Bulletin No. 274 - Dandelion Control with 2,4-D

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DANDELION CONTROL WITH 2,4-D

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GREAT INTEREST IN THE CONTROL OF DANDELION BY SPRAYING 2,4-D ON LAWNS HAS DEVELOPED FROM THE STRIKING RESULTS OBTAINED BY ITS USE. ALMOST COMPLETE ERADICATION OF DANDELION CAN EASILY BE OBTAINED, WITHOUT INJURY TO THE BLUEGRASS, IF THE 2,4-D IS PROPERLY APPLIED. (SEE FIG. 1.) THE WIDESPREAD DEMAND FOR INFORMATION HAS PROMPTED THIS REPORT OF ONE YEAR'S EXPERIMENTAL WORK, EVEN THOUGH POSITIVE CONCLUSIONS CANNOT BE DRAWN FROM THE DATA.

2,4-D DIFFERS FROM OTHER WEED-KILLERS IN ITS EFFECT UPON WEEDS. MOST HERBICIDES DESTROY BY VIRTUE OF THEIR DIRECT CAUSTIC ACTION ON THE PARTS OF THE PLANT WITH WHICH THEY COME IN CONTACT (1). 2,4-D, ON THE OTHER HAND, IS FIRST ABSORBED BY THE LEAVES. IT THEN TRAVELS SOME DISTANCE THROUGH THE PLANT TO INDUCE CHANGES WHICH CAUSE DEATH. THE PLANTS DO NOT "GROW THEMSELVES TO DEATH" AS HAS BEEN COMMONLY SUPPOSED, BUT RATHER THEY "CEASE GROWING," ACCORDING TO A REPORT BY DR. J. W. MITCHEL AND DR. J. W. BROWN. THESE TWO MEN BELIEVE THE VULNERABLE WEEDS DIE BECAUSE THEIR FOOD RESERVES ARE DEPLETED OR BURNED UP (2). DEATH DOES NOT OCCUR IMMEDIATELY AFTER PLANTS ARE TREATED. SEVERE GROWTH ABNORMALITIES (CUPPING OF LEAVES, BENDING OF SEED STALK) MAY BE APPARENT WITHIN A DAY FOLLOWING TREATMENT, FOLLOWED GRADUALLY BY CHLOROSIS AND BROWNING OF THE LEAVES. VULNERABLE PLANTS WILL GENERALLY DIE IN ONE TO THREE WEEKS, DEPENDING SOMEWHAT UPON THE TEMPERATURE FOLLOWING TREATMENT.

EXPERIMENT DETERMINES BEST SPRAYING TIME—

THE EXPERIMENT CONDUCTED AT THE EXPERIMENT STATION WAS DESIGNED TO DETERMINE THE EFFECT OF SPRAYING AT DIFFERENT TIMES DURING THE SEASON, A DIFFERENT SET OF PLOTS BEING SPRAYED EACH MONTH. SOME PLOTS WERE SPRAYED BUT ONCE, OTHERS WERE SPRAYED TWICE (AT MONTHLY INTERVALS), AND ONE SET OF PLOTS WAS SPRAYED FOUR TIMES AT THE DATES INDICATED IN TABLE I. IT HAD BEEN PLANNED TO START THE EXPERIMENT MAY 15, BUT SINCE THE 2,4-D WAS NOT AVAILABLE UNTIL
later, the first treatment was applied June 5. All plots were sprayed with $\frac{1}{10}$ of one per cent solution by weight of 2,4-D in water (Carbowax-1500 as dispersal agent) until all foliage was wet. The plots were sprayed by means of a three gallon knapsack sprayer. Plots were laid out in randomized block design with three replications.

All dates of spraying significantly reduced the dandelion in the sprayed plots as compared to the untreated check. Best results were obtained on the plots which were sprayed later in the season: i.e., (a) July 16, (b) August 15, (c) June 16 and July 16, (d) July 16 and August 15, and (e) those sprayed four times (see Table I). The differences between the above treatments were not statistically significant. They ranged in effectiveness from the July 16 and August 15 treatment, with only 0.8 per cent of the
original dandelion stand remaining, to 13.8 per cent for the plots sprayed four times. The check plots (untreated) averaged 125.6 per cent of the original dandelion population. The earlier treatments were somewhat less effective, probably due to the relatively low temperatures at the time of treatment and for the period thereafter. (See Fig 3.) It is known that absorption of 2,4-D through the plant leaves is much more rapid at the higher temperatures.

