POTASSIUM RELEASE AND ITS RELATION TO AMMONIUM IN THE ALLUVIAL SOILS

By

Ahmed Effat Ahmed El-Sherbiemy

B.Sc. 1959
M.Sc. 1964

Thesis

Submitted in Partial Fulfilment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in Soil Science

Soils Department
Faculty of Agriculture
University of Ain Shams

1970

APPROVAL SHEET

Name : Ahmed Effat Ahmed El-Sherbieny

Title : Potassium Release and Its Relation to Ammonium in the Alluvial Soils.

Thesis has been
Approved by :

Prof. Dr. A. H. El-Damaty

Prof. Dr. Fathy Ghoneim

Prof. Dr. ———————————

Date : —— / —— / 1970

...ooOoo...

A C K N O W L E D G E M E N T

The writer would be appreciated to express his deepest gratitude to Prof. Dr. H. Hamdy, Dean of Faculty of Agriculture, Ain Shams University.

The writer also feels great indebtness to Prof. Dr. El-Damaty for suggesting the problem, keen interest, guidance, constructive ideas, faithful help and precious advice during the study and preperation of this thesis.

Sincere gratitude and appreciation are also expressed to Prof. Dr. H. Omar, Professor of Soil Science, and Head of Soils Department, Azhar University and Dr. T. El- Sobbia Associate Professor of Soil Science for their encouragement, sincere helps, fruitful assistance and valuable suggestions throughout this study.

Thanks are also due to Prof. Dr. L. Fahmy, Dean of Faculty of Agriculture at Zagazig and all the staff members for providing facilities and encouragement.

...oo:oo...

C O N T E N T S

...oOo...

LIST OF FIGURES

LIST OF FIGURES (Cont.)

I. INTRODUCTION

The alluvial soils of the U.A.R. contain appreciable amounts of the different forms of potassium and are adequately for optimum crop production. This can be attributed to the annual addition of the suspended matter of the Nile carried during the flood season.

After the construction of the High Dam, there might be a necessity for potassium fertilization as considerable amounts of the Nile mud will be sedimented in front of the Dam. As the available part of soil potassium depends mainly on the quantity of potassium associated in equilibrium between soluble, exchangeable and nonexchangeable forms as well as on the rate of release from non-exchangeable potassium form, therefore, the amount of fixed potassium may be considered as a reservoir from which potassium is released to maintain crop demand. Accordingly potassium fixation may be considered as a benificial process.

Taking into consideration the aforementioned facts, fixed potassium in soils is of a great value in evaluating the future need for potassium fertilizers. In fact, it has been observed that a high correlation exists between

[illegible] potassium and both K-release and plant nutrition.

In fact both potassium and ammonium produce contracted lattice structure in the moist conditions, therefore, the alternative effect of potassium and ammonium was emphasized. In order to have a clear picture on the potassium release, the current investigation was planned to determine potassium release using chemical extractants, continuous leaching, thermal analysis and activity ratio, and to calibrate the previous methods by potassium supplying power biologically determined.

In addition, factors which effect potassium-release with special emphasis to the interrelationship between the contracting lattice ions were also considered.

2. REVIEW OF LITERATURE

For the sake of clarity, the literature pertaining to the various aspects of the potassium problem are reviewed in seperate sections as follows :

2.1. Forms of soil potassium.

2.2. The equilibrium relationship between the different forms of potassium.

2.3. Potassium release.

2.3.1 Chemical extractants and continuous leaching.

2.3.2 Thermal analysis.

2.3.3 Potassium activity.ratio.

2.4. Potassium release biologically determined.

2.5. Factors influencing potassium release.

2.6. The interelationship between potassium and ammonium.

2.1. Forms of soil potassium :

Soil potassium was intensively investigated by many investigators who indicated that there are different forms of soil potassium. These forms are related and form an equilibrated system. Reitemeier (1951) indicated that their availability to plants depends on the amount and relative mobility of the various forms, including the rate

of replenishment of depleted readily available forms by reserve supplier.

2.1.1 Water soluble potassium :

Reitemeier (1946) defined "soluble potassium" as the quantity existing at any one time dissolved in water of a soil under normal field moisture conditions and relatively unbounded by cation exchange forces.

Lachower (1940) found that the soluble portion constitutes from 19 to 33 per cent of the exchangeable plus soluble fraction in a 1:5 soil to water ratio. Jenny and Overstreet (1939), Reitemeier (1951) and Wiklander (1954) indicated that the replenishment of soluble potassium may occur directly and sufficiently rapid from the exchangeable form and indirectly from the non-exchangeable form to satisfy plant demands. It is of interest that York (1949), although recognizing the importance of the soluble-exchangeable equilibrium, concluded that the controlling factor in potassium absorption is the available supply in the soil solution. Wiklander (1954) pointed out that the concentration of potassium in the soil solution is dependent on such factors as the amount of exchangeable potassium, type of clay mineral, water content, other ions present and many other factors.