EXPERIMENTS IN CHEMICAL CONTROL OF GORSE.

By - Mr. A. Brodie, of Ivon Watkins
Ltd., - New Plymouth.

In 1948, the Department of Agriculture in Christchurch obtained satisfactory results on gorse seedlings and on bushes up to 2 feet in height with 2lb acid equivalent, of the ethyl ester of 2,4-D in 100 gals. of kerosene, per acre, during December. However, further reasearch along this avenue appeared to lead nowhere.

Very promising results were reported from America from the application of a mixture of 2,4-D and 2,4,4-T on brush wood. 2,4-D is very effective on some woody species, as for instance willows and poplars, and on the other hand, 2,4,5-T proves active in the control of brambles, manuka, briars, and a number of other woody growths. U.S.A. Trials reveal that a combination of 2,4-D and 2,4,5-T was giving excellent control of brush wood and some tree species which were more-or-less resistant to either of these two chemicals alone.

We decided to first manufacture experimental batches of the butoxy ethanol esters of 2,4-D and 2,4,5-T in the proportion of 1.6 and .8 lb approx. acid equivalent respectively per gallon concentrate, and also 2,4,5-T alone at 3.6 lb acid equivalent per gallon concentrate.

For the first three months trial plots were regularly laid down with varying rates of acid application per acre of both brush-killer mixture and the 2,4,5-T alone, using water and using kerosene or dieselene.

These early trials all proved only moderately successful, and we laid down 24 of these low volume trials arriving at the conclusion that for gorse, complete coverage of all above-ground plant surfaces was necessary. This called for approximately 60 gallons of spray mixture per acre for gorse up to nine or twelve inches high, and 100 gallons per acre for gorse around four feet high. Even at the higher rate it was found that great care had to be taken to moisten the whole plant surface.

One of the amazing properties of gorse is its apparent ability to survive and grow in one part while the remainder of the bush, which has been sprayed is quite dead. A gorse hedge was sprayed in November, 1949 with brush-killer mixed in the proportions $1\frac{1}{2}$ of concentrate, $8\frac{1}{2}$ of dieselene, plus 90 gallons of water per acre. The spray was applied to one side of the hedge in a very strong cross-wind. The results confirm the necessity for complete coverage to ensure complete control. They also suggest the best direction of application. If it is not possible to get around a bush to obtain complete coverage, then the best method is to apply the spray from above, under fairly high pressure through a moderate-sized nozzle. This will give the necessary penetrating momentum to the spray particles which of course under these circumstances must not be too fine.

Again this casts doubt on the success likely to be obtained in treating inaccessible hill-sides by hosing, unless the spray can be directed so as to fall more or less vertically.

We find that with the brush wand nozzles at 16" spacing, best results are obtained for a walking speed of about 2 m.p.h. by using size 59" fan-type tips, operating at 50 p.s.i. The fan nozzle gives a fairly uniform driving spray which will generally penetrate through the foliage on to the stem surfaces. With the brush wand held to one side of the operator as he walks slowly along, a very close approximation to the required 100 gallons per acre application will be obtained.

Throughout early 1949 some 30 to 40 trials were laid down on gorse, in each case using each of the following four mixtures:- 1 gallon of the butoxy ethanol ester formulation of 2,4,5-T per acre applied with 100 gallons of water per acre; 1 gallon of 2,4,5-T ester formulation mixed with dieselene alone at the rate of 50 gallons per acre; brush-killer with water alone at 100 gallons per acre; and brush-killer with Dieselene at 50 gallons per acre. Various concentrations of the acid equivalents were contained in these trials.

The size of the plots varied from 1/64th acre to half an acre, so, in all, we had a considerable area under treatment.

The gorse treated with dieselene base with each of the chemicals became brown within a week and showed very **spectacular** results. Where water was used as a carrier, two months elapsed, or even more, before the gorse turned yellow. Some four months after spraying the first differences in these plots became apparent.

