

Phosphorus and sulfur interactions in soil-plant systems. II. field studies on the effect of phosphorus on soil available sulfur in uncrazed plots.

C.C. Boswell^{ab}, A.R. Till^a, G.J. Blair^b

^aCSIRO Pastoral Research Laboratory, Armidale.

^bDepartment of Agronomy and Soil Science, University of New England.

The retention of sulfate anions in soil is dependent on numerous factors including soil type, pH and the concentration of phosphatic anions (1). The current pasture fertilizer practice of repetitive superphosphate applications on soils with inherently low S-retention capacities may cause the phosphatic anions to occupy adsorption sites in preference to sulfate. The effect is likely to be cumulative with continued regular superphosphate application and consequently there is increased risk of loss by leaching of sulfate. These assumptions are based on reports from laboratory soil column experiments, so a small-plot experiment was established at CSIRO Armidale to monitor the effects in the field.

Methods

Three rates of S (7.5, 15, 45 kg S ha⁻¹ as gypsum) and two rates of P (15, 90 kg P ha⁻¹ as triple superphosphate, 0.2% S) were applied to replicated (x3) plots of a long-established phalaris-dominant pasture on a gleyed podzolic soil overlying an orstein clay pan, in April 1980. In September 1980 the available-S was measured in 22 mm diameter cores at each of 5 depths (0-5 cm, 5-10 cm, 10-20 cm, 20cm-pan, pan).

Results and Discussion

The distribution of available-S down the profile differed between P treatments and rates of S applied (Fig. 1). At S_{7.5}, P had no effect on the distribution of available-S and was similar to the S₁₅ P₁₅ (Fig. 1).

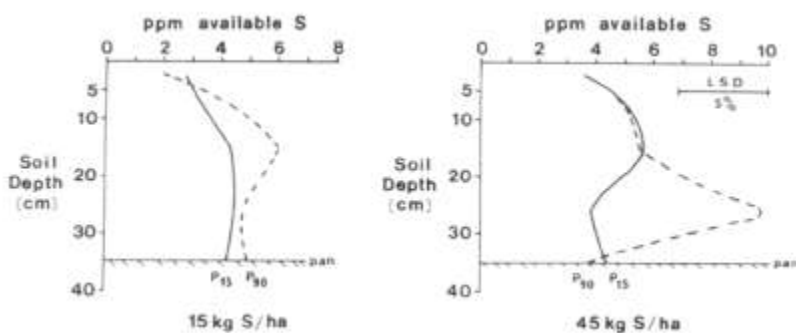


Fig. 1. The distribution of soil available-S at 2 levels of applied P & S.

Although there was no significant S x P x depth interaction, at S₄₅ there was a marked effect of P on the sulfate distribution (Fig. 1).

Where sulfur is forced beyond the rooting zone of pasture plants, as in the P₉₀ S₄₅ treatment, it could logically be expected to be a factor limiting pasture productivity, especially in a soil with a high fertility status as measured by the amount of extractable phosphorus in the topsoil. These data demonstrate that the long-term consequences of superphosphate application may be differential P and S movement. In addition there is a trend towards the use of "high analysis" fertilisers to correct particular deficiencies as they occur and it is possible that such practices could induce other deficiencies. Consequently it may be necessary to determine P and S requirements separately and adjust the ratio of the two nutrients accordingly.

1. Metson, A.J. and Blakemore, L.C. 1978. N.Z. J. Agric. Res. 21: 243-53.