CULTURAL WEED CONTROL IN LUCERNE

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Summary

Three characteristics of lucerne relevant to cultural weed control are discussed—its leguminous nature, its establishment rate, and its harvesting requirements. Throughout, the importance of developing a vigorous, competitive plant is emphasized and the effectiveness of this, in terms of weed control, is illustrated.

INTRODUCTION

THE PRINCIPLE of successful cultural weed control in lucerne is, quite simply, to employ certain features of lucerne to develop a strong, competitive plant and thus exert the most suppressive effect on the weeds.

The features of lucerne relevant to cultural weed control are:

- (1) Lucerne is a legume, thus its ability to fix atmospheric nitrogen should be exploited and its specific requirements as a legume must be met.
- (2) The lucerne seedling is slow establishing.
- (3) The growth pattern of lucerne demands a harvesting regime based on long spells and relatively quick defoliation.

LUCERNE IS A LEGUME

Lucerne has the ability to nodulate and fix atmospheric nitrogen, a feature which enables it to grow vigorously and persist in conditions where non-legumes cannot persist without additions of fertilizer nitrogen. The importance of nodulation is apparent: without it lucerne must eventually be supplied with fertilizer nitrogen. When this is done, the major competitive advantage that lucerne has as a legume is not being exploited.

The necessity to lime the soil to a pH of at least 6.0 before sowing, to achieve nodulation, has been stated, probably, hundreds of times, and yet in a recent survey of lucerne nodulation in Canterbury and North Otago, Blair (1971) found that, in over 50% of the new sowings examined, the pH was lower than 6.0. However, in only 28% of the mature stands was the pH lower than 6.0. These figures suggest that farmers are aware "lucerne needs lime" but they do not appreciate the absolute importance of getting the soil pH to acceptable levels by sowing time.

The sowing time of lucerne is important. The critically harmful effect of high soil temperatures and dry soil on rhizobia has been clearly demonstrated (Bowen and Kennedy, 1959; Soulides and Allison, 1961; Parle, 1967). Consequently, sowing into warm, dry soil does not enhance nodulation. This is relevant to both spring and autumn sowings. The effects of late spring sowing are illustrated in two trials comparing end of September with mid-November sowings at Winchmore (Tables 1 and 2).

TABLE 1: LUCERNE YIELD (kg DM/ha)

						<i>Time of Sowing</i>	
						<i>End Sep.</i>	<i>Mid-Nov.</i>
1st season	....	....	....	....	....	3,800	2,100
2nd season	....	....	....	....	....	14,000	11,900

TABLE 2: PERCENTAGE WEEDS IN CUT HERBAGE

						<i>Time of Sowing</i>	
						<i>End Sep.</i>	<i>Mid-Nov.</i>
1st Season:							
1st cut (1/2/71)	....	....	....	....	....	20	5
2nd cut (2/4/71)	....	....	....	....	....	2	8
2nd Season:							
Total of 4 cuts	....	....	....	....	....	0.5	6

These figures illustrate the fact that, while early sowing may reduce the opportunity for pre-sowing weed control cultivation, the more vigorous, competitive plants arising from early sowings soon overcome the slightly weedier seedbed and result in a cleaner, more productive crop.

Recently, Blair (1971) suggested that mineral nitrogen topdressing would be needed on a "great deal of lucerne in Canterbury . . . to ensure a reasonable duration of thrift and yield" as a result of a survey of lucerne nodulation in Canterbury and North Otago. Preliminary work at Winchmore, under two moisture regimes, indicates that topdressing well nodulated lucerne stands with fertilizer nitrogen has no effect on lucerne yield and increases weed invasion. This was observed under infrequent harvesting. It is reasonable to suppose that, as the degree of mismanagement increases, so would the effect of the nitrogen on weed invasion. A snowballing situation is envisaged where poor managers get poor nodulation and attempt to remedy it with nitrogen topdressing.

If the level of nodulation in Canterbury's lucerne is as bad as Blair (1971) states, growers need a sharp reminder on the principles of lucerne establishment. If the crop begins with faulty nodulation, weeds will surely exploit the situation.

The specific mineral requirements of lucerne as a legume must be met if the plant is to express fully its competitive ability. The high cation exchange capacity of the lucerne root system places it at a competitive disadvantage to most of the weed invaders, especially the grasses, in the absorption of anions and monovalent cations. The role of potassium (a monovalent cation) in reducing weed invasion in lucerne has been emphasized by Lobb (1967, 1969). However, in a survey of lucerne topdressing, Blair (1968) noted that in every South Island region except Nelson and Central Otago (Westland and Southland were not included) less than 10%, and in most cases less than 5% of the growers included potassium in their lucerne topdressing. The increasing acreage of lucerne being grown for processing, a system in which animal returns are generally negligible, emphasizes the need to maintain soil potassium levels if the lucerne crop is to remain vigorous and clean.

