1953 RESEARCH REPORT

RESEARCH COMMITTEE

WESTERN WEED CONTROL CONFERENCE

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INDEX OF COMMITTEES

Project Committees Page

CONTRIBUTORS INDEX

Effect of 2,4-D on the eradication of Canada thistle (Cirsium arvense) Tingey, D. C. An area in a pasture infested with Canada thistle was used for the experiment. Soil was a gravily texture and the pasture received frequent irrigations throughout the summer. The purpose of the study was to determine the relative effectiveness of various 2,4-D products applied at rates of 1, 2 and 4 pounds per acre. Each treatment was replicated 4 times and the plots were 1 square rod in area. One application was made each year at the bud to early bloom stage of growth. The experiment started in 1946 and continued until 1950, thus 4 treatments were made during the 4 years.

Kinds of 2,4-D used were sodium, ammonium, and triethanolamine salt, and butyl ester of 2,4-D. There were 2 triethanolamine salts used from different commercial products. Final results after the 4 years were based on the estimated percentage re-growth and the number of plants remaining on each square rod as determined by count.

Based on estimated re-growth, there was little difference in either kind or rate of chemical applied. Most of the treatments had reduced the re-growth to 2 or 3 percent.

Based on plant count there was some differences between the two sources of triethanolamine salt. One source averaged 11 plants per plot and the other averaged 35 plants. Average number of plants for other types of 2,4-D used fell between these two extremes. Number of Canada thistle plants per plot decreased with an increase in rate of application. The one pound rate averaged 28 plants per plot, the two pound rate 22, and the four pound rate 20 per plot.

While an application each year for four years had largely eradicated the Canada thistle, therewere still some plants remaining on most plots. On an individual plot basis, and based on an estimated percentage re-growth, the values varied from 0 to 15 percent with an average of all treatments of 2 percent. On a plant count basis the number varied from 0 to 150 plants per plot, with an average of all treatments of 23 plants per plot. Utah Agricultural Experiment Station, Logan, Utah.

Effect of 2,4-D on eradication of perennial sow thistle (Sonchus arvensis) and crop yields as related to management Tingey, D. C. A study was made to determine the effect of herbicides on the control of perennial sow thistle as related to crops grown, crop sequence, and commercial fertilizer and the interrelation of these factors to crop yields. 1/

An area of land in pasture and infested with perennial sow thistle was used for the study. The soil was a poorly drained clay loam, with the water table within 3 or 4 feet of the surface. The experiment began in the fall of 1948 and was continued through two growing seasons, those of 1949 and 1950. Because of the relatively few perennial sow thistle plants remaining on most of the plots at the end of the 1950 season, the study was discontinued, except for observations made of the weed regrowth during 1951.

Crops used in the study were fall wheat, spring barley, corn, and potatoes. Because of the severe herbicidal damage to potatoes, this crop was replaced with sweet corn after the first season. Herbicides used were the triethanolamine salt and ethyl ester of 2,4-D and 2,4,5-T. One and two applications of herbicide were made, the second application being made after the crop was harvested and at least 10 days before the land was fall plowed. Plots fertilized received 200 pounds of ammonium sulfate (21%N) and 200 pounds of treble superphosphate (43% P_2O_5) per acre. Provisions were made to grow crops continuously and in rotation. The short duration of the experiment permitted only one year of the rotation. Check or untreated plots of wheat and barley received no herbicide. Check plots of corn and potatoes were cultivated and hoed at 2 week intervals.

Herbicidal and fertilizer treatments, 11 in all, were superimposed on the larger plot of one crop. Smaller plots were 18 X 21 feet. Each treatment was replicated 3 times. There were 6 replications the first season.

Yields of small grains were determined by harvesting 4 square meter samples from each plot. Corn and potato yields were determined by harvesting the 4 center rows of a 6 row plot.

Herbicidal treatments definitely reduced the weed density when compared to untreated plots. Furthermore, where two applications were made, compared with one, the re-growth was much less and rather consistent for all replications of each herbicide, and particularly for the 2,4-D treatments. The 2,4,5-T was less effective on perennial sow thistle but more damaging to potatoes than the 2,4-D herbicides.

Acre yields of wheat the first year was 8 bushels per acre lower where no herbicide was applied. This is a reduction of 47 percent. Except for this there was no differential treatment effect on yield of wheat.

Acre yields of barley the first year averaged about 20 bushels per acre lower where no herbicide was applied. This is a reduction of 58 percent. There was a definite response to fertilizer, particularly on the plots with 2,4-D treatments though there was no response on the check plots.

Yields of silage corn and potatoes in 1949 on the cultivated and hoed plots were consistently higher than on the plots treated with herbicide. Herbicidal treatments as an average decreased the corn yields 25 percent. Corn responded to fertilizer on all comparisons. Corn with a combination of herbicide and fertilizer gave about the same yield as the cultivated and hoed unfertilized plots. Even though the 2,4,5-T was definitely less effective than 2,4-D on perennial sowthistle, the yield of corn where the two herbicides was used was about the same.

1/ An adjacent area was infested with Canada thistle on which a similar experiment was conducted. The data are reported in a separate abstract.

Potatoes were severely damaged by all herbicidal treatments. The 2,4-D herbicides on fertilized plots reduced the yields of potatoes 56 percent and on nonfertilized plots the yields were reduced 40 percent. Potatoes treated with 2,4,5-T were reduced 85 percent in yield. On the cultivated and hoed treatments, potatoes receiving fertilizer yielded about 60 percent more than those not fertilized.

In 1950, the acre yield of wheat was about double that for 1949, partly as a result of a change in variety and higher winter survival. While the 2,4,5-T was less effective in the control of perennial sow thistle in 1949, wheat in 1950 yielded as high as where 2,4-D had been used. Wheat grown continuously either fertilized or unfertilized, and treated with herbicides, yielded about the same in 1950 as wheat in competition with perennial sow thistle. Wheat following corn gave a 12 bushel or 30 percent increase compared to wheat after wheat. Fertilizer response was pronounced in all comparisons. A combination of rotation and fertilizer doubled the yield of wheat.

Barley yielded much higher also in 1950 as compared to 1949. The less effective 2,4,5-T treatments on weed control gave just as high a yield of barley in 1950. Barley in competition with perennial sow thistle yielded 21 bushels or 45 percent lower than where the weed had been eliminated. Response to fertilizer was marked except on the rotation check plots. A combination of weed elimination and rotation more than doubled the yield of barley.

Sweet corn was substituted for potatoes in 1950. All herbicidal treatments on sweet corn showed some damage and reduced yields about a ton per acre. Heavy weed density at the beginning of the season on plots sown to wheat and used as check in 1949 and weeds kept down by cultivating and hoeing in 1950, yeilded nearly as well as herbicidal treated plots and compared with weed free plots, the yields were down about 1.5 tons. Sweet corn showed some response to fertilizer.

On the field corn plots perennial sow thistle had been either largely eliminated by previous treatments or the weeds had been kept down during 1950 by cultivation and hoeing. Check plots in barley in 1949 began the 1950 season with a dense growth of perennial sow thistle but the cultivating and hoeing kept the weeds in control and the yields were about the same as for the herbicidal treatments. Hence, the weed growth had little or no differential effect on yields in 1950. Corn in rotation with barley yielded 3.5 tons more greenweight than corn continuous. There was little or no response of field corn to fertilizer in 1950. Utah Agricultural Experiment Station, Logan, Utah.

Effect of 2,4-D on eradication of Canada thistle and crop yields as related to management   Tingey, D. C. A study was made to determine the effect of herbicides on the control of Canada thistle as related to crops, crop sequence, commercial fertilizer, and the interrelation of these factors on crop yields.[1]

An area of land devoted to pasture and infested with Canada thistle was used for the study. The soil was a poorly drained clay loam, with a water table within 3 or 4 feet of the surface. The experiment began in the fall of 1948 and was continued through two growing seasons, those of 1949 and 1950. Because of the relatively few Canada thistle plants remaining on most of the plots, the study was discontinued, except for observations made of the weed re-growth during the third season.

Crops used were fall wheat, spring barley, corn, and potatoes. Because of severe herbicidal damage to potatoes in 1949, this crop was replaced with sweet corn in 1950. Triethanolamine salt and ethyl ester of 2,4-D were the herbicides used. One and two applications of herbicide were made, the second application being made after the crop was harvested and at least 10 days before the land was fall plowed. Plots fertilized received 200 pounds of ammonium sulfate (21%N) and 200 pounds of treble superphosphate (43% P_2O_5) per acre. Provisions were made to grow crops continuously and in rotation. The short duration of the experiment permitted only one year of crops in rotation. Check or nontreated plots of wheat and barley received no herbicide. Check plots of corn and potatoes were cultivated and hoed at 2 week intervals.

Herbicidal and fertilizer treatments, 7 in all, were superimposed on the larger plot of one crop. Smaller plots were 18 X 21 feet. Each treatment was replicated 3 times. There were 6 replications the first season since the rotation treatment could not start until the second year.

Yields of small grains were determined by harvesting 4 square meter samples from each plot. Corn and potato yields were determined by harvesting the 4 center rows of a 6 row plot.

Herbicidal treatments the first year gave almost complete eradication of Canada thistle on all plots treated except those planted with potatoes and here the density was reduced to about 50 percent of that of untreated plots.

Cultivating and hoeing on corn and potatoes was just as effective as the better herbicidal treatments.

One application of herbicides in the crop and another after harvest was no more effective than the one application made in the crop.

Triethanolamine salt and ethyl ester of 2,4-D both gave about equally good reduction in density.

In 1949, as compared with untreated plots, herbicidal treatments reduced the yield of wheat slightly, corn moderately, and potatoes severely, but increased the yield of barley.

Commercial fertilizer gave no increase in yield of silage corn, only slight increase in wheat, and considerable increases in potatoes and barley.

1. An adjacent area was infested with perennial sow thistle on which a similar experiment was conducted. The data are reported in a separate abstract.

At the end of the second and the following season on all potato plots, wheat, and barley plots used as check in 1949 and in rotation in 1950 the weed density had been reduced to a low percentage.

Weed density on most of the other plots that showed good eradication in 1949 had not changed much as a result of the 1950 treatments. There was still from a trace to a small percentage of Canada thistle on most plots.

Yield of wheat in 1950 as a result of the elimination of the weed growth in 1949 was 10 bushels or 33 percent higher than wheat in competition with Canada thistle.

Wheat in rotation and in combination with the elimination of Canada thistle nearly doubled the yield of wheat. Fertilizer gave little or no increase in yield of wheat grown continuously, though wheat in rotation with corn yielded 13.5 bushel or 40 percent higher than unfertilized.

Yields of barley in 1950 as a result of eliminating the weed growth in 1949 was 16 percent higher than barley grown in competition with Canada thistle. Barley in rotation with potatoes and free from weeds averaged 21 bushels or 50 percent higher than barley grown continuous and in competition with Canada thistle.

Fertilizer in 1950 gave little or no increase in yield of barley on either the continuous or rotated plots.

Sweet corn replaced potatoes in 1950 and it followed potatoes on the continuous plots and wheat on the rotation plots. Furthermore the check plots in potatoes in 1949 had been cultivated and hoed, which gave good eradication of Canada thistle. Except for a slight increase in yield as a result of fertilizer there were no differences in the yields of either ears or stover in sweet corn.

Principal difference in yield of silage corn was a result or rotation which was 3 tons or 19 percent higher than where grown continuously. Utah Agricultural Experiment Station, Logan, Utah.

<u>Eradication of biscuitroot (Lomatum leptocarpus) with herbicides</u> Tingey, D.C. Biscuitroot, a native range plant, has invaded a considerable acreage of land used for dry land wheat production in northern Utah and southern Idaho.

This weed is principally a problem on heavy soils with poor internal drainage. It is an early maturing perennial, reproducing both by seeds and roots. The plant produces a tuberous root and frequently has two or more bulb-like corms attached in a series like a string of beads. The inside texture of a root is similar to that of a biscuit. Plants are from 12 to 18 inches tall, flower petals yellow, and seeds that resemble parsnips except they are smaller and narrower.

Experiments have been conducted on the control of biscuitroot since 1946. This paper reports the result of an experiment wherein this weed was treated with herbicides in 1949 and again in 1950. Data were taken in the spring of 1951.

Treatments consisted of using 4 chemicals; triethanolamine salt and ethyl ester of 2,4-D, 2,4,5-T and a mixture of 75 percent ethyl ester of 2,4-D and 25 percent 2,4,5-T applied at 5 rates, none, .5, 1, 2, and 4 pounds per acre, in 3 amounts of water, 5, 20, and 80 gallons to the acre at 3 stages of growth, pre-bloom, bloom, and early seed. The treatments occured in all combinations making a total of 180.

Results of the first year's treatments showed no differential effects of the amounts of water used in applying the chemical on either weed eradication or crop damage. In 1950 a uniform amount of 20 gallons per acre was used in all cases and the 3 original amounts of water were used as replications in 1950.

Each plot was 12 X 22.5 feet in area, making the equivalent of one square rod. Results of the various treatments were based on an estimate of the density in 1951 after the plants had ample time to emerge.

Data obtained on this experiment from one year's treatments were reported in the June, 1950 issue of Farm and Home Science, and a more detailed report of the data herein reported will appear in the March 1952 issue of Farm and Home Science, a publication of the Utah Agricultural Experiment Station.

Stage of growth when the herbicide was applied, rate of application, and herbicides all showed differential effects on eradication of biscuitroot. Treatments made in the earlier stages of growth and heavier rates gave the greatest reduction in biscuitroot. Even though there were differences among the herbicides, they were relatively minor. As an average of the three stages of growth when the herbicides were applied, the four rates of application, and the three replications, making a total of 36 plots, there was a difference of 8 percent in density between the best and the poorest.

Mixture of 2,4-D and 2,4,5-T and 2,4,5-T alone seemed to be slightly more effective. These two treatments are also the most expensive. Some of this difference in herbicides may be because the rate of application the first year was not on an acid equivalent basis. Triethanolamine salt particularly, was at a disadvantage, and was applied at a lower rate as compared with the other chemicals.

Two of the interactions were significant, these were stage of growth x rate of application, and chemical x stage of growth. Interaction involving stage of growth x rate of application is somewhat involved. The 1 and 2 pound rates were relatively more effective at the pre-bloom stage than the one-half pound rate, and the 4 pound rate was relatively more effective at the bloom stage compared with the pre-bloom than the 1 and 2 pound rate. The 2 pound rate applied at the pre-bloom stage was about as effective as the 4 pound rate, however, at the bloom and early seed stages the 4 pound rate gave considerably better reduction in density than the 2 pound rate.

The interaction involving herbicide x stage of growth was also involved. Triethanolamine salt of 2,4-D applied at the pre-bloom stage of growth was just as effective as the other chemicals even though a lighter application was made the first year. There was practically no difference in the density of biscuit-root after two years with ethyl-ester and the mixture applied at the pre-bloom as compared with the bloom stage. Triethanolamine salt and 2,4,5-T were more effective at the pre-bloom compared with the bloom stage.

Considering the relative cost of the herbicides, and the likelihood of damage to the crops, the triethanolamine salt of 2,4-D is preferred over any of the other materials. Applications made before the plant blooms at the two pound rate seems to be the most economical amount to use. Utah Agricultural Experimrnt Station, Logan, Utah

PROJECT 2. PERENNIAL WEEDY GRASSES

F. L. Timmons, Project Leader

SUMMARY

Seven individual reports were received giving results of experiments on the control of Johnson grass in Arizona, of quackgrass in Idaho, Utah, and Washington, of reed canary grass in Utah, and of a number of perennial weedy grasses in Hawaii. The individual reports are included following this summary section.

Sodium trichloroacetate (TCA) gave satisfactory control of Johnson grass in Arizona and of torpedo grass, tall panicum, Hilo grass, Bermuda grass, and certain other grasses in Hawaii. TCA gave fairly good control of quackgrass and other ditchbank grasses at Meridian, Idaho, in 1952 but in previous years it has been reported to be relatively ineffective on quackgrass in experiments conducted in Idaho, Utah, and Washington.

Best results on Johnson grass in Arizona were obtained when TCA was applied on young growth late in October or on recently frosted growth in November at the rate of 110 pounds per acre. Similar applications on dormant Johnson grass in December, January, and February gave progressively poorer results at later dates. Best results on perennial weedy grasses in Hawaii were obtained with two to four repeat applications of TCA at 20 pounds per acre, three or four weeks apart during the growing season. TCA has been used to good advantage in combination with tillage in Hawaii.

CMU (3 p-Chlorophenyl 1,1-dimethylurea) gave complete or almost complete elimination of quackgrass at rates of 40 pounds per acre or more in experiments conducted in Idaho, Utah, and Washington. A much heavier rate of 120 pounds of CMU per acre was necessary to give satisfactory control of reed canary grass along the inside bank of an irrigation canal at Logan, Utah. At Meridian, Idaho, CMU at 20 pounds per acre gave control of miscellaneous ditchbank weeds including perennial grasses for one year while 40 pounds per acre gave satisfactory control for two years. CMU at 20 and 40 pounds per acre gave disappointing results on Johnson grass at Phoenix, Arizona, but at 80 pounds per acre the results became progressively more promising throughout the 1952 season.

Direct comparisons of different chemicals showed TCA to be more effective than CMU on Johnson grass in Arizona but showed CMU to be much more effective on quackgrass than TCA or sodium chlorate in Idaho and Utah. At Logan, Utah, CMU at 40 pounds per acre reduced the stand of quackgrass about the same as sodium chlorate at 640 or 960 pounds per acre and as Polybor-Chlorate at 1920 pounds per acre. Atlacide at 160 and 320 pounds per acre and sodium chlorate at 320 pounds per acre were much less effective on quackgrass at Meridian, Idaho, than was CMU at 40 pounds per acre.

Aromatic oil gave eradication of Johnson grass at Phoenix, Arizona, with seven spray applications during 1952 totaling 605 gallons per acre and gave good control of ditchbank weeds including perennial grasses at Meridian, Idaho, with two applications in May and July, totaling 240 gallons per acre. Experiments at Phoenix during 1952 comparing five different combinations of monocyclic and polycyclic aromatic oils clearly indicated the superiority of polycyclic aromatics for the control of Johnson grass.

Maleic hydrazide was ineffective in causing more than temporary retarding of Johnson grass growth even at the heaviest rate used in experiments at Phoenix.

INDIVIDUAL REPORTS

Control of Johnson Grass With Herbicides. Arle, H. Fred. Experimental spray applications of various herbicides for the control and eradication of Johnson grass were continued in the vicinity of Phoenix, Arizona, during 1951. A comparison of sodium trichloroacetate (TCA) with and without the addition of a wetting agent was made at rates of 80, 110, and 140 lb/A. The treatments were triplicated on plots 10x50 feet and were located along the banks of an unlined canal.

The treatments were made to Johnson grass regrowth on October 23, 1951. The height of the grass was approximately eight inches. About five inches of rain were received between date of treatment and normal resumption of growth in March. TCA at 80 lb/A reduced the stand of Johnson grass 65-70% but during the summer months the surviving plants completely re-infested the treated area. Very little difference was noted between rates of 110 and 140 lb/A with each affecting a 90-95% reduction.

There appeared to be a somewhat indefinite advantage in adding a wetting agent to the solution. In comparing some plots of comparable TCA rate, effectiveness was markedly increased by the addition of a wetting agent while in other replications this trend was not evident. A rainfall several days after treatment may possibly have obscured the advantages of including a wetting agent.

Applications of TCA at 110 lb/A were also made during the middle of November (immediately after the first frost), December, January, and February. Following each application rain was received in amounts usually considered sufficient to produce most effective results. In this series applications made in mid-November were equally as effective as treatments made to green foliage late in October. However, in following applications results became progressively poorer with the February applications resulting in some delay in appearance of regrowth but practically no reduction in stand.

Preliminary trials, using CMU (3-p-chlorophenyl 1, 1-dimethylurea) were made at 20, 40, and 80 lb/A. These rates were applied to Johnson grass infestations along several canals during November and December of 1951. In each case the soil was rather heavy. Rainfall during the winter months was considerably in excess of normal. Results of the two lowest rates of application have, thus far, not been encouraging. At 80 lb/A the results became progressively better throughout the 1952 season. It appears that in low rainfall areas a considerable length of time will be required to obtain maximum effect on deep-rooted perennials. All rates gave complete control of such winter annuals as wild oats, mustard, lambsquarters, and malva.

Maleic hydrazide was applied to Johnson grass at 3.0, 5.0, 10.0, and 20.0 lb/A. The first treatments were applied in mid-April to new growth which had attained a height of 8-10 inches. Only the 20-lb. rate showed any pronounced retarding effect on height growth. Three retreatments at monthly intervals were made. At 20 lb/A the grass was held in check during the early portions of the season. It recovered during the summer and later treatments were ineffectual. There was very little or no difference between treated plots and the adjacent untreated area at the end of the season.

The study involving applications of various aromatic oils was continued during the 1952 season. In each case the total aromatic content of the oil was maintained at 65%. This total consisted of varying percentages of monocyclic and polycyclic aromatics as follows:

	Richfield Weedkiller A	Ex. #1	Ex. #2	Ex. #3	Ex. #4
Total aromatics	65	65	65	65	65
Monocyclic arom.	4	20	34	50	61
Polycyclic arom.	61	45	31	15	4

Each oil was applied at a predetermined volume of 160 gallons per acre for the first two applications. For the five following treatments sufficient oil was used to obtain satisfactory coverage. The trend of results followed those of 1951 and clearly indicates the superiority of polycyclic aromatics. Oils high in monocyclic aromatic content did not show much effect on Johnson grass or wild oats which also were present on the plots. Results are indicated by the following table:

Material	No. of applic.	Total vol. applied Gal/A	Percent survival
Richfield Weedkiller A	7	605	0
Ex. #1	7	750	0
Ex. #2	7	810	1
Ex. #3	7	945	20
Ex. #4	7	1005	45

(Contributed by the Division of Weed Investigations, BPISAE, USDA, and the Arizona Agricultural Experiment Station, cooperating).

Eradication of Quackgrass with CMU. Bruns, V. F. On October 15, 1951, CMU was applied on quackgrass at rates of 0, 10, 20, 40, and 80 lb/A. Initial action of the chemical was very slow. When the first observations were made on March 10, 1952, some green growth of quackgrass appeared on all plots. However, about two weeks later all new growth of quackgrass was dying on the treated plots, especially on plots treated with 20 lb/A or more. On May 20 nearly 100 percent control of quackgrass was recorded for all plots treated with 40 and 80 lb/A. Shortly thereafter heavy stands of common horsetail (*Equisetum arvense*) and showy milkweed (*Asclepias speciosa*) developed on all treated plots. In June, drainage water escaped and ran across two of the treated plots. In the 3- to 40-foot strip which was wetted by the irrigation water, horsetail and milkweed began to die. Precipitation during the late fall and winter may result in the elimination of these species, especially on plots which received the heavier applications of CMU.

Excellent control of quackgrass was maintained throughout the season on plots treated with 40 and 80 lb/A of CMU. However, sufficient growth remained on plots treated with 10 and 20 lb/A to warrant retreatments in September. (Contributed by Division of Weed Investigations, BPISAE, USDA, and the Washington Agricultural Experiment Station, cooperating).

Quackgrass Control with Chemicals. Hodgson, J. M. Very effective control of quackgrass was obtained by applications of CMU at 40, 80, or 160 lb/A. The treatments were made in March 1952 and plots were undisturbed during the season. All three rates of applications gave over 99% or more elimination of quackgrass for the season. However, the higher rates may prove more effective over a longer period of time.

TCA treatments have given variable results in tests in the past three years. A group of TCA treatments made this year gave good control of quackgrass in the test with CMU. TCA applications of 80, 160, and 240 lb/A were made in March. Six months after treatment there was 13% of the quackgrass present where 80 pounds of TCA per acre had been applied. Quackgrass regrowth was 12 and 8% for the 160- and 240-pound rates, respectively. The heavier rates gave very little better control of quackgrass during the first growing season. These results are better than previous results of TCA treatments on quackgrass.

Atlacide at 160 and 320 lb/A and sodium chlorate at 320 lb/A did not give satisfactory control of quackgrass. Regrowth after six months was 48, 37, and 28 percent, respectively, for the three treatments. (Contributed by the Division of Weed Investigations, BPISAE, USDA, and Idaho Agricultural Experiment Station, cooperating).

Ditchbank Weed Control with Chemicals. Hodgson, J. M. Chemical control of miscellaneous plants including many perennial grasses such as timothy, brome, Kentucky bluegrass and broadleaf weeds such as sunflowers, goldenrod, sweet clover, and fleabane, has been investigated the past two seasons.

A few treatments have proven to give effective control of these plants but all are quite expensive. TCA when applied during the months of December to March when ditches were not in use gave good control for one season where 80 lb/A was applied. Forty pounds per acre was not enough to give control for a full season.

CMU was more effective than TCA for ditchbank weed control. The best time of application was December to March when rainfall leached the chemical into the soil. Rates of 10, 20, and 40 lb/A were tested. The light rate did not give satisfactory control. Twenty pounds per acre gave control for one season while 40 lb/A gave control for two seasons. The first regrowth on CMU plots occurred at the water line and consisted of grasses. The tops of ditchbanks were still bare at the end of two seasons where 40 pounds of CMU was applied per acre.

Atlacide and sodium chlorate did not give satisfactory control of these ditchbank plants at 320 lb/A applied in December or March.

Diesel fuel fortified with a dinitro general or 2,4-D at various rates did not give as good control as the aromatic weed oil (Richfield "A"). One hundred and twenty gal/A of this latter oil applied late in May 1952 when growth was 10 to 15 inches tall gave very good top kill of all plants on the ditchbanks. A second treatment was necessary to keep the ditchbank clean for the full season. (Contributed by the Division of Weed Investigations, BPISAE, USDA, and Idaho Agricultural Experiment Station, cooperating).

Control of Perennial Weedy Grasses in Hawaii. Hanson, Noel S. The following species of perennial weedy grasses are pernicious pests in sugar cane land in Hawaii:

Wet areas on windward slopes

* Torpedo grass	Panicum repens
* Tall Panicum (Paragrass)	Panicum purpurascens
* Hilo grass	Paspalum conjugatum
* Dallas grass	Paspalum dilatatum
* Vasey grass	Paspalum larranagai
Bermuda grass (Manienie)	Cynodon dactylon

Dry leeward and transitional areas

* Bermuda grass (Manienie)	Cynodon dactylon
* Sour grass	Trichachne insularis
* Guinea grass	Panicum maximum
Dallas grass	Paspalum dilatatum
Tall Panicum (Paragrass)	Panicum purpurascens

(* Most important in this habitat)

Tests over the last four years have included periodic tillage combined with herbicidal sprays, and sprays alone. Tillage experiments have proven rototiller or rotary hoe type implements the most satisfactory. Rootstocks are broken into shorter segments and torn loose from soil more effectively by the beater type rototiller than by disc plow, disc, or duckfoot type cultivator. Many experiments and field observations have shown that where TCA sprays or TCA plus 2,4-D are applied to the soil before the rootstock segments have re-rooted, a large percentage of the segments are destroyed by absorbing the chemical as new roots are formed.

Torpedo grass, tall panicum, Hilo grass and Bermuda grass can be effectively controlled by combination tillage plus TCA and respond very well to treatment by TCA without tillage. TCA alone is effective on these grasses, but experiments have shown a combination of $2\frac{1}{2}$ pounds of 2,4-D and 20 pounds of TCA per acre applied at the rate of 20 to 50 gallons per acre in water to be effective as a pre-emergence spray for general weed control in areas where the above species are common. The 2,4-D acts upon germinating seeds of other broadleaved weeds and grasses and the TCA upon the rootstock segments and young grass plants. From two to four repeat applications three or four weeks apart are necessary to knock out an established stand of these species. Some spot treatment may be necessary in the following crop. The other species listed above can be controlled by TCA spot sprays at three to four week intervals until the crop is closed in. (Contributed by the Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, Hawaii.)

Control of Quackgrass with Soil Sterilant Herbicides. Timmons, F. L. and Lee, W. O. Spray applications made in December 1951 compared CMU at rates of 10, 20, 30, 40, and 50 lb/A, sodium chlorate at 480, 720, and 960 lb/A, and Polybor-chlorate at 960, 1440, and 1920 lb/A for the control of quackgrass.

All chemicals were applied in water at the rate of 240 gal/A for CMU and 320 to 1280 gal/A for Chlorate and Polybor-chlorate ($1\frac{1}{2}$# chemical/gal). Each treatment was replicated three times on plots which extend from a fence row across an irrigation head ditch and into the edge of an alfalfa field. The frozen-down grass growth was removed from the plots before the chemical applications by burning in early November. A succession of heavy snows, beginning immediately after burning off the plots, delayed the chemical applications until December at which time it was necessary to apply the spray on top of snow which varied in depth from 4-12 inches. A warm rain melted much of the snow following the applications of chemical and there appeared to be no runoff from the plots.

In May 1952, CMU appeared to be considerably less effective than chlorate or Polybor-chlorate but the results improved as the season progressed so that by July the three chemicals looked about equally effective and by September CMU showed better control of quackgrass at the highest rates tested. At that time the average percentage survival of quackgrass was 52, 30, 25, 17, and 3 for the different rates of CMU, respectively, as compared to 22, 18, and 15 for different rates of chlorate and 30, 30, and 23 for the different rates of Polybor-chlorate.

All of the plots were retreated in October 1952 with amounts of chemical thought necessary to complete the eradication of quackgrass. Further observations of results will be made in 1953. (Contributed by Division of Weed Investigations, BPISAE, USDA, and Utah Agricultural Experiment Station, cooperating).

Control of Reed Canary Grass with Soil Sterilant Herbicides. Timmons, F. L., and Lee, W. O. Reed canary grass (*Phalaris arundinacea* L.) is rapidly becoming a serious problem along irrigation canals in Utah. The grass develops berms which extend into the canal and the rank growth hangs into the canal from midsummer on, greatly obstructing the flow of water. Spray applications made in early November 1951 compared CMU at rates of 30, 45, 60, 90, and 120 lb/A, sodium chlorate at 480, 720, and 960 lb/A, and Polybor-chlorate at 960, 1440, and 1920 lb/A. Each treatment was replicated three times on plots $8\frac{1}{2}$x33 feet along the canal bank. The frozen-down growth of grass was burned off on one series of replicate plots before the spray applications while the treatments were applied to the unburned growth in the other two series. One of these series of plots was burned off soon after the applications by an unknown person which resulted in destruction of most of the chemical and the loss of results from that series.

