Paper 1
LUCERNE IN THE 70'S

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INTRODUCTION

Since the mid 1960's the lucerne crop has experienced many changes and in this paper we will attempt to outline the important changes in lucerne culture over the period and, where possible, their causes. Statistics can show changes in such things as areas and climate, but the factors causing changes in usage can only be surmised and consequently this is our interpretation of events.

The review is in three major parts. Statistical evidence is presented in the first part and is followed by an examination of factors which have probably influenced statistical trends. In the third section the results of a South Island lucerne survey in 1966-8 (Blair, 1971) and a national lucerne survey carried out in 1975-6 will be discussed to illustrate current management practices and stand performance.

STATISTICS

A reasonably consistent picture of changes in lucerne areas and production can be obtained from the Agricultural Production Statistics and the Certified Seed Production Statistics taken together, although all available statistics have weaknesses. The area of lucerne cut for hay and silage (Fig. 1) is the only statistic which has been collected for a long enough period to give clear trends. The area cut for hay or silage has two major weaknesses — it fluctuates considerably between seasons and it need not represent the total area because of changes in the proportion of lucerne areas used solely for grazing. However, it is apparent from Figure 1 that in the period from 1960 to the mid 1970's the area of lucerne cut for hay or silage increased consistently throughout the country, so that by 1975 it had increased by 125%. Since 1977 this trend has reversed with declines being recorded in each subsequent season.

This trend is confirmed in the total lucerne area statistics which have been available only since 1974. There has been a drop of about 20,000 ha (or 8.2, 9.7 and 10.9%) in each of the statistical years 1978, 1979 and 1980. The decline in area from the mid to the late 1970's was fairly consistent in all areas although a lesser decrease was recorded in Otago and Marlborough while the only region to increase its area was South Auckland/Bay of Plenty. The South Island had a sharper increase in the early 1970's and also a more marked decline in the late 1970's (Fig. 2).

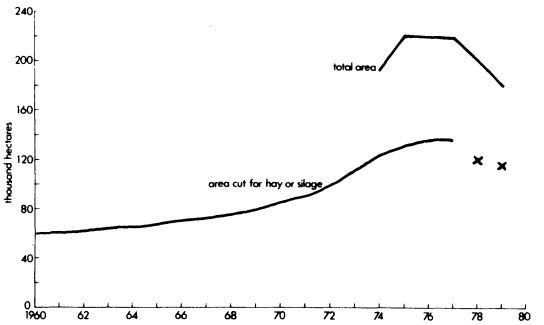

Figure 1. Area of lucerne cut for hay or silage (5 year centred moving average with actual figures for 1978 and 1979) and total area of lucerne in N.Z. 1974-1979 (N.Z. Dept. of Statistics).

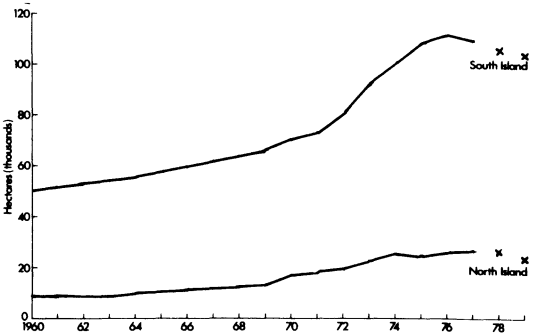

Figure 2. Area of lucerne cut for hay and silage (5 year centred moving average with the actual figures for 1978 and 1979) in the North and South Islands (N.Z. Dept. of Statistics).

Recent statistics also include the number of holdings with lucerne (Fig. 3). In the period 1975-9 there has been a similar substantial decline in the number of holdings with lucerne. Over New Zealand more than 2,500 fewer individual holdings (or 25.5%) were growing lucerne in 1979 than in 1975. Overall, the percentage decrease in number of holdings was somewhat greater than the decrease in area.

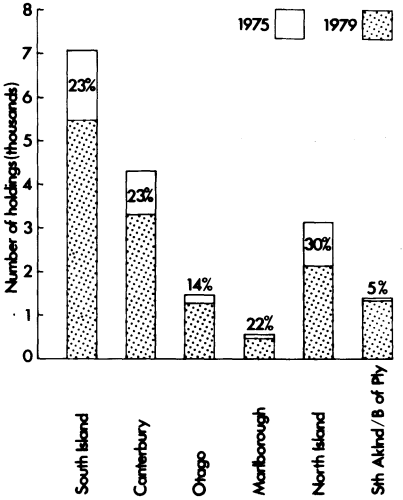

Figure 3. Number of holdings growing lucerne in 1975 and 1979 with percentage decrease (N.Z. Dept. of Statistics).

