Research Progress Report

Research Committee
Western
Weed Control Conference

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PREFACE

These Research Progress Reports consist of abstracts and summaries of current findings of research workers throughout the conference area. This report is particularly to be recommended for its timeliness. The results are fresh from the laboratory, greenhouse, and field and were conducted for the most part during the past year. They have been assembled in time to be available at this meeting only by the whole hearted cooperation of the individual contributors and project chairmen.

Due to the limited time for preparing this report certain editorial changes were made without consultation with the authors. Such editorial changes were necessary in order to obtain uniform composition. The editor trusts that such changes will be accepted in this light.

The research committee is organized into ten projects each having a project leader. The reports from each project were assembled and a summary written by the respective project chairman.

I wish to express my sincere appreciation to the individual contributors and particularly to the project chairmen without whose efforts this publication could not have been prepared.

Floyd M. Ashton
Chairman, Research Committee
Western Weed Control Conference

University of California
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NAMES AND DESIGNATIONS OF CHEMICALS USED AS HERBICIDES

Designation accepted by WSA	Chemical name
2,4-D	2,4-dichlorophenoxyacetic acid
MCPA	2-methyl-4-chlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
3,4-DA.	3,4-dichlorophenoxyacetic acid
4-CPA	4-chlorophenoxyacetic acid
2-(2,4-DP) . . .	2-(2,4-dichlorophenoxy)propionic acid
2-(MCPP)	2-(2-methyl-4-chlorophenoxy)propionic acid
silvex	2-(2,4,5-trichlorophenoxy)propionic acid
2-(3,4-DP) . . .	2-(3,4-dichlorophenoxy)propionic acid
2-(4-CPP)	2-(4-chlorophenoxy)propionic acid
4-(2,4-DB) . . .	4-(2,4-dichlorophenoxy)butyric acid
4-(MCPB)	4-(2-methyl-4-chlorophenoxy)butyric acid
4-(2,4,5-TB) . .	4-(2,4,5-trichlorophenoxy)butyric acid
4-(3,4-DB) . . .	4-(3,4-dichlorophenoxy)butyric acid
4-(4-CPB)	4-(4-chlorophenoxy)butyric acid
sesone[a]	sodium 2,4-dichlorophenoxyethyl sulfate
2,4,5-TES . . .	sodium 2,4,5-trichlorophenoxyethyl sulfate
MCPES	sodium 2-methyl-4-chlorophenoxyethyl sulfate
2,4-DEB	2,4-dichlorophenoxyethyl benzoate
TCA	trichloroacetic acid
dalapon	2,2-dichloropropionic acid
2,2,3-TBA . . .	2,2,3-trichloropropionic acid
DCU	dichloral urea
CDAA	2-chloro-N,N-diallylacetamide
CDEA	2-chloro-N,N-diethylacetamide
IPC	isopropyl N-phenylcarbamate
CIPC	isopropyl N-(3-chlorophenyl)carbamate
BCPC	sec-butyl N-(3-chlorophenyl)carbamate
barban[a]	4-chloro-2-butynyl N-(3-chlorophenyl)carbamate
CDEC	2-chloroallyl diethyldithiocarbamate
fenuron	3-phenyl-1,1-dimethylurea
fenuron TCA	3-phenyl-1,1-dimethylurea trichloroacetate
monuron	3-(p-chlorophenyl)-1,1-dimethylurea
monuron TCA . .	3-(p-chlorophenyl)-1,1-dimethylurea trichloroacetate
diuron	3-(3,4-dichlorophenyl)-1,1-dimethylurea
neburon	1-n-butyl-3-(3,4-dichlorophenyl)-1-methylurea
PCP	pentachlorophenol
DNBP	4,6-dinitro-o-sec-butylphenol
DNAP	4,6-dinitro-o-sec-amylphenol
DNC	3,5-dinitro-o-cresol
2,3,6-TBA[b] . . .	2,3,6-trichlorobenzoic acid
2,3,5,6-TBA[b] . .	2,3,5,6-tetrachlorobenzoic acid
NPA	N-1-naphthylphthalamic acid
endothal[a]	3,6-endoxohexahydrophthalic acid
PMA	phenylmercuric acetate
KOCN	potassium cyanate

Designation accepted by WSA	Chemical name
HCA	hexachloroacetone
IPX	isopropylxanthic acid
MH	1, 2-dihydropyridazine-3, 6-dione (maleic hydrazide)
TCB	trichlorobenzene
DCB	o-dichlorobenzene
amitrole[a]	3-amino-1, 2, 4-triazole
amitrole-T[c] . . .	3-amino-1, 2, 4-triazole-ammonium thiocyanate
OCH	octachlorocyclohexenone
EXD	ethyl xanthogen disulfide
MAA	monomethylarsonic acid
erbon	2-(2, 4, 5-trichlorophenoxy)ethyl2, 2-dichloropropionate
PBA[b].	polychlorobenzoic acid
CEPC	2-chloroethyl N-(3-chlorophenyl)carbamate
CPPC	1-chloro-2-propyl N-(3-chlorophenyl)carbamate
EPTC	ethyl N, N-di-n-propylthiolcarbamate
EBEP	ethyl bis(2-ethylhexyl)phosphinate
DIPA	P, P-dibutyl-N, N-diisopropylphosphinic amide
DMA	disodium monomethylarsonate
CBMM[c]	chlorate-borate-monuron mixtures
CBFM[c]	chlorate-borate-fenuron mixtures
CBDM	chlorate-borate-diuron mixtures
CBM[c]	chlorate-borate mixtures
BMM[c]	borate-monuron mixtures
BDM[c]	borate-2, 4-D mixtures
AMS	ammonium sulfamate
dichlone	2, 3-dichloro-1, 4-naphthoquinone
SMDC	sodium-methyldithiocarbamate
DMTT	3, 5-dimethyltetrahydro-1, 3-5, 2H-thiadiazine-2-thione
amiben[a]	3-amino-2, 5-dichlorobenzoic acid
fenac	2, 3, 6-trichlorophenylacetic acid
simazine[a]	2-chloro-4, 6-bis(ethylamino)-s-triazine
atrazine[a]	2-chloro-4-ethylamino-6-isopropylamino-s-triazine
ipazine[a]	2-chloro-4-diethylamino-6-isopropylamino-s-triazine
trietazine[a]	2-chloro-4-diethylamino-6-ethylamino-s-triazine
propazine[a]	2-chloro-4, 6-bis(isopropylamino)-s-triazine
chlorazine[a] . . .	2-chloro-4, 6-bis(diethylamino)-s-triazine
simetone[a]	2-methoxy-4, 6-bis(ethylamino)-s-triazine
prometone[a] . . .	2-methoxy-4, 6-bis(isopropylamino)-s-triazine
atratone[a]	2-methoxy-4-ethylamino-6-isopropylamino-s-triazine
diquat[a]	1, 1 -ethylene-2, 2 -dipyridylium dibromide
acrolein	acrylaldehyde
2, 4-DEP	tris(2, 4-dichlorophenoxyethyl) phosphite

a Common names "tentatively accepted" by the Terminology Committee of WSA, pending formal approval by ASA.

b These herbicides are usually available for use 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.

c These abbreviations are used to designate mixtures used as soil sterilants. The writer should indicate in a footnote the percentage composition of the product. For example: sodium chlorate--40.0%, sodium metaborate--57.0%, and monuron 1.0%.

PROJECT 1. PERENNIAL HERBACEOUS WEEDS

K. C. Hamilton, Project Chairman

Chemical control of Canada thistle, Cersium arvense. Alley, H. P. A preliminary report on volume of carrier and application date of amitrole and heavy rates of 2,4-D amine was presented in the 1960 progress report. Experimental plots to further study the effects of volume of carrier (H_2O) and date of chemical application was enlarged in 1959. Amitrole at 8 lbs/A in 40, 80, 160 and 240 gpa of water and 2,4-D amine at 40 lbs/A was applied at four dates (1) June 23 (Canada thistle 12" - 14" growth; (2) July 7 (full bloom), (3) July 24 (thistle seed in soft dough stage), (4) August 19 (thistle seed in hard dough stage).

Readings were made one year after the initial chemical application. Only at the early date of application (June 23) was control satisfactory. On this date and stage of application, 8 lbs/A of amitrole killed 95-98 percent control of the established stand of Canada thistle, regardless of the amount of H_2O used as a carrier. Latter applications were not effective. Heavy rates of 2,4-D (40 lbs/A) was not as outstanding as amitrole.

The 1960 data correspond very well with previous years work. From the information obtained in these experiments it does not appear that increases of volume carrier (H_2O) at rates up to 240 gpa has any effect upon the activity of amitrole as long as the rate of chemical application is constant and good coverage is obtained. (Wyoming Agricultural Experiment Station)

Water management in the use of chlorinated benzoic acid herbicides for control of Russian knapweed (Centaurea repens). Miller, J. H.; Kempen, H. M.; and Fischer, B. B. Two experiments were conducted on an Oxalis silty clay loam. (1) Russian knapweed was treated (7/23/58) with polychlorobenzoic acid (PBA) and 2,3,6 trichlorobenzoic acid (2,3,6 TBA) at rates of 20, 40, and 60 lb/A and 10, 20, and 30 lb/A, respectively. Following herbicide application the plots were subdivided and 0, 5, or 8 inches of water were applied by flood irrigation.

Evaluations made 3/27/59 and 3/10/60 indicated Russian knapweed control was 90 to 95% for the low rate of each herbicide and 99 to 100% for all other rates. No marked differences in weed control due to different amounts of water were observed except where the lowest rates of herbicides were used. There, 5 inches of water were superior to either 0 or 8 inches.

(2) Russian knapweed was treated (8/6/59) with 2,3,6 TBA at 20 lb/A and 5 inches of water were added by flood irrigation. Seven months after herbicide application the plots were subdivided and 10, 20, or 30 inches of water were applied by flood irrigation in an attempt to reclaim the land. The degree of reclamation was determined in part by seeding corn, cotton, sorghum, and cowpeas across the plots. Crop data indicate the presence of 2,3,6 TBA in all plots. Crop injury was slight to moderate when 20 to 30 inches of water had been used, and severe where 10 inches of water had been used.

Soil samples (one foot intervals) were taken to a depth of six feet for a greenhouse bioassay. The bioassay with pole beans, harvested 22 days after planting, showed that with 10 inches of water the herbicide was concentrated in the surface two feet with little herbicide in five to six-foot levels. With 20 inches of water, the data indicated a relatively uniform distribution throughout the six-foot profile. With 30 inches of water, the data indicated a marked dilution of herbicide in surface areas of the soil with increased amounts (approximating that found with 20 inches of water) at the lower depths.

The control of Russian knapweed could be correlated with the bioassay data. Where 10 inches of water was used control was 99% or better. Control decreased with additional increments of water indicating that water diluted the herbicide to sublethal dosages before all the knapweed plants were killed. (Contribution of Crops Research Division, ARS, USDA; Department of Botany, University of California, Davis; and University of California Extension Service, Fresno, California)

Two factors influencing the effectiveness of dalapon applied to clumps of Johnsongrass in cotton fields. Hamilton, K. C. Johnsongrass (*Sorghum halepense*) is one of the major weeds in cotton producing areas. Two or more spot treatments with 2,2-dichloropropionic acid (dalapon) has been one of the best control methods. However, the commercial results from spot treatments have been erratic. This study was initiated to determine how certain factors influence the effectiveness of dalapon in the field.

The study area was a cotton field at Marana, Arizona. The field was grown under normal grower practices except Johnsongrass was not disturbed during the hoeings. After cotton planting the locations of clumps of established Johnsongrass in the row were marked with permanent stakes. Treated Johnsongrass was thoroughly wet with a spray solution containing .15 lb of dalapon and 4 cc of "X-77", a wetting agent, per gallon of water. Treated clumps received approximately 30 lb/A of dalapon. After a given interval the topgrowth of Johnsongrass was removed by clipping at the ground level. Two and three weeks after clipping the number of growing plants, the length of the longest aerial stem and the number of stems per plant was determined.

A. Interval between treatment and removal of topgrowth.

In 1959 and 1960, during the second week in May, dalapon was applied to marked clumps of Johnsongrass 6 to 10 inches high. After intervals varying from 3 to 54 hours the topgrowth was removed. During the week of treatment the high and low temperature in the field averaged 92 and 50 degrees and high and low relative humidity averaged 52 and 9 percent. Two weeks after clipping the regrowth of all plants was measured. The data on effect of the interval between application of dalapon and topgrowth removal on regrowth are summarized in table 1. As the time interval increased from 3 to 9 hours the percent of plants growing decreased, the average of regrowth was shorter and the number of stems per plant decreased. Intervals longer than nine hours did not increase the effectiveness of dalapon applications.

Table 1. Effect of time between spraying and removal of topgrowth on applications of dalapon to Johnsongrass.

Hours between treatment and removal of topgrowth	Percent of plants growing* 1959	1960	Average length of longest stem on growing plants 1959	1960	Number of stems per growing plant 1960
Untreated check	100	100	11.7"	12.5"	14.0
3	100	90	9.0"	9.6"	11.1
6	85	87	4.4"	6.7"	9.2
9		27		4.2"	5.0
12		17		6.6"	5.4
24		30		5.3"	6.1
30	22		2.2"		
54	22		2.5"		

*Values in 1959 are based on 27 plants for each treatment; values in 1960 are based on 30 plants.

B. Height of Johnsongrass when treated.

During the third and fourth weeks in May of 1960 the topgrowth of 40 plants was removed at 3 to 4 day intervals to produce Johnsongrass with different heights. On May 30 these plants were sprayed with the dalapon solution described in part A. After 48 hours the topgrowth of all plants was removed. The data on the effects of applying dalapon to Johnsongrass with different amounts of topgrowth is summarized in table 2. All treatments affected the regrowth of Johnsongrass. However, plants averaging 3.1 inches when treated were less affected than plants 5.8 to 9.5 inches high.

Table 2. Height of Johnsongrass on effectiveness of dalapon applications.

Average height of plants when sprayed	Percent of plants growing 22 days after treatment*	Average length of longest stem on growing plants	Number of stems per growing plant
9.5"	11	16"	2.7
8.8"	11	13"	2.3
7.3"	11	12"	2.0
5.8"	7	6"	3.0
3.1	57	19"	7.6
Untreated check	100	19"	15.5

*Values are based on 28 plants for each treatment.

Regrowth of treated Johnsongrass did not occur from stems that were sprayed with dalapon. These stems and the attached rhizomes immediately beneath them seldom resumed growth. Most of the regrowth developed from side rhizomes (physically attached to the main rhizomes system) whose growing point was about to emerge from the soil when the plant was treated. The aerial stems developing from such rhizomes showed little or no foliage malformation and the rate of growth usually equalled that of the untreated Johnsongrass. (Arizona Agricultural Experiment Station)

PROJECT 2. HERBACEOUS RANGE WEEDS

Gerald J. Klomp, Project Chairman

SUMMARY

Eleven reports were received on seven herbaceous range weeds from nine groups of investigators.

Medusahead (Elymus caput-medusa). The four reports on this weed reflect the growing concern with this pest and the increasing interest in its control. In a report from California the taxonomy and nomenclature are reviewed and three forms, differentiated on the bases of morphology, geographical distribution, climates, and degree of weedings, are described. Another California report notes that data on plant development, dates of flower emergence, plant height and weight, seed maturity, seed germination, germination rate, and root elongation rate are used as measurements of ecotypic variation.

The role of native perennials in controlling medusahead and a comparison of seed carryover of medusahead and cheatgrass on burned and unburned areas are noted in a report on ecology and control from Idaho. In an Oregon report, the effectiveness of several herbicides in controlling medusahead is also presented with simazine, dalapon, and cacodylic acid showing good control at rates used, and EPTC yielding moderately good control (at 8 pounds per acre) under existing conditions.

Cheatgrass (Bromus tectorum). Several herbicides were applied either fall or spring in a Washington study to control cheatgrass in wheatgrass with varying control of cheatgrass and/or damage to wheatgrass. Most satisfactory was 4 pounds per acre of IPC applied in early spring.

Halogeton (Halogeton glomeratus). A study of seliniferous halogeton is made in Utah by feeding sheep, via rumen fistula, combinations of seliniferous and nonseliniferous halogeton and seliniferous, Atriplex canescens and A. preussii. Halogeton is not a heavy Se accumulator and seliniferous halogeton caused little or no damage to organs of sheep so fed.

Tall larkspur (Delphinium barbeyi). Several herbicides were applied to tall larkspur on three dates at two sites in Colorado. Early (June 11) date was best and on that date high rates of kill were obtained with silvex and 2,4,5-T. Moderately successful were fenuron, TCA, and inverton. Amitrole gave no control.

Puncture vine (Tribulus terrestris). From California progress is reported in a study of the host specificity of two weevils which attack puncture vine and two closely related desert plants.

Taxonomy and nomenclature of medusa head. Major, J. Elymus caput-medusae L. is an aggregate taxon. It is composed of 3 entities differing in morphology, geographical distribution, climates, and degree of weediness.

These taxa can be named as subspecies of Elymus caput-medusae or as species of Nevski's genus Taeniatherum. The latter is probably the best solution since they are unlike other species of Elymus and in fact in Europe have often been called species of Hordeum.

Taeniatherum caput-medusae (L.) Nevski (=Elymus caput-medusae L. ssp bobartii Asch. & Graebn.) is found from southern France along the coast through the Iberian peninsula except for the northwest corner. It is scattered, in ruderal sites, often in the mountains, associated with mediterranean annuals and macchie shrubs. It can be identified by the glumes which have awns 1/2 the length of the lemma awns. The other species have proportionately shorter glumes.

T. crinitum (Schreb.) Nevski (=E. c-m ssp. crinitus (Schreb.) Shmalh.) is a coarse-awned, large-headed, coarse plant with erect, short glumes. It is found from the mountains of Morocco through Algeria and Tunisia, across to Sicily, and Sardinia, across to Greece in Argos, Attica, the Macedonian mountains, Thrace, and some of the Cyclades. In the Balkans it is reported from Serbia, Bulgaria, Thrace, Macedonia, and Albania. It is common in Anatolia. It is on the southern fringe of the Crimea in an area of Mediterranean climate and in Transcaucasia and Armenia. In the south it occurs in the mountains of Sinai, is rare in Israel, is in Lebanon, Syria, in Iraq, across northern Iran and into Afghanistan. In the USSR it goes east in Central Asia to the Tien Shan Mts.

T. asper (Sim.) Nevski (=Elymus c-m L. ssp. asper (Sim.) Degen. is a slender, graceful plant with slender awns about 3 times the length of the lemmas which arch upward and may be quite spreading, at least when dry. It is native from central and southern Hungary, the northern and central Balkans including Thessaly, Thrace, the Pindus Mts., to the island of Corfu and the Asiatic side of the Bosporus almost to Izmit and to Troy. It occurs in southern Italy, separated by the toe of Italy, Calabria, from T. crinitum in Sicily. It is common in the Dobrudscha, the coastal steppe of Rumania, occurs on the coastal steppe of the Ukraine, into the Crimea and then the Caucasus. It is isolated in Kurdistan, is in mountainous Turkemenia, and goes east to the Pamir-Alai region of Tadzhikistan. This species is the most weedy of all 3; species crinitum in contrast, according to Soviet authors, grows "on stony foothills". This is the plant which is now a range weed in Washington, Idaho, Oregon, and California.

Probably many of our weeds are not "good" species. Their broad range of adaptability may be in very many cases a reflection of a diversity of ecotypes which may be recognizable as subspecies or even species. Since the only solution taxonomists have suggested for stabilization of plant nomenclature is intensified study of plants "to get it over with" so far as nomenclatural changes are concerned, those interested in weeds should insist that the plants that interest them be given intensive taxonomic study. (Dept. of Botany, University of California, Davis).

Measurement of ecotypic variation in medusa head. John P. Robison, C. M. McKell, and J. Major. Since medusa head has a wide geographical range, some indication of the variation that exists within this species is desirable. Seed from 13 locations in California, Oregon, Washington, and Idaho were collected in 1959. Five replicates of seed from each location were planted in Sept. 1959 in 10-ft. rows in a uniform garden at Davis, California. Detailed notes were taken on plant development, dates of flower emergence, plant height and weight, and seed maturity. In the laboratory and greenhouse seed germination, rate of germination, and rate of root elongation were observed.

There were statistically significant differences in % germination, speed of germination, rate of root growth, plant heights, and phenology. Seed from localities with relatively low precipitation had the highest germination % within

36 hours while seed from localities with relatively high precipitation had a germination peak within 48 hours.

The root growth studies were run in the greenhouse at 72° F. and in a growth chamber at 52° F. using seeds from the most northern, southern and driest and wettest localities. The most southern (Santa Barbara, California) and most northern (Whitman Co., Washington) plants had most rapid root elongation while the plants from the wettest site (Benton Co., Oregon) had slowest. Modoc Co. plants (driest) were intermediate in rate.

Flower emergence was earliest in plants from Stanislaus Co., California and latest from Benton Co., Oregon. The interval was 36 days, but this decreased to a difference of 15 days at time of seed maturity.

From comparisons of plant responses under uniform conditions it may be concluded that ecotypes exist in medusa head populations on western rangelands. Since the plant has been in the United States only since 1887 (near Roseburg, Oregon), it appears that adaptation of medusa head to new environments proceeds rapidly. (Dept. of Agronomy, Agricultural Research Service (USDA), & Dept. of Botany, University of California, Davis).

Ecology and control of medusahead (*Elymus caput-medusae*). Hironaka, M., Heller, T. and Tisdale, E. W. 1. Re-sampling in 1960 of an area protected from grazing since 1953 yielded results which are encouraging in regard to the ability of native perennials to compete with medusahead. The study area was a typical sagebrush-grass range converted to cheatgrass (*Bromus tectorum*) and other annuals by a combination of overgrazing and fire and later overrun by medusahead. The area was selected for its dense cover of medusahead and when the 10-acre exclosure was established, perennial grasses other than *Poa secunda* were so scarce that they were counted individually. Intensive sampling was done in 1955, by which time a noticeable increase in the cover of *Poa* had already occurred. Changes in the density of perennial species from 1955 to 1960 are indicated in Table 1.

Table 1. Average Number of Plants per 200 sq. ft.

Species	1955	1960	Diff.	Sign. at 5%
Poa secunda	60.6	56.8	- 3.8	No
Sitanion hystrix	9.5	18.5	+ 9.0	Yes
Other perennials (mostly Agoseris grandiflora	4.6	55.8	+51.2	Yes

Along with this increase in perennials has come a marked decrease in the density and vigor of medusahead; in fact this species no longer dominates the site.

Complete protection from grazing for long periods may not be a feasible practice, but the results show a greater recovery of perennials than was anticipated from this depleted site. Comparable results may be possible through grazing restricted to the fall season, and this approach may prove valuable on areas not suitable for artificial revegetation.

2. An initial study to determine relative amounts of seed carryover in medusahead and cheatgrass has just been completed. The method involved the collection of sods 6 x 8 inches and approximately 1 inch think. Collection was made early enough in the season to avoid danger of contamination from

seed of the current year. Germination under greenhouse conditions was determined during a period of 30 days. The average number of seedlings of medusahead varied from 3 per square foot on an area burned severely in 1959 to 230 on a heavily infested and ungrazed area. Cheatgrass seedlings varied more in numbers, ranging as low as 0.6 per square foot on one burned site to 38.5 on an unburned area dominated by medusahead. These results indicate that an appreciable carryover of seed is normal in these two annual grasses, and that even total destruction of a one year's seed crop cannot be expected to eliminate either species from a site. (Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, Idaho)

Control of medusahead (Elymus caput-medusae) by post-emergence treatment with several herbicides in eastern Oregon. Klomp, Gerard J.

Two sites were selected for a study of several herbicides in the Grande Ronde Valley near La Grande, Oregon. Both sites had dense stands of medusahead (Elymus caput-medusae) which existed in almost pure stands on a variable sandy loam soil. Site 1 (mouth of Ladd Canyon) at an elevation of 2,800 feet, has an annual precipitation of 16 inches. Site 2 (Mt. Emily foothills) at an elevation of 3,300 feet receives 21 inches of precipitation annually.

The herbicides were applied in the late fall (November 14, 1959), by which time medusahead had germinated and was up about one inch. Although there had been considerable freezing weather, medusahead had not been injured. There had not been any permanent snow.

Herbicides applied were ethyl di-n-propylthiocarbamate (EPTC), dimethylarsinic acid (cacodylic acid), 2-chloro-4,6 bis-(ethylamino)-s-triazine (simazine), and 2,2-dichloropropionic acid (dalapon). Dalapon was applied both in a granular form (10 percent) and in water. The EPTC was also applied in granular form (5 percent). The others were applied in water. All water-applied herbicides were sprayed at a rate of 50 gallons per acre. All chemicals were applied at three rates and all treatments were replicated three times at each site. The plots were examined June 15, 1960 and the percent control of medusahead was determined. The results, showing the average of three replicates of each treatment, are indicated in Table 1.

Incidental to the purposes of the study, the following selectivities were noted in the infrequent instances where species other than medusahead occurred on the plots. A lupine (Lupinus spp.) was not killed by simazine or dalapon at any of the three rates. A milkvetch (Astragalus spp.), salsify (Tragopogon spp.), bottlebrush squirreltail (Sitanion hystrix), and alfilaria (Erodium cicutarium) were not killed by cacodylic acid, dalapon, or EPTC at any of the three rates. Canada bluegrass (Poa compressa) was not killed by cacodylic acid or dalapon at the rates used.

(Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, La Grande, Oregon)

Table 1. The percentage control of medusahead by various herbicides at two sites in eastern Oregon.

Herbicide	Rate (lb./A.)	Percent medusahead control Site 1 (2,800'/16" ppn.)	Site 2 (3,300'/21" ppn.)
EPTC (gran.)	2	18	22
EPTC (gran.)	4	30	50
EPTC (gran.)	8	72	80
Cacodylic acid	2	20	30
Cacodylic acid	4	77	83
Cacodylic acid	8	95	97
Simazine	10	100	100
Simazine	20	100	100
Simazine	30	100	100
Dalapon	1	80	83
Dalapon	2	93	97
Dalapon	4	100	90
Dalapon (gran.)	1	80	57
Dalapon (gran.)	2	90	95
Dalapon (gran.)	4	98	100
Check		0	0

Evaluation of herbicides for control of Bromus tectorum in a semi-arid area of eastern Washington. Robocker, W. C., Canode, Chester L., Kerr, Harold D., and Muzik, Thomas J. An area was selected for trial of herbicides to remove cheatgrass (Bromus tectorum L.) from a stand of intermediate wheatgrass (Apropyron intermedium (Host) Beauv.) on the McGregor Land and Livestock Company Ranch at Hooper, Washington. The site is in sub-marginal wheat land and has an average annual precipitation of about 13 inches, most of which falls from September through May.

Herbicides used in fall or spring applications or both were 3-amino-1,2,4-triazole (amitrole), isopropyl-N-(3-chlorophenyl) carbamate (CIPC), sodium 2,2-dichloropropionate (dalapon), 3(3,4-dichlorophenyl)-1,1-dimethylurea (diuron), 3,6-endoxohexahydrophthallic acid (endothal), isopropyl N-phenylcarbamate (IPC), 3-(p-chlorophenyl)-1,1-dimethylurea (monuron), 2-chloro-4,6-bis(ethylamino)-s-triazine (simazine), sodium trichloroacetate (TCA), and 2,3,6-trichlorobenzoic acid (2,3,6-TBA).

One trial was established on February 27, 1958, as a randomized complete-block design with 10- x 30-ft. plots in two replications. Treatments consisted of three rates of eight herbicides in water. A second trial involving herbicides applied in water at two rates plus granular IPC at three rates was laid out in three replicates of 10- x 30-ft. plots in a randomized complete-block design on October 30, 1958. Herbicides applied in water were in a volume of 20 gpa.

Results were evaluated over a 3-year period for the treatments applied in the spring and over a 2-year period for those applied in the fall (Table 1). Endothal and 2,3,6-TBA applied in either spring or fall were unsatisfactory for control of cheatgrass. This is contrary to results obtained from use of endothal in the Spokane, Washington, area. Amitrole, TCA, and dalapon were unsatisfactory because of injury to the intermediate wheatgrass. Monuron at 2 lb/A gave poor control, but at 4 lb/A the residual control of cheatgrass was excellent. The 4 lb/A rate, however, caused damage to the intermediate wheatgrass.

Table 1. Percentage reduction of stand of cheatgrass by herbicides applied February 27, 1958, and October 30, 1958.

Herbicide	Rate	Evaluation date				
		Spring application			Fall application	
	(Lb/A)	7/58	7/59	5/60	5/59	5/60
Amitrole	2	40	0	0	---	---
	4	95	60	5	67	33
	8	100	92	10	100	40
CIPC	2	0	0	0	---	---
	4	50	50	10	90	57
	8	80	50	5	100	88
Dalapon	4	90	75	15	---	---
	8	100	92	25	---	---
Diuron	2	---	---	---	82	100
	4	---	---	---	93	98
Endothal	3	20	0	0	---	---
	4	---	---	---	10	0
	6	30	40	0	---	---
	8	---	---	---	60	7
	9	20	5	0	---	---
IPC (granular)	4	---	---	---	83	27
	8	---	---	---	96	43
	16	---	---	---	100	58
IPC (liquid)	2	65	42	0	---	---
	4	95	95	60	95	50
	8	85	95	75	98	33
Monuron	2	0	30	5	---	---
	4	100	100	35	---	---
	8	100	100	98	---	---
Simazine	2	---	---	---	100	100
	4	---	---	---	100	100
TCA	6	40	0	0	---	---
	12	90	70	0	---	---
	18	100	90	0	---	---
2,3,6-TBA	2	0	25	0	---	---
	4	0	25	0	30	0
	8	0	5	0	0	0

Results from application of herbicides in late October 1958 were more variable than those from spring application. In the 1960 growing season, CIPC at 8 lb./A appeared best, but on full comparison of the data, appeared to be scarcely better than 4 lb./A of IPC applied in the spring. While giving excellent control of cheatgrass, simazine at both 2 and 4 lb./A also caused severe injury to the wheatgrass. Diuron at 2 lb./A gave excellent control of cheatgrass and some injury to the wheatgrass, but the 4 lb./A rate caused more injury to wheatgrass during the first year after treatment.

Consideration of the herbicides tested and the time of their application indicates that for elimination of cheatgrass with a minimum effect on the wheatgrass, 4 lb./A of IPC applied in the early spring was most satisfactory. (Crops Research Division, Agricultural Research Service, U. S. Dept. of Agriculture, and Washington Agricultural Experiment Station, Pullman, cooperating.)

The accumulation of selenium by halogeton   Williams, M. Coburn.

Halogeton glomeratus has recently invaded the highly seleniferous soils of Eastern Utah. A study was initiated in 1959 to investigate selenium accumulation in this species and toxicology of seleniferous halogeton.