In the spring of 1952 results appeared to be better from chlorate and Polybor-chlorate but by September the results from CMU were considerably better than those from the other two chemicals. The average percentage survival of canary grass in September was 68, 50, 55, 35, and 10 for the different rates of CMU as compared to 90, 90, and 83 for the different rates of chlorate and 80, 83, and 55 for the different rates of Polybor-chlorate. The latter two chemicals appeared to leach out of the soil rapidly, especially near the water line and to permit rapid recovery of the grass late in the season. CMU appeared to maintain its effectiveness quite well even at the water line. The results indicate that much higher rates of all three of the chemicals tested are required to kill canary grass along a continuously flowing irrigation canal than are necessary on quackgrass in small irrigation ditches which carry water only periodically. (Contributed by Division of Weed Investigations, BPISAE, USDA, and Utah Agricultural Experiment Station, cooperating).

PROJECT 3. HERBACEOUS RANGE WEEDS

Roger M. Blouch, Project Leader

SUMMARY

A total of ten abstracts dealing with the ecology and control of six herbaceous range weeds were submitted for inclusion in this year's report of progress. Eight of the abstracts were contributed by committee members, and two were contributed by non-committee members. Of the eight assigned members, four contributed abstracts and the remainder reported work progressing, but data as yet unreportable.

For convenience in discussion, the weeds reported on have been grouped into the following three categories:

Weedy Grasses

The use of three chemicals was reported in controlling cheatgrass (Bromus tectorum and B. commutatus) on open rangeland. CMU, Oktone, and Chloro-IPC all gave satisfactory control when applied to spring-germinating cheat. Perennial grama (Bouteloua gracilis) was not injured by Oktone or Chloro-IPC, but the upper tolerance limit with CMU appeared to be exceeded at rates above 3 pounds per acre. In a companion study, residual life of Chloro-IPC on blue grama-cheatgrass range far exceeded any previous reports, following fall application of the chemical. Excellent control of April-germinating seedlings occurred on plots treated the previous September. Cool temperatures were considered the major contributing factor.

Weedy Forbs

Chemical and mechanical methods were employed in the control of mules-ear (Wyethia amplexicaulis). Deep moldboard plowing was found superior to tandem disking or duckfoot cultivating. Spraying with 2,4-D produced the same results more economically, however, and appears more feasible on a wider variety of sites. The latter treatment also permits spread of established native grasses, a savings over the full reseeding required in moldboard plowing.

Plantainleaf buttercup (Ranunculus alismaefolius) in mountain meadows has been successfully controlled by 2,4-D treatment. Late-bloom applications and a diesel oil-water carrier gave highest percent kill. The alkanolamine salt of 2,4-D was somewhat superior to butyl ester.

Conversely, the butyl ester of 2,4-D was found to be twice as effective as the amine form in controlling dyer's woad (Isatis tinctoria). Two treatments per year are needed to control this mustard family pest, as seed in the soil surface zone continues to germinate during the growing season.

Poisonous Plants

In an ecological and biological control study of Klamath weed (Hypericum perforatum), it was found that where Chrysolina beetles had been released in 1948 that remarkable decreases in Klamath weed had resulted. At the same time a sharp increase in annual grasses was noted. Beetle releases later than 1948 showed no appreciable results by 1952. Other factors concerning the interrelationships between Klamath weed and its beetle parasite are also reported.

Laboratory and greenhouse studies have revealed that halogeton (Halogeton glomeratus) probably has a wide range of adaptability to sites. Halogeton plants accumulate oxalates over a wide pH range in sand cultures, produce seed of high viability, and actually germinate more readily in an acid than in a basic medium. The ease with which halogeton may be grown under greenhouse conditions is indicative of its tolerance to changes in site.

Ecological studies of halogeton show that its spread is related to two factors, (1) the absence of perennial cover due to long depletion of range forage, and (2) the disappearance of other desirable halophytes due to insect depredations. Range recovery through careful management of dry and saline sites appears to be the most practical method of reducing halogeton populations.

A screening test run with 32 chemicals and combinations on halogeton stands proved that small quantities of dinitro-o-sec-amyl phenol definitely improve the kill achieved with 2,4-D. This is particularly true in pre-bloom or early-bloom stages. Promise was also shown by polybor chlorate, used alone and in combination with 2,4-D, CMU, and TCA.

Airplane spraying provided an economical means of control of halogeton during 1952. A Cub spraying 3 gallons per acre and a Travelair spraying 7 gallons per acre were used. Again, 2,4-D plus dinitro proved superior, but no chemical was effective after plants reached full-bloom stage.

REPORTS OF INDIVIDUAL CONTRIBUTORS

Control of cheatgrass with spring applications of Chloro-IPC, Oktone, and CMU. Blouch, Roger and Fults, Jess. On the basis of success obtained with C-IPC against fall-germinating cheat, applications of 6, 12, and 24 pounds per acre were made on blue grama-cheatgrass range west of Fort Collins on April 24, 1952. CMU at 3 and 6 pounds per acre and Goodrich Oktone (cyclic hydrocarbon) at 6, 12, and 24 pounds were also used. C-IPC at 6 pounds gave 15-20 percent control, 12 pounds yielded 80-90 percent control, and 24 pounds gave 100 percent control. Oktone at 12 and 24 pounds gave 60-70 percent control and CMU at 6 and 3 pounds gave 100 percent control. Blue grama was not visibly injured by any treatment except the 6 and 3-pound rates of CMU. All blue grama on the 6-pound plots was killed, but at the 3-pound level only slight die-back resulted, amounting to about 10-15 percent of the total grama stand. The lighter applications of C-IPC and Oktone did not give control, apparently due to the advanced growth stage (1½ to 2½ inches tall) of the cheatgrass at time of application. Evidence of residual effect on fall-germination could not be proved or disproved, as late-summer drouth conditions prevented any fall sprouting of cheatgrass. (Colorado Agricultural Experiment Station, Fort Collins, Colorado.)

Residual life of 3-Chloro-IPC on a blue grama-cheatgrass range. Blouch, Roger, and Fults, Jess. As reported previously, C-IPC effectively controlled fall-germinating *Bromus tectorum* and *Bromus commutatus*, without apparent injury to the residual stand of blue grama (*Bouteloua gracilis*). This application was made September 19, 1951. When re-evaluation of the plots was made on April 22, 1952, it was found that C-IPC at 12 pounds inhibited spring germination by nearly 90 percent, although the 6-pound plots showed only 10 percent control. This finding supports other reported evidence that C-IPC has a longer residual life during the cool months of the year, presumably because of reduced microbial activity and lesser rates of evaporation. The blue grama on these plots was observed throughout the summer of 1952, and no inhibition of growth was observed. Forage on the treated plots was still green and succulent on August 1, whereas the non-treated cheatgrass areas surrounding the test area were dry and useless for grazing by June 15. (Colorado Agricultural Experiment Station, Fort Collins, Colorado.)

Chemical and mechanical methods for controlling mules-ear. Doran, C. W. Mules-ear (*Wyethia amplexicaulis*) is used to some extent by livestock, but it is generally considered an undesirable range weed because it dries up after flowering in midsummer. The weed is especially aggressive on heavy soils. Weed control demonstrations on the Routt Forest in Colorado in 1950 and 1951 showed that moldboard plowing to a depth of 6 to 8 inches in July reduced the number of mules-ear plants 85 percent. Drilling to grasses such as timothy, smooth brome, orchardgrass, intermediate wheatgrass, or tall oatgrass either immediately after plowing or in late fall (October) resulted in fair to good grass establishment by 1952. Tandem disking 2 to 3 inches deep resulted in little or no reduction in mules-ear, and reseeded grasses failed, or produced only very poor seedling stands by 1952. Shallow plowing with a light duck-foot cultivator was also tested. This type equipment undercut about 4 inches deep, but slid around some of the thick roots. It reduced the number of mules-ear plants 40 percent, but reseeded grasses were very sparse a year later. Deep mold-board plowing was the only effective mechanical method of killing mules-ear and creating a suitable seedbed for successful reseeding. Naturally, deep plowing is an expensive and impractical operation on rough rangeland, especially where clay soils are often too wet or too dry to plow effectively.

Spraying mules-ear with 2,4-D appeared much more efficient and feasible. Test plots sprayed with 2,4-D ester, 2,4,5-T, or an equal parts mixture of the two chemicals killed 95 per cent of the mules-ear plants. The chemicals were applied at the rate of 3 pounds acid equivalent per acre with 50 gallons of water on June 23, 1951 when the mules-ear was beginning to bloom. After spraying, native grasses greatly increased in vigor, and produced nearly 3 times as much herbage as untreated check plots. (Grasses on sample plots were clipped and weighed in September 1952).

Some larger scale control projects are now being initiated. The Forest Service sprayed 240 acres of dense mules-ear in one park on the Routt Forest in the summer of 1952. A power wagon with 18-foot booms applied 2.5 pounds acid equivalent of 2,4-D and approximately 37 gallons of water per acre. Total cost of the job was $4.68 per acre. (Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.)

Chemical control of buttercup on mountain meadows. Cornelius, Donald R., and Graham, Charles A. Plantainleaf buttercup (*Ranunculus alismaefolius*) has been successfully controlled by use of 2,4-D on a mountain meadow at an elevation of 5,600 feet on the Lassen National Forest in northeastern California. Two pounds of the alkanolamine salt of 2,4-D in 9½ gallons of water and 1/2 gallon of diesel oil per acre, applied when the buttercup was in late bloom, gave 100 percent control. The butyl ester form of 2,4-D was slightly less effective than the alkanolamine salt. Both forms applied at the rate of 2 pounds acid equivalent per acre gave better control than 1 pound acid equivalent per acre.

Spraying with 1 pound acid equivalent of butyl ester of 2,4-D per acre at time of late bloom (June 20) killed 86 percent and the same treatment on May 20 at early bloom stage killed 73 percent. Three carriers at 10 gallons per acre were compared for applying 1 pound of butyl ester per acre. Diesel oil gave highest kill (95 percent), water-oil emulsion at proportion of 19 to 1 was intermediate (91 percent), and water alone as a carrier was lowest (86 percent) in kill of the buttercup. (Contribution of California Forest and Range Experiment Station, Berkeley, California.)

Control of dyer's woad with herbicides. Lee, W.O. and Timmons, F. L. An experiment was started in 1951 comparing 2,4-D in amine and ester forms at rates of 1/2, 1, and 2 lb/A acid equivalent. Retreatments of surviving woad and new plants developed from seedlings were made September 28, 1951, May 2 and June 27, 1952, using the same chemical and rate in each case except that the rates of 2,4-D in amine form were doubled. A second experiment was started on new plots May 2, 1952 and retreatments were made on June 27.

Results in the two experiments showed that twice as much 2,4-D in amine form as in ester form was required to give an equivalent degree of control. Only the highest rates tested, 2 lb/A as the ester and 4 lb/A as the amine, consistently killed 90% or more of the woad plants. After each spray application the plots became reinfested by a thick emergence of seedlings which necessitated the repeated applications twice each season. Results to date indicate that the control of woad (*Isatis tinctoria*) will require one or two spray applications each year for a period of several years until all seed in the surface soil is germinated and the plants killed before new seed can be matured. If the seeds of woad remain viable in the soil as long as some species of mustard, final elimination of an infestation probably would require repeated spray treatments for many years. (Contributed by Division of Weed Investigations, BPISAE, USDA, and the Utah Agricultural Experiment Station, cooperating.)

Ecology and control of Hypericum perforatum. Tisdale, E. W. and Hironaka, M. In 1952, the field work initiated in 1951 was continued. Several new sites were studied in addition to those established in 1951. Two sites on which Chrysolina gemellata beetles were released in 1948 showed remarkable decreases of Hypericum and great increase of annual grasses. At one of these sites, several small patches of Medusa-head (Elymus caput-medusae L.) were found. Medusa-head is an aggressive, undesirable annual grass. Areas in which beetles were released later than 1948 had not shown any marked reduction of Hypericum by 1952, although in nearly all cases the beetle populations have multiplied greatly, and effects on the weed stands are expected soon.

The spread of Hypericum by seedlings in 1952 was almost nil. Since the establishment of the seedlings is dependent upon summer rains, the prolonged summer drought of 1952 had a marked effect. Adequate information on the spread of Hypericum by rhizomes is lacking, but studies to date indicate that rhizomes may be of minor importance.

Under normal fall conditions, Hypericum produces basal growth upon which the adult beetles feed and deposit eggs throughout the winter. Due to the unusual fall conditions that occurred in 1952, little or no basal growth was produced. The effects which lack of fall growth of Hypericum may have on the beetles and on the plants themselves will not be known until the field season of 1953. (Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, Idaho.)

The effect of pH upon the seed germination and oxalate accumulation in halogeton. Bohmont, D.W. and Legg, J.W. In an effort to determine the influence of hydrogen ion concentration upon seed germination and the accumulation of potassium and sodium oxalates in seedling halogeton plants, a series of experiments were conducted using nutrient water cultures, nutrient sand cultures and natural soil from 4 different locations. The washed quartz sand experiment was conducted in glazed crocks, the soil in 4-inch clay pots, and the nutrient water culture experiment in 1-quart Mason jars with an aeration tube placed in each jar. All experiments were conducted in the greenhouse at temperatures ranging from 70 to 80 degrees Fahrenheit. The nutrient solution proposed by Arnon and Johnson (Plant Phys. 17:42) was utilized in the cultures, and tap water was used to maintain growth in the soil experiment. A pH of 4.0, 7.0, 8.4, and 9.0 was maintained by periodic adjustment in the nutrient solutions. The 4 soil types selected differed in pH and were as follows: Quarry limestone and soil - pH 6.9, Mountain soil - pH 7.0, Sherman granite sand - pH 7.6, Laramie river sand - pH 8.0.

Halogeton seed was germinated on blotter paper to which the 4 nutrient solutions were added. Each treatment replication contained 15 halogeton seed. The experiment was repeated 3 times with 4 replications being utilized each time. The seed germination percentage ranged from 72 to 94. As the pH level increased above 4.0, the percentage germination decreased, the lowest germination occurring at a pH of 9.0. By statistical analysis a pH of 4.0 was found to cause significantly better germination than the neutral or alkaline treatments. Three healthy halogeton seedlings were washed with distilled water and transplanted from the blotter paper to each treatment replication. The nutrient water culture did not support halogeton seedlings for any length of time. After one week the transplanted seedlings in the nutrient water culture with a pH of 4.0 were dead, the seedlings in the neutral culture died within 2 weeks, while those in the treatment with a pH of 8.4 and 9.0 remained alive over a 30-day period. The sand cultures watered every 2 weeks with the nutrient solution appeared to be the most practical approach to growing halogeton under greenhouse conditions. All plants in all treatments were still alive after 105 days, at which time the experiment was terminated. Although the stems of the halogeton plants tended to shrivel and dry at the ground level, the rest of the plant appeared succulent and normal. The plants growing at the lower pH grew more profusely than at the higher pH levels. While the plants survived in all types of soil used in the experiment, no measurements were taken due to the obvious differences in the soil fertility.

The oxalic acid content was determined on all surviving plants growing in the sand cultures, 105 days after transplanting. Oxalic acid was lowest in the plants which grew at a pH of 4.0 and was highest in the alkaline conditions of pH 9.0. A pH of 7.0 and of 8.4 produced intermediate amounts of oxalates, as shown by the following table.

pH Treatment	Percent C_2O_4
4.0	6.62
7.0	12.82
8.4	11.09
9.0	14.31

While these data are not conclusive they do indicate that (1) Halogeton may have a wide range of adaptation. (2) Halogeton seeds have a high degree of viability. An acid environment significantly increased the percentage germination compared to the neutral or alkaline environments. (3) Halogeton plants accumulate oxalates over a wide range of hydrogen ion concentrations. (4) It is possible to grow halogeton plants under greenhouse conditions. (Contribution of Wyoming Agricultural Experiment Station, Laramie, Wyoming.)

Ecology and control of Halogeton. Tisdale, E.W. and Holl, R.H. Work on this project is continuing. Seed longevity studies are underway, and more exact information is being sought regarding the nature and methods of seed dispersal. An intensive study is being made of the germinating qualities and requirements of the normal "black" form of seed and of the nature of the "brown" form. Studies of reseeding as a means of halogeton control are continuing, as are studies of the factors involved in the depletion of certain perennials, especially shadscale.

Preliminary tests indicate that little seed remains viable for longer than one year in the field or three years stored at room temperatures.

Further study has emphasized that in Idaho, halogeton reaches dangerous proportions only on sites where perennial cover is absent or depleted. Any factors causing depletion or destruction of the perennial vegetation leaves the area ripe for invasion by halogeton. It is well, therefore, to attempt to reseed only well-adapted sites. Until adapted species are found or reliable methods developed for seeding native species, the best policy appears to be to manage saline and very dry sites in such a manner as to allow the recovery of the native, salt-tolerant species already present.

The problem of insect depredations on native perennial species is complex, and its relationship to grazing pressure, plant vigor and weather conditions has received little attention. It appears doubtful that insects alone are the sole cause of serious depletion of native range vegetation. Various combinations of circumstances, involving heavy grazing and/or unfavorable weather, and a multiplicity of insects may allow a given insect to exert a destructive pressure far greater than would under normal conditions.

Further examination has shown that the snout moth (Eumysia sp.) is not alone in attacking the shadscale (Atriplex confertifolia) stands of the Raft River Valley. A scale insect (Orthezia annae) is also present and attacks the plants below the root crown, sucking out the plant fluids. Although the particular species of snout moth involved has not been previously collected, both insects are thought to be endemic. Similar insects have been observed in shadscale stands in other parts of Idaho, and other range plants are similarly affected. A special study of this phase of the problem is being undertaken in cooperation with the Entomology Department of the Idaho Agricultural Experiment Station. (Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, Idaho.)

Chemical screening tests in halogeton control. Burge, Lee M. A total of thirty-two different chemicals and combinations of chemicals were used in plots established within a twenty acre fenced area. Livestock did not have access to the plots, but rodents were not excluded. The plots were set up on the basis of representing normal terrain under actual field conditions, and for this reason they measured between 1/2 and 1 acre in size.

Low volatile esters used at one pound acid per acre in water alone, and in water and emulsifiers, proved unsatisfactory. Two pounds of low volatile ester in thirty gallons of water per acre in combinations with either summer oil or multifilm produced corresponding results to other forms of 2,4-D esters in general use. Low volatile ester acts much slower on Halogeton than other forms of 2,4-D. Plants remain soft and pliable after treatment for a longer period. Low volatile 2,4-D ester applied to pre-bloom Halogeton at 2 pounds acid per acre in combination with one pint of commercial dinitro-o-sec amyl phenol and one quart of summer oil in 30 gallons of water gave excellent control. Low volatile 2,4-D ester at 2 pounds and 1/2 pint multifilm applied the same day on pre-bloom growth in 30 gallons of water produced economic results comparable to other 2,4-D's in general use.

Isopropyl 2,4-D esters in combination with commercial dinitro show corresponding results to low volatile 2,4-D and dinitro. A small amount of dinitro definitely aids the kill with 2,4-D ester when applied to Halogeton in early bloom.

Three quarts of dinitro in combination with one quart of summer oil in 30 gallons of water applied to early bloom Halogeton on relatively level ground produced 100 percent kill. The same experiment substituting 1/2 pint of multifilm for summer oil and 50 gallons of water on a rough gravel dump area gave corresponding results except that definite misses were evident due to unavoidable boom whip.

A number of other materials have shown promising results, the best being polybor chlorate alone, or in combination with 2,4-D, CMU and TCA. Polybor chlorate at 40 pounds in combination with 2,4-D ester at one pound in 40 gallons of water per acre on small blooming plants in 1951 produced a 100 percent kill, and resulted in a 90 percent reduction in plant population in 1952. (Contribution of Nevada State Department of Agriculture, Reno, Nevada.)

Economic control of halogeton by airplane spraying. Burge, Lee M. A Cub plane was used to apply 3 gallons of material per acre and the larger Travelair to apply 7 gallons per acre of chemical and carrier, to plants of halogeton. Young plants up to 1/10 bloom sprayed in July, using 3 and 7 gallons per acre at a concentration of 2 pounds acid 2,4-D ester and 1 pint multifilm or 2 gallons summer oil per 100 gallons resulted in economic control.

Plants 1"-9" responded more slowly than seedlings. As the plants developed in size and as blooming increased, 2,4-D proved correspondingly ineffective.

Dinitro added to 2,4-D ester responded in identical proportion to those experiments with ground applications. 4"-8" partially blooming plants sprayed late in July with 2.6 pounds of 2,4-D acid per acre in combination with 2 gallons of summer oil to 50 gallons of solution gave excellent results at 3 gallons per acre. Early in August blooming plants 6"-10" tall sprayed with 2,4-D ester at two pounds acid and one quart dinitro in three gallons of water gave an excellent kill. Small plants 4"-6" tall in early bloom responded well to a formulation of one pound 2,4-D ester per acre in combination with 1½ pints dinitro in three gallons per acre. (Contribution of the Nevada State Department of Agriculture, Reno, Nevada)

PROJECT 4. UNDESIRABLE WOODY PLANTS OF FOREST AND RANGE LAND

Oliver A. Leonard, Project Leader

There were seven abstracts submitted for inclusion in the report on the control of undesirable woody plants of forest and range lands. Progress is evident in determining how to use chemicals effectively in controlling woody plants. It is also evident that some woody plants are not likely to be controlled by aircraft application of herbicides that are in common use; on the other hand, the use of aircraft will continue to increase and will include areas and brush types that are not now being sprayed. The types of brush not controlled by aircraft application can generally be killed by the basal spray method, provided this method is economically feasible. There appear to be very few woody plants that cannot be killed by the basal spray procedure.

There are many species of woody plants that are not likely to be killed by single applications of foliage sprays and some reapplication is generally necessary, even with basal sprays, in order to kill all of the plants. Repeated foliage applications result in a gradual weakening and death of the woody plants. Although most of the data is on the use of 2,4-D and 2,4,5-T, there is some indication that MCP may find a place in woody plant control. Perhaps past results have shown little promise because ineffective formulations were tested (such as sodium salt and butyl esters, or those in which no sticker-penetrants were added). CMU (3-(p-chlorophenyl)-1, 1-dimethylurea) is under test but few final readings have been obtained thus far.

The *Ribes* studies by the Bureau of Entomology and Plant Quarantine continue to be illuminating. *Ribes viscosissimum* and *R. lacustre* respond to esters of 2,4,5-T under a variety of physiological conditions (such as late season spraying) if some spray additive is used (such as summer-oil emulsion, ionic and nonionic detergents, free and combined fatty acids, propylene glycol, and various sticker-spreaders). It is of very great practical importance to have sprays that give control over a broad range of physiological conditions, not only because of convenience but because it is frequently not possible to know the precise physiological condition of the plants that are being treated. Respray of the above species were usually 100% successful.

Although *Ribes roezli* has been easy to kill with 2,4-D under favorable growing conditions, it has been difficult to kill the root crown in late season spraying or in association with heavy brush stands. Varietal forms of this species react differently to formulations of 2,4-D and 2,4,5-T. A new amine of 2,4,5-T looks promising for late season spraying and a butoxyethanol ester of 2-methyl-4-chlorophenoxyacetic acid gave a 100% kill in one test in August. As time goes along, more consistently effective sprays are being found.

The basal spray procedure continues to be more consistently satisfactory than foliage spraying; 2,4,5-T appears more consistent than 2,4-D and also helps by increasing the aromatic content. Basal sprays are generally satisfactory on most species of woody plants, especially those that sprout close to the crowns. Removing some soil around the crowns before spraying apparently insures a more complete kill than when the soil is not removed. Evidently the effectiveness of the basal spray is largely dependent on the killing that is accomplished by the spray mixture running down the roots beneath the surface of the soil.

California tests indicate that poison oak (Rhus diversiloba) is not likely to be killed by single applications of 2,4-D or 2,4,5,-T; however, a high degree of kill may be obtained by a second application. The importance of a sticker-spreader-penetrant is emphasized, particularly when the amine formulations are used. Evidently poison oak is sensitive to both 2,4-D and 2,4,5-T, although the latter may be slightly superior. In these tests the amine and emulsifiable acid formulations appeared to be superior to the esters.

Errata

Some changes in the data on p.73 of the Research Progress Report of the 13th Western Weed Control Conference is requested, so as to present the data that are being used in the "year-around" field operations on Berberis fendleri. The data in the following table may be used as a basis for recommendations on the control of barberry, and were obtained by L.W. Melander and E.A.Lungren. The information in the following table was obtained in the San Juan Basin in Colorado on old-mature (normal) barberry plants growing on level and hilly rocky soil. We are glad to have this information on highly effective foliage and dormant sprays, a goal which we hope to approach on other species of woody plants.

PLANT	TREATMENT						KILL, %
Stage	Type	Date	Formulation	Conc.	Dose	Diluent	Top/Root
Active	FS	1949-51	LE 2,4-D	1.6 AHG	2.9 PPA	Water	100/99+
Active	FS	1950-51	HE 2,4-D	1.6 AHG	2.9 PPA	Water	100/99+
Dormant	DS	1949-51	BK 2,4-D + 2,4,5-T	14 AHG	14.3 PPA	Oil	100/99+
Dormant	DS	1950-51	HE 2,4-D	14 AHG	14 PPA	Oil	100/99+

REPORTS OF INDIVIDUAL CONTRIBUTORS

A comparison of selective herbicides for control of sagebrush on northeastern California rangeland. Cornelius, Donald R., and Graham, Charles A. Various forms of 2,4-D and 2,4,5-T were tested for sagebrush control on rangeland at elevation of 5,600 feet on the Lassen National Forest, California. The different herbicides were applied in emulsion with 9½ gallons water and ½ gallon diesel oil per acre June 1951 and results were determined in August 1952. Percentage kill of the sagebrush for the different forms at 2 pounds of acid equivalent per acre was as follows: butyl ester of 2,4-D, 99; butoxyethanol ester of 2,4-D, 99; and butyl ester of 2,4,5-T, 96. One pound acid equivalent of 2,4-D for different forms gave percentage kill as follows: butyl ester, 83; butoxyethanol ester, 97; isopropyl ester, 87; and sodium salt, 97.

When considered with results for previous years, butyl ester of 2,4-D has consistently given excellent control of sagebrush. Isopropyl ester and sodium salt of 2,4-D and butyl ester of 2,4,5-T have given erratic performance; therefore, the butyl ester form of 2,4-D would be preferable to these other three herbicides. The results herein reported are the first for butoxyethanol ester of 2,4-D at this location. The 1 pound rate for this low volatile ester promises to be superior to the 1 pound rate of butyl ester. If such favorable results continue through tests now in progress, it may be possible to change from the generally recommended use of 2 pounds of butyl ester per acre to 1 pound of the butoxyethanol ester.

Three species of sagebrush were included in this test. The average percentage control by species for all treatments was 83 for big sagebrush (*Artemisia tridentata*); 88 for black sagebrush (*Artemisia arbuscula*); and 91 for silver sagebrush (*Artemisia cana*). U.S. Forest Service, California Forest and Range Experiment Station.

The effect of two applications of 2,4-D and 2,4,5-T on poison oak (*Rhus diversiloba*). Carlson, C.E., Leonard, O.A., and Osborn, L. - This project was initiated in 1950 by the State Division of Forestry in cooperation with the Farm Advisor of Yuba County and Robert Watwood of the Monsanto Chemical Company. A series of 9 plots of approximately 1/4 acre each were sprayed with various chemicals. The test was continued in 1951 by the authors and the data in the table were collected in September of 1952.

The plots were established at about 1400 feet elevation in the Sierra foothills in Yuba County. The poison oak was dense, and uniform in distribution and size (70% crown cover), with the plants being 5 to 6 feet tall. When the plots were sprayed in 1950, the plants were starting to bloom and were fully leafed out. The growth was considered to be vigorous.

During 1951 a check of the results showed a maximum degree of complete top kill of about 20%. The effect of the 1950 treatments on the four plots that were selected for retreatment are shown in the table. The amine of 2,4,5-T (1950 test) resulted in the poorest kill of the plots that were selected for retreatment. Referring to the results of the top and root kill obtained by the retreatment in 1951, the results on some plots were highly effective. There are some unexplained discrepancies that appear in the data; however, the effect of the initial treatments may have a very definite bearing on the final results. Two applications with the amine of 2,4-D gave a high

The effect of two applications of 2,4-D and 2,4,5-T on poison oak. The first application was made on April 17-18, 1950 and the second application on May 21, 1951. Plots were on the Carmichael ranch on the Brownsville Road, Stanfield Hill, in Yuba County. Readings were made on Sept. 16, 1952.

Treatment in 1950				Treatment in 1951				
Formulation	Diluent	Pounds per acre	Top/root kill, %	Formulation	Diluent	Pounds / acre	Gal. / acre	Top/root kill, %
LE 2,4-D	Diesel	4	11/3	LE 2,4-D	Diesel	4	20	85/47
LE 2,4-D	Diesel	4	11/3	HE 2,4-D 0.33%	2% Diesel + WA (single plants)	--	--	96/83
LE 2,4-D	Diesel	4	11/3	HE 2,4,5-T 0.33%	2% Diesel + WA (single plants)	--	--	59/39
Amine 2,4-D	Water	4	20/13	Amine 2,4-D	2% Diesel + WA	4	80	98/86
Amine 2,4-D	Water	4	20/13	Amine 2,4-D & Ammate	2% Diesel + WA	4 10	80	58/34
Amine 2,4-D	Water	4	20/13	Amine 2,4-D	2% Diesel + WA	2	80	100/87
Amine 2,4-D	Water	4	20/13	HE 2,4-D	2% Diesel + WA	2	80	88/64
LE 2,4,5-T	Diesel	4	12/3	LE 2,4,5-T	Diesel	4	20	93/85
LE 2,4,5-T	Diesel	4	12/3	Ammate	2% Diesel + WA	160	80	67/45
LE 2,4,5-T	Diesel	4	12/3	Emulsifiable acid 2,4,5-T	2% Diesel + WA	2	80	100/98
LE 2,4,5-T	Diesel	4	12/3	Suspended acid 2,4,5-T	2% Mineral Seal Oil	2	80	42/15
Amine 2,4,5-T	Water	4	5/3	Amine 2,4,5-T	2% Diesel + WA	4	80	95/70
Amine 2,4,5-T	Water	4	5/3	HE 2,4,5-T	2% Diesel + WA	2	80	47/27
Amine 2,4,5-T	Water	4	5/3	Amine 2,4-D	2% Diesel + WA	2	80	26/8

WA-- means wetting agent (MWC-1 of Colloidal Products Corp. was used). LE--means the lower esters (isopropyl used). HE--menas the heavy esters (propylene glycol butyl ether esters used). Emulsifiable acid 2,4,5-T was A.C.P. L-120.

degree of kill, except when Ammate was added; however, the amine of 2,4-D gave poor results when it followed a treatment with the 2,4,5-T amine. On the other hand, the 2,4,5-T amine followed by the reapplication of the same material with a sticker-penetrant gave a moderately high kill. The 2,4,5-T amine appears to be very effective on poison oak when used with a sticker. The amine of 2,4-D was not as effective as a second application, because the initial kill was poor. Evidently the amine of 2,4,5-T when used with a sticker is inherently more effective on poison oak than the amine of 2,4-D. The esters appear to be somewhat inferior to the amine forms in these tests. The emulsifiable acid of 2,4,5-T, which gave the highest kill of any treatment, bears further investigation. It appears that the amine of 2,4-D (when used with a sticker) can effectively control poison oak and was the least expensive material used. These applications were made at the optimum time for spraying, and would not necessarily hold for other dates of application. (Calif. Division of Forestry and University of California.)