Certified seed production also shows a recent decline following an increase from the mid 1960's to the mid 1970's. The area of lucerne entered into the certification scheme has shown a dramatic decline over the last 5 years (Fig. 4). Interpretation of these seed production statistics should take into account the change of cultivars which have taken place since the recognition of the pest and disease problems in lucerne growing in New Zealand in the early 1970's and the importation of seed of U.S. bacterial wilt resistant cultivars. Since the 1974/5 season the area of cv. Wairau entered for certification has declined by 88% and the proportion of Wairau in the area certified has declined from 96 to 51%. New cultivars — particularly Saranac now 22% and Rere now 18% — are taking an increased share of the seed area. Statistics on seed imports are unavailable but estimates are that about 100 tonnes are imported annually. It is clear that seed production has decreased substantially over the last 5 years but if production had not decreased a declining domestic use would have caused a surplus.

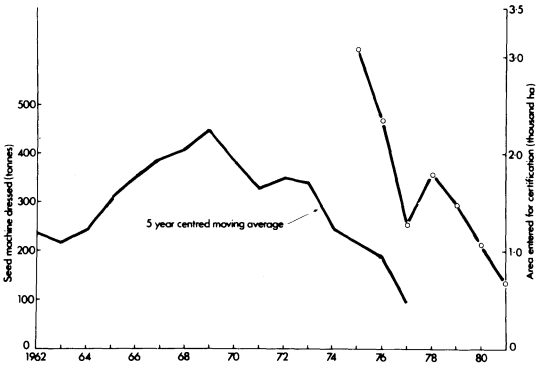

Figure 4. Machine dressed lucerne seed (5 year centred moving average) and lucerne area entered for certification (Seed Testing Station, Palmerston North).

The preponderance of lucerne in N.Z. in 1979 was in the South Island, particularly in the provinces of Canterbury and Otago (Fig. 5). Similarly South Auckland/Bay of Plenty dominates the North Island. The major difference in utilisation between North and South Islands is the increased proportion of lucerne used solely for grazing in the South Island. The proportion of lucerne used solely for grazing is as high as 43% in Otago but is only 17% in the North Island. Virtually all the lucerne in New Zealand is grazed at some time but some hay or silage is taken from most paddocks.

We can conclude from all these statistics that the lucerne area increased steadily until the mid 1970's and has declined since then. There is no evidence that the decline has stopped, or even slowed.

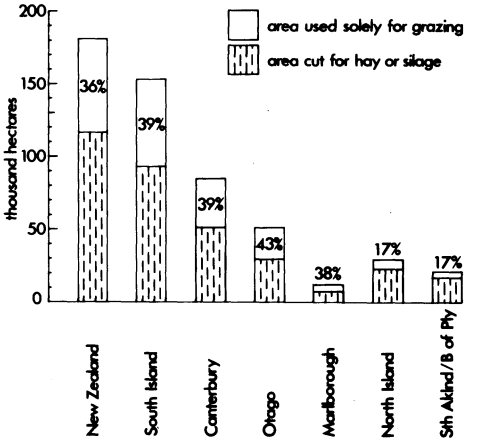

Figure 5. Area and utilisation of lucerne within major lucerne regions in 1979 (N.Z. Dept. of Statistics).

REASONS FOR CHANGES IN AREA

A large number of factors have contributed to the changes in the lucerne area that have been described and their effects are inter-related. However, they can be subdivided into factors which have had an indirect effect on the lucerne area through changes in farming systems, and those which have affected the lucerne area directly.

Indirect influences

A major use of lucerne is for the provision of hay or silage. Any farming practice which reduces the need for conserved feed, either for prolonged drought periods or for winter will influence the need for lucerne. Thus the considerable increase in irrigation during the period under review (e.g. Morven-Glenavy, South Rakaia schemes, increase in spray irrigation) have reduced the need for conserved feed and the consequent advantage of lucerne. Of equal effect has been improvements in grazing management, including feed budgeting, which have allowed "all grass" wintering schemes. This has again reduced the requirement for conserved feed and the necessity for lucerne.

Production of dehydrated lucerne meal has never been a major proportion of the total lucerne area. However, the collapse of the industry following the oil price rise of the middle 1970's has had an influence, particularly in areas such as Blenheim and southern Hawkes Bay.

Direct influences

These influences can be split into factors which have increased and those which have decreased the area of lucerne grown.

In our opinion the major factors promoting the spread of lucerne over the last decade have been the adult resistance of lucerne to important insect pests (eg. grassgrub and black beetle) and a series of dry years over the early part of the 1970's when the relative advantage of lucerne over ryegrass/clover pastures is greatest.

O'Connor *et al.* (1968) showed pure lucerne swards substantially (38%) outyielded ryegrass/white clover on deep soils at Lincoln and were much less variable in yield, especially over summer and autumn. On light land at Ashley Dene lucerne, although more variable in yield and strongly dependent on spring and summer rainfall, was even less variable than other pastures and outyielded them by larger amounts (50-100%) than at Lincoln (Iversen, 1965).