The stems of plants treated with water-based sprays were dry and brittle when cut with a knife, and showed brown bark with dry wood inside, that is, no sap whatever present in the stem. On the other hand the dieselene-based sprays which appeared to give brilliant results initially, showed stems in the plots still green even **though all the foliage** was dry and brittle.

Four months of course, is not long enough for a decisive test, so we examined the results again after seven months. Gorse treated in February 1949 on examination in September 1949, that is after spring revival was possible, showed the position was similar to that after four months. Whereas we have plants up to seven feet tall treated with brush killer and water which on being dug up are found to be quite dead, roots and all, the majority of the dieselene treated subjects show fresh basal shoots.

Although many of the brush killer/dieselene treated bushes may be found completely dead, the majority of the plants are still growing in the stem with regrowth shooting away from the crown.

The reason for these differences would appear to be that Dieselene burns or injures the foliage to severely, thus destroying the ability of the bush to absorb the chemical into its system. The water-based spray on the other hand being very, very slow in action, is able to penetrate without damaging the surface tissues.

In spite of the differences between the two carriers, we continued monthly trials for a full year, and discovered that the 1949 winter applications of brush-killer with dieselene were completely satisfactory. Hence our opinion is that this mixture is only partially effective if applied during the spring, summer, or autumn, but if circumstances require, as for instance in hill-country work, the application may be made with confidence during the winter months.

The brush-killer plus water mixture was found **invariably** to give equally good results at all seasons of the year.

At the end of 1949 another important development became evident from the comparison of plots treated with brush-killer and water as compared with those treated with 2,4,5-T and water. Our monthly experiments indicated that whereas the brush-killer plots, where coverage was adequate, never showed signs of regrowth, there was always some, and usually a very perceptible amount, of regrowth in the 2,4,5-T plots. This **relationship** prevailed throughout all the comparative trials from February 1949 to July 1950.

The 2,4,5-T definitely gave a high average percentage of control, but our tests indicated that complete control can be assured with the Brush-killer mixture.

Our recommendation that gorse should preferably be treated when three feet or less in height, is based purely on the necessity of obtaining complete coverage to get maximum control.

The gorse foliage has a naturally waxy surface so that even with the addition of wetting agents a based-water spray does not readily adhere. Our belief is that the addition of a small amount of dieselene in the proportion of 1½ gallons of brush-killer, up to 8½ dieselene, plus 90 of water, will assist coverage and adhesion of the spray. It is necessary under these circumstances to mix the concentrate and dieselene first, and then add the water. This mixture should be used as soon as possible and moderate

agitation as the resulting emulsion is not very stable. The dieselene is by no means essential. Equally good results in the absence of immediate rain are obtainable with the water-based mixture which provides a stable emulsion over an indefinite standing time.

Gorse greater than three feet in height can be sprayed successfully using a power driven unit supplying one or more bush wands, so long as thorough coverage is assured.

A section of half an acre was sprayed in December, 1949 with brush-killer and water. An interesting point is that two months ago small shoots appeared at the base of the plants. However after a few weeks after appearance they died, showing that there must have been a carry-over of sap in the dead or moribund plant. This phenomenon of a temporary resurgence of growth in the spring is likely to be encountered on many occasions.

Although some farmers and contractors have treated gorse seven feet high by the spray method with success, very large quantities of water and much time are consumed. Our suggestion is that "old man" gorse be burned or better still cut and burned in the autumn. This will crack a high percentage of the buried seed which will come away with the regrowth from the burned plants. In late summer or autumn a carpet of gorse will then lend itself ready for treatment by hand or machine spraying.

Some farmers report satisfactory control on tall gorse bruised, battered, and laid low, by a long bumper bar in front of a tractor which moves over the ground, applying brush-killer mixture from a spray boom at the rear of the tractor.

Whatever method is adopted for the control of gorse, it is essential to sow bare patches and re establish a tight strong pasture by fertilizing, to choke off germination of gorse seeds. Careful stocking and possibly the use of sheep will remove the necessity for other than a little spot of spraying as a follow-up treatment.

