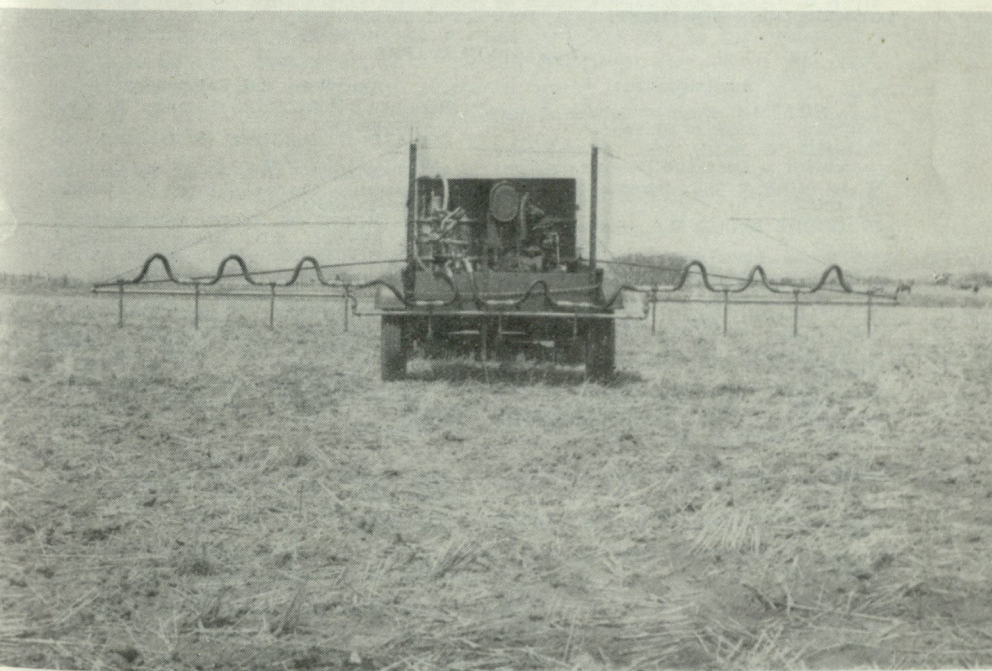


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Using 2,4-D in Wyoming



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*In cooperation with U. S. Department of Agriculture.

Using 2,4-D In Wyoming

DALE W. BOHMONT
Assistant Agronomist

Gratifying progress has been made in the use of chemical herbicides for weed control in the past few years. Each season answers some questions and brings forth new problems which need to be solved. While many facts about 2,4-D are known, much information is still needed. Research is continuing, however, with the result that knowledge about this chemical is steadily increasing.

Chemical weed control has a definite place in the operation of a farm or ranch. However, it is not the complete answer to the weed problem. A very important phase of weed control on tillable land which is often overlooked is a balanced crop rotation. The sensational results obtained by 2,4-D has overshadowed such time-established methods of weed control as cultivation. A balance between the two methods by using chemicals and cultivation may prove to be the answer.

Latest information is usually made available through bulletins, circulars, or letters. However, digesting this material and applying it to local situations is often difficult. Because of the variations in the recommendations, there is a definite need for clarifying and summarizing the recommendations made by various states. Such recommendations should not be used as a set rule but rather as a "rule of thumb". Judgment and knowledge are both needed in the application of 2,4-D.

COMMERCIAL TYPES OF 2,4-D

There are three general types of 2,4-D commercially marketed today: (1) sodium and ammonium salts, (2) amine salts, and (3) esters. The first is in powder or dust form, and the other two are liquids. The three materials do vary in their effectiveness and their ability to penetrate plants. The ester, an oily liquid, is usually the most effective on woody or hard-to-kill plants. The amine is considered intermediate in action. The salts are usually the cheapest; the amine is intermediate in price; and the ester is the most expensive.

It is of utmost importance that the prospective buyer of any type of 2,4-D read the label carefully. The composition of the compound and the 2,4-D acid equivalent should be listed. Many commercial concerns are now listing the actual amount of 2,4-D acid contained per pound, or in the case of liquids, the amount per gallon. This type of information is necessary to accurately mix and properly apply 2,4-D.

Since it is the acid in the 2,4-D which causes the herbicidal or killing action on plants, the preparation containing the largest acid equivalent is worth the most money for a given type of material.

TERMS USED IN RECOMMENDATIONS

Weed and crop plants usually are classified into three general categories according to the degree of their reaction to the herbicide.

Susceptible—Plants readily killed by 2,4-D.

Intermediate—Plants frequently killed by 2,4-D; several applications necessary for control.

Resistant—Plant system affected slightly or not at all; control by 2,4-D probably not practical.

It is an established fact that a given species may vary in its reaction to 2,4-D due to environmental factors and the stage of plant growth. Many species which are considered "susceptible" to 2,4-D in the seedling stage often become intermediate or resistant in reaction as maturity develops.

The recommendations in the use of 2,4-D are conveniently given in pounds of 2,4-D acid per acre. It is necessary, therefore, that the spray rig operator know not only the amount of solution he is applying per acre but also the concentration of 2,4-D acid in the formulation he is using. The difference between success and failure in the control of a weed may often hinge on the pounds of 2,4-D acid being applied.

