



'ACCUMULATION OF PLANT NUTRIENTS IN SANDY SOILS'

A thesis submitted by

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SUMMARY

This thesis deals with the accumulation of plant nutrients and changes in some soil properties as affected by pasture development and superphosphate application. The investigation was carried out on the siliceous sandy soils of the South East of South Australia.

The techniques and methods used in selecting paddocks that had been developed for different lengths of time are described.

Measurements of total phosphorus accumulation in the various soil layers, illustrated the importance of leaching in these sandy soils. In fact, for every 9 kg ha^{-1} phosphorus applied only 3.4, 3.2 and 2.0 kg ha^{-1} accumulated in the 0-10 cm soil layer for the Hundreds of Senior, Willalooka and Coles respectively. The reasons for these high leaching losses and differences between areas is discussed.

Similarly, sulphur accumulation in these soils was affected by leaching and recoveries ranged from 42 percent for the Hundred of Coles to 63 percent for the Hundred of Willalooka.

Although no fertilizer nitrogen had been applied to these soils, total nitrogen accumulated at rates of 55, 48 and $37 \text{ kg ha}^{-1} \text{ yr}^{-1}$ for the Coles, Willalooka and Senior Hundreds respectively.

Increases in the accretion of total calcium, organic carbon and available phosphorus occurred with time and superphosphate. Cation exchange capacity increased with time, while the pH levels in the various Hundreds fell.

The C:P, N:P and S:P ratios all declined with years of pasture development, reaching an equilibrium after approximately 10 years. The significance of this finding in relation to measuring when a soil has reached maintenance phase is discussed.

The results derived in the investigation were used to determine maintenance phosphorus requirements using a balance sheet approach. Calculated maintenance superphosphate values for grazed pastures were 125, 70 and $50 \text{ kg ha}^{-1} \text{ yr}^{-1}$ for the Coles, Willalooka and Senior Hundreds respectively.

DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and to the best of the author's knowledge and belief, the thesis contains no material previously published or written by another person, except when due reference is made in the text of the thesis.

Dale C. Lewis

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