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LUCERNE SEED PRODUCTION IN NEW ZEALAND - ACHIEVEMENTS AND POTENTIAL

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Abstract

For New Zealand's lucerne seed industry to develop it must reliably produce seed at a price competitive with seed produced overseas. To achieve this will require increased specialisation and co-operation from all parts of the industry including breeders, growers and merchants.

Recent research has resulted in a management package which will allow specialist growers to achieve consistently high yields and financial returns that will make seed production a specialist industry rather than a "catch crop" as in the traditional pastoral system. A trial at Lincoln to investigate the seed production capabilities of different cultivars showed there were no significant differences in yield between any of the cultivars currently being grown for seed in New Zealand. With the introduction of more efficient pollinators of lucerne, seed production may shift away from the traditional areas of Marlborough and into areas with more moisture retentive soils and areas where irrigation is possible.

It is speculated that if changes do not *occur* in the lucerne seed industry then all of New Zealand's seed will be imported by 1990.

Key Words: lucerne, *Medicago sativa,* seed production, cultivar

INTRODUCTION

Historically, Marlborough is a major lucerne growing area. Nevertheless lucerne seed production has traditionally been a "catch crop" in the New Zealand pastoral system once hay or grazing requirements have been met. Few stands have been established with seed production as their primary objective and few farmers have managed lucerne to facilitate pollination or pest control. While seed yields have been low and erratic throughout the country, this production system has basically satisfied seed demands until the 1970's. Since then a number of new cultivars bred for resistance to a range of pests and diseases have been listed. This has highlighted the need for the seed industry to rapidly multiply new cultivars.

In the short term, it was recognised that local seed production would need to be supplemented with imported seed of both United States and New Zealand bred cultivars. However with specialist seed production techniques, including consistently effective pollination, the New Zealand lucerne seed industry should be able to meet the new challenges and reduce the current 70% dependence on imported seed.

This paper reviews seed production research and management techniques within New Zealand, presents some preliminary results on seed yields of cultivars, and discusses ways in which New Zealand's lucerne seed-growing potential can be achieved.

SEED PRODUCTION IN NEW ZEALAND

Most recent research has been in three major areas: management of pollination, agronomic research to improve multiplication rates of new cultivars, and the control of pests and diseases in seed crops. There has been a dearth of research on weed control in seed stands, management of established seed stands and harvesting methods. Management of pollination has been extensively reviewed elsewhere (Donovan 1975; McFarlane 1976; Donovan and Wier 1978) and will not be included here.

AGRONOMIC RESEARCH

Agronomic research has provided several major conclusions. Firstly low seeding rates (0.5- 2kg/ha) have given just as high yields of seed as the rates conventionally used for forage production (Wynn-Williams and Palmer 1974, Wynn-Williams unpub. data 1974). However, contrary to United States results, there was no consistent advantage with wide row spacing (Wynn-Williams and Palmer 1974). A major advantage of wide rows is the easier roguing of problem weeds such as red clover than is possible in narrow rows or solid stands.

While evidence of seed yield responses to phosphate fertiliser application is inconclusive (R.C. Stephen pers. comm), there is evidence that boron may give a response in some situations (Cresswell 1980, R.C. Stephen pers. comm.).

PESTS AND DISEASES

Seed yield can be decreased by fungal pathogens and insects. Hart and Close (1976) showed a 45% seed yield increase in response to benomyl treatment. Plant insect pests of the Mirid group have severe effects on seed yield in New Zealand. Control measures have been well defined for similar pest problems in the United States and appropriate measures are being developed in New Zealand (Donovan 1981).

TABLE 1. SEED YIELD OF LUCERNE CULTIVARS AT LINCOLN.

Cultivar	Seed Yield (Machine Dressed) (kg/ha)
Hunter River	450
Pr 521	440
WL318	380
Washoe*	370
WL311*	350
Wairau*	340
Saranac*	330
Pr524	330
Rere*	320
AS13R	300
lsd	
.05	100
.01	130

* Cultivars entered for certification in Marlborough 1981-82.

Several experiments (Wynn-Williams unpub.), including that reported here (Table 1) and significant farmer experience (Cresswell 1980, Donovan 1981) have shown that it is possible to harvest 200-400 kg/ha of seed in the establishment season, provided good agronomic practices are followed and pollination is adequate.

SEED PRODUCTION OF DIFFERENT CULTIVARS

No comparative data are available on the seed production of different cultivars in New Zealand, although such information is common in the United States. There is also a lack of information on the possible alternative management requirements of different cultivars, needed by them to achieve their potential yields.

A trial to provide such information for cultivars currently on the National List was established at Lincoln on 13 October, 1981. The trial was a randomised complete block with eight replicates. Plots were a single row 10m long with 0.75m between rows. The sowing rate was 1 kg/ha and the entire experiment was surrounded by a buffer of cultivar Wairau. Pre-plant treatment with trifluralin and one inter-row cultivation gave good weed control. One irrigation was applied in December. The entire area was sprayed with demeton-S-methyl (0.24 kg/ha) to avoid build-up of sucking insects before flowering. During flowering bromophos (0.6 kg/ha) was used to avoid harming pollinators. Leafcutter bees (160,000 bees/ha) were used as pollinators. Four replicates were desiccated and harvested as soon as any seed was lost from the most mature pods (March 23 and 28). Four replicates were desiccated and harvested later (April 15 and 22) to test for seed retention. Plots were harvested with a Hege small plot harvester and the seed samples machine dressed.