Samples of leaves and stems were collected from June to November and analyzed for selenium and soluble oxalates. Halogeton was grown in the greenhouse in nutrient cultures containing 2, 4, and 8 ppm Se. During the summer of 1960, sheep were fed, via rumen fistula, nonseleniferous halogeton, nonseleniferous halogeton plus seleniferous Atriplex canescens, nonseleniferous halogeton plus seleniferous Astragalus preussii, and seleniferous halogeton. The dosage was calculated at a level which would permit sheep on full feed to survive 90 days without visable symptoms if the oxalates or selenium were fed separately but not in combination.

Only small quantities of selenium were absorbed by halogeton which grew on seleniferous soil. The highest quantity found was 95 ppm. Generally, selenium concentration averaged less than 10 ppm and dropped rapidly below 1 ppm when the plants died. Plants grown in the greenhouse in 8 ppm selenium contained 500 ppm Se. Selenium occurs in a form which cannot be detected in fresh material in the field. The odor of selenium is barely detectable in dried and powdered material.

Sheep which were fed sublethal quantities of halogeton containing 11 ppm Se showed no symptoms during the 30 day feeding trail. Some losses among sheep fed on sublethal doses of halogeton and either Atriplex or Astragalus occurred during the 30 day feeding trial. The toxic symptoms were inevitably followed by death. Death occurred primarily from oxalate poisoning as determined by the level of the blood calcium. Selenium reduced the quantity of oxalates required for death by reducing kidney function, thus blocking effective elimination of the oxalates. The remaining animals were sacrificed at the end of 30 days. Moderate to severe damage to the heart, kidneys, and liver were noted in the animals which had received both oxalates and selenium. Little or no damage resulted in the organs of animals which received only seleniferous halogeton. The selenium content of the seleniferous halogeton was lower than that provided when other plants were used as a selenium source. Had the same selenium content been used, the oxalate concentration would have passed the lethal level.

The small amount of selenium usually found in halogeton found in these areas is not likely to affect its toxicity. Prolonged consumption of high but normally sublethal concentrations of oxalates and selenium will result in fatalities in sheep whereas the consumption of the same quantities alone would not. Losses are much more likely to occur through overdoses of either oxalates or selenium rather than by sublethal combinations of the 2 poisons. (Weed Control - Grazing Lands, CPRB, CRD, ARS, U. S. Department of Agriculture)

Herbicidal control of tall larkspur (*Delphinium barbeyi* Huth.). Hervey, D. F. and Bruno Klinger. Tall larkspur, a poisonous perennial herbaceous range plant with a stout woody rootstock, heretofore has proven difficult to control with herbicides. After heavy cattle losses during the summer of 1958, livestockmen of the Holy Cross Cattlemen's Association provided financial support for renewed efforts in controlling tall larkspur; additional assistance was given by the U. S. Forest Service, Garfield County, and Amchem, Dow, and DuPont Chemical Companies. 1/100th-acre plots were treated June 11, 1959 (tall larkspur in vegetative stage 8 - 30" tall), June 29, 1959 (tall larkspur in bud-stage and about 36" tall), and July 10, 1959 (tall larkspur in bloom-stage). Spray applications were made in a water carrier at the rate of 100 gallons per acre; pellet and granular treatments were one tablespoon per tall larkspur plant placed at the base of the plant. All sprayed herbicides were applied at the rate of 6 pounds of acid equivalent per acre. Spray applications consisted of Kuron (or Silvex), 2-(2,4,5-Trichlorophenoxy) propionic acid; Dow's M-1445, a Forron formulation of Silvex; Dow's M-1456, a Forron formulation of 2,4,5-Trichlorophenoxyacetic acid; Amchem's M-422, an oil soluble amine of 2,4,5-Trichlorophenoxyacetic acid; 2,3,6-Trichlorobenzoic acid (2,3,6-TBA); 3-amino-1,2,4-Triazole (amitrole); pellet form of 3-phenyl-1, 1-dimethylurea (fenuron); granular form of 3-phenyl-1, 1-dimethylurea trichloroacetate (fenuron TCA); and an invert emulsion of 2,4,5-Trichlorophenoxyacetic acid (Inverton). The plots were located at about 8,700 feet elevation, one on an east facing open slope, and the other in an east-facing aspen "pocket" on the White River National Forest about 30 miles northwest of Glenwood Springs, Colorado. The number of larkspur plants were counted in each plot just prior to treatment, and again approximately one year after treatment. Results are given in the following table:

PERCENT OF TALL LARKSPUR KILLED BY CERTAIN HERBICIDAL TREATMENTS APPLIED ON THREE DATES AND IN TWO SITES

	Open Site			Aspen Site		
	June 11 (Vegeta.)	June 29 (Bud)	July 10 (Bloom)	June 11 (Vegeta.)	June 29 (Bud)	July 10 (Bloom)
	-----Percent-----					
Silvex	100	62	0	95	65	32
2,4,5-T, Oil Sol. Amine	100	26	14	94	6	83
2,4,5-T, Oil Sol. Amine + Plyac	100	9	0	92	27	61
Forron 2,4,5-T	98	18	0	100	60	64
Forron Silvex	86	16	0	65	49	6
2,3,6-TBA	32	0	0	0	0	0
Inverton	56	0	22	65	71	24
Fenuron TCA	75	69	0	76	19	--
Fenuron	75	7	16	88	8	0
Amitrole	0	0	0	0	0	0

Colorado Agricultural Experiment Station, Fort Collins, Colorado.

Biological control of puncture vine (Tribulus terrestris). Huffaker, Carl B. The joint University of California/U. S. Department of Agriculture, Agricultural Research Service, project on biological control of puncture vine, Tribulus terrestris, as a particular pest in California has been pursued in Europe and at Albany, California, during the past year. Personnel of the Paris and Rome laboratories of the A. R. S. and of the Department of Biological Control of the University of California at Albany, have completed tests on the host specificity of two weevils, Microlarinus lareyniei and Microlarinus pelitoranus, which attack this weed in the Eurasian area. The object is the introduction of these enemies of the weed into California and other states which have this weed as a problem. The question of their introduction has not yet been fully decided by authorities although the results of the tests are promising. These insects were shown to be incapable of economic damage to, or reproduction on, any plants other than puncture vine and the closely related desert plants Kallstroemia californica and K. grandiflora. These plants are so closely related to puncture vine that they were formerly considered to belong to the same genus. (Department of Biological Control, Agricultural Experiment Station, University of California, Albany, California)

Studies on the control of leafy spurge. Baker, Laurence O.

A dense stand of leafy spurge infesting native grasses was treated June 18, 1959. Triplicated rod-square plots were used for each treatment. The chemical for each plot was weighed or measured and was applied with a three-gallon knapsack sprayer using one quart of water. The area had been sprayed by the landowner with 2,4-D about two weeks prior to the treatment date. All spurge topgrowth was wilted and dying, but not yet dried up.

Regrowth in 1959 occurred on all plots except those treated with 2,3,6-trichlorobenzoic acid, ammonium sulfamate and all except the lowest rate of 2,3,6-trichlorophenylacetic acid (fenac).

The entire area was sprayed by the farmer with 2,4-D about June 12, 1960.

Treatments, together with the estimated percent regrowth at two dates in 1960 follow:

(Refer to Table on next page)

Treatment	Rate in lbs/acre	Percent regrowth* 6/21	8/12	Percent grass injury 6/21
2, 3, 6-trichlorophenylacetic	4	83	38	0
acid (fenac)	8	42	32	0
	12	33	20	0
	16	13	9	3
2, 3, 6-trichlorobenzoic	16	50	43	0
acid	24	18	6	0
N-(3, 4-dichlorophenyl)-	10	83	33	0
2-methylpentanamide	20	67	83	25
(N-4562)	30	58	78	33
2-chloro-4-ethylamino-	10	100	80	50
6-diethylamino-s-triazine	20	93	93	75
(trietazine)	30	73 dying	98	100
2-chloro-4, 6-bis	10	77 dying	98	97
(ethylamino)-s-triazine	20	35 dying	98	83
(simazine)	30	67 dying	100	97
2-methoxy-4, 6-bis	10	67 dying	93	100
(isopropylamino)-	20	10 dying	32	100
s-triazine (prometrone)	30	0	14	100
3-phenyl-1, 1-dimethyl-urea (fenuron)	30	93 dying	95	100
2-chloro-4-ethylamino-	10	100 dying	97	100
6-isopropylamino-s-	20	23 dying	85	100
triazine (atrazine)	30	7 dying	30	100
Ammonium sulfamate	5 lbs/sq rod	0	13	77
Untreated	--	92	37	0

Trietazine, simazine, prometrone, atrazine, fenuron, and ammate killed most of the grass. The highest rates of fenac, benzac, prometrone and ammate were most effective in preventing spurge regrowth. No material; however, gave complete spurge control thoughout 1960. (Montana Agricultural Experiment Station)

Chemicals for control of leafy spurge. Baker, Laurence O.

On May 13, 1959, treatments were applied to an area heavily infested with leafy spurge (Euphorbia esula) 2 miles north of the Central Montana Branch Station. The area was not being cropped and was infested to the point that little other vegetation except downy bromegrass (Bromus tectorum) was present. Prior to chemical application, but following the location of the plots the area was inadvertently burned over. Leafy spurge had just begun to grow, but was not particularly hurt by the fire which destroyed most old plant residue. Plots were 1 rod square and all treatments were triplicated.

Results obtained from this experiment follow:

Chemical	Rate	Date observations were made & % regrowth			
		7/24/59	5/10/60	6/29/60	
				Spurge	Downy bromegrass
Simazine	60 lbs/acre*	73 a/	100	15	0
Monuron	60 lbs/acre*	15	12	5	0
Fenuron	60 lbs/acre*	2	0	0	0
Atrazine	60 lbs/acre*	12	13	7	0
Urox	60 lbs/acre*	45 a/	53	35	0
Chlorea	4#/100 sq. ft.	30 a/	11	17	0
Ureabor	2.34#/100 sq. ft.	22 a/	23	12	0
2,3,6-TBA Sodium	15 lbs/acre*	28 a/ b/	7	28	100 c/
	20 lbs/acre*	28 a/ b/	0	21	92 c/
DB Granular	1#/100 sq. ft.	8 b/	17	50	97
	2#/100 sq. ft.	2 b/	7	9	60

* active ingredient
a/ some spurge seed formed
b/ did not control annual grasses
c/ normal stand, but height reduced about 25%

Observations in 1959 were made by Arthur Dubbs, Supt. of the Central Montana Branch Station.

Increased regrowth observed in June over that recorded in May 1960 was the result of sprouting from roots and was not due to seedling reestablishment. (Montana Agricultural Experiment Station)

Herbicidal treatment of wild caraway (*Carum carvi*). Baker, Laurence O., and Heikes, Eugene. Wild caraway in a mixed stand of grasses and legumes was treated May 18, 1959, when caraway was about four inches tall. Treatments were applied to triplicated rod square plots using water as the carrier at a rate of 40 gal. per acre. Observations were made May 23, 1960. Treatments and estimated percent kill of caraway, dandelions and legumes (principally alsike clover) follow:

Treatment	Percent kill - Avg. 3 reps.		
	Caraway	Dandelions	Legumes
1. 2,4-D LV Ester - 1 lb. per acre	82	65	35
2. 2,4-D LV Ester - 2 lbs. per acre	98	87	87
3. 2,4-D LV Ester - 3 lbs. per acre	99	91	90
4. MCP LV Ester - 2 lbs. per acre	79	87	40
5. MCP LV Ester - 3 lbs. per acre	65	85	79
6. 2,4,5-T LV Ester - 2 lbs. per acre	90	66	97
7. 2,4,5-T LV Ester - 3 lbs. per acre	95	75	98
8. Weedazol - 4 lbs. per acre	13	70	93
9. 2,4,5-TP - 2 lbs. per acre	32	48	98
10. 2,4-D amine - 3 lbs. per acre	93	80	83

(Montana Agricultural Experiment Station)

PROJECT 3. UNDESIRABLE WOODY PLANTS

O. A. Leonard, Project Chairman

SUMMARY

Twelve reports on the control of undesirable woody plants were received. These reports covered work having a variety of areas of interest (1) 5 reports related to some sort of control in forest lands, including the parasitic shrub, dwarfmistletoe, (2) 3 reports related to rangelands and/or watersheds, (3) 2 reports concerning control on cultivated land, (4) 1 report was for fuel-break purposes, and (5) 1 report related to saving water. Thus a wide variety of interests are represented in the above reports.

Woody plant control in forest lands has been receiving a great deal of attention in recent years, with action-programs often going ahead of research. It is encouraging to note the increased emphasis on research by both public and private investigators. It will be noted that some workers (and agencies) presented data for the Tables on Reaction of Woody Plants to Herbicides, who did not send in abstracts; thus the number of workers actually sending in data on woody plant control is at least twice that of those sending in abstracts.

It is interesting to note how aerial spraying during the spring dormancy (and bud break) has become an established commercial practice for controlling vine maple and red alder for "releasing" young Douglas fir (Lauterbach). The results of Sinclair and Amen suggest that salmonberry may possibly be practically controlled by summer spraying with amitrole. The control of the dwarfmistletoe with chemicals has yet to be achieved; however, the research program reported by Quick may lead to some method of control; the substituted phenoxy herbicides currently hold the greatest promise.

Only 3 of the abstracts involved woody plant control for purposes of range or watershed. The number of reports does not mean that there is less research with herbicides on rangelands, but there is a stabilization in what can be accomplished with present herbicides and methods of use. Some of the work is taking a more basic trend, which may be illustrated by the 3 papers that were submitted. The paper by Alley on big sagebrush control relates the value of spraying to subsequent yields of forage. Shrub control with soil applied herbicides has been highly variable, with a need for more basic research indicated. Such work has been initiated by Davis and Lillie and it is hoped that this work will be continued and expanded. A number of workers involved in woody plant control for range purposes did not send in abstracts, but did send in important data for the Tables on the Reaction of Woody Plants to Herbicides, that follow the abstracts.

Woody plant problems can even occur on tilled areas, as may be noted in 2 reports. Ames, McKay, and Erickson demonstrated the importance of reapplication in controlling wild rose in grain fields and was most strikingly demonstrated by a 2 lbs./A application in 1957, followed by another similar application in 1959. Shrub control in vineyards is indicated as important in a report by Leonard, Lider, and Sisson. This represents an area which will become more important as the use of diuron, etc. becomes more widely adopted. Actually, programs of complete vine-row weed control should become the accepted practice.

Fuel-break research and action programs are receiving a considerable increase in emphasis and stems from the desire to have more control of the disastrous fires that commonly occur in the brush and forest lands--perhaps more in California than in other Western States. The work that Plumb is doing represents one aspect of this work.

Woody plant control to save water is attracting more attention in the West than before, although this aspect is represented by only one abstract by Cords on saltcedar control. It is interesting to note the effectiveness of silvex and suggests that this chemical will receive a broadened usage in the future. Certainly, the effectiveness of silvex in blue oak and poison oak control (the tables on woody plants) would support this view.

Chemical control of dwarfmistletoes in conifer forests. Quick, Clarence R. A project to develop a method for direct chemical control of dwarfmistletoes (*Arceuthobium* spp.) in the montane forests of California has been reactivated in the Pacific Southwest Forest and Range Experiment Station. Use of oil soluble herbicides in kerosene, stove oil, and diesel oil is currently being emphasized. In general, each spray batch--each combination of chemical, concentration, and carrier--is applied (1) to individual dwarfmistletoe cankers on (a) a tree trunk, (b) a large branch, and (c) a twig; and (2) to a varying proportion of the trunk as basal stem spray of (a) smooth barked (young) trees, and (b) rough barked (older) trees. If we can kill individual parasitic infestations by direct spray treatment, we will have a control method, although a rather clumsy one. If we can find "systemic" herbicides that will safely kill dwarfmistletoe in the crowns of conifers after having been sprayed on the boles, we will have a much more widely usable method of control.

In the fall of 1959 several formulations of the substituted phenoxy herbicides were diluted with kerosene, with or without the addition of special solvents and penetrants, and sprayed on mistletoe infested Jeffrey pine saplings and poles. Many treated cankers, including some extensive trunk cankers on trees with 8- to 10-inch boles, appear to have been killed by the herbicides. Time will tell if the cankers are actually dead--they may yet resprout from parts of the parasite within the trees. A few small trees were killed by the treatments; some larger trees were damaged.

In 1960, 890 trees in 100 tests were treated with an assortment of herbicides. Tests were started on three pines (Jeffrey pine, ponderosa pine, sugar pine) and on two firs (red fir, white fir). Some trees treated in early July 1960 showed chemical damage by the first of September. Damage from basal stem sprays of phenoxy herbicides in petroleum oil carriers appears to concentrate in the upper parts of crowns of red fir and white fir but progresses rather uniformly over the entire crowns of Jeffrey and ponderosa pines. (U. S. Forest Service, Berkeley, California)

The effect of timing of amitrole applications for salmonberry control. Sinclair, A. T. and Amen, C. R. Since amitrole in previous trials had shown activity for control of salmonberry, a series of tests were put out in 1959 on the Oregon Coast to determine if control could be improved by timing applications. Three dates of application were used in the tests; in the spring on May 26, in midsummer on July 28, and in the fall on October 23. Rates used were equivalent to 1, 2, and 4 pounds active amitrole per acre. Duplicate plots were set up in dense stands of salmonberry with a hand gun sprayer at each date and rate. Volume of spray used was equivalent to 200 gallons per acre, and the equivalent of 10 oz. X-77 and 2 qts. kerosene were added to each 100 gallons of solution. Observations of regrowth during 1960 showed that the midsummer applications were much more effective than either the early or late season applications. The 1 pound rate was inadequate for any of the treatment dates with better than 75% regrowth. All early and late treatments resulted in 50% or more regrowth. There was approximately 25% regrowth in plots treated at the 2 pound rate in midsummer, and less than 10% regrowth resulted from the midsummer 4 pound treatments. (American Cyanamid Company)

Type of chemical and season of application are important when basal spraying red alder. Madison, Robert W. Of three herbicide solutions used, a 16-aihg concentration of a 1:1 mixture of 2,4,5-T and 2,4-D in diesel oil caused maximum defoliation at lowest cost when applied as a basal spray on red alder 2.5 inches in diameter. Treatments were effective only when applied during the growing season.

Size of tree apparently influenced effectiveness of herbicides applied during the dormant season. Only trees of 1-inch-average diameter were satisfactorily defoliated. Larger trees were not substantially affected.

Sprays applied during the dormant season were more effective when tree stems were dry than when they were wet from recent rain.

Effectiveness of basal sprays applied during the dormant season ranked according to the amount of 2,4,5-T in the solution. (Pacific Northwest Forest and Range Experiment Station, Forest Service, USDA).

Chemical basal treatments control salmonberry. Madison, Robert W. and Freed, Virgil. Salmonberry is a hard-to-kill brush species native to coastal areas where it often invades cutover land to the exclusion of conifer reproduction. Tests with basal sprays were started in 1955 after earlier tests indicated foliage sprays could provide control for only two or three years and permitted considerable resprouting. It was found that a 2.5 percent concentration of low volatile esters of 2,4-D plus 2,4,5-T in diesel oil effectively killed the salmonberry plants when applied to the lower six inches of the stems during March or April. A similar concentration of trichlorobenzoic acid was equally effective. Even diesel oil alone killed the plants when applied at bud bursting time in April. January results with 2,4-D plus 2,4,5-T were more variable with kill ranging from 77 to 100 percent. Diesel oil alone or trichlorobenzoic acid in diesel oil gave poor results when applied in January. (Pacific Northwest Forest and Range Experiment Station, Forest Service, USDA)

Woody plant control for conifer release. Lauterbach, P. G. Woody brush in the Pacific Northwest reduces forest growth by (1) overtopping more valuable conifers and reducing their growth, and (2) preventing restocking of conifers because of intense light competition.

Principle brush species involved include alder, willow, vine maple, bigleaf maple, cascara, cherry, salmonberry, and Ceanothus.

Present aerial spray programs have been developed for release of Douglas fir and other conifers from overtopping alder, willow, and vine maple with generally satisfactory results, although some damage is done to conifers. Both foliage and dormant application of herbicides are used in spray programs.

In 1958, field testing of 9 new chemicals was done on replicated 5 acre field plots. Through a cooperative agreement with Amchem Products and Weyerhaeuser companies, new formulations are tested on Northwest conifer and brush species in a herbicide nursery established in 1958 to screen new chemicals. Field testing of most promising herbicides is then done. In the summer of 1959, the first field testing under this agreement was done with foliage application of tri-ethylamine salt of 2,4-D butyric acid successfully defoliating alder and willow without any damage to the conifers. If control of these brush species continues, this use of this highly selective chemical will be a valuable addition to the list of chemicals used in the Northwest.

New developments in the Northwest by Weyerhaeuser research center personnel include (1) use of anthracene to measure the percent of full sunlight received at seedling height in sprayed and unsprayed areas, and (2) tests to evaluate quantitatively the herbicide effectiveness on brush species under field conditions, by use of transect sections of large scale vertical aerial ektachrome photographs run through a densitometer to record the spectral reflectance of live and dead vegetation. It is hoped this method of plot evaluation will prove to be effective. (Weyerhaeuser Research Center, Centralia, Wash.)

Effect of big sagebrush control (Red Desert) upon composition, density, and production of native forage species. Alley H. P. Plots were established in the Red Desert area in 1957. This area is only sparsely covered with the low growing form of *Artemisia tridentata* and receives approximately 10 inches of precipitation per year, mainly in the form of snow.

Vegetative surveys on the experimental area show the foliage cover of grasses increasing from 14.1 percent on the original unsprayed areas to 48.8 percent three years after killing 65 to 97 percent of the sagebrush. This represents better than a threefold increase in foliage cover of grasses three years following chemical application.

Production of the native grasses increased approximately 100 percent one year after spraying. Production in 1960, three years after spraying, showed a 500 percent increase, the unsprayed area produced an average of 118 pounds airdry forage per acre, whereas the sprayed areas produced 632 pounds air-dry forage per acre. (Wyoming Agricultural Experiment Station)

Evaluation of several granular and pelleted herbicides in the greenhouse for control of shrub live oak. Davis, Edwin A. One reason why shrub live oak (Quercus turbinella) has been difficult to control is that it is capable of profuse sprouting from its buried crown region. Single foliar applications may kill existing foliage, but generally they do not prevent the development of crown sprouts. Some methods that show promise of overcoming this problem are repeated foliar sprays, applications of granular and pelleted herbicides to the soil, and high-volume basal sprays; however, only the first two of these methods are practical for large areas.

A greenhouse experiment was conducted with 3-month-old shrub live oak seedlings to test the toxicity of a number of granular and pelleted herbicides. The seedlings were grown in gallon containers in a loamy sand top soil obtained from a chaparral site. The seedlings were about 6 inches tall when the granules and pellets were sprinkled on the soil surface. The following herbicides were evaluated: monuron, fenuron, monuron-TCA, 2,3,6-TBA, simazine, and the butoxy ethanol esters of 2,4-D, 2,4,5-T, and silvex. All herbicides were tested at rates of 2, 4, 8, and 16 lb of active ingredient per acre. Applications were made on December 31, 1958. After the herbicide applications, 1/4 inch of water was added to the soil. Thereafter, known amounts of water were applied regularly to maintain adequate moisture for growth and to leach the herbicides into the soil. The experiment lasted for 9 months, during which time the soil was irrigated with 54.5 inches of water added in 1/4-, 1/2-, and 1-inch increments.

Fenuron was the most effective herbicide for the control of shrub live oak seedlings. Not only was it the fastest acting herbicide but it was not exceeded by any of the other herbicides. After 4-1/2 months the 2-lb/A rate had killed 76% of the seedlings and the 4 to 16-lb/A rates had killed 100% of the seedlings. After 9 months these results were unchanged. Monuron, on the other hand, was slower acting. After 4-1/2 months the 2-, 4-, 8-, and 16-lb/A rates had killed 40, 43, 84, and 100% of the seedlings respectively. After 9 months these mortality figures had increased to 55, 55, 94, and 100%.

The final effect of monuron-TCA was slightly superior to that of monuron alone. This finding is of interest since the amount of monuron in the monuron-TCA treatments was about 50% less than the amount of monuron in the monuron treatments.

The final kill by 2, 3, 6-TBA was similar to that by monuron, but the striking effect of 2, 3, 6-TBA was stunting. For many weeks rates as low as 2 lb/A inhibited growth completely.

Simazine had very little effect on shrub live oak while 2, 4-D, 2, 4, 5-T, and silvex had low orders of activity requiring 16 lb/A applications to produce 85- 100% kill.

Simazine, monuron, and monuron-TCA were the most persistent herbicides as determined by the response of indicator plants. Fenuron was considerably less persistent than monuron or monuron-TCA. 2, 3, 6-TBA was less persistent than fenuron. The butoxy ethanol ester of 2, 4-D was the least persistent herbicide tested. It failed to show any activity 7 weeks after treatment. The butoxy ethanol ester of silvex was more persistent than the same ester of 2, 4, 5-T; silvex had the same order of persistence as fenuron.

On the basis of this investigation fenuron offers the greatest promise for the control of shrub live oak. 2, 3, 6-TBA is also of particular interest. The persistence characteristics of these herbicides offer hope that grass establishment in the field may be possible after an appropriate length of time following their application. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Tempe, Arizona)

<u>Effectiveness of soil-herbicide irrigation treatments for the control of shrub live oak in Arizona.</u> Davis, E. A. and Lillie, D. T. Since the leaching of soil-applied herbicides into the root zone of field plants depends on rainfall the relation between amount of natural or simulated rainfall and plant response to herbicide treatment should be known. Also, the potential activity of soil-applied chemicals can be evaluated with greater certainty if they are irrigated into the soil rather than left on the soil surface to be leached by chance rainfall.

The objectives of this study were to determine the effectiveness of soil applications of several pelleted and granular herbicides on shrub live oak

(Quercus turbinella) in the field and to determine the effects of irrigating the herbicides into the soil with various amounts of water.

Herbicides tested and the rates of application are listed below:

Chemical	Formulation	lb active ingredient per acre
Monuron	pellets	4, 8, 16
Fenuron	pellets	4, 8, 16
Monuron-TCA	granules	4, 8, 16
2,3,6-TBA	granules	4, 8, 16
Fenac	granules	4, 8, 16
2,4-D, butoxy ethanol ester	granules	8, 16, 32
Silvex, butoxy ethanol ester	granules	8, 16, 32

Galvanized sheet-metal frames were used to form 16-sq. ft. basins around individual bushes. The herbicide granules or pellets were sprinkled on the plots and were irrigated into the soil with 0, 1, 2, and 4 inches of water. Each treatment was replicated 3 times. Treatments were applied from August 18-25, 1959.

One and three months after treatment fenuron showed the greatest activity. Without irrigation but with 1 inch of rain fenuron failed to cause severe injury (maximum of 52% leaf injury at 16 lb/A after 3 months). But with irrigations of 1-4 inches of water plus 1 inch of rain (a total of 2-5 inches of water) fenuron at 8 lb/A caused moderate (ca. 74%) leaf injury and at 16 lb/A moderate to severe (71-98%) leaf injury. The 4-lb-per-acre treatments produced only minor effects after 3 months. The responses of shrub live oak to fenuron leached with 2-5 inches of water differed little, but the greatest injury occurred at the 5-inch level. Plant response to fenuron irrigation treatments was very rapid as demonstrated by injury symptoms 1 month after treatment.

The responses of shrub live oak to 2,3,6-TBA were slight and erratic; the highest amount of leaf injury was 45%. Monuron and monuron-TCA caused very little injury; monuron-TCA was slightly superior to monuron after 3 months. The effects of fenac, 2,4-D, and silvex were negligible.

These results indicate that shrub live oak contains a highly absorbent root system within the soil layer penetrated by 2-5 inches of water and demonstrate the potential effectiveness of fenuron for shrub live oak control in the chaparral type of central Arizona.

One year after treatment, injury to the fenuron-treated bushes had increased. None of the bushes was dead, but new growth continued to be killed. Injury to bushes treated with monuron, monuron-TCA, 2,3,6-TBA, and fenac had also increased but none was as effective as fenuron. 2,4-D- and silvex-treated bushes were uninjured. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Tempe, Arizona)

Chemical control measures on wild rose in a spring grain area. Ames, G. D., McKay, Hugh C., Erickson, Lambert C. Wild rose especially *Rosa woodsii* Lindl. control plots were initiated in cooperation with a farmer in the Ashton, Idaho area. The plots are located in an area of 18'' annual precipitation on medium textured soil 36 to 60 inches deep at an altitude of 5400 feet. Spring grain reaches the 4-6 leaf stage about the middle of July and the actively growing stage for wild rose is commencing at this time, hence the July spraying dates reported in the table. The sprays were applied at 20 gallons per acre using water. Growth had nearly ceased when the September sprays were applied.

Propylene glycol butyl ether esters of 2,4,5-T were compared with the triethanol-amine salt to the apparent advantage of the low volatile ester form.

The use of the 2,4,5-T low volatile ester at 1 1/2 ppa per year for two years resulted in a stem density reduction of 90% by the third year. Little reduction has been gained in the two years following in spite of yearly replications of this treatment, making a total of four applications.

Effective herbicidal action was found in 2,3,6-TBA on wild rose also. Only the dimethanol amine salt form was used. One application of 2,3,6-TBA at 2 ppa reduced the rose stem count in the year following application 89%. Control of 84% was maintained through the third year without additional treatment. A repeat treatment in the third year apparently improved the control at approximately the same geometric rate to provide a 95% stem density reduction from the initial count.

Amitrole is of little value in controlling wild rose and is possibly not as effective even as it appears in the table since other plots, not shown, treated at twice the active ingredient per acre, ie. 8 ppa, showed stem density increases between 15 and 40%. Since these figures take into account fluctuations yearly by the control plots receiving no treatments, these increases are greater than the control plots and greater than the initial stem density on the amitrol plots themselves.

Damage was evident to the crop eleven months following treatment with fenac at 2 and 4 ppa both in appearance and also detrimental to grain yield. On plots treated with 20 ppa of 2,3,6-TBA, barley stand was severely cut and surviving plants had shortened internodes, arrested root elongation and development.

Treatment of 20 ppa of low volatile esters of 2,4-D and 2,4,5-T have not adversely affected the appearance or yield of grain planted eleven months after application of the chemicals. The "percent kill" figures appearing for year 1960 may reflect high winds occurring during July, 1959 at time of materials application. (Tetonia Branch Experiment Station, University of Idaho)

Control of wild rose (Rosa woodsii Lindl.) in grain fields by repeated applications of several herbicides.

