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SOME FACTORS AFFECTING THE ESTABLISHMENT
AND EARLY GROWTH OF LUCEPNE
(Medicago sativa L.) ON
MANAWATU SAND COUNTRY

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requirements for the degree of Master of
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ABSTRACT.

The thesis reports two experiments carried out during 1973-74.

The field experiment studied the establishment and growth up to one year of two varieties of lucerne (Wairau and College Glutinosa) at three spacings (2.02cm., 9.16cm. and 15.22cm. in 15cm. rows) on two soil types (Puke Puke black sand - plain, and Motuiti sand-dune) and an intergrade near Taikorea in the Manawatu sand country.

From sowing in April, 1973 to December, 1973 soil moisture tension at 10cm. and 30cm. depth was higher in the Motuiti sand than in the Puke Puke black sand with the intergrade being intermediate. From December, 1973 to April, 1974 high soil moisture tension at 90cm. remained low for all three soil types for the duration of the experiment. The water table rose from May, 1973 to September, 1973 and fell from September, 1973 to April, 1974. Both soil moisture tension and water table were controlled by rainfall.

Wairau had a significantly higher percentage establishment than College Glutinosa in the first 110 days after sowing but these differences were not apparent one year after sowing. Plants spaced at 15.22cm. had a significantly higher percentage establishment than plants spaced at 2.02cm. or 9.16cm., 110 days after sowing. This difference appeared to be associated with damping-off by pathogenic fungous species. Plants spaced at 15.22cm. and 9.16cm. had significantly higher nodule dry weights and nodule dry weights per unit plant dry weight than plants spaced at 2.02cm. College Glutinosa plants had significantly higher root weights than Wairau plants. On Motuiti sand, plants had significantly higher nodule dry weights and nodule dry weights per unit plant dry weight than plants on the other two soil types. Lucerne dry matter production was significantly higher at 2.02cm. than at 9.16 or 15.22cm. spacing.

During January, 1974, dessication of many plants occurred and these plants exhibited root damage apparently caused by white fringed weevil (Grapognathous leucoloma Boh.) larvae. Subsequent investigations showed that the number of dessicated plants per unit area was greater in Motuiti sand than in the intergrade than in Puke Puke black sand. A similar trend was observed in the number of white fringed weevil larvae per unit area.

A glasshouse experiment was set up to investigate the mortality of lucerne seedlings (Variety: Wairau) from 8 to 14 weeks after sowing in Motuiti sand under two moisture regimes (10% and 20% of dry soil weight) with three populations of white fringed weevil larvae (22, 44 and 88 larvae/m²). It was shown that there was a significantly greater plant mortality at 10% M.C. than at 20% M.C. Furthermore at 10% M.C., surviving plants in plots with a popula-

tion of 22 larvae/m² had significantly higher root dry weights than plants in plots with population of 44 and 88 larvae/m². It was concluded that at high soil moisture tensions, damage by white fringed weevil larvae was more critical to the survival of the lucerne plants.

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INTRODUCTION.

This study was undertaken to examine some of the factors affecting the establishment of lucerne in the Manawatu sand country. Lucerne has proved a valuable summer crop in the sand country, yielding four times the dry matter production of pasture from November to mid-January at Flock House. However, difficulties have been experienced in establishing lucerne stands in this area.

The major limiting factors to the establishment and growth of lucerne in the sand country are generally considered to be the lack of soil structure resulting in wind blow, the low moisture holding capacity of the soil, and the high surface temperatures which can be experienced due to the thermal properties of the sand. Brown (1973) has recently studied the temperature factor and found that lucerne stands sown in the summer months are liable to high seedling mortality because of high soil temperatures.

The factors under investigation in the present study were the effects of different varieties and plant spacings on the establishment and early growth of lucerne on two soil types and an intergrade. From previous work (Cowie et al, 1967) it was expected that the soil types chosen would demonstrate differences in soil moisture status. The field experiment was designed to study how the three varieties with contrasting root systems would respond to these differences in soil moisture status at different plant spacings.

During the course of the field experiment, it became apparent that plant mortality attributable, at least in part, to the activity of white fringed weevil larvae was a major factor affecting the establishment of lucerne in this area. A further experiment under controlled conditions in a glasshouse was therefore designed to study the effect of white fringed weevil larvae and soil moisture status on the establishment of lucerne.