<u>Comparative effectiveness of 2,4,5-T on velvet mesquite when applied by airplane in different formulations, carriers, and volumes.</u> Glendening, Geo. E. -- Analysis of the data from 36 5-acre test plots sprayed by airplane in late May 1951 and observed in August 1952 reveals the following with respect to per cent actual plant kill and per cent top kill:

(1) On the Santa Rita Experimental Range where 3/4 lb/acre A.E. PGBE ester of 2,4,5-T and triethylamine of 2,4,5-T were applied at 5, 10, and 20 gal./acre in 1:3 and 1:7 diesel oil/water and in 1:3 and 1:7 nontoxic oil (Helix #15)-water emulsions: (a) Mean kill with ester was 33% and with amine salt 22%, with difference significant at 1% level of probability. (b) The 1:3 oil/water ratio was superior to the 1:7 ratio with difference significant at 5% level. (c) Difference between mean per cent kill with 5, 10, and 20 gal/acre volume, and between diesel oil/water and Helix oil/water emulsions are not significant at 5% level although means obtained indicate that per cent kill increases with volume and that diesel oil was superior to Helix.

(2) When the data from replicate tests comparing the ester and amine at 5, 10, and 20 gal/acre volume as 1:3 diesel oil/water emulsion at two additional sites in Santa Cruz County, Arizona, are treated together with the data from the same components of the Santa Rita tests: (a) Differences in actual plant kill due to formulation, volume and site are not significant at the 5% level, but site contributes greatest Mean Squared Variance, and volume contributes the least. (b) No difference in per cent top kill due to formulation, volume, or site is significant at 5% level, but volume was source of greatest variance and formulation was source of least.

Conclusions to be drawn are: (1) PGBE ester was superior to amine and 1:3 ratio is superior to 1:7 ratio with respect to actual plant kill of velvet mesquite on a single site, (2) some factor associated with site has greater effect on actual kill than formulation or volume, and (3) volume or coverage has greater effect on top kill than on actual plant kill. (A contribution from Southwestern Forest and Range Experiment Station, Tucson, Arizona.)

Chemical tests on cactus and burroweed. Roach, M. E., and George E. Glendening. CACTUS - A variety of herbicides has been tested on cholla cactus (Opuntia fulgida and O. spinosior) and prickly pear (O. engelmanni) in southeastern Arizona during the past five years. Tests show that complete wetting of the foliage of both prickly pear and cholla is necessary to obtain satisfactory plant kills. For this reason, effective spraying of cactus requires high volume and individual plant treatments. Application rates used for the herbicides discussed in the following paragraphs vary with plant size, but average approximately 1 pint per plant for prickly pear and 1 gallon per 15-20 cholla plants. These rates are about minimum for the size plants on the test plots.

The five most effective herbicidal mixtures tested to date are: (1) 1.1% DNOSBP in diesel oil. This material has resulted in average kills of approximately 90% on both prickly pear and cholla, (2) 1/2 to 3/4 lb/gal of TCA in water. One-half pound TCA per gallon is effective on prickly pear. For cholla, TCA is more effective at 3/4 lb/gal of water, (3) 2,4-D ester at 3,000 ppm A.E. plus 1% DNOSBP in diesel oil. This mixture has proved effective on cholla, but results have been erratic on prickly pear. (4) 12,500 ppm A.E. 2,4-D acid or ester in diesel oil have produced kills averaging 87% on cholla. At concentration of about 20,000 ppm A.E. 2,4-D ester in a 1:4 oil and water emulsion has produced comparable kills on prickly pear, (5) 10,000 ppm 2,4,5-T ester in diesel oil.

Several other mixtures, not so completely tested, show promise. In one unreplicated treatment 10,000 ppm A.E. 2,4,5-T amine in water gave a 100% kill on cholla. In another, 10,000 ppm A.E. 2,4-D acid in diesel oil produced an average of 70% kill on cholla, while on prickly pear a 1:4 oil/water emulsion was superior to straight oil as a carrier. Six tests of 5,000 ppm 2,4,5-T ester on cholla gave an average kill of 67% as opposed to 82% kill at 10,000 ppm. 1.5% PCP in kerosene or diesel oil was effective on cholla but not on prickly pear.

BURROWEED - Burroweed studies evaluated this year have shown the same erratic response to hormone herbicides applied as low volume foliage sprays as reported for the past four years. Response to herbicides has varied from year to year and from plot to plot. On the basis of tests made during the past two years, results have been discouraging with kills running less than 50% in all cases. Little consistent difference in effectiveness of 2,4-D and 2,4,5-T has been noted. Though yielding poor results in our recent tests, 1 lb/acre A.E. 2,4-D ester in 5 gal/acre of 1:4 diesel oil-water emulsion has produced effective kill on some areas and is being tentatively recommended. On the basis of one year's results, MCP appears to be worthy of further tests on burroweed. (Southwestern Forest and Range Experiment Station, Tucson, Arizona.)

Developments in chemical methods of Ribes suppression in the Western States during 1952. Moss, V. D., Quick, C. R., Burrill, W. S., and Offord, H. R. Progress in developing improved chemical methods of ribes suppression for the control of white pine blister rust (Cronartium ribicola Fischer) is here summarized to show results of 1951 tests and the scope of work undertaken during 1952.

In the white pine forests of Washington, Idaho, and Montana, 2,4,5-T is needed for satisfactory kill of Ribes viscosissimum and lacustre, the two principal species occurring in this region. The 1951 experiments on these two species were chiefly with uniform dosages of aqueous foliage sprays of commercial esters of 2,4,5-T, first alone and then with the addition of various amounts of summer-oil emulsion, solubilized petroleum oil, ionic and nonionic detergents, free and combined fatty acids, propylene glycol, and several combinations of these spreader-penetrant-sticker materials. In general the kill of ribes bushes was increased by these adjuvants, especially on lacustre, and in applications made late in the season when plant growth begins to slow down. For use in large power sprayers 0.1 percent of a solubilized oil containing free and combined fatty acids was preferred to 1 percent summer-oil emulsion because of convenience in handling a small volume of material and the low cost per gallon. For knapsack-spray work 1 percent of summer oil plus 0.1 percent of propylene glycol was favored, because this mixture aids in marking, in lubrication of the trombone pump, and in adding a penetrant-spreader and a hygroscopic agent to the aqueous 2,4,5-T. Respray of sprouting ribes with aqueous 2,4,5-T at 1,000 and 2,000 p.p.m. of acid equivalent 1 year later was usually 100 percent successful. At 8 pounds of 2,4,5-T acid per acre--the highest dosage used in 1951--no significant reduction was noted in the viability of ribes seed collected from the test plots.

From June through September 1952, in northern Idaho, the toxicity of long-chain (low-volatile) and short-chain (volatile) esters of 2,4,5-T and the volume of spray in relation to the effectiveness of a specific dosage of 2,4,5-T were studied in additional field tests on lacustre and viscosissimum. At the end of the season the plots given a high volume of spray were showing the most damage; however, no significant comments can yet be made about the relative merits of the several esters.

In the sugar pine forests of California and Oregon, the 1951 work with 2,4-D and 2,4,5-T consisted of 161 tests of aqueous foliage sprays and 140 tests of basal-stem sprays. Plots replicated throughout the season were compared as follows: Aqueous foliage sprays containing sodium and amine salts of 2,4-D; long- and short-chain esters of 2,4-D, 2,4,5-T, and mixtures of the two; the butoxyethanol ester of 2-methyl-4-chlorophenoxyacetic acid; emulsifiable acid of 2,4-D; and special formulations of a mixture of 2,4-D and 2,4,5-T containing a high percentage of emulsifier plus Diesel oil up to 10 percent by volume. Basal-stem treatments were made with 1, 2.5, and 5 percent of long- and short-chain esters of 2,4-D, 2,4,5-T, and mixtures of the two in Diesel oil. Comparisons were concerned with active ingredient, oil diluent, length of basal stem treated, and season of application.

Noteworthy results with foliage sprays are as follows: Ribes roezli is highly sensitive to 2,4-D and easy to kill with all spray formulations of 2,4-D or 2,4,5-T during the period of vigorous early-season growth. No formulation or type of these compounds thus far tested on this species has shown consistent and satisfactory kill of the root crown when applied as a dilute foliage spray in midseason and late season.

Repeated defoliation with low concentrations of 2,4-D have killed Ribes roezli. Exploratory aircraft studies were initiated to determine whether it might be possible to defoliate this plant using pellets containing a volatile ester of 2,4-D. The effect of the pellets was to cause some defoliation of the Ribes, but with improved procedures and repeated defoliation kills of the Ribes may be accomplished by aircraft application with little injury to forest.

Research at the Southwestern Forest and Range Experiment Station in Arizona is yielding valuable information on the control of woody plants in that area. Results from the aircraft spraying of velvet mesquite (Prosopis juliflora var. velutina) have been variable, with site having a greater effect on kill than either formulation or volume of spray. Volume of spray had a greater effect on top kill than on actual kill of the whole plant. On one site the PGBE ester of 2,4,5-T was superior to the amine formulation and the 1:3 Diesel oil/water ratio was superior to the 1:7 ratio. The evidence, though not significant, indicated that Diesel oil was superior to Helix oil/water emulsions. Similar evidence on other woody plants is indicated in some California tests.

These workers have also found a number of chemical combinations that are effective on cholla (Opuntia fulgida and O. spinosior) and on prickly pear (O. engelmani). Complete coverage is required for successful spraying. High degrees of kill were obtained with DNOSBP, 2,4-D, and 2,4,5-T in Diesel oil and TCA in water. In one test the amine of 2,4,5-T in water killed cholla. Burroweed (Haplopappus tenuisectus) continues to be a problem and results have been erratic. Present tentative recommendations are to use 1 lb/acre acid equivalent of a 2,4-D ester in a 1:4 Diesel oil-water emulsion.

Research on the control of big sagebrush (Artemisia tridentata) in Wyoming indicates that the best present treatment is using 1 pound per acre of a 2,4,5-T ester in 3-5 gallons of Diesel oil. Kills with 2,4-D have been inferior to those obtained with 2,4,5-T, but these do not include more recent tests with other diluents and combinations. The proper time to spray is determined by observing the growth development of associated vegetation as well as the plants to be sprayed. An important advantage gained by spraying was that grass production doubled following a 60% kill of the sagebrush and almost tripled following a kill of 95%. The increase in forage was enough to pay for the spraying in 5 to 7 years.

Research in northeastern California indicated somewhat different results than were obtained in the Wyoming tests on sagebrush. The species involved in these tests were Artemisia tridentata, A. arbuscula, and A. cana. Kills up to 99% were obtained with 2 pounds per acre of either the butyl or butoxy ethanol esters of 2,4-D and 96% kill with the butyl ester of 2,4,5-T. The spray mixture was not the same as used in Wyoming and may account for the difference in the results. This mixture consisted of ½ gallon of Diesel oil and 9 gallons of water per acre; however, one should not lose sight of the possibility that the differences might be due to varietal differences, such as have been observed in California with Ribes roezli. Some preliminary evidence in California indicates that the butoxy ethanol ester of 2,4-D was superior to the butyl ester, when applied at the rate of one pound per acre.

Research and the use of chemicals for woody plant control is indicated from the Hawaiian report. The aircraft application of chemicals for woody plant control is becoming well established in areas where the major species are sensitive and the brush is thick. Periodic spraying on an annual or biennial basis seems logical. Most of the spraying has been on areas where guava and sensitive range weeds are abundant. A table is presented on the sensitivity of the more common woody plants to foliage and basal sprays.

Ribes roezli in association with heavy stands of mixed species of brush continues to be especially difficult to kill. Varietal forms of this species (southern form on the Sierra N. F. and northern form on the Plumas N. F.) react differently to various formulations of 2,4-D, 2,4,5-T, and their mixtures. On the southern form aqueous sprays of the long-chain esters of 2,4-D were better than the short-chain esters. Moreover, a new amine formulation of 2,4,5-T looked promising for late-season spray work. When mixtures of 2,4-D and 2,4,5-T were employed on the northern form, the short-chain esters were at least as good as the long-chain esters throughout the season. On one foliage-spray plot a test of the butoxyethanol ester of 2-methyl-4-chlorophenoxyacetic acid in August gave a surprising 100 percent kill of *R. roezli*.

Throughout the season, and especially for midseason and late-season treatment of both forms, basal-stem treatments continued to show better kill and less erratic kill of bushes than foliage sprays. For June treatments 1 percent of these phenoxy compounds in oil was as good as the 2.5 and 5 percent, provided all stems were thoroughly wet. For late-season basal-stem treatments 2,4,5-T was more consistent than 2,4-D, and the long-chain esters were somewhat better than the short-chain type, in killing *roezli*. On the northern form, increasing the aromatic content of the oil diluent improved the bush kill. Defoliation tests at the end of the third consecutive year of treatment with aqueous 2,4-D at 50 p.p.m. of acid equivalent showed nearly complete kill on all plots.

In 1952, 289 plots were established in California, (1) to compare the toxicity of several of the long-chain esters of 2,4-D and 2,4,5-T with the short-chain esters in both foliage and basal-stem sprays, (2) to study the lethal dosages of 2,4-D and 2,4,5-T as modified by the length of basal stem covered in the treatment, (3) to establish the practical lethal dosage of the new soil poison CMU, 3(p-chlorophenyl)-1,1 dimethylurea, to *roezli*, and (4) to determine the effectiveness of 2,4-D sprays and pellets for defoliating and damaging *roezli* when rapid broadcast treatments were made from fixed-wing aircraft.

In the aircraft tests six plots totaling 160 acres were sprayed with 4 or 8 ounces of 2,4-D acid equivalent (butoxyethanol ester) in 1, 2, or 3 gallons of Diesel oil per acre, and one plot of 20 acres was treated with 10 pounds per acre of a special pellet containing 20 percent of 2,4-D by weight as a volatile ester. The Special Equipment Center of the Bureau of Entomology and Plant Quarantine furnished a pilot and an N3N biplane of 450 hp. for making the tests. Flight speed over plots was 100 m.p.h. at a height of 200-300 feet above the ground.

Spray droplets reached the ground in a satisfactory pattern until the air temperature exceeded 70° F. The 2,4-D pellets came down through the screen of trees and tall brush and damaged sensitive plants in the layer of vegetation within 3 feet of the ground without harming taller shrubs and trees. Two months after the aircraft tests the damage to *roezli* was greatest on the plots treated with 8 ounces of 2,4-D acid equivalent in 1 gallon of oil or 32 ounces in 10 pounds of pellets per acre. The percent of bushes, according to defoliation, on plots given the two treatments were as follows:

	Oil spray	Pellets
Defoliated less than 50%	7	35
From 50-80% - - - - - -	15	30
Over 80% - - - - - - - --	78	35

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U. S. Department of Agriculture, Berkeley, Calif.

CONTROL of big sagebrush (*Artemisia tridentata*) in Wyoming. Kissinger, N. A. and Vaughn, W. T. Investigation into chemical control of big sagebrush was started near Lander, Wyoming, in 1949. Data from both aerial- and ground-sprayed herbicide treatments made in 1949, 1950, and 1951 have been assembled for evaluation and comparison.

In the Lander area, the period when sagebrush twigs are growing most rapidly has been the key to high kills. The following table shows the relationship between the period of maximum twig growth and sagebrush kills; development of associated vegetation is also presented since this has proved a useful guide.

Periods of application, sagebrush kills, and vegetative development

TREATMENT PERIOD:	MAY 10 - 19	MAY 20 - JUNE 10	JUNE 11 - 26
SAGEBRUSH KILL:	66%	84%	52%
Species	Stage of vegetative development		
Big sagebrush	Current twig growth started but slow	Rapid twig and flower stalk growth	Twig growth nearly complete; flower stalk growth rate slowing
Native bluegrasses (Sandberg and Cusick)	Beginning to head out	In full bloom	Heads drying; seed in late dough to mature and disseminating
Native wheatgrasses (Thickspike and Bearded bluebunch)	Vegetative growth	In "boot"	Fully headed out; not yet in bloom
Hood's phlox	In full bloom	Flowers drying	Fruit mature

Sagebrush kills shown in the table were obtained with 1 pound acid equivalent per acre of the isopropyl ester of 2,4,5-T. These kills represent averages from applications using diesel oil as carrier at 3 and 5 gallons per acre; little difference due to these quantities of diesel oil have been found. The relationship between kill and period of application has been consistent for all 2,4,5-T alkyl esters tested. However, one year's data (1951) showed that 1 pound of the propylene-glycol-butyl-ether ester killed 71 percent of the sagebrush plants when applied during the May 10-19 period as compared with the 1950-51 average of 58 percent in the May 20 to June 10 period. This ester form of 2,4-D has not been used during the May 10-19 period.

One pound acid equivalent of 2,4,5-T per acre, regardless of formulation, has given higher kills than either 1 or 2 pounds of 2,4-D. This has been true when both chemicals were used in either 3 or 5 gallons of diesel oil or water carriers. Kills from 2 pounds of isopropyl ester of 2,4-D in 3 or 5 gallons of diesel oil applied at the optimum period (May 20 - June 10) have averaged 63 percent. At 1 pound, the kills averaged 53 percent.

SPECIES REACTION OF PASTURE WEEDS, SHRUBS AND TREES TO 2,4-D

Common Name	Scientific Name	Nature of Plant	Approximate Acreage Covered 1/	Rating for Control by 2,4-D Foliage	Rating for Control by 2,4-D Basal 2/
Airplant	Bryophyllum pinnatum	Small herbaceous shrub	2	VS	--
Amaranth, spiny	Amaranthus spinosus	Small herbaceous shrub	1	VS	--
Apple of sodom	Solanum sodomeum	Small shrub	1	MS	S
Blackberry	Rubus penetrans	Trailing shrub	2	MS	U
Black wattle	Acacia decurrens	Large shrub or tree	1	R	MS
Cactus (Panini)	Opuntia megacantha	Shrub	5	U	U
Castor bean	Ricinus communis	Herbaceous shrub	1	VS	--
Catsclaw	Caesalpinia sepiaria	Trailing shrub	1	R	MS
Cocklebur (Kikania)	Xanthium canadense	Herbaceous shrub	1	VS	--
Emex	Emex spinosa	Prostrate shrub	1	MS	--
Eucalyptus	Eucalyptus sp.	Tree	1	R	R
Firebush	Myrica faya	Large shrub or tree	1	U	U
Corse	Ulex europaeus	Shrub	1	R	MS
Guava	Psidium guajava	Large shrub	5	S	VS
Hawaiian Holly (Christmas berry)	Schinus terebinthifolius	Large shrub or tree	3	R	S
Java plum	Eugenia cumini	Tree	3	R	S
Joee (blue weed)	Stachytarpheta cayannensis	Small shrub	3	VS	--
Kiawe (Algaroba)	Prosopis chilensis	Tree	3	R	MS
Koa haole	Leucaena glauca	Large shrub	4	R	MS
Klu	Acacia farnesiana	Large shrub	2	R	MS
Lantana	Lantana camara	Shrub	5	R	S
Melastoma	Melastoma malabathricum	Shrub	2	R	R
Opiuma	Pithecellobium dulce	Large shrub or tree	1	R	S
Pamakani, Maui	Eupatorium adenophorum	Shrub	3	R	U
Pamakani, Hamakua	Eupatorium riparium	Shrub	3	R	U
Pluchea	Pluchea indica	Small shrub	1	R	MS
Pluchea, hairy	Pluchea odorata	Big shrub	1	R	MS
Puakeawe	Styphelia tameiameiae	Shrub	3	U	U
Rhodomyrtus	Rhodomyrtus tomentosa	Large shrub	1	R	R
Sacramento bur	Triumfetta bartramia	Shrub	2	R	MS
Silver Oak	Grevellia robusta	Tree	1	R	MS
Staghorn	Gleichenia linearis	Trailing fern	5	S	--
Verbena	Verbena littoralis	Small shrub	3	VS	--
Waiwi	Psidium cattleianum var.lucidum	Large shrub or tree	2	R	MS

1/ 5 = Greater than 50,000 acres coverage, 4 = 20,000 to 50,000 acres, 3 = 5,000 to 20,000 acres, 2 = 1,000 to 5,000 acres, 1 = less than 1,000 acres.

2/ VS = Very sensitive: over 95% of top growth killed by one application of 2,4-D. S = Sensitive: 50-95%. MS = Moderately sensitive: 10-50%. R = Resistant: less than 10%. U = Unknown effect of herbicide.

The propylene-glycol-butyl-ether ester of 2,4-D at 2 pounds per acre in 5 gallons of water gave average kills of 74 percent during May 20 - June 10, compared to 62 percent with oil. Of the various formulations of 2,4-D used and where a comparison is available, the isopropyl ester was the only one that proved to be more effective in diesel oil than in water.

Mixtures of 2,4-D and 2,4,5-T in the butyl, butoxyethanol, and the propylene-glycol-butyl-ether esters were tested. The 1:1 mixture of poly-propylene-glycol esters particularly shows promise but data are not yet complete enough to present a clear picture for comparison.

Higher rates than 2 pounds of 2,4-D ester and 1 pound of 2,4,5-T ester per acre have been tested but the sagebrush kills were not, in any case, enough higher to warrant the expenditure for the additional chemical.

Production of native perennial grasses on untreated sagebrush range in this area averages 220 pounds (air-dry) per acre. This production more than doubled following a 60-percent sagebrush kill and nearly tripled with a 95-percent sagebrush kill. By increasing the range carrying capacity it is estimated that this increased grass production will pay all costs of spraying in a period of 5 to 7 years. Rocky Mountain Forest and Range Experiment Station, Forest Service, Fort Collins, Colorado, and Branch of Soil and Moisture Conservation, Bureau of Land Management, Lander, Wyoming.

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Control of Woody Plants on Rangeland in Hawaii. Hanson, Noel S. and Ripperton, John C. The acreage of woody plants mainly in ranch lands in Hawaii that has been treated with herbicides has roughly doubled each year since 1948. Some 6,554 acres were treated in 1951 and it is estimated that over 11,000 acres will have been treated by the end of 1952.

The species of woody plants that are most common on rangeland in Hawaii are as follows:

Moist to Wet Windward Areas

* Guava	*Psidium guajava*
* Firebush	*Myrica faya*
* Java plum	*Eugenia cumini*
* Melastoma	*Melastoma malabathricum*
* Rhodomyrtus	*Rhodomyrtus tomentosa*
* Staghorn fern	*Gleichenia linearis*
Lantana	*Lantana camara*
Pamakani, Maui	*Eupatorium adenophorum*
Pamakani, Hamakua	*Eupatorium riparium*
Blackberry	*Rubus penetrans*

Dry Leeward Areas

* Koa Haole	*Loucaena glauca*
* Hawaiian Holly (Christmas berry)	*Schinus terebinthifolius*
* Kiawe (Algaroba)	*Prosopis chilensis*
Klu	*Acacia farnesiana*
* Lantana	*Lantana camara*
Opiuma	*Pithecellobium dulce*
Sacramento bur	*Triumfetta bartramia*

* Most important species under the habitat. Other general species are shown in the table below.

Experimental studies and observations on ranches where spraying has been done have given the following indications:

1. In relatively large and densely infested areas where the major species are susceptible to foliage sprays of 2 to 4 pounds 2,4-D and/or 1 to 2 pounds 2,4,5-T, it is the most practical to spray such areas by aircraft. Periodic spraying of regrowth in established pastures on an annual or biennial basis appears logical for continuous control.
2. Where a moderate to sparse stand of woody species exists in areas that are readily accessible to ground sprayings, it is most logical to use basal sprays of 2,4-D and 2,4,5-T in oil.
3. Where areas are cut over the stump should be sprayed with 2,4-D in oil.
4. Based on present information, the wide scale use of herbicides on rangeland in Hawaii will be restricted largely to areas infested with guava and sensitive herbaceous weeds, mainly in the moist to wet areas. Most Hawaiian woody plant species are sensitive to basal treatments of 2,4-D and/or 2,4,5-T in oil but presently this is not economical on large scale.

(Contributed by the Experiment Station, Hawaiian Sugar Planters' Association and the University of Hawaii, Honolulu, Hawaii.)

Chemical control of big sagebrush. Hyder, Donald N. Results from three years of spraying in southeastern Oregon at an elevation of 4600 feet have indicated that applications should be made during the month of May for the control of big sagebrush. With soil moisture conditions favorable to continuous growth activity, spray applications would probably be effective until the middle of June. Consequently, soil moisture and growth activity should be observed closely after the middle of May for the close of the effective period. The effective period terminated about two weeks earlier on a south exposed site than on a bottom site. Loss of green color in the leaves of Sandberg bluegrass (Poa secunda) is an indication of depletion of soil moisture that precedes termination of the effective period.

A 1:1 mix of the isopropyl esters of 2,4-D and 2,4,5-T reached the peak of effectiveness at an earlier date than did butyl ester of 2,4-D.

Isopropyl esters of 2,4-D and 2,4,5-T were applied individually and in mixtures of 2:1, 1:1, and 1:2. In general, kills were higher with increased concentrations of 2,4,5-T. At one pound per acre acid equivalent rate, IPE 2,4-D killed 25 percent and IPE 2,4,5-T killed 70 percent of the sagebrush. Amine formulations of 2,4-D and 2,4,5-T and mixtures of the two were relatively ineffective--about equal to IPE 2,4-D.

With acid equivalent rates of 1, 2, and 3 pounds per acre applied on three dates during May, 1950, average kills were 35, 86, and 90 percent respectively for sodium salt of 2,4-D, butyl ester of 2,4-D, and a 1:1 mix of IPE 2,4-D and 2,4,5-T. When both costs and efficiency are considered, butyl ester of 2,4-D has been the most practical material used for killing big sagebrush. The use of formulations of sodium salt, amine, and isopropyl ester of 2,4-D should be discouraged.

Butyl ester of 2,4-D applied during May 1950 in 10.9 GPA of diesel oil emulsion killed 79, 87, and 93 percent respectively at acid equivalent rates of 1, 2, and 3 ppa.

An ecological study was initiated during 1951 to measure vegetation response to spraying. In 1952 herbage production was 173 ppa on untreated plots and 529 ppa on sprayed plots. Most of the increase was made by grasses with June grass (Koeleria cristata) and squirrel tail (Sitanion histrix) showing as the leading increasers; however, the production of weeds (mostly Lupine) was also greater on the sprayed plots than on untreated plots.

Reduction in spray volume through selection of the most effective carrier solvents and improvement in spray distribution equipment will lead to practical and economical control of big sagebrush on range land. Squaw Butte-Harney Range and Livestock Experiment Station.

PROJECT 5. UNDESIRABLE WOODY PLANTS OF IRRIGATION SYSTEMS AND IRRIGATED LANDS

W. Harold Hirst, Project Leader

SUMMARY

Reports of experiments and field tests to determine effective methods of controlling salt cedar, mixed stands of sandbar willow and wildrose, black willow, and choke cherry were submitted. Reports of the experiments and analyses of results by respective authors are included under "Reports of Individual Contributors" which follow the brief summaries below.

Tests for the control of salt cedar were made on the McMillan Reservoir Delta, Carlsbad, New Mexico. Treatments were made by airplane applications of various mixtures of 2,4-D and 2,4,5-T in the early summer and in the fall. Results of the first applications, consisting of two pounds of 2,4-D (sodium salt) per acre in one gallon of diesel oil plus sufficient water to make five gallons of emulsion, appeared to be very promising but subsequent tests with similar treatments did not substantiate results of the first treatments.

Choke cherry experiments at Logan, Utah included foliage sprays during June and April, and basal sprays at the early leaf stage. Various combinations, types, and concentrations of 2,4-D and 2,4,5-T were used in the experiments as well as ammonium sulphamate. Observations of the June 1951 foliage applications in which the amine and propylene glycol butyl ether esters of 2,4-D and 2,4,5-T alone and as 50-50 mixtures, and ammonium sulphamate were used, showed that the mixture of 2,4-D and 2,4,5-T esters gave best results. Observations of April 1952 foliage applications in which an Lv ester of 2,4,5-T and a 50-50 mixture of Lv esters of 2,4-D and 2,4,5-T were used, showed that 2,4,5-T was less effective than the 50-50 mixture. Observations of basal sprays also indicated that the 50-50 mixture of Lv esters of 2,4-D and 2,4,5-T gave better results than the Lv ester of 2,4,5-T alone.

Methods of controlling mixed stands of sandbar willow and wildrose were tested on an infested area along the Humboldt River near Battle Mountain, Nevada. The tests were conducted on one square rod plots during May and August by applying herbicides with a small hand spray gun. Lv and regular esters of 2,4-D and 2,4,5-T alone and as mixtures were tested at two different rates per acre. Lv esters of 2,4-D and 2,4,5-T fortified with PCP were also tested. Preliminary results, based upon observations during the fall indicated best results with Lv and regular esters of 2,4,5-T with a slight advantage of the Lv ester over the regular ester.