Crop	Date		Chemical Form	Dose	% Shoot kill
Fallow, plow	July ,	56	ester 2,4,5-T	1.5 ppa	-
Wheat	" ,	57	" "	"	19
Oats, stubble	Sept.,	58	" "	"	90
Fallow, plow	July ,	59	" "	"	92
Barley	-	60	- -	-	79
Wheat	July ,	57	amine 2,3,6-TBA	2 ppa	-
Oats	-	58	- -	-	89
Fallow, plow	July ,	59	amine 2,3,6-TBA	2 ppa	84
Barley	-	60	- -	-	95
Fallow, plow	July ,	59	Na fenac	4 ppa	-
Barley	-	60	-	-	72
Fallow, plow	July ,	56	amine 2,4,5-T	3 ppa	-
Wheat	" ,	57	" "	"	20
Oats, stubble	Sept.,	58	" "	"	57
Fallow, plow	July ,	59	" "	"	71
Barley	-	60	- -	-	63
Fallow, plow	July ,	56	amitrole	4 ppa	-
Wheat	" ,	57	"	"	11
Oats, stubble	Sept.,	58	"	"	24
Fallow, plow	July ,	59	"	"	27
Barley	-	60	-	-	47
Fallow, plow	July ,	59	Na fenac	2 ppa	-
Barley	-	60	-	-	36
Oats, stubble	Sept.,	58	amine 2,3,6-TBA	20 ppa	-
Fallow	-	59	-	-	99 plus
Barley	-	60	-	-	59
Oats, stubble	Sept.,	58	ester 2,4,5-T	20 ppa	-
Fallow, plow	July ,	59	" "	"	73
Barley	-	60	- -	-	46
Oats, stubble	Sept.,	58	ester 2,4-D	20 ppa	-
Fallow, plow	July ,	59	" "	"	44
Barley	-	60	- -	-	10

Effect of amitrole upon poison oak and grape vines in a vineyard. Lider, L. A., Leonard, O. A., and Sisson, R. L. The present experiment was in a commercial vineyard, grafted upon the rootstock, St. George, and of mixed varieties--principly Zinfandel. This vineyard was in Sonoma county and was infested with poison oak (Rhus diversiloba). The treatments were applied on June 3, 1959 while the vegetation was still actively growing. Amitrole (3-amino-1,2,4-triazole) was applied using 1, 2, 4, and 8 pounds of actual chemical per 100 gallons of water, containing about 2 ounces of X-77 wetting agent. Amitrole-T (amitrole-ammonium thiocyanate) was applied at 2 pounds of actual amitrole per 100 gals. of water. The objectives were two-fold (1) to observe the control of poison oak in a vineyard, and (2) to obtain some information on grape tolerance. The results were recorded on August 23, 1960.

The one-pound application of amitrole had essentially no effect on the grape vines, but poison oak was affected moderately. Poison oak was killed to the ground by 2 or more pounds of amitrole, but the reaction of the grapes varied with variety. The St. George rootstock and the Mission variety were not visibly damaged by any concentration of amitrole, but the reaction of Zinfandel varied from mild to severe. Both the poison oak and the grapes responded in about the same manner to amitrole and amitrole-T, to comparable dosages of amitrole. (University of California, Davis)

Results of broadcast spraying chamise sprouts with several rates and volumes of 2,4-D. Plumb, T. R. When the FUEL-BREAK* program began in southern California in 1958, recommendations for killing resprouting chamise were based primarily on brush control work done in central and northern California. We used a standard, ground broadcast application of 4 lb ae of low volatile esters of 2,4-D, 1 gal of diesel oil, and 18 gal of water per acre. Results that year were generally very successful.

The object of a study in 1959 was to determine if this was the most effective rate and volume for conditions in southern California.

Chemical rates of 2, 4, and 8 lb ae of 2,4-D in volumes of 10, 20, and 40 gpa were tested on an area burned by wildfire in December 1958. At the time of treatment, May 25, sprouts were 8 to 16 inches long and growing vigorously; seedlings were 1 to 2 inches tall. Chemical was applied with a tractor mounted spray boom. Diesel oil at 1 gpa was included in all applications. The plots were approximately 40 by 100 ft; each treatment was duplicated.

Soon after spraying plant kill obviously was less than desired. Final results were sampled in June 1960. Although there was some variation between replications, average results indicated: 1. increasing volume, with chemical rate held constant, gave slightly better kill at the 2 lb level, made little difference at the 4 lb level, and gave variable results at 8 lb. 2. increasing chemical rate gave higher plant kill at all three volumes. A 1 lb rate, also applied, was practically ineffective. But even the best kill, 75% for 8 lb in 10 gpa, was rated poor. Fuel-break personnel aim for a kill of 95% or better with one spray treatment.

Although the plants were of a size judged right for spraying, results indicate that they were not in a proper physiological condition for successful treatment. Growing conditions that year, in contrast to 1958, were very poor. Initial sprout growth was delayed. There was no surge of growth; rather, new sprouts emerged throughout the growing season. The timing of an application is hard to judge in such a year. The 'optimum' time to spray may be very limited and possibly not even occur.

The results of this study are not conclusive enough to warrant a change in the standard recommendation of 4 lb in 20 gpa. Until better, more consistent results are obtained with one application, a spray program should be set up on at least a two-year basis. A study was started in 1960 to determine the best time to spray as timing seems to be one of the most important factors affecting success. (Pacific Southwest Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture)

*FUEL-BREAK-- a program sponsored by the fire-fighting agencies of southern California; extensive areas of brushland are being broken up by strips and blocks converted to a cover of light fuel.

Average kill of several rates and volumes of 2,4-D low, volatile esters broadcast on 1 year old chamise sprouts

Chemical Rate/A	Volume Per A	Complete kill	Results of Spraying Topkill Resprouting	Part Topkill: Resprouting	Total number of plants
lb ae	gal	%	%	%	
1	20	1	0	99	242
2	10	31	7	62	177
2	20	41	14	45	206
2	40	50	12	38	166
4	10	51	11	38	109
4	20	50	20	30	131
4	40	52	14	34	182
8	10	75	6	19	169
8	20	59	14	27	176
8	40	59	9	32	161

Chemical control of saltcedar. Cords, H. P. A series of tests was begun in 1959 comparing silvex, 2,4,5-T and 2,4-D all as the propyleneglycolbutylether ester for the control of saltcedar. An area with a uniform stand of 2-5 year old shrubs near Lovelock, Nevada was chosen. All treatments were applied in diesel oil at 12 gallons per acre. Applications were made at four phenological stages: fully leafed in spring, appearance of first blooms, just prior to leaf drop in fall, and winter dormant. Each chemical was applied at five rates: 1, 2, 4, 8 and 16 lb/A ae basis. All were applied as an over-all spray. Results are given in the table.

(Refer to Table on next page)

Table 1. Effect of chemical treatment on saltcedar (Tamarix pentandra Pall.)

	Percent kill of 2-5 year-old shrubs				
Treatment	Leafed Stage (5-7-59)	Bloom Stage (6-30-59)	Fall (10-1-59)	Winter Dormant Stage (12-23-59)	Average for Materials
2,4-D 1 lb/A	62	51	38	47	50
" 2 "	64	72	71	58	66
" 4 "	90	62	69	80	75
" 8 "	85	60	94	86	81
" 16 "	78	87	78	84	82
2,4,5-T 1 lb/A	88	81	57	60	72
" 2 "	72	57	84	78	73
" 4 "	88	89	89	93	90
" 8 "	79	81	96	95	88
" 16 "	98	92	96	91	94
silvex 1 lb/A	95	68	73	85	80
" 2 "	96	87	86	93	90
" 4 "	99	100*	87	99	96
" 8 "	99	97	100	100	99
" 16 "	99	96	100	100	99

* Single plot only.

Silvex was the most effective chemical at all dates and the fully leafed stage appeared to be the best stage by a slight margin. However, excessive drift due to a breeze that proved to be too strong the morning of May 7 obscured the results to some extent, tending to make poor treatments better and good treatments poorer than they probably acually were. Later treatments were made only when dead calm conditions prevailed.

These studies were largely financed by a grant from the Bureau of Reclamation. (Nevada Agricultural Experiment Station)

TABLES ON REACTION OF WOODY PLANTS TO HERBICIDES

Prepared by O. A. Leonard

New chemicals have come into use since the last tables on Classification of Woody Plant Responses to Herbicides were prepared for the 1954 Research Progress Report of the Western Weed Control Conference. In addition, considerably more information has been obtained on the reaction of woody plants to the older chemicals; the reliability of much of the data has been subject to test in practical brush control programs. Much new and important plant reactions have been obtained through these practical brush control programs.

The purpose for seeking new information for the present tables was the hope to obtain as much reliable data as possible on field-tested methods and to present additional experiences with respect to the control of the plants listed in the 1954 report. Then again, much has been said and reported on the reaction of woody plants to some of the new chemicals, leaving the research worker in a quandary as to the facts, and to what extent these newer chemicals may find a place in practical brush control programs. The writer wishes to express his thanks to those of you who contributed information for the tables.

Symbols Used in Evaluating the Effect of Chemicals

Plant

Name -- scientific and common names.
Age --- S-seedlings; YM- young mature; OM- old mature; Spts- sprouts; CS- crown sprouts; RS- root sprouts.
Stage -- C- commencing; A-active; PA- post active; D- dormant.

Treatment

Type -- FS- foliage spray; BS- basal spray; CS- cut surface; D- dormant spray; Stp- stump; S- soil; aerial spray.

Date -- usually the month.
Chemical -- Weed Society designations used when space available; A & E used for amine and ester.
Concentration--aehg- as acid equivalent per 100 gallons; aihg- as active ingredients per 100 gallons; others as %.
Dose -- lbs/A--as pounds per acre; others as described.
Diluent--DO- diesel oil; K- kerosene

Control

Control is expressed in terms of top/root kill; for example, 100/100 would be a complete kill of all tops & roots, while a 100/0 would represent a complete top kill but no root kill; this would result in all of the plants developing either crown or root sprouts.

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
Abies concolor		(white fir)		Latour State Forest, Shasta Co., Calif.					
Y	D	FS	Oct-Nov	2,4-D + 2,4,5-T E (1-1)	4 aehg	4/A	DO & water	10-20/0 recovered	soil dry
Abies magnifica		(red fir)		Latour State Forest, Shasta County, Calif.					
Y	D	FS	Oct-Nov	2,4-D + 2,4,5-T E (1-1)	4 aehg	4/A	DO & water	10-20/0 recovered	soil dry
Acacia constricta		(whitethorn)		E. M. Schmutz, AES, Arizona					
OM	A hand	FS	Aug.	2,4,5-T esters	0.5%	2/A	2% DO	90-100/80-100	rainy
"	" ground	"	"	"	5.0%	8/A	"	70/35	season
"	" hand	"	"	2,4-D esters	4.0%	8/A	"	95-100/90-100	
"	" ground	"	"	"	5.0%	8/A	"	70/35	
"	" hand	"	"	silvex esters	1.0%	2/A	"	100/100	
"	"	S	"	" granules	20%	8/A	clay	60/30	
"	"	"	"	monuron granules	25%	8/A	"	100/100	
"	"	"	"	fenuron granules	25%	4/A	"	95-100/90-100	
"	"	"	"	PBA granules	25%	8/A	"	35/0	
"	"	"	"	Urab granules	22%	4/A	"	100/100	
Acer circinatum		(vine maple)		P. Lauterbach, Weyerhaeuser Co., Centralia, Wash.					
S-YM-OM	D	aerial	Mar.	2,4,5-T ester	20 aehg	2/A	oil	80-90/30-50	10 gal./A
" " "	C	aerial	Apr.	2,4,5-T ester (invert emulsion)	20 aehg	2/A	oil--water 2-7	80-90/ 30-50	9.5 gal./A
Acer macrophyllum		(big leaf maple)		M. Newton, McDonald Forest, Corvallis, Oregon					
OM	C, A, PA	BS	Mar-Sept	Silvex PGBEE	2.5-80 aehg	16-64 oz/sq ft basal area	DO	40-100	
		Conclusions: (1) high volume sprays most effective and (2) March & Sept. better than June; however, June O.K. with high volume sprays.							
Adenostoma fasciculatum (chamise)				T. Plumb, PSW Forest & Range Expt. Sta., Southern Calif.					
OM	CS 1st yr.	FS	June	2,4-D esters	3.3 aehg	4/A	1% diesel	100/94	gravely

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
OM	CS 1st yr.	FS	May	2,4-D esters	3.3 aehg	4/A	1% diesel	40-100/25-100	
OM	CS 2nd yr.	"	"	"	"	4/A	1% diesel	100/99	
Alnus rubra		(red alder) Madison, Corvallis, Oregon							
S	D	BS	Dec-Mar	2,4-D & 2,4,5-T PGBE E	16 aehg	2.8 fl. oz/tree	diesel	32/0	sandy loam
"	A	BS	June	"	"	"	"	97/97	"
		P. Lauterbach, Weyerhaeuser Company, Centralia, Wash.							
S-YM	D	aerial	April	2,4,5-T ester	20 aehg	2/A	oil	100/100	Best after
M	D	aerial	April	" "	" "	2/A	"	50/50	buds swol-
S	A	aerial	June-July	2,4,5-T emulsive acid	" "	1/A	water	100/100	len but be- fore buds
S-YM	A	aerial	June-July	2,4-D & 2,4,5-T esters 2-1	" "	1/A	oil-water 1-4	100/100	break. Ap- plications
M	A	aerial	June-July	2,4-D & 2,4,5-T esters 2-1	30 aehg	1 1/2/A	oil-water	100/100	by helicop- ter at 5-10
YM	A	aerial	June	2,4-D	20 aehg	2/A	oil	100/100	gal. /A
Amelanchier alnifolia		(Saskatoon serviceberry) PNW Forest & Range Expt. Sta., Jackson County, Ore.							
YM	A	FS	Aug	2,4-D PGBE E	0.5 aehg	drip point	water	33/0	pumice
	first respray with above treatment							90/40	
YM	A	FS	Aug	2,4-D PGBE E	2 aehg	drip point	water	50/0	
	first respray with above treatment							90/40	
YM	A	FS	Aug	2,4-D PGBE ester	4 aehg	drip point	water	44/0	
"	"	"	"	2,4,5-T PGBE E	0.5 aehg	"	"	33/0	
"	"	"	"	"	2 aehg	"	"	69/0	
"	"	"	"	2,3,6-TBA	1 aehg	"	"	5/0	
"	"	"	"	2,4-D PGBE E amitrole	0.5 aehg 0.5 aehg	"	"	43/0	
Arctostaphylos canescens		(hoary manzanita) PNW Forest & Range Expt. Sta., Josephine County, Ore.							
YM	A FS	FS	July	2,4-D PGBE E	1 aehg	drip point	water	100/100	
"	"	"	"	"	2 aehg	"	"	100/100	

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
YM	A	FS	July	2,4-D PGBE E	2 aehg	drip point	5% DO	100/100	
"	"	"	"	2,4,5-T PGBE E	1 aehg	"	water	97/85	
"	"	"	"	"	2 aehg	"	"	100/100	
"	"	aerial	"	2,4-D + 2,4,5-T PGBE E 50-50	40 aehg	10 gal/A	19% DO	100/100	
Arctostaphylos columbiana (hairy manzanita) PNW Forest & Range Expt. Sta., Douglas county, Ore.									
YM	A	FS	July	2,4-D PGBE E	1 aehg	drip point	water	100/100	
"	"	"	"	"	2 aehg	"	"	100/100	
"	"	"	"	"	2 aehg	"	5% DO	100/100	
"	"	"	"	2,4,5-T PGBE E	1 aehg	"	water	100/79	
"	"	"	"	"	2 aehg	"	"	100/100	
Arctostaphylos hispidula (Howell manzanita) PNW Forest & Range Expt. Sta., Jackson county, Ore.									
YM	A	FS	July	2,4-D PGBE E	1 aehg	drip point	water	99/85	pumice
"	"	"	"	"	1 aehg	"	5% DO	97/80	
"	"	"	"	"	2 aehg	"	water	100/95	
"	"	"	"	"	2 aehg	"	5% DO	100/99	
"	"	"	"	2,4,5-T PGBE E	2 aehg	"	water	96/85	
"	"	"	"	"	2 aehg	"	5% DO	95/95	
"	"	aerial	June	2,4-D isooctyl E	31 aehg	2/A	14% DO	97/74	
"	"	aerial	"	"	62 aehg	4/A	14% DO	99/96	
"	"	aerial	"	2,4-D + 2,4,5-T isooctyl esters (2-1)	46 aehg	3/A	14% DO	100/96	
Arctostaphylos parryana var. pinetorum (manzanita) Latour State Forest, Shasta County, Calif.									
S	D	FS	Oct-Nov	2,4-D + 2,4,5-T esters 1-1	4 aehg	4/A	DO & water	100/100	dry, rocky soil
Arctostaphylos patula (greenleaf manzanita) PNW Forest & Range Expt. Sta., Josephine County, Ore.									
YM	A	FS	July	2,4-D PGBE E	2 aehg	drip point	water	95/15	
		first respray using the treatment above						100/45	
YM	A	FS	July	2,4-D PGBE E	2 aehg	drip point	5% DO	91/20	
"	"	"	"	"	4 aehg	"	water	96/10	

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
YM	A	FS	July	2,4,5-T PGBE E	1 aehg	drip point	water	89/0	
"	"	"	"	"	2 aehg	"	"	84/0	
"	"	"	"	"	1 aehg	"	"	90/5	
"	"	aerial	"	2,4-D PGBE E	40 aehg	3/A	10% DO	100/30	rocky
"	"	aerial	"	2,4-D + 2,4,5-T PGBE E 1-1	53 aehg	4/A	10% DO	82/15	deep
"	"	aerial	"	"	106 aehg	8/A	10% DO	91/0	rocky
Artemisia tridentata (big sagebrush) B. Kay, Modoc County, Calif.									
OM	D	S	Dec.	fenuron pellets	25%	4/A		98/100	gravel loam
"	"	"	"	"	"	8/A		100/100	over clay
"	C	"	Feb.	"	"	4/A		75/75	
"	"	"	"	"	"	8/A		100/100	
"	PA	"	Oct.	"	"	4/A		100/100	
Castanopsis chrysophylla (golden chinkapin) PNW Forest & Range Expt. Sta., Douglas County, Ore.									
YM	A	FS	July	2,4-D PGBEE	2 aehg	drip point	water	85/15	(after respray)
"	"	"	"	2,4,5-T "	2 aehg	"	water	85/25	(after respray)
"	"	"	"	amitrole	4 aihg	"	"	80/20	(after respray)
"	"	"	"	2-(2,4-DP) PGBEE	2 aehg	"	"	51/0	
"	"	"	"	silvex "	2 aehg	"	"	58/0	
"	"	"	"	50-50 silvex & amitrole	4 aihg	"	"	90/30	(after respray)
Castanopsis chrysophylla var. minor (golden evergreen chinkapin) PNW For. & Range Expt. St., Josephine Co., Ore.									
YM	A	FS	July	2,4-D PGBEE	2 aehg	drip	water	85/20	(one respray)
"	"	"	"	2,4, 5-T "	2 aehg	"	"	90/15	(one respray)
"	"	"	"	amitrole	4 aihg	"	"	70/40	(one respray)
"	"	"	"	2-(2,4-DP) "	2 aehg	"	"	62/0	
"	"	"	"	silvex "	2 aehg	"	"	44/0	
"	"	aerial	"	2,4-D + 2,4,5-T PGBEE 1-1	53-106 aehg	4-8/A	10% DO	34-37/0	
Castanopsis sempervirens (chinkapin) Latour State Forest, Shasta County, Calif.									
S & CS	PA	FS	Oct-Nov	2,4-D + 2,4,5-T esters 1-1	4 aehg	4/A	DO & water	95/80-90	

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
Ceanothus cordulatus (mountain whitethorn) PNW Forest & Range Expt. Sta., Douglas County, Ore.									
YM	A	FS	Aug.	2,4-D PGBEE	2 aehg	drip	water	100/20	(one respray)
"	"	"	"	2,4,5-T "	2 aehg	"	"	100/65	(one respray)
"	"	"	"	2-(2,4-DP) "	2 aehg	"	"	100/0	
"	"	"	"	amitrole	2 aihg	"	"	88/0	
"	"	aerial	July	2,4-D + 2, 4,5-T PGBEE 1-1	53-106 aehg	4-8/A	10% DO	72-98/0	
Ceanothus integerrimus (deerbrush) PNW Forest & Range Expt. Sta., Jackson County, Ore.									
YM	A	FS	Aug.	2,4-D PGBEE	2 aehg	drip	water	100/90	pumice
"	"	"	"	2,4,5-T "	2 aehg	"	"	100/85	
"	"	"	"	amitrole	2 aihg	"	"	98/95	
"	"	"	"	2,3,5-TBA	2 aehg	"	"	95/80	
Ceanothus velutinus (snowbrush) PNW Forest & Range Expt. Sta., Jackson County, Ore.									
YM	A	FS	July	2,4-D PGBEE	2 aehg	drip	5% DO	100/65	(one respray)
"	"	"	"	2,4,5-T "	2 aehg	"	"	100/80	(one respray)
"	"	"	"	2,4,5-T "	4 aehg	"	"	100/95	(one respray)
"	"	"	"	2-(2,4-DP) "	2 aehg	"	"	99/50	
"	"	"	"	silvex "	2 aehg	"	"	100/0	
"	"	"	"	amitrole	4 aihg	"	water	100/0	
"	"	"	"	AMS	20 aihg	"	4% DO	93/5	
"	"	"	"	4-(2,4-DB) dimethyl amine	2 aehg	"	water	18/0	
M. Newton & Jones, Ore. State Univ. & Bur. Land, Mgt., Oregon									
OM	C, A	BS	Apr-July	2,4,5-T ester	16 aehg	runoff	oil	100/100	Field tested
"	C, A	FS	April	"	16 aehg	"	water or oil	100/100	
"	C	aerial	"	"	80 aehg	4/A in 5 gal.	diesel	100/100	
Latour State Forest, Shasta County, Calif.									
Sprouts	D	FS	Oct-Nov	2,4-d 2,4,5-T esters 1-1	4 aehg	4/A	DO & water	100/60-80	soil dry

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
Ceanothus velutinus var. laevigatus (varnishleaf ceanothus) PNW For. & Range Expt. Sta., Josephine Co., Ore.									
YM	A	FS	July	2,4-D PGBEE	2 aehg	drip	5% DO	100/60	(one respray)
"	"	"	"	2,4,5-T "	2 aehg	"	"	100/95	(one respray)
Chrysothamnus sp. (rabbitbrush) B. Kay, Modoc County, Calif.									
YM	D	S	Dec.	fenuron pellets	25%	16/A	clay	100/	
OM	D	S	"	"	"	16/A	"	50/0	
Chamaebatia foliolosa (mountain misery) O. Leonard, Amador County, Calif.									
OM	A	FS	June-Aug.	2,4-D amine & ester	2 aehg	4/A	water	98/98	with a respray 2 years after the 1st spray
OM	A	FS	June-Aug.	2,4,5-T E.	2 aehg	4/A	water	80/80	" "
"	"	"	"	Ammate	100 aihg	200/A	"	98/98	"
Flourensis cernua (tarbush) E. Schmutz, AES, Arizona									
OM	A	FS hand	Aug.	2,4,5-T esters	0.5%	2/A	2% DO	100/100	rain season
"	"	" ground	"	"	5.0%	8/A	"	80/50	
"	"	" hand	"	2,4-D esters	1.0%	2/A	"	100/100	
"	"	" ground		"	5.0%	8/A	"	95/80	
"	"	" hand	"	silvex esters	1.0%	2/A	"	80-100/40-100	
"	"	S	"	silvex granules	20%	8/A		80/40	
"	"	"	"	monuron granules	25%	8/A		95-100/90-100	
"	"	"	"	fenuron granules	25%	4/A		100/100	
"	"	"	"	PBA granules	25%	8/A		50/20	
"	"	"	"	Urab granules	22%	8/A		95/90	
Larrea tridentata (creosotebush) E. Schmutz, AES, Arizona									
OM	A	FS hand	Aug.	2,4,5-T esters	1%	2/A	2% DO	90-100/60-100	
"	"	" "	"	2,4-D esters	1%	2/A	"	90-95/50-90	
"	"	" ground	"	2,4-D + 2,4,5-T esters 1-1	1%	2/A	"	75/15-20	
"	"	" hand	"	silvex esters	1%	2/A	"	95/80	
"	"	S	"	silvex granules	20%	8/A	clay	50/20	

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
OM	A	S-hand	Aug.	monuron granules	25%	8/A	clay	80-95/40-80	
"	"	"	"	fenuron granules	25%	8/A	"	100/100	
"	"	"	"	PBA granules	25%	8/A	"	80/40	
"	"	"	"	Urab granules	22%	8/A	"	90/80	
Lithocarpus densiflorus (tan oak) B. Kay, J. Street, O.' Leonard, Humbolt County, Calif.									
OM	D	Stump	Oct-Feb.	2,4-D amine	400 aehg	6 ml/in diam.	ave.	0.1-3.6 spt/stump	
RS	A	FS	June-July	2,4-D or 2,4,5-T esters	4 aehg	drip	1% DO	100/100	(3 applic.)
Lithocarpus densiflorus var montanus (scrub tan oak) PNW For. & Range E.S., Josephine C., Oregon									
YM	A	FS	July	2,4-D PGBEE	2 aehg	drip	5% DO	90/35	(2 applic.)
"	"	"	"	2,4,5-T PGBEE	2 aehg	"	"	90/20	(2 applic.)
"	"	aerial	"	2,4-D 2,4,5-T PGBEE 1-1	53 aehg	4/A	10% DO	16/0	
Opuntia fulgida (Jumping cholla) F. Tschirley, ARS, Pima, Arizona									
OM	A	FS	Aug.	Silvex esters	10 aehg	drip	20% DO	87/87	coarse
"	"	"	"	2,4,5-T esters	10 aehg	"	"	37/37	alluvium
"	"	"	"	2-(2,4-DP) "	10 aehg	"	"	45/45	
"	"	"	"	2,3,6-TBA	10 aehg	"	"	5/5	
"	"	"	July	Na TCA	50 aihg	"	water	100/100	
"	"	"	"	DNOSBP	1.5%	"	DO or K	100/100	
"	"	"	Apr.	"	"	"	"	85/85	
Pinus jeffreyi (Jeffrey pine) Latour State Forest, Shasta County, California									
S	D	FS	Oct-Nov.	2,4-D + 2,4,5-T esters 1-1	4 aehg	4/A	DO & water	20/0 recovered	soil
Prosopis juliflora var. velutina (velvet mesquite) F. Tschirley, ARS, Arizona									
all	all	BS	all	diesel oil	---	1 pt/tree		95/95	
"	"	"	"	2,4,5-T E	4 aehg	1/2 pt/tree	DO	90/90	
"	A	aerial	May 54-5	2,4,5-T E	4 aehg	3/4-3/4/A	1:7 DO:water	95/58	5 gal/A
"	A	"	54-5	"		3/4-1/2	"	88/36	"

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
all	A	aerial	May 55-6	2,4,5-T E	4 aehg	1/3-1/3/A	1:7DO:water	86/26	5 gal/A
"	"	"	" 56-8	"		1/2-1/2/A	"	73/33	"
"	"	"	" 57-8	"		1/2-1/2/A	"	50/9	"
"	"	"	" 56-8	"		1/2-1/2/A	"	54/15	2.5 gal/A
"	"	"	" 57-8	"		1/2-1/2/A	"	58/18	"
"	"	"	" 56-8	"		1/3-1/3/A	"	62/19	5 gal/A
"	"	"	" 57-8	"		1/3-1/3/A	"	55/14	
"	"	"	" 56-8	"		1/3-1/3/A	"	38/11	2.5 gal/A
"	"	"	" 57-8	"		1/3-1/3/A	"	60/22	"
"	"	"	" 56-8	"		1/4-1/4/A	"	57/14	5 gal/A
"	"	"	" 57-8	"		1/4-1/4/A	"	56/12	"
"	"	"	" 56-8	"		1/4-1/4/A	"	56/20	2.5 gal/A
"	"	"	" 57-8	"		1/4-1/4/A	"	53/13	"
Quercus chrysolepis (canyon live oak) PNW Forest & Range Expt. Sta., Josephine County, Oregon									
YM	A	FS	July	2,4-D PGBEE	2 aehg	drip	5% DO	98/0	(2 applic.)
"	"	"	"	"	4 aehg	"	"	98/0	(2 applic.)
"	"	"	"	2,4,5-T "	4 aehg	"	"	37/0	
"	"	aerial	"	2,4-D "	40 aehg	3/A	10% DO	25/0	
"	"	"	"	2,4-D + 2,4,5-T PGBEE 1-1	106 aehg	8/A	"	18/0	
O. Leonard, B, Kay, J. Street, Humbolt County, Calif.									
RS	A, PA	FS	July-Sept	amitrole	8 aihg	drip	water	75/75	
"	"	FS	"	2,4-D amine	32 aehg	"	"	80/80	
OM	PA	CS	Sept.	2,4-D amine	400 aehg	2 ml/in diam		90/90	
RS	A, PA	FS	July-Sept	2,3,6-TBA	32 aehg	drip	water	0/0	
RS	A	FS	June-July	2,4-D 2,4,5-T E	4 aehg	drip	1% DO	100/100	(3 applic.)
Quercus douglasii (blue oak) O. Leonard and C. Carlson, Amador County, Calif.									
OM	A	aerial	May-June-May	Silvex PGBEE	20 aehg	2/A	10% DO	92/92	(3 annual app)
Quercus dumosa (scrub oak) T. Plumb, PSW Forest & Range Expt. Sta., Southern Calif.									

