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AN EVALUATION OF SULPHUR TOPDRESSING  
STRATEGIES IN EASTLAND PASTURES

A thesis presented in partial fulfilment  
of the requirements for the degree of  
MASTER OF AGRICULTURAL SCIENCE  
in Soil Science at Massey University

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1982

## ABSTRACT

Two sampling surveys for soil and herbage, one in autumn and the second in the following spring, were carried out to assess the pasture sulphur status in the Eastland area of the North Island.

A preliminary glasshouse experiment using ryegrass as an indicator plant was also conducted to determine which soil test method best estimated the plant available sulphur pool in the soils covered by the survey. In comparison with calcium chloride extractable sulphur, soil sulphur extracted with calcium phosphate solution was shown to relate well to the yield response of ryegrass. Thus a calcium phosphate extractant was used as the criterion of soil sulphur status in the survey.

In most of the soils surveyed, the levels of phosphate-extractable sulphur tended to decrease with depth down to 30 cm and were not constant throughout the year. Levels were lower in spring than in autumn, possibly due to the leaching loss of sulphate and the slow mineralisation rate of soil organic sulphur during winter. The decrease in soil sulphate levels during winter was observed even at sites with low annual rainfall (900 - 1000 mm) and in soils with anion retention capacities as high as 70% as measured by the phosphate retention test. Although the levels of Olsen extractable soil phosphorus also tended to decrease over winter, this decrease in available phosphorus was not nearly as great as for sulphate, suggesting that sulphate, being the more weakly adsorbed anion, had been leached more readily.

Soil sulphur levels in autumn also reflected the sulphur fertiliser history more markedly than those in spring, thus providing further evidence of sulphate leaching during winter.

The results obtained from the herbage survey were consistent with

those derived from the glasshouse study and soil survey in showing that the sulphur status of pasture herbage, whether expressed in terms of total sulphur, sulphate or N:S ratios was generally lower in spring than in autumn. The lower sulphur status of soil and herbage in spring suggests that if sulphur deficiencies do occur in the Eastland pastures, they may be most apparent in early spring.

To confirm the suspected spring sulphur deficiency observed in the survey, five field trials were laid down in the spring of the following year on soils belonging to three New Zealand soil groups: a yellow-grey earth, an intergrade between yellow-grey and yellow-brown earths and a yellow-brown pumice soil. Significant yield responses to spring application of sulphur were recorded at three out of the five sites. These sulphur-responsive sites included both those where there had been no recent application of sulphate-containing fertiliser and also those which had received regular autumn applications of sulphate at rates of 25 to 33 kg S ha<sup>-1</sup> annum<sup>-1</sup>.

Spring application of sulphur-free nitrogen fertiliser greatly increased dry matter yield but did not appear to aggravate the effect of sulphur deficiency on pasture growth at the sulphur-deficient sites, as evidenced by the fact that yield responses to sulphur application in the presence of nitrogen fertiliser were of similar or lower magnitude than those obtained with sulphur in the absence of nitrogen fertiliser. However, spring application of sulphur-free nitrogen led to very wide N:S ratios (18:1 to 23:1) in mixed herbage at two sulphur-deficient sites. In such situations, there may be a decrease in the nutritive value of the extra feed produced by a tactical application of nitrogen fertiliser.

## ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to:

My supervisors, Mr. R.W. Tillman, for his valuable guidance, patience and encouragement throughout the course of this study, and to Dr. P.E.H. Gregg, for his advice and continual support.

Mr. J. Sykes and other members of the Department of Soil Science who assisted with the field and laboratory work.

The East Coast Fertiliser Company Limited and the Massey University Research Foundation for their financial assistance.

Messrs. J. Mauger and J. Every of the East Coast Fertiliser Company Limited for their cooperation in the initial planning of the research, the selection of sites and the collection of soil and herbage samples.

Farmers on whose properties this study was conducted.

My wife Sharon, for her encouragement and the proof-reading of much of the text. Also, the additional assistance of Mr. and Mrs. B.C.Edgecombe with the proof-reading is gratefully acknowledged.

Mrs. Dianne Syers for her competent typing of this thesis.

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## CHAPTER 1



## INTRODUCTION

More than 80 percent of the phosphatic fertiliser used in New Zealand is applied as superphosphate (MacKay et al., 1980). The cost of this superphosphate to the farmer has increased substantially during the last two years and further price increases are likely in the near future. As a result of this trend, many farmers are already being forced to consider a reduction in the use of superphosphate or to seek alternatives.

Since superphosphate is formed by acidulating phosphate rock with sulphuric acid, about 11 percent of the bulk of superphosphate is sulphur (During, 1972). Over the years, as superphosphate has been applied to satisfy the phosphorus requirements of pasture, the soil has received sulphur, often incidentally.

Any move towards reducing applications of superphosphate or substituting it with high analysis phosphatic fertiliser containing little or no sulphur, will result in lower sulphur additions to soils. Consequently, a sulphur deficiency is likely to occur in areas where sulphur inputs to the plant available soil sulphur pool from other sources, are insufficient to offset losses occurring from this pool. In order to identify these potentially sulphur deficient areas so that steps can be taken to avoid or minimize such a deficiency, a sound knowledge of the sulphur cycle in the soil-plant-animal system is necessary.

The aim of this project is to assess the relative importance of the factors affecting soil and herbage sulphur status in Eastland pastures. Those factors primarily responsible for inducing or aggravating sulphur deficiency may then be established and fertiliser topdressing programmes can be planned and put into effect to minimize such deficiency.