

Iowa Reports on Summer Tests of 2,4-D

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WEEDS got a fatal dose with the discovery and use of the 2,4-D (2,4 dichlorophenoxyacetic acid) and related compounds. Discovered and reported upon in these columns and elsewhere, 2,4-D was given considerable publicity as a herbicide in the fall and winter of 1944. The reported results as to the preliminary experiments were so overwhelming as to lead some of us to wonder whether 2,4-D was not too good to be true. Rather extensive experiments conducted in 1945 at Ames, Iowa on the Turf Garden and on the fairways of a local golf course largely confirm the conclusions which were reached and published upon during the latter part of last year.

The following is a brief report of the experimental work done at Ames, Iowa this past season.

The 2,4-D formulations used for this experiment were as follows:

DuPont IN6065	a concentrate
DuPont IN4311-A9	a concentrate
DuPont IN6065-A7	a diluted form
DuPont IN6065-A9	a diluted form plus ammonium sulfamate
Carbowax-2,4-D	
Dow A510	
Ammate (Ammonium sulfamate)	

Plan of the Experiments

During spring and early summer rainfall was excessive. Cool weather prevailed until the middle of June. Since it was recommended that 2,4-D applications be made when the temperature was 70°F. or over, the initial plot sprays were not made until June 11. A second group of plots was sprayed June 22.

The preliminary test plots were 5 X 120 feet; 600 sq. ft. and designed to fit the 3 gallon knapsack pressure sprayers which were used. Three gallons of solution were sprayed on each of the plots so as to conform to the rate of application recommended which was five gallons per 1000 sq. ft.

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Twenty plots were sprayed in the June experiments with one plot in the center being left as a check. The areas outside of the plots were also regarded as check plots. The plots were arranged side by side on No. 2 fairway of a local golf club. The turf was close-clipped and heavily invaded with dandelions and a few broad-leaf plantain. The dandelion population varied, but in many parts of this fairway there were 5 to 15 dandelions per square foot. The dandelions had been blooming for about four weeks and were a source of great annoyance to the golfers. There was also a considerable amount of white clover and the blossoms were very objectionable.

The plan of the experiment was to apply the minimum concentrations of each formulation as recommended by the manufacturer on one set of plots. On another

Dilutions
.1 and .2%
.125 and .25%
1. and 2%
6. and 3%
.1%
.15%
½ lb. and
1/3 lb. per gal.

set of plots, the dilutions applied were double the minimum. For example, DuPont IN6065 was applied at .1 per cent and at .2 per cent and so on throughout the DuPont series of formulations. The other 2,4-D formulations were used at the concentrations recommended, except in Weedone which was diluted 1 gallon to 100 gallons instead of 1 to 60.

Weed Reactions Pronounced

Weed reactions to the spray were pronounced within 24 hours following the application and after 48 hours the dandelions showed greatly accelerated growth. The leaves assumed a more or less upright position as compared with the untreated plants, the blossom stems became twisted, turned and bent into unnatural positions, and within a week the foliage took on a purplish brown coloring, began to droop, and the flower buds did not expand and

open thereafter. In about three to four weeks, practically all dandelion plants had disappeared leaving only their blackened and disintegrated remains.

Plantain reacted in a less spectacular manner, but all treated plants died completely. White clover showed a definite amount of injury, was thinned out, and has not bloomed since the sprays were applied. The bluegrass was not injured. In fact, bluegrass appeared to be of darker green color than the untreated grass in the checks.

As to the varying dilutions, there were no appreciable differences in the reactions of the weeds nor in the rate and completeness of the kill. Under the conditions of this experiment, the minimum concentrations produced the same results as double the minimum concentrations.

The formulation, DuPont IN6065-A9 which contains ammonium sulfamate applied in a 6 per cent solution did excessive damage to the bluegrass and failed to kill as large a percentage of dandelions as were killed by the 2,4-D formulations. This formulation probably has no place in the dandelion control problem on the fairway. We did use it, however, along the fence where there were numerous rag and giant rag weeds, and with excellent results. This suggests its possible value for the control of large weeds which are often a real nuisance along the fences, in

the creeks, and roughs where mowing is difficult.

Ammate (ammonium sulfamate) at $\frac{1}{2}$ lb. per gallon killed too much of the short clipped bluegrass and gave only a fair kill of the dandelions. We found Ammate to be valuable in killing poison ivy in the fence rows and also the coarse weeds which often thrive along the fences.

