TOLERANCE OF CLOVERS TO WEEDKILLERS

J. N. FITZGERALD, Department of Agriculture, Mosgiel.

WITH the advent of pasture spraying for the control of weeds the important point is the effect which hormone weedkillers may have on the clover content of the pasture. In many instances it has been observed that the clover plants have suffered some check in growth, but the extent of this has never been fully determined.

A series of observational trials was laid down in the 1951-52 season to study the tolerance of clovers to TCA, IPC, and the more commonly used hormone weedkillers. These were followed by a larger trial laid down in December 1952, which included the 4 species white, subterranean, broad red, and Montgomery red clovers. Treatments have been applied as pre-emergence and post-emergence. This trial is still in progress with the mature plant applications to be applied in the spring of 1953.

The material presented in this paper is from the earlier observational trials and the present trial. Montgomery red clover was included as a fourth clover in this trial, and the weedkillers were applied at the same stages of growth with identical rates being used in all cases. The clover plants in these trials were not grazed at any time.

PLANT COUNTS

Observations were made at frequent intervals on the treated plots. To supplement these the percentage of clover survival was determined by using the point analysis technique. Clover plants alone were counted, the number of hits giving a measure of the actual clover density. The point analysis counts were made approximately 10 weeks after each application. The percentage of clover survival in the treated plots was compared with the controls, which were based as being 100 per cent. These counts are to be followed by others later.

Generally the clovers showed increasing resistance with increasing age. Hodgson (1951) found this to be so when he applied 2,4-D to clovers.

Hormone Weedkillers

The hormone weedkiller treatments were:—

1. Sodium salt of MCP.
2. Butyl ester of MCP.
3. Triethylamine of 2,4-D.
4. Butyl ester of 2,4,5-T.

These were applied at 1lb. of acid equivalent per acre, and the fifth treatment was the butyl ester of 2,4,5-T at 3lb. per acre.

The times of application were:—

- (a) After the seed leaf stage.
- (b) Semi-mature plants.
- (c) Mature plants.

The earlier trials also included other related preparations which were omitted in the present trial. The effects of each treatment will be dealt with in turn.

1. Sodium salt of MCP: In all cases the application of 1lb. of acid equivalent per acre reduced the number of plants in the clover stands. The mature plant application on white clover reduced plant density by

20 per cent., this being so with two applications. Two months after the application on seedling white clover plant density was reduced by 50 per cent. Montgomery and broad red clover were similar in reaction, and applications at the seedling stage reduced plant density only by 15 per cent. and 20 per cent. respectively. However, they were less tolerant at the semi-mature stage, plant density being reduced by 25 per cent. and 40 per cent. Mature broad red clover was reduced by 30 per cent. 2 months after the application. Subterranean clover was also very susceptible at the seedling stage, but proved to be the most resistant species at the semi-mature application, plant density being reduced by only 10 per cent.

2. Butyl ester of MCP: This preparation of MCP proved to be severe on all the clover species. Seedling clovers were all reduced by 50 per cent. or more and white clover was the most susceptible at the three stages of application, the mature plants being reduced by 60 per cent. Subterranean clover showed increasing resistance, with only a 10 per cent. reduction in plant density at the semi-mature application. Montgomery and broad red clover suffered only a 25 per cent. loss at this stage, whereas white clover was reduced by 70 per cent. When the material was applied to mature broad red clover, plant density was reduced by 35 per cent.

3. Triethylamine of 2,4-D: This was the only compound of 2,4-D to be included in the second trial. Earlier trials on white and broad red clover with the triethanolamine salt of 2,4-D and the ethyl ester of 2,4-D showed that they were similar in action with severe effects on both these clover species. Applications to white clover resulted in a 50 per cent. kill of mature plants and a 60 per cent. kill of semi-mature white clover. On broad red clover there was a 60 per cent. kill on mature plants and an 85 per cent. kill on semi-mature plants. Applications of the two to subterranean clover resulted in a 40 per cent. kill of plants at the semi-mature stage.

The ethylamine of 2,4-D proved to be similar in action, and it was particularly severe at all times of application. Mature plants of white and broad red clovers were reduced in plant density by 50 per cent. and 60 per cent. respectively. Applications to semi-mature clovers caused heavy reductions of plant numbers, 90 per cent. with Montgomery and broad red clovers and 80 per cent. with white. Subterranean clover showed increased resistance with only 20 per cent. kill at this stage. At the rate of 1lb. of acid equivalent per acre, these results show the severity of the amines and esters of 2,4-D on clovers.