Figure 6 shows annual rainfall for Lincoln for the period 1967 to 1980. Lincoln is reasonably representative of Central Canterbury and shows below average rainfall each year from 1969 to 1973. Similar average rainfall conditions were common throughout most of the lucerne growing areas of the country in this period. These two factors were largely responsible for a considerable extension "push" for lucerne, including the lucerne establishment subsidy ($50/ha) which was introduced in 1972 for some areas in Taupo and Rotorua counties. Between May 1974 and December 31st 1975 the scheme was extended on a national basis with a subsidy of $50/ha being paid for South Auckland, Auckland and Northland areas and $25/ha for the rest of N.Z. The grant was reintroduced for Taupo and Rotorua counties and the Galatea basin in 1976 and continued until 31st May 1979.

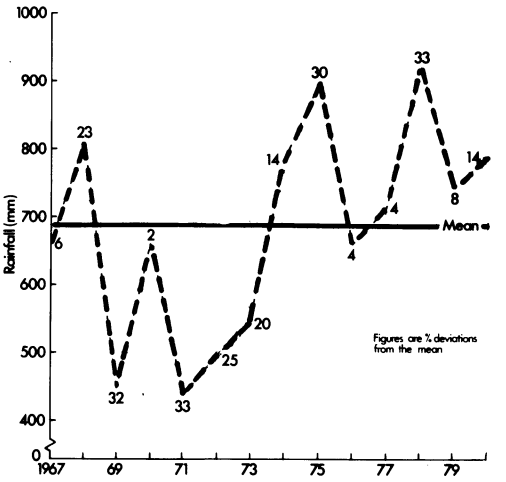

Figure 6. Rainfall at Lincoln 1967-80 compared with the mean (Meterological Service).

In our opinion the major factors which have caused the current loss of farmer confidence in lucerne have been the influences of newly introduced or newly recognised diseases or pests exacerbated by a series of seasons with considerably above average rainfall (Fig. 6).

In the 1967 Lucerne Symposium held at Lincoln College pests and diseases were considered of minor significance in lucerne production in New Zealand. It is apparent that now they are a major factor limiting lucerne production. Since 1967 bacterial wilt (*Corynebacterium insidiosum*) (Close and Mulcock, 1971) has been recognised throughout New Zealand's lucerne growing areas and in addition *Verticillium albo-atrum* and *Phytophthora megasperma* are considered to be serious problems in some areas. Stem nematode (*Ditylenchus dipsaci*) is becoming increasingly widespread in North Otago and Canterbury. Perhaps the most visible pathogens have been the lucerne aphids, blue-green aphid (*Acyrthosiphon kondoi*) recorded here in 1975 and pea aphid (*A. pisum*) in 1977, and also Sitona weevil (*Sitona discoideus*). These pests have been blamed, probably unjustly, for the poor performance of lucerne over the last five years.

It is clear to us that combinations of pests and diseases are major factors in lucerne productivity at present and their influence will be overcome only by a combination of resistant cultivars and good management.

The influence of diseases has been increased by the prolonged periods of wet weather that have occurred in the last few years. Raised water tables have resulted in loss of whole stands through the influences of lack of aeration and diseases. High rainfall not only has a negative influence on lucerne production through increasing disease but the increased moisture favours competitive species such as broadleaved weeds and annual and perennial grasses. Thus lucerne management practices which may be marginal but successful in dry conditions because the competitive advantage is sufficiently great, may tip the balance in favour of weed species in wetter seasons.

Good lucerne management requires more effort than does ryegrass/white clover pastures, particularly at high stocking rates. Management to maximise lucerne production and persistence, yet provide for seasonal demands of stock, is not easy and this extra managerial requirement is often suggested as a cause of reduction in lucerne area. Associated with this managerial skill are the major stock health questions concerning lucerne. Many dairy farmers in the Volcanic Plateau are now handling 60% of their farms in lucerne through drenching and wilting so bloat should no longer be a problem, except where beef cattle are run on an extensive scale. The other major stock health problem with lucerne has been considered to be the effect lucerne can have on reproductive performance through raised oestrogen levels. This problem has been shown clearly to be associated with infection of the lucerne by either aphids or foliar fungi and there are often management options to overcome this.

High establishment costs, particularly high seed costs have been rated as a deterrent to lucerne production by some. It is, however, possible to economise considerably on seed with no detriment to plant population, and in other establishment costs (Palmer and Wynn-Williams, Paper 6).

