaluated under the different cultural methods showed considerable difference in residual characteristics. The crops used in the evaluation varied greatly in their sensitivity to herbicide residues. Effect of furrow irrigation and power driven incorporation on the residual characteristics of various herbicides are present in the accompanying table.

Trifluralin showed virtually no residue when surface applied and sprinkle irrigated. However, considerable residue resulted when this herbicide was mechanically incorporated under a sprinkler or furrow irrigation. Nitralin showed residual phytotoxicity, especially with susceptible crops similar to trifluralin, except under sprinkler irrigation, where considerably more residual was observed from nitralin at eight months than with trifluralin. The amount of residual effect when surface applied, however, was less than when mechanically incorporated. DCPA, like nitralin, showed some residual with exceedingly high rates under sprinkler irrigation, but considerably more under furrow irrigation or when mechanical incorporation was included. Diphenamid and prometryne showed very little residual under any method at eight months. Some residual activity at four months after application was recorded. Dichlobenil applied to soil surface and sprinkle irrigated showed considerable residue at 16 lb/A after eight months, but very little at 4 lb/A. The amount of residual effect was much less than when this herbicide was mechanically incorporated into the soil as shown in earlier experiments. Surface applied MSMA at 16 to 256 lb/A showed some slight phytotoxicity on barley at four months, but virtually none at eight months. No phytotoxicity was observed at 16 or 64 lb/A 2,4-D (like MSMA and dalapon) showed very little residual phytotoxicity even at 64 lb/A four months after application. The results with pyrazon showed residual at the high rate after eight months when applied to the soil surface and sprinkle irrigated. However, under mechanical incorporation considerable phytotoxicity was observed even at 4 lb/A after eight months. These results are consistent with results from two previous trials in the same soil. RH-315 showed considerable residual activity at eight months at the high rate of 16 lb/A, but essentially none at the 4 lb/A rate. VCS-438 at 4 lb/A showed considerable residual at eight months. These data are consistent with other trials in orchard work. R-7465 showed heavy residual activity at 4 lb/A at eight months when mechanically incorporated. The herbicide was not evaluated surface applied under sprinkler incorporation. (University of California, Riverside.)

The effect of furrow irrigation and power driven mechanical incorporation[1/] on the residual characteristics of herbicides in a Panoche clay loam at eight months
West Side Field Station, Five Points, California

Herbicides	lb/A	Average[2/] Stand and Injury Evaluation at 8 mo.			
		Barley	Milo	Cotton	Tomatoes
trifluralin	1	3.0	5.0	3.0	3.0
trifluralin	4	3.0	9.0	0.3	2.0
nitralin	1	0	5.6	1.0	2.0
nitralin	4	4.3	10.0	3.6	4.3
DCPA	8	4.0	8.3	2.0	3.3
DCPA	32	2.6	10.0	1.0	4.0
diphenamid	4	.6	3.3	1.0	1.6
diphenamid	16	3.3	4.0	2.0	1.3
prometryne	1	3.3	4.0	1.6	1.3
prometryne	4	.3	3.0	1.3	1.0
RH-315	4	3.3	2.0	1.0	1.0
RH-315	16	8.6	8.3	1.3	10.0
VCS-438	4	6.6	5.6	4.6	9.3
R-7465	4	8.0	10.0	6.0	3.0
R-7465	16	9.6	10.0	8.6	4.0
pyrazon	4	3.0	5.0	7.0	8.3
pyrazon	16	8.3	7.6	9.6	9.0
Check	0	1.0	2.6	1.3	1.0

1/ Herbicides were applied and incorporated December 13, 1968, and furrow irrigated. First crops were planted 11 and 14, April, 1969, without disturbing the soil. The first crop was worked under in July. Prior to planting the crop in August, the beds were worked with rolling cultivators and a power-driven rotary tiller. The crops were planted and furrow irrigated. Plot Size: 2 beds, 30" x 20', with 5' guard. 3 replications.