APPLICATION OF 2,4-D ON BROADLEAF PERENNIAL WEEDS

Perennial weeds constitute a major problem on both farm and range lands in Wyoming. Because perennials live for a period of two years or more, it is necessary to eradicate the established root system as well as to kill the above-ground vegetative portion.

On some perennials 2,4-D will accomplish both after several applications; on other perennials only the vegetative portion is injured with little or no apparent effect on the roots.

Best results have been obtained when the material was applied at the rapid stages of growth and usually during the pre-bud to early-bloom stage. While defoliation and top kill may result from one application, more treatments are usually necessary before complete control can be attained.

Field Bindweed

For infestations in non-cultivated areas 1 to 1½ pounds of either the ester or amine per acre should be applied at the first bloom stage. If good growing conditions and rapid growth are occurring, the lower limit should be applied; if conditions are dry, the upper limit will be the most effective. If regrowth occurs, a second treatment should not be made until the foliage has completely emerged and is growing actively. Infestations in growing crops which are tolerant to 2,4-D should be treated with ½ to ¾ pound of ester or ½ to 1 pound of amine for control. If eradication of the bindweed is desired, the heavier rates may be applied; however, a noticeable reduction in crop yield should be anticipated with the heavier applications.

Canada Thistle and Perennial Sow Thistle

Although top kill is easily attained on these weeds, several treatments are necessary to kill the roots. For control on non-cultivated or sod areas, 1½ to 2 pounds of the ester or amine should be applied. Treatment should be made at the pre-bud or early bloom state of growth and treated again at the four-to-six-leaf stage. If good growing conditions and ample moisture are present, the amine formulation

is recommended. For control in tolerant crops, $\frac{1}{2}$ to 1 pound of either the ester or amine formulations can be applied.

White Franseria (Silverleaf Poverty Weed)

Considered intermediate in reaction to 2,4-D, White Franseria can be controlled by repeated treatments. Material should be applied at early stages of growth at the rate of 1 to $1\frac{1}{2}$ pounds of the ester or amine per acre. If not treated until the bloom stage, 2 pounds of 2,4-D should be applied.

White Top (Hoary Cress)

Application of 2,4-D at the pre-bloom stage and again at the rosette stage in the fall is recommended. Rates of $1\frac{1}{2}$ to 2 pounds of the ester or amine, with the heavier rates being applied under dryer or adverse conditions, are most effective. The competition of a cereal or grass crop in combination with the spraying of 2,4-D at the rate of $\frac{3}{4}$ to $1\frac{1}{2}$ pounds will effectively control this weed over a several-year period.

Russian Knapweed and Leafy Spurge

Although top kill can be attained with 2,4-D, there is apparently little or no movement of the material into the roots. The stands are very seldom killed, although by spraying the seeding can be prevented at the pre-bloom stage. One-half to 1 pound of ester or amine should be applied for seed control. Root kill should not be anticipated.

Other Herbaceous Perennials

Many herbaceous perennials such as Goatsbeard, Wild onion, Poverty weed, Cattail, Docks, and Dandelion are considered intermediate in reaction to 2,4-D and can be controlled by applying 1 to 2 pounds of the ester or amine. However, many other perennials such as Milkweed, Ground cherry, and Horse nettle suffer little or no injury from 2,4-D and are considered resistant.

APPLICATION OF 2,4-D ON BROADLEAF ANNUAL WEEDS

Most broadleaved annual weeds are susceptible or intermediate in reaction to 2,4-D treatments and are quite readily killed. The application of $\frac{1}{2}$ to $\frac{3}{4}$ pounds of 2,4-D during the earlier stages of growth is recommended. Many annuals such as Rough Pigweed, Russian thistle, and Cocklebur become more resistant as they reach maturity. A heavier application may be necessary to kill the mature weeds.

APPLICATION OF 2,4-D ON MEADOW AND RANGE LAND

Sagebrush

Woody perennials which often infest meadow or range land may be controlled or eradicated by the proper use of 2,4-D. Although sagebrush is of vital importance under some western range conditions where the understory vegetation is sparse, other situations warrant the removal of this brush. The application of 1 to 2 pounds of the ester formulation after the plant has fully leafed out and is actively growing is effective. At higher elevations later application is advisable due to the cold ground and slow growing conditions.

Willows

The improvement of meadows by the removal of willows can be affected by the application of 1 to 1½ pounds of the ester formulation. Very poor results have been obtained when willows were sprayed in early spring. It is advisable, therefore, to wait until the plants are fully leafed and actively growing. A quite heavy application of solution should be made to insure complete coverage. If any sprouts are noticed, a second application should be made.

Poisonous Range Plants

A weed problem which in itself is quite unique and which has had relatively little attention on control studies to date is the poisonous range plants. Because of their localized growth characteristics, they are often well adapted to control with selective herbicides. Locoweed (*Oxytropis*) can be controlled with 1 to 1½ pounds of 2,4-D. The material should be applied at pre-bloom to bloom stage of growth. Preliminary results indicate that Milk Vetch (*Astragalus* sp.), which is often seleniferous, may be controlled by similar concentrations. Although other poisonous plants such as Death Camas, Larkspur, and Lupine have been treated, no conclusive results have been obtained yet.

