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# SUCCESSFUL LUCERNE GROWING IN INLAND OTAGO

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Abstract

Although lucerne substantially outproduces pasture in the 350-800 mm rainfall environment of Central Otago, the area has only been maintained in two counties – Vincent & Lake. In the third, Maniototo, the area has declined. Impeded drainage with wet seasons is considered a cause. The identification of areas suitable for lucerne establishment is aided by a soluble aluminium test of the soil and profile examination. In Central Otago pest incidence is low. and disease is only a problem on irrigated lucerne. Lenient management in the autumn and early spring will aid total production.

Keywords: establishment, soil-test, pests, disease, management.

## INTRODUCTION

The Central Otago climate is characterised by low rainfall and extremes of temperature. In this environment large areas of brown-grey earths have developed where the rainfall is below 450 mm, and between 450-900 mm yellow-grey earths (McCraw 1965). Lucerne produces well in this environment and in the 300-800 mm rainfall zone the average production advantage of dryland lucerne above pasture is 43%, while irrigated lucerne will produce only 20% more than pasture (Douglas J. 1986). Depending on rainfall, the annual yield of lucerne varies considerably from year to year. For example the annual production at a dryland site near Alexandra varied between 1.9 t DM/ha and 12.3 t DMlha over fourteen years. Irrigation reduces variability and an irrigated stand in the Maniototo produced annually between 8.9 t DMlha and 16.1 t DMlha over a 6 year period (G.G. Cossens pers comm).

In Central Otago (Lake, Vincent and Maniototo counties) the brown-grey and yellow-grey earths represent about 600,000 ha or 30% of the land area (NWASCO 1975-79), are about 70% steeplands, and have 250,000 ha suitable for lucerne establishment.

However, the area of lucerne in New Zealand has declined dramatically over the last ten years from a peak of 220,000 ha to 104,000 ha in 1985. The causes of decline which include a sequence of wet seasons, increased incidence of pests and diseases, inappropriate grazing management and increased irrigation, are relevant to Central Otago.

The total lucerne area in Central Otago declined from 32,500 ha down to 30,100 ha. In the Maniototo county the area of lucerne dropped from 22,000 ha in 1980 to 12,300 ha in 1985. In the Vincent county the lucerne has increase to 16,400 ha and in Lake county the area has been relatively static about 1200-1400 ha.

## SOIL SUITABILITY FOR LUCERNE

Although many soils of Central Otago are chemically suited to lucerne growing they can have a dense and compact subsoil (McCraw 1965), and with irrigation or in wet seasons drainage becomes impeded. It was quickly recognised that irrigated lucerne was short-lived on some soils (Tennant and Marks 1924) and stands deteriorate very quickly with disease (Brash 1985). The decline of lucerne in the Maniototo area during the early 1980s appears to be associated with high winter rainfall (G.G. Cossens pers comm). Irrigation development reduces the area of lucerne