2/ Evaluation based on a 0 to 10 scale: 0 = no injury, 10 = death of plants. 3 replication per treatment.

PROJECT 7. CHEMICAL AND PHYSIOLOGICAL STUDIES

Project Chairman - T. J. Muzik

SUMMARY

Five progress reports were submitted. They report that:

Methods of identifying qualitative differences in injury caused by soil-incorporated herbicides including color infrared photography and infrared spectrophotometry are being developed.

A close temporal relationship between the initiation of lateral roots and the appearance of some new soluble cytoplasmic proteins in pea seedlings treated with 2,4-D has been established. A technique for the isolation of the protein by preparative scale gel electrophoresis has been developed.

Rapidly photosynthesizing Canada thistle plants exuded greater quantities of picloram from the root system than did slowly photosynthesizing plants. Picloram tended to stabilize in the plant but 2,4-D continued to exude.

Kinetics of adsorption and desorption are similar for 2,4-D and 2,4,5-T in forest floor material. The initial rate of desorption of picloram was more rapid than its rate of adsorption. Desorption of amitrole was slower than adsorption.

A one-year study on the persistence of S-6115, SD-15418 and atrazine in soil showed that S-6115 gave the best weed control and was about as persistent as atrazine at the 2 and 4 lb. rate. SD-15418 was less persistent.

<u>Symptomology of herbicide injury on crop plants</u>. Bohmont, Bert L. Five different crops commonly grown in Colorado and Wyoming, corn, barley, sugar beets, field beans and potatoes, are being used in a study to determine qualitative differences in injury caused by certain soil-incorporated herbicides. Studies are based on greenhouse and field samples using four different rates each of dicamba, 2,4-D, trifluralin, picloram, atrazine and pyrazon.

Visual observations and detailed written descriptions of the symptoms elicited in each crop are being made. Information is recorded at the seedling stage, at or before flowering, and at maturity.

Techniques used to graphically record symptoms include black and white photography, color photography and color infra-red photography.

Infra-red spectrophotometry is being investigated as a possible method for identification of herbicide action through a study of the changes in infra-red absorption of certain plant constituents. This is a different approach than the use of gas chromotography where the objective is to identify and measure herbicide residues.

When completed, the information from this study should serve as a useful tool for identification of specific herbicide injury. (Colo. Cooperative Extension Service and Botany and Plant Pathology Department, Colo. State Univ., Fort Collins, Colo.)

<u>Protein metabolism as influenced by growth regulator chemicals in plants.</u> II. Norris, Logan A. and R. O. Morris. We reported our initial studies of the alteration of patterns of protein synthesis in plants treated with growth regulator chemicals last year. With procedures previously outlined,[1/] we have now established a close temporal relationship between the initiation of lateral roots and the appearance of some new soluble cytoplasmic proteins in 2,4-D-treated pea seedlings. These proteins have an R_f of 0.41 in acrylamide gels after electrophoresis.

Cross sections taken 5 mm behind the root tips of control or treated (5×10^{-5} M 2,4-D between 48 and 50 hours of age) seedlings were examined with a microscope. Cell divisions induced by 2,4-D were initiated opposite all three xylem poles between 6 and 9 hours after start of the treatment. Serial sections of treated roots showed cell division was induced over the length of the root.

Control and 2,4-D-treated seedlings were exposed to C^{14}-alanine and the soluble cytoplasmic proteins extracted from sections 3 to 11 mm behind the root tip. After electrophoresis, the distribution of radioactivity in the gels was determined by solubilizing and counting 1.6 mm serial sections of each gel. Preferential incorporation of radioactivity into the protein(s) with R_f 0.41 occurred between 6 and 12 hours after 2,4-D treatment. No increase in incorporation was observed in similar control root sections or in sections 10 and 20 mm below the cotyledons of control seedlings over a 24-hour period.

These results show a definite association between the appearance of the proteins with R_f 0.41 and the initiation of cell division leading to lateral root proliferation in 2,4-D-treated seedlings. The possibility of a cause and effect relationship has not been established, but it cannot be ignored.

