LUCERNE TOLERANCE

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SUMMARY

INVESTIGATIONS carried out in South Canterbury have shown that lucerne is highly susceptible to chemical weedkillers. They often check growth or thin out the stand. Some formulations particularly at low rates of application do not affect the crop. However, weedicides within this range may be inadequate for effective weed control. Good lucerne tolerance often means poor weed control and good weed control often means lucerne damage. Weed suppression by sowing cocksfoot or timothy with lucerne is becoming increasingly popular in South Canterbury. Under good management lucerne is tolerant to these grasses and such mixtures hold more promise in controlling weeds in lucerne than do chemicals.

Lucerne has assumed a major role in South Canterbury's farming economy both as a source of high-quality hay and as a special-purpose pasture. Efficiently managed it can play an invaluable part in enabling a farmer to maintain a high stock-carrying capacity which might otherwise be limited by periods of grass shortage. The economic value of the crop is such that the area has risen from an average of 3763 acres in the 5-year period 1946-50 to an average of 7413 acres in the 5-year period 1951-55 and is still steadily increasing. Two successive summer droughts have done much to arouse interest in the crop's potentialities, but the rate of increase has not been as great as might be expected. This can be attributed to both managerial and cultural difficulties associated with the crop.

The major managerial problems may be listed as follows:—

1. Difficulties of harvesting: for example, interference from wet weather when taking the first hay cut.
2. Seasonal labour problems: haymaking often coincides with spring cultivation, shearing, or other farm operations and competes with them for labour.
3. Contract labour problems: contract labour for mowing, baling, or cartage and stacking of bales is often not available when required.
4. Capital expenditure: large sums are required for haymaking equipment and hay barns.

Cultural problems arise in the establishment of a clean lucerne stand, and the maintenance of a weed-free stand.

Quick establishment and early production are often prevented by the smothering effects of annual weeds. As a result of this weed competition the stand is low producing for its first 18 months. Subsequently, the stand may be gradually invaded by more permanent weeds, particularly grasses and clovers. This often means a rapid fall in production after 4 to 5 years, when the crop should be at its peak production with a potentially long and useful life ahead.

Once weed invasion of a lucerne stand takes place it is extremely difficult to achieve any measure of control. Cultivation or grazing management may prolong the crop's life, but rarely accomplishes any significant increase in production.

Chemical weed control offers a possible solution to these difficulties, as many of the weeds commonly occurring in lucerne stands have proved susceptible to various weedkillers. However, when these weeds are growing in association with a susceptible crop the problem becomes one both of weed control and crop tolerance.

Past attempts at lucerne weed control had shown that the crop was often highly susceptible to weedkillers. It was obvious that before weedicide recommendations could be made with any guarantee of success more definite knowledge of the consequences of their use would have to be obtained. As a result a series of investigations to determine the extent of lucerne tolerance was initiated and is the subject of this paper.

The first series of trials carried out in South Canterbury compared the non-hormone weedkillers. These were applied in May, June, and September 1956 and January 1957 to 1-, 3-, and 4-year-old lucerne stands. The lucerne was 2in. to 4in. high at time of treatment. The following results were obtained:—

TCA at 20lb. per acre caused 50 to 80 per cent. bleaching in the leaves and stems and plant collapse after 1 to 3 weeks. Within 2 to 3 months, however, fresh regrowths from the bottom of the plants had replaced the desiccated tissue and all plots made a complete recovery. At 40lb. per acre the results were more variable and in some trials extremely severe. In the 3- and 4-year-old stands the May applications caused 100 per cent. desiccation and finally 70 to 80 per cent. lucerne death. The June spraying was followed by 6 weeks of very cold, wet conditions, and the lucerne recovered after slight burning at the tips. The September trial suffered 50 per cent. loss of chlorophyll, the upper stems and leaves collapsed, and the lucerne was retarded in growth by 2in. to 3in. When applied to a 1-year-old stand in January the same treatment was responsible for a severe check in growth, the treated area being 3in. to 4in. shorter than control. By April 20 to 30 per cent. of the plants were apparently dead.

Dalapon at 3lb. per acre caused 30 to 80 per cent. yellowing at the tips. The trials most severely affected were those laid down in May. Despite the initial setback all plots made a good recovery, with the height, colour, and density of the lucerne similar to the untreated. At 6lb. per acre dalapon was much more severe. In the May trials 60 to 80 per cent. yellowing with plant collapse occurred and this was followed by a 40 to 50 per cent. reduction in plant population. The June trial became slightly yellow and later suffered a 3in. check in growth. The spring application completely recovered after a slight depression, which included a little yellowing at the tips. Dalapon at the high rate was too severe when applied in January to a 1-year-old stand. After much yellowing in the leaves severe depression with a 10 to 20 per cent. possible mortality occurred.

