A survey of soil pH and exchangeable aluminium on the Northern Tablelands of NSW

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Previous surveys of soil acidity on the Northern Tablelands of NSW have concentrated on the effect of fertiliser and pasture improvement on soil pH (Crocker and Holford 1991; Duncan and Crocker 1998). These surveys indicated that, although the acidification of pasture soils is less than that of southern NSW, Northern Tablelands soils, particularly granite-derived soils are at risk. As soil pH falls, aluminium levels can increase to toxic levels, restricting root development and immobilising P in the soil and plant. This paper reports on the effects of pasture improvement on soil pH and exchangeable aluminium on the three major soil types of the Northern Tablelands of NSW.

Methods

Samples were taken from 18 paired paddock sites from Walcha (30°59'S) to Liston (28°40'S). Each site consisted of an unimproved and an improved pasture area. Unimproved sites were stock reserves or roadsides with little or no previous fertiliser. Improved areas had received at least 1.5 t/ha of superphosphate (8.6% P; 11.5% S) over the last 20 years and included at least one introduced clover and grass. At each site, 20 soil cores (2.5 cm diameter) were taken at three depths (0-10 cm, 10-20 cm and 20-30 cm). Soil was analysed for pH, exchangeable aluminium, CEC, P, and S. Soils were grouped according to their parent materials into basalt (5 samples), granite (7 samples) and sedimentary rock (6 samples).

Results

There were no significant effects on soil pH or exchangeable aluminium as a result of fertiliser use and pasture development on any soil type (Table 1). For all soil types, there was a significant ($P<0.05$) increase in exchangeable aluminium as pH decreased. At some of the granite sites, there were high levels of exchangeable aluminium at depth (20-30 cm) on both the unimproved and improved sites (41% and 20% of total cations respectively).

Table 1. Soil pH and exchangeable aluminium for unimproved (U) and improved (I) pasture sites (Means ± standard deviations).

Soil parent material	pH $CaCl_2$		Exch. Al as % of total cations	
	U	I	U	I
Basalt				
0-10 cm	5.4±0.4	5.2±1.1	1.0±1.0	2.0±2.4
10-20 cm	4.9±0.2	5.3±1.5	3.0±4.7	4.0±4.5
20-30 cm	5.5±1.5	5.5±1.5	4.0±5.1	4.0±6.7
Granite				
0-10 cm	4.8±0.4	4.9±0.4	4.0±6.7	4.0±3.4
10-20cm	4.9±0.3	5.2±0.9	11.0±16.6	4.0±2.3
20-30cm	5.0±0.4	5.2±0.7	12.0±15.5	4.0±2.4
Sedimentary rocks				
0-10 cm	4.9±0.2	4.8±0.2	2.0±1.6	4.0±3.1
10-20 cm	4.8±0.2	4.7±0.1	4.0±2.6	7.0±2.9
20-30cm	4.9±0.2	4.7±0.2	4.0±3.1	6.0±3.6

Discussion

These data support those of Crocker and Holford (1991). Their study also showed no significant effect on pH of the amount of fertiliser applied or length of fertiliser history, although trends were evident within soil groupings. Those formed from granite showed the largest decline in pH where the greatest amount of superphosphate was applied. Thus, the lighter-textured, less well-buffered soils are potentially at greater risk, in particular where nitrogen is not efficiently taken up by deep rooted perennials.

The high levels of exchangeable aluminium in the subsoil on the granite soils are probably the result of high organic matter levels on the soil surface. These amounts of exchangeable aluminium may be impeding the root activity of deep-rooted perennial grasses. However, this relationship requires further investigation.

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References

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