The identity of the protein(s) with R_f 0.41 is not known and there is no assurance the same protein(s) is in different root sections.

1/ Norris, L.A. and R. O. Morris. 1969. Research Progress Reports, Western Society of Weed Science. pp. 103-104.

We have developed a technique for the isolation of this protein(s) by preparative scale gel electrophoresis. (A joint contribution from USDA, Forest Service, Forestry Sciences Laboratory and Oregon Agricultural Experiment Station, Oregon State University, Corvallis, Oregon.)

Time after treatment (Hours)	Number of cells with condensed chromatin per section*	
	(Control)	(Treated)
3	155	164
6	170	158
9	155	273**
12	188	325**

* Mean of 25 observations for each point (five sections from each of five roots).

** Differences between control and treated significant at 5 per cent level.

Exudation of picloram and 2,4-D from Canada thistle roots. Lee, G. A. and H. P. Alley. A study was conducted to determine the effect of photosynthetic rate on exudation of picloram and 2,4-D alone and in combination from Canada thistle roots. Plants were grown hydroponically in Erlenmeyer flasks to a height of 8-10 in. Equal numbers of plants were subjected to 24 hours of total darkness and 24 hours of light prior to treatment with radioactively tagged herbicides. Treatments consisted of picloram* and 2,4-D*. The rate of application was three uc of radioactive C^{14} per plant. Plants were subjected to continuous light during the sampling period. Erlenmeyer flasks were brought to volume with distilled water to correct transpiration loss before 1 ml of solution was extracted. Radioactivity in the sample was determined on a Geiger Proportional Counter after evaporation of the solution.

Plants which were preconditioned with light and treated with picloram exuded a greater quantity of herbicide in the first hour than in the following 18 hour period (attached table). A large portion of the picloram was apparently reabsorbed into the plant by the second hour and then slowly released. The greatest concentration of radioactivity measured in the nutrient solution was at 21 hours after treatment. The picloram continued to be exuded and absorbed during the remainder of the experiment.

* Radioactively tagged herbicide.

Plants which were subjected to 24 hours of darkness before herbicide treatment were assumed to be producing more photosynthetic products when placed in the light. Plants which were placed in the dark prior to picloram treatment exuded the greatest amount of herbicide at the three hour sampling. For the most part, greater amounts of picloram were found in the nutrient solution throughout the study in the plants preconditioned under darkness than plants subject to light.

Plants which were subject to light prior to treatment with 2,4-D* had much the same exudation pattern as plants treated with picloram* during the three hours after treatment. At the 21 hours sampling, excessive amounts of 2,4-D began to concentrate in the nutrient solution. From 54 to 90 hours after treatment, large quantities of 2,4-D were exuded from the plant.

Small fluctuations in exuded 2,4-D were noted during the first six hours after treatment in plants preconditioned with 24 hours of darkness. From 9 to 18 hours after treatment, the 2,4-D was reabsorbed into the plant roots thus reducing the concentration in the nutrient solution. The 2,4-D was exuded in greater quantities with some cycling during the period of 21 to 42 hours. However, excessive quantities of 2,4-D continued to concentrate in the nutrient solution from 54 to 90 hours after treatment.

These data indicate that Canada thistle plants which are rapidly photosynthesizing will conduct greater quantities of herbicide to the root system, thus allowing exudation to occur. Picloram tends to stabilize in the plant while 2,4-D continues to exude from the roots after 24 to 36 hours. (Wyoming Agricultural Experiment Station, Laramie, SR-218.)