4. Butyl ester of 2,4,5-T: The toxicity of 2,4,5-T to most farm plants is well known, but this form of 2,4,5-T was included and applied at the two rates of 1 and 3lb. of acid equivalent, as it is the standard treatment for gorse and other brush weeds. The application of the butyl ester of 2,4,5-T at 1lb. of acid equivalent per acre on mature white and broad red clover plants resulted in only 5 per cent. survival after 7 months. Three pounds of acid equivalent per acre resulted in a complete kill of all plants at the semi-mature application, and 1lb. of acid equivalent per acre reduced all the clover by 85 to 90 per cent. after 2 months. Again subterranean clover showed slightly more resistance than the other clovers, plant density being reduced by 70 per cent. at the semi-mature stage.

TCA—sodium trichloroacetate

TCA was applied at three rates, 5, 10, and 20lb. per acre, the times of application being pre-emergence, post-emergence, and mature plants.

Clovers were found to be most susceptible to TCA as a pre-emergence treatment. Five pounds per acre of TCA as a pre-emergence treatment reduced plant density in Montgomery, broad red, and subterranean clovers by 40 per cent., and white clover by 22 per cent. The 20lb. per acre application resulted in an 86 per cent. decrease with these three clovers and 64 per cent. decrease with white clover. Post-emergence applications

showed that the clovers had gained some tolerance, especially subterranean clover, on which 20lb. per acre of TCA reduced plant density by 25 per cent. compared with 66 per cent. for Montgomery and broad red and 30 per cent. for white clover. Five pounds per acre of TCA at this stage had no effect on the plant density of white and subterranean clovers and reduced Montgomery and broad red clovers by 22 and 32 per cent. respectively. The 10lb. per acre of TCA had an effect intermediate to these two, with subterranean clover showing the most resistance.

Mature plant applications of TCA at the above rates had no visible effect 7 months after the application on white clover. With broad red clover 20lb. per acre of TCA resulted in a 40 per cent. reduction in plant density with 10lb. per acre of TCA giving only a 5 per cent. reduction.

White and subterranean clover proved to be the most tolerant of the 4 species to TCA. A characteristic effect of TCA on clovers was that the leaves of affected plants became folded, thickened, and remained that way until either the plant died or recovered. This was noted by Barrons and Hummer (1951) working with TCA on clovers and lucerne.

IPC—*isopropyl-N-phenyl-carbamate*

The rates of application for IPC were 1, 2, and 4lb. per acre and the times of application were pre-emergence, post-emergence, and mature plants.

In both seasons' trials and at all stages of application IPC was found to have no effect on the clovers. The form of IPC used in these trials contained an aromatic solvent which caused burning and wilting of the foliage. The effect was only temporary and the clover plants soon recovered to full growth. Point analysis counts were not made on these plots and at no stage of the observations could any differences be discerned between treatments and controls.

Conclusions

1. Clovers become more tolerant of weedkillers with increasing age.
2. Preparations of MCP appear to be less severe on clovers than preparations of 2,4-D.
3. 2,4,5-T is lethal to clovers at all stages of growth with rates of 1lb. of acid equivalent per acre and more.
4. Montgomery and broad red clovers show similar tolerance to hormone weedkillers and TCA.
5. Subterranean clover appears to be the most tolerant of the 4 clovers to hormone weedkillers and TCA.
6. IPC appears to have no effect on clovers at the rates applied.
7. Applications of hormone weedkillers to mature clovers resulted in appreciable reductions in the density of clover plants, the least severe being the sodium salt of MCP, which reduced white clover 20 per cent. in plant density 2 months after the application.

References

- Barrons, K. C., and Hummer, R. W. "Agricultural Chemicals" (U.S.A.) Vol. 6 (No. 6) 1951, p. 48.
Hodgson, J. M. Proc. N.W.W.C.C. (1951) p. 97.

DISCUSSION

Q. Which amine of 2,4-D was used in the trials?

A. (Fitzgerald): The triethylamine salt of 2,4-D.

Comment: Spraying of pure stands of clover is important in clover seed production.

FIG. 3