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
RS	PA	FS	June	2,4-D + 2,4,5-T E	4/A aehg	drip	2% DO	100/20	1st year spts.
"	A	"	"	" "	8/A aehg	"	"	100/75	" " "
"	"	A	"	2,4-D esters	4/A aehg	"	"	100/30-40	" " "
"	"	"	Aug.	2,4-D 2,4,5-T esters 2-1	4/A aehg	"	"	100/40-50	" " "
Quercus garryana (Oregon oak) M. Newton, McDonald Forest, Corvallis, Oregon									
OM	C, A	CS	Mar-June	2,4-D amine	400 aehg	1 oz/ft base		100/50	
"	"	BS	July	2,4,5-T ester	16 aehg	2 oz/in diam	DO	90/70	
O. Leonard, Humbolt County, Calif.									
OM	D	CS	Oct.	2,4-D amine	400 aehg	1 ml/in diam.		100/100	
Quercus turbinella (turbinella oak) E. Schmutz, F. Tschirley, R. Wagle, ARS & AES, Arizona									
YM-CS	A	FS	May	2,4,5-T esters	0.5%	1/A	2% DO	93/67	(3 applications)
" "	"	aerial	"	"	4.2%	5/A total	12.5% DO	83/41	(3 applications)
" "	"	FS	"	silvex esters	0.5%	1/A	2% DO	89/41	(3 applications)
" "	"	aerial	"	"	4.2%	5/A total	12.5% DO	84/44	(3 applications)
" "	"	S	July	monuron granules	25%	8/A		58/16	
" "	"	"	"	fenuron granules	25%	8/A		98/95	
Quercus wislizenii (interior live oak) O. Leonard, Amador County, Calif.									
OM	D	CS	Dec.	2,4-D amine	400 aehg	2 ml/in diam.		100/100	near 100% if well done
OM	D	CS	"	2,3,6-TBA	100 aehg	8 ml/in diam.		0/0	
OM	D	Stump	"	2,4-D amine	400 aehg	2 ml/in diam. (on top)		90/90	
Rhus diversiloba (poison oak) Bur. Reclamation, Roseville & Oroville, Calif.									
OM	PA	S	Nov.	fenuron pellets	25%	1 tbsp/bush		0/0	
"	"	FS & Stp.	"	2,4-D + 2,4,5-T E	25 aehg	runoff	DO	100/100	
O. Leonard, El Dorado County, Calif.									
OM	A, PA	FS	June-July	2,3,6-TBA	32 aehg	drip	water	0/0	
"	PA	BS	Sept.	"	16 aehg	runoff	DO	0/0	
"	A	FS	May	amitrole	4 aihg	drip	water	90-100/90-100	(respray)

REACTION OF WOODY PLANTS TO HERBICIDES

PLANT		TREATMENT						% KILL	
AGE	STAGE	TYPE	DATE	CHEMICAL	CONC.	DOSE	DILUENT	TOP/ROOT	NOTES
OM	A	FS	May	2,4-D ester	4 aehg	drip	water	90/90	(respray)
"	"	"	"	2,4,5-T ester	4 aehg	"	"	"	"
"	"	aerial	"	silvex ester	20 aehg	2/A	10% DO	100/90	(3 sprays)
Ribes roezli (Sierra gooseberry) H. Offord & C. Quick, PSW For. & Range E. S., Calif.									
S	A	S	July	2,4-D methyl ester as pellets	20%	16/A	clay	100/100	Must be warm & dry. Used
S	D	S	Sept.	"	"	32/A	"	100/100	in control
CS	A	S	June-Sept.	"	"	16/A	"	100/90	work
Ribes tularense (Tulare currant) H. Offord & C. Quick, PSW For. & Range Expt. Sta., Calif.									
OM	A	FS	July-Aug	Ammate	100 aihg	1000/A	water	95/90	
Rubus spectabilis (salmonberry) Madison & Freed, Corvallis, Oregon									
Spts. 4-years	D	BS	Jan.	2,4-D & 2,4,5-T E	2.5%	4 oz/plant	DO	95/81	sandy soil
"	"	"	"	2,3,6-TBA	"	"	"	53/43	
"	"	"	"	none	---	"	"	35/50	
"	C	"	Apr.	2,4-D & 2,4,5-T E	2.5%	"	"	100/100	
"	"	"	"	2,3,6-TBA	"	"	"	100/100	
"	"	"	"	none	---	"	"	100/100	
P. Lauterbach, Weyerhaeuser Co., Centralia, Wash.									
S-YM M	D	aerial	Mar.-April	2,4,5-T ester	20 aehg	2/A	oil	90-100/0	Helicopter
"	A	FS	June-	Amitrol-T	2 aihg		water	100/100	(2 yrs.) Road-side spray
Vitis sp. (St. George grape rootstock) O. Leonard and L. Lider, Davis, Calif.									
OM	A	Soil injection	June	DD mixture	100%	200 ml/plant		99/90	Being used
"	"	"	"	EDB fumigant		200 ml/plant		100/100	

PROJECT 4. ANNUAL WEEDS IN CEREALS AND FORAGE CROPS

D. G. Swan, Project Chairman

SUMMARY

Twelve reports were received for this project. Two papers were concerned with alfalfa, one with crimson clover, two with chemical fallow, one each with red fescue, flax, Kentucky bluegrass, rice, and three with wild oat.

Alfalfa. EPTC was incorporated, EPTC, neburon, CDEC, endothal, and CIPC were applied pre-emerge for weed control in alfalfa seedling establishment. Disking the EPTC into the soil increased its effectiveness. CDEC, EPTC, and neburon increased alfalfa yield.

Simazine was applied to established alfalfa at 3/4 to 3 lb/A. Excellent weed control with no yield reduction was obtained.

Crimson clover. Rates, dates, and methods of applying herbicides were tested. CIPC at 4 and 6 lb/A incorporated, IPC at 4 lb/A gave significant yield increases. These treatments also gave good grass control. Accumulative results showed IPC at 4 lb/A to be the best treatment.

Chemical fallow. In Wyoming atrazine at 2 and 4 lb/A gave complete control of all weeds for the entire fallow period. 2, 3, 6-TBA, amitrole, and simazine controlled weeds for shorter periods. The atrazine plots yielded more than the conventional method. In Oregon, studies were aimed at two aspects of chemical fallow, one for a non-residual winter fallow and the other complete summer fallow. Amitrole plus 2, 4-D at 1 and 2 lb/A gave good control for the winter fallow project. Combinations of atrazine plus amitrole or dalapon gave season long vegetative control for the chemical summer fallow program.

Red fescue. Simazine and atrazine were fall applied for the control of winter germinating weeds in red fescue. All rates of application gave good weed control. Atrazine caused some injury to the crop. Seed yields are shown in table form.

Flax. Several herbicides were tested. G-34698 gave best weed control. Simazine was injurious. I and EPTC gave good weed control and did not reduce yield. Amiden did not control ryegrass.

Kentucky bluegrass. Six herbicides were tested for pre-emerge crabgrass control in new seedlings. III and II had residual toxicity 20 weeks following treatment. Calcium arsenate and L-13489 were gone in two weeks. PAX lasted 12 weeks and Balcite was residual 12 to 20 weeks.

Rice. FW 734 was tested for watergrass control in rice. The later applications and higher rates gave best control. Best treatment was 8 lb/A four weeks after planting. No injury to the rice occurred from any treatment.

Wild oat control. In Wyoming barban at 1/2 lb/A gave outstanding control of wild oat. Treated plots yielded better than the check.

In Oregon, I, barban, G-34361, and N-5996 were tested. The Avadex was soil incorporated. All rates and materials gave good control. Data are presented in table form.

Extensive testing (28 experiments) in California showed barban to be an effective wild oat herbicide in barley and wheat. Yields were unaffected or were increased dependent upon the wild oat infestation. Reduced yields at herbicidal rates in about half of the trials.

Effects of soil applications of herbicides in new seedings of alfalfa. Hamilton, K. C., Arle, H. F., and McRae, G. N. In young alfalfa seedings annual weeds sometimes reduce stands and affect hay yields. Application of herbicides to the soil prior to or after seeding may control weeds and allow alfalfa seedlings to develop without weed competition.

An experiment was conducted at Mesa, Arizona, to determine whether herbicides applied to the soil could be used to control weeds in alfalfa grown under flood (border) irrigation. The Laveen clay loam was given a pre-planting irrigation and allowed to dry until the surface could be harrowed with a disk. On October 28, 1959, ethyl N,N-di-n-propylthiolcarbamate (EPTC) was applied and immediately disked into the soil. Arivat barley and Southern Giant Curl mustard were seeded to insure a uniform stand of "weedy" plants. A mustard, *Sisybrium irio*, was present in the test area. Moapa alfalfa was then planted. EPTC, 2-chloroallyl diethyldithiocarbamate (CDEC), isopropyl N-(3-chlorophenyl) carbamate (CIPC), 3,6-endoxohexahydrophthalic acid (endothal), and 1-n-butyl-3-(3,4-dichlorophenyl)-1-methylurea (neburon) were applied to the surface of the soil and the area was then flood-irrigated with about 4 inches of water.

The effects of herbicides on barley, mustard, and alfalfa stands and vigor were estimated four times during the winter and are expressed as percent control in Table I. Because weedy growth that developed on the checks and certain treated plots was dense the area was mowed twice to prevent weed competition from destroying the alfalfa. The plots were harvested for hay four times from April to July and total yields are summarized in Table I.

(Refer to Table on next page)

I 2,3-dichloroallyl diisopropylthiol-carbamate
II 0-2,4-dichlorophenyl 0-methylisopropylphoroamidothioate
III 2,3,5,6-tetrachloroterepthalic acid

Table I. Effect of herbicides on barley, mustard, and alfalfa.

Treatment Herbicide	Rate (lb/A)	Percent control (Average of estimates, Dec.-Mar.) Barley	Mustard	Alfalfa	Yield[1*] of hay (percent of average of checks in four cuttings, April-July)
Untreated check		0	0	0	110 cde
EPTC, incorporated	3	29	39	1	123abc
EPTC, incorporated	6	77	24	7	125ab
EPTC	3	9	5	0	115 bcd
EPTC	6	87	49	27	132a
Neburon	1	13	91	1	124ab
Neburon	2	74	100	22	125ab
Neburon	4	78	100	37	121abcd
CDEC	5	79	47	20	131a
Endothal	5	12	0	54	101 ef
CIPC	5	100	54	53	109 de
Untreated check		0	0	0	90 f

[1]Calculated average yield of hay on checks was 5,359 lb/A.
*Values with the same subscript letters are not significantly different.

Effective barley control was achieved with CDEC, CIPC, and the higher rates of EPTC and neburon. Disking EPTC into the soil increased the effectiveness of the lower rates of this herbicide. All rates of neburon gave excellent control of mustard. Soil application of CDEC, EPTC, and neburon increased the yields of alfalfa. The increases in hay yields were greatest in the first cutting. Yields on plots treated with the higher rates of EPTC and neburon averaged 150 percent of the checks. In the fourth cutting yields on these plots averaged only 115 percent of the checks. (Contribution by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Arizona Agricultural Experiment Station, cooperating.)

The use of simazine for weed control in alfalfa. Swan, D. G. Weeds are an ever present problem to the producers of high quality alfalfa hay in the Oregon Columbia Basin. Control of these pests without injury to the crop is being studied.

Weed control observations for three years and yield results for one show simazine to be a promising herbicide for weed control in alfalfa. Rates of 3/4 to 3 lb/A of simazine were applied in December 1957-59 to established alfalfa on Walla Walla silt loam and Ephrata loamy sand soils. On the Walla Walla silt loam the 1 1/2 and 3 lb/A rates of the chemical gave satisfactory control of foxtail fescue and bulbous bluegrass. There was no control of crested wheatgrass or big bluegrass. The 3 lb/A rate caused a chlorotic effect on a few of the alfalfa leaves. On the Ephrata loamy sand all rates gave complete downy brome, common rye, and tansy mustard control. Again, there were a few chlorotic alfalfa leaves from the 3 lb/A rate. Yield results were obtained from one location on Ephrata loamy sand. Analysis of these data showed no significant differences between treatments. Other observations showed rates as low as 1/2 lb/A of simazine giving 100% downy brome control. (Oregon Agriculture Experiment Station, Pendleton)

Comparison of several rates, dates, and methods of applying IPC, EPTC, and CIPC for control of winter-germinating grasses in crimson clover seed fields. Lee, William O. An experiment conducted during 1959-60 compared several rates, dates, and methods of applying herbicides for control of winter-germinating grasses in crimson clover seed fields.

Pre-plant applications

Ethyl-N, N-di-n-propylthiolcarbamate (EPTC) and isopropyl N-(3-chlorophenyl) carbamate (CIPC) were compared at 2, 4, and 6 lb. /A. as preplant soil-incorporated treatments. Each treatment was applied by two methods. The one method was to inject the herbicide directly into the soil to a depth of 4 inches by use of a blade injector. The other was to make a soil application and incorporate the chemical immediately with a rotovator. After treatment the soil was harrowed to firm the treated plots and seeded the same day.

Pre-emergence applications

Pre-emergence applications compared isopropyl N-phenylcarbamate (IPC) and EPTC at 4 and 6 lb. /A. These treatments were applied immediately after planting.

Post-emergence applications

Post-emergence applications compared IPC at rates of 2, 4, and 6 lb. /A. made on two dates, November 6 or December 16, and CIPC at 3 lb. /A. on February 10 or March 1. When the November 6 IPC applications were made, the crimson clover plants were in the seedling stage and had 3 to 5 leaves. On this date the grasses had 1 to 11 leaves.

On December 16 the crimson clover plants were fairly well established and had begun to stool. Most plants were 3 to 4 inches in diameter and averaged 17 leaves. Grasses were well established and averaged 30 or more leaves. Ryegrass was 6 to 10 inches high and growing rapidly.

Observations on February 10 and March 1 showed that the crimson clover had continued to stool and individual plants were 4 to 5 inches in diameter. The plants were still prostrate with numerous buds at the crown. No upright growth had been initiated. Grasses on these dates were somewhat larger than the crimson clover and tended to form a canopy over the clover.

Observations on April 22, 1960, showed that a number of the treatments compared gave almost complete grass control with only minor or temporary visible injury to the crimson clover. In all the better treatments crimson clover seed yields surpassed those of the untreated check. Treatments which showed significant seed yield increases were CIPC at 4 and 6 lbs. /A. applied as surface applications and tiller incorporated and IPC at 4 and 6 lbs. /A. applied December 16. The IPC treatment gave consistently good results in past years whereas rather severe injury and yield reductions have occurred with the CIPC treatment under some conditions. On the basis of this experiment and results in past years, it is felt that IPC applied at 4 lb. /A. in December is the best treatment for control of winter germinating grasses in crimson clover under western Oregon conditions.

Crimson clover seed yields on plots treated with 4 lb. of IPC in December yielded an average of 671 lb. seed/A. as compared with 416 lb./A for the untreated check. If the crimson clover seed is worth $.16/lb., then the value of the 255 lb. increase is $40.80/A. Since the cost of application would run from $10. to $12. per acre, the net increase brought about by the IPC treatment would be $28.80 to $30.80 per acre. (Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Oregon Agricultural Experiment Station)

Chemical summer fallow. Alley, H. P. Atrazine (2-chloro-4-ethylamine-6-isopropylamino-5 triazine has shown great promise for complete control of weed in fallowed wheat land.

Of the chemicals included in the chemical fallow program, atrazine, at 2 lbs/A as a spring application and 4 lbs/A as a fall treatment has eliminated both grassy and broadleaved weeds for the entire normal fallow period. Moisture is necessary soon after application of the chemical in the spring, therefore, under Wyoming conditions the fall treatment have shown greater promise.

Other compounds such as 2,3,6 trichlorobenzoic acid, amitrol, and simazin have effectively controlled the weeds for short periods of time but recovery of weeds has occurred on many of the treated plots.

Atrazine treated plots at the Archer Experiment Station yielded an average of 31.5 bushels of wheat per acre as compared to 25.0 bushels per acre for conventional fallowed plots.

There was a good stand of winter wheat on all the 1959 fall treated plots when visited this fall (1960). (Wyoming Agricultural Experiment Station)

Chemical fallow on Oregon grain lands. Phipps, F. E., Swan, D. G., and Furtick, W. R. Research has been conducted for several years on herbicide combinations for chemical fallow in the grain fallow areas of Oregon. Work the past year was concentrated on two different approaches to the problem. One approach was to use non-residual chemicals after complete germination of downy bromegrass Bromus tectorum, volunteer grain, and the various other winter vegetation. These weeds make it very difficult to carry out a satisfactory stubble mulch type of conservation farming. This is particularly true in wet springs where the light tillage merely transplants the weeds. The most satisfactory results on this chemical winter fallow program was a combination of one pound Amitrole with two pounds of any 2,4-D ester. This gave good kill of all winter growth and made it easy to establish a weed-free stubble mulch in the spring. This program was labeled for grower trial in the fall of 1960.

The second approach was to attempt a complete chemical fallow until time of seeding. The most efficient materials for this purpose appear to be either atrazine and amitrole or atrazine and dalapon. These combinations were used after complete germination of volunteer grain in the fall. A rate of 1.6 pounds of atrazine was required to maintain complete weed control until seeding time the next fall.

One pound of amitrole, or 3.4 pounds of dalapon were needed to kill all the volunteer grain during the fall after harvest. Some of the treated areas were seeded with a deep furrow drill without tillage, others were given one tillage in the late summer. Weed control was complete, so tillage was only for seed bed preparation. Stands of grain appear satisfactory at all locations.

Study of atrazine residues in the soil will be necessary before this practice can be recommended. (Oregon Agricultural Experiment Station)

Control of winter-germinating weeds in pennlawn red fescue raised for seed production. Lee, William O. An experiment initiated October 28, 1959, compared 2-chloro-4, 6-bis-(ethylamino)-s-triazine (simazine) and 2-chloro-4-(isopropylamino)-6-(ethyl-amino)-s-triazine (atrazine) at rates of 1, 2, 3, 4, and 5 lb. of active ingredient per acre for control of winter germinating weeds in a 3-year-old Pennlawn red fescue seed field. At the time of application the fescus was just beginning growth following burning of the straw from the field. Weeds present on this date were newly germinated and very small.

All the treatments caused some initial burn and discoloration of the fescue foliage. The degree of burn increased with increased rates of application. As the winter progressed, the injury symptoms disappeared from many of the plots. Observations on April 28, 1960, showed that the injury symptoms had mostly disappeared from plots treated with simazine at all rates and from those treated with atrazine at 1 or 2 lb. /A. Where atrazine was applied at 3, 4, or 5 lb. /A., injury symptoms persisted and actual stand reduction occurred at 4 and 5 lb. /A.

All rates of application gave good to excellent control of winter germinating weeds which included common ryegrass (Lolium spp.), rattail fescue (Festuca myuros), ripgut brome (Bromus rigidus), dogfennel (Helenium spp.), and mustard (Brassica spp.)

The effect of treatment upon red fescue seed yields is summarized in the following table.

Chem. applied in 40 gal. water/A.	Lbs. of clean fescue seed/A.	
Lbs. active ingredient/A.	Simazine	Atrazine
1	809	856
2	886	524
3	732	180
4	---	208
5	609	78
0 (check)	739	739

LSD at .05 = 80 lbs. seed/A.

These results indicate that simazine at rates of 1 to 2 lb. /A. shows promise for control of winter annual weeds in red fescue seed fields. The safety margin in the case of atrazine is probably too narrow to permit selective removal of winter-germinating weeds from this crop. (Contribution of the Crops Research Division, Agricultural Research Service, U.S.D.A., and the Oregon Agricultural Experiment Station.)

Weed control in flax. Furtick, W. R., Appleby, A. P., and Phipps,

F. E. Several herbicides were evaluated on winter flax and four spring varieties; B-5128, Redwood, Marine, and Punjab. The most effective weed control of both grasses and broadleaf type weeds was obtained with one to two pounds per acre of G-34698 (2-chloro-4-isopropylamino-6-(3-methopypropylamino)-3-triazine. By comparison, flax was shown to have only slight tolerance for simazine. Other herbicides which did not reduce yield and gave good weed control were I (2, 3-dichloroallyl diisopropylthiol-carbamate) at two pounds per acre and EPTC at three pounds per acre. Both of these materials were disced into the soil prior to planting. They did not give satisfactory broadleaf weed contro, but a pre-emergence treatment of one or two pounds per acre of Amiben (3-amino 2, 6-dichlorobenzoic acid) in addition to the other herbicide gave complete control of all weeds without yield reduction. Amiben alone did not give complete control of annual ryegrass Lolium multiflorum. The use of MCP or DNBP amine also gave satisfactory broadleaf control. CDEC at four pounds per acre was satisfactory for grass control, but needed to be combined with a later treatment of MCP for best weed control. All treatments yielded as much or more than the check. (Oregon Agricultural Experiment Station)

Residual toxicity of six pre-emergence crabgrass herbicides to new seedings of Kentucky bluegrass. Ross, M. A. and Fults, Jess L. This study was initiated to determine the minimum time interval needed between the application of six pre-emergence crabgrass herbicides and time of seeding with Kentucky bluegrass. This is an important question that must be answered in certain areas and under certain conditions where Kentucky bluegrass reseeding is desirable following use of a pre-emergence crabgrass herbicide. All the chemicals selected for these tests have been designated for pre-emergence crabgrass control in established bluegrass turf and are not particularly suited to pre-planting crabgrass control on freshly prepared seedbeds.

Chemicals tested were I @ 20 lbs. /acre (0-2, 4-dichlorophenyl 0-methyl isopropylphosphoroamidothioate.); II @ 10 lbs. /acre (2, 3, 5, 6-tetrachloroterepthalic acid, dimethylester); III @ 20 lbs. /1000 ft^2 (chlordane 7%, thiram 1%, nitrogen 7%, phosphate 5%, chelated "9% iron sulfate" 5%); CS-1609 (Calcium arsenate 60%, nitrogen 5%--.) and L-13489 @ 3. 32 lbs. /acre (diphenylacetonitrile 48 lbs/acre of 8. 3% active granules--) and IV @ 20 lbs. formulation per 1000 ft^2 (lead arsenate, other arsenicals, nitrogen and carrier).

The level area selected for these tests was located on the Bay Farm, owned by Colorado State University Agricultural Experiment Station at Fort Collins, Colorado. The soil was a slightly alkaline clay-loam. The seedbed was prepared and rolled with a cultipacker in September 1959 following a summer of clean fallow. In the spring of 1960 the seedbed was further leveled and packed before chemical treatment or grass seeding.

Each of the six chemicals was applied dry with a small fertilizer distributor in north-south strips such that each strip was five feet wide by 42 feet long. Treated strips were in pairs with an untreated control strip adjacent to each treated strip. Each chemical was used in duplicate but on non-adjacent strips. Kentucky bluegrass was seeded in east-west, six foot wide strips at right angles to the chemical strips. The intervals of seeding were 0, 2, 4, 8, 12 and 20 weeks following chemical application. All chemicals were applied on April 15, 1960 and the first seeding made on the same day. Following seeding each sub-plot was individually lightly raked in such a manner that there was no carryover of soil or seed from plot to plot.

The entire area was adequately sprinkler irrigated from April through

September. Line transects were run on October 26, 1960 for Kentucky bluegrass only. Many of the plots contained annual broadleaved weeds and annual grasses but no counts were made. As a result of field evaluation supported by the data from line-transects, the following trends at the end of the 1960 growing season are apparent: (1) Both II and I have a serious residual toxicity against bluegrass seedlings, 20 weeks following treatment; (2) Residual toxicity of the calcium arsenate and L-13489 was gone 2 weeks after treatment; (3) the toxicity of IV lasted for 12 weeks; and (4) the toxicity of III was definite for 12 weeks and some was still present after 20 weeks. Further evaluation will be made during the 1962 season. (Colorado State University Agricultural Experiment Station, Fort Collins, Colorado)

An evaluation of 3,4-dichloropropionanilide (FW-734) as a post emergence treatment for the control of watergrass (Echinochloa crusgalli) in rice. Viste, K. L. The herbicide 3,4-dichloropropionanilide (FW-734) was evaluated for its effectiveness in controlling watergrass infestations in rice. Rates of 1, 2, 4, and 8 pounds active ingredient were applied in an overall spray of 40 gallons of water per acre. Applications were made 1, 2, 3, or 4 weeks after planting. Rice and watergrass were 8-10 inches high by 4 weeks after planting.

Because of the heavy watergrass stand the untreated plots lodged severely and produced grain yields of only 860 lbs./A. FW-734 killed watergrass immediately. Considerable watergrass was reestablished after the early applications, largely because of delayed germination of seeds. There was little recovery of the grass after later applications. Thus, in this test, watergrass control improved progressively with later applications and also with higher rates. No treatment injured rice. Rice yields increased in proportion to watergrass control. The most effective treatment was 8 lbs./A applied 4 weeks after planting, which provided nearly 100 percent control of watergrass and produced a yield of 5300 lbs/A of rice. Qualitative observations indicated that later applications did not control watergrass and suggest that watergrass becomes tolerant at late-tillering stages. (Cooperative investigation of Crops Research Division, Agricultural Research Service, USDA, and the California Agricultural Experiment Station)

Wild oat control. Alley, H. P. Barban (4-chloro-2-butynyl N-(3-chloro phenyl) carbamate as a post-emergent wild oat herbicide was tested at Newcastle, Wyoming in spring wheat. Large 5 acre demonstration trials in cooperation with the county agent were established. Application was made with a broadjet sprayer which resulted in poor coverage on the outside edges of the spray swath.

Barban at 1/2 lb/A gave outstanding control of wild oats. It was estimated by visual rating that better than 90 percent control resulted. Actual seed counts showed the spring wheat seed from the treated plots containing an average of 11 wild oat seeds per pound, wheat seed from untreated plots contained an average of 58 wild oat seeds per pound. The treated plots yielded 26.9 bu/A as compared to 18.7 bu/A for the untreated. (Wyoming Agricultural Experiment Station)

Wild oat control in wheat and barley. Appleby, A. P., Phipps, F. E., and Furtick, W. R. A wide variety of herbicides were tested at Corvallis for wild oat control in Druchamp winter wheat, Cascade winter barley, Red Houston spring wheat, and Hannchen spring barley. The plots were overseeded with wild oats and common ryegrass.

The most promising chemicals on winter grains are listed in Table I. I (2,3-dichloroallyl diisopropyl thiolcarbamate) was applied pre-plant and incorporated 3 inches deep. G-34361 (2-chloro-4-allylamino-6-isopropylamino-s-triazine) and N-5996 (2,6-dichlorobenzonitrile) were applied pre-emergence and barbane (4-chloro-2-butynyl-N-(3-chlorophenyl) carbamate) was sprayed post-emergence when the wild oats were in the 2-leaf stage. Wild oat control, ryegrass control, and yield are given in Table I.

Table I.

Wild Oat Control in Winter Cereals

1959-1960

Treatment	Rate	Winter Wheat Wild Oat Control	Winter Wheat Ryegrass Control	Winter Wheat Yield (Bu/A)	Winter Barley Wild Oat Control	Winter Barley Ryegrass Control	Winter Barley Yield (Lbs/A)
I	1	87	77	73.3	88	70	2543
I	2	97	94	70.0	96	90	2371
Barbane	0.5	98	88	74.1	97	70	2694
Barbane	1	100	98	70.9	99	91	2749
G-34361	4	99	97	60.7	99	98	2435
N-5996	2	98	98	70.0	98	100	2235
Check	0	0	0	50.1	0	0	1357

In the spring, I was sprayed and incorporated but rains forced the postponement of planting for more than a week. For this reason, the treatment was repeated at the time of planting. These two dates of application are indicated in Table II as Date I and Date II. The relatively poor control with I on the spring grains is attributed to the leaching of the chemical out of the germination zone due to unusually heavy rains.

Table II:

Wild Oat Control in Spring Cereals

1960

Treatment	Rate	Wheat % Control	Barley % Control
I (Date I)	1.5	27	33
I (Date II)	1.5	47	40
Barbane	0.5	77	88

Research in the Columbia Basin of Oregon gave evidence that rye is killed by 1 pound per acre of barbane. The problem in this area is with a diploid rye that has escaped domestication, and has become a serious contaminant of wheat and barley. This work is only in the very preliminary stages but looks encouraging. (Oregon Agricultural Experiment Station)

Field evaluation of 2,3-dichloroallyl diisopropyl-thiolcarbamate (I) and 4-chloro-2-butynyl N-(3-chlorophenyl) carbamate (barbane) as wild oat herbicides. Foy, Chester L. and Bayer, David E. Preliminary field and greenhouse studies in 1958-59 indicated that two experimental materials, I and barbane, warranted more extensive field testing as potential wild oat herbicides. Thus during the 1959-60 season, I and barbane were evaluated in 28 locations throughout the state of California for selective control of wild oats in cereal grains.

1. I was tested at 9 locations on barley and 2 on wheat. The chemical was applied at the rates of 0, 1, 2, and 3 lbs./A active ingredient, prior to planting, and incorporated into the soil by general tillage equipment such as discs, harrows, etc. In general, the wild oat control was fair for the 1 lb/A rate and good at higher dosages. I was ineffective when left unincorporated on the surface of the soil. Crop injury occurred, from very slight to severe with increasing dosage rates, as indicated by visual ratings and grain yields. For the 1 lb/A rate, yields were lower (or tended to be lower) than in untreated checks in about half of the tests. Wheat appeared to be more severely injured than barley.

2. Barbane was tested in 17 locations on barley and wheat at 0, 1/4, 1/2, and 1 lb/A. The chemical was applied by hand-operated or tractor-drawn field sprayer at a volume of 7 to 55 gals/A. Application was made post-emergence to barley and wheat and critically timed to spray when most wild oats were in the 1 1/2 - 2 1/4 leaf stages. In general, the grain yields were not reduced by any of the above treatments. Barbane at 1 lb/A caused noticeable injury to barley and wheat but did not reduce stands or yields in fields heavily infested with wild oats. In all instances, regardless of degree of infestation of wild oats, neither the 1/4 nor 1/2 lb./A rate caused any reduction in yields. Yield increases from treating with barbane, however, were directly dependent upon the degree of wild oat infestation. In infestations rated as wild oat free, very slight, and slight, yields were not significantly influenced. Fields rated as having moderate, heavy, or very heavy infestations of wild oats showed increased yields or trends toward increased yields, accordingly. Both crop and wild oats were sometimes stunted initially, most noticeably at the 1 lb/A rate of barbane, but the wild oats were slowly suppressed or killed whereas the crop recovered. Frequently, many of the wild oats were not killed but were retarded in development. Control of wild oats was strongly enhanced by crop competition. (Botany Department, University of California, Davis)

Resistence of barley genotypes to various herbicides. Baker, Laurence O., Eslick, R. F., and Hockett, E. A. A one factor difference has been used to genetically explain the tolerance of certain barley varieties to the insecticide DDT. If such barley tolerance to certain herbicides is found it would become possible to control weeds, purify a barley variety and if the factor for male sterility is linked with the factor for herbicide tolerance then the production of hybrid barley is greatly facilitated. In an effort to determine if such tolerance exists between barley varieties several herbicides were applied preplanting with soil incorporation and post emergence at rates in excess of those normally used. A mechanical composite of about 6000 genotypes of the world barley collection was used at a seeding rate of about 2/3 bushel per acre. Plots were 3000 square feet in size so that each variety had a high probability of being present at least once.

Preplant treatments were made June 13 followed by double discing and harrowing. Post emergency applications were made July 5. Almost no precipitation occurred prior to a sprinkler irrigation in late July. However, plants were not seriously injured by lack of water because of the thin stand and due to good soil moisture at seeding time.

No treatment killed all barley plants. Normal appearing plants were observed on all plots. Treatments, estimated percent stand at harvest, and yield as a percent of the untreated check follow:

Preplant treatments	Lbs. per acre	Percent stand	Yield % of check
Dalapon	8	20	39.5
A	5	20	26.0
2,3,6-TBA	5	15	9.0
2,4-D amine	5	80	116.4
CDAA	8	20	39.5
2,4,5-TP	5	30	34.5
Methoxone	5	30	27.1
2,4,5-T ester	5	50	67.2
Post emergence			
Barbane	5	70	93.2
DNBP	10	65	76.3
Amitrole	4	80	23.7
2,4-D amine	10	85	50.8
2,4,5-T ester	10	85	49.2
Check	--	100	100

A = 2,3-dichloroallyl diisopropyl-thiolcarbamate
(Montana Agricultural Experiment Station)

PROJECT 5. WEEDS IN HORTICULTURAL CROPS

Jerry F. Renfrow, Project Chairman

SUMMARY

Twelve reports were received from 14 investigators in five states. A summary of these reports is given below:

Apple and Pears. Post-emergence. Four years of testing shows diuron to be an effective herbicide for use in non-bearing apple and pear orchards under sprinkler irrigation, but not satisfactory for rill irrigated orchards. Diuron plus amino triazole applied as a foliage spray to the weeds gave minimum tree injury. One years trial using the herbicide Casoron incorporated into the soil looks very promising for the control of common orchard weeds including perennial grasses.