**TABLE I**

Control of dandelion in the lawn with 2,4-Dichlorophenoxyacetic acid when sprayed at the dates indicated. All plots sprayed with 0.1% solution of 2,4-D in water; Carbowax-1500 (Polyethylene Glycol) served as dispersal agent.

<table>
<thead>
<tr>
<th>Date of Spraying</th>
<th>Number of Dandelion per square foot of lawn</th>
<th>Estimated average per cent of clover remaining (October 3, 1945)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average¹</td>
<td>Average per cent of original stand remaining</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>June 5</td>
<td>12.08</td>
<td>4.75</td>
</tr>
<tr>
<td>June 16</td>
<td>14.00</td>
<td>2.41</td>
</tr>
<tr>
<td>July 16</td>
<td>10.16</td>
<td>0.25</td>
</tr>
<tr>
<td>August 15</td>
<td>9.41</td>
<td>0.16</td>
</tr>
<tr>
<td>June 5 and June 16</td>
<td>13.58</td>
<td>3.41</td>
</tr>
<tr>
<td>June 16 and July 16</td>
<td>22.75</td>
<td>1.00</td>
</tr>
<tr>
<td>July 16 and Aug. 15</td>
<td>10.25</td>
<td>0.08</td>
</tr>
<tr>
<td>June 5, June 16,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 16, and Aug. 15</td>
<td>12.08</td>
<td>1.67</td>
</tr>
<tr>
<td>Check (no treatment)</td>
<td>12.41</td>
<td>15.67</td>
</tr>
<tr>
<td>Standard error of the mean</td>
<td></td>
<td>4.9</td>
</tr>
<tr>
<td>Least difference for significance (5% level)</td>
<td></td>
<td>13.9</td>
</tr>
</tbody>
</table>

¹Average of three replications (stand count based on four separate foot square quadrates). Spring count made in June; Fall count made October 3, 1945. Many of the dandelion counted in October were seedling.

²Estimates based on per cent of area in which white clover could be found.

**2,4-D Hurts White Clover—**

White clover in the lawn unfortunately is also injured by 2,4-D. The stand of clover on sprayed plots was significantly lower than the check plot in six out of eight of the treatments.
Fig. 2. This control plot received no 2,4-D. At the end of the season, the dandelion stand was 125.6 per cent of the original stand.

(See Table 1.) with only the June 5 and July 16 treatments showing stands of clover with no significant reduction. No attempt to explain the high survival of clover for the two dates mentioned will be ventured, and the results might not be duplicated in another trial. In no case was white clover entirely killed, although in those plots treated four times, only scattered plants could be found.

Fast Growing Plants Easily Killed—

Successful control of dandelion tends to be associated with the growth activity of the plant and the temperature at the time of treatment. As a general recommendation based on limited data, it would appear that best results are obtained if 2,4-D is used when the daily average temperature is above 60° F. Higher temperature is desirable. Weather which favors rapid growth of grass
should favor control of dandelions with 2,4-D. Late spring to early fall is the most favorable time for control, if but one treatment is possible. If more than one treatment can be applied, then an earlier spraying will lessen the amount of seed that will be set. Plants escaping the early treatment can be controlled by the later spraying. If the lawn is in a state of high fertility and is not kept mowed too short, the re-establishment of dandelion seedlings will be greatly retarded.