Experiments to determine methods of controlling black willow were conducted in the Lake Henshaw drainage basin, San Diego County, California. The experiments included basal sprays during the summer and "gash" treatments during the summer and when the willow was dormant. An isopropyl ester and an alkanolamine salt at various concentrations were tested in the dormant willow "gash" experiment. Polypropylene glycol butyl ether esters of 2,4-D and 2,4,5-T alone and as a 1:1 mixture at two concentrations in kerosene and in diesel oil were used in the summer basal spray experiment. Results of the "gash" treatment indicated that the alkanolamine salt is more effective than the isopropyl ester. Results of the summer basal treatments indicated that 2,4,5-T was more effective, whether alone or in combination with 2,4-D, than 2,4-D alone.

REPORTS OF INDIVIDUAL CONTRIBUTORS

Salt cedar control investigations McMillan Reservoir Delta - [illegible], New Mexico. Koogler, John G. The Bureau of Reclamation has made several previous reports to the Western Weed Control Conference showing the results secured in the salt cedar control test work which has been carried on during the period September 1948 to December 1952 on the McMillan delta near Carlsbad, New Mexico.

Previous reports submitted to this group were in the nature of progress reports. The chemical formulations, method of application, and the seasonal results secured have been reported, and it is only at this time when two of the major salt cedar control tests have been concluded that some results can be compared and at least a partial analysis made of some of the factors which may have had a bearing on the results.

This report will deal specifically with the two completed tests involving the use of 2,4-D and 2,4,5-T applied by airplane.

Records have been maintained of conditions which existed on the McMillan delta during the period 1948 to 1951, when 2,4-D and 2,4,5-T was applied by airplane. These data included date and time of application, wind velocity, temperature, humidity, soil moisture, etc., and a notation as to whether the plants in the areas sprayed were areas of young plants or old mature plants.

There is little doubt but that each of these factors have a direct bearing on the results secured during the test periods, although it may be difficult to pinpoint the controlling factor which is responsible for the degree of success attained in these experiments.

A brief description of the chemical control spray program, which was completed first, follows:

First salt cedar control test. 200 acres of dense adult salt cedar sprayed by airplane. Sprayed September 18, 1948 with an emulsion containing one pound 2,4-D parent acid (converted to sodium salts); one gallon diesel oil, and water to make five gallons, applied to each of the 200 acres. Sprayed June 24, 1949 for the second time with a similar emulsion containing two pounds of 2,4-D acid equivalent per acre in the form of sodium salts.

Translocation of the 2,4-D spray materials within the plant tops and roots was secured in most of the plants in the test described above. This was apparent to observers in the field in the early spring of 1949, when a complete secondary foliage kill occurred throughout the area. Some recovery occurred in the very large plants, particularly along the lower third of the larger stems and in small areas which appeared to have been skipped due to changes in the elevation of the plane applying the spray, or to faulty operation of it. The June 1949 application killed some of the surviving plants, and a form of chronic poisoning accounted for all except 5 percent of the plants. The entire test was spectacular and convincing, but was never duplicated in subsequent operations, due to the physical and climatic changes in the area which had occurred when subsequent tests were made.

Second salt cedar control test. In June 1951, and again in October of the same year, 2,630 acres of adult salt cedar were sprayed by airplane with four formulations of 2,4-D and 2,4,5-T as follows: 640 acres of salt cedar sprayed with 2# acid equivalent of the Amine Salts of 2,4-D per/A in the [illegible] oil water emulsion applied at the rate of 5 gallons per acre. 1,240 acres of salt cedar sprayed with 2# acid equivalent of 2,4-D per acre in the form of the Amine Salts in water solution applied at the rate of 5 gallons per acre. 700 acres of salt cedar were sprayed with 2# acid equivalent of a 50-50 mixture of the low volatile esters, 2,4-D and 2,4,5-T per acre in water, with detergent added, applied at the rate of 5 gallons per acre.

Comparison of Data. A research analysis of the result secured from the application of the hormone type herbicides to salt cedar under field conditions is difficult, if not impossible. The tests are planned and accomplished with ever-changing physical conditions, and it is practically impossible to repeat or varify significant results, and no attempt will be made in this paper to present definite conclusions or recommendations. It is possible, however, to summarize and compare briefly the data which was recorded during the two major field tests which were completed on the McMillan delta for the consideration of research and other field workers. The pertinent data comparisons are shown in the following table.

	FIRST TEST		SECOND TEST	
	1st Appl.	2nd Appl.	1st Appl.	2nd Appl.
Spray Application Dates	Sept. 18-20 1948	June 24-25 1949	June 24-25 1951	Oct.19-24 1951
Acres Sprayed	200	200	2630	2630
Chemical Applied Lbs. Acid Equivalent 2,4-D and 2,4,5-T	1#	2#	2#	2#
Wind Velocities (Miles per hour)	0-1 @ 7:AM 6-10@ 10:AM	Same	0 @ 5:AM 8-10 @ 10:AM	Same
Temperatures	100°	100°	59° to 95°	65° to 78°
Soil Moisture and Depth to Water Table	0' to 4'	Same	10' to 22'	Same
Humidity (Average)	30°	30°	33°	33°
Percent Kill Tops		90 to 95		80 to 90
Percent Kill Roots		90 to 95		10

Observations.-- Observations made throughout the entire period did not develop any significant trend in favor of any of the formulations used. From 80 to 95 percent of the salt cedar top growth was killed with two applications of each of the formulations used.

Translocation occurred throughout the tops and roots in the first test. In the second test, translocation occurred in the tops only and did not carry into the roots except a few widely scattered locations.

Wind velocities did not appear to have any effect on the results secured in either test. Wind did affect plane performance and either the wind or heat thermals may have been responsible for some crop damage reported in June 1951.

Temperature on the average was much higher during the first test than during the second test, but since practically all tops were killed in both tests, we have not been able to assign any significance to either temperature or humidity. Each of these factors may have had some bearing on the physiological condition of the plants at the time the spray was applied, but it was not apparent.

Soil moisture or the position of the water table did appear to have considerable effect on the results secured. In both of these tests, and in several other tests not completed at this time, results have been very poor where the plants were standing in water, or where the water was only a few inches below the surface of the soil. Under these conditions, the foliage would often fall off plants without serious injury to either stem or root parts.

Attention is called to the lateness of the second application of spray materials in the second test, October 19 to 24, 1951. It was originally planned to make the second application of spray material in August 1951; however, some damage to a few fields of cotton were reported when the June spray was applied, and the October dates were selected in order to prevent further cotton damage. Observations made at the time of application showed that leaves and stems had reached seasonal maturity, and the spray may not have been effective.

Chronic poisoning, for want of a better term, often occurred among plants in certain locations within a treated area, and some of these plants eventually died, while others recovered without any apparent reason.

Additional large scale programs for control of mixed phreatophytes are presently being studied in the Middle Rio Grande Project area in New Mexico. One 400-acre demonstration area is about to be concluded and information and results should be available in the summer of 1953. Numerous other tests have been made using truck mounted spray equipment in regular project patrol operations. These patrol operations show that repeated applications of 2,4-D, in formulations containing from 3000 to 5000 P.P.M., applied over a period of two or three years, will eliminate these and other woody plants along irrigation canals and laterals. This patrol procedure is proving to be a valuable and relatively economical method of eliminating woody plants and is used in project maintenance programs throughout Region 5. U. S. Department of the Interior - Bureau of Reclamation, Region 5.

Chemical control of chokecherry. Timmons, F. L. and Lee, W. O. Experiments by the Department of Botany and Plant Pathology at Utah State College have shown that western chokecherry (Prunus virginiana var. melancarpa) is an important carrier of virus X infection of stone fruits. An experiment was started June 5, 1951 comparing four chemicals at two rates each for effectiveness in killing chokecherry. Each of the treatments was replicated twice on six-year-old chokecherries planted in rows for virus X studies in an experimental orchard at Farmington, Utah. The chemicals tested in the experiment were 2,4-D in the amine and propylene glycol butyl ether ester forms, each at 1000 and 2000 ppm, a 50-50 mixture of 2,4-D and 2,4,5-T as the propylene glycol butyl ether esters at 1000 and 2000 ppm and ammonium sulfamate at the rates of 1/2 and 1 pound per gallon of water. All chemicals were applied in sufficient volume to give uniform and thorough coverage of all foliage. Volumes of spray ranged from 270 to 490 gal/A while rates of 2,4-D or mixture of 2,4-D and 2,4,5-T ranged from 2.2 to 6.7 lb/A for the different treatments.

Observations in the spring of 1952 showed that the mixture of 2,4-D and 2,4,5-T esters gave the best results and that the 2,4-D ester was considerably more effective than either the amine of 2,4-D or ammonium sulfamate. The survival of top growth ranged from 3% for the mixture at 2000 ppm to 85% for the amine at 1000 ppm. Regrowth from roots and top wood in 1952 ranged from 38% for the mixture at 2000 ppm to 100% for the amine at 1000 ppm. There was 85% or more regrowth on most of the plots.

Retreatments of regrowth were made June 20, 1952, using the same applications as for the original treatments in 1951 except on the plots that had been sprayed with the amine salt of 2,4-D at 1000 ppm and those treated with ammonium sulfamate. Those plots were used for applications of amine and ester forms of 2,4-D and the mixture of the esters of 2,4-D and 2,4,5-T at 4000 ppm. In addition an emulsifying agent was used with all retreatments in 1952. The top kill of regrowth was much more rapid and complete in 1952 than from the original applications in 1951. Final observations of results in this experiment will be made in 1953.

Basal spray applications were made on a series of chokecherry plots at the early leafing stage April 25, 1952 comparing a low volatile ester of 2,4,5-T and a 50-50 mixture of low volatile esters of 2,4-D and 2,4,5-T at 2% and 8% concentration in diesel oil. The volume of oil spray applied averaged about 30 gal/A for the different treatments while the rates of application averaged about 4 lb/A for the light rate and 20 lb/A for the heavy rate. Most of the sprouts 3/4-inch in diameter or less were killed but larger sprouts and trees maintained almost normal growth and vigor throughout the season despite severe splitting of bark and considerable exudate in the application zone from the ground up to 15 inches. Observations will be continued in 1953 to record the final results of these basal applications.

In another experiment the same chemicals were compared at concentrations of .5% and 2% applied April 23, 1952 in a 1-7 oil-water emulsion as an over-all spray at the preleafing stage on chokecherry bushes that ranged in height from 3-6 feet. The volumes of spray applied for the different treatments ranged from 120-186 gal/A while the rates of chemical on the acid equivalent basis ranged from 5-20 lb/A. The different treatments gave 25-98% top kill but regrowth from the roots and bases of the trunks was nearly 100% on all plots. As in the experiment with basal applications, 2,4,5-T was less effective than the 50-50 mixture of 2,4-D and 2,4,5-T. This was somewhat surprising in view of the definite superiority of the 50-50 mixture over the 2,4-D ester in the foliage spray experiment begun in 1951. (Contributed by Division of Weed Investigations, BPISAE, USDA, and Utah Agricultural Experiment Station, cooperating).

Chemical control of willows and wild rose. Hirst, W. Harold. Small plots of sandbar willow, Salix exigua, and wild rose (Rosa Sp.) infestations along the Humboldt River near Battle Mountain, Nevada, were treated with chemicals for the purpose of determining a method which would give best results in large scale treatments scheduled during 1953. Plots treated were one square rod in size and infested with approximately an equal density of each plant. Water and diesel oil were used as diluents at the rates of 50 and 20 gallons per acre respectively. Treatments were made on two different dates. Plot treatments and preliminary results observed during the Fall of 1952 are as follows.

Plot No. & Herbicide	Amount of herbicide per acre (pounds)	Diluent (type)	Results observed: Willows Top Kill (%)	Willows Regrowth (%)	Wild Rose Top Kill (%)	Wild Rose Regrowth (%)
May 27, 1952 Treatments						
Tetrahydrofurfuryl ester of 2,4,5-T						
1	3	water	100	70	100	10
2	3	oil	95	70	100	5
3	1.5	water	100	50	100	15
4	1.5	oil	100	50	100	10
Tetrahydrofurfuryl ester of 2,4-D						
5	3	water	100	50	30	2/
6	3	oil	100	75	5	2/
7	1.5	water	100	40	40	2/
8	1.5	oil	100	70	20	2/
Mixture containing equal parts of Tetrahydrofurfuryl esters 2,4,5-T and 2,4-D						
9	3	water	100	60	90	20
10	3	oil	100	40	90	25
11	1.5	water	100	50	100	40
12	1.5	oil	100	70	90	40
Butyl ester of 2,4,5-T						
13	3	water	95	40	100	10
14	3	oil	100	50	90	50
15	1.5	water	40 1/	90	95	20
16	1.5	oil	100	60	90	20
Isopropyl ester of 2,4-D						
17	3	water	100	50	10	2/
18	3	oil	100	25	10	2/
19	1.5	water	100	15	5	2/
20	1.5	oil	80	70	5	2/
Tetrahydrofurfuryl ester of 2,4,5-T						
21	3	oil & water	100	60	90	70
22	1.5	oil & water	100	40	90	70
Butyl ester of 2,4,5-T						
23	3	oil & water	90	70	90	60
24	1.5	oil & water	95	70	90	20
Oil check plot						
25	0	oil	0	2/	0	2/

Plot No. & Herbicide	Amount of herbicide per acre (pounds)	Diluent (type)	Willows Top kill (%)	Willows Regrowth (%)	Wild Rose Top kill (%)	Wild Rose Regrowth (%)
	August 7 and 8, 1952 treatments3/					
Tetrahydrofurfuryl ester of 2,4,5-T						
1	3	water	100	10	95	2
2	3	oil	100	3	95	1
3	1.5	water	90	10	90	3
4	1.5	oil	95	10	80	10
Butyl ester of 2,4,5-T						
5	3	water	100	3	95	2
6	3	oil	100	20	95	2
7	1.5	water	100	5	85	15
8	1.5	oil	95	10	90	15
Mixture containing equal parts of tetrahydrofurfuryl esters of 2,4-D and 2,4,5-T						
9	3	water	100	5	95	15
10	3	oil	100	10	95	5
11	1.5	water	100	5	90	5
12	1.5	oil	95	5	95	5
Tetrahydrofurfuryl ester of 2,4,5-T fortified with PCP						
13	3 lbs 2,4,5-T+2 lbs PCP	Diesel oil	100	2	100	1
14	3 " " +1 lb. PCP	" "	100	2	100	1
15	1.5 " " +2 lbs PCP	" "	100	10	95	2
16	1.5 " " +1 lb. PCP	" "	100	2	95	1
Butyl ester of 2,4,5-T fortified with PCP						
17	3 lbs 2,4,5-T+ 2 lbs PCP	" "	100	10	100	2
18	3 " " + 1 lb. PCP	" "	100	20	95	3
19	1.5 " " + 2 lbs PCP	" "	100	20	95	5
20	1.5 " " + 1 lb. PCP	" "	95	5	95	1
Mixture containing equal parts of tetrahydrofurfuryl esters of 2,4-D and 2,4,5-T						
21	3 lbs acid+ 2 lbs PCP	" "	100	1	95	1
22	3 lbs " + 1 lb. PCP	" "	100	10	95	1
23	1.5 lbs " + 2 lbs PCP	" "	100	2	95	3
24	1.5 lbs " + 1 lb. PCP	" "	90	2	95	2
PCP						
25	2 lbs.	" "	50	40	30	5
26	1 lb.	" "	60	40	20	5

1/ It appeared that the low percent of top-kill was due to inadequate coverage.

2/ Regrowth could not be determined because of little or no effect on top growth.

3/ Amount of regrowth could not be accurately determined because of the shortness of time between treatment and observation.

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Definite conclusions as to the superiority of any individual treatment cannot be made from observations since the plants had only a part of one growing season to make regrowth, particularly on plots sprayed during August. However, the observations indicate an advantage of 2,4,5-T over 2,4-D in controlling mixed stands of willow and wild rose. They also indicate an advantage of 2,4,5-T over mixtures of 2,4-D and 2,4,5-T. The advantage of tetrahydrofurfuryl ester of 2,4,5-T over the Butyl ester of 2,4,5-T is so slight that very little credence can be given to the difference at the present time. Observations will be made during the spring of 1953 to obtain more conclusive evidence of results. (Contributed by the Bureau of Reclamation, Region 4).

A report of preliminary investigations of the treatment of riparian trees with 2,4-D and 2,4,5-T by basal techniques. Swezey, A. W. Field plots of large trees of Black Willow and Fremont Cottonwood were treated with 2,4-D and 2,4,5-T formulations by the "gash" technique and by basal sprays in oil. This work was carried out in the Lake Henshaw drainage basin, San Diego County, during 1950. This area, of 50,000 acres contains about 5,000 acres of riparian trees that have been estimated to use up as much as 20% of the drainage water.

2,4-D "GASH" TREATMENTS OF DORMANT WILLOW, SALIX NIGRA

Treatment	No. of Gashes 1/	No. ml/ Gash	No. Trees	Aver. Tree Diameter	% Kill
2,4-D Isopropyl 2/ ester	3	8	8	15.0"	11
" "	3	16	9	11.0"	48
" "	4	8	10	12.6"	40
" "	4	16	7	13.4"	50
" "	4	12	5	13.0"	50
2,4-D Alkanolamine Salt 3/	4	8	7	10.0"	84
" "	4	16	3	14.0"	87

1/ Made with an axe so as to expose the cambium.
2/ As a concentrate containing 3.34# acid/gal.
3/ As a concentrate containing 4# acid/gal.

SUMMER TREATMENTS OF WILLOW BY THE "GASH" METHOD WITH 2,4,D

Treatment	ml. Dosage	ml. Water	No. Trees	Average 2/ Diameter	% Tree Kill
2,4-D Alkanol amine salt 3/	4/gash	12/gash	10	7.1"	98
" "	8/gash	8/gash	10	7.8"	94
" "	16/gash	0/gash	10	8.1"	85

1/ 2 gashes per tree on opposite sides, 1' to 2' from base.
2/ Diameter range - 4" to 12".
3/ As a concentrate, containing 4# acid/gal.

Lower volumes of concentrate than those noted in the tables were not tried. It is possible that lesser amounts of 2,4-D can be used, especially with summer treatments. From this work it is considered that the alkanolamine salt is a more effective derivative for this work than the isopropyl ester. This point is further indicated by work similar to that listed in Table 1, but carried out in the summer. However, insufficient replication precluded the use of tabular information of this summer work in this summary. A rule of thumb measurement of 2 ml of 2,4-D salt concentrate per inch of tree diameter in the winter and 1 ml per inch of tree diameter in the summer is indicated as the dosage range.

SUMMER TREATMENTS IN THE CONTROL OF WILLOW (BLACK) BASAL SPRAYS OF 2,4-D and 2,4,5-T

Treatment1/ 5/	ppm/ Acid Eq.	Carrier	No. Trees	Aver.2/ Diam.	% Kill
2,4-D polypropylene glycol butyl ether ester	10,000	Diesel	9	7.7"	86
	20,000	Diesel	12	8.2"	76 3/
	20,000	Kerosene	10	8.4"	80
2,4,5-T polypropylene glycol butyl ether ester	10,000	Diesel	8	7.4"	91
	20,000	Diesel	11	9.0"	100 3/
	20,000	Kerosene	6	6.0"	100
2,4-D & 2,4,5-T polypropylene glycol butyl ether esters (1:1)	10,000	Diesel	8	8.4"	99
	20,000	Diesel	14	8.6"	93 4/
Check	--	Diesel	4	7.0"	4

1/ Trunks sprayed to run-off at base to 3' high.
2/ Diameter range - 3" to 16"; 85% of trees, 5" to 12".
3/ Two trees over 12" in diameter.
4/ One tree over 12" in diameter.
5/ Approximately 3 qts. used per 10 trees, sprayed with hand knapsack sprayer.

In this work 2,4,5-T was more effective, whether alone or in combination with 2,4-D, than was 2,4-D alone. (The Dow Chemical Company)

SUMMARY

Committee No. 7 - R. L. Warden, Chairman

Work was reported on the susceptibility of Cascade winter barley to various hormone herbicide formulations. The formulations showed considerable variation in their injury to barley sprayed in the boot stage. Oil and water were compared as carriers with oil showing no more injury than water. All treatments injured barley in the boot stage.

Trials on fiber flax were reported in which MCP, dinitro selective, and CMU all showed good results. IPC and Cl IPC were found to severely injure fiber flax in spring applications.

Greenhouse trials on various MCP formulations were also reported in which oats, ryegrass and mustard were used as test plants.

Weed control in fiber flax. Furtick, W. R. and Freed, V. H. Under western Oregon conditions fiber flax planted in the fall will winter through during most seasons. Fall planted fiber flax generally yields much higher in fiber than spring planting, but this has not become a common practice due to the serious competition of weeds, particularly grasses. This trial was established to determine whether herbicides could be used in an early spring application to check the grasses and broadleafed weeds. The chemicals used were MCP alone used at 3/4 pound per acre, and in combination with dinitro selective used at the same rate. IPC was used at 4 lbs per acre in combination with MCP, MCP and dinitro selective, and 2,4-DS. Chloro IPC at 4 lbs per acre was used in combination with 2,4-DS at the same rate. In addition 2,4-DS was used alone. CMU was used at the rate of 3 lbs per acre.

Weed counts were not made, but the best control of broadleafed weeds was observed with the use of MCP at 3/4 lb per acre and dinitro selective used at 3/4 lb per acre. This was followed closely by the use of MCP alone. The best control of both grasses and broadleafed weeds was obtained with CMU. Fair control of grasses was obtained with both IPC and chloro IPC but both materials caused severe injury to the flax. 2,4-DS also gave slight injury to the flax but the flax largely recovered by the time of harvest.

The unthreshed weight of the harvested flax was highest where MCP and dinitro selective had been used. The weight was 874 grams per plot as compared to 839 grams for the control. MCP alone gave 872 grams followed by the IPC, MCP dinitro selective combination with a yield of 724 grams; 2,4-DS alone yielded 723 grams; CMU yielded 727 grams. The most severe yield reduction resulted from the use of IPC at 4 lbs per acre in combination with 2,4-DS at 4 lbs per acre with a yield of only 408 grams per plot.

This trial indicates that the best weed control without injury to the flax can be obtained by using MCP and dinitro selective in combination. CMU gave excellent weed control but reduced yield of the flax about 8%. IPC and chloro IPC both gave good grass control, but both severely injured the flax. (Contributed by Oregon Agricultural Experiment Station)

A comparison of various hormone herbicides on their injury to fall barley when sprayed in the boot stage. Furtick, W. R., and Freed, V. H. Fall barley of the Cascade variety was sprayed in the boot stage at the rates of 1½ and 3/4 lb per acre with each of the following materials: 2,4-D butyl ester, and low volatile ester; 2,4,5-T butyl ester and low volatile ester; MCP ester; a combination of 2,4-D and 2,4,5-T both as butyl esters and low volatile esters; combinations of MCP and 2,4,5-T butyl esters; and 2,4-D butyl esters at 1½ lbs per acre in 1, 2 and 4 gallons of helix oil and 1, 2, and 4 gallons of aromatic weed oil.

All treatments reduced the yield of the barley which had an average plot yield of 439 grams for the check. The most severe yield reduction was obtained using 2,4-D and 2,4,5-T low volatile esters in combination at 1½ lbs per acre, which gave a yield of 161 grams per plot. The low volatile ester of 2,4-D proved less injurious than did the butyl ester of 2,4-D. The low volatile ester of 2,4,5-T was more injurious than the butyl ester of 2,4,5-T. At the higher rates of application MCP appears to be the least injurious of the water carried materials. Oil emulsion as a carrier did not reduce yield over water as a carrier. A generality that can be drawn from this trial is that there appears to be considerable differences between both formulations and materials in relationship to their injury of barley in the boot stage. (Contributed by Oregon Agricultural Experiment Station)

<u>The effect of MCP derivatives on oats, ryegrass and mustard</u>. Sherburne, R., and Freed, V. H. A greenhouse trial was set up using MCP (Na salt), MCP (Na sulfate), MCP (ethanol), and 2,4-DS on oats, ryegrass, and mustard. This trial was designed to determine the effectiveness of these compounds. The materials were applied as a 1% dust at the rate of 2 and 4 lbs per acre pre-emergence. The pots were harvested and replanted at intervals until all effectiveness was lost when compared with the check.

MCP (Na salt) showed the longest residual effect and was the most effective on all the test plants used. MCP (Na sulfate) and MCP (ethanol) showed some selectivity between the oats and the ryegrass. The oats showed very little damage while the ryegrass showed severe damage. 2,4-DS was effective on both the oats and ryegrass during the first planting only. All treatments gave good control of the mustard. (Contributed by Oregon Agricultural Experiment Station)

<u>The selectivity of various chemicals between wheat and cheatgrass (Bromus sp.)</u>. Bayer, D. E., and Freed, V. H. Various chemicals have been screened in the greenhouse to determine the selectivity between cheatgrass (<u>Bromus sp.</u>) and wheat. The chemicals have been applied pre-emergence. Various carbamates, ureas, and some other compounds have been tried without any success. The only compounds that have shown any degree of success are some of the ketone group. The compound designated as T-15 showed remarkable selectivity between the cheatgrass and wheat. The wheat germinated normally but on emergence had a curvature effect which was soon outgrown without further effect from the chemical. This chemical seems to have a limited period of effectiveness. It is not known at present just what becomes of the chemical -- whether it breaks down, volatilizes, or isomerizes.

The chemical appears to become inactive by one of the above mentioned processes or by some other process, because some of the cheatgrass seed that has been treated will germinate and will make normal growth approximately a month after treatment. Some other compounds similar to T-15 have shown some selectivity but not markedly better than T-15. (Contributed by Oregon Agricultural Experiment Station)

SUMMARY

Committee No. 7 - W. R. Furtick, Chairman

Abstracts include work done in Colorado, New Mexico and Oregon. The work covers pre-emergence and post-emergence treatments on seedling ladino clover and lotus in which 2,4-D, MCP, and Cl IPC all showed promise post-emergence. Control of broadleafed weeds in seedling red clover with dinitro selective showed promise. The control of wild barley in alfalfa with Cl IPC was found to be satisfactory. The use of IPC, Cl IPC and various other herbicides was reported for controlling annual grasses in perennial grass seed crops. Fall applications of Cl IPC were found to be the most satisfactory.

Control of perennial sow thistle in red clover. Yeo, R. R. Application of dinitro selective at the rate of one pound per acre in 80 gallons of water, applied the latter part of November, was found to be 100% effective in controlling annual sow thistle, Sonchus oleraceus, and 50% effective in controlling London rocket, Sisymbrium Irio, in a new seeding of Kenland red clover. Tansy mustard, Descursinia sophia, was completely unaffected. In areas where the red clover was heavily seeded a slight scorching of the exposed leaf tips was noted. A similar application of the alkanolamine salts of DNOSBP gave no control. The weeds were in the 6-8 leaved stage. The temperature was 65° F. at the time of application. (Contributed by New Mexico Agricultural Experiment Station)

Control of foxtail barley in alfalfa. Blouch, Roger, Fults, Jess, and Garber, R. H. It has been long recognized that foxtail barley (Hordeum jubatum) is a serious problem in second-year alfalfa pastures in the largely sub-irrigated San Luis Valley of southern Colorado. Results from two seasons of testing have shown that control of mature foxtail barley plants in alfalfa stands is not practical with present chemicals and techniques. Satisfactory long-range control may, however, be achieved by killing the germinating seedlings with pre-emergence applications of 3-Chloro-IPC. Two spraying schedules were followed in making these determinations. These were (1) early spring, just before germination, and (2) early fall, after the last cutting of alfalfa. Of the two dates, the latter appears more successful, apparently due to the longer residual life of C-IPC during the cool months following. First-year alfalfa plots seeded purposely to foxtail barley were sprayed at 6, 12, and 24 pounds of C-IPC per acre in September, 1951. Readings taken in April, June, and July, 1952 show that 6 pounds had very little residual effect. At 12 pounds, however, 90-95% control of emerging seedlings was observed, with no damage to alfalfa. Although the 24-pound rate gave 100% control, it was included merely to observe tolerance of alfalfa. Very little injury to alfalfa resulted at this excessive rate of C-IPC. At present it appears that the best procedure would involve fall-spraying a first-year stand of alfalfa with 8-12 pounds of C-IPC per acre if the field has been known to have a history of foxtail infestation. Waiting until the plants become evident is too late for any effective control. (Colorado Agricultural Experiment Station)

Weed control in seedling legumes. Furtick, W. R. and Freed, V. H. Various chemicals were tried both pre- and post-emergence on ladino and birdsfoot trefoil to determine the best material for weed control as an aid in the establishment of these crops. The materials used pre-emergence were the dinitro compounds; amine salt and two dinitro selective formulations; chloro IPC; endothal and sodium acid cyanamide.

Stand and weed counts were taken after emergence by the line transect method. The stand of ladino clover was reduced from an average of 14 plants in the check to 2 plants where endothal was used at 4 pounds per acre. No stand reduction was apparent in lotus. Chloro IPC seriously reduced the stand of both crops, with an average stand count of four plants per transect for ladino and 2 plants per transect for lotus when Cl IPC was used at the rate of 4 pounds per acre. The only appreciable difference in weed count was found where chloro IPC and dinitro selective had been used. The greatest weed reduction was apparent with chloro IPC. Most of the weeds found were of the broadleaf type. The weed reduction with chloro IPC was seven weeds per transect as compared to 24 for the control. Dinitro selective reduced the weed count from 24 to 13. Post-emergence applications were the amine salt and dinitro selective at 3/4 pounds per acre, chloro IPC at 4 pounds per acre, MCP dust at .4 pounds per acre, 2,4-D at .4 pounds per acre. All of these materials gave some weed reduction with the exception of chloro IPC. The greatest weed reduction was obtained with 2,4-D and dinitro selective, both reducing the stand count to 4 weeds per transect in comparison to 19 in the check. The amine salt of dinitro was second with 7 weeds per transect followed by MCP with 11 weeds per transect. A stand count on ladino clover showed it was seriously affected by all the dinitro formulations. The stand reduction ranged from an average count of 14 on the check to one for dinitro selective and 6 for the amine salt. The stand count for 2,4-D was 8 per transect. Neither MCP nor chloro IPC gave a reduction of ladino. The stand reduction in lotus was most severe with the amine salt of dinitro. The stand was completely eliminated. The stand reduction for dinitro selective was from an average of 7 on the check to 3 with dinitro selective. None of the other materials reduced the stand. These trials indicate that low rates of MCP and 2,4-D both can be used on seedling ladino and lotus with reasonable weed control. The spring applications of dinitro appears to be hazardous from the standpoint of stand reduction. (Contributed by Oregon Agricultural Experiment Station)

A trial of various herbicides for the control of weedy annual grasses in Alta fescue. Bayer, D. E., and Freed, V. H. Various chemicals were used in a field trial on Alta fescue (*Festuca arundinacea*) for the control of rattail fescue (*Festuca myuros*) and common ryegrass (*Lolium multiflorum*). This trial was designed to discover new chemicals which may be used to control weedy annual grasses in Alta fescue.

