

Liming reduces the soil strength of a Krasnozem

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Agricultural limestone broadcast at 2.5t/ha in 1968 and 1971-75 inclusive (total 15t/ha) increased herbage dry matter from pasture grown on a krasnozem (pH 5.5) in north western Tasmania by an average 1t/ha/year (1,2). Liming also appeared to improve the friability of the soil but no attempt was made to quantify soil structural changes until 1985 (10 years after the final application of limestone), when differences in soil strength were measured and compared with differences in soil pH and organic carbon levels recorded 12 months earlier.

Methods

A 'RIMIK' cone penetrometer was used to record the soil strength every 15 mm to a depth of 450 mm at six positions in each of the limed and unlimed plots. Readings for each plot were combined to give mean values for the depths shown in Table 1 before variance analysis. The readings were taken in a 24 hour period, 2 days after 37 mm of rainfall when the soil was at field capacity.

Results and discussion

Table 1. Differences in soil strength (kPa), pH and organic carbon levels due to liming (ns = P>0.10; * = P<0.05; ** = P<0.01; * P<0.001; Δ= limed - unlimed).**

Depth (mm)	Soil Strength kPa		% reduction	ΔpH	ΔOrg C%
	Unlimed	Limed			
0-50	1 277	1 009	21.0***	0.67***	-0.49***
50-100	1 434	1 199	16.4***	1.04***	0.11ns
100-150	1 608	1 364	15.2***	1.03***	0.16ns
150-225	1 687	1 651	ns	0.43**	0.11ns
225-300	1 844	1 801	ns	0.20*	0.31ns
300-375	1 929	2 029	ns	-	-
375-450	2 083	2 190	ns	-	-

Liming reduced the soil strength at field capacity by 15-21% but only in the surface 150 mm. The reduction in soil strength occurred where calcium, which had leached from the surface, had had the largest effect on soil pH. However, below 150mm no differences in soil strength were recorded although soil pH had been altered to 300mm. The differences in soil strength were not associated with changes in the amount of soil organic matter although liming reduced organic carbon levels in the surface 50mm and was associated with small but non significant increases in organic carbon levels below this level.

Heavy liming (50t/ha) has been shown to improve the structure of heavy clay soils although the mechanisms remain uncertain (3). The measured improvement due to liming on this krasnozem was unexpected since krasnozems are recognised for their very stable structure and the soil had been continuously under pasture for 26 years.

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3. Russel, E.W. (1973). 'Soil conditions & plant growth' p 511-512 (Longman, London).