Effect of lime on pH of a granite soil on the Northern Tablelands of NSW

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Survey work by Crocker and Holford (1991), Duncan and Crocker (1998) and Harris and Duncan (1999) has shown that acidification of soils on the Northern Tablelands under permanent pasture appears to be slower than that of southern NSW. However, soils derived from granite may be at greater risk of acidification under pasture improvement than other commonly encountered soil types.

Lime is the only practical means of correcting soil acidity and reducing aluminium toxicity. This paper reports on the effect of different lime rates (0, 1.75, 2.5 and 3.75 t/ha), application method (topdressed or incorporated) and lime material (agricultural or horticultural) on acidity of a degraded pasture soil of granite origin.

Methods

The experimental site located on the eastern side of Tenterfield (29°02'S 152°11'E) on the Northern Tablelands of NSW is representative of acid, granite soil types in an area dominated by African lovegrass *(Eragrostis curvula)*. Initial soil $pH_{(Ca)}$ ranged between 4.8 and 5.0 (0-10cm), 4.7 and 5.0 (10-20cm). Cation exchange capacity (meq/100g) ranged from 4.02 - 4.41 (0-10cm) and 3.45 - 4.12 (10-20cm). Exchangeable aluminium levels ranged from 1 to 5% (0-10cm) and 1 to 3% (10-20cm) of the cation exchange capacity.

The experiment consisted of eight treatments; nil lime (control), lime at 1.75 t/ha (L1.75), 2.5 t/ha (L2.5), 3.75t/ha (L3.75), lime at 2.5 t/ha plus gypsum at 4.0 t/ha (L+G), lime incorporated at 1.75 t/ha (Lincorp 1.75), 3.75 t/ha (Lincorp 3.75) and horticultural lime at 1.75 t/ha (horti 1.75). The experiment was a randomised block design with three replications. Lime treatments were applied on 19 May 1999. Lime was incorporated on the appropriate plots to a depth of 10cm using a rotary-hoe.

On each plot 20 soil cores (25mm diameter) were collected at two depths (0-10 and 10-20 cm) prior to the application of lime in May 1999 and 12 months later. Soil was dried and ground to pass through a 2mm sieve. Soil was sent to a commercial laboratory and analysed for soil pH, cation exchange capacity and exchangeable aluminium.

Results and Discussion

The effect of lime on soil pH, cation exchange capacity and exchangeable aluminium at 0-10cm and 10-20cm is presented in Table 1.

All lime treatments increased soil pH in the topsoil and subsoil. The change in $pH_{(Ca)}$ varied with treatment, but generally soil pH increased as lime rate increased. The coarse granite soil at the experimental site was sandy, poorly buffered and had little structure suggesting small applications of lime may result in significant increases in pH.

Topdressed lime is generally regarded as being less effective than incorporated lime, due to low solubility and slow downward movement. In this experiment there was no significant difference in soil pH between the topdressed and incorporated treatments in both the topsoil and subsoil. In sandy soils where the annual average rainfall is greater than 600mm, lime applied to the surface may move to 10 cm depth in two years (Fenton *et al.* 1996).

The level of exchangeable aluminium from the initial soil test ranged between 1 and 5 per cent of cation exchange capacity. The application of lime reduced the level of exchangeable aluminium in the soil to negligible amounts in all treatments.

Table 1. The effect of lime after 12 months on soil pH, cation exchange capacity and exchangeable aluminium at 0-10cm and 10-20cm on granite soil at Tenterfield NSW.

	0-10 cm			10-20 cm		
	Change in $pH_{(Ca)}$	CECmeq/100 g	Al %	Change in $pH_{(Ca)}$	CECmeq/100 g	Al %
Control	0.1	4.10	1	0.1	3.71	1
L1.75	0.6	5.10	0	0.8	4.44	0
L2.5	1.1	5.70	0	1.4	5.32	0
L3.75	1.6	6.60	0	1.2	5.91	0
L+G	0.7	5.70	0	0.4	5.20	0
Lincorp 1.75	0.7	5.40	0	0.7	3.96.	0
Lincorp 3.75	1.5	5.80	0	1.3	4.87	0
Horti 1.75	1.1	6.50	0	0.8	4.61	0

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