The chemicals used in this trial included IPC, Cl IPC, CMU, and 2,4-DS all applied at 4 lbs per acre; PCP and endothal applied at 10 lbs per acre; and TCA and NaMCA applied at 20 lbs per acre. The above mentioned rates were calculated from the actual parent material. DNG was applied at $1\frac{1}{2}$ qt. of commercially prepared material per acre, and aromatic solvent 80 was applied at 40 gallons per acre. DNG was applied in 40 gallons of diesel oil, PCP was applied in 20 gallons of diesel oil plus 20 gallons of water, and all other compounds were applied in 40 gallons of water. Applications of the chemicals were made in October and again in February. Plots were one-half square rod in size replicated 4 times.

Based on this trial Cl IPC gave the best weed control and the yield of Alta fescue seed was highest. Cl IPC was followed by IPC and CMU which gave good weed control and the seed yield of the Alta fescue was not reduced as compared to the check. Lack of effectiveness of 2,4-DS was probably due to the stage of growth of the weedy grasses when the chemical was applied. The weedy grasses were approximately one inch tall at time of application.

The compounds that gave good weed control with no damage to the Alta fescue in the October treatment showed severe damage in the February treatment. (Contributed by Oregon Agricultural Experiment Station)

The effect date of application of IPC and Cl IPC has on annual grass control and seed yield of Alta fescue. Bayer, D. E., and Freed, V. H. A field trial was established, using one-half square rod plots with four replications, to determine the time when IPC and Cl IPC should be applied when used as a selective for weedy grass control on Alta fescue. IPC and Cl IPC were applied at 4 and 6 lbs actual parent material per acre at monthly intervals starting October 13 and ending February 13 on a solid stand of Alta fescue uniformly infested with rattail fescue (*Festuca myuros*) and common ryegrass (*Lolium multiflorum*).

The best weed control was in the October treatment with decreasing effectiveness in order of the application. This was due largely to the stage of growth of the weedy grasses when the chemical was applied. The younger plants were easier to kill than the older plants.

The yields from the October treatment were the highest with a marked decrease in seed yield with the remaining treatments. Reduction in seed yield was more marked with IPC than with Cl IPC. (Contributed by Oregon Agricultural Experiment Station)

The effect of rate of application on weed control in Alta fescue when using IPC and Cl IPC. Bayer, D. E., and Freed, V. H. A field trial was established on a solid stand of Alta fescue infested uniformly with rattail fescue (*Festuca myuros*) and common ryegrass (*Lolium multiflorum*) to determine the most effective rate of IPC and Cl IPC for controlling these weedy grasses. IPC and Cl IPC were applied at the rates of 2, 3, 4, 5, 6, and 7 lbs actual parent material per acre. One-half square rod plots were used with 4 replications. Application was made October 16.

The four pound rate of both IPC and Cl IPC gave good weed control and showed no effect on the seed yield. IPC did not have any effect on the spring germinated annuals while Cl IPC gave excellent control of these spring annuals. The heavy rates of IPC reduced the seed yield markedly but did not kill the old Alta fescue plants. At the same heavy rates the Cl IPC did not reduce the seed yield as markedly but had a greater effect on the old established Alta fescue plants. (Contributed by Oregon Agricultural Experiment Station)

Weedy annual grass control in Alta, red and chewings fescue. Bayer, D. E., and Freed, V. H. A field trial was set up using IPC as an emulsifiable liquid alone and in combination with $CaCN_2$, as a 50% wettable powder and Cl IPC. The chemicals were applied at three different times: October, November, and December. The October rates of application for IPC were 3 and 4.5 lbs per acre; Cl IPC, 3 and 4.5 lbs per acre; and the IPC:$CaCN_2$ combination, 3 and 320 and 3 and 480 lbs per acre respectively. The November and December rates of application were 4.5 lbs per acre for both the IPC and Cl IPC.

Applications were made on a solid stand of tall fescue, red fescue, and chewings fescue that was uniformly infested with rattail fescue (*Festuca myuros*). Plots were 10 feet by 16 feet replicated 3 times.

This trial has run 3 years with each year duplicating the same treatment on the same plot. This was done to determine whether there was any carry over or detrimental effect of the chemical to the seed crop when treatment was made in successive years.

There is no apparent detrimental effect to plants or the seed yield from plots treated in October from any of the compounds. The November and December treatments show reduced seed yields with some reduction of stand, especially in the chewings and red fescues. (Contributed by Oregon Agricultural Experiment Station)

PROJECT 9 ANNUAL WEEDS IN ROW CROPS AND VEGETABLES
E. R. Laning, Jr. Project Leader

Fourteen individual reports were submitted giving results of various experiments on crops ranging from cotton to sugar cane.

Pre-emergence trials on cotton indicate that CMU, 3 Chloro IPC and phthalamic acid should be investigated further since weed control was very good without apparent cotton damage at certain rates of application.

In addition to the more or less standard recommendations of calcium cyanamid and potassium cyanate on onions, it is apparent that 3 Chloro IPC shows considerable promise as a pre-emergence treatment. It seems possible that the dangers associated with improper moisture conditions in relation to cyanamid might be overcome by the use of 3 Chloro IPC.

Other reports indicated that CMU should be tested further on many crops as a pre-emergence treatment at low rates. The amine salt of dinitro also appears to be a good pre-emergence chemical especially for beans and corn.

Other crops mentioned are peas, potatoes, table beets, carrots, asparagus, and a group of vegetables treated with CMU.

Most of the reports are of a preliminary nature and recommendations are not made.

All individual reports are presented in the following pages.

Some greenhouse tests on the effect of 3 chloro IPC and CMU on cotton and on watergrass. Leonard, O. A., and Harvey, W. A. The objective of this experiment was to determine the sensitivity of cotton (an Acala variety) and watergrass (Echinocloa crusgalli) to CMU and 3-Cl IPC when applied (1) to the surface of the soil and (2) mixed with the soil. Yolo fine sandy loam and Yolo clay loam were used in order to study extremes in soil types. The procedure was to place 500 grams of air-dry soil in no. 2 cans and the herbicides applied. The cotton and watergrass seeds were planted about one-half inch deep, immediately before the surface application and immediately after the treatment in which the chemicals were mixed with the soil. The 3-Cl IPC was used at the rates of 0, 5, 10, 20, 40, and 80 pounds per acre, while the CMU was applied at the rates of 0, 1, 2, 4, and 8 pounds per acre. Data were recorded about 7 weeks after planting. The soil was then allowed to dry, removed from the cans and pulverized, returned to the cans and replanted. This was continued until four separate croppings had been made.

Table 1. Effect of CMU on cotton and watergrass. The CMU was applied (1) to the surface and (2) mixed with soil. Planted Feb. 8 and harvested March 24.

Lbs per acre of CMU	Yolo Clay Loam				Yolo Fine Sandy Loam			
	Surface		Mixed		Surface		Mixed	
	Cotton ht.	Watergrass	Cotton ht.	Watergrass	Cotton ht.	Watergrass	Cotton ht.	Watergrass
Lbs.	inches		inches		inches		inches	
0	19	Dense	19	Dense	15	Dense	15	Dense
1	23	Sparse	21	Dense	10	Dead	14	Medium
2	17	Dead	21	Medium	8	Dead	11	Sparse
4	12	Dead	20	Dead	Dead	Dead	Sparse	Dead
8	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead

Table 2. Effect of 3 chloro IPC on cotton and watergrass. The 3 chloro IPC was applied (1) to the surface and (2) mixed with the soil. Planted Feb. 8 and harvested March 24.

Lbs. per acre of 3-Cl IPC	Yolo Clay Loam				Yolo Fine Sandy Loam			
	Surface		Mixed		Surface		Mixed	
	Cotton ht.	Watergrass	Cotton ht.	Watergrass	Cotton ht.	Watergrass	Cotton ht.	Watergrass
Lbs.	inches		inches		inches		inches	
0	21	Dense	21	Dense	22	Dense	22	Dense
5	22	Sparse	21	Dense	21	Sparse	22	Dense
10	20	None	20	Dense	22	None	20	Dense
20	Dead	None	15	Medium	Dead	None	15	Medium
40	Dead	None	10	Sparse	Dead	None	8	Sparse
80	Dead	None	Dead	None	Dead	None	Dead	None

The results from the first cropping are shown in tables 1 and 2. The results with CMU indicate (1) that more CMU was required to produce a herbicidal effect on the clay than on the sandy soil, (2) mixing CMU with the soil decreased its herbicidal effectiveness, (3) that watergrass could be selectively removed from cotton, (4) there was a greater margin of safety in the use of CMU on the clay soil than on the sandy soil.

The results from the first cropping of 3-Cl IPC indicate (1) that 3-Cl IPC was affected less by soil type than was CMU, (2) that mixing 3-Cl IPC with the soil had a greater depressing effect on herbicidal toxicity than it did with CMU, (3) that death of cotton plants with 3-Cl IPC is due to a combination of contact and systemic effects, while the effect of CMU is primarily systemic, (4) that watergrass can be selectively removed from cotton with 3-Cl IPC.

The results of the second run indicate that with CMU in the sandy loam soil, watergrass was dead with the 4 pound treatment and cotton was dead with the 8 pound treatment. With the clay loam soil, watergrass was dead with the 4 pound treatment and cotton was yellowish with the 8 pound treatment. Very little effect remained with the 3-Cl IPC, even the 80 pound rate of application, either on the cotton or on the watergrass.

The results of the third and fourth runs were similar. Cotton was not affected by any of the rates of CMU that had been used on either soil type. Watergrass was affected at the 4 pound rate of application and was all dead at the 8 pound rate of application. There was a slight depressing effect of the 3-Cl IPC on cotton at the 80 pound rate of application.

The above results indicate that there is probably no reason to be concerned about residual effects due to either CMU or 3-Cl IPC, when used at the normal rates of application. These conclusions are strengthened by results from a toxicity-series experiment which indicates that no toxic residues have been formed from either CMU or 3-Cl IPC. (A contribution from the Botany Department, University of California, Davis, California).

Effect of pre-emergence applications of eight herbicides on cotton and annual grasses. Whitworth, J. W. This experiment was primarily designed as a screening test to evaluate the feasibility of using pre-emergence herbicides for controlling annual weeds in cotton grown on the heavy clay adobe soils of the Mesilla valley. The weed problem in this area usually consists of late season annual grasses which become a real problem after the tall growth of cotton restricts cultivation. Of these grasses, Jungle-rice (*Echinochloa colonum*) and sprangle-top (*Leptochloa* species) are the worst offenders.

Eight herbicides were applied each at three rates on plots 2 rows x 20 ft. long. A randomized block design was used and an adjacent untreated check plot was included for each treated plot to permit a covariance analysis. All treatments were replicated three times.

On April 26, 1952, cotton, variety 1517-C, was seeded on previously irrigated beds at the rate of about 16 pounds per acre. Two 40 inch rows were planted on the double bed,and in the same operation a ridge of soil was thrown over each row. On May 2, just before the cotton emerged, the ridges were struck and the herbicides were applied in 50 gallons of water per acre. The cotton emerged to a heavy, uniform stand over the entire field. On May 22, the stand was counted and thinned to a stand of one plant per foot. The plants were hand pulled to prevent disturbing the chemically treated band. On July 9, typical CMU injury symptoms became apparent on the cotton growing on plots treated with the 3 and 4 lb/acre rates of CMU. This delayed appearance of injury symptoms in contrast with a similar experiment conducted at this station in 1951 by Dotzenko. (See page 110 of the 1952 WCC Research Report.) The moisture factor might explain this conflicting data since irrigation water was applied to Dotzenko's plots immediately after applying the CMU. In this experiment, the first moisture to reach the plots, except for a 0.06 inch rain, came in the form of the first crop irrigation applied seven weeks after applying the CMU. In 1952, cotton sown on Dotzenko's 1951 plots came up to a stand and died out shortly thereafter. It is possible the same thing will happen on the 1952 plots when they are seeded again in 1953.

Of the eight herbicides tested, CMU and phthalamic acid showed promising weed control possibilities. Nine weeks after applying the herbicides, the average stand of annual grasses on the CMU plots (2, 3 and 4 lb/acre) was 0.3 plants per square foot as compared to 4.1 on the adjacent checks and 0.2 on the napthyl phthalamic acid (formulation 1) plots (2, 4 and 6 lb/acre) as compared to 6.8 plants on the adjacent checks. At harvest time, 20 weeks after application, some carry-over of these two chemicals was still apparent. The stand of grass on the CMU plots averaged 0.2 plants per square foot as compared to 3.1 on the adjacent checks and 0.9 plants on the phthalamic acid plots as compared to 5.1 plants on the adjacent checks. During the period of the experiment the field received six irrigations (approximately 3 inches each) and 5.92 inches of rainfall.

The cotton yields of the area averaged over two bales of lint per acre. None of the eight herbicides at any of the three rates tested significantly reduced either the stand or yield of cotton as compared to the adjacent checks. With a C.V. of 11.2% it was possible to measure yield differences of 20%. If the apparent injury caused by the 3 and 4 lb rate of CMU reduced yield, the precision of this experiment was not fine enough to detect this reduction.

The cotton on the CMU and phthalamic acid plots and adjacent checks was sampled for lint percent, strength index and other fiber properties, and seed germination. Only the lint percent and strength index have been completed. There were no differences between treated vs. nontreated in regard to these two properties. (New Mexico Agricultural Experiment Station, State College, New Mexico.)

Effect of pre- and post-emergence applications of herbicides recommended for the control of annual weeds in cotton. Whitworth, J. W. Recommendations for chemical weed control are available for many cotton producing areas. The experimental data that furniched the necessary background for these recommendations is not yet available for the Mesilla Valley. This experiment was designed to test the feasibility of using borrowed recommendations for chemically controlling weeds in cotton in this area.

Identical cultural practices were followed on this experiment and the above screening test and the pre-emergence treatments were also made in a like manner. The post-emergence chemicals were applied by using a hand boom that placed the spray in a band at the base of the cotton plants. Each treatment was replicated four times and paired with an adjacent check plot to permit a covariance analysis. The plots were four (40 inch) rows by 20 feet long.

The eight pre-emergence treatments included the water and oil soluble dinitros applied at 8 and 12 lb / acre, 3-Cl IPC at 4 and 8 lb/acre and a petroleum distillate at 40 and 60 gallons/acre. None of these treatments reduced the yield or stand of cotton as compared with the adjacent untreated check plots. Weed control data based on percent of check calculated on data taken nine weeks after applying the treatments showed no essential differences in rate. Percentage control of weeks at this time was 91, 86, 76 and 50 respectively for the oil soluble dinitro, 3-Cl IPC, petroleum distillate and the water soluble dinitro. A weed count taken just before harvest showed percentage weed control as 30, 67, 61 and 33 respectively for these chemicals. Apparently, IPC and the petroleum distillate had the longest residual action.

Eight post-emergence treatments were applied using a placement spray when the cotton was in the early square stage. At this time the weeds were about 1-2 inches tall and at a susceptible stage. Unfortunately, however, by this time the cotton had lost its waxy cutin and bark formation had started. As a result the dinitro, the naptha, and the IPC in naptha reduced the yield 22, 26, and 14% respectively. Neither rate of the TCA which was applied at 10 and 20 lb/acre reduced the yield of seed cotton. Both rates gave 99% control of the annual grasses. The grasses that were present on these plots died out and the plots remained grass-free for the remainder of the growing season. (New Mexico Agricultural Experiment Station, State College, New Mexico.)

Effect of pre-emergence and post-emergence chemical treatments on annual weeds and onions. Timmons, F. L. and Lee, W. O. An experiment conducted in 1952 tested seven chemicals at different rates in comparison with untreated, cultivated, and hand-weeded checks in 24 pre-emergence and post-emergence treatments, each replicated five times in randomized blocks on plots 8 x 15 feet, each containing six rows of yellow sweet Spanish onions. The onions were seeded April 10, about a month later than the normal date of planting, due to late melting of the unusually heavy winter accumulation of snow. All plots were cultivated and irrigated uniformly by the usual method for growing market onions. All treated plots and untreated check plots were cultivated and hand-weeded as necessary during the season and the hand-weeding time required was recorded separately for each plot. The four middle rows in each plot were used for onion yield determination.

The pre-emergence applications were made April 19 after the onions had sprouted but when no onions and few weeds had emerged. The treatments compared endothal at 1, 2, and 3 pounds per acre, 3 chloro IPC at 2, 4, 6, and 8 pounds per acre, sodium TCA at 4, 8, and 12 pounds per acre, and calcium cyanamid (granular) at 200 and 400 pounds per acre. The endothal, CIPC, and TCA were applied in 60 gallons of water per acre while the cyanamid was applied with a fertilizer spreader. No effective precipitation was received after the pre-emergence treatments were made and previous to the first cultivation and hand-weeding which occurred on May 14. The plots were sprinkler irrigated May 15.

Only the heaviest rates of CIPC, TCA, and cyanamid gave significant reductions in the first crop of weeds and in hand-weeding time. After the first cultivation and hand-weeding and the sprinkler irrigation of May 15, most of the pre-emergence treatments gave some reduction in the second crop of weeds. The hand-weeding time necessary for both crops of weeds ranged from 22-52 man-hours per acre for the different treatments as compared to 67 man-hours for the untreated check. Cyanamid at 400 pounds per acre gave the best weed control but reduced the stand of onions 46% and the yield of marketable onions 30%. CIPC at 6 and 8 pounds per acre reduced hand-weeding time 29 man-hours per acre, caused no reduction in the stand of onions and increased the yield of onions 10-14%. The endothal treatments had little effect on the stand of onions or weeds but reduced onion yields 23-57% for the different rates. The TCA treatments produced severe injury to onions resembling that of 2,4-D and reduced the yields 14-57% at different rates. It seems likely that the supply of TCA used had become contaminated with 2,4-D.

The post-emergence treatments in this experiment compared potassium cyanate (KOCN) and sodium pentachlorophenate (PCP) at rates of 5, 7½, 10, and 15 pounds per acre. The first post-emergence spray applications were made May 1 when the onions were mostly emerged with the seedling in the crook stage; the first crop of weeds had 2-6 leaves. At that time the surface soil was quite dry and the onion seedlings were low in vigor. The second post-emergence applications were made May 30 when the onions had 2-3 true leaves and the second crop of weeds had 2-4 leaves. Crag herbicide (2,4-D sodium ethyl sulfate) was tested May 30 at 2½ pounds per acre.

Weed control from KOCN and sodium PCP in 1952 was the best that has been obtained in four experiments conducted in consecutive years. The hand-weeding time was reduced 42-56 man-hours per acre, 65-85% less time than was required for the untreated check. However, the first applications which were made when the onions were in the early seedling stage severely reduced the stand of onions. The reduction ranged from 30-60% for different rates of KOCN and from 70-96% for different rates of sodium PCP. Yields of U. S. No. 1 onions were reduced 4-36% by the KOCN treatments and 53-98% by the sodium PCP treatments as compared with untreated checks. In previous experiments these two chemicals at similar rates did not cause significant reductions in the stand or yield of onions. Crag herbicide reduced the yield of onions 70% in the 1952 experiments.

The results in 1952 emphasized the necessity for sufficient rainfall or overhead irrigation following pre-emergence treatments to carry the chemicals into the surface soil and make them effective on germinating weeds. The results also demonstrate that KOCN and sodium PCP can cause severe damage to onions when applied too soon after emergence. The results in 1952, like those in 1951, indicated that 3 chloro IPC is a promising herbicide for control of annual weeds in onions and that endothal is not safe for use as a pre-emergence treatment in onions. (Contributed by the Division of Weed Investigations, BPISAE, USDA, and the Utah Agricultural Experiment Station, cooperating.)

Aero Cyanamid and Aero Cyanate for weed control in onions. Ferguson, A. C. In 1952 an experiment was conducted on the Arkansas Valley Branch Station at Rocky Ford, Colorado, to test rates and time of application of both Aero Cyanamid (granular) and Aero Cyanate sprays. Aero Cyanamid at 200 and 400 pounds per acre was applied to the surface of the soil before the first irrigation on one set of plots, and before the second irrigation on another set of plots. When the onions were in the "crook" stage another set of plots was sprayed with Aero Cyanate at a rate of 7.5 pounds in 100 gallons of water per acre. After the onions had reached the "two-leaf" stage, one-half of each treatment was sprayed with Aero Cyanate at a rate of 7.5 pounds in 100 gallons of water. The following results were obtained:

Treatment (per acre basis)	Yield 50# sck/A	Onion plants/ yd row	Weeds per sq. ft. Grass	Broad-leaf	Total
A/					
1. 400# Aero Cyanamid before 1st irrigation	949	20.5	8.2	3.3	11.5
2. 400# Aero Cyanamid before 1st irrigation, plus 7.5# Aero Cyanate at "2-leaf" stage	892	17.8	6.4	1.8	8.2
B/					
1. 400# Aero Cyanamid before 2nd irrigation	765	15.6	4.8	1.3	6.1
2. 400# Aero Cyanamid before 2nd irrigation, plus 7.5# Aero Cyanate at "2-leaf" stage	745	14.8	2.8	0.7	3.5
D/					
1. 200# Aero Cyanamid before 1st irrigation	927	20.7	13.0	4.3	17.3
2. 200# Aero Cyanamid before 1st irrigation, plus 7.5# Aero Cyanate at "2-leaf" stage	852	17.5	8.4	1.2	9.6
E/					
1. 200# Aero Cyanamid before 2nd irrigation	854	19.1	9.0	1.7	10.7
2. 200# Aero Cyanamid before 2nd irrigation, plus 7.5# Aero Cyanate at "2-leaf" stage	714	18.0	2.6	0.6	3.2
G/					
1. 7.5# Aero Cyanate at "crook" stage	800	17.9	5.0	0.5	5.5
2. 7.5# Aero Cyanate at "crook" stage, plus 7.5# Aero Cyanate at "2-leaf" stage	639	15.4	4.9	0.8	5.7
H/					
1. Check	877	22.1	12.1	10.6	22.7
2. 7.5# Aero Cyanate at "2-leaf" stage	923	16.0	12.8	1.6	14.4
L. S. D. 5%	151	2.8	4.6	2.7	3.8
L. S. D. 1%	209	3.7	6.3	3.8	5.4

Discussion of results:

1. All treatments reduced the total number of weeds significantly when compared with the untreated check.

2. Treatments B2 and E2 gave the best control of weeds, showing respectively 3.5 and 3.2 weeds per square foot as compared to 22.1 weeds for the check. However, these treatments appear to reduce yields.

3. All treatments were very effective in the control of broadleaf weeds, but only treatments A2, B1, B2, E2, G1, and G2 were effective in reducing the number of annual grasses.

4. Treatments A1, A2, D3, E1, and G1 appear to be the most satisfactory since they gave good weed control without reducing the yield of onions.

Note: 1. Aero Cyanamid can be applied to the surface of the soil on a field scale with a Gandy fertilizer spreader. Tests with this machine have shown that it can be calibrated with little difficulty to spread evenly the exact amount of material over the soil surface.

2. Onion seedlings should not be sprayed with Aero Cyanate when in the "flag leaf" stage as heavy losses in stand may result. Onions appear to be more tolerant to the spray when in the earlier "crook" stage or later "2-leaf" stage. (Colorado Agricultural Experiment Station.)

EFFECT of Various Herbicides on Stands and Yields of Asgrow Y41 Onions. Barnard, E. E. Asgrow Y41 onion transplants, 60 days from seed were planted in prepared plots on May 24, 1952. Previously, on May 20, in randomized plots, replicated three times, the following pre-planting treatment had been applied: CIPC at 2 and 4 pounds per acre, TCA sodium salt at 4 and 8 pounds per acre, endothal at 2 and 4 pounds per acre, DNOSBP alkanolamine at 2, 4, and 6 pounds per acre, and stoddard solvent at 40 and 80 gallons per acre. Each treatment, with the exception of stoddard solvent, was applied in 50 gallons of water per acre. All weeds not killed by the treatments were suppressed mechanically throughout the season. Good moisture conditions were maintained by sprinkler irrigation. Plant survival counts were made and the bulbs were harvested, weighed, and graded on September 8.

Although there were no great variations in plant survival counts, they were so uniform that small differences between treatments assumed statistical significance. The greatest variation from the check resulted with the 2-pound treatment of endothal which caused a highly significant reduction. The plots treated with 8 pounds of TCA or 80 gallons of stoddard solvent closely approximated the check. All other treatments had survival counts greater than the check, those treated with 4 pounds of CIPC, 4 pounds of TCA, 4 pounds of endothal, or 4 pounds of DNOSBP significantly so.

All but four of the treatments approximated the check or exceeded it in the number of marketable onions produced. The number was reduced materially by the following treatments: 2-pound rate of DNOSBP, 12.5% reduction; 2-pound rate of endothal, 27% reduction; 40-gallon rate of stoddard solvent, 50% reduction; and the 80-gallon rate of stoddard solvent, 90% reduction. These treatments caused highly significant reductions in yield (total weight and weight of marketable bulbs) as well, the most severe reductions occurring with stoddard solvent with 50% or more at the 40-gallon rate, and 80% or more at the 80-gallon rate.

The direction of action of the herbicide materials was the same for total weights and weights of marketable onions. Statistical significance followed the same pattern as well. The plots treated with 2 or 4 pounds of CIPC or 4 pounds of TCA exhibited significant increases in yields over the check, the increase being highly significant with the 2-pound rate of CIPC. Those plots treated with 4 or 6 pounds of DNOSBP also showed increased yields but not significantly so. The plots receiving 8 pounds of TCA or 4 pounds of endothal closely approximated the check. The four treatments causing reductions are discussed in the preceding paragraph.

With the exception of stoddard solvent, all materials exhibited promise. Further work with them for weed control with onion transplants is desirable. (Contribution of the Montana Agricultural Experiment Station.)

EFFECT of Various Herbicides on Stands and Yields of Perfected Detroit Beets. Barnard, E. E. Perfected Detroit beets were planted on June 6, 1952. On June 24, the following pre-emergence sprays were applied in randomized plots, replicated four times: TCA sodium salt at 4, 8, and 12 pounds per acre, endothal at 2 and 4 pounds per acre, sodium isopropyl xanthate at 15 and 25 pounds per acre, and IPC at 2, 4, and 6 pounds per acre. Each treatment was applied in 50 gallons of water per acre. All weeds not killed by the treatments were suppressed mechanically throughout the season and good moisture conditions were maintained by sprinkler irrigation. Plant stand counts were made and the plots were harvested on August 27.

Stand counts were not appreciably affected by the treatments of endothal or IPC or by the 4-pound rate of TCA. However, there was a general decrease in counts as the rate of application with TCA increased, although no significant reduction occurred. Significant reductions in stand counts were caused by sodium isopropyl xanthate which caused reductions of 50% or more.

The response of weight yields to the treatments was similar to the response of stand counts. The plots treated with endothal or IPC produced yields closely approximating those of the check. Those treated with TCA showed an increasing reduction in yield as the rate of application increased, with a significant reduction being caused by the 12-pound rate. Highly significant reductions in yields were caused by sodium isopropyl xanthate at 15 or 25 pounds per acre, the reductions being 50% and 64% respectively. (Contribution of the Montana Agricultural Experiment Station.)

EFFECT of Various Herbicides on Stands and Yields of Tendersweet Carrots. Barnard, E. E. Tendersweet carrots were planted on June 6, 1952. On June 24, the following pre-emergence sprays were applied in randomized plots, replicated four times: TCA sodium salt at 4, 8, and 12 pounds per acre, endothal at 2 and 4 pounds per acre, sodium isopropyl xanthate at 15 and 25 pounds per acre, and stoddard solvent at 40, 60, and 80 gallons per acre. Each of the herbicides, with the exception of stoddard solvent, was applied in 50 gallons of water per acre. All weeds not killed by the treatments were suppressed mechanically throughout the season and good moisture conditions were maintained by sprinkler irrigation. Plant stand counts were made and the plots were harvested on September 19.

Stand counts were not appreciably affected by the treatments of stoddard solvent, lower rates of TCA, or the 25-pound treatment of sodium isopropyl xanthate. As the rate of application with TCA increased, there was a general decrease in counts to nearly a significant reduction with the 12-pound rate. A significant reduction was caused by the 15-pound rate of sodium isopropyl xanthate. The most severe reductions were caused by endothal treatments which caused a 92% reduction with the 2-pound rate and a 98% reduction with the 4-pound rate.

Only the plots treated with stoddard solvent closely approximated the check in weight yields. The plots treated with 25 pounds per acre of sodium isopropyl xanthate were somewhat reduced but not significantly so. Significant reductions were caused by TCA at 4 pounds per acre, and highly significant reductions were caused by TCA at 8 and 12 pounds per acre, endothal at 2 and 4 pounds per acre, and sodium isopropyl xanthate at 15 pounds per acre. (Contribution of the Montana Agricultural Experiment Station.)

EFFECT of MCP and 2,4-D on Stands and Yields of Freezonian Peas. Barnard, E. E. Freezonian peas were planted on June 3, 1952. On June 24, the following post-emergence sprays were applied in randomized plots, replicated four times: MCP sodium salt at .1, .2, .3, and .4 pounds per acre, and 2,4-D alkanolamine at .1, .2, .3, and .4 pounds per acre. Each treatment was applied in 50 gallons of water per acre. All weeds not killed by the treatments were suppressed mechanically throughout the season and good moisture conditions were maintained by sprinkler irrigation. Peas were harvested at the green pod stage and run through a separator to obtain shelled pea weights on August 7, 13, and 18, after which stand counts were made and the patch was abandoned.

Stand counts were not found to be affected appreciably by any of the treatments.

