



FACTORS AFFECTING THE CONCENTRATIONS OF COPPER
MOLYBDENUM AND SULPHUR IN PASTURE PLANTS

A thesis submitted

by

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for the degree of
MASTER OF AGRICULTURAL SCIENCE
in the Faculty of Agricultural Science
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September, 1976.

Awarded March 1977.

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SUMMARY

The effect of fertilizer application (P,S,Cu,Mo and CaCO₃) and soil temperature and water content on the concentrations of Cu, Mo and S in subterranean clover have been investigated in a series of glasshouse experiments with several soil types. In addition, seasonal variation in the concentrations of these elements in subterranean clover, silvergrass, Wimmera ryegrass and capeweed has been examined both in the glasshouse and in field sampling studies.

In a pot experiment, application of Mo to a lateritic podzolic soil increased the dry matter production of subterranean clover only when applied in conjunction with P. In other pot experiments, application of high amounts of S to lateritic podzolic soils and a red-brown earth tended to decrease the dry matter production of subterranean clover with a concomitant decrease in the concentration of Mo in the plant to near or below the critical limit for subterranean clover (about 0.10 ppm in the shoot). At low P,Cu and Mo supply, application of CaCO₃ to the lateritic podzolic soil increased the dry matter production of subterranean clover but ^{at} higher applications of ^{P,Cu and Mo,} CaCO₃ had no effect. The dry matter production of subterranean clover was decreased by soil water stress and increased by increasing the temperature of the lateritic podzolic soil and calcareous sand from 12 to 22^oC. On the lateritic podzolic soils and a red-brown earth, the two major constituents of superphosphate (viz P and S) produced opposite effects on the concentrations of Cu,Mo and S in subterranean clover. Application of P decreased Cu and S but increased Mo concentration in the plant, while application of S increased Cu and S but markedly decreased Mo concentration. The extent to which P application affected the concentrations of Cu,Mo and S in the plant depended on the amounts of Cu,Mo and S applied to the soil. The decreases in the concentrations of Cu and S in subterranean clover where P was

applied were greater at low Cu and S supply than at high Cu and S supply to the soil. Application of P increased the concentration of Mo in subterranean clover to an increasing extent as Mo supply in the soil increased.

On the calcareous sand, application of P decreased the concentration of Cu but had no effect on Mo and S in subterranean clover, while application of S had no effect on the concentration of Cu but markedly decreased the concentration of Mo and increased that of S in the plant.

When equal amounts of P and S were applied together to the soils, the effect of S on the concentration of Mo in the plant was greater than that of P; the net result was a marked decrease in the concentration of Mo.

Increasing soil temperature from 12 to 22°C significantly increased the concentrations of Cu and Mo, but not S, in subterranean clover grown on a lateritic podzolic soil and calcareous sand. Soil water stress slightly decreased the concentration of Mo but had no effect on Cu and S in subterranean clover.

Subterranean clover contained higher concentrations of Cu and S but lower Mo than silvergrass and Wimmera ryegrass. Capeweed contained higher concentration of Cu and Mo but lower S than subterranean clover. In general, the concentrations of Mo and S in capeweed were similar to that found in the grasses. The concentration of Cu and S in all genotypes declined as the season advanced (autumn to spring): the decline was faster in the grasses than in subterranean clover and capeweed. The concentration of Mo in plants tended to remain constant throughout the season.

The results indicate the factors that need to be taken into account when

regulating the concentrations of Cu, Mo and S in pasture plants. Results also show that care must be taken not to impair the quality of the forage in terms of the Cu nutrition of grazing ruminants in an effort to maximize the yield of pastures by the application of fertilizers. Testing of the effects of fertilizers on the composition in pasture plants must be done under field conditions for each soil type and genotype, and under different environmental conditions.

STATEMENT

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

Gogu Damodar Reddy

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to Drs. A.M. Alston, K.G. Tiller and R.D. Graham for their interest, frank criticism and helpful advice during the course of this study.

The work was carried out in the Agronomy Department of the University of Adelaide at the Waite Agricultural Research Institute by kind permission of Dr. R. Knight, late Dr. K.P. Barley and Professor C.J. Driscoll.

My sincere thanks are due to Messrs. C.M. Rivers, C. McLean, D.L. Messent, Miss J.S. Ascher and Mrs. I. Bumbieris for their assistance with the experimental work and Mr. D.J. Williams for help and technical advice so willingly given. Special thanks are due also to Mrs. G.R. Bishop and Mr. T.W. Hancock, Biometry Section of the Waite Institute for their guidance with statistical analysis and use of the computer, Mr. D.F. Tam for autoanalysing the plant samples for P, and Messrs. P. Clayton and L.H. Smith of C.S.I.R.O. (Division of Soils) for analysing the soil samples for some important physical and chemical properties.

I also express my thanks to Mrs. D. Cain and Mr. A.G. Ewart for preparing the diagrams, Mr. B.A. Palk for preparing the photographs, Mrs. M. Nelson for typing the draft and Mrs. W. Billinghamurst for typing the final copy of the manuscript.

I am highly indebted and grateful to the Reverend Malcolm McKenzie, The Master of St. Mark's College, Professor D.J.D. Nicholas, Mr. C. Reynolds and Sri T.G.K. Murty who gave me so much encouragement and support throughout the duration of this study without which it would have been impossible to submit this thesis.

Financial support was provided by a University of Adelaide Postgraduate Research Scholarship which is gratefully acknowledged.