Asparagus. Pre-emergence. Monuron at 4 lbs/A. in late winter or early spring, followed by shallow rotovation gave outstanding control of annual weeds each year from 1954 through 1959 with no injury to asparagus. Diuron applied in the same manner each year from 1956 through 1959 gave similar weed control with no apparent injury to the asparagus. Fall applications of diuron at 3 lbs/A. without rotovation gave unsatisfactory weed control the first year, but gave good weed control the following year.

Carrots. Pre-emergence. A summary of two years trials on several plantings show amiben at rates of 1/2, 1, and 2 lbs/A. to give complete annual weed control with no injury to carrots. Higher rates caused injury to the crop. Ipazine and propazine gave similar weed control, but slight crop injury was experienced.

Cane and Trailing Berries. Post-emergence. Diuron at 9.6 and 16.0 lbs/A., atrazine at 6.4 and 9.6 lbs/A., applied in March over the grass top growth gave satisfactory control of quackgrass and velvet grass with no apparent injury to the berry plants. A combination of diuron at 6.4 lbs/A. and atrazine at 6.4 lbs/A. gave poorer control than either herbicide at 9.6 lbs/A. alone.

Christmas Trees. Pre-emergence. Two years evaluations for controlling vegetative competition in areas newly planted to 2 year seedlings of Douglas and True fir species have given promising results with atrazine at 3.2 lbs/A., propazine at 3.2 lbs/A., simazine at 3.2 and 6.4 lbs/A. These materials may have possibility for use in post planting applications made before trees break dormancy.

Shelterbelts. Pre-emergence. Nine different chemicals applied as fall treatments were evaluated for annual weed control in shelterbelts. Monuron, simazine, atrazine, methoxy propazine and N-5996 at 2 lbs/A. all gave good control of cheatgrass and annual broadleafs.

Spinach. Pre-plant and pre-emergence. Ten herbicides were applied singly and in combination as pre-plant and pre-emergence treatments for the control of annual broadleaf weed species. None of the treatments resulted in adequate selective weed control. IPC caused the least injury to the spinach, however, weed control was not adequate. Combinations of CIPC and CDEC

showed some promise and should be further evaluated.

Strawberries. (a) Pre-plant. Six weeks of excellent annual weed control was obtained by incorporating the following herbicides prior to planting strawberries in 1959 and 1960: EPTC at 3 and 6 lbs/A; simazine at 1/2, 1, 1 1/2, and 2 lbs/A; 2,4-DEP at 4 lbs/A; amiben at 2 lbs/A; II at 5 lbs/A; and III at 2 lbs/A. Control through September was accomplished with simazine, ipazine, and atrazine at 1 lb/A. or higher rates. (b) Pre-emergence. A fall application of atrazine, simazine, and ipazine at 2 lbs/A. were made to compare the effect on strawberry yield. No yield differences were noted. Ipazine did not satisfactorily control winter annual weeds in this trial. Simazine and atrazine gave excellent annual weed control.

Tomatoes. Pre-plant. Applications of CDEC and R-2061 at rates of 3 lbs/A. of each chemical controlled both watergrass and pigweed with no damage to direct seeded tomatoes.

Miscellaneous Vegetable Crops. Pre-plant. A new thiolcarbamate, R-1856, similar to EPTC in structure and herbicidal action; has a wider range of selectivity for controlling grass weeds in a number of vegetable and field crops that are not tolerant to EPTC. It is necessary to thoroughly incorporate this material into the soil prior to planting. Crops that were resistant to R-1856 at 5 - 10 lbs/A. were the cucurbit and brassica families, tomatoes, spinach, pepper, lettuce, endive, celery, onions, table beets, carrots, field corn, sweet corn, cotton, barley, and rice. The rates of 5 - 10 lbs/A. of R-1856 gave satisfactory control of common annual grasses as well as the perennials nutgrass and Johnson grass.

Turf. II, silvex, and 2,4-D were applied singly and in combination at monthly intervals starting in mid-April for the control of crabgrass and chickweed. Readings made in late August showed II at 20 lbs/A. eliminated chickweed and crabgrass as a single or split application if applied before May 20. Silvex at 2 and 1 lbs/A. gave control of chickweed equal to 20 and 10 lbs/A. of II respectively. 2,4-D had no effect on chickweed at either 2 or 1 lbs/A.

Evaluation of monuron and diuron for weed control in asparagus. Bruns, V. F., Dawson, J. H., and Clore, W. J. Annual applications of 3-(p-chlorophenyl)-1,1-dimethylurea (monuron) at 4 lb/A in late winter or early spring, followed by shallow rotovation, gave excellent control of summer and winter annual weeds throughout each year from 1954 through 1959 without injury to asparagus. Similar results were obtained with fall applications of monuron at 4 and 6 lb/A without rotovation. Heavy rates of monuron (40 lb/A on December 6, 1954 and 20 lb/A on December 6, 1954 plus 10 lb/A on March 26, 1956) maintained excellent weed control during 1955, 1956, and the early part of 1957. However, these rates caused severe injury to the asparagus in one replicate wherein the crowns were near the soil surface.

Annual applications of 3-(3,4-dichlorophenyl)-1,1-dimethylurea (diuron) at 3 or 4 lb/A in late winter or early spring, followed by shallow rotovation, also gave excellent weed control each year from 1956 through 1959 without apparent injury to the asparagus. Two pounds per acre were less effective.

II 0-2,4-dichlorophenyl 0-methylisopropylphoroamidothioate
III N-(3,4-dichlorophenyl)-2-methylpentanamide

Fall applications of diuron at 3 lb/A without rotovation gave unsatisfactory weed control the first year, but gave good weed control thereafter.

After applications in February 1957, both monuron and diuron at 4 lb/A presisted sufficiently in the soil in February 1958 to cause severe injury to oats. Diuron appeared very immobile, being concentrated in the surface 2 inches (approximate depth of rotovation). Monuron was more mobile and less concentrated than diuron. Residual monuron was detected to a depth of 4 inches in the soil. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and Washington Agricultural Experiment Stations, cooperating.)

Annual summer weed control in carrot plantings. Bullock, R. M. and Smith, R. L. Weed control trials in carrot plantings have been conducted in Clackamas County, Oregon with county agents and growers cooperating during the past two years. Assorted annual weeds appearing in checks included pigweed (*Amaranthus retroflexus* L.), lamb's quarter (*Chenopodium album* L.), corn spurry (*Spergula arvensis* L.) and the dominant weed dog-fennel (*Anthemis Cotula* L.). Ratings of weed control are based on density of weed cover with 1 indicating a 100% cover and 10 indicating complete eradication. Crop damage ratings are made on the basis of 10 indicating no damage and 1 indicating a 100% kill of crop plants. Herbicides were applied in water with ordinary sprinkler cans over the bed in plots 5 feet wide by 20 feet long (100 sq. ft.). Ratings represent averages of replications at all locations.

It appears that three of the four herbicides listed have potential for pre-emergent weed control in carrot planting. One material may have potential as a post-emergent treatment in extreme situations. (North Willamette Experiment Station, Extension Service, Oregon State College)

		Active Chem. lbs/Acre	No. of Replications	Weed Rating	Crop Damage Rating
Pre - Emerge Application *1					
amiben		1/2	4	10	10
	light daily	1	4	10	10
	watering	2	4	10	10
		4	4	10	8
		6	4	10	9
amiben	watering 10	1	8	6.3	9.8
	day interval	2	4	8.7	9.8
ipazine		1	8	9.5	9.5
propazine		1	8	10	9.3
atrazine		1	4	10	1.0
Post - Emerge Application *2					
amiben		1	3	4	10
ipazine		1	3	9	8.3
propazine		1	3	5.3	10
atrazine		1	3	7	7

*1 - 4 days after planting.
*2 - 20 days after planting.

Perennial grass control in established cane and trailing berry plantings. Bullock, R. M. and Smith R. L. Perennial grass control trials in established plantings of cane and trailing berries have been conducted in five counties of the North Willamette Valley with respective county agents and growers. Various perennial grasses occurred in differing amounts in the various locations. The dominant grass present in all locations was Quackgrass (Agropyron repens L.). Creeping velvet grass (Holcus mollis L.) was also present occasionally. All ratings are based on populations of these grasses, with 1 indicating complete cover of grass and 10 indicating elimination of all visible top growth. In crop damage ratings, 10 = no damage and 1 = 100 percent damage. Berry plantings were of red and black raspberries, evergreen blackberries and boysenberries varying from 3 to 7 years of age in the field.

Herbicides were applied in March 1959 for plots with 9 month and 21 month readings and in March 1960 for plots with only the 9 month readings. Ratings are averages of all replications at all locations. Herbicides were applied over the row in plots 3 ft. wide covering 100 sq. ft. Except where granular materials only were available, herbicides were applied in water and sprinkled over the grass top growth accumulation using an ordinary sprinkler can.

It is indicated that several herbicides offer promise used in this manner. Urox caused foliage damage in fruiting canes the year applied, but the damage did not persist and did not appear in the newly developing canes in either the year of application or the year following in trailing berries. In black and red raspberries the injury from this material makes its use inadvisable. (North Willamette Experiment Station, Extension Service, Oregon State College)

	Active Chem. lbs/Acre	No. of Locations	Weed Rating Original Ave.	Weed Rating 9 mo. Ave.	Weed Rating 21 mo. ave.	Crop Damage Rating
Urox (1)	6	4	2.3	4.5		10
	12	5	2.2	5.6		9.5
	25	7	2.5	9.2	9.5 (2)	9.0
	50	3	2.3	9.7	8.0 (3)	7.5
diuron	1.6	2	1.5	4.0		10
	3.2	4	4.3	6.0		10
	6.4	2	1.5	4.5		10
	9.6	12	2.1	7.5	7.1 (4)	10
	16.0	2	3.0	8.0	7.0	10
simazin	3.2	2	1.5	5.5		10
	6.4	2	1.5	4.5		10
	9.6	10	2.8	6.4	9.3 (2)	10
atrazin	3.2	3	3.3	7.0		10
	6.4	2	3.0	8.5		10
	9.6	2	1.0	10.0		10
(diuron + atrazin)	1.6 + 1.6	2	2.0	2.0		10
	3.2 + 1.6	2	2.0	3.5		10
	3.2 + 3.2	2	2.0	3.5		10
	6.4 + 6.4	1	2.0	8.0		10
Ureabor + DB Granular	109 + 327	2	3.0	6.5		10
	218 + 218	2	2.0	6.0		10
	435 + 435	1	2.0	8.0	10.0	9

(1) Urox = 3-(p-chlorophenyl) -1, 1-dimethylurea trichloroacetate, (2) 3 locations, (3) 2 locations, (4) 7 locations.

Control of competitive weeds in newly planted Christmas trees. Smith, R. L. and Bullock, R. M. Trials have been conducted in Clackamas County, Oregon for the past two years in attempting to control vegetative competition in areas newly planted to 2 yr. seedlings of Douglas Fir (*Pseudotsuga menziesii*) and True Fir (*Abies grandis* and *Abies procera*). Annual Bluegrass (*Poa annua* L.), Ryegrass, (*Lolium perenne* L.), Creeping Velvet (*Holcus mollis* L.), Creeping Bent (*Agrostis stolonifera*. L. C.) and various annual broadleaf weeds appeared in differing amounts in the untreated checks. Ratings of weed control are based on density of weed cover with 1 indicating a 100% cover and 10 indicating no weeds present. All plots were rated at the time of treatment. Herbicides were applied in February (4 to 6 weeks after planting) in water with common garden sprinkler cans. Plots were 100 sq. ft. in area. Final ratings were made in December.

Several of the materials would seem to have possibilities for use in post planting application made before trees break dormancy. (Extension Service, North Willamette Experiment Station, Oregon State College)

Material	Active Chem. lbs/Acre	No. of Replications	Weed Rating	Crop Damage Rating
Atrazine	3.2	6	9	10
Propazine	3.2	6	8.5	10
Simazine	1.6	3	7.3	10
Simazine	3.2	9	7.9	10
Simazine	6.4	3	8	10
Diuron	1.6	3	6.7	10
Diuron	3.2	9	7.3	10
Check			2.0	10

Weed control in shelterbelts. Alley, H. P. Fall treatments were made at the Cheyenne Horticulture Station at Cheyenne, Wyoming and the Sheridan Experimental Station, Sheridan, Wyoming in the fall of 1959. The treatments were applied to areas with established shelterbelts containing seven species of trees. Nine different chemicals at two rates of application were made.

The 1960 evaluation show monuron, simazin, atrazine, methoxy propazine and N-5996 at 2 lbs. /A all giving good control of Downy bromegrass (Bromus tectorum) and annual broadleaved weeds. All treatments except N-5996 caused considerable burning of the leaf margins. Some of the resulting damage may have been enhanced by the extremely dry weather as leaves on trees not growing in the treated area showed similar symptoms. (Wyoming Agricultural Experiment Station)

Annual weed control in spinach. Peabody, Dwight V., Jr. At the present time in western Washington there is no effective and safe method of selective annual weed control in spinach. Although IPC, CIPC, monuron, and CDEC have all been used on an acreage basis, results have not been consistent and the annual weed problem has continued to be one of the major limiting factors in the economic production of this crop.

The objectives of this year's (1960) experiment was to (1) determine the efficacy of several different pre-planting and pre-emergence herbicide applications on a number of common broadleaved annual weeds, and (2) determine the effect of these treatments on the growth and yield of spinach.

This test was located at the Northwestern Washington Experiment Station on a Puget silt-loam soil having a pH of approximately 5.8. All herbicides at the designated rates of application were applied with a small tractor-mounted plot sprayer at a pressure of 40 psi in a total volume of water equivalent to 45 gallons per acre. Plots which received pre-emergence applications were planted April 27, 1960. All herbicidal sprays were applied April 29, 1960. Plots which had not as yet been seeded were spiketoothed harrowed at this time, and these plots were then seeded on May 9, 1960, twelve days after the herbicides had been applied. The experimental design was a randomized complete block arranged as a split plot, each chemical treatment being replicated 4 times. Sub-plot size was 3 rows, each 20 feet long. The spinach variety was Viroflay.

On June 8, approximately six weeks after herbicidal treatments had been applied, annual broadleaved weed cover was estimated with a 5-section quadrat 0.5 feet by 5 feet. Principal annual weed species present in order of their importance were: Senecio vulgaris L., groundsel; Polygonum persicaria, smartweed; Chenopodium album L., lambs-quarter; and Stellaria media Cyrill, chickweed. On June 22, all spinach shoot growth from the pre-emergence treatments was harvested from a four-foot section of the center row of each plot and weighed to the nearest 0.01 pound. In a similar fashion, spinach samples were harvested on June 28, 1960, from plots which received pre-planting applications.

Experimental results are presented in the following table. It is indicated by these results that no treatment resulted in adequate selective weed control. Effective herbicidal treatments on the weed population present resulted in severe spinach injury and reduced yields. Herbicides which did not affect spinach had little or no effect on the broadleaved annual weeds. IPC is still the best herbicide to use in spinach, although weed control is by no means adequate. Combinations of CIPC and CDEC showed some promise as selective weed control treatments and should be tested further in different ratios as pre-planting, soil-incorporated herbicides. (Northwestern Washington Experiment Station, Washington State University)

Yields and annual weed control estimates of 1960 herbicide evaluation test in processing spinach.

TREATMENT		YIELD[2]		ANNUAL WEED COVER	
Herbicide	Rate[1]	Pre-plant Tons/A	Pre-em. Tons/A	Pre-plant %	Pre-em. %
IPC emulsive	4.0	3.7	3.1	45	60
G-34365	1.0	2.8	2.9	83	85
TCA-Monuron	0.8	2.8	2.5	33	58
CIPC + CDEC	0.25+4.0	2.2	3.6	25	53
CIPC + CDEC	0.5+1.0	2.1	1.9	88	75
IPC wettable	4.0	1.9	2.4	50	53
G-34472	1.0	1.4	1.9	68	88
no herbicide	---	1.2	2.3	90	93
CIPC + CDEC	0.25+2.0	1.0	2.4	38	58
Monuron	0.8	0.9	1.3	5	28
CIPC	1.0	0.7	1.1	28	33
Neburon	3.0	0.7	0.2	8	38
G-34696	1.0	0.4	0.3	15	43
CDEC	8.0	0.3	0.6	45	53
N-5996	1.0	0.2	0.5	18	25
	$\bar{x}$	1.51	1.82		
	$SE_{\bar{x}}$	0.94	1.07		

1 Rate of application expressed in pounds active ingredient per acre.

2 Yields are fresh weight of all spinach leaf and stem growth harvested two months after planting.

Pre-plant herbicides in strawberries. Bullock, R. M. and Sheets, W. A. At strawberry planting time, it is often difficult to apply herbicides at the right time and under the best soil moisture and weather conditions for best weed control. Also, there may be weakness in planting stock that make it inadvisable to apply an herbicidal chemical over the tops of newly set or weakly established plants.

This study was set up to improve the above situation and control annual weeds until the strawberry plants are well established. The herbicides were applied uniformly over the soil surface with a boom sprayer. This was followed immediately by a spike tooth harrow set to incorporate the chemical in the surface inch of soil. Strawberry plants of the Northwest variety were planted within 3 days of treatment.

The principle weeds present were lamb's quarters (Chenopodium album), redroot pigweed (Amaranthus rectoflexus), dog fennel (Anthemis Cotula), Annual bluegrass (Poa Annua), and common Chickweed (Stellaria media).

Herbicide materials incorporated prior to planting strawberries in 1959 and 1960 included the following: EPTC at 3 and 6 pounds per acre; simazine at 1/2, 1, 1 1/2, and 2 pounds per acre; CDEC at 4 pounds per acre; ipazine and atrazine at 1 1/2 pounds per acre; falone, tris-(2,4-dichlorophenoxyethyl) phosphite at 4 pounds per acre; amiben, 3-amino-2, 5-dichlorobenzoic acid at 2 pounds per acre; zytron, 0-2, 4-dichlorophenyl, 0-methyl isopropylphosphoramidothioate at 5 pounds per acre and Karsil at 2 pounds per acre.

All of the above herbicides gave excellent weed control for 6 weeks. Simazine, ipazine and atrazine at 1 pound per acre or higher controlled weeds satisfactorily through September. Ipazine and atrazine at 1 1/2 pounds per acre caused moderate to severe plant damage under these conditions. Yields in 1960 from plantings treated in 1959 prior to planting, showed no significant differences from plots weeded by hand throughout the season. Herbicides giving control for only 6 weeks were reapplied during the season. All plots were handled in a manner to keep weed competition at a minimum throughout the season to assess any effect of the herbicides on subsequent yields. (North Willamette Experiment Station, Oregon State College)

Effect of three S-triazine herbicides on strawberry fruit yields. Peabody, Dwight V., Jr. The principal objective of this test was to compare the effect of atrazine, simazine, and ipazine on the yield of strawberry fruit. These three herbicides, each at two pounds active ingredient per acre, were applied to three different strawberry varieties (Northwest, Puget Beauty and Marshall) on Sept. 28, 1959. All treatments were applied with a small tractor-mounted sprayer at a pressure of 80 psi in a total volume of water equivalent to 45 gpa. Prior to treatment application, standard management practices in regard to row trimming, cultiviation, and fertilization were carried out.

The experimental design was a randomized complete block replicated three times. Plot size was 7 rows, each 32 feet long. Harvesting was started in mid-June and continued through mid-July at 6- to 7-day intervals for a total of four separate pickings. All 7 rows of each plot were picked; marketable fruit were weighed to the nearest ounce, and the weights recorded.

The experimental results recorded in the following table show that there are no significant differences in the fruit yield due to chemical treatments. These results indicate that atrazine and ipazine are as safe to use in the fall on strawberries as simazine for the control of winter annual weeds, principally Senecio vulgaris, groundsel, and Stellaria media, chickweed. It should be noted that ipazine in this test did not control these winter annual weeds; however, both simazine and atrazine resulted in excellent control. (Northwestern Washington Experiment Station, Washington State University)

Strawberry fruit yields[1] of three varieties treated with fall applications of three different S-triazine herbicides.

TREATMENT Herbicide	Rate[2]	VARIETY Northwest Tons/A	Puget Beauty Tons/A	Marshall Tons/A
Simazine	2	4.1	4.3	2.5
Atrazine	2	5.1	3.7	2.3
Ipazine	2	4.3	3.8	2.2
	$\bar{x}$	4.50	3.95	2.32
	$SE_{\bar{x}}$	0.42	0.37	0.30
	CV	7.9%	16.2%	22.5%

[1] Yields are season totals of four separate pickings.

[2] Rate of application expressed in pounds active ingredient per acre.

Weed Control in Direct Seeded Tomatoes. Ashton, Floyd M. During the past several years we have been field testing a large number of herbicides for weed control in direct seeded tomatoes. All pre-emergence treatments have been discared because of variable weed control results; perhaps some of these treatments, such as CDEC and R-2061 (propyl ethyl-n-butyl-thiolcarbamate), would be satisfactory with rainfall or overhead irrigation.

Pre-plant soil incorporation to a depth of two inches with a power driven bye-hoe of CDEC and R-2061 alone and in combination offer promise. CDEC caused no injury to tomatoes at rates less than 8 pounds per acre, 16 pounds per acre caused some thinning of the stand and a slight temporary stunting. Control of watergrass of barnyard grass was satisfactory at rates greater than 8 pounds per acre and of pigweed at rates greater than 4 pounds per acre. R-2061 caused no injury to tomatoes at rates less than 12 pounds per acre. Weed control of pigweed was satisfactory at rates greater than 8 pounds per acre and of watergrass at rates greater than 4 pounds per acre. The combination of CDEC and R-2061 at rates of 3 pounds per acre of each controlled both watergrass and pigweed without damage to the tomatoes. (Department of Botany, University of California, Davis)

A new thiolcarbamate herbicide for grass control in vegetable and field crops. Gray, Reed A., and Curtis, Ralston. R-1856 (t-butyl di-n-propylthiolcarbamate) is the latest in a series of thiolcarbamate herbicides. The chemical is similar to EPTC in structure and herbicidal action, but offers sufficient differences in selectivity to make it useful for controlling grass weeds in a number of vegetable and field crops that are not tolerant to EPTC.

Greenhouse tests conducted during the past six months showed that R-1856 at rates of 5-10 lbs./acre incorporated thoroughly in the soil before planting, gave complete control of many annual grasses and controlled perennials such as nutgrass from tubers and Johnson grass from rhizomes for over 3 months. Crops that were resistant to R-1856 at 5-10 lbs./acre were the cucurbit and brassica families, tomatoes, spinach, pepper, lettuce, endive, celery, onions, table beets, carrots, field corn, sweet corn, cotton, barley and rice.

Among the annual grasses controlled by R-1856 at rates of 5-10 lbs./acre were green foxtail (Setaria viridis), yellow foxtail (Setaria lutescens), watergrass (Echinochloa crusgalli), hairy crab grass (Digitaris sanguinalis), smooth crab grass (Digitaria ishaemum), wild oats (Avena fatua), and annual bluegrass (Poa annua). R-1856 required as much as two weeks to induce injury symptoms on some susceptible grasses, but control was usually complete in one month. The low water solubility (45 ppm. at 25° C.) of R-1856 compared to other thiolcarbamates may account for the comparatively slow response observed.

Greenhouse tests showed that a single application of 5 lbs./acre, incorporated, prevented nutgrass (Cyperus rotundus) growth from tubers for over 3 months. Similar tests with Johnson grass (Sorghum halepense) rhizomes showed that 10 lbs./acre of R-1856 gave complete control for 3 1/2 months, and 5 lbs./acre gave 100% control for 1 month and 83% control for 3 1/2 months. Since control of these perennials may be of shorter duration in the field, it may be necessary to make repeated applications or use higher levels in order to obtain season long control.

Limited field tests that have been carried out so far, have confirmed the greenhouse results. Green foxtail, watergrass, wild oats and Sudan grass were controlled when 5 lbs./acre of R-1856 was incorporated 3" deep immediately after spraying on dry soil in the field. Cantaloupes, cucumbers, tomatoes, carrots, lettuce, spinach, cabbage, field corn and sweet corn were not injured by R-1856 at a rate of 10 lbs./acre. Corn that was seeded 4" deep in the treated soil showed no ill effects. The application procedures for R-1856 are the same as for other thiolcarbamates, in that preplant incorporation by either disc, spike tooth harrow or power driven tiller immediately after surface spraying is required.

R-1856 has shown a variable response on broadleaf weeds in the field. In one location, control of red-root pigweed (Amaranthus retroflexus) and purslane (Portulaca oleracea) was good at 5 lbs./acre while lack of control of red-root pigweed occurred in another location at 10 lbs./acre.

Mixtures of other herbicides with R-1856 may be needed for controlling broadleaf weeds and grasses in certain crops. In field trials completed late this summer, the combination of 5 lbs./acre R-1856 plus 2 lbs. of 2,4-D acid/acre incorporated in the soil was shown to be especially promising on both types of weeds in corn. (Stauffer Chemical Company, Agricultural Research Laboratory, Mountain View, California)

Control of crabgrass and chickweeds with zytron, silvex, and 2,4-D. Erickson, Lambert C. and Swenson, Charles F. The lawn area was infested with several species of caryophyllaceae -- *Cerastium*, *Stellaria*, *Sagina*, and with the advance of summer came crabgrass *Digitaria ishaemum*.

Treatments were applied at monthly intervals in mid-April, May and June. The treatments were applied in single and split applications on a basis of time intervals, e.g., zytron (liquid) at 20 lbs./A in April; 10 lbs. in April plus 10 lbs. in May; 10 lbs. in April plus 10 lbs. in June; 10 lbs. in May plus 10 lbs. in June; and 10 lbs. only in April or May or June.

Table 1. The effects of 0-2,4-dichlorophenyl 0-methylisopropylphoroamidothioate (Z), silvex (S) and 2,4-D (D) on the control of crabgrass and chickweed when applied singly or in combinations at six dates. Final readings August 23, 1960.

August % of plot areas infested with chickweed

Date of treatment Material & lbs./A	April	April & May	May	April & June	May & June	June
Z20	0		0			1
Z10 & 10		0		0	0	
Z10	7		2			9
S2	1		0			0
S1 & 1		0		2.5	0.5	
D2	95		98			98
D1 & D1		98		97	95	
Z10 & S1	.5	1.5	0	.2	0	2
Z10 & D1	3.3	3.7	1.5	3.7	2.2	1.5
Checks	100	95	95	93	90	97

August % of plot areas infested with crabgrass

Date of treatment Material & lbs./A	April	April & May	May	April & June	May & June	June
Z20 lb.	0		0			4
Z10 & 10		1.3		1		0
Z10	6		2.6			10.3
Z10 & S1	1.5	1.5	25	23	27	37
Z10 & D1	8	2	3	8	8	30
S2	47		35			35
S1 & 1		52		48	52	
S1	51		63			77
Checks	27	30	28	31	24	30

A digest of Table 1 shows the following results:

1. Z at 20 pounds per acre eliminated both chickweed and crabgrass when it was applied prior to May 20 either as a single treatment or in split applications.

2. Z at 10 pounds per acre was effective but not practical in that about 5 per cent of both crabgrass and chickweed infestations remained.

3. When 1 pound of silvex was added to 10 pounds of Z, chickweed control was almost total.

4. Silvex at 2 and 1 pounds per acre gave control of chickweed equal to 20 and 10 pounds of Z respectively.

5. 2,4-D had no effect on chickweed at either 2 or 1 pounds per acre.

6. Applications of silvex increased the density of crabgrass by eliminating the competition otherwise offered by the chickweed.

7. 2,4-D did not affect any control of either species.

(Idaho Agricultural Experiment Station)

Chemical weed control in potatoes. Iritani, Willy M. Chemical control of weeds in potatoes is desirable for several reasons. One of the more important reasons being the elimination of two, possibly three cultivations. With the advent of bulk harvesters it is imperative to have as few clods as possible. The clods being formed in many cases from packing of the soil with tractor operations.

On June 9, 1959, the chemicals were applied with a knapsack sprayer on plots 5 rows wide and 35 feet long, replicated 4 times. The potatoes were just beginning to emerge (pre-emerge application). After application the chemicals were incorporated into the ground by sprinkler irrigation for 3 hours. All cultivations were dispensed with thereafter.

Weed counts were made on July 25 on the two center rows of each plot. Weeds consisted mainly of broadleaves (Amaranthus retroflexus L.), Russian thistle (Salsola kali L.), some nightshade (Solanum nigrum) and a few grasses mainly green foxtail (Setaria viridis L.). Weed control ratings were made on September 13. Harvesting was conducted on October 5 and yield and grade changes recorded.

The 1960 applications were made with a small plot sprayer mounted on bicycle wheels at a pressure of 40 p.s.i. and 50 gallons per acre of water. The granular material was applied with a quart glass jar in which the top was perforated. Five reps were used on plots 4 rows wide and 30 feet long. On July 13 a weed count was taken of a random 2 square foot area in each plot. On August 9 the plots were rated for weeds.

The performance of the herbicides are shown in Table 1. Neburon, Trietazine and 2-4-D at 1 pound per acre were also used in 1959. The data were left out because of poor performance. In looking at the percent weed control, NPA and 2,4-DEP showed the best possibilities. Of the two, NPA appears to be the better. Although NPA stunted the foliage slightly; no statistically significant reductions in yield, grade or quality were obtained. The grade was measured by percent No. 1's and quality by the specific gravity.

Diuron and EPTC have some possibility. Higher rates of application would possibly do the job. Application with a log dilution sprayer at 4 times recommended application did not show any apparent stunting with either chemical. (University of Idaho, Branch Expt. Sta., Aberdeen)

Table I. Two year's data on chemical weed control in potatoes.

Herbicide	Rate of Application Lbs. Active/A		Percent Weed Control of Check		Total Yield Sks/A		Percent No. 1's		Specific Gravity	
	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960
2,4-DEP	4.0	4.0	61.0	81.5	298	191	80.3	45.6	1.0903	1.0850
NPA	4.0	4.0	95.0	74.7	261	172	62.1	51.7	1.0850	1.0850
Diuron	1.5	1.5	65.0	60.0	304	155	75.7	40.5	1.0882	1.0838
EPTC	3.0	3.0	65.0	56.4	300	199	71.7	52.7	1.0922	1.0859
Esteron G*	–	2.0	--	47.4	-	199	--	47.2	--	1.0855
Pre-emerge G*	-	8.0	--	44.4	-	154	--	50.6	--	1.0847
2,4-DEP	-	4.0	--	75.2	-	207	--	46.4	--	1.0839
NPA G*	-	4.0	--	85.0	-	195	--	35.8	--	1.0840
Check (hoed)	-	-	100.0	100.0	292	199	79.2	47.7	1.0932	1.0856
Check (no treatment)	-	-	0.0	0.0	267	169	68.2	46.1	1.0952	1.0841
L.S.D. @5%					N.S.	N.S.		N.S.	N.S.	N.S.

* G = granular

Use of herbicides as a substitute for cultivation around non-bearing pome fruit trees. Benson, Nels R. Diuron has been shown to be a satisfactory herbicide for use in non-bearing apple and pear orchards under sprinkler irrigation, but not satisfactory for rill irrigated orchards. For minimum tree injury, maximum economy and convenience it should be applied as a foliage spray to the weeds with a good contact herbicide. Amitrole was effective when used with diuron.