The plots treated with the two lower rates of MCP produced slightly greater yields than the check, and the plots treated with the two higher rates produced slightly less than the check, but neither increases nor decreases were significant. The plots treated with 2,4-D exhibited an increasing reduction in yield as the rates increased, the lowest rate causing a slight reduction, the next two rates causing significant reductions, and the high rate causing a highly significant reduction from the check. MCP demonstrated sufficient advantage over 2,4-D to indicate that further investigations with it are desirable for weed control in peas. (Contribution of the Montana Agricultural Experiment Station.)

Weed control in green beans. Laning, E. R. Jr. and Freed, V. H. Tender green bush beans were planted with fertilizer applied in bands on May 22, 1952. The area was sprinkler irrigated immediately and the chemicals listed in Table 1 were applied on May 27, 1952, as pre-emergence treatments. All chemicals were sprayed on in 60 gallons of water per acre, except the granular calcium cyanamid. The control plots were treated as much like a commercial planting as possible.

Weed counts were made on July 14, 1952, 43 days after treatment, after which all plots were cultivated until after picking. Yield data were taken on July 30, 1952. These results are shown in Table 1.

WEED CONTROL AND YIELD OF GREEN BEANS
RESULTING FROM PRE-EMERGENCE
CHEMICAL TREATMENTS

Treatment	Rate Lbs/A	Total Weed Count--3 reps	Yield in grams Total - 3 reps
1. NaPCP	6	31**	4345
2. NaPCP	10	33**	4165
3. Na 2,4,5-TCP	6	71	4660
4. Amine 2,4,5-TCP	6	66	4450
5. Premerge	3	34**	4350
6. $CaCN_2$ (gram)	200	58	3245
7. CMU	2	12**	5955
8. Endothal	4	71	3350
9. Light Oil	40 gal.	89	3300
10. DN5 (see butyl)	3	23**	4010
11. DN5	3	23**	4580
12. DNG	1 qt.	70	3930
13. 3-Cl IPC	3	50	3690
14. IPC	3	91	4335
15. 2,4-DB	2	43*	3605
16. Control-weeded		79	3265

* Significantly better than check at 0.05 level.
** Significantly better than check at 0.01 level.

Analysis of variance (using weed counts converted to square roots) showed the following:

1. There was no significant difference in yields resulting from various treatments.

2. The CMU, NaPCP, Premerge, and dinitro selective gave highly significant and 2,4-DB gave significantly better weed control as compared to the control plots.

3. There was no difference among the dinitro selective treatments but all were better than dinitro general. (Oregon State College.)

Weed control in sweet corn. Laning, E. R., Jr. and Freed V. H. Golden cross bantam sweet corn was planted with fertilizer applied in bands on May 22, 1952. Immediately after planting the area was sprinkler irrigated, and the chemicals listed in Table 1 were applied as pre-emergence treatments on May 27, 1952. All chemicals were applied as a spray except calcium cyanamid. The control plots were treated as much like a commercial planting as possible.

Weed counts were made on July 14, 1952, 43 days after treatment. All plots were then cultivated. Due to an excessive stand the corn did not mature good ears and yield data were not collected. The weed counts are shown in Table 1.

PRE-EMERGENCE WEED CONTROL IN SWEET CORN

Treatment	Rate lbs/Acre	Weed Count Total for 3 reps
1. Na 2,4-D	1	35*
2. Amine 2,4-D	1	43
3. NaMCP	1	61
4. Amine MCP	1	35*
5. Premerge	3	9**
6. $CaCN_2$	300	32*
7. $NaHCN_2$	20	52
8. 2,4-DS	2	35*
9. 2,4-DB	2	32*
10. CMU	2	11**
11. Control	-	69

* Significant decrease at 0.05 level compared to control.
** Significant decrease at 0.01 level compared to control.

The analysis of variance (using weed counts converted to square roots) showed the following:

1. Na 2,4-D, Amine MCP, $CaCN_2$, 2,4-DS, and 2,4-DB all reduced the weed population significantly as compared to the control plots.

2. Premerge and CMU reduced the weed population to a highly significant degree.

3. Premerge and CMU also controlled the weeds better than any other treatment.

4. Observations indicated that CMU was the only treatment which injured the corn. CMU injured the corn severely and reduced the stand by more than half. (Oregon State College.)

Pre-emergence and post-emergence chemical control of annual weeds in Red McClure potatoes in the San Luis Valley of Colorado. Fults, Jess; Blouch, Roger; Livingston, Clark; and Thornton, B. J. Recently the vegetable crops division of Cornell University has recommended the use of pre-emergence chemical weed control in potatoes in New York State. Recommendations are based on six years testing under widely different conditions. It is stated that one pre-emergence chemical spray may be substituted for two cultivations with significant savings in time and money. Final hilling operations are carried on at the usual time just prior to closure of the rows by vines.

Tests were begun at the San Luis Valley Experimental farm near Center, Colorado, on May 20, 1952, to determine whether pre-emergence or early post-emergence chemical weed control in Red McClure potatoes was a profitable operation under the arid conditions of this area. Spring and early summer rainfall in this region is erratic, and usually deficient, and most crop production in the area is dependent on subirrigation.

The procedures used in 1952 were of an exploratory nature with the object in mind of evaluating the pre-emergence and post-emergence effectiveness of several herbicides. Because of this, all comparisons were made with unweeded, uncultivated and unhilled plots. None of the treated plots received the usual hilling operation for the same reasons.

Potatoes were planted in the usual 34 inch rows spaced 10 to 12 inches apart on May 20, 1952, and were harvested September 15, 1952. The length of season was 118 days. Pre-emergence treatments were made on May 23 and 24, and post-emergence treatments were made 32 days after planting on June 21. On this date the potato plants were 6-8 inches tall. The two most important weeds were redroot (*Amaranthus retroflexus*) and lambsquarters (*Chenopodium album*). Weed counts were made on June 21 to obtain data on pre-emergence chemical effects. Post-emergence treatments, as well as pre-emergence treatments, were evaluated on July 28. The bases of comparison in all cases were unweeded, uncultivated control plots. Harvest of all plots for potato yields was carried out on September 15. Plots were 2 rows wide x 50 feet long. Treatments were replicated 3 times in randomized blocks. Moisture was deficient, both in the form of natural precipitation and subirrigation, until August 2. Moisture and temperature and light were adequate from August 2 until harvest.

All data are summarized in Table 1. These data suggest that very good to excellent pre-emergence weed control may be secured with CMU at rates of 3 to 6 pounds per acre with no depression in yield. TCA and C-IPC appear fair to good. P-162 was very promising as a post-emergence treatment when used in kerosene, but it was of no value when used in water. With these trends as a guide, trials on a larger scale are being planned for next year using cultivated and hilled, cultivated and not hilled, not cultivated but hilled controls.

Table 1. An evaluation of pre- and post-emergence chemical weed control in Red McClure potatoes. San Luis Valley Experimental Farm, Center, Colorado. 1952.

No.	Treatments	June 21 Pre-emergence evaluation: Total weeds[3]	June 21 Pre-emergence evaluation: % kill	July 28 Pre-emergence & post- " evaluation: % kill	September 15 Harvest evaluation: Yield /plot lbs.	September 15 Harvest evaluation: % unweeded controls %
1.	C-IPC @ 8#/acre[1]	105	34	27	132	68
2.	C-IPC @ 8#/acre[1] Aerocyanate 10#/A[2]	58	63	30	354	182

(Table 1 continued on following page.)

1. Treatments applied pre-emergence.
2. Treatments applied post-emergence.
3. Total annual weeds in 3 plots, area 50'x6" between the 2 treated rows.

Table 1, Continued

No.	Treatments	June 21 Pre-emergence evaluation: Total weeds[3]	June 21 Pre-emergence evaluation: % kill	July 28 Pre-emergence & post- " evaluation: % kill	September 15 Harvest evaluation: Yield /plot lbs.	September 15 Harvest evaluation: % unweeded controls %
3.	TCA @ 10#/A[1]	40	75	30	315	162
4.	TCA @ 10#/A[1] Aerocyanate 10#/A[2]	20 (2 plots only)	81	35	226	175
5.	CMU @ 3#/A[1]	55	65	57	264	136
6.	CMU @ 6#/A[1]	6	96	100	350	180
7.	Niagarthal @ 10#/A[1]	85	46	7	252	130
8.	Aerocyanate @ 10#/A[2]	160	--	7	180	93
9.	Crag #1 @ 10#/A[1]	147	7	0	195	100
10.	C-IPC @ 8#/A[1] Crag #1 @ 10#/A[1]	80	49	25	280	144
11.	P-162@ 20#/A in H_2O[2]	125	--	17	176	91
12.	P-162 @ 20#/A in kerosene[2]	142	--	77	269	139
13.	2,4-D L.V. ester[1] @ 2#/A	88	44	0	229	118
14.	4-C-IPC @ 8#/A[1]	171	0	0	208	107
15.	Premerge @ 2 gal./A[1]	130	8	0	193	100
16.	Control, weedy	158	--	--	194	--

1. Treatments applied pre-emergence.
2. Treatments applied post-emergence.
3. Total annual weeds in 3 plots, area 50 ft. x 6 inches between the two treated rows. (Colorado Agricultural Experiment Station.)

CIPC and CMU for weed control in seed crops and asparagus. Zobel, M. P. and Harvey, W. A. An exploratory type of experiment was conducted in 1952 in commercial fields of carrots, beets, onions and peas, all being grown for seed. Non-replicated plots using 3 chloro IPC at 3 and 6 pounds per acre and CMU at ½, 1, 1½, and 2 pounds per acre were used. All crops were well established with considerable new growth. The plots received several rainfalls of ½ to 1 inch each, as well as showers. Carrots were completely unaffected by all treatments. Onions were unaffected by all treatments except CMU at 2 pounds per acre which caused some leaf burning but with complete recovery later. On beets, CMU removed the red color from the leaves but growth continued and the red color returned within three weeks. CIPC resulted in stunting with both rates and some mortality at 6 lbs. With peas, CIPC caused stunting at both rates and no complete recovery while CMU resulted in a 25% stand at ½ pound rate, 10% stand at 1 pound rate and complete mortality at 1½ and 2 pounds. CIPC gave good control of weeds while CMU resulted in excellent control of the weeds in these plots.

On an established shallow planting of asparagus, non-replicated plots were laid out using CIPC at 3,6, and 9 pounds per acre and CMU at ½, 1, 1½, 2 and 4 pounds per acre. The asparagus was beginning to produce spears. No treatment caused visible damage yet weed control was good especially with the higher rates of CMU except for Common Groundsel and Asparagus seedlings. Both appear to be resistant to CMU. Also CMU was tried as a pre-emergence weed control on an asparagus nursery. Time of application was after seeding and well before emergence of weeds on asparagus. The treatments consisted of $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, 3, and 4 pounds per acre of CMU. A later spraying on separate plots, when fern growth was present, was tried. There was no loss of stand or damage to ferns, and weed control was excellent. All plots received natural rain or artificial rain.

The varieties in the above plots were Nantes carrot, perfected Detroit beets, white sweet Spanish onions, canners perfection peas, and U C 500 asparagus. (University of California, College of Agriculture, Davis.)

Residual action of 3-(p-chlorophenyl)-1, 1-dimethyl urea. Yeo, R. R. Samples from the upper inch of an adobe clay soil, which was treated with 32 pounds per acre of CMU in July, 1951, for control of nutgrass, were placed in flats in the greenhouse and cabbage, turnip, lettuce, chili, tomato, okra, muskmelon, pea, carrot and onion seeds were planted. To serve as a control, samples of untreated soil from areas surrounding the plot were collected, mixed, placed in flats and seeded to vegetables. The CMU did not appear to have any effect on germination of the vegetable seeds when compared to the checks, but apparently did effect germination of the weed seeds. Eight days after planting, the average number of weeds per square foot was 9.1, while in the checks it was 287. Observations showed only a few weeds emerged in the CMU treated soil. At the end of 27 days all plants in the CMU treated soil were dead. None of the vegetables grew beyond the cotyledon stage. The tips of the cotyledons were first to yellow, followed by yellowing of the whole cotyledon. The onions grew to a height of $1\frac{1}{2}$ inches and then appeared to have the cells destroyed at the base of the stem. Chili and okra appeared to have the greatest tolerance to the CMU. The amount of rainfall from July, 1951, to December, 1952, was 9.87 inches. (Contributed by the New Mexico Agricultural Experiment Station.)

Weed Control with CMU in Sugar Cane. Hanson, Noel S. Experiments with CMU for controlling weeds in sugar cane during 1951 and 1952 have shown this chemical to be a very effective pre-emergence herbicide for use on most Hawaiian soils.

Following are summary statements from 33 tests conducted on sugar plantations in Hawaii during 1951 and 1952:

1. In four tests, CMU applied in CADE (Concentrated Activated Diesel Emulsion) substantially increased the period of control over CMU applied in water. In six tests, the two formulations were practically equal when compared at the same dosages of CMU.

2. In 22 out of 33 tests, the days effective control increased with an increase in dosage.

3. In 9 out of 15 tests, CMU at 2.5 pounds per acre increased the number of days effective control over an equal dosage of 2,4-D by from one to 34 days. In four out of 15 tests, 2,4-D was ahead by from 11 to 18 days over CMU.

4. Out of 33 tests, the longest period of control for 2.5 and 5.0 pounds of CMU per acre was 83 and 134 days, respectively. The shortest period was 7 and 10 days, respectively. The longest period of control for 2.5 pounds 2,4-D was 58 days and the shortest was 6 days.

5. In one test, an appreciable depression in growth resulted from application of 10 and 20 pounds of CMU over cane from 6-20 inches tall. In another test neither 10 nor 20 pounds caused growth depression, whereas 40 pounds caused severe depression on cane sprayed at 18 to 24 inches. In both tests, the CMU-Water suspension was sprayed over the plants.

6. The logical recommendation from these data is the application of not over 5.0 pounds CMU per acre and at least 2.5 pounds. The chemical can be applied either in water suspension, if properly agitated, or suspended in straight CADE. Unless a water suspension is agitated during its application, the uniformity of its distribution in the field will be erratic. The CADE formulation is the more stable and will give more uniform control. CMU in CADE remains in complete and uniform dispersion for an indefinite period of time. The main advantage of the combination with CADE is that both a contact and pre-emergence spray is applied at once. The CADE will kill the weeds that have emerged, and the CMU will ensure pre-emergence control.

7. Combinations of CMU with 2,4-D and TCA did not increase the period of control over CMU suspended in CADE.

8. Poorest results from CMU in sugar cane have been on alluvial soils.

Contributed from Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, Hawaii.

PROJECT 10 AQUATIC WEEDS

J. M. Hodgson, Chairman

SUMMARY

Aquatic weeds as considered under this Project of the Western Weed Control Conference concerns those plants which must grow for at least a part or all of their life cycle in water. Two divisions of aquatic weeds are also considered, those that grow submersed and those that grow with a majority of their foliage above water, the emergent type. Prior to this year these two types were reported under separate projects.

Aquatic weed problems are found on irrigation and drainage systems, in recreational waters, and domestic water storage and delivery. However, all contributions of research reports to this committee have been concerned with the first listed category, waterweeds of irrigation and drainage systems. There is undoubtedly additional work in control of waterweeds in the two other phases that is not available to this committee.

Ten individual reports of various control studies are included in this project report. All except one are concerned with chemical treatments on one or more of the following species of Aquatic weeds.

American pondweed (Potamogeton americanus)
Leafy pondweed (Potamogeton foliosis)
Richardson's pondweed (Potamogeton Richardsonii)
Sago pondweed (Potamogeton pectinatus) & variety interuptus
Water weed (Elodea densa)
Green algae (Chladophora spp)
True watercress (Nasturtium officinali)
Cattail (Typha latifolia)

REPORTS OF INDIVIDUAL CONTRIBUTORS

Field application of Rosin Amine D Acetate (RADA) for control of submersed waterweeds. Hodgson, J. M. RADA gave good control of green algae in a small ditch in a test in 1951. It was also observed in this test that there was a definite effect of RADA inhibiting the growth of horned pondweed (Zannichellia palustris).

During the summer of 1952 a trial application of RADA was made in a ditch infested with sago pondweed (Potamogeton pectinatus) & leafy pondweed (Potamogeton foliosis) for control of these species.

Forty-two pounds of actual RADA were dissolved in fifty gallons of water to make a 10 per cent solution of RADA and water. This solution was applied to 1 cfs of water in 20 minutes. An additional 1.9 cfs of waste water entered the ditch about 100 yards below the point of treatment.

The first part of the ditch received 560 ppm of RADA for 20 minutes while the lower part of the ditch received about 190 ppm of RADA for approximately 20 minutes.

The pondweeds and green algae in the vicinity of the application were immediately discolored. The plants seemed to become whitish, then turned black and then brown. Complete kill and removal of pondweed was obtained in this upper portion of the ditch. Effect of the RADA was noted 1 mile down the ditch where 75 per cent of the leaves of the pondweeds turned brown and were sluffed off. Old stems were not killed at this point and new leaves were being formed 3 weeks after the treatment. Results of this trial indicated that Rosin Amine D Acetate has good possibilities of becoming an effective chemical for control of submersed pondweeds and further tests should be made. (Contributed by the Division of Weed Investigations, BPISAE, USDA, & the Idaho Agricultural Experiment Station, cooperating).

Aromatic Solvent Dinitro for control of submersed pondweeds. Hodgson, J. M. This test consisted of an application of 8 gallons of Ortho Aquatic Weed Killer fortified with 2 quarts of Dinitro Ortho Secondary Butylphenol in 2 cubic feet per second of water in 30 minutes time.

Within 2 days the waterweeds were all brown and the water level in the ditch had receded 8 inches. The treatment was effective for 1 mile and lasted 6 weeks when the pondweeds had made sufficient regrowth to need a second treatment. The effect of 2 quarts of Dinitro was about equal to 6 gallons of the solvent weed killer in the treatment. Cost of the treatment was as much as if an additional 6 gallons of solvent had been used. Further testing of various combination of rates of these materials will be necessary to determine the best combination and whether they are economical or not. (Contributed by Division of Weed Investigations, BPISAE, USDA, & the Idaho Agricultural Experiment Station, cooperating).

Tolerance of Grain Sorghum to RADA. Arle, H. F. During the 1952 season, applications of Rosin Amine D Acetate (RADA) were made in irrigation water to determine the possibilities of injury to grain sorghum. The grain sorghum, variety - Double Dwarf 38, was irrigated with treated water at the first, third and fifth irrigations and untreated water was used for the second, fourth and sixth irrigations. Concentrations included 10, 20, 40, and 80 ppm with 3 acre inches water being turned on to the plots during the application time. Each treatment was replicated four times.

There was no injury, abnormal plant development, delay in blooming or maturity as a result of these treatments. Harvest of seed heads, indicated a tendency for slightly increased yields as concentrations were increased, however, these increases fell below levels required for significiance.

Considerable trouble was experienced in keeping the intake screen and nozzle screens from being plugged by a gummy, resinous material. In overcoming this difficulty, we met some success by constant agitation of the solution during the application period. (Contributed by the Division of Weed Investigations, BPISAE, USDA & the Arizona Agricultural Experiment Station, cooperating).

Effect of 2,4-D on submersed aquatic weeds in irrigation canals. Lee, W. O. and Timmons, F.L. An experiment was started in the fall of 1951 testing the butoxy ethanol ester of 2,4-D at rates of 5,10, 15,20, and 25 lb/A and an amine salt of 2,4-D at rates of 10 and 20 lb/A for effectiveness in the control of pondweeds. The applications were made October 4, 9, and 10 on duplicate plots 33 feet long extending across one irrigation canal infested with giant sago pondweed (Potamogeton pectinatus var. interruptus) and on another canal infested with sago pondweed (P. pectinatus) and Anarchris. The water was turned out of these canals for the treatments and the applications were made as soon as the water quit moving and before the waterweeds were desiccated. The growth of pondweeds was quite mature at the time of treatment. Water was turned back into the canals 17-20 hours after the spraying was completed. Water samples taken from the first water over the plots and at intervals of 5 minutes, 1 hour, and 7½ hours indicated that the 2,4-D concentration collected 5 minutes or more after the first water flowed over the plots were only 6 ppm or less.

Observations in 1952 showed no effect whatever of any of the treatments on the regrowth of pondweed in the canals. Examination of the pondweed roots and tubers in the silt at the bottom of the canals in the treated plots showed no consistent evidence of injury as compared with those in untreated check plots. These field results are quite different from the promising laboratory results which have been reported from experiments conducted in the Bureau of Reclamation Chemical Engineering Laboratories at Denver, Colorado. Probably the lateness of the season and the advanced stage of growth of pondweed were important factors in the poor results obtained with 2,4-D treatments in these field experiments. A rather thorough investigation of the situation indicates that it would be seldom possible or practical to turn water out of irrigation canals in most sections of Utah for long enough periods during the growing season to make the chemical spray applications on pondweeds in the bottom of the canals when the weeds were in earlier stages of growth. (Contributed by Div. of Weed Investigations, BPISAE, USDA, & the Utah Agricultural Experiment Station, cooperating).

The effect on submersed aquatic weeds of soil sterilant herbicides applied in the bottom of an irrigation canal. Lee, W.O. & Timmons, F.L. In the fall of 1951 an experiment was started to determine whether soil sterilants are effective in controlling pondweeds in irrigation canals where the water is turned out during the winter months. The chemicals tested were CMU at rates of 5,10,20,40 and 80 lb/A, sodium chlorate at 160,320, and 640 lb/A, and Borascu at 960 and 1920 lb/A. All treatments were duplicated on plots 25 feet long and 11 feet wide extending across a small irrigation canal. The applications were made November 27 at a time when there was one to two inches of snow on the bottom of the canal.

Observations during the 1952 growing season showed that none of the treatments had any effect upon the regrowth of sago pondweed (P. pectinatus). A luxuriant growth of the weed developed on all treated plots and the canal was treated with aromatic solvent in July to provide temporary control of the pondweed. (Contributed by Division of Weed Investigations, BPISAE, USDA, and the Utah Agricultural Experiment Station, cooperating).

Relation of volume of 2,4-D spray to effectiveness on cattail at different stages of growth. Lee, W. O. and Timmons, F. L. In an experiment started in 1951 2,4-D at 4 lb/A as a low volatile ester was applied on cattail in different volumes of spray: 80, 160, 240, and 320 gal./A. The treatments were replicated twice in original applications made at an early growth stage and another series at the heading stage. In each case the spray solution contained 10 gal/A of deisel oil. The early growth series was sprayed twice in 1951 (June 7 and August 30) while the heading series was sprayed only on July 26.

Cattail regrowth in the spring of 1952 showed that two repeated applications at early growth stages were considerably more effective than a single treatment at the heading stage, and also that 4 pounds of 2,4-D in 80 gal/A of spray was much less effective in both series than the same amount of 2,4-D in 160 gal/A or greater volumes of spray. The average percentage survival of cattail in the early growth series was 70,15,6, and 5 respectively for the different volumes as compared with 55,33,29, and 33 in the heading series. Retreatments using the same volume as in the original treatment in each case were made on the early series June 17 and August 26, 1952 while retreatments on regrowth in the heading stage were made July 14, 1952. Final results from these retreatments will not be apparent until 1953. (Contributed by the Division of Weed Investigations, BPISAE, USDA, and Utah Agricultural Experiment Station, cooperating).

Effect of growth regulator chemicals and additives on common cattail (Typha latifolia) Lee, W. O. and Timmons, F. L. An experiment started in July 1951 tested 16 different chemical treatments for effectiveness on cattail in a continuously flowing irrigation drain canal. The treatments compared 2,4-D in amine and in butoxy ethanol forms at 4 pounds per acre alone and in combination with deisel oil at 5 and 10 gallons per acre, sodium TCA at 20 pounds per acre, and ammonium sulfamate at 20 pounds per acre. The amine and ester forms of 2,4-D were also compared at 6 pounds per acre in combination with 5 gallons of deisel oil. The sodium salt of 2,4-D was tested at 4 pounds per acre (acid equivalent) in combination with 20 pounds per acre of TCA and an ionic emulsifier. Four different spreading and sticking agents were tested with the amine salt of 2,4-D. All treatments were applied in 200 gallons per acre of spray solution made up of water except for the chemicals and oil. The original spray treatments were made July 31, 1951 when the cattail was in the fully headed stage. Retreatments using the same chemical and rate in each case were made June 17, 1952 when cattail regrowth was just beginning to head.

The original treatments made in 1951 were not very effective, probably because of the advanced stage of growth when the cattail was sprayed. Cattail regrowth in the spring of 1952 ranged from 38 to 88% with the ester of 2,4-D in combination with desiel oil giving the best results.

The results of retreatments made June 17, 1952 showed much greater differences between chemicals and rate. Cattail regrowth in August 1952 ranged from only 1% to as much as 93%. The combination of 4 pounds per acre of 2,4-D as a sodium salt plus 20 pounds per acre of TCA plus an ionic emulsifier reduced the stand of cattail 99% as compared to reductions of 92-98% for combinations of 2,4-D at 4 and 6 pounds per acre in amine and ester forms plus deisel oil at 5 and 10 gallons per acre. The ester plus deisel oil was somewhat more effective than the amine plus deisel oil. Deisel oil was more effective at 10 gallons per acre than at 5 gallons per acre, especially in combinations with amine form of 2,4-D. The amine salt of 2,4-D combined with TCA and emulsifier reduced the stand of cattail only 77% as compared with 99% by the same combination with sodium salt substituted for the amine salt of 2,4-D. Ammonium sulfamate proved much less effective as an additive in combination with the amine form of 2,4-D than did sodium TCA. Neither the amine nor the low volatile ester forms of 2,4-D with an emulsifier but without deisel oil or TCA gave a significant reduction in the stand of cattail. Of the 4 spreading and sticking agents tested, a nonionic emulsifier proved considerably more effective in combination with the amine salt of 2,4-D than did the other 3 additive materials. (Contributed by Division of Weed Investigations, BPISAE, USDA, and the Utah Agricultural Experiment Station, cooperating).

Effect of rosin amine D acetate on submersed aquatic weeds. Bartley, T. R. Rosin amine D acetate (RADA) in addition to being a good algaecide has also been found to be effective in controlling submersed waterweeds. The data from several treatments are shown in the following table:

Plant species treated	Rooted or excised	Concn. ppm*	Contact time	Percent kill (estimated)
Leafy pondweed (Potamogeton foliosus)	exc.	50	30 min	95
Leafy pondweed (P. foliosus)	Excised	100	30 min	99
Leafy pondweed (P. foliosus)	Excised	250	30 min	100
Leafy pondweed (P. foliosus)	Rooted	250	30 min	98
Leafy pondweed (P. foliosus)	Excised	25	Cont'd	98
Leafy pondweed (P. foliosus)	Excised	50	Cont'd	100
Sago pondweed (P. pectinatus)	Rooted	250	30 min	98
Sago pondweed (P. Pectinatus)	Rooted	35	24 hr	100
Sago pondweed (P. pectinatus)	Rooted	35	8 hr	98
Waterweed (Elodea densa)	Excised	100	30 min	0
Waterweed (Elodea densa)	Excised	250	30 min	100
Waterweed (Elodea densa)	Excised	500	30 min	100
Green algae (Spirogyra spp.)	--	1	30 min	90
Green algae (Spirogyra spp.)	--	5	30 min	100
Green algae (Spirogyra spp.)	--	10	30 min	100
Green algae (Cladophora spp.)	--	1	30 min	25
Green algae (Cladophora spp.)	--	2	30 min	100
Green algae (Cladophora spp.)	--	5	30 min	100

*Based on active ingredient.

The temperature of water ranged from 75° to 80°F in these tests.

The injury caused by RADA is noticeable in 1 to 2 days after treatment and apparently acts by dissolving the chlorophyll out of the plant. The regrowth of plant material is very slow, indicating that there is probably a residual effect.

An advantage of using RADA over an emulsifiable oil is that it is water soluble. Therefore, it should kill the plant material for a greater distance from point of application in a canal, and it can also be used at a lower concentration.

Probably the main disadvantage in using RADA comes where the water to be treated contains a relatively medium to high content of sulfate ion. Sulfate ion caused the RADA to precipitate in an insoluble form which apparently reduces the effective concentration of RADA below the toxic level. Mixing a small percentage of a nonionic type emulsifier with the RADA solution prevents this precipitation. However, a turbid mixture results. Other ions ordinarily found in natural waters will usually cause some turbidity. No precipitation occurs immediately after mixing but a slight amount may be noticed after standing several days.

The tolerance of field crops to irrigation water containing an effective concentration of RADA should be known before it is safe to use in field applications. (Contributed by the USDI, Bureau of Reclamation, Denver Office, Denver, Colorado, in cooperation with the Division of Weed Investigations, BPISAE, USDA.)

Effect of endothal on submersed aquatic weeds. Bartley, T. R. The relatively new herbicide endothal (disodium 3,6-endoxohexahydrophthalate) has been found to be very effective in controlling some of the submersed aquatics. The following table shows the results of some of the initial studies:

Plant species treated	Rooted or excised	Concn. ppm*	Contact time	Percent kill (estimated)
Leafy pondweed (*Potamogeton foliosus*)	exc.	24	30 min	95
Leafy pondweed (*P. foliosus*)	Excised	60	30 min	99
Leafy pondweed (*P. foliosus*)	Excised	120	30 min	100
Leafy pondweed (*P. foliosus*)	Rooted	48	30 min	98
Sago pondweed (*P. pectinatus*)	Rooted	24	30 min	25
Sago pondweed (*P. pectinatus*)	Rooted	60	30 min	60
Sago pondweed (*P. pectinatus*)	Rooted	50	Cont'd	100
Sago pondweed (*P. pectinatus*)	Rooted	240	30 min	99
Sago pondweed (*P. pectinatus*)	Rooted	240	30 min	100
Sago pondweed (*P. pectinatus*)	Rooted	120	60 min	100
Sago pondweed (*P. pectinatus*)	Rooted	240	60 min	100
Sago pondweed (*P. pectinatus*)	Rooted	480	60 min	100
Sago pondweed (*P. pectinatus*)	Rooted	960	60 min	100
Leafy pondweed (*P. foliosus*)	Rooted	25	Cont'd	100
Waterweed (*Elodea densa*)	Excised	80	30 min	0
Waterweed (*Elodea densa*)	Excised	240	30 min	0
Waterweed (*Elodea densa*)	Excised	400	30 min	0
Green algae (*Cladophora spp.*)	---	1	30 min	0
Green algae (*Cladophora spp.*)	---	10	30 min	0
Green algae (*Cladophora spp.*)	---	20	30 min	0

*Based on active ingredient.
The temperature of water ranged from 75° to 80° F in these tests.