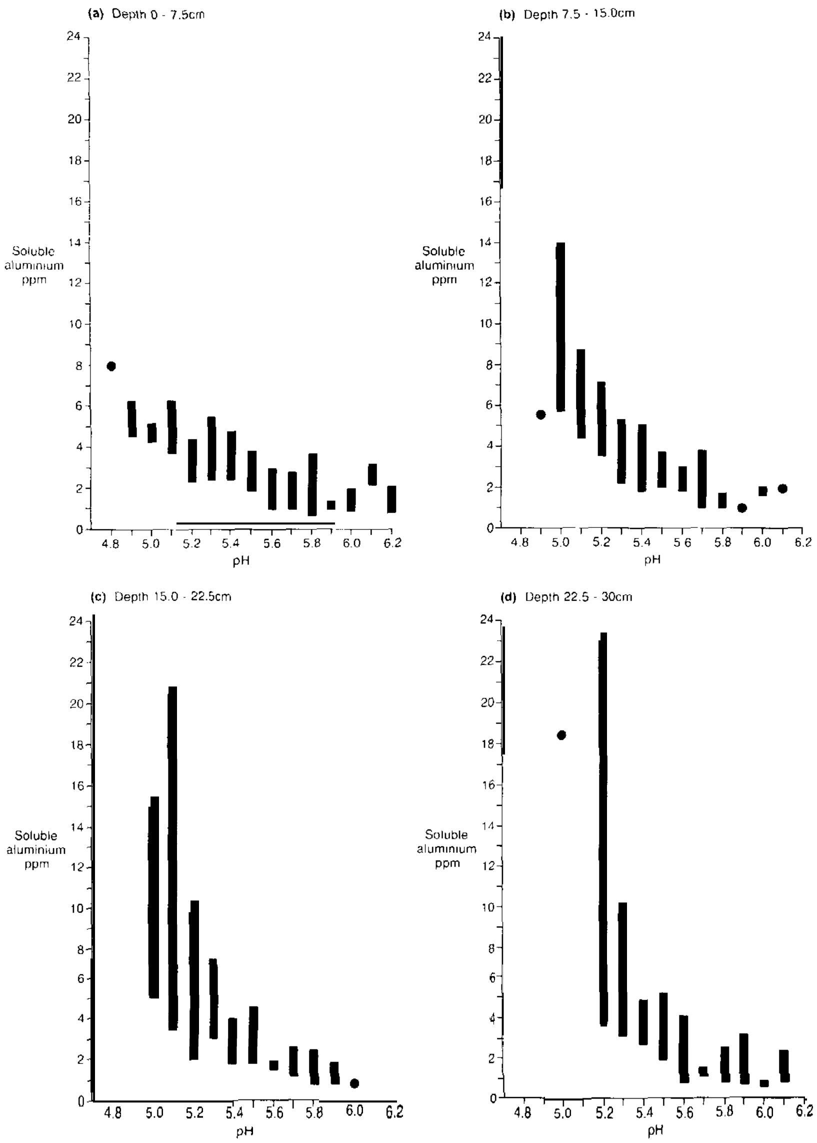


Figure 1: The range in soluble aluminium and pH levels from 68 lucerne paddocks in the Upper Waitaki River catchment, recorded from four soil sampling depths.

grown and it can be surmised that the reduced lucerne area in the Maniototo has been influenced by the development of 3850 ha of irrigation.

Soil pH, has been our guide to where lucerne should be grown. Although there is no direct relationship between soluble aluminium and pH (MacLead &Jackson 1967), (fig. 1), the latter has served by default as the indicator to the potential presence of soluble aluminium in soils. Grigg (1981) demonstrated for a wide range of South

Island soils that soluble or exchangeable aluminium levels are low above a pH of 5.8, and that levels increase with increasing acidity. Deterioration of root growth in the B horizon may be caused by aluminium toxicity and even in limed soils, soluble or exchangeable aluminium in the subsoil may restrict penetration of plant roots below the surface layers, making plants more susceptible to drought (MacLeod and Jackson 1967).

A lucerne survey in the Upper Waitaki has confirmed the presence of sub-soils antagonistic to lucerne (Douglas M. 1986). Of the 86 paddocks sampled over half the soil profiles down to 300 mm were below pH 5.6. For these soils the aluminium extracted in 0.01 m CaC12 solution was variable (Fig. 1), and there were paddocks which had similar pH profiles but very different aluminium status (Table 1). Although the profiles were below recommended pH levels for lucerne, the lucerne was only poor when the soluble aluminium levels rose above 5 ppm, and was completely lacking in vigour when above 10 ppm.

**Table 1: Soil profile analysis for pH and soluble aluminium from two paddocks of poor shallow rooted lucerne and two paddocks of high producing lucerne.**

| | POOR | | | | GOOD | | | |
|---|---|---|---|---|---|---|---|---|
| **Profile** | A | | B | | C | | D | |
| **Soil Depth mm** | pH | Al | pH | Al | pH | Al | pH | Al |
| 0-75 | 4.8 | 8.0 | 5.4 | 3.8 | 4.9 | 4.6 | 5.3 | 2.8 |
| 75.150 | 5.0 | 13.8 | 5.2 | 6.0 | 5.1 | 4.5 | 5.2 | 3.6 |
| 150.225 | 5.1 | 20.5 | 5.2 | 9.6 | 5.2 | 4.2 | 5.4 | 3.1 |
| 225.300 | 5.2 | 22.0 | 5.0 | 18.5 | 5.3 | 5.1 | 5.3 | 3.1 |

Thus, diagnosis of topsoil pH alone does not determine if lucerne will have a productive advantage over other legumes. The soluble aluminium test, in conjunction with the pH test, provides a better basis to determine if lucerne will perform on an acid soil. The soluble aluminium level can increase markedly down the profile, and thus subsoil profile sampling is necessary to ascertain if lucerne roots will develop down the profile.

High aluminium subsoils are associated with yellow-brown earths, but these can occur in Central Otago on old freely drained terraces, fans and morainic gravels in a 600 mm rainfall, more typical of a yellow-grey earth environment (McCraw 1965). Although soils may appear suitable for lucerne, in reality they are not.

## ESTABLISHMENT

Since the pioneering establishment experiments of the 1950s there have been technological advances in herbicides, drilling equipment, seed pelleting and inoculation which all improve the reliability of establishment by sod seeding (Brash et al. 1981, Douglas M. 1986).

At Tara Hills, on country too steep for machines, sheep trampling after sowing has provided successful establishment. Thus, irrespective of topography or ground conditions, there are methods to establish lucerne.