Outstanding success was obtained with the herbicide Casoron when incorporated into the soil. The common orchard weeds including perennial grasses, annual grasses, annual broadleaf weeds and bindweed were either killed or held in check. Some evidence of tree injury was noted but not sufficient to discourage extensive testing of this herbicide.

Trials need to be established to determine tree performance in rill irrigated orchards with Casoron.

Trials need to be established to determine if Casoron can be adapted to a grass sod culture with an area weed-free around the trees without resorting to cultivation. (Tree Fruit Experiment Station, Wenatchee, Washington)

Table I - A comparison between cultivated and diuron-treated non-bearing apple and pear trees

Treatment	Orchard Trunk Increase in Centimeters						
	A	A 1/	B	C	D	E	F
Cultivated	6.2	8.0	1.6	5.7	4.7	3.4	3.2
5 pounds per acre diuron	6.2	8.0	2.0	6.2	4.4	3.2	2.2

1/ Orchard A was treated in 1957 and not treated again in 1958, but cultivated plots were cultivated both years.

Table II - A comparison between cultivated and various herbicide-treated apple and pear trees

Treatment	Orchard Trunk Increase in Centimeters					
	A	B	C	D	E	F
Diuron	4.7	2.0	1.4	5.7	0.9	4.4
Diuron + amitrole	5.1	4.4	2.1	5.2	1.9	3.8
Amitrole	5.7	3.5	---	3.5	1.9	3.5
Cultivation	5.6	4.0	2.1	5.2	0.8	4.0

PROJECT 6. WEEDS IN AGRONOMIC CROPS

James A. Wilkerson, Project Chairman

SUMMARY

Sixteen abstracts involving the work of 20 men from 6 states were received. This was a sizeable increase over the previous year which involved 10 papers from 13 men in 4 states. The papers are summarized by crop, specific weed in one case, or residual studies.

CROP

Field Beans. In Wyoming various methods of applying granular and liquid EPTC and CDEC were compared. Both herbicides gave excellent weed control with increased bean yields, with no differences being obtained between granular and liquid formulations or when soil incorporated or not.

Field Corn. In Arizona, atrazine gave 100% weed control and no corn injury nor yield reduction when applied pre-plant. Simazine, diuron and EPTC either stunted corn or reduced stands with resulting decrease in yield in the same experiment. Atrazine also showed the most promise in Wyoming when compared with EPTC, Simazine and 2,4-D by Alley. In Calif., a new group of pre-emergence compounds, oxazolidine diones showed selectivity up to 8 lb./A with control of watergrass and pigweed with rates under 4 lb./A.

Cotton. Arizona workers obtained seasonal weed control by applying diuron as a pre-plant treatment. Weed control was better when it was applied prior to furrowing-up for the pre-plant irrigation as compared to applying it after furrowing. California workers reported that a new material, DCPA shows much promise in the control of barnyardgrass (E. crusgalli) with a long residual, and cotton being tolerant in tests up to 32 lb./A. Other California workers reported that cotton was also tolerant of the oxazolidine dione materials, previously mentioned, up to 8 lb./A. with good weed control at less than 4 lb./A.

Grass Seed. Peabody of Washington continued his studies involving the effects of six growth-regulating type herbicides on the yields of orchardgrass, timothy, creeping bentgrass and creeping red fescue. Yield reduction of creeping red fescue was obtained when sprayed with silvex in early spring.

Safflower. In Arizona, EPTC, endothal and CIPC were compared. CIPC and the higher rates of EPTC gave good weed control and yields were not affected when treatments were applied to row plantings, while EPTC resulted in 20% yield increases when drill planting was employed. Endothal had no effects on weed control nor yields.

Sorghum. Injury was obtained from directed applications of silvex with a resultant yield decrease under Arizona conditions.

Sugar Beets. Antognini tested EPTC and two of its analogs under wide conditions, using different rates and means of soil incorporation. He concluded that R-2061 showed the best results from the standpoint of weed control and lack of beet injury. In Oregon, several materials were applied: (1) pre-plant (2) pre-emergence and (3) at-emergence. Conclusions were that best results of currently available herbicides are obtained from soil incorporation of pre-planting treatments. Materials included TCA, DCU, EPTC, endothal, CDAA, CDEC, M-6936, and SD 4777. Combinations of herbicides for better grass and broad-leaf control were suggested. In Colorado, 3 year's work showed EPTC and endothal as giving the best over-all pre-emergence weed control. In 1960, I, barban, L-13489, II, and III were added to the previous two mentioned materials. EPTC gave the best general weed control, with I and endothal being amost as good.

Wheat. In eastern Washington, cheatgrass control is a difficult problem. At present, Simazine and atrazine appear to show the greatest promise, with timing of application being somewhat critical. Some 20 chemicals were screened at one location. In fallow land, control of cheatgrass and volunteer grain with atrazine also looks promising. The combination of amitrol and 2,4-D ester controlled winter germinating species.

SANDBUR CONTROL

One report dealing with the chemical control of this weed was submitted by Oregon workers. Greenhouse and field tests showed that it may be controlled with several materials applied pre-emergence, at-emergence, or early post-emergence. Materials tested included CDAA, CIPC, EPTC, TCA, simazine, atrazine, amitrole, dalapon, CDAA "T", and 2,4-D amine.

RESIDUAL STUDIES

Two papers dealing with the residual effects of monuron, diuron, and fenuron were submifted by Arizona workers. Low rates of monuron and diuron applied and mixed to soil in the field 3 weeks before seeding barley reduced yields. In the second study the build-up of monuron, diuron and fenuron from annual applications to cotton fields was studied by taking soil samples from the field and growing five crops in flats. The responses of the various crops--alfalfa, cucumbers, oats, sorghum and squash--to these soil residues were similar. Diuron produced more effect than fenuron, with monuron disappearing at a faster rate.

Chemical control of annual weeds in field beans with EPTC and CDEC. Comes, R. D. and Timmons, F. L. Experiments for the control of annual broadleaved and grassy weeds in dry field beans were conducted in Wyoming during the past 5 years. These experiments showed ethyl N,N-di-n-propylthiolcarbamate (EPTC) and 2-chloroallyl diethyldithiocarbamate (CDEC) to be the most effective herbicides. In 1960, an experiment was conducted at Torrington, Wyoming, on sandy loam to compare the granule and liquid formulations of EPTC and CDEC. Seven methods of application were also studied. These methods were (1) applying in an 8-inch band immediately before planting and incorporating with (a) a rototiller, (b) a fingerweeder, (c) a rotary-hoe, or (d) not incorporating, and (2) broadcasting soon after planting and incorporating with (a) a fingerweeder, (b) a rotary-hoe, or (c) not incorporating. The rototilling and band applications were made with a machine, designed by the University of Wyoming Agricultural Engineering Section, which applies liquid or granular formulations. Broadcast applications of liquid formulations were made with a constant-pressure plot sprayer and granular formulations

I 2,3-dichloroallyl diisopropylthiol-carbamate
II 0-2,4-dichlorophenyl 0-methylisopropylphoroamidothioate
III 2,3,5,6-tetrachloroterepthalic acid

with a fertilizer spreader. All EPTC treatments were applied at 3 lb./A and all CDEC treatments at 6 lb./A.

Plots were 150 feet long and contained four rows of Pinto beans planted on 22-inch spacings. The treatments were replicated three times in a completely randomized block design.

The number of beans, broadleaved weeds, and grasses was recorded for 20 feet of bean row on June 25 by placing a 2x5-foot frame across the two center bean rows at five different places in each plot and counting the plants. The yield of beans from each plot was also recorded.

All chemical treatments gave highly significant weed control as compared to controls, and bean yields from treated plots ranged from 9 to 54 percent higher than yields from controls. EPTC was more effective in controlling weeds than CDEC; however, there was no difference in bean yields. Statistical analysis of the data shows that there was no difference in weed control between liquid and granular formulations or between incorporation and nonincorporation. A rain of 0.17 inch fell immediately after the treatments were applied and may have masked the effects of incorporation. Band applications were as effective as broadcast applications. (Contributed by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and Wyoming Agricultural Experiment Station, cooperating.)

Effect of soil applications of herbicides on field corn. Hamilton, K. C., McRae, G. N., and Arle, H. F. Soil applications of herbicides in corn in the irrigated Southwest have received only limited commercial acceptance. If corn is planted in moist soil under a dry mulch annual weeds are seldom a problem until after the first irrigation. With other planting methods early-season weeds may be a serious problem.

An experiment was conducted at Mesa, Arizona, to determine the effects on field corn and weeds of herbicides incorporated into the soil before planting. On February 28, 1960, Arivat barley and Southern Giant Curl mustard were seeded to insure a uniform stand of "weedy" plants. Ethyl N,N-di-n-propylthiolcarbamate (EPTC) was applied to the soil and the area was immediately furrowed for the preplanting irrigation. 2-chloro-4,6-bis-(ethylamino)-s-triazine (simazine), 2-chloro-4-ethylamino-6-isopropylamino-s-triazine (atrazine), and 3-(3,4-dichlorophenyl)-1,1-dimethylurea (diuron) were then applied to the entire ridge and furrow. About 12 inches of water were then applied to the Laveen clay loam. The surface soil was allowed to dry until the tops of the ridges could be harrowed. On March 19, field corn (Asgrow 102) was planted in moist soil. The experimental area was not cultivated after planting. Weeds on hoed checks were controlled throughout the season.

During the growing season the effects of the herbicides on weeds and corn were noted. The center row of each plot was harvested when moisture of grain was 10 to 12 percent. Data on weed control and corn stand and yield are summarized in the following table.

(Refer to Table on next page)

Effect of preplanting applications of herbicides in corn.

Herbicide	Rate (lb./A)	Percent weed control (May 2)	Corn stand and vigor (May 2)	Yield* (percent of hoed check)
Check-hoed		97	Normal	100a
Check-not hoed		0	Normal	93ab
Simazine	2	97	Stunted	81 b
Atrazine	2	100	Normal	99a
Diuron	1	85	Reduced	61 c
EPTC	6	65	Reduced	59 c

[1]Calculated yield of ear corn on check plots averaged 6,016 lb./A.
*Values with the same subscript letter are not significantly different.

Weed control on plots treated with atrazine was excellent from emergence until harvest. Neither diuron nor EPTC gave satisfactory weed control. Corn stands were reduced 50 to 60 percent by diuron and EPTC. Corn on plots treated with simazine was stunted. On May 30 corn on these plots averaged 18 inches shorter than that on check plots. The yields of ear corn on plots treated with simazine, diuron, and EPTC were significantly less than yields on the hoed, untreated checks. (Contribution by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Arizona Agricultural Experiment Station, cooperating.)

Weed control in corn. Alley, H. P. Plots were established at Torrington, Powell, and Worland in 1960. The main evaluation in the tests was placed on atrazine. At Torrington, treatments were made just as the corn was emerging. Application at Powell and Worland were made before the emergence of the corn.

Atrazine at 1 lb./A on sandy soils gave outstanding control, whereas, 2 lb./A was needed on the clay type soils. The control of both grassy and broadleaved weeds was outstanding at all stations. The corn on the treated plots obtained a height of 10" to 16" greater than corn on the non-treated plots. Yield data was not obtained.

Application of simazine, EPTC, and 2,4-D also gave good control of weeds but was not as outstanding as atrazine. (Wyoming Agricultural Experiment Station)

The oxazolidine dione herbicides. Corkins, Jack P., Wilkerson, James A., and Riddell, John A. The oxazolidine diones are a group of herbicidally active compounds. Pre-emergence weed control experiments with a 50% wettable powder formulation of 3-para-chlorophenyl-5-ethyl-2,4-oxazolidine dione were conducted on cotton and corn. These crops appeared to tolerate as much as 8 lb./A. Watergrass and pigweed were controlled with 1 to 4 lb./A.

Pre-emergence experiments involving soil incorporation and/or overhead application of water resulted in little or no weed control. This has been attributed to a high degree of soil mobility. Other compounds of this group are presumed to be less mobile in the soil and will be tested next year. (Naugatuck Chemical Division of the United States Rubber Company)

Effect of pre-planting applications of diuron on weeds and cotton. Hamilton,

K. C., Arle, H. F., and McRae, G. N. Application of the urea herbicides 3-(p-chlorophenyl)-1, 1-dimethylurea (monuron) and 3-(3, 4-dichlorophenyl)-1, 1-dimethylurea (diuron) at cotton layby for late-season control of annual weeds is an accepted practice in much of the irrigated Southwest. Although early-season annual weeds are usually controlled by mechanical cultivation and other cultural practices, there is interest in chemical weed control from cotton planting until layby. Past tests have indicated pre-planting applications of diuron in cotton can control annual weeds for an entire growing season.

In 1959, pre-planting applications of diuron were made in Acala-44 cotton at the Cotton Research Center at Phoenix, Arizona. The field was level on March 5, when diuron was applied to the soil at rates of 1.6, 2.0, 2.4, and 2.8 lb./A. The area was then furrowed for the pre-planting irrigation. On March 16 diuron was applied to other plots at rates of 1.6, 2.0, and 2.4 lb./A. The area was irrigated on March 18 with about 1 acre-foot of water. On April 9 the field was harrowed, cotton was planted in moist soil, and the drill row was covered "capped" with soil by disk hillers trailing the planter. The caps were removed on April 14.

The soil of the study was a McClellan clay loam. Panicum fasciculatum was the most numberous and competitive weed present. Plots were 4 rows, 40 feet long. Treatments were replicated 4 times.

Treated plots were not cultivated or hoed during the growing season. Check plots were hoed several times. The area was furrowed between the drill rows prior to the first post-emergence irrigation, on May 27.

Cotton emergence was normal. Few annual weeds appeared before the first irrigation. By then cotton was already 10 to 12 inches high. On treated plots grassy weeds then emerged, yellowed, and died. Initial grass control was excellent on all treated plots. About 2 weeks after the first irrigation cotton on plots treated after furrowing developed temporary chlorosis. By midsummer grass control was better on plots treated before furrowing than on plots treated after furrowing.

Before harvest ten-boll samples were taken from each plot for fiber testing. Cotton was hand-picked in October and December. The yield and weed control data are summarized in table 1.

Table I. Effect of pre-planting applications of diuron on weeds and cotton yield.

Diuron application Time	Rate (lb./A)	Weed control (percent) on July 7	Yield of cotton (percent of check[1])
Before furrowing	1.6	93	104
Before furrowing	2.0	97	102
Before furrowing	2.4	97	104
Before furrowing	2.8	98	99
After furrowing	1.6	86	104
After furrowing	2.0	85	98
After furrowing	2.4	96	99
None (hoed check)		--	100

[1] Calculated yield of seed cotton on checks was 3,772 lb./A.

Yields of seed cotton on plots treated with pre-planting applications of diuron equalled the yields on the hoed checks. Diuron had no effect on cotton fiber properties (length, strength, and fineness) or boll components (boll weight, percent lint, and seeds per boll). (Contribution by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Arizona Agricultural Experiment Station, cooperating.)

An evaluation of DCPA for weed control in cotton. Kempen, H. M. and Miller, J. H. Studies conducted during 1960 indicated that dimethyl-2, 3, 5, 6-tetrachloroterephthalate (DCPA) to be a promising herbicide for weed control in cotton. Cotton appears to be rather tolerant to DCPA and DCPA seems adaptable to western irrigated conditions.

In two preliminary studies, DCPA was applied logarithmically at rates of 1 to 16 lb./A for annual grass control in furrow-irrigated cotton grown on a Hesperia fine sandy loam. Cotton was planted 2 inches deep and the herbicides were incorporated to a depth of 1 1/2 inches in a simultaneous operation. Specially designed equipment permitted seeding of cotton and barnyardgrass (Echinochloa crusgalli), logarithmic spraying, and incorporation of the sprayed herbicides all in one operation.

In one study, initial control of barnyardgrass was achieved where light rains (0.63 and 0.57 inch) occurred 3 and 7 days after planting, and residual control occurred after one furrow irrigation 7 weeks after planting. Rates providing control were 2 to 16 lb./A.

Where no initial rainfall occurred, control utilizing only soil moisture was effected at 8 to 16 lb./A, and continued control existed at these rates after a .50 inch rainfall 3 weeks after planting.

In both tests, after additional moisture was provided, the developing adventitious roots on previously emerged barnyardgrass became severely clubbed upon entering the soil treated at 1 lb./A or more. Transferral of affected plants to fresh water permitted the less injured roots to elongate normally again. Thus, residual activity was indicated at these rates 2 months after planting in either instance.

No cotton injury was observed in either test.

In a pre-plant autumn experiment DCPA at rates of 4, 8, 16, and 32 lb./A was applied broadcast to soil which was then disked twice, listed, and irrigated on September 12. When planted 18 days later, cotton was not injured by any of the rates. Barnyardgrass control was excellent at all rates before planting cotton, but lack of grass emergence in check or treated plots prevented control observations after planting.

Air temperatures varied greatly during the investigations. Mean maximums varied from 76 to 92 degrees, while mean minimums varied from 50 to 58 degrees Fahrenheit. No great differences in response were evident despite these large temperature differences. (Cooperative investigations of the Department of Botany, University of California, Davis, and Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture)

Effect of growth-regulating herbicides on seed yield of four species of grass. Peabody, Dwight V. Jr. The principal objective of this test was to determine the effect of six different growth-regulating type herbicides (see table) on the seed yield of the following grass species: (1) orchardgrass (S-143), (2) timothy (Climax), (3) creeping bentgrass, (Seaside), and (4) creeping red fescue (Illahee). This experiment was located at the Northwestern Washington Experiment Station and is a continuation of that test which was reported in the 1960 Research Progress Report. Methods and materials were the same as in 1959, with the exception of an earlier treatment date - April 26, 1960. At this time creeping red fescue was in the boot stage of growth; the other three species were in "pre-boot" growth stages.

The 1960 seed yields are given in the table. Again in 1960 there are no significant statistical differences among the seed yields of orchardgrass, timothy and bentgrass due to herbicidal treatment. However, as in 1960, the seed yield of creeping red fescue was reduced by a significant amount when the plants were sprayed with silvex in early spring. This reduction was probably due to spraying at the susceptible boot stage of growth. (Northwestern Washington Experiment Station, Washington State University)

1960 seed yields of four grass varieties treated with six different growth-regulating herbicides.

TREATMENT		VARIETY OF GRASS			
Herbicide	Rate[1]	Orchard	Timothy	Bent	Fescue
		lb/A	lb/A	lb/A	lb/A
Silvex (ester)	2	300	505	262	326
2,4,5-T (ester)	2	447	482	267	543
MCPA (amine)	2	385	436	285	588
2,4-DB (amine)	2	409	501	243	520
2,4-D (acid)	2	407	511	266	611
2,4-D (amine)	2	455	497	235	555
No chemical treatment	-	407	428	259	639
	$\bar{x}$	401.3	480.2	259.6	540.1
	$SE_{\bar{x}}$	44.9	31.6	21.6	59.5
	CV	27%	16%	20%	27%

[1] Rate of application expressed in pounds parent acid per acre.

Evaluation of soil applications of herbicides for controlling weeds in safflower. McRae, G. N., Hamilton, K. C., and Arle, H. F. Three herbicides were applied to the soil prior to planting Gila safflower on January 22, 1960. Treatments included ethyl N,N-di-n-propylthiolcarbamate (EPTC) at 4, 6, and 8 lb./A, 3,6-endoxohexahydrophthalic acid (endothal) at 4 and 8 lb./A, and isopropyl N-(3-chlorophenyl)carbamate (CIPC) at 6 lb. /A. Herbicides were applied in 40 gpa of water. The plot area was harrowed with a disk twice to incorporate the herbicides into the top 3 inches of soil. Arivat barley at 85 lb. /A and Southern Giant Curl mustard at 15 lb. /A were planted to insure a uniform stand of "weedy" plants. Safflower was then planted in 40-inch rows and with a grain drill. Each herbicide treatment was replicated 3 times in both types of planting. Safflower was planted slightly below the soil surface and irrigated up. The test area was not cultivated after safflower was planted.

EPTC at 6 and 8 lb. /A and CIPC at 6 lb. /A were effective in controlling both barley and mustard for they resulted in 78, 90, and 98 percent control, respectively, in the row planting and 99, 100, and 100 percent control in the drill planting. EPTC at 4 lb. /A did not maintain effective weed control. Safflower growing in the EPTC-treated plots was not affected by the herbicide, whereas CIPC reduced crop stands by 20 percent. Endothal treatments did not control weeds and had no apparent effect on safflower. Safflower seed yield was not affected by herbicide treatments in the row planting. In the drill planting yields were 20 percent higher on plots treated with 6 and 8 lb. /A of EPTC than on those given other treatments. (Contribution by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Arizona Agricultural Experiment Station, cooperating.)

Effect of silvex on grain sorghum. Arle, H. F., McRae, G. N., and Hamilton, K. C. Because 2-(2,4,5-trichlorophenoxy)propionic acid (silvex) is less hazardous than 2,4-D to cotton, it has been used by farmers for controlling annual broadleaved weeds in grain sorghum. During 1960, an experiment was conducted at Mesa, Arizona to determine the effect of various rates of silvex applied as a directed, post-emergence spray on a grain sorghum (Var. RS610).

Silvex was applied on July 6 in sorghum with 5 to 7 leaves and approximately 12 inches tall. The directed spray covered the row middles but only the basal 2 to 3 inches of the sorghum plant. Silvex was applied at rates of 0.5, 1.0, 1.5, 2.0, and 2.5 lb. /A.

All silvex applications gave complete control of Tribulus terrestris and volunteer castor beans. Approximately 20 days after treatment all rates of silvex were retarding growth of fibrous roots and causing abnormal development of brace roots of sorghum. Brace roots were shorter and club-shaped and did not afford support for the sorghum plants. Some plants were blown over by the wind. The higher rates of silvex caused sorghum plants to be shorter, reduced head size, and delayed maturity.

All rates of silvex caused a reduction in the yields of grain. The plots treated with 0.5, 1.0, 1.5, 2.0, and 2.5 lb. /A of silvex yielded 89, 86, 84, and 83 percent of the untreated checks, respectively, which had a calculated average yield of 5,900 lb. /A. There was no significant difference between the yields of plots treated with 0.5 and 2.5 lb. /A of silvex.

The effect of silvex on the growth of sorghum has been recognized by growers. However, the loss caused by severe weed competition is much greater than that caused by silvex. (Contribution from the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Arizona Agricultural Experiment Station, cooperating.)

Weed control in sugar beets with preplant applications of EPTC and EPTC analogs. Antognini, J. and R. Curtis. EPTC and two of its analogs were applied in fifteen large scale field trials to compare their herbicidal activity and their selectivity on sugar beets. The identity of the compounds is as follows:

EPTC - ethyl di-n-propylthiolcarbamate
R-2060-ethyl ethyl-n-butylthiolcarbamate
R-2061-propyl ethyl-n-butylthiolcarbamate

In the majority of trials each material was applied at 2,4 and 8 lbs. per acre in 50 gallons of water per acre. In all trials the chemicals were incorporated into the soil immediately after application. Incorporation tools used were discs, spike tooth harrows, and various types of power driven rotary tillers. Solid treatments (overall coverage) were made where discs and harrows were used and band treatments were made where power driven tillers were used.

Data obtained from the trials included weed counts or weed control ratings, beet stand counts, beet growth and injury ratings, yield and sugar content of beets and bioassays during the season of the treated soil.

The stand of beets was not reduced by any rate of R-2060 and R-2061 and the only injury to beets with these two compounds was very slight early stunting at the 8 lb. rate. Beet stands with EPTC were not reduced with 2 lbs. per acre, slightly to moderately reduced with 4 lbs. per acre, and moderately to severely reduced with 8 lbs. per acre. Early growth of beets with EPTC was very slightly stunted with 2 lbs. per acre, slightly to moderately stunted with 4 lbs. per acre, and severely stunted with 8 lbs. per acre.

Yield and sugar contents were obtained from the R-2061 4 lb. per acre treatment in four trials. The data obtained showed that in all cases the yield of sugar per acre was increased over the checks.

Soil bioassays using oats from the 4 and 8 lb. rates of all chemicals showed that the 4 lb. rates would pose no chemical residual problem in relation to subsequent susceptible crops.

Grassy weeds such as watergrass, wild oats and foxtails, and broadleaves such as red-root pigweed, lamb's-quarters and purslane were controlled very satisfactorily by the 4 lb. rate of all chemicals. Annual grass control was fair to good with all chemicals at 2 lbs. per acre.

Considering the data from all of the trials the best treatment from the standpoint of weed control and lack of beet injury was R-2061 at 4 lbs. per acre.

All the field trial data obtained to date clearly show the importance of incorporating these chemicals into the soil immediately after application. It appears that discs and spike tooth harrows can be used satisfactorily where solid treatment is desired. Where band treatment is desired a Bye-Hoe is the best tool to use. When additional data are obtained it may be found that other types of power driven rotary tillers and perhaps even certain types of ground driven tillers may be effective.

Weed control in sugar beets. Anderson, W. P. and W. R. Furtick. The sugar beet is a high valued row crop in which it has been most difficult to find an herbicide for the selective control of grass and broadleaf weeds. The following results indicate that there may be chemicals available which can be used for this purpose but that timing and method of application are highly important factors in their ultimate effectiveness. These results represent the most promising leads obtained from research conducted at the Malheur Branch Experiment Station, Ontario, Oregon, during 1956, 1957, and 1958, for the control of weeds in sugar beets grown under conditions of furrow irrigation. The principal weeds present were watergrass, lamb's quarter, redroot pigweed, and hairy nightshade. Materials tested included TCA, DCU, EPTC, Endothal, CDAA, CDEC, M-6936, and SD4777.

In general, pre-planting treatments were the most effective with each of the above chemicals giving very good to excellent grass and broadleaf control. In all cases, some injury occurred to the sugar beets in the seedling stage but, in about six weeks, the beets had recovered and were essentially the same in growth and appearance as those not treated. Materials thus applied were sprayed directly on the soil surface and immediately incorporated in the upper two inch soil layer using Howry-Berg Spray Tillers. The sugar beets were then seeded into this treated soil layer at a depth of 3/4 inch. The operations of spraying, incorporation, and seeding were done as a single tandem operation from the same tractor. Although all of the materials applied pre-planting gave very promising results, they were most effective, with the least beet injury, applied at the following rate expressed in pounds per acre of active ingredient: TCA - 10, DCU - 10 to 20, EPTC - 2 (lowest rate tested), M-6936 - 6, CDAA - 6 & 8, endothal - 4 & 6, and SD4777 - 6 & 8.

Applied pre-emergence and at-emergence, the effectiveness of most of these herbicides was greatly reduced (DCU and CDEC not applied at these stages). However, several continued to show considerable promise. The most outstanding material applied early pre-emergence, i.e. one day after seeding, was TCA at rates of 10, 15, and 20 lbs./A, which gave excellent control of grass and broadleaf weeds but with some initial beet injury. Endothal and 6936 were slightly less effective in their control of grass weeds but excellent in controlling broadleaf weeds with, in the case of Endothal, no sugar beet injury. Applied just prior to emergence or at-emergence of the weeds and sugar beets, TCA at 10 to 20 lb./A and CDAA at 4 to 8 lbs./A, were outstanding in their control of grass weeds with essentially no injury to the sugar beets. The other materials were considerably less effective and none gave broadleaf control.

Based on these results, indications are that soil incorporated pre-planting treatments are potentially of greatest value in obtaining selective grass and broadleaf weed control in sugar beets with currently available herbicides. Endothal is a most promising selective broadleaf herbicide and, when applied as a soil surface spray after planting, must be applied within a day or two after seeding to be most effective. Excellent selective grass control can be obtained with pre-emergence or at-emergence applications of TCA or CDAA. Since none of the materials tested controlled both grass and broadleaf weeds when applied as a pre-emergence soil-surface-spray it would appear desirable to combine two such materials, e.g. endothal and TCA or CDAA, to be applied as a single application or as separate applications made at the most beneficial time. (Oregon Agricultural Experiment Station)

Comparisons of herbicides for prethinning weed control in sugar beets. Ross, Merrill and Fults, Jess L. In this study several chemicals were compared to determine which ones would most nearly control both broadleaved and annual grass weeds prior to thinning time. The ideal herbicide or combination of herbicides for use in sugar beets should control both broad-leaved weeds and annual grasses without injury to beets. Results from tests in 1957, 1958 and 1959 have indicated that endothal (3, 6-endoxohexahydrophthalic acid), EPTC (ethyl-N-N-dipropylthiolcarbamate) have given the most consistent pre-emergence general weed control (i.e., both broad-leaved plus annual grass weeds) in beets under Colorado conditions. During the 1960 season, endothal and EPTC were compared with several newer chemicals. These were selected from a long list of possibilities tested under greenhouse conditions in 1959. New chemicals field tested in 1960 were I (2, 3-dichloroallyl di-isopropyl-thiolcarbamate) @ 1 1/2 and 3 lbs./acre; barban (4-chloro-2-butynl N-(3-chlorophenyl) carbamate @ 1/2 and 1 lb./acre; L-13489 (diphenylacetonitnile) @ 8 and 16 lb./acre; II (0-(2, 4-dichlorophenyl)0-methyl isopropylphosphoroamidothioate) @ 10 and 20 lbs./acre and III (2, 3, 5, 6-tetrachloroterepthalic acid, dimethyl ester) @ 5 lbs./acre. All chemicals were applied pre-emergence at time of planting except barban which was used post-emergence on May 18 or 1 week before thinning. Date of planting and chemical application was April 7th. The I was incorporated with a rototiller, others were incorporated with Howrey-Berg tillers attached directly to the planter. Great Western Sugar Company monogerm beet seed was planted at 8 lbs./acre. Colorado 37 oats and common millet (Setaria italica) were broadcast over the whole test area at rates of 60 and 10 lbs./acre, respectively, to simulate an even stand of grass weeds. Twelve treatments were used in a randomized block design with eight replications of each treatment. Plots were four rows wide (20 inch rows) and 30 feet long. The center two rows were harvested October 15th for yield and sucrose data. Pre-thinning weed and beet counts were made on May 25. Counts were made in the two center rows of each plot in two strips 100 inches x 4 inches. The number of inches containing beets in each of these strips was also recorded. Beets were hand-thinned and blocked. Following thinning the II and III plots were discarded because at the rates used they were much too toxic to the beets. The test with barban indicated that it was a grass growth-retardant similar in action to dalapon (2, 2-dichloropropionic acid).

All data are summarized in the following table. It was noted that EPTC @ 1 1/2 lbs./acre gave the best general weed control. I @ 3 lbs./acre and endothal @ 6 lbs./acre were almost as effective. EPTC was the most effective chemical against broad-leaved weeds and was good against oats; Avadex at both 1 1/2 and 3 lbs./acre was excellent against oats. EPTC, endothal and L-13489 were all about equally good against millet (Setaria italica); Avadex @ 3 lbs./acre was nearly as good. Reductions in gross sucrose in tons per acre of p.2, 0.3, and 0.5 tons were observed for endothal, L-13489 (@ - 16 lbs./acre) and barban @ 1 lb./acre respectively. No reduction in gross sucrose occurred in the other treatments. (Colorado State University Experiment Station, Fort Collins, Colorado)

Weed control in sugar beets. 1960 Season. Bay Farm, Colorado State University Agricultural Experiment Station, Fort Collins, Colorado.