Seed yields are presented in Table 1. Overall yields were high and could have been further improved with another irrigation in early January when conditions were dry. There was no significant difference between harvest dates and no interaction between cultivars and harvest dates. Some significant (5%) differences between cultivars were apparent and these differences may be confirmed by subsequent research. There were no significant differences between any of the cultivars currently being grown for seed in New Zealand: Washoe, WL311, Wairau, Saranac and Rere.

These results suggest seed growers could confidently grow any currently available cultivars. More detailed analysis of results from this experiment including yield components, may indicate the sources of yield differences.

ACHIEVING NEW ZEALAND'S LUCERNE SEED POTENTIAL

If the lucerne seed industry in New Zealand is to flourish, it must produce seed with sufficient reliability to meet production goals at a price which is competitive with overseas produced seed. Otherwise the seed industry will languish and most seed will be imported. The key to a successful lucerne seed industry is consistently high yields. It is unrealistic and unnecessary to expect New Zealand seed yields to match those of climatically more favourable areas such as California. The lower production costs in New Zealand (Table 2) mean the break-even yields (direct costs only) are only 60-100 kg/ha in New Zealand compared with about 400-500 kg/ha in California. Thus yields averaging 200-500 kg/ha in New Zealand can be financially very attractive and should encourage

Table 2: COMPARATIVE COSTS ($NZ) OF LUCERNE SEED PRODUCTION
(Direct costs only)

	California (a)	New Zealand (b)
Establishment (c)	115	70
Pre-harvest (d)	1210	245
Harvest (e)	365	130
Total	1690	445

(a) Figures adapted from Marble (1982)
(b) Figures based on costs from 1981 Lincoln College Budget Manual
(c) Based on three-yeanstand-life
(d) Includes all growing costs including pollination and desiccation
(e) Includes harvesting, transport, bags and dressing charges

specialist producers to develop the technical expertise necessary to achieve such yields in New Zealand's marginal seed production climate.

To achieve consistently good seed yields it is necessary to:

(1) produce large numbers of flowers
(2) pollinate these flowers in the shortest possible time
(3) protect flowers and developing seeds against pests
(4) harvest early to minimise weather risks and seed loss

The New Zealand costs (Table 2) are derived from a management package which farmer experience and research results indicate will best achieve the above objectives. The essentials of the package follow.

Establishment

(1) Preparation of a fine, firm seedbed and the use of a pre-plant herbicide (Butler 1982)
(2) Low seeding rates (about 1 kg/ha) in rows with 0.75m row widths to facilitate inter-row cultivation
(3) Early sowing (no later than mid-October) for seeding season harvest
(4) Non-acid fertilisers (for example, reverted superphosphate) drilled with the seed for increased early growth
(5) early post-emergence herbicide application, if necessary, for broad-leaf weed control (Butler 1982)
(6) inter-row cultivation and roguing if necessary for problem weeds such as red clover

Pre-Harvest Management of Established Stands

(1) Use strategic winter grazing or herbicide application (Butler 1982) to remove weed competition
(2) Time hay-cut or spring grazing so that closing date for seed crop will be about the first week in December
(3) Consider irrigation at closing to ensure strong growth, and again at bud stage if conditions are dry
(4) Monitor sucking insect populations and foliar fungi and spray if necessary

(5) Ensure effective pollination in concentrated flowering period using leaf-cutter bees (30-50,000 bees/ha) or short-tongued bumble bees (1-2,000 bees/ha)

(6) Desiccate as soon as the first pollinated pods start to lose seed. This should be mid-March and seldom after early April.

Harvest

(1) Direct harvest as soon as the crop is sufficiently dry

Successful implementation' of this package by seed growers should give financial returns from seed, such that hay or grazing should be very much secondary to seed production. Because leafcutter bee populations allow growers to pollinate seed crops quickly and at the optimum time, lucerne seed production could move away from traditional areas which rely mainly on natural pollinators. Areas of Canterbury and Marlborough with deeper, more moisture-retentive soils and areas where irrigation is possible, are likely to become more important for lucerne seed production. Climatic data (Table 3) shows much of Canterbury and Marlborough have sufficent number of days for leaf-cutter bee pollination (maximum temperature above 20 degrees Celsius) and good seed production in most seasons.

TABLE 3. NUMBER OF DAYS WITH MAXIMUM TEMPERATURE ABOVE 20° C IN SEED GROWING AREAS. Data from 1972-1981 New Zealand Meteorological Service Records

Location	December	Monthly Mean January	February	Three Month total Mean	Range
Blenheim Airport	21.7	25.1	23.1	69.9	81 – 65
Lake Grasmere	16.2	20.5	16.5	53.2	71 - 40
CRD Lincoln	13.3	21.0	17.6	50.9	66 – 17

These changes in growing techniques will need to be matched by changes in other sectors of the industry. Specialist seed growers who rely on lucerne for a large proportion of their income, will need some consistency in seed prices. Seed production of any particular cultivar will consequently have to be related to market demand and some form of contract growing, with price related to supply being essential. It would be desirable to have a flexible system similar to that used in the United States where area only is contracted at sowing, a minimum price is agreed at.the beginning of the season and the final payment negotiated near harvest. This would allow merchants more flexibility in contracting areas and would mean growers would share some of the risks and reap some of the benefits in forecasting seed supplies and market demands. Certification requirements should be reviewed in line with recent research findings, (Brown et *al.* 1979; Marble *era/.* 1979) allowing reduced isolation distances for production of commercial grade seed. This would ease current problems with isolation in traditional growing areas.

Increased specialisation and co-operation from all sectors of the industry – breeders, growers, merchants, will allow self-sufficiency in lucerne seed production and possible exports to Australia and South America. The key factor will