2,4-D Needs Mixing Agent—

Some attention should be given to the preparation of the spray and to the proper spraying of the solution on the plants to be killed. It is important that the right amount of 2,4-D and other ingredients be used in preparing the spray. If one of the commercial preparations is used, follow the instructions closely. By itself, 2,4-D does not dissolve easily in water. However, when mixed with some other substances, the white powder can be dispersed in water and used as a spray. Among these other substances is Carbowax No. 1500, a polyethylene glycol. For homemade mixtures, one part of 2,4-D dissolved in 6 1/2 parts of melted Carbowax 1500 by weight has given good results. An ounce of this mixture is dissolved in a gallon of water. It is more easily soluble in warm water; however, water at room temperature should be satisfactory. The 2,4-D-Carbowax 1500 mixture will keep indefinitely, but the water solution may form a precipitate on standing. Ordinarily the water solution should be used within 48 hours.

On lawns, 4 to 5 gallons of spray are required to treat 1,000 square feet. In places where larger plants are found, 7 1/2 gallon per 100 square feet, or 300 gallons per acre, is necessary. Enough 2,4-D should be used to wet the foliage thoroughly. At prices prevailing in July 1945, enough materials to treat an acre of lawn with homemade preparations of 2,4-D-Carbowax 1500 can be bought for from $4.00 to $6.00. It may cost $8.00 per acre for large field weeds.

After using a sprayer for 2,4-D, the same sprayer should not be used for ornamental plants or garden crops. Even a very small quantity left in the sprayer machine may endanger these useful
plants. Until more definite information is available, the broad-leaved plants may be considered to be vulnerable. The grasses in general are not injured by 2,4-D.

Many Weeds Affected—

The number of plants upon which 2,4-D will act has not been fully explored. It has been reported effective against the following:

- Dandelion
- Fan Weed
- (Thlaspi arvense)
- Wild mustard
- Pigweed
- Narrow-leaved plantain
- Curled dock
- Ragweed
- Wild lettuce
- Annual sow thistle
- Chickweed
- Lawn pennywort
- False strawberry
- Annual morning glory
- Daisy
- Heal-all
- Wintercress
- Pokeweed
- Three-seeded mercury
- Burdock
- Japanese honeysuckle

Experimental work is being done to determine the effect of 2,4-D on the more serious weeds. While results so far have been somewhat promising on such weeds as field bindweed, canada thistle,
white top, russian knapweed, leafy spurge, perennial sowthistle, gaura, poison ivy, and others, it is not known whether the treatment will be permanently successful.

Many chemical supply houses sell 2,4-D (2,4-dichlorophenoxyacetic acid). Some companies distributing the substance are: Dow Chemical Co., E. J. DuPont de Nemours Co., Associated Chemist, Inc., American Chemical Paint Co., Merck Chemical Co., and Eastman Kodak Co.

“Carbowax-1500” is sold by the Carbide and Carbon Chemical Corp. It should be remembered that this substance is only a mixing agent and not a weed-killer in itself.

There are a number of commercial preparations now on the market ready for mixing with water. Most of these have not been tested by the Experiment Station; their listing herein should not be construed as a recommendation as to their merits. Some of these preparations are known as Weedanol M1; Weedicide; Weed-one; En-Dow-Weed; Weed-Tox 2,4-D; Concentrate No. 6, and Chipman 2,4-D Weedkiller.

Conclusions—

Almost complete eradication of dandelion can be obtained, without injury to the bluegrass. The white clover stand may be injured.

Best results are obtained when conditions are favorable to the rapid growth of grass. The spray is more readily absorbed through the leaves at the higher temperatures.

If a commercial preparation is used, follow the instructions carefully. Home-made preparation gave good results when dissolved in water at a concentration of 1 part 2,4-D to 1000 parts of water by weight (1/10 of one per cent).

After using a sprayer for 2,4-D, the same sprayer should not be used for ornamental plants or garden crops.
LITERATURE CITED

1. New York State Agricultural Experiment Station—Progress Report No. 6381, Dec. 1, 1945.


4. "2,4-D Carbowax Mixture." Mimeographed material, April 16, 1945.

ACKNOWLEDGMENT

Acknowledgment is made to the United States Department of Agriculture, Bureau of Plant Industry, for their cooperation in furnishing the 2,4-D-Carbowax mixture used in the experiment herein reported.
The following publications of the Wyoming Experiment Station may be had upon request: (Revised list, January, 1946.)

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