WEED CONTROL IN LUCERNE

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LUCERNE has become established as one of the chief fodder crops grown in New Zealand. It can be grown on practically all types of well-drained soils, and a well-established stand can produce up to 5 tons or more of highly nutritious hay in a season. However, as a perennial crop lucerne is not well fitted to combat weeds owing to the relatively slow growth of the seedlings and the long dormant period during winter. For this reason where lucerne is to be established the land should be as free as it is possible to make it from annual weeds and particularly twitches. Hence the practice of sowing cleaning crops such as potatoes, green-feed, or root crops to get the ground in good condition before sowing.

Many agriculturists in New Zealand today would like to see farmers increase the area in lucerne on their farms, but the fact is that weed problems in many districts are stopping the increase in the acreage of this crop. It is difficult and expensive to establish and many farmers are disappointed when the life of their stands is shortened considerably by the ingress of weeds.

WEED GROWTH IN LUCERNE

Weeds which seriously curtail the life of a lucerne stand are the grassy-type weeds. These are mainly browntop, ryegrass, cocksfoot, Yorkshire fog, *Poa annua*, etc., all of which make volunteer growth and compete with the lucerne for the soil moisture and nutrients. A high-producing stand of lucerne can become run out in 2 to 3 years due to vigorous grass growth, with a big reduction in the quantity and quality of the hay produced.

Broad-leaved and annual weeds such as fat-hen (*Chenopodium album*) and spurrey (*Spergula arvensis*) are usually serious in the period after germination, as also are perennial weeds arising from root regrowths, for example, Californian thistle (*Cirsium arvense*), docks (*Rumex* spp.), and couch grasses (twitch). The broad-leaved annuals are reduced by the repeated mowings of the crop, but they do heavy initial damage by smothering lucerne seedlings. In some localities particular weed problems arise; for instance, storksbill (*Erodium cicutarium*) is a common weed in lucerne stands in Central Otago. Lucerne on heavy land, for example, Taieri Plain, is often infested with the common daisy (*Bellis perennis*).

CULTIVATION TREATMENTS

In the past farmers tried to check weed growth, particularly grasses, by cultivating lucerne paddocks. Some control can be obtained by grubbing the area, but the result is only temporary and it can be said that cultivation often aids the grass as well as the lucerne. Cultivation is generally inadvisable in dry districts as the operation usually causes considerable damage to the lucerne plants and thins the stand.

CHEMICAL CONTROL

(a) Grassy Weeds in Established Lucerne Stands

(i) **TCA and IPC:** Trial work with these materials on lucerne was done previously and is published in "The New Zealand Journal of Agriculture" (1). Results of these trials showed that lucerne could tolerate

very high rates of TCA and IPC without being killed out, though hay production was substantially reduced. Moreover, it was shown that mature lucerne could tolerate TCA and IPC applied at rates sufficient to kill strong-growing perennial and annual grasses without any adverse effects. Time of application proved to be important; some foliage burn was observed where treatments were applied on lucerne showing rapid growth after the first cut. As TCA and IPC act primarily by being absorbed by the root systems of plants, applications were made in the winter dormant period. This gave no foliage burn, as the lucerne was showing no young growth and also it ensured that sufficient rain had fallen to taken the TCA and IPC down to the rooting zone. Annual grasses germinating in spring were quickly controlled. Rates of TCA employed in these trials were 5, 10, 20, 40, and 80lb. per acre. Best control of perennial grasses, browntop, and ryegrass was obtained with the 20lb. and over per acre applications. The 20lb. per acre treatment caused a slight decrease in hay yield, from 5 to 10 per cent. less than the control in the first cut compared with the control, with no difference from control in the second cut. TCA at 40lb. per acre gave a big decrease in the hay yield from the first cut, with no effect in the second cut. Observations from these trials showed that mature lucerne would tolerate 20 to 30lb. per acre of TCA with only a slight check to the lucerne in the first cut, a rate of application sufficient for the control of most perennial grasses.

Rates of IPC used in trials were 1, 2, 4, 8, and 16lb. per acre. It was found that lucerne could tolerate up to 4lb. per acre with only a slight growth check in the first cut. Four pounds per acre was found to be sufficient for grass control and the recommended rate would be 3 to 4lb. per acre applied during the winter months when the lucerne was dormant.

(ii) **Dalapon:** The physiological response of plants to Dalapon is similar in many respects to the response to TCA. Its main difference from TCA is that it is actively absorbed and translocated by living grass foliage, whereas TCA is absorbed and poorly translocated. Also Dalapon is absorbed to some extent by roots following soil application. These facts pointed to its being a chemical useful for controlling grassy weeds in lucerne. Being directly absorbed by the foliage and translocated it would give a more rapid kill and probably a surer kill than TCA, which has to be absorbed from the soil into the rooting system to give reasonable control. However, like TCA when applied at relatively high rates it causes a foliage burn, which is believed to be distinct from the systemic growth regulator effect and also may reduce systemic activity. This foliage burn effect limits its use on lucerne, as reductions in hay yield result. Best results are obtained by applying Dalapon on the actively growing grasses. This, however, unfortunately coincides with the most active growing period of the lucerne, that is, spring growth leading to the first cut. In an endeavour to avoid this a trial was laid down in the North Otago area in July 1955. The lucerne was in its third year and the main weed was cocksfoot, which was becoming thick between the drilled rows of lucerne. The treatments were:—

TCA 10lb. and 20lb. per acre.

