Phosphorus and sulfur interactions in soil-plant systems, III. effects of grazing and superphosphate on soil sulfur profiles

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Many Australian soils are deficient in sulfur for maximum production of crops and pasture and it is usually provided by single superphosphate (about 12% S). Recurrent deficiencies are attributed to various losses from soil, including leaching away or to depths beyond the reach of most plant roots. Elsewhere in these proceedings, Boswell *et al* have shown that high levels of P on ungrazed plots affect S retention on some soils. This paper reports sulfur movement in soil profiles at Armidale, N.S.W., following high inputs of P and S under a) prolonged superphosphate treatment and b) sustained excretal deposition.

Methods.

Experiment A involved 5 rates of superphosphate at 0, 63, 126, 252, (2 x 126) kg $ha^{-1}a^{-1}$ for 25 years on fenced off 10m x 200m plots, of two replications, grazed at about 10 sheep ha^{-1}. In experiment B, a 1 ha paddock, receiving almost 4000 kg superphosphate in 11 years, was grazed continuously at 20 sheep ha-l. Typical sheep camps developed on one end of each plot. Soil cores, 5cm dia., lm deep, were taken in both experiments, subdivided in 10cm depths and analysed for S. In A, 4 cores/plot were taken, away from camp influence, but in B single cores were located on a transect from the camp centre to mid-plot at approximate intervals of 0 (camp), 10m (camp edge), 30m and 100m.

Results and Discussion.

Experiment A: There was a large increase in available S between depths of 30 and 60cms for 126 and 252 kg treatments, especially the latter (see Figure la). However only 30% to 45% of the total S applied (370 kg and 740 kg respectively) in 25 years could be accounted for in the 0 to 60cm band. In experiment B there was a similar movement of total S in the profiles, small to huge corresponding to increasing deposition toward the camp (see Fig. lb). The high, figures for the camp edge could be from extra S in run-off from the bare camp area. In both experiments the greater S movement was associated with high surface P levels (see Table 1).

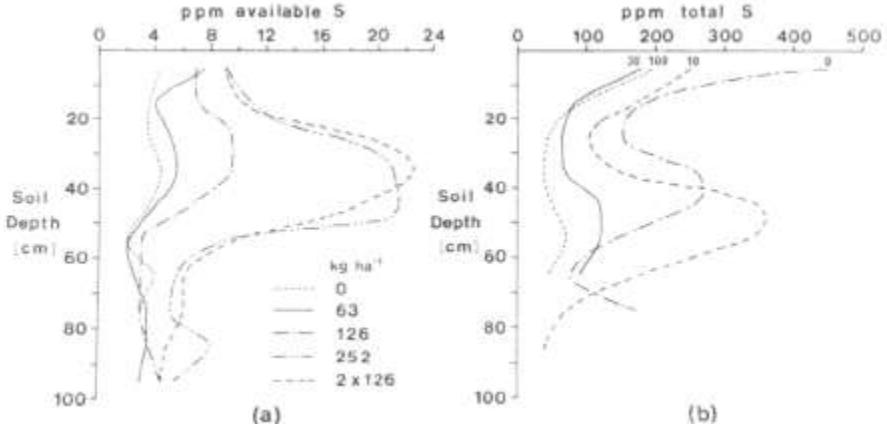

FIG 1. Distribution of Sulfur in soil from experiments A and B.

Table 1. Phosphorus levels in soil, 0-10cms in Experiments A and B.

Experiment A	Super. kg $ha^{-1}a^{-1}$	0	63	126	252
	Bicarb. P-ppm	10	21	39	92
Experiment B	Distance from camp (m)	0	10	30	100
	Bray P-ppm	420	277	66	77

These data support the hypothesis that high soil P concentrations compete for adsorption sites, leading to losses of S from the system.