Treatment	Lbs/A	*Number of Beet inches	*Broad-leaved Weeds	*Oats	*Setaria	Yield Tons/A	Sucrose Percentage	Gross Sucrose Percentage (Tons/acre)	Percent Weed Control
Control		553	464	278	1394	21.4	15.9	3.4	0
A	1 1/2	634	92	36	657	21.9	15.9	3.5	63
A	3	552	118	6	305	21.0	16.0	3.4	80
Barban	1/2	585	145	287	1321	21.2	15.8	3.4	18
Barban	1	429	79	276	493	18.1	16.1	2.9	60
L-13489	8	499	298	441	428	21.7	16.0	3.4	45
L-13489	16	358	201	289	175	19.5	16.0	3.1	69
Endothal	6	460	139	192	183	20.0	16.0	3.2	76
EPTC	1 1/2	465	31	48	185	21.7	16.1	3.5	88

*Average per plot (consists of 100" of counts in each of the two center rows). 8 replications per treatment.

Progress report on cheatgrass control in wheat. Anderson, W. P. and Muzik, T. J. Cheatgrass or Downy Brome (Bromus tectorum) is a very serious weed in the dry land wheat farming areas of the Pacific Northwest. It is an annual grass whose life cycle closely corresponds with that of winter wheat. During the 1959-60 crop year, research plots were located at the Dry Land Experiment Station, Lind, and on the McGregor Ranch, Hooper. At each location, five materials, IPC, CIPC, endothal, simazine, and atrazine, were applied on eight different dates, extending from October, 1959 into April, 1960, and at several rates. At Lind, all treatments were applied to three wheat varieties, Burt, Omar, and Itana. Only Omar was seeded at Hooper.

Results have shown that all five materials are excellent cheatgrass herbicides but that only two, simazine and atrazine, have sufficient selectivity in wheat to warrant further testing.

At Lind, the best two treatments were simazine and atrazine applied at a rate of 3/4 lb/acre (active ingredient). Simazine gave best results when applied in the fall, October into December, and atrazine in February or early March. When applied in the fall atrazine killed the wheat. Simazine, applied later than December, gave no control of cheatgrass.

At Hooper, simazine and atrazine were also the best two treatments. However, twice as much simazine, 1 1/2 lbs/acre, was needed here as was necessary at Lind. From October into December appeared to be the best time to apply simazine. Applied later than this, simazine was ineffective. Atrazine gave best results applied in February at a rate of 3/4 lb/acre (active ingredient) and, in contrast to results at Lind, it also gave excellent control of cheatgrass when applied in the fall, with little or no wheat injury.

At Lind, about twenty chemicals were screened to determine their value for the selective control of cheatgrass in wheat. These materials were applied at two growth-stages, pre-emergence and early post-emergence, and at various dosages. Of those tested, three, N-5996, CDAA, and prometone, showed excellent potential for pre-emergence application. Four materials, N-5996, trietazine, atratone, and prometone, gave excellent results when applied post-emergence. Before their value can be fully determined, these chemicals must be tested under varied conditions in replicated trials.

Limited testing was conducted this past year on the chemical control of cheatgrass and volunteer wheat in fallow land. Perhaps the most promising of the materials tested was atrazine. The combination of amitrol and 2,4-D ester controlled winter germinating annual weeds and volunteer wheat. Applied in the fall, this combination did not control Spring germinating weeds.

In the use of the triazine herbicides, such as atrazine, the question of active soil residual life is an important one. At Hooper, indications are that this material is present in the upper soil level one year after application. Fall germinating cheatgrass and volunteer wheat appear to be controlled, indicating that fallow land weed control may be obtained with this chemical from applications made for selective control in wheat during the previous crop year. (Washington State University Agricultural Experiment Station)

Chemical control of sandbur. Anderson, W. P. and Furtick, W. R. Sandbur, Cenchrus pauciflorus, is a common annual grass weed in the Hermiston, Oregon, area. Its seed burs, when encountered, are an uncomfortable nuisance to man and animals. In 1958, limited greenhouse and field experiments were conducted at Oregon State College and at the Umatilla Branch Experiment Station to study the use of herbicides to control this weed.

Results of these experiments indicate that sandbur is readily controlled by many of the common grass herbicides when applied pre- or at- emergence. Under greenhouse conditions, all materials tested gave excellent control of sandbur when applied at these times as an aqueous spray. These materials and their respective rates were: CDAA, CIPC, and EPTC at 4, 6, and 8 lbs/A, TCA at 10, 15, and 20 lbs/A, and Simazine at 1, 2, and 3 lbs/A. Applied early post-emergence, Amitrole also gave excellent control at rates of 4, 6, and 8 lbs/A.

In field experiments, applied pre-emergence, TCA at 10, 15, and 20 lbs/A, EPTC at 4, 6, and 8 lbs/A, and CDAA at 6 and 8 lbs/A gave excellent control of sandbur. Applied at-emergence, excellent control was obtained with atrazine and simazine at rates of 1, 2, and 3 lbs/A, CDAA, CDAA "T", and dalapon at 4 and 6 lbs/A, and with 2,4-D dimethylamine at 2 lbs/A, acid equivalent. Except for CDAA, these materials were not applied pre-emergence but they would be expected to be equally effective applied in this manner.

Where sandbur is a problem along ditchbanks and other non-cropped areas, any of the effective herbicides may be utilized for its control. In a crop rotation system where sandbur is a serious problem, corn is an appropriate crop in which to utilize these herbicides since it is resistant to most of them. Under a rotation system, it is feasible for all infested fields to be treated during the corn crop year. In badly infested fields, it may be desirable to grow corn two years in succession with an appropriate herbicide applied each year. (Oregon Agricultural Experiment Station)

Effects of soil residues of monuron and diuron on barley. Arle, H. F., Hamilton, K. C., and McRae, G. N. 3-(p-chlorophenyl)-1, 1-dimethylurea (monuron) and 3-(3,4-dichlorophenyl)-1, 1-dimethylurea (diuron) are being used by many farmers to control annual weeds in cotton. This practice has frequently limited the crops which can be grown immediately following cotton.

Monuron was applied to a silty clay loam at rates of 0.03, 0.06, and 0.09 lb/A and diuron at rates 0.03 and 0.06 lb/A to determine the effects of these herbicide residues on Arivat barley. Immediately after the application the treated area was disked to mix the herbicides into the top 4 inches of soil. The area was then flood-irrigated. Arivat barley was planted 3 weeks later.

Neither herbicide had any apparent effect on germination, seedling growth, or development of the barley. However, grain yields obtained from plots treated with 0.09 lb/A of monuron and 0.03 and 0.06 lb/A of diuron were 86, 83, and 76 percent, respectively, of the yields of the untreated checks. Where barley is grown under flood irrigation as little as 0.06 or 0.09 lb/A of urea herbicides remaining in the soil may affect grain yields. (Contribution by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Arizona Agricultural Experiment Station, cooperating.)

Persistence of diuron, fenuron, and monuron in a Cajon silty clay loam. McRae, G. N., Arle, H. F., and Hamilton, K. C. A biological study was made to determine the presence of 3-(3,4-dichlorophenyl)-1, 1-dimethylurea (diuron), 3-phenyl-1, 1-dimethylurea (fenuron), and 3-(p-chlorophenyl)-1, 1-dimethylurea (monuron) in a Cajon silty clay loam. The soil was obtained from a study area on which cotton has been grown for the past 6 years. One and 2 lb/A of the herbicides have been applied each year to the same plots. Treated plots have received a total of 6 or 12 lb/A. The plots were last treated in July, 1959, at cotton layby, and soil samples to a depth of 3 inches were taken prior to re-treatment in June, 1960. For each herbicide treatment a composite soil sample was made from the 4 replications. The composite samples were placed in 18 x 18 x 4-inch flats and single rows of Moapa alfalfa, Marketer cucumber, Markton oats, RS 610 sorghum, and Earlie Prolific Straight Neck squash were planted in each flat. The plantings were replicated twice. The greenhouse plantings were made July 11. The stand and green weight of crops 34 days after planting are shown in the following table.

Treatment		Crop response[1]	
Herbicide	Annual application lb/A	Stand	Green weight
Diuron	2	60	22
Fenuron	2	77	36
Monuron	2	92	70
Diuron	1	92	87
Fenuron	1	102	95
Monuron	1	109	103
Untreated check		100	100*

[1]Crop response ratings are given as percentages of untreated checks.
*Green weight of untreated checks was 686 grams.

The responses of the five crops to soil residues were very similar. Crop plants were affected by herbicide residues in the soil treated with the 2 lb/A applications. Diuron had more effect than fenuron on crop stands and green weight, whereas monuron had much less effect than diuron or fenuron. Although the toxicity of these urea herbicides in the field usually disappears in a 12-month period, these data suggest crop injury by the 2 lb/A applications where these herbicides have been applied over a period of 6 years. (Contribution by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Arizona Agricultural Experiment Station, cooperating.)

PROJECT 7. AQUATIC AND DITCHBANK WEEDS

R. R. Yeo, Project Chairman

SUMMARY

Four abstracts concerning aquatic weeds and one abstract involving a ditchbank weed were submitted. Two reports included the results of research on common cattail in Wyoming and Montana. Researchers in Wyoming observing plots in 1960 found that late applications of dalapon at 20 lb./A applied in 1958 and retreated in 1959 were more effective than early applications made during the same years. Amitrole at 12 lb./A was more effective with late applications when similarly applied. 2,4-D at 6 lb./A was equally effective when applied early in 1958 and retreated twice in 1959.

In Montana applications of dalapon at 10, 20 and 30 lb./A, amitrole at 5, 10, and 20 lb./A and erbon at 20, 40 and 80 lb./A made on cattails before formation of the inflorescence, in 1959 and observed in 1960, were found to be less effective than applications made after formation of the inflorescence. The highest rate of each herbicide gave the best control. Applications of 2,4-D at 4 lb./A in the spring and retreated in the fall was least effective.

A uniform regional experiment on sago pondweed growing in irrigation systems was conducted in Wyoming and Montana. Different rates of a new anionic-nonionic blend emulsifier added to xylol and compared with a single rate of a nonionic emulsifier were investigated. One and 2 percents of the anionic-nonionic blend emulsifier were equal to, or more effective, than the nonionic emulsifier at 2 percent.

Granular preparations of two formulations of esters of 2,4-D at 20 lb./A, one ester formulation of silvex at 20 lb./A and monuron TCA at 30 lb./A gave 85% control or better of watercress when applied before the watercress had emerged. Foliar applications of amitrole at 4 lb./A and amitrole plus either the sodium salt of MCPA or dimethylamine salt of 2,4-D at 2 plus 2 lb./A gave 85% or better control of watercress.

A large number of herbicides and herbicidal combinations at several rates were screened to determine those treatments which would give an immediate kill and would control fireweed for two years. Only simazine plus prometone at 2 plus 6 lb./A, and prometone at 10 and 15 lb./A gave a rapid kill and controlled fireweed for two seasons.

Improved control of sago pondweed (Potamogeton pectinatus L.) using a new emulsifier with xylol. Yeo, R. R., Comes R. D., and Timmons, F. L. Extensive laboratory testing has shown a new emulsifier (Emcol AD-410) to be superior in stabilizing xylol-water emulsions. It is a blend of anionic-nonionic types, whereas previously used emulsifiers have been of the nonionic type. In the laboratory a rate of 1% of the new emulsifier has given greater stability of xylol-water emulsions than 2%. The objectives of the regional tests described herein are to determine the extent of control of sago pondweed using different rates of the new emulsifier in xylol, and to compare each to a nonionic emulsifier in xylol. Seven treatments were applied to six canals in Montana and one in Wyoming. All were infested with sago pondweed. A rate of 10 gal./cfs of xylol was used with each treatment. The emulsifiers and rates used were as follows: The new emulsifer--1% (2 canals), 2% (3 canals), and 3% (1 canal), and a polyethylene glycol-type emulsifier--2% (1 canal). The tabulation below shows the treatment and result data. Satisfactory control consisted of at least 85% sloughing of dead foliage from stems. The sago pondweed was 2 to 4 feet long when treated.

Results: One percent of the new emulsifier gave control over the entire length of the pondweed infestation, 4 1/2 and 3 miles in two canals. The 2% rate was effective over a distance of 3 miles in the Wyoming canal and 4 miles on one Montana canal. On the Hammond canal in Montana, control occurred over a shorter distance. This was attributed to the samll amount of water flowing in the canal at the time of treatment. Half the normal flow of water at the time of treatment probably would have been more satisfactory. A rate of 3% of the new emulsifier gave control over a short distance. This was attributed to the anionic portion of the anionic-nonionic blend being increased with a 3% rate to the extent of having an antagonistic effect on the stability of the emulsion rather than a synergistic effect, which apparently results with lesser amounts of the blend. The polyethylene glycol type emulsifier at 2% was effective for 3 miles, slightly less than the overall infested area. Both 1% and 2% rates of the new emulsifier resulted in control of sago pondweed over equal or longer distances than the nonionic emulsifier at 2%. (Contributed by Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, the Huntley Branch Station of the Montana Agricultural Experiment Station, and the Wyoming Agricultural Experiment Station, cooperating.)

RESULTS OF 1960 TREATMENTS FOR CONTROL OF SAGO PONDWEED IN IRRIGATION CANALS

Name of canal	Date of application	Chemical applied	Rate of chemical applied (gal/cfs)	Total amount of chemical applied (gals)	Time chemical applied in water (min.)	Ditch flow normal (cfs)	Ditch flow treated (cfs)	Miles of canal infested with weeds	Miles of satisfactory control of foliage
Upper Lockwood Billings, Mont.	7-25	Xylene plus new emulsifier (anionic-nonionic)	10 + 1%	100	60	20	10	4 1/2	4 1/2
Lateral "O" Huntley, Montana	8-2	Xylene plus new emulsifier (anionic-nonionic)	10 + 1%	70	60	15	7	3	
Hammond Forsyth, Montana	7-20	Xylene plus new emulsifier (anionic-nonionic)	10 + 2%	50	47	20	5	5	2 1/2
Coulsen Billings, Montana	7-28	Xylene plus new emulsifier (anionic-nonionic)	10 + 2%	100	60	20	10	4	4
Lyons Valley Lander, Wyo.	7-16	Xylene plus new emulsifier (anionic-nonionic)	10 + 2%	100	55	30	10	5	3
Dog Race Drain Billings, Montana	7-25	Xylene plus new emulsifier (anionic-nonionic)	10 + 3%	43	35	6-8	4	1 1/2	3/4
Lower Lockwood Billings, Montana	7-25	Xylene plus new emulsifier Polyethylene glycol type (nonionic)	10 + 2%	100	46	10	5	3 1/2	3

Chemical control of common cattail. Timmons, F. L. and Comes, R. D. Previous experiments in Wyoming have shown 3-amino-1, 2, 4-triazole (amitrole), 2, 2-dichloropropionic acid (dalapon), and ester formulations of 2, 4-dichlorophenoxy acetic acid (2, 4-D) to be the most effective herbicides for control of common cattail (Typha latifolia L.). An experiment designed to test the effect of treatment date with amitrole at 12 lb. /A and dalapon at 20 lb. /A was begun in 1958. The most effective rate and date of applying 2, 4-D had been established in previous experiments and this treatment was included as a check on the degree of control that could be obtained with 2, 4-D. Diesel oil at 10 gpa and an emulsifier at 0.4 gpa was added to the 2, 4-D solutions and at 5 gpa and 0.2 gpa, respectively, to all dalapon solutions. Diesel oil and emulsifier were added because they had previously been necessary for best results in controlling cattail. All sprays were applied in a total volume of 240 gpa with a constant-pressure knapsack sprayer equipped with a single-nozzle boom and used as a wand. All treatments were replicated three times on 16 x 21-foot plots arranged end to end in a drain canal.

Final results, taken July 7, 1960, show that dates of applying amitrole and dalapon are very critical. Amitrole applied at 12 lb. /A on August 29, 1958, and again September 2, 1959, controlled 97 percent of the cattail, whereas the same treatment applied July 31, 1958, and again August 1, 1959, gave 89 percent control. The earlier dates, however, were more effective for dalapon. Dalapon applied at 20 lb. /A on the earlier dates controlled 99+ percent of the cattail and at the later dates only 66 percent. On July 31, 1958, the seed bearing female catkins were full size, and there was some natural yellowing of the leaves from maturity. On August 29, 1958, seed bearing female catkins were fully mature, and there was considerable yellowing of the leaves from maturity.

Applications of butoxyethanol ester of 2, 4-D at 6 lb. /A on June 19 and August 29, 1958, and again on July 9 and September 2, 1959, controlled 99+ percent of the cattail. The cattail was 1 to 6 feet tall, and the spikes were in the boot-to-just-emerged stage on June 19. (Contributed by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and Wyoming Agricultural Experiment Station, cooperating.)

Control of cattail (Typha latifolia L.) with applications of herbicides before and after formation of the inflorescence: Trial II. Yeo, R. R. Four herbicides were applied in 1959 to cattails in two stages of growth. The herbicides included 2, 2-dichloropropionic acid (dalapon) at 10, 20, and 30 lb. /A, 3-amino-1, 2, 4-triazole (amitrole) at 5, 10 and 20 lb. /A, 2-(2, 4, 5-trichlorophenoxy)ethyl 2, 2-dichloropropionate (erbon) at 20, 40 and 80 lb. /A, and the butoxyethanol ester of 2, 4-dichlorophenoxyacetic acid (2, 4-D) in oil at 5 lb. /A in 4 gallons of diesel oil. The first applications were made June 12 before the flower stalks had formed. The second applications were made July 17 after the inflorescence had formed and pollination was complete. Four percent of a nonionic emulsifier was added to the 2, 4-D--oil combination. Water was then added to the mixture in an amount equivalent to make 200 gallons of spray solution per acre. The 2, 4-D treatments were repeated on August 25, 1959. Each treatment was replicated three times. Stand counts were made in August of 1959 and in July of 1960 on 10% of the treated area of each plot. This is the second trial of this type; the first trial was reported in the 1960 Progress Report.

Results: In the table below the stand counts made in 1959 indicate that dalapon at 30 lb. /A gave satisfactory control when applied either before or after formation of the inflorescence. Erbon was most effective when applied after formation of the inflorescence. In 1960 stand counts none of the treatments made before formation of the inflorescence showed satisfactory results. However, the control resulting from treatments made after formation of the inflorescence carried over into the second year. The sodium salt of dalapon at 30 lb. /A, amitrole at 20 lb. /A, and erbon at 40 and 80 lb. /A gave satisfactory control of the cattail. Lighter rates of dalapon, amitrole and erbon gave fair control but both 2,4-D treatments resulted in poor control. In general, applications of dalapon, amitrole and erbon were more effective in controlling cattails the second year when applied after formation of the inflorescence both in Trial I (1958) and in Trial II (1959). (Contributed by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture and Huntley Branch Station of the Montana Agricultural Experiment Station, cooperating.)

Treatment		Stage of development of infloresence			
		Before formation		After formation	
	Rate	1959	1960	1959	1960
Material	(lb/A)	count	count	count	count
Sodium salt of dalapon	10	8.0	27.7	7.3	10.7
	20	3.7	35.3	5.0	3.8
	30	1.3	17.7	0.3	0.3
Amitrole	5	16.3	27.7	54.3	5.3
	10	11.3	23.0	52.3	3.7
	20	7.7	12.7	48.0	1.3
Erbon	20	16.7	7.0	12.7	2.7
	40	8.3	30.0	2.0	1.7
	80	3.3	25.7	0.0	1.0
Butoxyethanol ester of 2,4-D	4	11.7	20.0	11.3	9.3
Check		29.7	28.7	77.0	35.7
LSD at 5% level		7.0	N.S.	15.8	2.14

Control of watercress (Nasturtium officinale R. Br.) with pre-emergent and foliar applications of herbicides. Yeo, R. R. Several granulated herbicides and sprays were applied April 30 to an exposed ditchbottom previously infested with watercress, and to the foliage of watercress that had emerged up to 1 1/2 feet from the water surface on August 30. Each treatment was replicated 3 times.

Observations of the control of watercress with pre-emergent applications were made on August 22 and the foliar applications on October 20. Pre-emergent applications giving 85% or better control of watercress were polyethylene glycol butyl ether (PGBE) and butoxyethanol esters of 2,4-dichlorophenoxyacetic acid (2,4-D), both 20% granular, at 20 and 40 lb. /A, PGBE ester of 2-(2,4,5-trichlorophenoxy)propionic acid (silvex), 20% granular, at 20 and 40 lb. /A, and 3-(p-chlorophenyl)-1, 1-dimethylurea trichloroacetate (monuron TCA), 11% granular, at 30 and 60 lb. /A. Treatments not effective were 2-chloro-4-ethylamine-6-isopropylamine-s-triazine (atrazine), 4% granular, and 2-chloro-4,6 bis(ethylamine)-s-triazine (simazine), 4% granular, at 20 lb. /A. Foliar applications controlling 85% or better of the stand of watercress were 3-amino-1,2,4-triazole (amitrole) at 4 lb. /A, amitrole plus the sodium salt of 2-methyl-4-chlorophenoxyacetic acid (MCPA) at 2 plus 2 lb. /A, and amitrole plus the dimethylamine salt of 2, 4-D at 2 plus 2 lb. /A. The sodium salt of MCPA and the dimethylamine salt of 2, 4-D each at 2 lb. /A were not effective. (Contributed by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Huntley Branch Station of the Montana Agricultural Experiment Station, cooperating.)

Control of fireweed (Kochia scoparia L.) Schrad) on ditchbanks. Yeo, R. R. Occasionally irrigation projects do not have adequate equipment to spray all existing ditchbanks infested with fireweed and other annuals during one year. The objective of the trials reported here was to find one or more treatments that would control fireweed for 2 years and thus allow a spray applicator to obtain control on twice the area usually sprayed. From June 2 to 5, 1959, three trials were made: Trial I concerned combinations of 2-chloro-4, 6-bis(ethylamino)-s-triazine (simazine) with other herbicides; Trial II involved different formulations and derivatives of the phenoxyacetic acids; and Trial III was composed of various other herbicides, and included burning with a propane burner. The fireweed was 3 to 5 inches tall when treated. Each treatment was replicated three times. Stand counts were made at different times on 10% of the treated area of each plot: (1) after 1 month to determine the immediate effect on the fireweed; (2) after 3 months to determine the extent of control the first season; and (3) after 12 months to determine the degree of control the second year.

Results: In Trial I (see table below) all treatments of simazine plus 3-amino-1, 2, 4-triazole (amitrole) and the simazine combination with 6 lb. /A of 2-methoxy-4, 6-bis(isopropylamino)-s-triazine (prometone) gave a rapid foliage burn. All treatments except simazine at 2 and 4 lb. /A gave satisfactory control by the end of the season. During the next year all treatments except simazine plus amitrole at 2 plus 6 lb. /A gave entirely satisfactory control of the fireweed and this treatment gave more than 90 percent control as compared to the check.

In Trial II, a formulation of 2, 4, 5-T plus 2, 4-D (Forron) gave a rapid topkill. After 3 months, all the butoxyethanol ester formulated herbicides, a formulation of 2, 4, 5-T plus 2, 4-D (Forron), and the dimethylamine salt of 2, 4-D gave satisfactory control. None of these treatments gave satisfactory control the second year.

In Trial III, prometone at 10 and 15 lb. /A, 3-(p-chlorophenyl)-1, 1-dimethylurea trichloroacetate (monuron TCA) at 5, 10 and 15 lb. /A, and a heavy burn gave severe contact effects. In addition to these chemicals being effective after 3 months, the sodium salt of 2, 3, 6-trichlorophenylacetic acid (fenac) and 2, 3, 6-trichlorobenzoic acid (2, 3, 6-TBA) also controlled the fireweed. Prometone at 10 and 15 lb. /A was the only herbicide to give a rapid foliage kill and control the fireweed the second year. The 5 lb. /A rate of prometone was also effective. All rates of the imide and sodium salts of fenac and sodium salt of 2, 3, 6-TBA, except the 2 lb. /A, gave good control of the fireweed through the second year. (Contributed by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Huntley Branch Station of the Montana Agricultural Experiment Station, cooperating.)

Treatment Material	Rate (lb/A)	Stand Count 1 month	3 months	12 months
		Trial I		
Simazine	2	62	16	3
"	4	61	7	0
"	6	32	4	0
Simazine + amitrol	2 + 6	2	2	6
" "	4 + 4	0	2	3
" "	6 + 2	2	3	2
Simazine + sodium salt of 2, 3, 6-TBA	2 + 6	3	1	0
" "	4 + 4	16	1	0
" "	6 + 2	16	2	0
Simazine + sodium salt of fenac	2 + 6	11	1	0
" "	4 + 4	17	3	0
" "	6 + 2	7	0	1
Simazine + prometone	2 + 6	0	1	0
" "	4 + 4	4	1	0
" "	6 + 2	4	1	1
Check		103	35	99
LSD at the 5% level		24	7	20
		Trial II		
Dimethylamine salt of 2, 4-D	2	3	3	12
Butoxyethanol ester of 2, 4-D	2	6	1	45
Solublized acid of 2, 4-D	2	27	3	50
Oso-octyl ester of 2, 4-D, (10% granular)	10	33	11	52
Butoxyethanol ester of 2, 4, 5-T	2	8	3	79
Formulation of 2, 4, 5-T (Forron)	2	3	9	51
Butoxyethanol esters of 2, 4, 5-T + 2, 4-D	1 + 1	6	2	67
Formulation of 2, 4, 5-T + 2, 4-D (Forron)	1 + 1	0	2	30
Diethylamine salt of 4-(2, 4-DB)	2	101	11	48
Butoxyethanol ester of 4-(2, 4-DB)	2	10	2	57
Sodium salt of MCPA	2	97	11	21
Butoxyethanol ester of silvex	2	4	3	23
Check		143	37	143
LSD at the 5% level		31	9	28

Trial III

Erbon	20	104	14	95
"	40	93	13	50
"	60	81	18	76
Dalapon + butoxyethanol ester 2,4-D	10 + 1	144	22	116
" "	15 + 1	115	7	85
" "	20 + 1	84	10	10
Amitrole	1	140	15	111
"	2	109	29	162
"	3	50	14	78
Amitrole + ammonium thio-cyanate	1 + 1	133	11	118
" "	2 + 2	104	44	126
" "	3 + 3	76	14	144
Sodium salt of 2,3,6-TBA	2	102	8	10
" "	4	69	9	0
" "	8	64	3	0
Imide salt of fenac	2	70	8	2
" "	4	83	37	0
" "	8	4	30	0
Sodium salt of fenac	2	128	32	2
" "	4	74	19	0
" "	8	57	3	0
Diester of dalapon + PGBE of silvex	4 + 1/2	87	28	192
" "	8 + 1	21	15	119
" "	12 + 1 1/2	12	9	153
Prometone	5	8	4	1
"	10	0	0	0
"	15	0	0	1
Monuron TCA	5	3	3	28
"	10	0	2	14
"	15	0	0	7
Heavy burn (with propane)		1	1	85
Check		227	60	125
LSD at the 5% level		74	23	135

<u>Evaluation of soil-applied herbicides for control of aquatic weeds in irrigation canals.</u> Frank, P. A. Soil applications of herbicides for the control of aquatic weeds in irrigation canals have not been successful. Herbicides tested to date have shown little or no activity on aquatic weeds when applied in this manner. To aid the search for more active compounds, a method was developed for evaluating the activities of herbicides and experimental chemicals. The evaluation tests require a minimum of time and materials and can be conducted in a greenhouse.

Approximately 50 herbicides and experimental compounds were evaluated. The majority of the compounds showed no activity when tested at rates of 5 and 20 lb./A. Herbicides showing the most promise were fenac (2,3,6-trichlorophenylacetic acid), fenac amide (2,3,6-trichlorophenylacetamide), and silvex (2-(2,4,5-trichlorophenoxy)propionic acid). The results indicate that the first two compounds may control aquatic weeds at application rates of 5 to 20 lb./A. (Contributed by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and Division of Engineering Laboratories, Bureau of Reclamation, cooperating.)

PROJECT 8. CHEMICAL AND PHYSIOLOGICAL STUDIES

V. Freed, Project Chairman

SUMMARY

The increasing interest in the application of chemical and physiological studies to weed control is very apparent in the number and range of subject matter of abstracts submitted to this section this year. The abstracts run the gamut from studies on the physiology of translocation in brushy plants to the biochemistry of metabolism of triazine herbicides by plant extracts. There is also evidence of a continued effort toward the elucidation of the basic principles involved in soil behavior of herbicides. All of this points up the recognition of the usefulness of such data in achieving more effective results in practical weed control.

The loss of CIPC from soil by evaporation. Montgomery, M. and Freed, V. H. Although the vapor pressure of CIPC is comparatively low, it has been felt that some of the variable results obtained with this chemical is due to its loss from soil by evaporation. In order to evaluate the role of vaporization and co-distillation as means of loss of this chemical from soil, the rate of disappearance of CIPC from soil was measured. This was done under conditions such that the principle mode of loss was by vapor escape.

CIPC was thoroughly mixed with Chehalis sandy soil and the concentration of chemical at the start of the experiment determined by extracting the chemical from the soil with ether and applying the colorimetric method for the chemical which has been described previously. The soil-chemical mixture was then placed in shallow containers and allowed to stand for 16 hours and the amount of chemical lost at the end of this time determined. Comparisons were made between the rate of loss in dry and moist soil and the influence of air movement and temperature on this rate of loss. The following table presents the results thus obtained.

Percent Loss of CIPC from Soil in 16 Hours
(T = 24° C)

Soil Condition	Type	Air Movement	% Loss
Dry	Loam	no	6.0
Dry	Sandy	no	9.3
Wet	Loam	no	8.8
Wet	Sandy	no	10.0
Wet	Loam	yes	25.7
Wet	Sandy	yes	33.7

The trend in rate of loss of chemical from soil follows a pattern that would be predicted from application of known chemical loss. These data are in further confirmation of the validity of the physical loss in describing herbicide behavior. (Department of Agricultural Chemistry, Oregon Agricultural Experiment Station.)

Vapor losses of EPTC from soil. Vernetti, J. and Freed, V. H. In the use of EPTC for weed control, it has been found that substantially better results are obtained by incorporating the chemical into the soil. These better results are attributed to the fact that the chemical being quite volatile is lost in a surface application. Similarly, it has been found that application to a moist soil under conditions of high evaporation rates results in poorer control of the weeds. In order to study the vapor losses of EPTC from soil in more quantitative manner, the experiments reported on here were undertaken.