Our programme of research in this field includes trials of new chemical forms and formulations, some of which show a distinct advance on those in current use.

QUESTIONS AND DISCUSSION

Replying to Mr. Gray (Federated Farmers) who asked about the cost of treatment, Mr. Brodie said: We know that farmers are paying £40 an acre to have gorse grubbed and cleared, but several have told me they are paying as much as £80 an acre and more to get rid of gorse. The recommendations by commercial firms are what is considered safe quantities for general conditions throughout the country, but because we suggest you use a gallon of this per acre that is not the last word. Unfortunately a few farmers find they have to use more than we recommend. Any farmer can save money if he is prepared to carry out a little research which may take six months or a year on his own type of land. He may find that he can obtain complete control at even as low as one quarter of that recommended. Given at the right conditions, the right time, and so on, a remarkable control can be obtained with very small quantities of the liquids. Costs based on commercial recommendations are likely to be higher than costs for the work done after a little research. If a farmer treats his own gorse, allowing for his own time and labour and equipment, which is inexpensive, he should be able to treat his gorse at no more than £10 per solid acre of gorse. If he does not manage his farm right he may have to go over the farm in two or three years time and wipe out the seedlings.

Mr. Gordon (Wellington): I am surprised because the experiments mentioned in Mr. Brodie's paper do not conform to a lot of experiments I have seen. I still feel that it is 2,4,5-T which does the job on gorse. When the question of cost is considered any comparison is only terms of 2,4,5-T acid. It will do a very good job on gorse and blackberry. I cannot understand, from a scientific point of view, how you get a root kill with a contact spray. Sodium chlorate can be used as a root kill, but I can't see how material such as 2,4,5-T can give a root kill unless it is translocated.

Replying to Mr. Gordon's suggestion that 1.75 lb. was a minimum quantity of 2,4,5-T to be used, MR. BRODIE said that the brush-killer mixture had only .79 of a lb. of 2,4,5-T acid per gallon.

Discussing the translocation of the hormones and their action on gorse, MR. BRODIE said: One sees gorse bushes in which 90 or 95 per cent of the bush appears to be completely dead, yet one branch which did not contact the spray is still flourishing. That appears to upset the translocation theory. It may be years before we really know what is happening; whether the chemical is translocated or is contacted as spray we have not yet found out, but we have found that the brush-killer mixture kills the gorse very satisfactorily, so you can take your choice.

DR. YEATES: There is one aspect I feel has been overlooked. We are dealing with the matter here too much as though you are going to spray solid gorse, which I think would be bad farming. The spray should be used on regrowths and scattered gorse, but only on rare occasions should be used on gorse in block. It is bad to create a wrong impression of the economic use of these weed-killers.

MR. BRODIE: You will find that most farmers with flat land will take to gorse with a plough, but the difficult problem which cannot be conquered by mechanical means is the hillside gorse.

MR. HENDERSON (Southland): On steep rocky faces and inaccessible places almost entirely given over to gorse one would have to burn the plants first.

MR. BRODIE: Burning is recommended in the autumn, partly because the bushes are more inflammable and it tends to starve the roots in winter so that regrowth in spring is weaker. In autumn the gorse is sprayed. I should imagine that the procedure would be autumn, winter, or early spring application, some resowing where necessary, and then a gradual stocking up in the early spring in the hope that the sheep will eat off the tender early shoots.

To Mr. Matthews, MR. BRODIE said: When we used dieseline as a vehicle for the hormones the results were spectacular. Within a week or a fortnight the bushes were completely brown or yellow. With the water vehicle results took two, three, or four months, to reach the same stage in appearance. The saving was merely in the weight of liquid that had to be transported. We do not recommend dieseline as a general rule.

Thanking the speaker THE CHAIRMAN said he would like to emphasise that the great problem was the gorse on land which could not be got into and not on land where implements could be used.

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