

2,4-D Questions Answered by Field and Lab. Tests

By DR. PAUL C. MARTH*

At the Beltsville experiment station we have been working in the plant hormone section on a wide list of compounds; anything that we can get hold of that may have possibilities of growth-regulating properties in plants. Weed killing is one of the exponents that we are continually looking for.

Today we have not found a compound that is superior, among all these chemicals that have growth-regulating properties, to 2, 4-D. We hope that there will be a compound a little more wide in its range, a little more selective in its action, especially with the bent grasses. But now 2, 4-D is the representative herbicide of this plant-regulating type. There are other herbicides which have come forth, which show considerable promise, but they are not growth regulators.

For weeds that are relatively easy to kill, I don't think you will find much difference in any formulation that you may be able to purchase. All our experiments are performed at Beltsville, under the conditions at Beltsville, but the acid formulation, in general, has given us somewhat better results on the weeds that are easy to kill, as well as some that are a little more difficult.

Another group are the esters. These are very potent, the most potent of the group as far as weed killing is concerned, and they will hit a wider range of plants than the other two, salts or acids.

The salts are easy to get into solution. When they are in dry form they are easy to package. It would be advantageous from that standpoint to use them in some instances. They are, however, water-soluble. The acid form, which is insoluble, relatively speaking, in water, is usually put out in a carrier and stays a longer period and in that way gives a little better weed killing. The esters seem to be a little more potent because they are put up in carrier, but they seem to be inherently a little more rigorous in their growth-regulating properties. Each form has its advantage and disadvantage.

Volatile Esters Need Watching

If I had a weedy stand of young grass, I would be inclined to use the salt form. It has less harmful action, or delaying effects on the growth of young grass. The

esters are volatile and in our region, cause some trouble. In the north parts of the country, where temperatures run moderate or low in the season you would be applying them, you might not have any difficulty as far as volatilization of the esters is concerned. In volatilization the compound is released into the air and is carried by air currents to distances that may be considerably from the point of application. For instance, we treated last fall, 3-ft. squares of sod, and planted our sensitive plants at different distances from this area. It was in our cooler season. Plants of tomato and bean that were 100 feet away were curled up and made worthless. This might have application where you are treating your golf course or where it extends near to the place where you would have flower plants or a vegetable garden, or even sensitive trees for that matter.

We have been interested in the development of grass following application of 2, 4-D. We realize that where 2, 4-D did not seem to have a really rigorous and retarding effect on grass, it did have some effect and we thought it to be desirable to overcome this retarding effect. Recently, we have been working with dry mixes of 2, 4-D, mixed in the recommended fertilizer—the amount that you would give a sod area; using a 10-6-4 complete fertilizer and including amounts of 2, 4-D in the mixture, we have applied this 3 seasons of the year, spring, summer and fall. Rates of application have been 1½ pounds, 3, 6 and 9 pounds of 2, 4-D in 600 pounds of fertilizer, per acre.

Fall application of 2, 4-D in fertilizer has been as low as a pound and a half, and has given excellent control of many weeds such as dandelions and clover. They have been killed fairly well even at 1½ pounds. A 3-, 6-, and 9-pound, fall application has not had a retarding effect on the grass, that we could pick up by measuring the clipping weights.

The 6- and 9-pound applications have given a perfect clean-up in our plots, but we do not feel that it would be safe to use that strong an amount over a period of years.

With spring applications, put on early in the spring, we had fair control at 1½ pounds and good control at 3 pounds and excellent at 6 and 9. The 6 and 9 in spring

application, however, have had a very detrimental effect on the growth of grass. In fact, the grass foliage did not come out normally; it was very long and drawn out, like a toothpick.

Temperature A Governing Factor

We applied some applications in summer in connection with another experiment, not because we thought it was the desirable time to fertilize a lawn, but to get a reading on 2, 4-D at the different season. Summer applications of 2, 4-D of the same mixture that we had been using previously, failed to kill the weeds. It killed the grass. So temperature and other factors, as Dr. DeFrance has pointed out, are important.