Monuron at 2½lb. per acre caused intense yellowing in the upper leaves and stems, but all trials made a complete recovery after 2 to 3 months. There was no evidence that any plants had suffered adversely. At 5lb. per acre changes in plot appearance were quite spectacular. Sixty to 80 per cent. vivid yellowing occurred and this was followed by leaf collapse. Despite these initial drastic changes the lucerne in the May trials completely recovered and the June one was only slightly checked. In the September application plants suffered a 1in. to 2in. check in growth. Not all trials got off as lightly, however, as extreme lucerne damage occurred when the 5lb. rate was applied to a 1-year-old stand in January. After 80 per cent. yellowing and leaf collapse the plants wilted, gradually died out, and finally left 75 per cent. bare ground.

The sodium salt of MH at 2lb. and 4lb. MH equivalent per acre did not affect the lucerne at any stage in any trial. There was never any suggestion of colour change, reduction in height, or alteration in plant density. Similarly, crops showed good tolerance to propham at 2lb. and 6lb. per acre except in the June application, when the lucerne was severely checked in height. It is possible that the prolonged and heavy rainfall which followed the laying down of this trial leached the chemical down to a root zone level where it could do damage to the plant.

The ammonium salt of dinoseb applied at 2lb. acid equivalent per acre caused 50 to 100 per cent. yellowing and leaf wilt within 1 to 2 days. Though the weedkiller appeared particularly drastic in its action, complete recovery within 6 to 8 weeks took place in all trials. As with all other contact weedicides the one used was not translocated into the roots and therefore did not kill the plants.

A second series of trials laid down on 3-, 4-, and 5-year-old stands in May, June, and September 1956 and March 1957 compared the effects of the hormone weedkillers. As in the previous series the lucerne was 2in. to 4in. high at time of treatment.

The potassium salt of MCPA applied at 1lb. acid equivalent per acre caused 80 to 100 per cent. severe distortion and wilting, usually within 24 hours. Plants turned parallel to the ground and became a whitish green. After 4 to 6 weeks, 90 to 100 per cent. of lucerne had been killed in all trials.

The sodium salt of MCPB applied at $\frac{1}{2}$ lb. and 1lb. acid equivalent per acre caused 25 to 80 per cent. distortion and wilting within 1 to 2 weeks. The trials least affected were those applied in June and one of the May treatments. Despite the severity of the early symptoms, the lucerne made a good recovery in all plots. The same hormone applied at 2lb. acid equivalent per acre was much more severe. Sixty to 100 per cent. severe distortion, wilting, and plant collapse occurred, and this was followed by a 25 to 30 per cent. thinning out of the crop.

The sodium salt of 2,4-DB applied at $\frac{1}{2}$ lb. acid equivalent per acre on a 7-year-old lucerne stand last March did not affect the crop. The same hormone applied at 1lb. acid equivalent per acre caused slight distortion only, but it is too early to evaluate the final results.

The butyl ester of 2,4-DB was much more severe in its action than the sodium salt, though results were rather variable. At 1lb. acid equivalent per acre one of the May trials showed no apparent ill-effects but in another 60 per cent. of the plants became wilted and bleached. After 3 to 4 weeks the latter recovered in appearance, but were retarded in growth by 3in. to 6in. The June trial showed no detrimental effects at any stage, but the September one had 50 per cent. severe distortion and wilting within 2 to 3 weeks. Unlike the second May trial there was no reduction in height, but at the final inspection there had been a 10 to 20 per cent. thinning out of plants. The same treatment applied in March 1957 caused 80 per cent. distortion and wilting. At 2lb. acid equivalent per acre the butyl ester of 2,4-DB was usually far too severe on the crop. Though it did not affect lucerne in the June trial, it is likely that the low temperatures and wet conditions prevailing at the time played an important part. When applied in May this treatment caused 70 per cent. distortion and wilting with some bleaching and plant collapse. After a further 3 to 4 weeks 50 per cent. kill of lucerne had taken place. The September trial had 80 per cent. of plants distorted and wilting shortly after application. Within 2 to 3 weeks the lucerne

was thinned out 20 per cent. and the remainder retarded in growth. The March 1957 application caused 100 per cent. distortion and wilting within 2 to 3 days, but it is too early to evaluate the final results.

The final series of trials compared the hormone weedkillers on crops of immature lucerne.

