RESEARCH NOTES ON WEED CONTROL

By J. J. A. McLAUGHLIN, Imperial Chemical Industries
(N.Z.) Limited, Christchurch

SOME FACTORS INFLUENCING THE EFFECT OF 2,4,5-T ON GORSE

A rate by time trial was started in March 1953 with the objects firstly of getting information on the optimum dilution of 2,4,5-T to use to destroy gorse (*Ulex europaeus*) and secondly of relating effectiveness of the various treatments to the month of application, the age of the gorse, and its growth form.

The gorse was growing from an old fenceline on light, shingly soil. The hedge had not been maintained for many years with the result that bushes at least 20 years old were growing along with seedlings. The bushes chosen for treatment were within the 5- or 6-year-old to the 20-year-old group. The technique used was as follows: a number of bushes of gorse, at least 4 in each treatment, were sprayed as thoroughly as possible and any waste of material was avoided. The bushes were selected as being typical of the types of bushes growing in the vicinity. Dilutions used were 1 part of 2,4,5-T (as the butyl ester, containing 3.6lb. acid equivalent per gallon) in 80, 160, 240, 320, and 400 parts of water and treatments were repeated at monthly intervals throughout the year. A small spray unit with a rotary geared pump was used at 100lb. pressure per square inch.

Notes were taken on the growth form of bushes sprayed, whether previously cut or burnt, the degree of flowering at spraying time, and the age of each bush was estimated.

RESULTS

Experience had shown that the results of spraying gorse with 2,4,5-T could not be finally measured within a few years of actual treatment. This trial was no exception and in fact there were few bushes (and there were almost 300 treated) which did not show some signs of regrowth during the growing season following treatment. In some cases this regrowth died down in a few months and very weak regrowth appeared again the following spring, mainly about ground level. In some treatments this also died back. This "pendulum" action of regrowth and death of new shoots following spraying suggests an internal struggle in the plant which ends either by the bush rehabilitating itself or by its death. The key to the circumstances which favour the life or the death of the individual bush was not revealed in any definite way by this experiment as it was hoped it would be. We can perhaps because of the number of bushes treated do the next best thing by pointing to general tendencies. The answer to the problem of regrowth is surely based on the physiology of the gorse plant and a review of the results we obtained may give a lead in that direction.

It should be kept in mind that the first plots were sprayed almost 3½ years ago and the last treatments were applied almost 2½ years ago. The results now given are *averages* taken from all treatments at the particular dilutions and of course include what appear to be anomalies.

EFFECT OF DILUTION

Over the *whole* series (that is, for the 12 consecutive months) the lower dilutions of 1 : 80 and 1 : 160 have given the best results, but it will be seen that the season of the year has an important bearing on lower dilutions. The 1 : 400 dilution has been generally unsatisfactory as to mortality of the bushes and evidently did not supply the critical dose for the average bush, using the technique described above.

EFFECT OF TIME OF TREATMENT

Midsummer treatments (January) were the best for all dilutions used and those of the 1 : 80 to 1 : 320 have given similar results.

In the May, June, and July treatments the 1 : 80 and 1 : 160 dilutions have given results similar to the average of the midsummer treatments at all dilutions except the 1 : 400. Although some bushes sprayed at the 1 : 240 level are judged dead, a few too many survive to include this rate with the two higher ones in the winter treatments.

In the same way as the 1 : 400 dilution fails by close comparison with the lower dilutions in the January treatment, so does the 1 : 320 dilution suffer in the early spring (September) and late autumn (April) applications.

EFFECT OF FLOWERING

Whether the bushes were without flowers, in part flower, or in full flower had little effect on the final results.

EFFECT OF AGE OF GORSE

The age of the gorse bush seemed to be the most important determining factor on the effectiveness of 2,4,5-T. Young bushes up to say 3ft. to 4ft. in height which had not suffered any check by burning, excessive grazing, or cutting, were the most easily killed and made up the biggest proportion of those plants recorded as destroyed. Of the other bushes classified death could not consistently be related to growth form.

