FACTORS AFFECTING SULPHUR NUTRITION OF SUBTERRANEAN CLOVER
ON SANDPLAIN SOILS OF SOUTH-EASTERN SOUTH AUSTRALIA.

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Summary

Sulphur availability and plant yields on Laffer Sand were examined in a field experiment. Fine gypsum (<300 mesh) applied at the rate of 224 kg per ha in autumn or late winter disappeared from the top 20 cm of soil before subterranean clover (Trifolium subterraneum, L.) could respond. Downward movement of gypsum following rain caused increases in the $\text{SO}_4^{2-}$-S content of the 10-20 cm layer of soil, showing that leaching was occurring. Plant yield responses to the autumn application of gypsum were small, and no responses to the winter application occurred. No residual effects from previous applications of gypsum were evident.

Soil $\text{SO}_4^{2-}$-S content of the top 10 cm of unfertilized plots remained close to 1 ppm throughout the growing period, but the corresponding plant tops were only moderately deficient, suggesting that mineralization was supplying S for plant uptake.

In an incubation experiment, soil water contents between 6% and 18% had little effect on $\text{SO}_4^{2-}$-S accumulation, but at 3%, mineralization was limited. At a soil water content of 24% in the presence of 30 ppm of added $\text{SO}_4^{2-}$-S low recoveries of mineral N and S were recorded, suggesting that losses of volatile forms of S had occurred. The addition of $\text{SO}_4^{2-}$-S lowered $\text{SO}_4^{2-}$-S accumulation at all soil water contents.
In a second incubation experiment, intermittent leaching of soil samples increased recoveries of \( \text{SO}_4^{2-} \)-S in the leachates compared with those from samples unleached until the end of the experiment. Increases in incubation temperatures from 8.5\(^\circ\)C to 32.5\(^\circ\)C led to increased \( \text{SO}_4^{2-} \)-S accumulation in leached and unleached soils.

Two pot experiments tested the effects of soil temperature, plants, added \( \text{SO}_4^{2-} \)-S and soil organic matter accumulation on S mineralization. Failure to recover significant quantities of S originally present in the soil and soil/plant systems provided evidence of volatile S losses. Less S was recovered from the bare pots than from planted pots.

Differences in organic matter contents and C/N/S ratios of Laffer Sands after periods of topdressing ranging from 0 to 27 years had almost no influence on net S mineralization. As the level of organic S rose a decreasing proportion was mineralized. The pattern of organic matter accumulation in the six soils examined suggested that in Laffer sands, under existing cultural practices, an equilibrium may be nearly reached as early as five years after development.

One soil in pot experiment II was fertilized with \( ^{35} \text{S} \) sulphate and increases in the proportion of unlabelled S in plant tops between harvests I and II, and with increasing soil temperatures, showed that mineralization was supplying S for plant uptake. Radiochemical estimation of S in soil \( \text{SO}_4^{2-} \)-S extracts were higher than those made
by reduction with hydriodic acid, showing that some of the added $^{35}$S-sulphate had been converted to reduced forms.

The experiments led to the conclusion that in spite of evidence of S mineralization on Laffer Sands there is a need for regular S fertilization using material such as fragmented rock gypsum, that will maintain S supplies for an extended period.