Injury to aquatic plants caused by endothal does not appear nearly as soon after treatment as that resulting from an application of aromatic solvents. Discoloration of the leaves and stems becomes apparent from 2 to 4 days after treatment with the plant material disintegrating rapidly. The facts that endothal gives good weed control at low concentrations and should kill at a greater distance from point of application in a canal due to its complete water solubility, may make the material economically feasible to use for aquatic weed control. Preliminary investigations indicate that endothal gives a greater control of some of the aquatic weeds at low concentrations and short exposure times than any other herbicide tested. Where all plant material is not killed, the regrowth is very slow.

A formulation containing ammonium sulfate on a basis of approximately five times the weight of endothal appears to increase the effectiveness very little if any over that of endothal alone.

Tolerance of field crops to irrigation water containing an effective concentration of endothal should be known before it is safe to use in field applications. (Contributed by the USDI, Bureau of Reclamation, Denver Office, Denver, Colorado, in cooperation with the Division of Weed Investigations, BPISAE, USDA.)

Use of herbicidal pellets in the control of aquatic weeds. Oborn, E. T. Pelletized powders of 2,4-D free acid, 2,4-D sodium salt, alpha benzene hexachloride, derivative of abietic acid, 10 per cent 3(p-chlorophenyl) -1,1-dimethyl urea and boric anhydride were placed on the submerged soil bottom of water-filled tanks in which true watercress (*Nasturtium officinale* R. Br.), leafy pondweed (*Potamogeton foliosus* Raf. var. *genuinus*), American pondweed (*Potamogeton nodosus* Poiret), sago pondweed (*Potamogeton pectinatus* L.), and Richardson's pondweed (*Potamogeton richardsonii* (Ar. Benn.) Rydb.) plants were rooted. A tabulation follows of observations made 5 weeks after herbicidal pellets were placed on the inundated soil bottom in which submersed rooted aquatic plants were growing.

Chemical compound used	Plant species	Observation 5 weeks after experiment was underway
2,4-D, free acid	True water cress	Replaced by *Spirogyra* sp.
	Sago pondweed	Mostly dead--a little regrowth
2,4-D, sodium salt	Leafy pondweed	Replaced by *Spirogyra* sp.
	American pondweed	Mostly dead--a little regrowth
	Sago pondweed	Mostly dead--a little regrowth
	Richardson's pondweed	Mostly dead--a little regrowth
Alpha benzene hexachloride	True water cress	No effect
	Sago pondweed	No effect
Derivative of abietic acid	Leafy pondweed	Mostly dead
	American pondweed	Mostly dead
	Sago pondweed	Mostly dead--a little regrowth
	Richardson's pondweed	No effect

Chemical	Plant species	Observations
10% 3(p-chloro-phenyl)-1, 1-dimethyl urea	True water cress	Tank clear of vegetation
	Leafy pondweed	Tank clear of vegetation
	American pondweed	Mostly dead--a little regrowth
	Sago pondweed	Tank clear of vegetation
Boric anhydride	True water cress	Regrowth stunted
	Leafy pondweed	Regrowth stunted
	American pondweed	Regrowth stunted
	Sago pondweed	No effect
	Richardson's pondweed	Regrowth stunted

All of the powders evaluated, except the alpha benzene hexachloride, showed promise as effective herbicides on submersed aquatic weeds in static water situations. Final evaluation of the pellets as herbicides will be made at the conclusion of the 1953 growing season. (Contributed by the Division of Weed Investigations, BPISAE, USDA, in cooperation with the Bureau of Reclamation, USDI.)

COMMITTEE 11. CHEMICAL AND PHYSIOLOGICAL PHASES

A. W. Swezey, Chairman

SUMMARY

Workers at Colorado A. & M. College have continued their study of the effect of "growth regulators" on Red McClure potatoes. Mid-season field treatments with three derivatives of 2,4-D at 8 ounces per acre and with maleic hydrazide (MH) at 3 pounds per acre did not prevent sprouting of the stored tubers one year later although the combination of 2,4-D and MH did. The suggestion is made that perennial weeds with large root reserves of carbohydrates might be profitably treated by this combination.

Previous studies at Colorado A. & M. College have shown that mid-season treatment of 2,4-D to Red McClure potatoes increases the amount of free glutamic acid in the tubers and decreases the relative amounts of eleven other free amino acids. More recent work showed that the specific gravity and protein of the tubers were increased by the above treatment, but not the nitrate nitrogen. It is theorized that 2,4-D might, with the above situation, be competitive to indoleacetic acid. Other experiments by these workers included MH treatments to flowering Setaria spp. and a combination herbicidal, fungicidal and soil conditioning experiment as a pre-emergent treatment in sugar beets.

As a part of an intensive program of field research in woody plant control a technique of branch tip application was used by workers of the Botany Department of the University of California at Davis. It was reasoned from this work that with woody plants if penetration is difficult, esters should be used in preference to acids or salts (of growth regulators). If penetration is relatively easy, esters would still be preferred if translocation is slight or moderate, whereas acids or salts would be preferred if translocation is marked. Greenhouse droplet tests were run with red kidney bean using 2,4-D and 2,4,5-T derivatives in water, oil-water emulsions and in straight oil. This work indicated that the most effective treatment with either 2,4-D or 2,4,5-T was when the toxicants were applied in straight oil.

Laboratory and field studies were carried out at the University of California Citrus Experiment Station on the control of nutgrass tubers using methyl bromide and several other fumigants.

Work is in progress at Davis concerned with cell membrane structure and permeability in relation to hydrocarbon toxicity. Some of the physical factors involved are reviewed.

Work of the Richfield Oil Corporation has indicated that the highly toxic weed oils are those that have a polycyclic aromatic content approaching 40%. Adsorptograms showing the refractive indices of 3 oils are presented.

Workers at the Experiment Station of the H.S.P.A. at Hawaii developed a technique of stabilizing a wettable powder suspensionof CMU by combining it with an emulsion of sodium pentachlorophenate, diesel oil and water.

Preliminary work at the Southwestern Forest and Range Experiment Station with greenhouse-grown velvet mesquite seedlings treated with 2,4,5-T indicate more effective upward transport if all leaves have not been contacted by the spray. Field studies over a 3 year period show that in Arizona mesquite is most susceptible to 2,4,5-T when in full succulent leaf, during the late bloom.

Cooperative work at the BPSIAE and the Bureau of Reclamation at Denver showed that starch grains were used up in rhizomes of cattail treated with 2.7 pounds of 2,4-D per acre or more. Work was also carried out on studying the radioactivity of imbedded cattail sections previously treated with 2,4-D-1C14.

REPORTS OF INDIVIDUAL CONTRIBUTORS

The direct and interacting effects of 2,4-D and maleic hydrazide on the sprouting of Red McClure potatoes. Fults, Jess L., Merle G. Payne, and Clark Livingston. During the summer of 1951 field plots of Red McClure potatoes were sprayed with (1) the sodium salt of 2,4-D @ 1/2 lb./acre, (2) the sodium salt of 2,4-D plus maleic hydrazide (MH30) @ 3 lbs./acre, (3) maleic hydrazide @ 3 lbs./acre and (4) untreated controls. Spraying was done at the early bloom stage when most of the young tubers were 3/4 inch in diameter and plants were growing rapidly. The crop was grown at the San Luis Valley Experimental Farm at Center, Colorado. At the time of harvest, 200 pounds of tubers of each treatment free of mechanical-digging injury were placed in storage in a standard potato cellar at Fort Collins, Colorado. These remained in storage from August 14, 1951 until June 15, 1952 at which time a detailed study of the amount of sprouting showed:

1. All treatments using 2,4-D @ 8 oz./acre alone sprouted.
2. All treatments using MH(30) @ 3 lbs./acre alone sprouted.
3. None of the combination treatments had as much as 1 percent sprouting.

Results with the sodium salt of 2,4-D @ 4 oz./acre, the amine salt of 2,4-D @ 8 oz./acre and an isopropyl ester dust of 2,4-D @ 8 oz./acre gave similar results when combined with maleic hydrazide.

These studies suggest that combinations of maleic hydrazide with 2,4-D might be very profitably used as herbicides where either one alone may fail. Perennial weeds with roots or underground stems and containing large reserves of carbohydrates may be adapted to such a combination treatment. (Colorado Agricultural Experiment Station)

Protein and nitrate nitrogen content and specific gravity changes in Red McClure potatoes due 2,4-D treatment. Payne, Merle G., Jess L. Fults, Ruth J. Hay, and Clark Livingston. Previous studies from this station have indicated that 2,4-D treatment of Red McClure potato plants during the early pre-bloom stage significantly increases the amount of free glutamic acid in tubers and decreases the relative amounts of eleven other free amino acids. This has suggested that a basic effect of 2,4-D is concerned in its action on specific transaminases and oxidative deaminases. Steward and Caplin have indicated that 2,4-D stimulates protein synthesis of isolated potato tissue. Stahler has reported that sugar beets sprayed with 2,4-D develop an excessive amount of nitrate nitrogen in the leaves. Prince and Blood of the New Hampshire Agricultural Experiment Station have indicated significant increases in specific gravity of 2,4-D-sprayed potatoes. These facts have stimulated workers at this station to make similar investigations of the 2,4-D effects on the protein content, nitrate nitrogen, and specific gravity of Red McClure potatoes. Comparative data on ethyl alcohol precipitated protein were secured for samples grown at the San Luis Valley Experimental Farm in 1951.

Analysis were made on untreated controls and on potatoes from plants sprayed with the sodium salt of 2,4-D @ 1/2 lb./acre in the early-bloom stage. Specific gravity determinations were made by weighing samples in air and under water and making the necessary calculations. Nitrates were determined by the diphenylamine sulfonic acid method as outlined by Kolthoff.

Results of the effect of treatment on protein nitrogen and specific gravity at two different sampling dates in January and February, 1952 are shown in the following table:

Table I. Protein and specific gravity changes in Red McClure potatoes due to 2,4-D treatment.

Dates 1952		Treated	Untreated	Difference	Minimum Difference Required for .05	.01
Jan.	Specific Gravity	1.099	1.074	+ .025	.011	.015
Feb.	Specific Gravity	1.084	1.074	+ .010	.005	.008
Jan.	Protein[1/]	22.3	20.0	+ 2.3	1.4	2.0
Feb.	Protein	26.0	18.2	+ 7.8	4.0	6.0

1/ The unit of measurement was milligrams of protein per milliliter of juice.

These results are in accord with results of previously mentioned workers, i.e., increased protein and increased specific gravity in potato tubers from treated plants.

Results of the nitrate determinations showed no significant increase in nitrate nitrogen in the tubers.

Discussion: If auxin (indole acetic acid) functions as a coenzyme (as a number of workers have suggested) this implies that it is only active when combined with a specific apo enzyme which means a specific protein. Assuming that 2,4-D, which is known to act in many ways like indole acetic acid, also acts as a coenzyme it might act as a competitive metabolite to indole acetic acid. In such a situation all the available indole acetic acid apo enzyme fractions might be tied up in an unavailable form. This might then stimulate the synthesis of unusual amounts of protein which is what we have observed. (Colorado Agricultural Experiment Station)

Reduced viability of seeds from *Setaria* plants treated with maleic hydrazide. Blouch, Roger. In this study MH was applied to the foliage of *Setaria viridis* and *Setaria italica* when the grasses were in the early boot stage of flower development. Ripe seed was harvested from treated and control plants when these were fully matured and dry. After a storage period of 5 months the seed was tested for germination at the Colorado State Seed Laboratory to determine if MH treatment had affected viability. Only whole, ripe seed of uniform size and weight was used. No visible differences between treated and control seed were apparent. Results from these test are shown on the following page.

Species	MH treatment (pounds per acre)	Percent germination
Setaria viridis	control	58
	$1\frac{1}{2}$	22
	3	18
Setaria italica	control	67
	$1\frac{1}{2}$	28
	3	31

Data from this preliminary study would, therefore, seem to indicate that MH not only inhibits flowering and seed set, but affects the viability of the seed that is produced. (Colorado Agricultural Experiment Station)

Interrelationship of C-IPC, Krilium, and Arasan in sugar beet culture. Blouch, Roger and Norman Gerhold. Tests were run in a sugar beet field near Sterling, Colorado to determine compatibility or antagonism of three common agricultural chemicals when used concurrently on a given area. Materials used were C-IPC (herbicide), Arasan (fungicide), and Krilium (soil conditioner). These were applied alone, and in all possible combinations, pre-emergence to the beet crop. Results were read in terms of stand counts for beets and by arbitrary visual evaluation of weed control. In early stand counts none of the materials used alone injured the beets excessively, although a slight inhibition was noted for Arasan. By the last stand count date, however, the C-IPC treatment had lost the most seedlings of these three treatments. This was apparently due to the fact that the seedlings were slightly arrested in growth during the early seedling stages, thus permitting *Fusarium* to invade more plants and cause characteristic damping-off. Any combination of any of the three treatments further reduced stands, the triple combination itself causing the greatest reduction. Rates used were: C-IPC, 8 pounds per acre; Arasan, 4 pounds per acre; Krilium, .05 percent concentration.

Weed control was achieved as follows:

Number legend: 1 - no weeds; 2 - few weeds; 3 - numerous weeds; 4 - as many weeds as weediest check. (Average of 3 replications)

Check -	3.66	Ara + K -	2.00
Arasan -	3.66	C-IPC + K -	1.33
C-IPC -	1.66	Ara + C-IPC -	1.33
Krilium -	2.33	Ara + C-IPC + K -	1.00

From the results obtained it appears that combinations of agricultural chemicals may reduce sugar beet populations if the individual treatment only slightly exceeds the tolerance of the beet. It is probable that if rates of each were more closely adjusted to crop tolerance, the beneficial effects desired from concurrent use of fungicide, herbicide, and soil conditioner would be obtained. (Colorado Agricultural Experiment Station)

A satisfactory method of dispersing CMU. Hance, Francis E. A chemical examination of one lot of CMU in Hawaii showed that it contained 84 percent of the pure chemical, 14 percent of finely divided clay, and approximately 1.5 percent of a dry, granular wetting agent. The mixture was finely powdered, and most probably had been micronized.

Since the CMU itself and its clay component are difficultly soluble in water (practically insoluble), the application of the compound in the field requires that it be suspended in a liquid vehicle in order that a uniform and even applicatitr may be made on the bare soil.

There are a number of objections to the most logical means of suspension, that is, in water. In the first place CMU and its clay component rapidly settle out of the water suspension. Therefore, to attain any degree of accuracy in applying five or six pounds of CMU per acre in an even and uniform manner, vigorous agitation of the suspension must be maintained. Secondly, when agitating with water, the commercial 80 percent CMU produces copious foaming and suds, and interferes seriously when transferring the mixture from the mixing container to field equipment. It also interferes with measuring volumes of the mixture because of the presence of the foam. Since it must be vigorously agitated during application in the field, the objectionable foaming persists throughout this operation.

In Hawaii, we have found that the commercial 80 percent CMU powder can be worked up into a smooth magma by adding to it, in small, successive increments, the herbicide emulsion developed here and known as CADE. This magma can be diluted further by simply stirring in any desired quantity of additional CADE and bringing the mixture to a pre-determined volume. CADE will carry in suspension as much as 3 pounds of 80 percent CMU per gallon without becoming too thick or viscous for field application. On the other hand, as little as 1/4 pound of CMU dispersed in 1 gallon of CADE, using the magma technique, will hold up equally as well. Between these extreme concentrations of CMU, any desired ratio of the CADE vehicle to the chemical may be used.

During the past year of research by the writer on the dispersion problem, and its application in the field by Mr. Noel S. Hanson, it was indicated that CADE dispersion was superior to any other which had been studied. The writer determined in the laboratory that a suspension of CMU and CADE remained quantitatively dispersed for a period as long as one year. Furthermore, foaming is eliminated entirely by using the CADE scheme.

The advantage of using CADE with CMU, in addition to its ideal dispersing properties, is that CADE will knock down any young or incipient weed growth that may be present in the cane field which has been prepared for the forthcoming crop but which has not been given its first spraying because of some irregularity in the plantation program. In such a case, the young weed growth quickly succumbs, and the CADE lays down its residue of CMU on the surface of the soil where it does the maximum good.

CADE is an emulsion which carries 67 percent of diesel oil (or an aromatic oil) and 33 percent of an aqueous fraction, the latter carrying an alkyl aryl sulphonate emulsifier, plus 3 percent of the HSPA Activator (sodium pentachlorophenate - U.S. Patent 2,370,349). The emulsion is prepared by homogenization at a pressure of 2000 pounds per square inch, the finished product containing 1 percent of the activator. (Experiment Station, Hawaiian Sugar Planters' Association)

Significance of polycyclic aromatics in herbicidal oils. Bronson, A. H. From our field observation of successful applications of non-selective petroleum herbicides with subsequent laboratory analysis of these oils, we found that the oils which were of the greatest value in the field were those that, by chromatographic analysis, were shown to have the highest polycyclic aromatic content. To prove this observation to be true under controlled conditions, we supplied the BPISAE field office at Phoenix with a series of aromatic oils of a constant total aromatic content. Within these series the relationship of monocyclic to polycyclic aromatics were varied. After three years of field work by the BPISAE in the control of Johnson grass in Arizona, it has been definitely established that as a polycyclic aromatics increased, greater control was achieved with fewer gallons per acre. It is interesting to note that, when plotted, the control curve flattened out when the polycyclic aromatic content approached 40%. Beyond this point, the number of gallons required to achieve control continued to decrease in direct relationship to the increasing polycyclic aromatic content. The full data relative to these tests will, no doubt, be published by the BPISAE in the near future.

The polycyclic aromatic content of a given oil can be determined by a separation process using a titration tube 1/2" - 3/4" diameter by 18" - 20" long, a black light, silica-gel and solvents such as pentane, benzene, and cyclohexane. While these tests for polycyclic aromatic content are not adapted for field evaluation, they can be easily run in any laboratory.

Attached are adsorptograms of two commercial weed oils, Richfield Weedkiller "A" and Shell 20, and a diesel oil. The polycyclic aromatic content can easily be determined by inspection of the adsorptogram inasmuch as these aromatics have a refractive index of over 1.550 whereas the refractive index of the monocyclic aromatics falls between 1.490 and 1.550; the dicylic between 1.550 and 1.605; the tricyclic between 1.605 and 1.680.

Should the polycyclic aromatic content of a given oil be accepted by this group as a measure of an oil's herbicidal activity, such adsorptograms might well become a yardstick for the purchase of herbicidal oils for non-selective use. (Richfield Oil Corp., Los Angeles, California)

Preliminary studies on the effect of placement and formulation upon translodation of 2,4,5-T applied topically to velvet mesquite seedlings. Hull, Herbert M. The effect of partial and complete coverage of foliage with herbicide was studied on greenhouse-grown seedlings by means of painting every leaflet on some plants and every third leaflet on others (upper surface in both cases) with a small camel's-hair brush. These conditions should be somewhat comparable to field treatment in which a given volume of herbicide is applied as a fine mist or as a coarse droplet spray, the latter method resulting in the wetting of only a certain percentage of the leaflets.

The herbicide consisted of 1,000 ppm polyethylene glycol butyl ether ester of 2,4,5-T made up in a 1:7 oil (Shell Vapona)-water emulsion and containing 1 percent Shell Weed Killer Emulsifier. Although general appearance and ultimate defoliation was about the same for both treatments, epinasty of the terminal portion of the shoot was greater in the plants where every third leaflet was treated, as measured two days after treatment. In view of the knowledge that carbohydrate and herbicides are commonly translocated together, it may be possible that the photosynthate formed in the non-treated leaves acts as a carrier for the herbicide. This experiment would seem to indicate that in the case of field application, a given volume applied in the form of large droplets is at least as effective as a fine mist. The former type of application would normally be recommended in view of decreased tendency of large drops to drift to adjacent susceptible crops.

Since the successful action of hormone-type herbicides is dependent upon sufficient translocation of these materials from the treated foliage to the basal bud zone and root system, several experiments were run in an effort to determine the condition for maximum translocation. As earlier experiments had indicated some very good kills with the triethylamine salt of 2,4,5-T, this herbicide was used throughout. Experiments included 2,500 ppm of the 2,4,5-T amine formulated in water, in a 1:4 diesel oil-water emulsion, and in a similar emulsion utilizing a new experimental non-toxic oil. Several different emulsifiers were used at one and two percent concentration, including Monsanta H, L, M, R, and CD. Foliage painted with the herbicide included the lower three leaves and cotyledons, three centrally located leaves, and three youngest leaves, excluding the growing point. Petioles and stems were not treated.

In general, there was a greater upward translocation of herbicide when formulation included the non-toxic oil emulsion as compared to the diesel oil emulsion or water only. This upward translocation, as evidenced by formative effect and often death of the growing point and youngest leaves, occurred regardless of whether application was to the basal, central, or upper three leaves. Callus formation of the upper stem was also common. Translocation of the herbicide in the non-toxic oil emulsion was further enhanced by certain of the emulsifiers, particularly Emulsifier H. On the other hand, basal transport of the herbicide appeared to be no greater with the non-toxic oil emulsion than with the diesel oil emulsion. Further work, however, is needed in both laboratory and field before these translocation studies can be considered conclusive. (Southwestern Forest and Range Experiment Station, Tucson, Arizona)

Relationship of growth stage to response of velvet mesquite trees following foliage spray application of 2,4,5-T. Roach, Mack E. and George E. Glendening. Frequent-interval spray studies aimed at determining the growth stage at which velvet mesquite (Prosopis juliflora var. velutina (Woot.) Sarg.) is most susceptible to foliage sprays of 2,4,5-T ester have been conducted on the Santa Rita Experimental Range during each of the past three years.

The herbicidal solution used in all cases was 5,000 ppm A.E. 2,4,5-T PGBE esters in a 1:4 nontoxic oil/water emulsion. In the 1950 and 1951 studies, spraying was done on small trees, and complete, but light, coverage was obtained with 200 ml. of solution. In 1952 larger, more representative size trees were sprayed. These required 500 ml. per tree for equivalent coverage. Application was made from a "Sur-shot" spray can at 40-60 p.s.i. pressure in 1950 and 1951, and from an orchard spray can at 20-30 p.s.i. pressure in 1952.

Each year treatments were made at twice weekly intervals commencing at first leaf burst in early spring and ending when the leaves reached full maturity in June. In 1950 the same treatment was also applied in the fall during the period immediately preceding the cessation of growth. In 1951, in addition to the spring treatments, spraying was resumed during August at which time summer rains had resulted in active tree growth. In 1952 treatments were made continuously during the period between first leaf growth in the early spring and early October when all pods had dropped and leaves were yellowing

Based on three years' data, the period at which mesquite exhibits greatest susceptibility to 2,4,5-T has occurred during late spring or early summer and was characterized by (a) full size, but succulent leaves, and (b) blooming nearly complete on most catkins and some pods up to 1 inch in length. The elapsed time between the opening of leaves and the period of greatest susceptibility to the herbicide was 38 days in 1950, 25 days in 1951, and 78 days in 1952. Calendar dates for the beginning of this period were April 18, May 4, and June 21, in 1950, 1951, and 1952, respectively.

Among the factors being studied to determine their correlation, if any, with the growth stage at which the greatest susceptibility to 2,4,5-T occurs are (1) leaf moisture, (2) soil moisture, (3) air temperatures, (4) relative humidity, and (5) leaf reactions to the herbicide. There is some evidence that rate of maturation of leaves and pods may be associated with soil moisture, but none of these factors has been related consistently or closely enough to warrant any conclusions at this date.

Thus, on the basis of our present data, the best date for spraying cannot be accurately predicted. However, the period of maximum susceptibility can be recognized at time of attainment on a given site by noting the stage of growth on the mesquites with respect to the status of pods as well as leaves. (Southwestern Forest and Range Experiment Station)

Physical factors in phytotoxicity studies. Currier, H. B. In 1939, Ferguson in England pointed out that the toxicity of indifferent substances (acting essentially in a physical manner) is more related to degree of saturation in the diluent than to concentration. He also suggested that since the chemical potential of a toxicant is the same in all phases of a system at equilibrium, one may determine the potential at the site of action in the cell, even though this site be unknown. Activity may be used as an expression of chemical potential. These principles were illustrated in studying the acute phytotoxicity of hydrocarbons, where benzene, for example, is isotoxic at 0.0026 ml. in air, 0.0083 ml. in water, and approximately molar in paraffin oil. At these levels air is 50% and water 35% saturated. Also explained are such observations that in vapor form (diluted with air) benzene is more toxic than hexene on a molar basis, but in aqueous solution the reverse is true.

There is good evidence that acute hydrocarbon injury, the typical response to common weed oils, is due to an accumulation and cytolytic action in the external plasma membrane, resulting in an irreversible increase in permeability. Different kinds of low boiling hydrocarbons seem to be structurally indifferent, since apparent differences in toxicity can be explained as due mainly to the influence of the diluent on activity.

Hydrocarbons are promising tools in studying plasma membrane structure and permeability, since they are non-metabolized, can be used as vapor or in solution, exhibit a narrow concentration range, are rapid in effect, and site of action is believed to be the protoplast surface.

In addition to pH effects on degree of dissociation, and to direct effects on membrane structure and function, part of the activation or deactivation effect of additives in an herbicidal solution may be a change in activity of the toxicant. Thus, W. L. Miller in 1920 explained the fact known already in 1895 that inorganic salts increase the toxicity of phenol-in-water solutions towards bacteria. (University of California, Botany Department, Davis, California)

<u>The branch tip method of testing herbicides on woody plants.</u> Leonard, O. A. Spraying the tips of single branches of woody plants may give information on (a) the effect of the chemical upon the sprayed part and (b) the effect beyond the point of spray. This information may be of value in predicting the herbicidal effect of hormone sprays upon different species of woody plants.

The apical 6 to 10 inches of the branches were sprayed and a tag was placed at the juncture between the sprayed and unsprayed parts. The spray was applied as uniformly as possible in the various tests, with an attempt to apply the spray at a rate of 40 gallons per acre. The concentration of the mixtures varied from 5,000 to 40,000 p.p.m. and was applied in water, diesel oil emulsions and in diesel oil. Because of marked variation in the reaction of different branch tips, there were no apparent differences between the different treatments. However, there were marked differences in the reaction of different species of woody plants, which are of interest.

Some of the differences in the reaction of different species of woody plants to the hormone sprays are shown in Table 1. These same differences exist in the oase in which these same species are killed in actual spraying tests. Only 22% of the interior live oak branch tips sprayed with 2,4-D showed any effective translocation beyond the point of spray and only 29% of those tips sprayed with 2,4,5-T. Of the branch tips that showed translocation effects, the die-back still only averaged 7 inches for both 2,4-D and 2,4,5-T. These results are similar to those that have been observed in field tests, in which there was little difference between 2,4-D and 2,4,5-T; several treatments were necessary in order to obtain a complete kill.

Blue oak, which is much easier to kill than interior live oak, had 66% - 70% of the branches showing die-back beyond the point of spray, with the die-back averaging 12 inches. Again, as with live oak, there was little if any difference between 2,4-D and 2,4,5-T, which is about the same as was obtained in actual tests where the entire plants were treated.

Poison oak was the only species tested which exhibited marked translocation beyond the point of spray. It is interesting to note that 100% of the branches had die-back beyond the point of spray. Sixty per cent of the branches treated with 2,4-D died to the ground, and 68% of those treated with 2,4,5-T died to the ground. The branches that were not killed to the ground were killed back for an average distance of 15 inches with 2,4-D and 20 inches with 2,4,5-T. These tests are in line with foliage spray tests, where it has been found that both 2,4-D and 2,4,5-T are almost equally effective against poison oak -- but two or more spray operations appear to be necessary to kill all of the underground stems.

Other branch-tip studies indicate that effective translocation in toyon (*Photinia arbutifolia*) and black oak (*Quercus kellogii*) is intermediate between interior live oak (*Quercus wislizenii*) and blue oak (*Quercus douglasii*).

A theory is developed which might be used in predicting some of the requirements for an optimum herbicidal effect upon different species of woody plants. (1) If a species exhibits very little translocation, then the esters should be superior to the salts and the acids -- if penetration is a problem. An example is interior live oak. Poor translocation may be due to natural chemicals inside the leaves and the bark which absorb the 2,4-D and 2,4,5-T, thus making appreciable translocation impossible. Effective translocation appears to be the dominant herbicidal problem. (2) If a species exhibits moderate translocation, then esters should be used if penetration is a problem (toyon--*Photinia arbutifolia*) , or acid or salts should be best when penetration is not so much of a problem (blue oak--*Quercus douglasii*). (3) If a species exhibits marked translocation, and penetration is not a serious problem, then the acid or salt form should be best. Poison oak (*Rhus diversiloba*) is a good example. Penetration problems develop with most plants under some environmental conditions and as the leaves become older, thus shifting the penetration requirements, and the necessity for using esters.

Table 1. The effect of spraying the branch tips of several woody plants with esters* of 2,4-D and 2,4,5-T, on the percentage of stems showing die-back beyond the point of spray. Treated May 22, 1950, and the data recorded on May 17, 1951.

Species and Treatment	% of stems treated showing die-back	Ave. distance of die-back beyond point of spray (for just those plants showing die-back)
Interior live oak (*Quercus wislizenii*)		
Ave. 2,4-D	22	7 inches
Ave. 2,4,5-T	29	7 inches
Blue oak (*Quercus douglasii*)		
Ave. 2,4-D	66	12½ inches
Ave. 2,4,5-T	70	12 inches
Poison oak (*Rhus diversiloba*)		
Ave. 2,4-D	100	60% dead to ground
Ave. 2,4,5-T	100	68% dead to ground

* Isopropyl and mixed propylene glycol butyl ether esters of 2,4-D and 2,4,5-T used at 5,000, 10,000, 20,000, and 40,000 p.p.m. in water, 25% diesel oil emulsions, and in diesel oil. The above data represents an average of all 2,4-D and 2,4,5-T treatments. (University of California, Botany Department, Davis, California)

Greenhouse tests with 2,4-D and 2,4,5-T on bean plants. Leonard, O. A. This abstract is to report the results of a number of tests conducted on the red kidney bean (*Phaseolus vulgaris*) under greenhouse conditions. The procedure was to grow the plants until unifoliate leaves had completely enlarged and then to apply a known quantity of 2,4-D or 2,4,5-T using a pipette graduated in 0.01 ml. divisions. Because of limited space, the results will be summarized.

