Pasture Response to Lime on Acid Sodic Soils

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Soil acidity and sodicity are a dual problem on many of the hard setting ironstone clay soils of central west NSW. These soils have a history of poor crop and legume pasture production and become progressively worse as the organic matter level declines.

These soils are hard setting duplex red brown clay loams with ironstone nodules through the surface profile. The surface pH is usually 4.6 - 5.0 ($CaCl_2$). Exchangeable aluminium levels are relatively low (<1%). Topsoils are mildly sodic with exchangeable sodium levels of 4-6%, overlying a heavier more sodic alkaline subsoil. Exchangeable calcium levels are relatively low at around 45-50% of total CEC. There is some evidence that manganese could be adversely affecting plant growth. Timber is a mix of ironbark, narrow leaf box and some rosewood. Naturalised medics are common, however growth is often poor because of acidity induced problems.

INVESTIGATIONS

In 1987 a lime rate trial was commenced at Balladoran, north of Dubbo NSW, to investigate poor crop and legume pasture growth on these problem soils.

The site is a typical hard setting red clay loam with ironstone nodules spread through the surface. Soil pH ($CaCl_2$) is 4.7 and exchangeable aluminium less than 1%. Exchangeable calcium is low at 45% and exchangeable sodium 5% (mildly sodic). Phosphorus content is moderate. Pasture growth at commencement of the trial was very poor with the whole site having a sour appearance.

Finely ground agricultural lime was applied in early April 1987 at 0.625, 1.25 and 2.5 t/ha and incorporated to about 10 cm with two passes of the cultivator. Plots are 10 m x 30 m and the experimental design is a randomised block with three replications.

The trial was oversown with a pasture mixture of 3 kg Dalkeith sub clover, 3 kg Sephi barrel medic and 1.5 kg Maxidor II lucerne per hectare in early May 1987. Dry matter cuts were taken annually in early spring from 1988-1991.

RESULTS AND DISCUSSION

Large dry matter responses in pasture growth occurred to applied lime as shown in the Table 1. Consistent dry matter responses in excess of 200% were obtained in the heaviest lime plots.

Table 1: Pasture dry matter response to applied lime over 4 seasons.

Lime rate (t/ha)	Pasture dry matter response (t/ha)				
	26.7.88	8.9.88	14.9.89	14.8.90	10.9.91
Nil	0.44	1.33	1.88	2.11	0.74
0.625	0.77	1.64	2.05	2.92	1.10
1.25	1.14	1.77	3.04	3.40	1.52
2.5	2.53	3.28	3.86	4.98	1.74
$LSD_{(5\%)}$	0.76	1.10	0.64	1.26	0.21
CV (%)	30	27	12	19	10

In addition there was a marked change in botanical composition of pasture as the lime rate increased. At nil lime rate sub clover was the dominant species, whilst medic became highly dominant as lime rate increased (Table 2).

Table 2: Changes in botanical composition at various lime rates.

Species	Lime rate (t/ha)			
	Nil	0.625	1.25	2.5
	Pasture composition (%)			
8/9/88				
Medic	14	33	72	92
Subclover	85	66	26	4
Lucerne	1	1	2	4
6.10.89				
Medic	22	30	53	88
Subclover	78	70	47	12
Lucerne	Nil	Nil	Nil	Nil
14.8.90				
Medic	19	43	81	93
Subclover	78	52	14	3
Wimmera ryegrass	3	5	5	4

Lucerne establishment and growth improved markedly with increasing lime application, however it died out quickly due to the hard setting nature of the soil.

The pH ($CaCl_2$) in the top 10 cm of soil was raised from 4.7 to 6.3 with 2.5 t lime/ha. Reasons for these responses could be due to a combination of the following:

- reduced manganese and aluminium toxicity;
- more favourable soil environment for *Rhizobium* bacteria;
- possible soil structural improvement; and,
- possible correction of calcium deficiency or imbalance.

CONCLUSION

Lime application significantly improved pasture growth on this acid sodic ironstone soil. Rates of 1.25 t/ha are worthwhile however 2.5 t/ha is significantly better. Increased soil pH has allowed the barrel medic to perform well and dominate the pasture.

REFERENCES

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