APPLICATION OF 2,4-D ON SMALL GRAINS

The use of 2,4-D in small grains for the selective control of weeds offers the farmer a double opportunity to control the weedy areas. Wheat, oats, and barley are considered tolerant to 2,4-D; however, the degree of tolerance does vary among varieties.

The amount of material to apply will depend upon the weed to be controlled. However, as the concentration is increased, a greater injury to the crop plant should be expected. In the control of perennial weeds, it may be necessary to decide between two factors: (a) killing the top growth to prevent seeding off and to aid in harvesting, or (b) applying a heavier dosage in an attempt to kill the roots of the weed even though the grain may suffer some injury. In heavy infestations the point should not be overlooked that even if the heavy dosage does injure the crop plant, the actual yield may be increased due to the reduction of the weed competition.

Material should not be applied to the grain during the boot stage of growth, since it is at this stage that the greatest injury is noted. 2,4-D should not be applied when small grains are grown as a nurse crop with legumes.

PRECAUTIONS IN USING 2,4-D

Volatility and Drift

The ester formulations of 2,4-D are volatile (escape as a gas) and are not recommended in highly diversified farming areas where acreages of susceptible crops are grown.

2,4-D should not be applied when there is wind or rapid air movement since the fine particles may be carried for some distance. It should be remembered that high pressure application has a greater chance of drifting than application at lower pressures.

CLEANING SPRAY EQUIPMENT

Equipment which has been used to apply 2,4-D should be thoroughly cleaned before it is used to apply other materials. Several methods which are used in removing the 2,4-D residue from metal containers are:

(a) Preparing a solution of household ammonia and water at the ratio of two teaspoons of ammonia per quart of water, thoroughly rinsing the sprayer; leaving the solution in the sprayer for 24 hours; and following by rinsing with clean water.

(b) Mixing a box of laundry soap and an ordinary box of baking soda (1 pound) per 100 gallons of warm water; rinsing thoroughly; and following by rinsing with clean water.

It is a wise precaution to spray some susceptible plants after the equipment has been cleaned to see that all traces of 2,4-D have been removed.

RESIDUAL EFFECTS

2,4-D has a residual or lasting effect in soils. The length of time the material may persist depends upon the soil type, and environmental factors such as temperature and moisture and soil organisms. While normal rates of foliage application cause no noticeable soil sterility, the policy of applying the material directly to the soil may pose a definite problem.

TOXICITY OF 2,4-D TO ANIMALS AND MAN

2,4-D is apparently non-toxic to both animal and man. Tests at the University of Wyoming indicate that normal concentrations of 2,4-D as applied in weed control had no effect on chickens. By direct feeding of chicks, it was found that at an application rate of 1 pound of 2,4-D per acre, a chicken weighing 2 1/5 pounds would have to consume all of the 2,4-D applied on a 72 square foot area within a day or two to obtain a lethal dose.

If 2,4-D is spilled directly on the skin, irritation may result unless immediately removed with soap and water.

COMPUTING 2,4-D CONCENTRATIONS

Because it is the general practice to give recommendations in pounds of 2,4-D per acre, it is necessary that the operator know the concentration of the material before he can apply it economically and effectively.

While many commercial chemical producers indicate the percent of 2,4-D acid equivalent and the weight of the material per unit volume on their product, it is not a general practice to designate the pounds of 2,4-D acid contained.

The following formulas are given to assist in computing the pounds of 2,4-D acid in a given quantity of material.

LIQUIDS

(a) To find the weight of one gallon of material if the specific gravity is given:

Specific gravity X 8.335 equals Weight for 1 gallon of material

(b) To find pounds of 2,4-D acid per gallon:

Percent 2,4-D acid equivalent X Weight of 1 gallon of material.

(c) To convert into convenient measure, use the following equation:

<u>Pounds 2,4-D per Gallon</u>	equals	Amount of 2,4-D
Number of units per gal. (qts. cups, etc.)		per unit measure

1 gallon equals 4 quarts or 8 pints or 3785 cc.

1 quart equals 2 pints or 4 cups or 946 cc.

1 pint equals 2 cups or 473 cc.

1 cup equals 16 tablespoons or 236.5 cc.

1 tablespoon equals 3 teaspoons or 15 cc.

POWDERS

(a) To find the amount of 2,4-D per pound of material:

<u>1 pound of Material X 100</u>	equals	amount of material for
Percent of 2,4-D acid Equivalent		1 pound of 2,4-D acid

1 pound equals 16 ounces or 453.6 grams.

1 ounce equals 28.35 grams.

THE WEED CONTROL OUTLOOK

2,4-D should not be considered the final answer to any weed problem. In fact, it is only an indication of the possibilities of future weed control methods.

At present many new chemicals are in the experimental stage of development. As the new chemicals are made available, they no doubt will help solve many of the problems for which we have no answer at present.

Although perfection in weed control is a long way off, continued research and use of the knowledge gained will assist progress toward that goal.