We have been working with those factors. What causes the persistence or lack of persistence in soils? Much of this work has been done in laboratories. We have been able to chalk up as far as they will let us in the field, but a lot of our control experiments have been in the greenhouse and under controlled temperature conditions. Temperature itself is one of the big factors. Many of these factors are interrelated. Temperature alone has an effect. Moisture is one of the big factors, especially to the salts. We work with soils of varying organic content and we have found organic matter, itself, has a pronounced effect on how long 2, 4-D persists in the soil.

Tie-up With Soil Organisms

These factors all tie up, to some extent, to soil organisms. Working with sterilized soil, we found that the soil organisms themselves are one of the big factors in determining how long 2, 4-D persists in the soil. Fortunately, under field conditions, your soil flora is rather active. There is also a tie-up with the soil fertility. It is again working through the soil microbes, presumably. That is, soil of low fertility has, in general, greater ability to hold the 2, 4-D longer than soil of high mineral content.

Aside from all these factors, there is the direct effect of the soil particles themselves. 2, 4-D is absorbed directly into the film that surrounds the soil particle. Much of the 2, 4-D that is absorbed that way is not available to the plant, because we can plant plants in that soil and they will not respond. But chemical analysis shows that 2, 4-D that is held bound to the soil particles can be freed. We are not too much concerned with it, and we do not feel it will be a factor for golf courses where we have the resistant grasses to deal with.

There is just another side issue. We have been working a little with the use of 2, 4-D in grass seed production, and we are concerned with those experiments. In some of the fall treatments we have allowed the

bluegrass seed to develop. We found the germination of grass seed produced from these plots treated with varying amounts of 2, 4-D, and from the fall treatments, was not adversely affected. There was not an adverse effect on the germination of the seed. There was an improvement in yield, free of weed seeds, which, I think, is the big point. Much of the grass seed is lost in the thinning operation that is given to remove weed seeds. These seeds, a lot of them, can be removed in the field and not get into the package that you buy. We hope this might lead to improvement in the quality of grass seed in general.

So far, we have just worked with bluegrass. We are carrying on these experiments, treating grass at different stages of development. There is a change that the flower and stalk of grass, and I think a good change, at some stages of its development, might be directly affected. We don't know yet, but these experiments are under way.

Marth Answers Questions

QUESTION: I would like to ask what results you have had with 2, 4-D with clover, under normal conditions at normal application, on fairways.

DR. MARTH: We don't have any fairways at Beltsville, but Fred Grau is going to take care of that situation pretty soon now.

PROFESSOR H. B. MUSSER: We have had very excellent clover control in the application that we made late in the fall. Our clover counts on replicated plots have shown a reduction from a start of about 25 per cent clover population down to less than 2 per cent, and that has maintained itself through an entire season. Granted, with fertilizer treatments, heavy mineral treatments and light hydrogen treatments, we do expect the clover to come back, but we believe when we get it down that low, proper treatment will very easily control it.

QUESTION: How would you differentiate between the volatile gases that are evolved from the esters and the spray that might have drifted at the time of application?

DR. MARTH: Our sprayers were put on in some of these control experiments, using a guard around a treated area to avoid spray drift. In other cases in the field we have had the effect show up, that is, using a 3-gallon sprayer, 100 ft. away. These treatments were applied in hot weather, mind you. The treatment showed on the opposite side of a house back of a 25 ft. screen of evergreens. There is no question in our minds that the material volatilizes, but also the 2, 4-D spray drift is a big factor when you are treating near

a sensitive, desirable vegetation. The esters may not give any trouble at all when used in cool weather, and we are not recommending the use of 2, 4-D in warm weather because we don't think that is the time from the standpoint of the growth of grass to recover, or the time to do the treating. If we treat in the summer we will knock out a lot of weeds, or even in the late spring, we get a heavy infestation of crab grass which is worse than the weed we started off with.