## PESTS AND DISEASES

In the late 1960s, Pottinger and Macfarlane (1967) concluded that no pests limited lucerne growth in New Zealand. They listed grass grub, white-fringed weevil and stem nematode as potentially the most serious pests. Since then blue-green lucerne aphid, pea aphid, spotted alfalfa aphid and Sitona weevil have become established. The arrival of pea and blue-green lucerne aphid in Otago caused considerable damage to lucerne in the seasons immediately after their appearance in the late 1970s. Since then infestations have not been severe except for occasional outbreaks.

Grass grub causes establishment problems in lucerne, but after about six months, plants become resistant. In many parts of Otago, two year life cycle grass grub populations can severely deplete seedling numbers after spring sowing. Control can be achieved by thorough cultivation before sowing or application of insecticides before or at the time of sowing.

Sitona weevil was first discovered in 1974 near Napier and it has now spread into most lucerne growing areas in Otago and high populations have been widely reported. Adult defoliation of lucerne in January-February can be severe, but the main concern is the larval feeding on nodules and root hairs. This problem is most serious in stands less than four years old, affecting nitrogen metabolism and water uptake of plants. At present there is no specific control for the larvae, but insecticide can be applied in mid winter to control egg-laying adults. A parasitic wasp has also been released at Middlemarch and Dunback in an attempt to obtain biological control.

Autumn-sown lucerne can be at risk from weevils which feed on the seedlings. A complete overnight loss of an apparently good strike of lucerne seedlings was reported from Middlemarch. Where possible, lucerne should be sown in the spring, or precautionary measures taken.

In general terms, the invertebrate pest problems of lucerne in Central Otago are not severe and can be managed. A greater farmer awareness of potential problems before and during the initial years after establishment would help maintain productive and persistent stands.

There are few disease problems in lucerne in Central Otago except where irrigation, high rainfall or a high water table increases the incidence of bacterial wilt, verticillium wilt and phytophthera root rot (Brash 1985). Thus, disease resistance is the most important attribute of lucerne in wetter conditions (use Washoe, WL311, WL318) whereas under dry land conditions, production is the most important attribute (use Saranac, WL318, WL311, PR524 or Wairau, Brash 1985).

## GRAZING MANAGEMENT

Inappropriate grazing management has been noted as one of the direct influences in the decline of lucerne. The effects of severe or lenient autumn and spring management on lucerne productivity were tested in the Maniototo (Table 3).

Table 2: Effect of severe (two cuts) and lenient (one cut) management in spring and autumn on annual lucerne production (kg DM/ha) at Ranfurly.

| Cutting Management | 1983-84 | 1984-85 | 1985-86 |
|---|---|---|---|
| 1. Autumn Severe/Spring Severe | 9210 | 6380 | 7340 |
| 2. Autumn Severe/Spring Lenient | 10700 | 7530 | 10320 |
| 3. Autumn Lenient/Spring Severe | 8880 | 8110 | 9340 |
| 4. Autumn Lenient/Spring Lenient | 10830 | 9265 | 12070 |
| SED | 220 | 420 | 1120 |
| Main effects yield advantage of lenient over severe management | | | |
| 1. During previous Autumn | -100 | +1730 | +1880 |
| 2. During Spring | +1720 | +1150 | +2850 |
| SED | 160 | 300 | 790 |

Severe management in spring and autumn reduces lucerne production potential and the results show that the effects can be cumulative. It is known the effects of various stress factors can be additive. Superimposing poor management on a stand under stress may cause the stand to collapse, even though the stress (disease, impeded drainage etc) alone may not cause the collapse. Managers need to be aware that the short term impact of typical practices, such as spring grazing of lucerne by ewes and lambs and autumn flushing of ewes can reduce the production and longevity of the lucerne stand.

## PLACE ON THE FARM

In Central Ctago, lucerne is used as specialist crop to provide conserved feed for winter, specific feed for lambing, lamb fattening or ewe flushing.

It appears the farming community are not willing to adopt lucerne for widespread grazing use because of the perceived difficulties of management and because of the complete autumn loss of top growth. The biggest disadvantage with lucerne as a pasture is that it has no ability to hold into the winter. Although winter blocks are often most suitable for lucerne, it does not provide a useful standing winter feed.

On such areas lucerne/grass mixtures are considered to have potential, using the lucerne nitrogen transfer to boost the grass production for winter foggage.

## CONCLUSION

As a legume for Central Otago, lucerne has great value and potential which would be hard to surpass. We are now in a position where we can recognise the soil factors which provide optimum conditions for lucerne growth and those which will limit its productivity and longevity. Central Otago includes 250,000 ha suitable for lucerne establishment. Given appropriate cultivar selection, establishment, fertiliser, ‘grazing management and pest control strategies, there are no technological problems associated with lucerne. Managers need to understand the needs of lucerne in order to capitalise on its productive advantages.

We believe greater usage of lucerne in Central Otago would benefit the region.

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