OTHER OBSERVATIONS

The reaction of the gorse to the various dilutions was of interest. This reaction was much quicker with the lower dilutions and regrowth was also much quicker. This led to the tentative conclusion that dilutions like 1 : 80 and 1 : 160 were less effective than the higher ones; but these conclusions had later to be modified as indicated above, as such regrowth died completely more often at these dilutions than at higher ones. The May, June, and July treatments appeared fruitless at first because barely observable reactions were noted until the following September, when almost overnight the typical responses to 2,4,5-T appeared, first on the lower-dilution plots and then less quickly on the higher-dilution ones.

Judged at the present time and taking the absence of any regrowth as the criterion, the *best treatments* appear to have given a kill of around 80 per cent. Where regrowth persists on other bushes it is still relatively small and would be difficult to spray at this stage on account of the dead foliage still present. After the lapse of another 12 months it is thought that the dead foliage will have fallen and that there will be good access to regrowth for respraying. From the user's point of view the same

thing could be said in another way: 2,4,5-T applied at the most favourable dilutions will provide control of an area of gorse for at least 2 or 3 years. After this time regrowth will require respraying, a job which will require much less material and labour than the initial treatment.

CONTROL OF HAWTHORN (*Crataegus monogyna*)

Hawthorn has become a major problem in hill country in certain areas of North Canterbury. It is very aggressive and it can establish on very thin soils so densely that other useful plants are completely excluded. Because casual farm labour is in short supply, it was thought desirable to attempt control during winter when permanent labour can be used, and the first series of trials were put down in early July 1955 as follows:—

1. Neat 2,4,5-T painted liberally on cut stumps.
2. A 50/50 mixture of 2,4,5-T and dieselene painted on to cut stumps.
3. Basal spraying with 2,4,5-T and dieselene in the ratio of 1 : 20.
4. CMU at 80lb. per acre sprayed on and around cut stumps.
5. CMU at 80lb. per acre sprayed at ground level round standing bushes.

In early November 1955 the two treatments which appeared best were those basal sprayed with 2,4,5-T and dieselene 1 : 20 and those where the cut stumps were treated with a similar mixture. The smaller, basal-sprayed bushes had not come into leaf and the above-ground portions were dead; larger bushes had come into leaf, but some had dropped them by early November and others were dropping them. At that time the root systems were still sappy. By the following March, however, the aerial parts of all these were dry and brittle and there was no suggestion of regrowth from the root systems which were found to be deteriorating.

The CMU treatments were poor by comparison, as regrowth had occurred from the cut stumps and one only uncut bush on the ground-sprayed plot showed slight marginal leaf burn.

At this time (November) a second series were treated (a) by basal spraying at the 1 : 20 2,4,5-T in diesel mixture and (b) cut stumps were painted with the same mixture; (c) cover sprays with dilutions ranging between 1 : 80 and 1 : 400.

It is too early yet to assess the results of the cover sprays, but these do not appear at all promising. Cutting and painting the stumps are so laborious that the work entailed would not have much appeal except on small areas which are to be cleared. Summer basal spraying also seems very effective. Basal spraying facilitates the treatment of large areas and allows the use of labour whenever available independently of the season of the year.

TOTAL WEED CONTROL WITH ATLACIDE

It was reported by Little and Isaacs (N.Z. Weeds Control Conference 1954) that the chlorate-type weedkillers were disappointing under high rainfall and high fertility, but there were indications that their performance was better under conditions of lower fertility.

In order to obtain information on the rate of leaching of chlorates, the importance of time of application and rates required for control of the weeds named below, a small trial was put down on a roadside not far from Christchurch with the first treatment in August 1954. The soil was deep, but of course the top few inches were covered with fine

shingle. The first application was made in August at the 3cwt., 4½cwt., and 6cwt. per acre rates to the herbage which was dominantly browntop (*Agrostis tenuis*), but also contained cocksfoot (*Dactylis glomerata*), Yorkshire fog (*Holcus lanatus*), sweet vernal (*Anthoxanthum odoratum*), and a few other weeds like sorrel (*Rumex acetosella*), and plantain (*Plantago* spp.). A close watch was kept on the area for regrowth. Plots were resprayed just as soon as new growth reached the 2in. to 3in. stage and would cause inconvenience to pedestrians in light footwear.