The first trial compared the sodium salt of MCPB with the sodium salt of 2,4-DB. Both weedicides were applied early in April 1957 at $\frac{1}{2}$ lb. and 1 lb. acid equivalent per acre to a 6-months-old stand. The lucerne was 2 in. to 4 in. high and making limited growth because of competition from speedwell (*Veronica arvensis*) and fat-hen (*Chenopodium album*). After 2 to 3 weeks moderate distortion had occurred in all plots, but their appearance in late May suggested the likelihood of a good recovery.

The second trial compared the same treatments applied in early April to a 6-weeks-old stand. At the time of application the lucerne was 2 in. to 3 in. high and growing quite vigorously under ideal conditions. At no stage was the crop affected.

The investigations have shown that caution is necessary when attempting to treat lucerne with chemical weedkillers. It is obvious from the results that though lucerne is a very susceptible crop, care in the selection of formulation and rate of application can prevent damage to the lucerne.

Of the hormone weedkillers used the sodium salt of MCPB at $\frac{1}{2}$ lb. and 1 lb. acid equivalent per acre and the sodium salt of 2,4-DB at the same rates are safe. Other hormone weedkillers are far too severe on the crop.

Lucerne treated with non-hormone weedkillers showed good tolerance to TCA at 20 lb. per acre, dalapon at 3 lb. per acre, the ammonium salt of dinoseb at 2 lb. acid equivalent per acre, and monuron at 2 $\frac{1}{2}$ lb. per acre. The 5 lb. rate of monuron is apparently not safe to use on lucerne less than 2 years old. The higher rates of TCA and dalapon caused very adverse effects and must be viewed with suspicion.

Thus the range of chemicals and the rates at which they can be used to control weeds in lucerne has been considerably narrowed. Unfortunately weedicides within this lucerne tolerance range may be inadequate for effective weed control. To sum up good lucerne tolerance often means poor weed control and good weed control often means lucerne damage.

A further complication in South Canterbury is unpredictable weather. Chemicals applied at the same times in different years often give widely different results. In both experimental and field work this tends to give a wide range of results which are difficult to evaluate. From this it follows that there is little reliable local information available for making chemical weed control recommendations on a field scale.

Because of the difficulties involved in striking a happy medium between crop tolerance and weed control there has been a tendency to try and eliminate weeds in lucerne by other means than chemical. Such methods involve sowing a companion grass such as cocksfoot or timothy with the lucerne. As the latter is slow to establish and forms a weak crown, it is liable to be smothered by the more vigorous component of the sward. However, by carefully adjusting the sowing rates of the two species, sufficient grass can be established to suppress weeds and yet be insufficient to cause undue competition with the lucerne. The rates per acre most commonly recommended are 12 lb. of lucerne plus 1 $\frac{1}{2}$ to 2 lb. of either cocksfoot or timothy. Even at these recommended sowing rates the grass can become too aggressive after establishment. The worst offender in this respect is cocksfoot, which because of its tendency to form a dense crown is liable to smother and cause a gradual thinning out of the legume.

In spite of this tendency a good lucerne/grass balance can be maintained by heavily grazing the dominant species in winter and early spring when the lucerne is dormant. Under good management a well-balanced, high-producing sward suitable for both hay and grazing can be maintained almost weed free for a considerable number of years.

Field experience in South Canterbury to date would indicate that suitable lucerne/grass mixtures hold more promise as a means of controlling weeds in lucerne than do chemicals.

DISCUSSION

Q.—Are oats sown with lucerne a satisfactory nurse crop?

A.—Oats are too vigorous and give too much competition. They are often oversown into lucerne and the crop cut for silage in spring.

Q.—2,4-DB applied May and June is not considered the best time to apply weed control chemicals for weed control in lucerne.

A.—The trials were mainly to gauge the effect on lucerne and not on the weeds.

Q.—Has any trouble been experienced in establishing lucerne in sorrel (*Rumex* spp) infested country?

A.—Summer fallows carried out in South Canterbury give good control and no trouble is experienced from this weed.

Q.—In the cocksfoot-lucerne mixtures is the cocksfoot sown in 7in. or 14in. rows?

A.—The mixture of lucerne and cocksfoot is sown together in the one drill and rows are 3½in. apart.

Q.—What is the experience of broadcasting lucerne with a view to obtaining a better initial ground cover to control weeds and at what rate should it be sown?

A.—Broadcasting of lucerne is not recommended. It should be drilled with fertiliser about November and preferably through 3½in. coulters at 12lb. to 15lb. per acre.