Minimum Dilutions Effective

The June treatments with 2,4-D gave close to 100 per cent kill of dandelions and plantain, and the minimum dilutions were as effective as the double strength dilutions. Furthermore, it soon became apparent that on the close-clipped fairways that three gallons or less were sufficient to give a thorough coverage on 1,000 sq. ft.

The June spray applications were the clue to procedures for larger scale applications which followed on August 8 and September 4 and 5. A 50-gallon power sprayer was rigged up with a 10-ft. 6-nozzle boom which delivered a fine mist of spray materials at the rate of $2\frac{1}{2}$ gallons per minute at 275 lbs. pressure.

Partly by design and partly by accident, the areas sprayed on August 8 varied in size per 50 gallons of spray materials applied as shown in the following table:

Formulation	Dilution per 50 gallon	Area sprayed
Fairway No. 1		
Dow A510	$\frac{5}{8}$ lb.	33,000 sq. ft.
Weedone	2 qts.	26,000 sq. ft.
Fairway No. 2		
Dow A510	$\frac{5}{8}$ lb.	25,000 sq. ft.
DuPont IN6065	.4 lb.	23,000 sq. ft.
DuPont IN6065-A7	4. lbs.	40,000 sq. ft.

In each of the above plots, there was no discernible difference in the rate of kill nor in the total kill of dandelions. At the end of two weeks the entire areas covered by each of the 2,4-D applications were practically free of weeds. The population of dandelions varied somewhat, but the entire area was badly infested.

On September 4 and 5, spray applications were made on the remaining portions of Fairways 2 and over into Fairway 4 which ran parallel to Fairway 2.

over the area. The areas sprayed per 50 gallons varied in size from 25,000 sq. ft. to 56,400 sq. ft. It was observed that a fine dew-like mist covered the dandelion

Formulation	Dilution per 50 gallon		Area sprayed
DuPont IN6065	.4 lb.	.1%	25,000
DuPont IN4311-A9	.5 lb.	.125%	25,000
DuPont IN6065-A7	.4 lb.	1.0%	31,200
DuPont IN4311-A9	.5 lb.	.125%	39,600
DuPont IN6065	.4 lb.	.1%	56,400
DuPont IN6065-A7	.2 lb.	.5%	45,600
DuPont IN4311-A9	.5 lb.	.125%	50,400

On each of the above plots, 50 gallons of the 2,4-D spray material was applied. The variation in the size of the plots covered was due entirely to different rates of speed at which the sprayer was driven

foliage even when the sprayer was moving at a speed as to allow a 50-gallon tank to cover 56,000 sq. ft. of area.

Within 24 hrs., the dandelions in all
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of the plots showed an acceleration of growth. This was followed by bending and twisting and a purpling of the leaves. On October 12 the dandelions were flattened out and practically all dead on all of the plots regardless of size which is a most surprising result for it showed that under the conditions of this experiment the hormone sprays when applied at the remarkably low rate of one gallon per thousand square feet did as good a job of killing dandelions as when applied at two gallons per thousand square feet.

The rate of application as is indicated by our results, then might conceivably be as low as 40 or 50 gallons per acre, provided, however, that the spray be delivered in the form of a fog-like mist.

By the middle of October there was a very marked improvement in the quality and density of the turf on those plots which were sprayed on August 8. The bluegrass was darker in color than that in the unsprayed areas, and the turf had thickened up considerably. This improved condition is likely due to the removal of weed competition. The grass now gets the available soil moisture and plant food materials which it formerly had to share with the weeds.

2,4-D for the Future?

The 2,4-D formulations with the single exception of DuPont IN6065-A9, in our judgment, produced similar results in

weed kill. Weedone, Dow A510, and Carbowax-2,4-D compared favorably with the DuPont formulations. All of these preparations go into solution or suspension very readily. Tap water from the City of Ames was used throughout these experiments. The City of Ames uses a water softener and the water is regarded as soft.

Results last year at Ames confirm the results of 1944 as reported by Davis, Mitchell, Marth, and others. The fact that the bluegrass has shown no injury is without parallel in the history of weed killing. According to *Timely Turf Topics*, August, 1945, issue, results in many states are similar to those secured in Iowa. It appears that 2,4-D is a real contribution to our list of weed killers and that it is exceedingly well adapted to the control of weeds on the fairways of golf courses. It is pleasant to use, is non-corrosive to machinery, and apparently harmless to man.

In 1946, 2,4-D will, in all likelihood, be ready for the market. A number of chemical companies are already manufacturing 2,4-D in one or more of its several formulations.

