POTASSIUM STATUS AND SACHARCE CHARACTERISTICS OF SOME LOWLAND SOILS IN LUZON

[illegible]

[illegible]

POTASSIUM STATUS AND EXCHANGE CHARACTERISTICS OF SOME LOWLAND SOILS IN LUZON

PEARL R. BASILIO

SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
UNIVERSITY OF THE PHILIPPINES AT LOS BANOS
IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE
DEGREE OF

MASTER OF SCIENCE
(Soil Science)

October, 1988

ABSTRACT

BASILIO, PEARL R., University of the Philippines at Los Baños, October, 1988. Potassium Status and Exchange Characteristics of Some Lowland Soils in Luzon.

Major Professor: Dr. Genaro O. San Valentin

The study was conducted to evaluate the potassium (K) status and exchange characteristics of ten soils representing important lowland areas in Luzon. An inventory of the K content of the soils was made using the following extracting solutions: hydrogen fluoride (HF) for total K, sodium tetraphenylboron (NaTPB) for nonexchangeable K and ammonium acetate (NH_4OAc) for exchangeable K. Quantity/Intensity (Q/I) parameters derived from the Q/I curves were tested against K availability indices to assess its value in characterizing K status. Q/I data described K status by relating the intensity (I) of K to the amount (Q) of labile K in the soil.

A greenhouse experiment was conducted to determine the influence of K addition and K uptake on the Q/I parameters of selected lowland soils and at the same time assess their K supplying capacity. A high soil to plant ratio was used to exhaust available K supply in a short period.

Eight of the soils studied contained 2:1 expanding type of clay minerals. Bantog and Tarlac were dominated by vermiculite. X-ray diffraction patterns of the sand fractions of all the soils showed the presence of quartz and feldspars. The soils varied in their chemical characteristics which include pH, cation exchange capacity, organic

matter content, exchangeable K, NaTPB-extractable K, AR^K_e, $\triangle K^o$ and PBC^K.

The exchangeable K contents (NH_4OAc extractable K) of eight soils were found to be below the satisfactory level of exchangeable K for rice. Only San Manuel I and Bantog had exchangeable K level higher than 0.2 me/100g. Significant correlation were found between exchangeable K and AR^K_e (r = 0.77) and $\triangle K^o$ (r = -0.96). Sodium tetraphenylboron extractions gave higher values for K than NH_4OAc extractions since it was able to extract even the "difficultly available" K.

Although the soils contained low exchangeable K, most of the soils with the exception of La Paz, Tarlac, and Buenavista, have high buffering capacities (PBC^K). Significant correlation between PBC^K and clay content (r = 0.81) and CEC (r = 0.87) were recorded.

The Q/I relations of the soils used in the greenhouse experiment (Maligaya I and San Manuel I) redetermined after K addition and after the soils have been depleted of K by crop uptake were transposed vertically on the direction expected.

The Q/I parameters (AR^K_e, $\triangle K^o$, K_x and K_L) increased with K additions but decreased with time of incubation. K uptake decreased AR^K_e and $\triangle K^o$ with time. Significant correlation between the increase in K uptake and decrease in $\triangle K^o$ was obtained.

The intensive cropping technique employed caused a rapid decrease in AR^K_e in a short period and the release of nonexchangeable K to plant.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX TABLES

INTRODUCTION

Potassium (K) is one of the major nutrients required by plants but unlike nitrogen (N) and phosphorus (P), the available information on its management in rice soils is meager. Soils used in earlier studies often contain adequate potassium reserves and so the lack of crop response to K fertilizers has led to the general view that K fertilizers are not important. Low responses of lowland rice to K application have also been observed. It has been reported that most rice soils in Asia do not need K as much as nitrogen and that only a small and variable increase in rice yield is obtained with K fertilizers (De Datta, 1981).

Most rice growing soils in the Philippines are geologically young and release considerable K from weathering of primary minerals (De Datta, 1985). While K deficiency is not at present a serious problem in the country, intensive cropping and continuous use of modern rice varieties could drain the K reserves. Depletion is also aggravated by heavy N application so that in few years' time, soils which so far have been considered well supplied with the nutrient would require K application a necessity in establishing high yields. Recent studies in many tropical countries have demonstrated this effect. Large responses to K fertilizers have been observed and depletion of available K have been confirmed by laboratory analyses.

Determining the correct rates of K application is a difficult aspect of K management. In agricultural practice, it is important to know for any given location whether K application can significantly