LABORATORY STUDY ON THE FATE AND REACTIVITY OF PHOSPHATE ADDED TO YELLOW BROWN PUMICE SOILS.

Thesis

presented at Massey University of Manawatu in part fulfilment of the requirements for the Degree of Master of Agricultural Science.

By

Hong-hee Chuah.

- 1965 -

TABLE OF CONTENTS

LIST OF TABLES.

LIST OF PLATES AND FIGURES.

I. INTRODUCTION

Volcanic ash blankets almost two-thirds of the North Island (Baumgart 1954). Of the volcanic ash soils, rather more than one third are classified as yellow brown pumice soils (Baumgart 1954) derived from rhyolitic pumiceous ash having clay fractions made up principally of allophane (Fieldes and Taylor 1961). This mineral shows a considerable capacity for fixing phosphate (Jackman 1951). Yellow brown pumice soils present an interesting field of research for the soil scientist, since they are among the most dynamic of soils - their equilibrium with the environment is quite unstable (Baumgart 1954). An attempt is being made in New Zealand to bring the yellow brown pumice soils to a high level of production through both foresting and agriculture. Phosphate topdressing is essential for establishment and maintenance of improved pastures. It appears from the results of Jackman (1955) that a substantial proportion of fertilizer phosphate becomesconverted to organic forms and accumulates as such. He has shown also that these soils in the virgin state contain a high proportion of their total phosphorus in the organic form.

Less information is available on the trend of inorganic fixation of phosphate in these soils and the laboratory studies reported herein, were undertaken with a view to elucidating these trends. In particular,

information was sought on the relative significance of aluminium-,iron- and calcium-binding of phosphate as influenced by time of contact between added phosphate and soil, and on changes in the solubility and exchangeability of phosphate occuring throughout the time of contact.

To these ends use was made of

(a) The phosphate fractionation procedures developed by Fife (Fife 1959a,b; 1962; 1963; priv. comm.),

(b) Truog's procedure for the determination of available phosphate (Truog 1930),

(c) An anion exchange resin technique (Saunders and Metelerkamp 1962, Cooke and Hislop 1963, Saunders 1964, Fife and Spedding priv. comm.)

(d) A radio-isotopic exchange procedure (Furkert 1962, Shao 1963, Spedding priv. comm.).