The method of application, pending other developments, will be by spraying. The dilution and the rate of application will be determined by the manufacturer.

In a good many cases, weed killing will

Iowa Greenkeepers meet at Iowa State college, Ames, to discuss postwar maintenance. With H. L. Lantz, asst., research prof., the greenkeepers inspected turf experimental station work on various bent strains, fertilizing, fungicides and weed control.



necessarily have to be supplemented by the adoption of a fertilizer program to fit the needs of the soil and the condition of the turf.

It should also be remembered that the fairway soil is well seeded with weed seeds. One 2,4-D spray in the forepart of the season will clean up a fairway nicely for that year. In the crabgrass area an early application of the herbicide may open up the turf and lead to a serious infestation of crabgrass later on. The second year, new weeds may appear in such numbers as to make it desirable to repeat the spraying program and this may be true for a number of years, or until the turf has reached a desirable density and the weed population is no longer troublesome. Dr. O. J. Noer stated the case very nicely in August GOLFDOM and indicated the need of considering a fertilizer program which should go right along with the weed-killing program.

In reporting the results of these 2,4-D experiments, it is neither the intention to imply that the use of hormone herbicides is the one and only best method of controlling weeds on golf courses nor is it intended to infer that the 2,4-D compounds are superior to other herbicides that have been in more or less common use for some years. We are simply reporting one summer of experiences. The results were overwhelmingly good.

It should be stated that the season in Iowa was comparatively cool and that the rainfall was abundant throughout the growing season. Weeds were green and succulent and likely prime for killing with the hormone sprays. Whether the same good results which followed the applications of 1945 would, for example, follow in a season when the temperatures were high and rainfall deficient remains to be determined. Perhaps that question has been answered this past year in states where rainfall was not abundant.

CHECKS 2,4-D TESTS.—Malcolm MacLaren, supt., and Franklin L. Miller, green chmn., Canterbury GC, Cleveland, where the 1946 National Open will be played, have had Cleveland district greenkeepers greatly interested in their experimental plots on 2,4-D. Charts have been carefully maintained on applications of the various 2,4-D preparations, and results. Tests were begun June 27 and continued through Sept. 11.

Experimental plots were in strips on fairways with check plots adjacent in every instance.

Of the general results of the tests Miller comments:

"The arrangement of the testing plots was made so periodic applications could be most easily observed. The tests were made on one of our regular fairways, the grass being chiefly blue grass, with a sprinkling of Astoria bent. The last application, made on September 11, had the dandelions in the first stages of wilting, but not much damage to clover. There was no effect on the grasses. In the application made on September 5, the dandelions were badly wilted and the clover almost completely eradicated. There was a slight discoloration of the grasses. In the application made on August 14 no clover was left in these spots, and only holes where dandelion roots had been. The grasses were completely back to their normal state. The application made on June 27 showed more dandelions than when the application was made, which probably means that they were new ones that had started from seed this year. The plots on which the four applications were made were completely free of clover and weeds. The grasses had a slight burn, but were in good playable condition.

Garard Elected Western GA President

Western GA at its annual meeting selected James L. Garard, Winnetka, Ill., as its president for 1946.

Other officers named: Leon G. Kranz, Northwestern university; Jerome P. Bowes, Jr., Chicago; and Maynard G. Fessenden, Oak Park, Ill., v.p.s.; Charles Evans, Jr., Chicago, and J. Leslie Rollins, Harvard university, Honorary v.p.s.; Roy W. Walholm Winnetka, Ill., sec.; Cameron Eddy, Evanston, Ill. treas.; Carleton Blunt Winnetka, Ill., Counsel.

Directors for the forthcoming year include all the officers other than the honorary v.p.s., and Joseph M. Batchelder, Boston; Bing Crosby, Hollywood; T. P. Hefelfinger, Minneapolis; Gordon Kummer, Milwaukee; Martin Morrison, Cleveland; John G. Searle, Winnetka; Stuart Smithson, Evanston; Thomas J. Walsh, Chicago; and T. C. Butz, Highland Park, Ill.

Pres. Garard, recently in the Navy as a Lt.-Comdr., announced resumption of the Western's tournaments next summer. Sites and dates are to be announced later. The Association's scholarship fund now is \$60,000. Sixty-one former caddies have received a college education at Northwestern university through awards made by the fund on a competitive basis. The WGA is planning to establish similar scholarships at other universities throughout the country.