Effect of lime rate on lucerne persistence and productivity

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Lucerne is very sensitive to soil acidity and soil exchangeable aluminium. Establishment, persistence and production can be severely affected when soil pH ($CaCl_2$) falls below around 4.9 and exchangeable aluminium is present in the soil.

Many sandy loam soil paddocks under cereal/pasture legume systems have acidified by up to 1 pH unit over the past 20-30 years and have become problem paddocks. Many of these paddocks initially grew lucerne or medics but as a result of further acidification, lucerne now grows poorly, is very patchy or in some cases, fails to establish at all. Some of these soils have sub-surface acidity which aggravates the problem.

In 1990 a trial was established at Tomingley on a problem sandy loam soil to investigate the effect of applied lime on lucerne persistence and productivity.

Methods

The soil type was a granitic sandy loam with a soil pH ($CaCl_2$) in the top 10cm of 4.4 and 14% exchangeable aluminium. The 10-20cm zone had a pH ($CaCl_2$) of 4.3 and 21% exchangeable alumin-ium. This paddock grew good lucerne when first cropped around 25 years ago. Exchangeable calcium levels were low (42% in 0-10 cm and 42.7% in 10-20 cm zones).

Fine lime was applied to 10 m x 6 m replicated (4) plots at rates of nil, 1, 2 and 3 t/ha and incorporated with disc harrows in April 1990. Trifecta lucerne was sown at 3kg seed/ha and 120 kg single superphosphahte/ha in May 1991.

Lucerne plant counts were taken annually and dry matter measurements were taken at opportune times, usually each spring or summer.

The trial was grazed on a rotational basis with sheep.

Results

Table 1 shows the soil test results 2 years after lime application while Fig. 1 and 2 show lucerne persistence and production between 1991 and 1996.

Discussion

Lucerne persistence was directly affected by lime application. Lucerne plant population per square metre in the nil lime treatments declined very quickly compared with the plus lime treat-

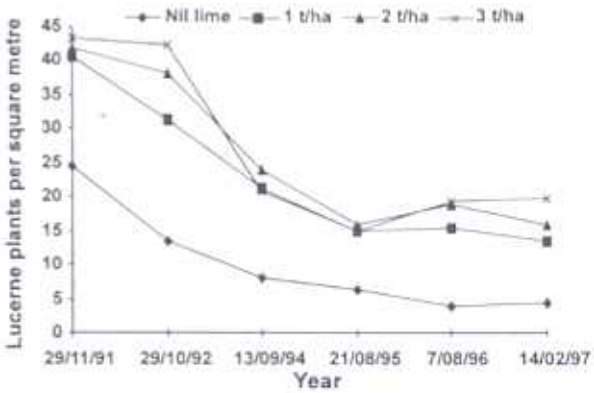

Figure 1: Effect of lime rate on lucerne persistence.

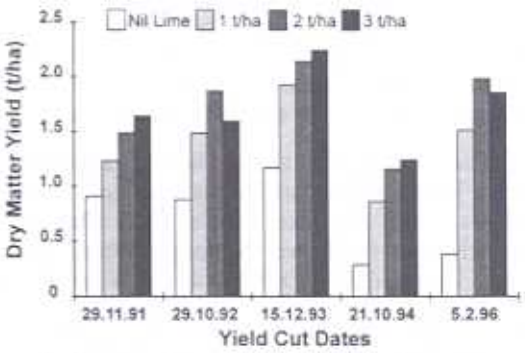

Figure 2: Lucerne dry matter response to lime.

Table 1: Soil tests for results for different lime application rates.

Lime Rate	Soil test (0-10 cm)			Soil test (10-20cm)		
(t/ha)	pH ($CaCl_2$)	Exch. Al%	Exch.Ca%	pH ($CaCl_2$)	Exch. Al%	Exch. Ca%
Nil	4.37	14.4	42.0	4.28	21.4	42.7
1	4.85	2.6	60.4			
2	5.40	0.5	66.8			
3	5.86	0.2	68.2			

ments (Fig. 1). Most plants in the nil lime treatments were weak and retarded and gradually died out, whereas the plus lime treatments remained healthy and productive after seven years. Plus lime treatments maintained plant population at or above 15 plants/m^2.

Generally, there was a significant dry matter response to applied lime at the 1t, 2t and 3t/ha rate over nil lime. Production fell off very dramatically after 2-3 years on the nil limed areas, compared with the limed areas which were still productive after 7 years (Fig. 2). The 2 and 3t lime/ha rates corresponded to the soil pH ($CaCl_2$) levels having been lifted to 5.4 and 5.86 respectively and exchangeable aluminium being reduced to negligible levels. Exchangeable calcium levels were also above 65% compared to 42% on nil lime treatments.

It is commonly believed that lucerne will not persist on soils where the subsoil is highly acidic. However, this trial has shown that in certain situations, lucerne can persist and be productive with subsoil acidity provided the surface has been rectified. This has also been observed to be the case in similar situations in commercial paddocks.

Acknowledgments

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