Chehalis sandy soil containing 3-1/2 to 6 p.p.m. EPTC was thoroughly mixed in a rotary blendor. Samples of the soil were withdrawn and analyses performed to determine EPTC concentration in soil. The analyses for initial concentration and final concentration was conducted by steam distillation of the soil sample using a modified essential oil determination apparatus. The chemical, trapped in petroleum ether was then determined by means of gas chromatography.

It was postulated that the rate of loss of EPTC could be reduced by dissolving the chemical in a nonvolatile solvent. This is an application of Raoult's law which states that the reduction in vapor pressure is a function of the reduction of the mole fraction of the chemical in question. Comparisons were made between the rate of loss of EPTC in wet and dry soil and the EPTC dissolved in oil. To compare results of EPTC with a higher boiling analog Stauffer 2061 (propyl, ethyl, n-butyl thiolcarbamate) was chosen. The same conditions and procedures were used in obtaining the comparison results. The data included in the table show that the 2061 vapor losses are smaller as to be expected.

% of Original Concentration of
Chemical Lost from Soil in 24 Hrs.

	Dry soil	Moist soil	B.P. at 20 mm. Hg
EPTC	18.3	33.4	127.0° C
2061	16.6	24.8	142.5° C
EPTC + oil 2.3 mg/mg EPTC	5.6	23.4	
2061 + oil 1.73 mg/mg 2061	4.9	15.3	

All determinations were made in triplicate. (Department of Agricultural Chemistry, Oregon Agricultural Experiment Station.)

Determination of 2-(2,4,5-trichlorophenoxy) propionic acid in bigleaf maple by means of bioassay. Newton, Michael. The presence of 2-(2,4,5-trichlorophenoxy) propionic acid, 2-(2,4,5-TP) in woody plant tissue may be detected with the use of bioassay methods.

Radish seedlings with radicles of uniform length, (or 2 mm length, or 40 hours germinating time @ 70° F) respond in a uniform manner to known concentrations of 2-(2,4,5-TP) in water. A similar response was also noted when the seedlings were placed on ground samples of wood or phloem tissue from basally sprayed bigleaf maple trees, Acer macrophyllum pursh. The samples were incubated for 48 hours at 70° F.

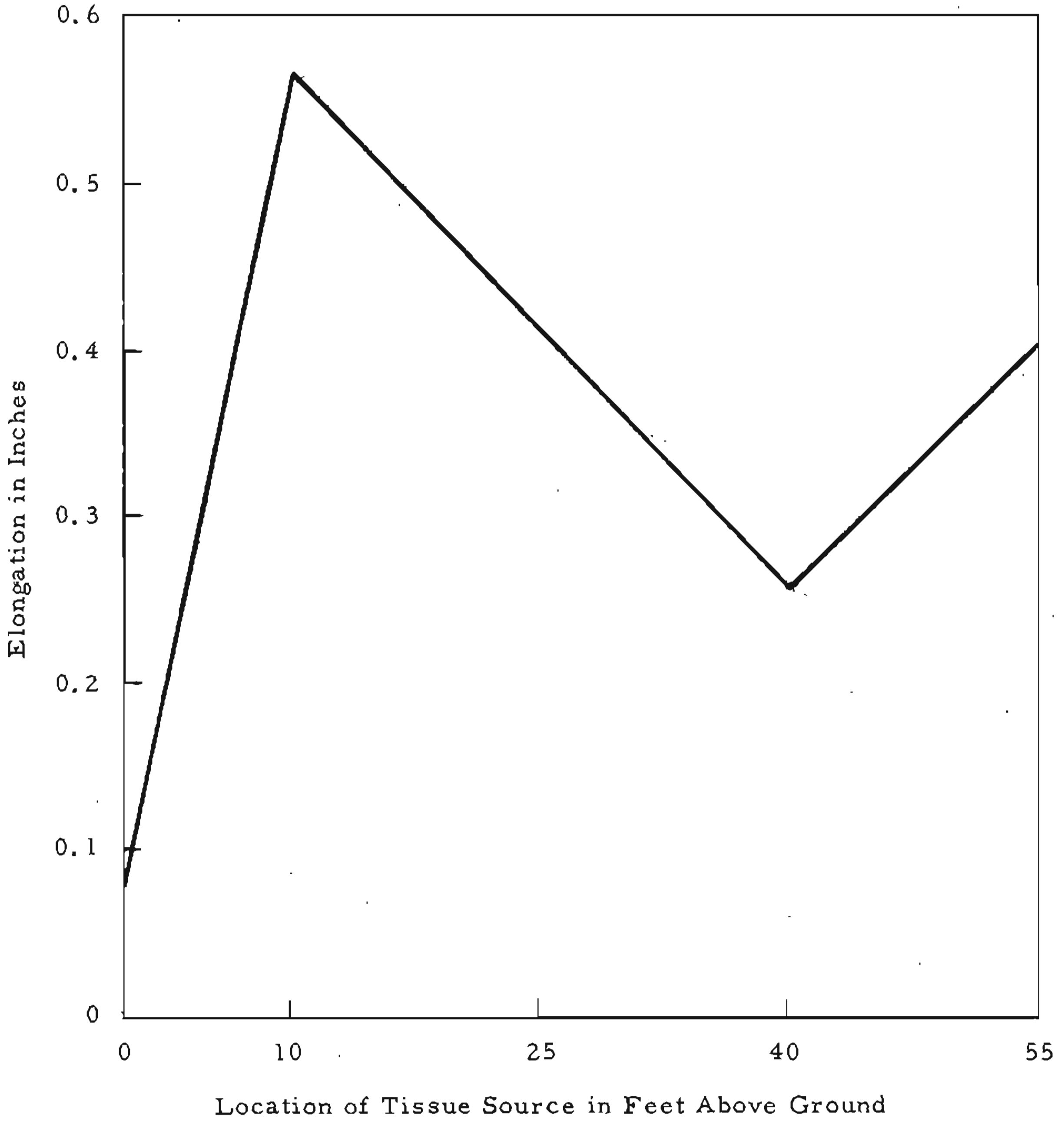
The degree of elongation inhibition was observed as an indication of available 2-(2,4,5-TP) acid. Controls for this method were not sufficiently accurate to determine the precise amount of acid present, for an unknown portion of the material was in the adsorbed state and not available to the seedlings.

However, variation in the amount of available acid was evidence in tests on bigleaf maple tissue taken from points ranging from ground level to 55 feet. Elongation at the ground level, (treatment area) was negligible, indicating a high acid concentration. At 10 feet above ground, the inhibition was negligible.

Progressing further up the stem, concentration apparently increased to a peak at the 40' level. Above 40' there was too much variation to draw any consistent conclusions except that some acid was present. There was no measurable difference between the concentrations measured in sapwood and phloem.

These tests indicate (1) that variations in translocated herbicides may be detected with the bioassay method; (2) that measurable and toxic quantities of herbicide are translocated away from the treatment area of basally sprayed trees; and (3) suggests that the effect of basal sprays is indeed systemic in nature. (School of Forestry, Oregon State College.)

Elongation of Radish Radicles in Inches
Samples Taken From Phloem and Sapwood of Mature Bigleaf Maple Trees
Basally Sprayed With 2-(2, 4, 5-TP)



A new method for studying herbicide metabolism. Kief, Mabel. A new method has been developef for studying plant metabolism of various herbicides. The method involves use of the herbicides in question as the substrate for a soluble enzyme preparation. The action of the enzyme on the herbicide is followed by means of a dye which is colored in its reduced state. The dye acts as the ultimate electron acceptor and enables the experimenter to follow the reaction spectrophotometrically.

In this laboratory the enzyme preparation used is a fatty acid oxidizing system and is used for studying the metabolism of 2, 4-DB.

In addition to studying reaction rates, concentration effects and temperature effects, it is possible to isolate various intermediates from the reaction mixture via paper chromatography. Metabolism of 2, 4-DB has produced at least two C_1^{14} labeled intermediates neither of which has been positively identified. (Department of Agricultural Chemistry, Oregon Agricultural Experiment Station.)

Deposition of 2, 4-DB in mammalian tissue. Kief, M. and Freed, V. H. In order to determine the levels of chemical which might be deposited in the animal body, varying concentrations of C^{14} labeled 2, 4-D and 2, 4-DB were fed to 10 rats via their drinking water.

The animals were sacrificed by CO_2 suffocation and tissue samples removed and placed in chloroform. Tissues examined were fat because of interest in milk and butterfat, liver, as the site of fatty acid metabolism and muscle, kidney, and heart, from general interest.

The tissues were extracted with chloroform for at least 24 hours. Both aliquots of the solutions and the extracted tissue were examined for radioactivity.

A high level of activity was found in both the liver and the fatty tissue of the animals fed 2, 4-DB.

Of the animals fed 2, 4-D, only on a long-term feeding trial was any chemical deposited and then only a small amount in the liver.

These data led the experimenters to conclude that 2, 4-D is not deposited in mammalian tissue and that the activity in the bodies of animals fed 2, 4-DB is probably in the form of some metabolic intermediate rather than 2, 4-DB per se. (Department of Agricultural Chemistry, Oregon Agricultural Experiment Station.)

Volume, season, and amount of active chemical as variables in basal spraying of bigleaf maple. Newton, Michael. Bigleaf maple. Acer macrophyllum pursh. has been treated with basal sprays of 2-(2, 4, 5 trichlorophenoxy) propionic acid with highly satisfactory results. In order to determine the minimum expense required for satisfactory control, 420 trees were treated to measure the effects of season, volume of spray applied, amount of active acid per unit of tree size, and interaction among these. March, June and September were selected for seasonal tests. Volumes and amounts of acid were based on cross-sectional area of the stem at breast height, (basal area) this dimension being closely correlated with crown area. Two levels of volume were used: one pint and four pints per square foot basal area. The amount of active acid used carried from 1/4 oz. to 2 oz. per sq. ft. basal area in five dosage levels. All trees were sprayed on the lower eight inches of the trunk, i.e. at the ground line. The results obtained in these tests are presented in the following table.

Crown Kill in Percent of Bigleaf Maple
Treated at Various Seasons with 2,4,5-TP

Volume	Concentration*	Oz. Act. Acid per sq. ft.	March	June	September
1 pt.	10	1/4	71	--	45
"	20	1/2	87	79	85
"	30	3/4	98	61	100
"	40	1	93	63	99
"	80	2	96	80	93
4 pts.	2.5	1/4	74	--	64
"	5	1/2	92	94	90
"	7.5	3/4	80	89	100
"	10	1	99	97	100
"	20	2	100	100	100

*ahg

The results indicated that during any season, satisfactory control may be had with one-half ounce of active acid per square foot basal area in a high volume of carrier. With the low volume, however, the trees treated in June had markedly poorer results, indicating a very highly significant test for season x volume interaction. During March and September, the low volume treatments were nearly as satisfactory as the high volume tests, the difference being non-significant at the 5% level.

In these tests, the concentration of acid in the spray did not affect the results except as a function of total acid. The satisfactory treatment of 1/2 ounce acid in 4 pints of diluent was a 5 ahg spray solution. The same amount of acid was equally effective in low volume except for the June treatment. (School of Forestry, Oregon State College.)

Possible reasons for the ineffectiveness of soil applications of simazine on shrub live oak. Davis, Edwin A. Since simazine is a potent herbicide for a wide variety of plants, the reason for its ineffectiveness as a soil application for the control of shrub live oak (Quercus turbinella) is of interest. The lack of control of shrub live oak by simazine is not surprising, however, since simazine is recommended for weed control in nursery stock. Nevertheless, the following questions arise: Is simazine ineffective against shrub live oak because it is not leached into the root zone, or is shrub live oak tolerant to simazine?

The distribution pattern of simazine in soil treated for the control of shrub live oak in gallon cans was studied. The soil was treated with 2, 4, 8, and 16 lb./A of simazine and subsequently watered with 54.5 inches of water applied in 1/4-, 1/2-, and 1-inch increments. The response of indicator plants showed that simazine was not leached in phytotoxic amounts to the bottom inch of soil, which contained the bulk of the shrub live oak root system. At the 2- and 4-lb./A rates toxic amounts of simazine were restricted to the top inch of soil. At the 8- and 16-lb./A rates toxic amounts of the herbicide penetrated to greater depths, but the herbicide was present in sub-lethal amounts in the bottom inch of soil. This indicates that shrub live oak is protected physically against simazine by virtue of simazine's extreme resistance to leaching.

Subsoil applications of simazine at rates of 8 and 16 lb./A were ineffective against shrub live oak even though the simazine was placed in close contact with the mat of roots, indicating that shrub live oak is tolerant to simazine. Similar treatments with monuron and fenuron at 8 lb./A caused 70 percent leaf injury after 10 weeks. Soil-surface applications of monuron are usually slower acting than fenuron, but in this experiment in which soil penetration was eliminated they acted with equal speed.

A nutrient-solution experiment also demonstrated that shrub live oak has considerable tolerance to simazine. Seedlings grew without injury for 11 weeks in nutrient solutions containing as much as 125 ppm simazine. The phytotoxicity of the simazine solutions was established by the response of tomato and cotton plants, which were injured by concentrations of 0.04 ppm and 0.2 ppm, respectively. The lethal threshold concentration of fenuron for shrub live oak was between 1 and 5 ppm.

The conclusions are that shrub live oak is protected physically from simazine because of simazine's resistance to leaching and that shrub live oak has considerable tolerance to simazine. (Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Tempe, Arizona.)

Absorption and translocation of 2,4,5-T in velvet mesquite seedlings, with particular reference to temperature effect. Hull, Herbert M. Chilling central 10-cm portions of mesquite seedling stems to 3-5°C will induce a growth repression of 55-percent the first week and 82-percent the second week as compared with growth of non-chilled controls. It thus appears that cold inhibition of acropetal transport of assimilates (and possibly growth hormones elaborated in roots or basal portions of plants) becomes more pronounced with time.

Similar experiments in which basal leaves below the chilled zone were treated with various formulations of 2,4,5-T have generally demonstrated an increased apical epinasty and subsequent chlorosis and death of the apical foliage as compared to non-chilled plants. These effects, however, appear to depend partially on herbicide concentration. Thus, one experiment has shown that very high concentrations (6,400-25,600 ppmw) of 2,4,5-T when painted on basal leaves results in greater apical injury to non-chilled plants. There may be several explanations for this reversing effect of concentration, a discussion of which is prohibited by limited space. Preliminary work with MH, 2-methoxy-3,6-dichlorobenzoic acid, and 2-methyl-3,6-dichlorobenzoic acid has indicated that these compounds behave quite similarly to 2,4,5-T as far as temperature effect on translocation is concerned.

The experiments corroborate earlier work which demonstrated that a relatively narrow threshold concentration exists for maximum herbicidal effect. Too high a concentration injures the phloem at or near the point of application and thereby prevents further translocation. At too low a concentration a lethal quantity of herbicide may simply not be available. It now appears that this threshold concentration may be interrelated with both degree and duration of temperature. Although many herbicides are known to move with assimilates, assimilate translocation in velvet mesquite seemingly has a temperature coefficient of at least 2, whereas the Q_{10} of 2,4,5-T transport (particularly in short-term responses) is variable, and under some conditions may be unity or less. This difference suggests that the two compounds may not necessarily be transported by identical mechanisms.

This is a normal dieback of basal leaves on non-treated control plants after they reach a certain age, because of normal catabolism and transfer of food reserves from the older leaves to more actively growing regions. However, basal leaves treated with a low concentration of the triethylamine salt of 2,4,5-T remain green far longer than comparable leaves on non-treated plants. This effect is not unlike the response of various tropical plants to the butyl ester of 2,4,5-T described by Osborne (Tropical Agriculture 35: 145-158, 1958). In studies on leaf abscission, she noted that 0.0025-ml drops of an ethanol solution of 2,4,5-T applied to the leaf lamina resulted in eventual chlorosis and senescence of the area surrounding the treated spots. The spots themselves, however, retained their green color. It was proposed that the increased metabolic activity below the droplets caused a drain of metabolic substrates from surrounding areas to the treated areas and created a premature senescence in the untreated parts of the leaf blade. In the present series of experiments on mesquite, application of 100 ppmw of 2,4,5-T to the entire upper surface of basal leaves actually protected them from early senescence. The relatively low herbicide concentration was sufficient to markedly repress subsequent apical growth without causing visible contact injury to the treated leaves, and thereby largely eliminated demands on the older leaves for food reserves. Senescence of the basal foliage resulting from such demands, when present, was apparently far more severe than injury resulting from complete coverage of the leaves with 100 ppmw of 2,4,5-T. (Crops Research Division, Agricultural Research Service, United States Department of Agriculture, Box 5735, Tucson, Arizona.)

The absorption and translocation of acid and ester forms of labeled 2,4,5-T in gorse and broom seedlings. Leonard, O. A. Gorse (*Ulex europaeus*) and Scotch broom (*Cytisus scoparius*) seedlings were treated with 5 microliters of carboxyl C-14 labeled acid and butoxy ethanol ester forms of 2,4,5-T, having a total activity of 0.125 microcuries. Each treatment contained 24 ug of 2,4,5-T with the acid and 35 ug with the ester form. The acid was applied in 50% ethanol containing 0.1% each of Vatsol OT and Tween 20; the ester was applied in acetone, containing 0.1% Tween 20. The plants were harvested and freeze dried 8 days after the applications were made. These plants were later mounted and exposed to X-ray film for one month.

The results of this study are indicated in the table below. The translocation of 2,4,5-T was visually rated by observing the density of the silver precipitation in the film. A 0 rating represented no autograph and a 10 represented the most intense autograph possible (black). Some of the comparisons were: (1) leaf versus stem applications, (2) plants covered with polyethylene bags and not covered, (3) non-toxic oil (Solvaspray 100) added and not added. The results of this study are summarized below.

1. Both the ester and the acid forms of 2,4,5-T were absorbed and translocated poorly from leaf applications under normal greenhouse conditions (about 85° F and 70% r.h.). Raising the humidity to saturation by covering the plants with polyethylene bags throughout the experimental period greatly enhanced the absorption and translocation of both forms of 2,4,5-T. It will be pointed out that in an earlier trial, a relative humidity of 95% was not appreciably more effective than one of 70%, with the acid of 2,4,5-T on the same species. Evidently, the humidty must be at or near saturation to be markedly beneficial.

2. Stem applications of the ester of 2,4,5-T was considerably more effective than any leaf treatment (including a saturated atmosphere), and was not improved by the inclusion of Solvaspray 100 as an additive to the treatment.

3. Stem applications of the acid of 2,4,5-T resulted in very little material migrating to either the roots or the shoot apices; however, Solvaspray 100 did markedly improve stem absorption of the acid. (Botany Department, University of California, Davis.)

Effect of several treatments on the absorption and translocation of carboxyl C^{14} labeled 2,4,5-T by gorse and Scotch broom seedlings, as determined by visually rating the intensity of the images produced on X-ray film.

Treatment	Broom seedlings			
	Ester activity*		Acid activity	
	Shoot	Root	Shoot	Root
Leaf---plants uncovered	1	1	3	2
Leaf---plants covered	6	3	5	3
Stem---no Solvaspray 100	8	4	2	1
Stem---with Solvaspray 100	7	3	7	3
	Gorse seedlings			
Leaf---plants uncovered	1	1	1	1
Leaf---plants covered	4	2	6	3
Stem---no Solvaspray 100	8	4	1	1
Stem---with Solvaspray 100	8	4	6	2

*Ratings: 0 equals no autograph (image)
10 equals a black autograph

Uptake of radioactive 4-chloro-2-butynyl N-(3-chlorophenyl) carbamate (barbane) and translocation of C^{14} in Hordeum vulgare and Avena spp. Foy, Chester L. Under field conditions, barbane applied post-emergence has shown considerable promise as a selective wild oat herbicide. Although plant response is usually slow and not spectacular at first, crop yields are often increased as a result of treatment. The basis of selectivity among closely related (grass) species is not known.

Barbane-C^{14}, labeled in various positions on the molecule, was employed in several experiments to study the absorption and translocation of C^{14} in two cereal grains and wild oat. For the present, reference is made to C^{14} movement only, since the translocated substance(s) must yet be identified.

From the first three experiments using barbane labeled in the ring, C-1, and carbonyl positions, respectively, the following tentative conclusions seem justified:

(1) C^{14} was absorbed and translocated in small amounts following drop

treatment of the upper surface of the first leaf, the greatest movement apparently being in the transpiration stream toward the tip of the leaf. Treatment in the axil of the first leaf resulted in far greater, and more rapid uptake of C^{14} by the shoots. Part of the initial downward movement in the latter instance was attributed to creeping and ready penetration of succulent tissue. In all cases, movement beyond the old seed and into the roots was slight.

(2) The total amount of C^{14} absorbed and translocated by either route was proportional to the period of treatment (3 1/2 hours, 24 hours, 1 week).

(3) As revealed by gross autoradiography, there were no apparent differences in absorption and translocation of C^{14} among species (barley, oat, wild oat).

(4) Gross distribution patterns of C^{14} also were similar for barbane labeled in all three positions. Possible differential rates and routes of breakdown of barbane labeled in various positions require further investigation.

One experiment was designed primarily as a residue study. Oat, wild oat, and barley were grown to maturity in large clay pots in the greenhouse. At the 2-leaf stage they were treated by hand placements in the axils of the first leaves with either 0, 13 ug. (10 ul), or 26 ug (20 ul) of ring labeled barbane-C^{14}. The plants were irrigated and fertilized as necessary for normal growth. At harvest, grain yields were as shown below.

	Seed yields (grams/pot)		
	Oat	Barley	Wildoat
Untreated	8.48	4.50	4.08
13 ug	1.54	2.79	2.22
26 ug	1.21	3.28	2.19

Seed samples were then ground to 40 mesh in a Wiley mill and assayed directly for radioactivity. There were no detectable counts above background in any of the seed samples. This leads to the conclusion that, within the limits of reproducibility of the method, no residues of C^{14} (.˚. of barbane) existed, either in oat, wild oat or barley. (Botany Department, University of California, Davis, California).

Detoxification of radioactive simazine, 2-chloro-4, 6-bis(ethylamino)-s-triazine-2, 4, 6-C^{14}, by extracts of *Zea mays*. Castelfranco, Paul; Foy, Chester L., and Deutsch, Deborah B. Even in the absence of any quantitative information on the rate of uptake of simazine by corn under field conditions, it appears probable that this species possesses a system that is sufficiently active to degrade simazine as fast as it is taken up by the plant.

Using an assay based on the retention of C^{14} labeled hydroxy simazine by charcoal, we have found a system in extracts of *Zea mays* which is capable of converting simazine-C^{14} to the corresponding 2-hydroxy analogue.

The active constituent is dialysable, soluble in 90% acetone, extractable with ether and ethyl acetate and totally destroyed by ashing. In the crude extract the active constituent is destroyed by boiling. After the preparation has been cleaned up by acetone precipitation, boiling for five minutes causes no loss of activity. These properties indicate that the active constituent is not a protein. The detoxification product was identified as the 2-hydroxy analogue by comparing it with authentic hydroxysimazine using two paper chromatographic techniques.

While Zea mays is resistant to the toxic action of simazine, Avena is susceptible. Extracts of Avena sativa contain none of the simazine-destroying activity which is present in the extracts of Zea mays. (Botany Department, University of California, Davis, California)

The longevity of buried seeds of barnyard grass, green foxtail and yellow foxtail. Dawson, J. H. and Bruns, V. F. Studies on the longevity of seeds of barnyard grass (Echinochloa crusgalli), green foxtail (Setaria viridis), and yellow foxtail (S. glauca) in Sagemoor fine sandy loam were initiated in October 1957. After soil fumigation with methylbromide, ten series of seed lots were buried in a split-block experiment with three replications. Soil moisture is maintained in one block by sprinkler-irrigation, whereas the other receives natural precipitation only.

Open-top seed baskets, 2 inches deep and 6 inches in diameter, were made from Lumite plastic screen and sewed with nylon thread. After placing exactly 1 inch of soil in the bottoms, 200 seeds of either barnyard grass, green foxtail, or yellow foxtail were layered in the baskets. The baskets were then placed in the ground and covered with additional soil so that seeds of each species were buried at 1, 4, and 8 inches. Handles of heavy nylon monofilament fishing leader attached to each basket protruded above the ground to maintain location and identity. Thus, the seeds were subject to natural soil conditions, could germinate and emerge in the field, and could be recovered at will. Seeds are exhumed in the spring and placed in flats of soil in the greenhouse for viability determination based on the number of emerging seedlings. One series will be exhumed each year for 5 years. Thereafter, the interval between exhumings may be extended as necessary to cover the longevity period.

A record of field emergence has been kept. Most of the seeds buried at the 1-inch depth germinated and emerged in the field early in 1958. A few seedlings emerged from the 4-inch depth; none emerged from the 8-inch depth. Seeds were exhumed in 1958, 1959, and 1960. In 1960, seeds from the 4- and 8-inch depths still showed fairly high viability. However, the percentage germination was lower than that of seeds from the same lots held in dry storage at room temperature. In 1960 viability of seeds from the irrigated soil tended to be lower than that of seeds from unirrigated. (Crops Research Division, ARS, USDA, and Washington Agricultural Experiment Stations, cooperating.)

Effect of various spectal regions upon the activity of herbicides. Alley, H. P. and Chamberlain, H. E. Preliminary studies have been completed on the effect of quality on the toxicity of 2,4-D on two Canada thistle ecotypes.

Results indicate that different light colors may alter the toxicity of 2,4-D. Canada thistle plants sprayed with an equivalent of 1 lb./A of L. V. ester of 2,4-D and exposed to a red light source showed a significant reduction in top growth when compared to either one of the three other light qualities - blue, green, and warm white check supplemented with incandescent light. Results also indicate that lower rates of chemical are more effective when exposed to the red light than other light qualities studied. (Wyoming Agricultural Experiment Station)

Dwarfing effects of CCC on wheat. Appleby, A. P., and Furtick, W. R. CCC (2-chloroethyltrimethylammonium chloride), applied in February on Druchamp winter wheat, caused a considerable decrease in height and a slight increase in yield. The plants appeared to have broader leaves and a stiffer straw, suggesting a possible decrease in susceptibility to lodging.

Rates used were 20#/A on a regular plot and a range of 40#/A to 1#/A on a logarithmic plot. A rate of 20#/A on Red Houston spring wheat applied one month after planting gave a similar decrease in height. No appreciable dwarfing was noted on Hannchen spring barley.

AMAB (allyltrimethylammonium bromide) was also tested but was much less effective than CCC. (Oregon Agricultural Experiment Station).

Effect of various environmental factors on the persistence and movement of 2,3,6-trichlorophenylacetic acid in soil. Hattrup, A. R., and Muzik, T. J. The effect of temperature, soil moisture, leaching and organic matter on the persistence and movement of 2,3,6-trichlorophenylacetic acid in soil were studied. Soil was treated and stored at 32, 70, and 90 degrees Farenheit with the moisture constant at 15%. Other flats were filled with soil, treated and stored at 10, 15 and 20% soil moisture and maintained at one temperature condition (65 to 75 degrees F.). At intervals of 2, 4, 8, and 12 weeks one series was removed from each storage condition and planted to wheat and peas. Another group was treated by autoclaving, or the addition of 1,000, 2,000, or 4,000 lbs. of manure. These were stored two weeks before planting. Leaching studies were conducted with three soil types at five rates of rainfall. Field experiments were set up in two locations to relate the greenhouse studies to actual field conditions.

High temperatures (70 to 90 degrees F.) were conducive to a more rapid disappearance of the chemical than a low temperature (32 degrees F.). Moisture levels (10 to 20%) tested did not show great differences. The addition of 1,000 lbs. manure per acre appeared to cause a more rapid rate of disappearance. Peas were generally more susceptible to 2,3,6-trichlorophenylacetic acid than wheat although the chemical caused drastic effects on the root growth of both peas and wheat.

2,3,6-trichlorophenylacetic acid moved through 3 soil types in proportion to the amount of water applied. Movement was greater in light soils than in heavy soils. The chemical was not removed from the surface layer of soil by up to three inches of precipitation.

Under field conditions at Pullman, Washington the chemical disappeared from the 1 and 2 lb. per acre plots in about 4 months. The 5 lb. rate had been partially dissipated at this time, but 10, 20, and 40 lbs. per acre were still very detrimental to plant growth. (Washington State University Agricultural Experiment Station)

Absorption and translocation of foliage applied carbon-14 labeled 2,4-D and amitrole in the Tokay grape. Leonard, O. A. and Weaver, R. J. One uC of carboxyl carbon labeled 2,4-D (2,4-dichlorophenoxyacetic acid) having a specific activity of 12.3 uC/mM and 0.56 uC of 3-amino-1, 2, 4-triazole-5-C^{14} having a specific activity of 2.34 uC/mM were applied in 20 microliters of 50% ethanol containing 0.1% Tween 20 to the leaf-blade directly below and directly above the flower cluster of Tokay grapes on May 9, 1960. Collections of leaves, buds, cross sections of stems, and flowers or fruit were made 3, 21, and 112 days following treatment. Both counting and autoradiography methods were used.

Both compounds had moved only apically when the first collection was made 3 days after treatment. Some of the radioactivity went into the flower cluster from the leaves treated below the flowers, but none from the leaves treated above the flowers. Twenty-one days after treatment, translocation had become reversed, and the flowers now had activity in them from the treatments made to leaves above the flowers. Activity was still present in some of the buds, leaves, stems, and fruit 112 days after treatment.

Total activity (corrected for self absorption) in the flower (or fruit) clusters resulting from treating the leaf directly below the clusters with labeled 2,4-D and amitrole. Results are averages of 3 treatments.

Days after treatment	Activity per cluster in counts/minute			
	amitrole		2,4-D	
	ethanol soluble	ethanol insoluble	ethanol soluble	ethanol insoluble
3	300	1000	1100	50
21	100	1000	4000	1400
112	0	3000	3000	4500*

*Result from only one treatment, as the 2,4-D killed the fruit clusters from the other two similar treatments.

The table above shows the total activity in the flower (or fruit) clusters at different periods following treatment. It will be noted that amitrole as such became quickly incorporated into the ethanol insoluble fraction, whereas this did not occur with 2,4-D. The composition of the 2,4-D ethanol fraction was further examined by chemical purification and paper chromatography and found to consist mainly of 2,4-D. (University of California, Davis.)

PROJECT 9. RESEARCH TECHNIQUES

P. A. Frank, Project Chairman

A shoe injector for placement of herbicides. Phipps, F. E., and Furtick, W. R. A shoe injector was designed for placing herbicides in a band below the surface of the soil at the time of planting. The shoe resembles a 12-inch duck-foot cultivator welded to a plate and shaft. This is mounted ahead of the planter. A wide-angle flood nozzle is mounted in the point of the shoe and sprays to the rear. Plastic hose leading to the nozzle facilitates inspection of the system for normal nozzle operation.

Tests with EPTC (ethyl-N, N-di-n-propylthiolcarbamate) and several other herbicides were very promising. This device could be used to minimize the loss of volatile materials such as EPTC. It may also be useful in placing herbicides in moist soil zones, especially in areas where rainfall is not dependable following pre-emergence herbicide applications. (Oregon Agricultural Experiment Station.)

PROJECT 10. ECONOMIC STUDIES

D. C. Myrick, Project Chairman

No Reports Received