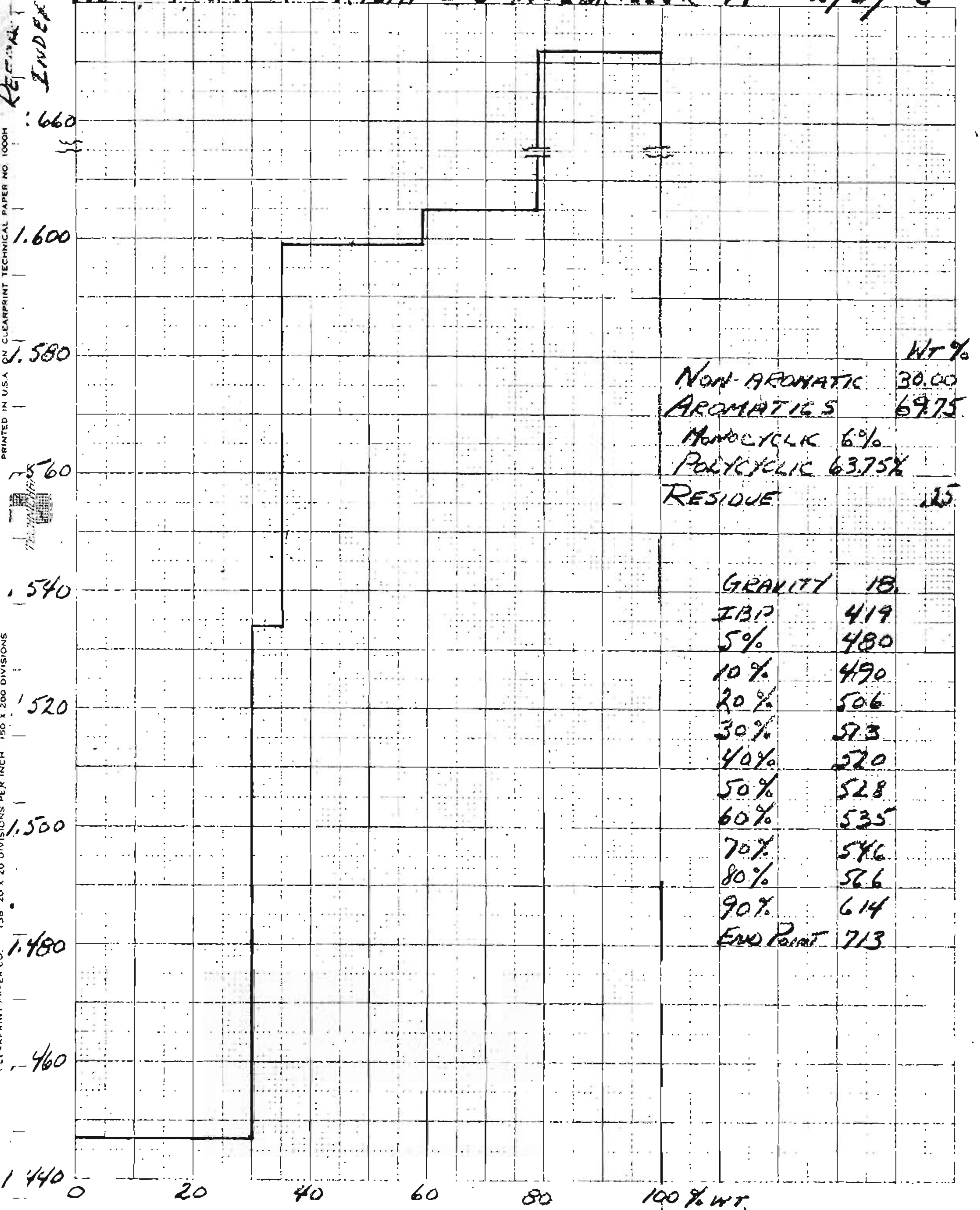
(1) Objective: to compare the effect of 2,4,5-T (propylene glycol butyl ether ester) in diesel oil, Shell Mineral Seal Oil, Shell Tank Mixes 1, 2, 4, and 5; also to compare the 10% and 1% oil emulsions of the above oils and the water emulsion with the straight oils. 0.01 ml. of 1% 2,4,5-T acid equivalent (100 gammas) was used on each bean plant, the droplet being placed on the midrib of one of the primary leaves. Death of the bean plants was used as a criterion of effectiveness. Results: the kill with diesel oil was faster than with the other oils, but the final effect was about the same. The 10% and 1% oil emulsions were poorer than with the straight oils. The diesel oil emulsions were superior to the other oil emulsions. The water emulsions produced the least effect.

(2) Objective: to determine the effect of adding varying quantities of emulsifier (Griffin R-400) to Esteron 2,4,5-T in Shell Mineral Seal Oil, 10% and 1% Shell Mineral Seal Oil emulsions and water. 0.01 ml. of 1% 2,4,5-T acid equivalent (100 gammas) was used on each bean plant, the droplet being placed on the midrib of one of the primary leaves. Results: most of the plants died with the straight oil mixtures, whether extra emulsifier was added or not. The 10% and 1% oil emulsions with the highest concentration of emulsifier used (0.8%) produced kills that were inferior to that produced with the straight oil mixtures, and lower quantities of emulsifier resulted in a reduced effect. The highest concentration of the emulsifiers in water increased the effect of the 2,4,5-T on the bean plants over treatments having lower concentrations of emulsifier but the results were poor in comparison to those obtained using the straight oil.

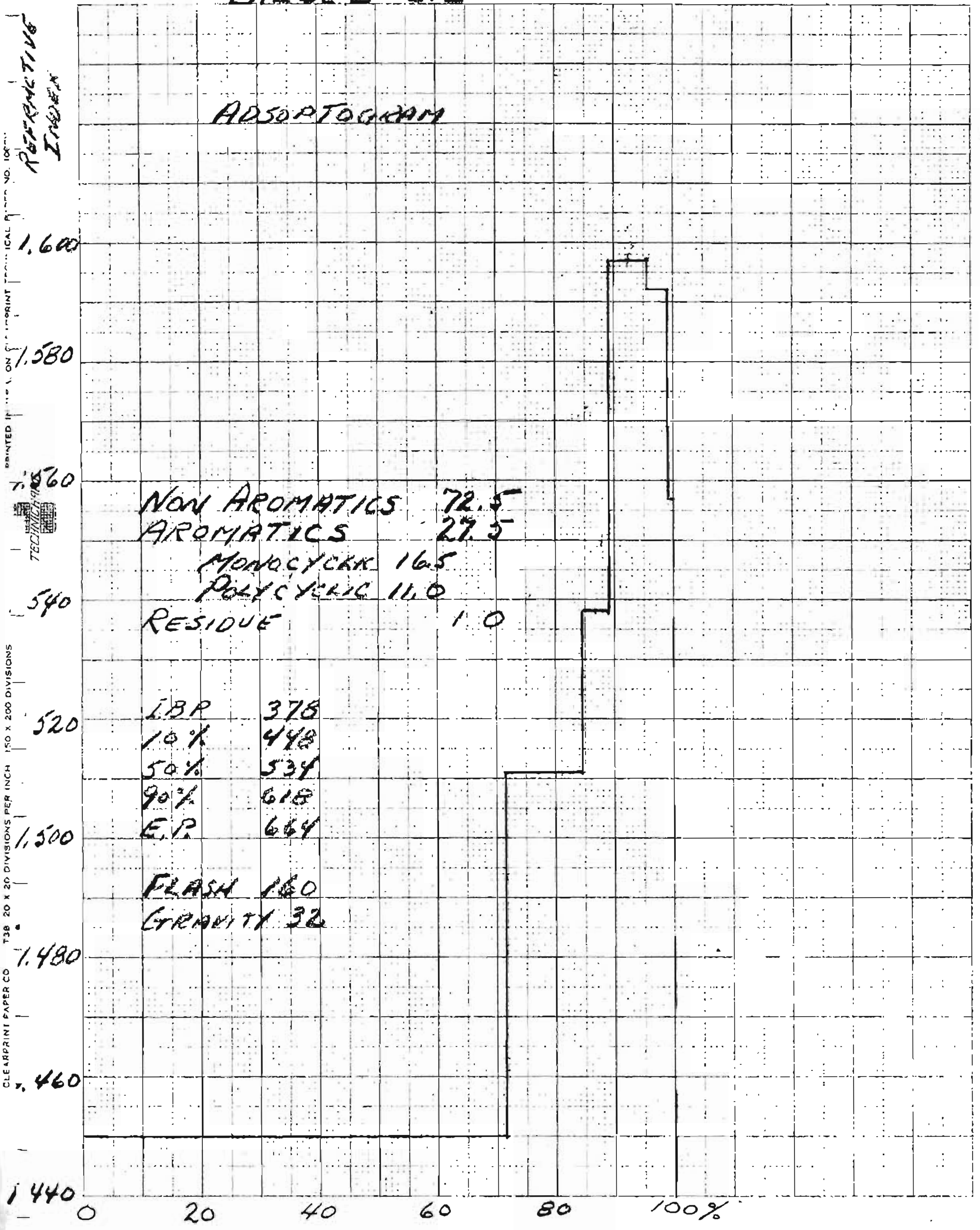
(3) Objective: to test the effect of location of applied chemical on its herbicidal effectiveness. 0.01 ml. (100 gammas) of 1% 2,4,5-T acid equivalent in Shell Tank Mix No. 1 was applied (a) in the center of the blade, (b) base of the blade, (c) tip of blade, and (d) edge of blade. Results: applications to the tip and edge of the blades produced little effect on the bean plants. Applications to the center of the blade and base of the midrib produced marked effects, killing most of the plants.

(4) Objective: to determine the effect of the amine (Formula 40) with and without Nonic 218 (0.1%) in water, acid (A.C.P. 638) in water, and ester (Esteron ten-ten) in water and in diesel oil, using a concentration of 1% acid equivalent of 2,4-D. 0.01 ml. (100 gammas) were placed on the midrib in one test and 0.04 ml. (400 gammas) on the edge of the leaves in the other test. Results: in general, 100 gammas of 2,4-D on the midrib produced a greater effect than 400 gammas of 2,4-D on the edge of the blade; however, this was not true with the amine of 2,4-D, with which the greatest effect was produced when the amine was placed on the edge of the blade. The addition of Nonic to the edge of the blade produced an effect that was superior to all other treatments. The addition of the 2,4-D ester in oil to the edge of the blades actually resulted in the death of some of the plants, which appeared to have been due to the creeping of the oil along the veins to the midribs; however, even including these plants in the over-all averages, the effect of the amine plus Nonic was still the best treatment (average fresh weight of the shoots above the primary leaves). The ester in oil was by far the most effective treatment applied to the midribs. (University of California, Botany Department, Davis, California)

ADSORPTOGRAM RICHFIELD WEEDKILLER "A" 2/3/53



DIESEL OIL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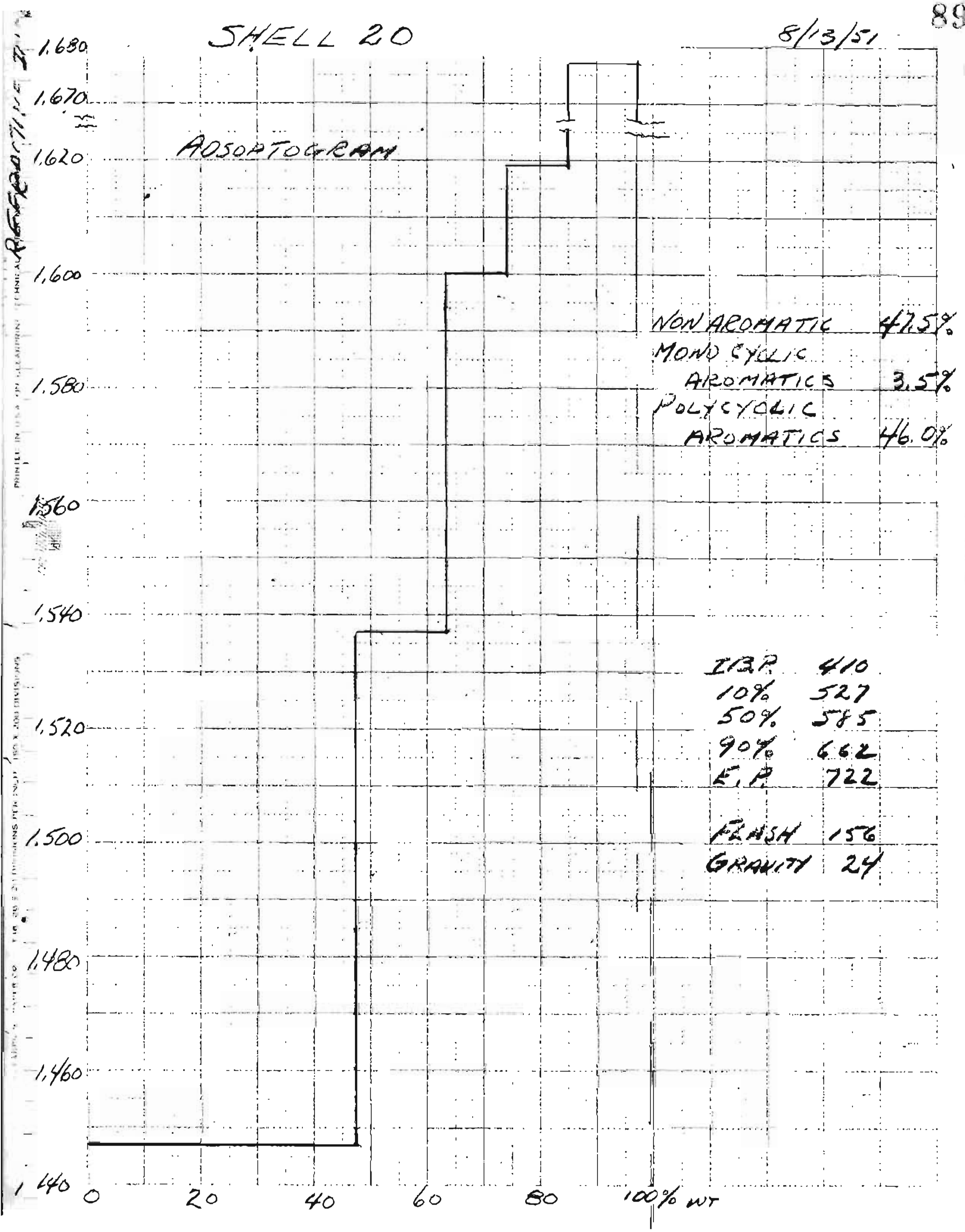
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1.440
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20
40
60
80
100% WT
NON AROMATIC 47.5%
MONO CYCLIC AROMATICS 3.5%
POLYCYCLIC AROMATICS 46.0%
I.B.P. 410
10% 527
50% 585
90% 662
E.P. 722
FLASH 156
GRAVITY 24

Correlation of rate of 2,4-D application on cattails, physical presence of starch grains in usual storage organs and percentage carbohydrate in oven-dry roots. Oborn, E. T. Greenhouse grown cattails, emerged 100-140 cm above the container water surface, were sprayed in a manner to give complete coverage with an ester and an amine salt formulation of 2,4-D at rates ranging from 1.4 to 108.1 pounds per acre. Rhizome sections were taken simultaneously from dormant field specimens, from cattails 6 weeks following aerial herbicidal application under greenhouse conditions, and from untreated greenhouse controls.

Part of the cut rhizome material from each treated and untreated tank and from the dormant field condition was killed, embedded, and sectioned in paraffin. The remainder of the rhizome material collected, and not used for histological section preparation, was chemically analyzed for carbohydrate content. In tabular form are presented the starch grain and carbohydrate findings on the treated cattail specimens.

Plant species	Pounds per acre 2,4-D	Average height above water line cm	Starch grains	Percentage carbohydrate in oven-dry roots
Typha angustifolia L.	0.0	0.0	Abundant	60.2
Narrow-leaved	0.0	129.7	Abundant	43.4
cattail	1.4	143.0	Present	--
	2.7	124.8	Absent	31.7
	5.4	126.6	Absent	27.0
	27.3	125.8	Absent	--
	54.6	123.0	Absent	--
	108.1	128.8	Absent	23.0
Typha latifolia L.	0.0	0.0	Abundant	50.7
Broad-leaved	0.0	131.5	Abundant	40.2
cattail	1.4	100.4	Present	29.8
	2.7	103.6	Absent	--
	4.8	73.0	Absent	28.5
	27.3	110.2	Absent	26.6
	54.6	100.4	Absent	25.9
	108.1	89.0	Absent	26.7

The table shows that in both species of cattails: (a) the starch grains were readily used up even when the lower concentrations of 2,4-D were applied; (b) in general, the percentage carbohydrate decreased as the higher quantity of 2,4-D per acre was applied; and (c) from a standpoint of the relative amount of carbohydrate in the roots of treated plants, there was little or no increased effectiveness with the increase in quantity of 2,4-D applied.

This study emphasizes the fact that relatively small quantities of 2,4-D per acre, used at the correct time of plant development, with adequate cosolvent or wetting agent present, are adequate to have a pronounced effect on the reduction of starch grains and associated carbohydrates in cattail rhizomes which affect regrowth potential. (Contributed by the Division of Weed Investigations, BPISAE, USDA, in cooperation with the Bureau of Reclamation, USDI.)

Control of nutgrass with soil fumigants. Day, Boysie E. and Robert C. Russell. Nutgrass, Cyperus rotundus, fails to respond to the usual chemical and cultural control methods because of its highly resistant tuber system. Fumigation by methyl bromide and chloropicrin kills the tubers thus securing complete control in one operation. A study of the factors affecting the toxicity of methyl bromide and several other fumigants to nutgrass under California conditions was determined.

Excised tubers were killed by 3% (by volume in air) methyl bromide after an exposure of 2 hours. Lower concentrations required fumigation for increasing time intervals up to 36 hours at 0.6%. Fumigation was not greatly affected by variation in temperature. Presence of moist soil or water in the fumigation chamber exerted protective action against the fumigant presumably by absorbing the fumigant.

A large number of halogenated hydrocarbons were screened for toxicity to nutgrass tubers. Of these, trimethylene chlorobromide, ethylene chlorobromide, ethylene dibromide, 1,1,2-tribromoethane, bromopicrin, 2,3-dibromopropene, ethylene bromohydrin, tetramethylene bromide and 1-chloro, 3-bromopropene were found to be toxic to the tubers in low concentrations. Commercial formulations of liquid fumigants were tested both in the laboratory and in the field. Effective materials were ethylene dibromide (85%), chlorobromopropene (CBP-55), and dichloropropenes (DD). These materials kill nutgrass when applied at rates of 60, 80, and 80 gallons per acre respectively. Carbon bisulfide and a commercial formulation of dichlorobutenes were not highly toxic to the tubers.

Under field conditions, it is difficult to obtain a sufficient concentration of fumigant to kill tubers contained in the top layer of soil. In dry, well-tilled soil in Southern California during the summer, surface tubers of C. rotundus will be killed by desiccation obviating the necessity of obtaining toxic concentrations of fumigants at the surface. (University of California, Citrus Experiment Station)

Use of 2,4-D-1C14 in studying solubility of 2,4-D in certain solutions used in the preparation of plant histological sections. Oborn, E. T. The presence of radioactivity in killed, embedded histological sections after previous treatment with 2,4-D-1C14 was investigated. Autoradiograms were made on plant components situated immediately adjacent to the area from which leaf, petiole, and stem transverse histological sections were taken. Specimens were killed either by chromeacetic acid or by formaldehyde-alcohol-acetone mixtures. In either case, usual procedures for dehydration of specimens by alcohol and clearing by xylene were followed. The killing and clearing solutions were concentrated in stainless steel disks and were counted in a proportional counter. Autoradiograms of these evaporated solutions were made after completion of counting. Radioactivity in the thin sections was investigated by counting specimens in the proportional counter, and by making a 3-week exposure to Kodak No Screen X-ray film. Untreated control material was processed in a like manner.

The major portion of 2,4-D-1C14 was removed in the killing solution. Radioactivity was present in greater quantities in the dehydrating than in the clearing solutions. In spite of these extractions by the solutions used to process the histological sections, definite evidence of radioactivity was present in autoradiograms made of the completed thin sections. (Contributed by the Division of Weed Investigations, BPISAE, USDA, in cooperation with the Bureau of Reclamation, USDI.)

Some effects of CMU and 2,4-D upon the nitrogen uptake and reserve sugars of bean and sunflower plants. Piper, K. C. and Freed, V. H. The purpose of this work was to further investigate the effects of N (p-chlorophenyl) N N' dimethyl urea (CMU) and the isopropyl amine salt of 2,4-dichlorophenoxyacetic acid (2,4-D) upon the nitrogen uptake and reducing sugars of bean and sunflower plants. Since the apparent symptoms of both CMU and 2,4-D poisoning seem to show nitrogen deficiency, research was undertaken to determine if these herbicides prevented plants from absorbing nitrogen in the form of the nitrate nitrogen from a nutrient medium. A corresponding study was made to determine what effect these chemicals had upon the reserve sugars.

The bean and sunflower plants were germinated and then grown in one-half pint size Sani-Pak containers. These contained a nutrient medium in which a quantitative measurement could be made of the nitrate ions present. Some plants were treated with a 500 ppm solution of 2,4-D and some with a 2000 ppm solution of CMU. Two weeks after treatment the plants were harvested.

The analysis of the nutrient medium before and after treatment showed that both CMU and 2,4-D poisoning apparently do decrease the nitrate nitrogen uptake of both plant species. Analysis of the plant stems showed a corresponding decrease in the amount of reserve sugars present in both plant species and treatments. (Contributed by Oregon Agricultural Experiment Station)

SUMMARY

Committee No. 12 - Luther Jones, Chairman

Abstracts cover work in Oregon on the use of contact herbicides for preharvest maturation of Alta fescue, sudan grass, and crimson clover. Shatterproofing trials on lotus are also reported. Endothal, sodium acid cyanamide, and sodium monochloro acetate were promising on crimson clover. Sodium monochloro acetate showed promise on Alta fescue and sudan grass. Methocel and bark wax showed the most promise for shatterproofing lotus.

Pre-harvest maturation of Alta fescue (Festuca arundinacia). Furtick, W. R., and Freed, V. H. As a follow-up to preliminary work started in 1951 several of the more promising chemicals were sprayed on a field of row Alta fescue, using plots 2 rows wide and 130 ft long, to determine the effect on moisture content of the seed at harvest time. Application was made on July 3, 1952 during a period of hot dry weather. The plots were harvested 3 days after treatment and immediately threshed so the seed could be oven dried to determine moisture content. The best treatment proved to be sodium monochloro acetate at 40 lbs per acre, followed by aromatic weed oil at 40 gallons per acre. The moisture content of the harvested seed was reduced from 27.18% in the check to 14.64% by 40 lbs of sodium monochloro acetate. The moisture content where weed oil had been used at 40 gallons per acre was 17.97%. All materials were applied using a volume of 80 gallons of water in plots replicated three times.

The top growth of the fescue was rated for top kill prior to the harvesting of samples for moisture content determination. Their rating on percent top kill followed closely the moisture content of the harvested seed. Sodium monochloro acetate at 40 lbs per acre gave complete top kill in 3 days following spraying, with the top kill where aromatic weed oil had been used rating 30%.

This trial would tend to indicate that the sodium monochloro acetate might be used at a lower rate effectively. (Contributed by Oregon Agricultural Experiment Station)

Pre-harvest maturation of crimson clover. Furtick, W. R. and Freed, V. H. One square rod plots were sprayed with various contact herbicides to determine which chemical is the most effective as a pre-harvest maturation aid on crimson clover being raised for seed production. In the trial endothal was used at the rate of 2, 4, and 6 lbs in 80 gallons of water and at 4 lbs in 20, 40, and 80 gallons of water. Endothal was used at 4 lbs per acre in combination with sodium acid cyanamide at 40 lbs per acre and ammonium sulfate at 8 lbs per acre. In addition sodium acid cyanamide was used alone at 40 lbs per acre. Other materials used were sodium monochloro acetate at 40 lbs per acre and pentachloro phenol at 10 lbs per acre. Samples were harvested from the plots one week after application and the seed threshed from the samples. Both the vegetative material and the seed were immediately dried separately to determine the moisture content of each.

The only appreciable reduction in moisture content of the vegetative portions resulted from the use of sodium monochloro acetate at 40 lbs per acre. The moisture content for the check was 55.9% as against 34.89% where 40 lbs of sodium monochloro acetate had been used.

There were wide differences in the moisture content of the seed between the various materials, ranging from 22.35% for the check to 14.33% where 6 lbs of endothal had been used. The second best treatment was sodium monochloro acetate at 40 lbs per acre with a moisture content of 14.85%. Sodium acid cyanamide used alone at 40 lbs per acre give a moisture content of 15.45%. All material gave a moisture percentage lower than the check except endothal at 2 lbs per acre which was slightly above the control. (Contributed by Oregon Agricultural Experiment Station)

Pre-harvest maturation of sudan grass. Furtick, W. R., and Goetze, N. Three contact herbicides, endothal, sodium monochloro acetate, and sodium pentachloro phenate, were used as pre-harvest sprays for the maturation of sudan grass. Samples of sudan grass were harvested one week after application and the threshed seed immediately dried to determine the moisture content.

The average moisture content ranged from 32.89% in the check to 19.63 where sodium monochloro acetate had been used at the rate of 30 lbs per acre. The moisture content resulting from endothal at 4 lbs per acre was 23.46% and for sodium pentachloro phenate at 30 lbs per acre was 24.76%.

Observations on the apparent top kill closely followed the reduction in moisture content. Application under cool fall conditions indicate that less favorable results are obtained than under the warm summer conditions when the perennial grasses such as Alta fescue are harvested. (Contributed by Oregon Agricultural Experiment Station)

Prevention of seed shattering of Lotus corniculatus. Goetze, N. R., Howell, H. B., and Freed, V. H. Previous work conducted at Astoria and Corvallis has indicated that certain film producing chemicals were effective in reducing the rate of seed shattering of Lotus corniculatus. Trials were established on the J. J. Astor Branch Experiment Station at Astoria to further test the previous results and to test other chemicals which might be of value.

Field plots were established using sodium acid cyanamide, endothal, Douglas fir bark wax, 3M, and methocel as the treatments applied as the pods turned from green to brown. The crop was mowed, placed on canvasses, and allowed to dry. When harvested with a stationary threshing machine, the seed was divided into a lot which had shattered onto the canvas and a lot which was threshed from the pods. All treatments had a higher rate of shattering than the check plots with bark wax and 3M more nearly approaching the untreated areas. The treated plots matured before the check plots and some seed had already shattered before harvesting. Methocel was found to be unsatisfactory under field conditions because of the difficulty to get it into solution.

Seed samples from each lot were analyzed at the Oregon Seed Laboratory at Corvallis. In all treatments including check plots, seeds which had shattered gave consistently lower germination results and higher hard seed percentages. Total germination including hard seeds was uniformly higher in the shattered lots. 60 lbs of sodium acid cyanamide per acre increased the germination of the threshed lot 7% above the check while the germination of the shattered lot was 4% higher than the check. Six lbs of endothal per acre gave corresponding 4% and 3% increase. Differences of other treatments were not significant.

The laboratory separated the heavy and light seeds with a South Dakota blower. In the 15 gallons of 3M per acre treatment there was very little difference between percentages of heavy seeds in the two lots. In all other treatments there were more light seeds in the threshed lots than in the shattered lots.

Smaller experimental plots were treated with the same chemicals at varied rates. Counts of shattered and non-shattered pods were made instead of weighing threshed seed. All treatments reduced the percentage of the number of shattered pods over the check plots with methocel plus spreader, 12 lbs bark wax per acre, 5 gallons 3M per acre, and 8 lbs bark wax per acre giving the best results in the order listed. Endothal and sodium acid cyanamide caused a faster vegetative maturation and more of the pods shattered before the counts were made.
(J. J. Astor Experiment Station, Astoria, Oregon)

PROJECT 14. NOMENCLATURE AND CLASSIFICATION

V. F. Bruns, Project Leader

The committee on nomenclature and terminology was activated early in October, 1952. The greatest task confronting this committee is the development of a uniform system of herbicidal terminology, especially for the newer herbicides which are being formulated from organic compounds. The present system of using abbreviations of the compounds, e.g., 2,4-D, 2,4,5-T, PCP, MCPA, TCA, MH, PMA, DNOC, DNOCHP, DNOSBP, and DNOSAP, is believed by many to be inadequate and inconsistent and to be perplexing and confusing to the ordinary layman and the common user. As more and more of these formulations are developed, the terminology will become increasingly difficult. Coined names are being used for many insecticides and such a system might be developed for herbicides. However, it is understood that this system has its limitations and drawbacks also.

One of the first accomplishments of this committee was to evaluate the recommendations of the Committee on Terminology, Northcentral Weed Control Conference, Oklahoma City, December 13, 1951, and to offer suggested revisions for consideration by the committee at the Northcentral Weed Control Conference meetings at Winnipeg, Manitoba, December 9-10-11, 1952. A national committee on standardization of terminology, under the auspices of the Association of Regional Weed Control Conferences, is being formed and your committee is taking an active part in this development. Until the national committee is able to function properly, your committee will cooperate with other Regional Committees in an attempt to develop some type of uniformity and to profit by the experiences of others. Unfortunately, your committee did not have sufficient time to draft a set of recommendations on terminology for consideration by the Research Section at the Boise meetings. However, such recommendations undoubtedly will be submitted for official action at the regular meeting of the Western Weed Control Conference in 1954. If the Research Section so desires, suggested recommendations on terminology could be submitted to all members prior to the 1954 meeting for use in the preparation of individual contributions for the Research Progress Report.

With respect to nomenclature and classification of weedy plants, this committee is attempting to publish an approved list of common and Latin names of significant weed species and other plants of concern to the Western Weed Control Conference. Unfortunately, Dr. J. H. Robertson, University of Nevada, was forced to withdraw from this committee because of other commitments and pressing duties. On the otherhand, this committee was fortunate in obtaining the services of Mr. Bruce Thornton and Dr. H. D. Harrington of Colorado A & M who, together with Dr. A. N. Steward of Oregon State College, are preparing a basic list of common and scientific plant names. The committee will make every effort to complete and to disseminate this list prior to the preparation of the 1954 Research Progress Report.