The 3cwt. plot required retreatment by the end of October and it was divided in two with one half receiving a further 3cwt. and the other half receiving 4½cwt. On the same day, a second series using the same rates was put down. The August 4½cwt. plot required retreatment by early December and was divided with one half receiving a further 4½cwt. and the other half 6cwt. The August plot receiving the 6cwt. treatment was showing sparse regrowth by early January and at that time it was divided with one half receiving 4½cwt. and the other half 6cwt. By this time the 3cwt. rate had been abandoned, because the August plot which was again treated at this rate in October required retreatment and 2 months' control is considered inadequate. In early January a third series was treated with 4½cwt. and 6cwt. per acre.

By late autumn the plots receiving the two applications of 4½cwt. in August and December were still good and those receiving the higher rates in August and December were virtually weed free. At this time the plot receiving its first 4½cwt. in October needed retreatment, but the 6cwt. plot treated at the same time was still satisfactory. The plots receiving the 4½cwt. and 6cwt. in January were both satisfactory by late autumn.

Observations showed that control was closely related to rate of application and did not, in this instance at least, seem to be influenced very much by the season when applications were made.

In view of this a single trial was arranged on an adjacent site, using Atlacide at the 6cwt. and 8cwt. per acre rates, in early January. The growth was mainly browntop, Yorkshire fog, twitch (*Agropyron repens*), and cocksfoot. The 8cwt. rate completely destroyed all vegetation and 12 months later the only growth was a profuse crop of seedling mouse-eared chickweed. The 6cwt. rate just failed to destroy all the perennial grasses and by the following spring the twitches were beginning to rehabilitate themselves slowly along with seedling annuals.

From the observations presented it is concluded that under the Canterbury climate at least the important consideration is dosage rate; and that a single application is more effective than the same quantity applied as a split application, because it completely destroys the perennial weeds present on the trial area. Where several applications of "sub-lethal" doses were applied the weeds showed remarkable powers of recovery, which indicates that where retreatment is done as described, the effects of chlorates are not additive.

CLOVER TOLERANCE TO THE SODIUM SALT OF MCPB

A trial was arranged at Lismore on medium-light plains land with nodding thistle (*Carduus nutans*) as the test weed. The potassium salt of MCP was used at the standard rate of ¾lb. acid equivalent per acre and the sodium salt of MCPB was used at the same strength; both were applied in 11 gallons of water per acre. The first application was made on 13 September 1955 to a pasture where subterranean clover was the dominant clover, but white clover was adequately present for that type

of country. Red clover plants were few. There was little growth in the paddock, which had been well grazed. Observations at weekly intervals after this application failed to show any setback to the clover on either treatment. Thistle control on the sodium salt of MCPB plots appeared disappointing at first, but at the end of a month it was similar for both treatments.

The farmer sprayed the balance of his paddock during the first week of October with the potassium salt of MCP at the $\frac{3}{4}$ lb. acid equivalent per acre rate without observable effect on clovers. Finally, on 18 November a second series of replicated plots were sprayed at the $\frac{3}{4}$ lb. acid equivalent per acre rate with the potassium salt of MCP and the sodium salt of MCPB and again no visible check to clovers was observable. Thistle control on this occasion was again achieved more quickly by the potassium salt of MCP but equally well by the sodium salt of MCPB in the end. A disadvantage associated with the slower kill obtained from the sodium salt of MCPB was that the ground previously occupied by the larger thistles was not recolonised before the summer dry period set in.

In contrast to this Isaacs reports from Auckland (in a private communication) a clover tolerance trial with celery leafed buttercup (*Ranunculus sceleratus*) as the test weed. The sodium salt of MCPB, the potassium salt of MCP, and the ethyl ester of 2,4-D were applied on 14 September 1955 to a pasture containing white and red clover and sown the previous autumn. The weedkillers were applied at the $\frac{1}{2}$ lb. and 1lb. acid equivalent per acre rate in 11 gallons of water.

Five days after treatment there was a marked reaction by the buttercups on all plots. At the time the ethyl ester of 2,4-D at the 1lb. acid equivalent per acre rate had caused slight burning of the clover leaves.