Counts per minute of radioactively tagged herbicide in nutrient solution

Time after Treatment	Herbicide treatment			
	picloram* (Light)	picloram* (Dark)	2,4-D* (Light)	2,4-D* (Dark)
1 hr	682	699	682	626
2 hr	495	544	393	602
3 hr	496	802	578	506
4 hr	554	561	410	617
5 hr	530	640	650	626
6 hr	641	530	441	713
9 hr	650	513	537	434
12 hr	506	634	544	689

Time after Treatment	Herbicide treatment			
	picloram* (Light)	picloram* (Dark)	2,4-D* (Light)	2,4-D* (Dark)
15 hr	352	641	337	434
18 hr	706	723	578	472
21 hr	795	761	1074	915
24 hr	568	747	971	747
30 hr	303	506	609	737
36 hr	506	778	1084	568
42 hr	304	537	795	658
54 hr	313	361	1301	1091
66 hr	320	602	1380	1380
78 hr	448	626	1653	1918
90 hr	489	593	1628	2120

* Radioactively tagged herbicide

The kinetics of adsorption and desorption of 2,4-D, 2,4,5-T, picloram, and amitrole on forest floor material. Norris, Logan A. The interaction of herbicides with forest floor material will influence their persistence, movement, and fate in the forest floor. I found the speed and degree of adsorption of 2,4-D, 2,4,5-T, picloram, and amitrole on forest floor material varies with the herbicide.

The adsorbent was air dried 10- to 50-mesh forest floor material (L, F, and H horizons) from a red alder (*Alnus rubra* Bong.) stand. The herbicides used were C^{14}-carboxyl labeled 2,4-D, 2,4,5-T, picloram, and amitrole-5-C^{14}.

For adsorption, 2.5 g of adsorbent was weighed into a 50 ml glass stoppered centrifuge tube, 15 ml 10^{-2} M potassium phosphate buffer (pH 6.5) added, and the mixture oscillated at 30°C. After 30 minutes, 10 ml additional buffer containing the herbicide was added, the tubes returned to the shaker, and the adsorption period started. The weight ratio of adsorbent to liquid was 1:10, and the concentration of herbicide was 1 x 10^{-5}M.

The contents of three tubes were individually filtered through Whatman #42 filter paper at each sampling time. The radioactivity of duplicate aliquots was measured in a liquid scintillation counter. The radioactivity not recovered in the filtrate was assumed to be adsorbed herbicide. For studies of desorption, the adsorbent was first equilibrated with a 1×10^{-5}M herbicide solution (weight of solid to liquid = 1:10) and then the unbound liquid phase removed by vacuum filtration. The amount of herbicide adsorbed was calculated from the radioactivity in solution before and after equilibration. The adsorbent was reweighed and fresh buffer added to restore the ratio of adsorbent:liquid to 1:10 and the flasks returned to the water bath. Samples were withdrawn at intervals and filtered. The radioactivity in the filtrate was a measure of herbicide desorption. Three flasks were used for each herbicide, and each determination was made in triplicate.

The data are expressed as ϕ_a for adsorption and ϕ_d for desorption. ϕ is the percent attainment of equilibrium.

At equilibrium (30° C), 34% of the 2,4-D originally in solution was sorbed compared to 61% for 2,4,5-T, 27% for picloram, and 72% for amitrole. Marked differences were observed in the speed with which equilibrium was attained. Amitrole required 2,580 min. to reach equilibrium at 30° C but only 960 min. at 52°C.

The kinetics of adsorption and desorption seem similar for 2,4-D and 2,4,5-T. The initial rate of desorption of picloram was more rapid than its rate of adsorption. Desorption of amitrole was slower than adsorption, and the original point of equilibrium was not reached. Degradation of amitrole observed in similar material may account for this discrepancy.* (Forestry Sci. Lab., Forest Serv., U.S. Dept. Agri., Corvallis, Oregon.)

* Norris, Logan. A. 1969. Research Progress Reports, Western Society of Weed Science. pp. 21-22.