Disappointing lucerne yield has probably been a factor in the decline in lucerne popularity. While lucerne yield is greater in seasons with more rainfall the yield of lucerne relative to conventional ryegrass/white clover pasture declines in wet years. C.C. McLeod (pers. comm.) conducted three trials over the period 1971/72 to 1977/78 comparing yield of lucerne and ryegrass/white clover pastures. Averaged over the nine trial-year comparisons, lucerne outyielded ryegrass/white clover by 51%. However, the three years with the highest rainfall in the lucerne growing season (1974/5, 1975/6 and 1976/7) corresponded to the lowest yield of lucerne relative to ryegrass/white clover. In these three seasons the mean advantage favouring lucerne under a good management system was only 19%. Where management of the lucerne is poor this difference would be lessened and perhaps reversed.

In summary, while a large number of factors are undoubtedly involved with the declining performance and popularity of lucerne in New Zealand over the past five years or so, the major causes are probably disease and insect pests coupled with sub-optimal management in a series of wet seasons. Leath and Byers (1977) pointed out that in a perennial forage plant, such as lucerne, the effect of stress factors like disease, poor management and insect pests is always cumulative whether the factors are occurring simultaneously or sequentially. Thus superimposing poor management or extra weed competition on a stand with some disease may cause the stand to collapse, even though the disease 'incidence' alone may not appear sufficient cause.

SURVEY RESULTS

Blair (1968 and pers.comm.) over the period 1966-8 contacted 300 growers by questionnaire and a further 160 crops were inspected. All growers and crops were in the South Island. In the summer of 1975/76 a non-random sample of 248 paddocks throughout New Zealand were surveyed primarily for pest and disease incidence but agronomic and management information was also collected.

Pathogens

Blair found that Verticillium wilt was prevalent but of a low order of severity and bacterial wilt was absent. In contrast the 1975/76 survey found 19% of stands to be infested with bacterial wilt; 66.8% to be infected with Verticillium wilt; and all but one crop sampled had crown-rot to some extent. Other diseases, including *Stemphylium botryosum, Pseudopeziza medicaginis, Phoma medicaginis* and *Leptoshaerulina briosiana,* were recorded in more than 75% of the crops sampled, although their economic significance has not been established. Blair found that stem nematode was widespread and occasionally severe. The 1975/6 survey basically only confirmed the pest situation as it preceded the spread of blue-green aphid.

Stand Longevity

Blair estimated the average stand life at 9 years. Stands sampled in the 1975/76 survey were followed up in 1980/81 and based on 155 replies, average stand life throughout New Zealand was again 9 years. Although the actual number of years stands remain fully productive is likely to be less than that reported in both surveys, and undoubtedly varied from farmer to farmer, the surprising feature is that in spite of a major influx of pests and diseases stand "longevity" has not altered in the 13 year period 1968-81. However, it would be realistic for farmers' expectations of stand life to be revised downwards because of pests and diseases, and expansion into less suitable soils and environments.

Soil acidity

Blair found a mean pH of 6.0. In the disease survey the mean pH was 5.9. From stands for which both pH and age at ploughing were known it was apparent that soil acidity and stand life were not correlated ($r = 0.13$, $n = 90$). However, this is not conclusive evidence that soil pH has no effect on stand life. The Taupo-Rotorua-Galatea region had lower soil pH (mean 5.6, 33 stands) than the rest of N.Z. but stands were not ploughed until 10 years old.

However, experience would suggest that lucerne stands are retained in this region after they would have been ploughed in other regions.

Attempts were made to use the survey data to measure associations between known stand longevity as revealed by the survey and factors which might be considered to influence stand life, such as soil pH, rainfall, disease incidence, seeding rate and management. The only factors found to be associated were winter management and incidence of crown-rot in young stands (Table 1). Stands that had hay fed out on them, or were used as a run-off during the winter, had a significantly higher incidence of crown-rot than those which were closed to stock over the winter. In older stands however, there was no difference in incidence of crown-rot. Thus while the short-term benefits from mob stocking in winter are dramatic the long-term drawback from increased incidence of crown-rot may have a more serious effect.

Table 1: Crown-rot incidence (as number of stand in each category of infection) and winter management in stands < 4 years old.

Winter management	% of plants with crown-rot		
	<20	20-30	>30
Closed to stock	32	13	4
Hay fed/Run off	17	28	4

Chi square = 10.08** df = 2, P = <0.01

CONCLUSION

A number of statistics indicate that lucerne usage in N.Z. increased sharply in the late 60's and early 70's but has experienced an equally sharp decline since the mid 70's. Increased irrigation, "all grass" wintering systems and the collapse of the dehydrated meal industry are all suggested as having indirectly influenced the decline in lucerne usage.

Wet seasons, increased lucerne pests and diseases, no serious grass grub or black beetle outbreaks, and inferior grazing management are suggested as direct causes of the decline. Surveys indicate that stand life did not decline over the period and stand pH has remained low with a mean of 5.9 - 6.0.

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