By 18 October 1955 the buttercups had disappeared from all plots except the sodium salt of MCPB ones, where death was not complete. On the same date the following observation was made regarding clover suppression.

Treatment	Per cent. clover suppression	
Sodium salt of MCPB	both rates	Nil
Potassium salt of MCP	$\frac{1}{2}$ lb.	20
Potassium salt of MCP	1lb.	25
Ethyl ester 2,4-D	$\frac{1}{2}$ lb.	50 to 60
Ethyl ester 2,4-D	1lb.	60

On 5 November 1955 a visitor to the trial, told of the treatments but not of their location, was able to identify each plot after inspecting the clover. He was unable, however, to separate the two plots of sodium salt of MCPB.

On 12 December 1955 only the ethyl ester 2,4-D plot at the 1lb. acid equivalent per acre rate showed clover suppression. At that time some buttercups still remained on the sodium salt of MCPB plots, indicating that insufficient of this material was applied.

COMPARISON OF THE SODIUM SALT OF MCPB AND THE POTASSIUM SALT OF MCP ON PEAS

In a sighter trial on the tolerance of Greenfeast peas both the sodium salt of MCPB and the potassium salt of MCP were used at the $\frac{1}{2}$ lb., $\frac{3}{4}$ lb., and 1lb. acid equivalent per acre rate. The peas were 4in. to 5in. high (4 nodes on the average per plant). The potassium salt of MCP at 1lb. acid equivalent per acre was far too severe, the peas were still lying flat 4 days after treatment and had a chlorotic appearance. The

sodium salt of MCPB at the 1lb. acid equivalent per acre rate and the potassium salt of MCP at the $\frac{1}{2}$ lb. acid equivalent per acre rate caused similar epinasty, but the peas recovered fairly quickly and were erect again 4 days after treatment, showing only a slight yellowing, but could be separated from untreated plots until flowering. The sodium salt of MCPB at the $\frac{3}{4}$ lb. acid equivalent per acre rate caused epinasty, but the peas had almost fully recovered 3 days after spraying, and a week after treatment appeared to be growing along with the untreated ones and could not be separated from them by eye. As a consequence of these observations a part paddock trial was then arranged, the potassium salt of MCP at $\frac{1}{2}$ lb. acid equivalent and the sodium salt of MCPB at $\frac{3}{4}$ lb. acid equivalent per acre being used. The effect on the peas was similar here to what it was on the plots; the sodium salt of MCPB was the more lenient on the peas at weedkilling rates.

Weed Control

Californian thistle (*Cirsium arvense*), fat-hen (*Chenopodium album*), cornbind (*Polygonum convolvulus*), and wireweed (*Polygonum aviculare*) were the main weeds present. The sodium salt of MCPB at $\frac{3}{4}$ lb. acid equivalent seemed equal or slightly superior to the potassium salt of MCP at $\frac{1}{2}$ lb. acid equivalent per acre on Californian thistles. Fat-hen was controlled equally well by both, but young cornbind up to 3in. to 4in. in height and wireweed with a spread of 4in. or under were more affected by the sodium salt of MCPB than by the potassium salt of MCP.

Isaacs (in a private communication) reports similar reactions of Greenfeast peas shortly before flowering and Victory Perfection peas 6in. high to the sodium salt of MCPB in Auckland, but with his test weeds wild turnip (*Brassica campestris*) and spurrey (*Spergula arvensis*) the sodium salt of MCPB at the highest rate applied, viz. $\frac{3}{4}$ lb. acid equivalent per acre, failed to control wild turnip or even to check the spurrey sufficiently to give the peas a temporary advantage in the competition for nutrients, etc. The potassium salt of MCP effectively controlled the wild turnip and checked the spurrey so severely that the peas overgrew it.

DISCUSSION

Q.—Are the results quoted from gorse trials in Canterbury or elsewhere?

A.—From a single trial in Canterbury.

Q.—After repeated spraying is there a hormone build-up in the soil to affect stock thrift?

A.—Hormones are broken down by soil organisms and repeated sprayings cause bug population build-up and more rapid dissipation.