Adsorption and desorption of herbicides on forest floor material

2,4-D 30°C			2,4,5-T 30°C			Picloram 30°C			Amitrole 52°C		
Time (Min)	ϕ_a	ϕ_d	Time (Min)	ϕ_a	ϕ_d	Time (Min)	ϕ_a	ϕ_d	Time (Min)	ϕ_a	ϕ_d
5	44	--	5	51	--	10	41	75	10	33	--
10	62	67	10	64	66	20	48	79	20	39	--
15	65	--	20	72	75	30	56	--	30	42	43
20	56	74	30	--	83	40	59	86	40	49	--

2,4-D 30°C			2,4,5-T 30°C			Picloram 30°C			Amitrole 52°C		
Time (Min)	ϕ_a	ϕ_d	Time (Min)	ϕ_a	ϕ_d	Time (Min)	ϕ_a	ϕ_a	Time (Min)	ϕ_a	ϕ_d
30	74	82	40	95	--	60	59	--	60	56	46
45	68	85	45	--	88	80	--	93	90	62	--
60	82	89	60	97	95	100	85	--	120	68	--
75	77	--	90	100	98	150	82	--	180	71	57
90	79	95	120	98	98	160	--	97	360	82	64
105	85	--	150	--	98	200	85	--	480	86	71
120	79	95	180	101	100	210	--	100	600	--	68
150	91	97	240	100	--	300	96	--	720	--	71
180	94	97	360	100	--	360	100	101	900	--	75
210	--	100				480	89	--	960	100	--
240	97	--				960	100	100	1080	100	71
360	100	--				1200	100	--	1200	100	--

Triazine residues in soil. Zimdahl, Robert L. This study was designed to determine the field persistence of two triazine herbicides, SD-15418 (Bladex), and 2-chloro-4-cyclopropylamino-6-isopropylamino-1, 3,5-triazine (S-6115 Gulf Chemical Company) compared to Atrazine. One location with two replicates was established with 70 plots per replicate; each individual plot was ten by ten feet. Two application dates were used. The first was May 15th which approximated the timing for a preemergence application on corn. The second application was made on June 7th and this approximated a postemergence application on corn. The application rates used pre- and postemergence and the chemicals are shown in table 1.

After the postemergence application an initial planting of four crops was made. One ten foot row of field beans, sugar beets, Moravian barley, and Scout wheat was planted in each plot. Separate plots were planted on June 13, July 7, August 7, and September 8. An additional planting will be made in the spring of 1970. These plots were furrow irrigated and this created some problems in obtaining sufficient moisture for germination on the later plantings.

After the preemergence treatments were applied, weeds immediately started to grow, and although this was not primarily a weed control study, some data were obtained and are shown in Table 2. The weed population was restricted to pigweed and *Setaria* spp. From the data in Table 2, it is obvious that all of the herbicides gave better activity postemergence than preemergence. S-6115 was the best herbicide, especially when used postemergence. Preemergence applications of Bladex were not very effective for the control of pigweed and *Setaria* spp.

S-6115 was about as persistent as Atrazine at the 2 and 4 pound rate. However, we do not know what the carryover will be for 1970. One would expect from past experience, that Atrazine will carry over and still injure beans and sugar beets. Bladex is much less persistent than Atrazine and S-6115.

Sugar beets are extremely sensitive to all of the herbicides used especially when they are planted shortly after treatment. There was some indication that sugar beets were starting to survive all treatments at the time of the September planting. Barley and wheat are about equally sensitive to these triazines but much less so than sugar beets. Beans are sensitive, but the crop tolerance is greater and a one year delay should be sufficient for Bladex, but will probably not be a sufficient time interval for S-6115. (Weed Research Laboratory, Department of Botany and Plant Pathology, Colorado State University, Fort Collins.)

Table 1.

Application Rates and Chemicals Used

Triazine residue study

Application	Rate lbs ai/acre
Atrazine	2.0
S-6115	1.0
S-6115	2.0
S-6115	4.0
Bladex	2.0
Bladex	4.0

Table 2.