QUESTION: You mentioned applying 2, 4-D dry, with fertilizer, 600 pounds per acre; did you try to brush it in the grass or did you let it stay where it fell?

DR. MARTH: The fertilizer treatments were put on after all dew had evaporated from the grass and it was just applied dry.

QUESTION: You did not brush the grass?

DR. MARTH: No. We have applied it to the soil without touching the leaves of grass or weeds in greenhouses, and we find it is absorbed more readily into the ground than is the case when it is loose on top. Leaf applications have sometimes failed to give an effect; root applications have always given us an effect. The effect is more sustained.

QUESTION: How careful should we be of the men using the powder? Standing 10 ft. away from the spray, you can feel the effect in your nose.

DR. MARTH: The question is, what about the animal and human toxic effects? There have been quite a lot of experiments since the use of 2, 4-D has spread, on the effects on animals. Dr. Mitchell has experimented on this phase. We have had cows and sheep and we have given those animals massive doses of 2, 4-D and veterinarians have dissected the animals and tests have been run on the various parts of the animals and there have been no harmful effects as far as the livestock is concerned. One human has consumed 100 milligrams a day for 2 weeks without any adverse effects. There might be sensitivity, as you find with all individuals differing in form of allergies, but we haven't experienced those ourselves. Breathing dust, as you mention, of course, isn't too good.

GREENKEEPERS COMBINE ANNUAL NATIONAL TOURNAMENT AND PENN STATE MEETING

Annual national golf tournament of Greenkeeping Supts. Assn. of America this year will be held in conjunction with Pennsylvania Agricultural Experiment station's annual summer turf meeting at State College, Pa., Sept. 15 and 16.

The tournament has been growing as part of the GSA plan to encourage greenkeepers to take some time for playing golf in order that they may be thoroughly conversant with playing conditions.

MONDAY, SEPTEMBER 15

A.M. Golf Tournament (First round)

12:30 p.m. Luncheon, Nittany Lion Inn.

Addresses: F. F. Lininger, Director Penna. Agr. Exp. Sta. and H. R. Albrecht, Head Dept. of Agronomy

2:00 p.m. Inspection of Turf Experiments

(1) Effect of Potash on Red Fescue, Kentucky Bluegrass and Creeping Bent—C. D. Jeffries

(2) Turf Quality Tests of Vegetated Creeping Bent Selections—H. B. Musser

(3) Turf Quality Tests of Seeded Species and Strains of Bent (Creeping, Colonial, Velvet)—H. B. Musser

(4) Species and Strain Tests for Lawn, Park, Fairway and Airport Turf—H. B. Musser

(5) Green Construction Experiment. Value of various physical conditioning materials (peat, vermiculite, etc.) used in the surface course, under different degrees of permeability of base course materials—F. G. Merkle

(6) Effect on fungicides, insecticides and herbicides on putting green bent turf—H. W. Thurston and H. B. Musser

(7) Commercial Seed Production of Creeping Red Fescue—H. B. Musser

TUESDAY, SEPTEMBER 16

A.M. GSA Golf Tournament (Second round)

Noon Luncheon, Nittany Lion Inn. Address and Award of Tournament Prizes by Carl P. Schott, Dean, School of Phys. Ed.

2:00 p.m. Inspection of Turf Experiments.

(1) Weed Control. (a) Comparisons of 2,4-D formulations on an established Kentucky Bluegrass-Red Top-White Clover turf. (b) Dry applications of clear 2,4-D acid and the sodium salt with fertilizer—H. B. Musser

(2) Fairway watering, clipping, compaction and fertilization tests—J. R. Watson, Jr.

(3) Nitrogen Availability Experiment—H. B. Musser

(4) Breeding Nurseries for Seed and Turf Production—(Red Fescue and Creeping Bent)—H. B. Musser

(5) Tests of New Fungicides—H. W. Thurston

(6) Fairway Weed Control and Aerification—J. R. Watson, Jr. and H. B. Musser

F. V. Grau, Director of USGA Green Section, also will participate in the discussions.