Dalapon 10lb. and 20lb. per acre.

This trial was designed to give some indication of the effect of Dalapon on lucerne compared with similar rates of TCA. By the time the lucerne was ready for the first cut Dalapon at 20lb. proved to be most severe on the lucerne, it being stunted and only a third the height of the control. At the 10lb. rate the lucerne appeared to be checked to some extent, but not approaching that in the 20lb. plot. Control of cocksfoot by both treatments was excellent. TCA at 10lb. and 20lb. had no visible effect on the lucerne, though no plot weights were taken in this

trial. Cocksfoot control was good in the 20lb. per acre plot and only reasonable in the 10lb. per acre plot. This trial showed that Dalapon could be absorbed by the roots, the effect on the lucerne showing up 4 months after application.

Reports of American trials (2) show that control of grassy weeds can be obtained with application of 5lb. to 10lb. per acre of Dalapon. Trials carried out by the Department of Agriculture and reported elsewhere at this conference show that this has been done with success in New Zealand. It appears that the best time of application would be immediately after the first cut or when the lucerne makes its first spring growth, but some difficulties can be expected in the practical application. During the time lag involved from cutting to the removal of the baled hay the lucerne plants usually make rapid growth. Spraying Dalapon at that stage would cause some foliage burn. It appears that 10lb. per acre is the maximum amount that can be applied to lucerne without causing a severe growth check in the first cut. Five to 7½lb. per acre should be enough to control most grasses in lucerne.

(b) Weeds in Seedling Lucerne

(i) Pre-emergence treatments: In many areas the reason why more lucerne is not sown is because of the heavy infestation of broad-leaved weeds in seedling lucerne. Chemical control measures to combat these have been pre-emergence applications of TCA and IPC. Trials (1) were carried out with these materials at rates of 5, 10, and 20lb. per acre of TCA, and 1, 2, and 4lb. per acre of IPC. The area was particularly weedy before sowing and after sowing became infested with chickweed (*Stellaria media*), spurrey, fat-hen, shepherds purse (*Capsella bursa-pastoris*), Yorkshire fog, and other grasses. Time of sowing and application of the treatments was January and observations up to the first cut the following October were as follows.

Control in the TCA plot at 20lb. per acre was initially good, but the effect of the chemical was gone by the time of the first cut and seedling grasses were appearing in the plots. IPC at 4lb. per acre proved to be much better and the plots were weed free by the time of the first cut. IPC tends to last longer in the soil than TCA, particularly under cool temperature conditions, and for this reason it appears to be more suitable for pre-emergence treatments than TCA on lucerne. In this trial full control of chickweed, spurrey, and all grasses was obtained with the 4lb. treatment. At the 2lb. rate control was also good. At the first cut there were no yield differences between the treatments and control. Though CIPC was not used in these trials, it is thought to be just as suitable as IPC for pre-emergence spraying of lucerne and probably more suitable for the control of broad-leaved weeds.

(ii) New weedkillers: Lucerne cannot tolerate the hormone-type weedkillers, but the discovery and preparation of the gamma butyric acid group and their extreme selectivity toward clovers led to the view that they would be suitable for use on seedling lucerne for the control of broad-leaved weeds. However, trial reports from England stated that MCPB even at low rates is quite severe and it could not be recommended for use on lucerne. This has been borne out by trials laid down in New Zealand with both the sodium salt and the butoxy ethanol ester of MCPB. However, a closely related compound 2,4-DB has shown considerable promise in New Zealand trials (3). Applications of the butoxy ethanol ester of 2,4-DB to seedling lucerne gave good control of weeds with no apparent effect on the lucerne. From the yield figures obtained lucerne appears to be fairly tolerant to 2,4-DB at rates up to 1lb. acid equivalent. Times of application did not appear to influence this tolerance; these were the 2 to 3 and 3 to 6 leaf stage and 3-month-old plants.

However, the best weed control was obtained at the first two times of application. Weed control at the latter stage was virtually nil. This is understandable, as the weed growth would be vigorous at that stage and best results with the gamma butyric group on weed growth of this type have been obtained with applications of 1lb. to 2lb. acid equivalent. More work remains to be done on these new weedkillers, but they show considerable promise as a means of controlling weeds in seedling lucerne.

CONCLUSIONS

At this stage the following recommendations can be made:—

1. In established lucerne applications of 20lb. to 30lb. of TCA or 4lb. of IPC per acre applied in the winter dormant period will control most invading grasses.
2. Dalapon at 5lb. to 10lb. per acre will give control of actively growing grasses, especially browntop. Time of application needs to be when the lucerne has the minimum amount of foliage to avoid leaf burn.
3. Weeds in seedling lucerne can be controlled with IPC, CIPC, or TCA applied as pre-emergence treatments.
4. Preparations of 2,4-DB show promise in the control of weeds in seedling lucerne at rates of up to 1lb. acid equivalent per acre.

REFERENCES

1. J. N. Fitzgerald, New Zealand Journal of Agriculture, March 1955, p. 301.
2. Dow Chemical Company, Dalapon Bulletin No. 2, 1953, p. 11.
3. M. S. Foreman, private communication.

DISCUSSION

Q.—How would the speaker introduce lucerne into Manawatu sand country containing rye, white, Yorkshire fog, and lupins without ploughing?

A.—By using Dalapon at up to 20lb. per acre to remove grasses and hormone weedkillers to remove the broad leaved weeds.