Weed Control Ratings

Triazine residue study

Treatment	Rate lbs ai/acre	Control Rating	
		Pigweed	*Setaria* spp.
Preemergence			
Atrazine	2	5	3
S-6115	1	4	4
S-6115	2	7	5
S-6115	4	8	5

Treatment	Rate lbs ai/acre	Control Rating Pigweed	*Setaria* spp.
Bladex	2	2	2
Bladex	4	2	5
Postemergence			
Atrazine	2	8	4
S-6115	1	9	8
S-6115	2	9	9
S-6115	4	10	9
Bladex	2	5	7
Bladex	4	6	8

NOMENCLATURE AND ABBREVIATIONS

Tables 1 and 2 below are nomenclature and abbreviation lists of the Weed Society of America (Nomenclature Weeds 16(4), 1968). Authors are urged to use this termionology and abbreviation whenever applicable.

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

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

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

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

Table 1. Common and Chemical Names of Herbicides (Continued

Common name	Chemical name[b]
I	
ioxynil	4-hydroxy-3,5-diiodobenzonitrile
ipazine	2-chloro-4-(diethylamino)-6-(isopropylamino)-s-trazine
IPC (see propham)	
isocil	5-bromo-3-isopropyl-6-methyluracil
K	
KOCN	potassium cyanate
L	
lenacil	3-cyclohexyl-6,7-dihydro-1H-cyclopentapyrimidine-2,4(3H,5H)-dione
linuron	3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea
M	
MAA	methanearsonic acid
MAMA	monoammonium methanearsonate
MCPA	[(4-chloro-o-tolyl)oxy]acetic acid
MCPB	4-[(4-chloro-o-tolyl)oxy]butyric acid
MCPES	2-[(4-chloro-o-tolyl)oxy]ethyl sodium sulfate
MCPP (see mecoprop)	
mecoprop	2-[(4-chloro-o-tolyl)oxy]propionic acid
metham	sodium methyldithiocarbamate
metobromuron	3-(p-bromophenyl)-1-methoxy-1-methylurea
MH	1,2-dihydro-3,6-pyridazinedione
molinate	S-ethyl hexahydro-1H-azepine-1-carbothioate
monolinuron	3-(p-chlorophenyl)-1-methoxy-1-methylurea
monuron	3-(p-chlorophenyl)-1,1-dimethylurea
monuron TCA	3-(p-chlorophenyl)-1,1-dimethylurea mono (trichloroacetate)
MSMA	monosodium methanearsonate
N	
naptalam	N-1-naphthylphthalamic acid
neburon	1-butyl-3-(3,4-dichlorophenyl)-1-methylurea
nitralin	4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline
nitrofen	2,4-dichlorophenyl p-nitrophenyl ether
norea	3-(hexahydro-4,7-methanoindan-5-yl)-1,1-dimethylurea
NPA (see naptalam)	
O	
oryzalin	3,5-dinitro-N^4,N^4-di(n-propyl)sulfanilamide
P	
paraquat	1,1'-dimethyl-4,4'-bipyridinium ion
PBA	chlorinated benzoic acid

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

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

[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]This herbicide usually is 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 minutes
hr	hour(s)
ht	height
in	inch(es)
l	liter(s)
lb	pound(s)
mg	milligram(s)
mi	mile(s)
min	minute(s)
ml	milliliter(s)
mm	millimeter(s)
mp	melting point
mph	miles per hour
oz	ounce(s)
ppmv	parts per million by volume
ppmw	parts per million by weight
ppt	precipitate
psi	pounds per square inch
pt	pint(s)
qt	quart(s)
rd	rod(s)
rpm	revolutions per minute
sp gr	specific gravity
sq	square
T	ton(s)
tech	technical
temp	temperature
wt	weight
w/v	weight per volume. Do not use this abbreviation. Instead give specific units (examples: g/l or lb/gal)

Table 2. Abbreviations of terms used in weed control (continued)

Abbreviations	Definitions
NCWCC	North Central Weed Control Conference
NEWCC	Northeastern Weed Control Conference
SWSS	Southern Weed Science Society
WSSA	Weed Science Society of America
WSWS	Western Society of Weed Science

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