THE LUCERNE SEEDLING IS SLOW ESTABLISHING

This fact must be remembered in the management of lucerne during its establishment season.

In an irrigated trial conducted at Hinds, in mid-Canterbury, lucerne was cut at the early flower and the pre-bud stage in its establishment year; these two treatments resulted in 3 and 5 cuts, respectively, being taken in the season. The effects of these treatments were measured in the second season when all the lucerne was cut at the flower stage (Table 3).

TABLE 3: EFFECTS OF TWO CUTTING TREATMENTS

First Year Cutting Treatment	Second Year Performance 1969/70			
	Height of Lucerne 7/10/69 (cm)	Total DM (kg/ha)	Lucerne DM (kg/ha)	% Weeds
Pre-bud	34 bB	16800 bB	15000 bB	11
Early flower	45 aA	19600 aA	19300 aA	1

These results illustrate the overriding importance of correctly managing the stand in its first season. Only under a regime of infrequent harvesting will vigorous, competitive lucerne develop. Even when management is corrected in the second year, the first year's mismanagement has resulted in shorter growth, 4300 kg DM/ha less lucerne and a markedly higher weed percentage.

While frequent cutting of established stands will produce similar effects, other treatments in this same trial and work conducted at Winchmore (Janson, 1971) have shown the effects are not produced as rapidly as when first-year lucerne is harvested too frequently—i.e., management in the establishment year is of critical importance.

LUCERNE HARVESTING MUST BE RELATED TO THE GROWTH PATTERN

An understanding of lucerne's growth cycle is the cornerstone of successful cultural control of weeds in this crop. Simple accounts of its growth pattern are detailed in Langer (1968) and Janson (1971). If harvesting is fitted to this growth cycle, a very vigorous and very competitive plant develops (provided soil and climatic conditions are satisfactory) and, under these conditions, weed control is not a major problem.

The habit and growth pattern of lucerne can be powerful tools in the control of weeds during its active growth period. A combination of two factors are responsible for weed control. First, there is the dense, smothering effect of the lucerne canopy which reduces root growth and general plant size of the understorey weeds. Secondly, there is the sudden exposure, caused by cutting or hard grazing, to hot sun and desiccating winds when the weeds are in this weakened condition which has such a drastic effect on established weeds or on weed seedlings struggling to become established. When this treatment is repeated three or four times through the season, a quite remarkable degree of weed control can be achieved and the vigour of the lucerne is greatly improved.

The effectiveness of this management is illustrated by Table 4. Lucerne was sown in February 1970 into an area heavily infested with weed seeds. The area was grazed for 3 to 4 days at the time of the first two harvests; thereafter stock was not used. At no time was the lucerne subjected to heavy trampling, and no herbicides were used.

The weeds were mainly *bromus mollis* (*Bromus mollis*), *poa annua* (*Poa annua*), browntop (*Agrostis tenuis*), chickweed (*Stellaria media*),

TABLE 4: PRODUCTION OVER TWO SEASONS

Harvest Date	Lucerne (DM kg/ha)	Weeds (DM kg/ha)	% Weeds
First season:			
18/6/70	40	2940	99
12/11/70	70	2810	98
22/1/71	1660	590	26
16/3/71	2220	20	1
28/5/71	860	190	18
Second season:			
2/11/71	3205	610	16
21/12/71	3960	140	3
2/2/72	3130	25	1
30/3/72	2480	80	3

sorrel (*Rumex acetosa*) and shepherd's purse (*Capsella bursa-pastoris*) with smaller amounts of narrow-leaved plantain (*Plantago lanceolata*), dandelion (*Taraxacum officinale*), yarrow (*Achillea millefolium*) and white clover (*Trifolium repens*).

Thus a highly productive and relatively clean crop was produced from a very doubtful start in which it faced severe competition from both annual and perennial weeds. This result was achieved on a soil not well suited to lucerne (restriction of root development) and under irrigation, two factors which reduce the competitive advantage of lucerne.

Weed control measures are wasted in lucerne which is regularly cut too early or grazed for long periods with insufficient spelling, for removal of the weeds will not result in increased lucerne growth, as the misguided harvesting programme inexorably saps the vigour of the crop.

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