EFFECT OF CERTAIN SOIL PROPERTIES ON ZINC AVAILABILITY AND LEVEL IN PLANT

BY

MOHAMED ALY OSSMAN ELSHARAWY

A thesis submitted in partial fulfillment

of

the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Agricultural science

(Soil Science)

Department of Soils

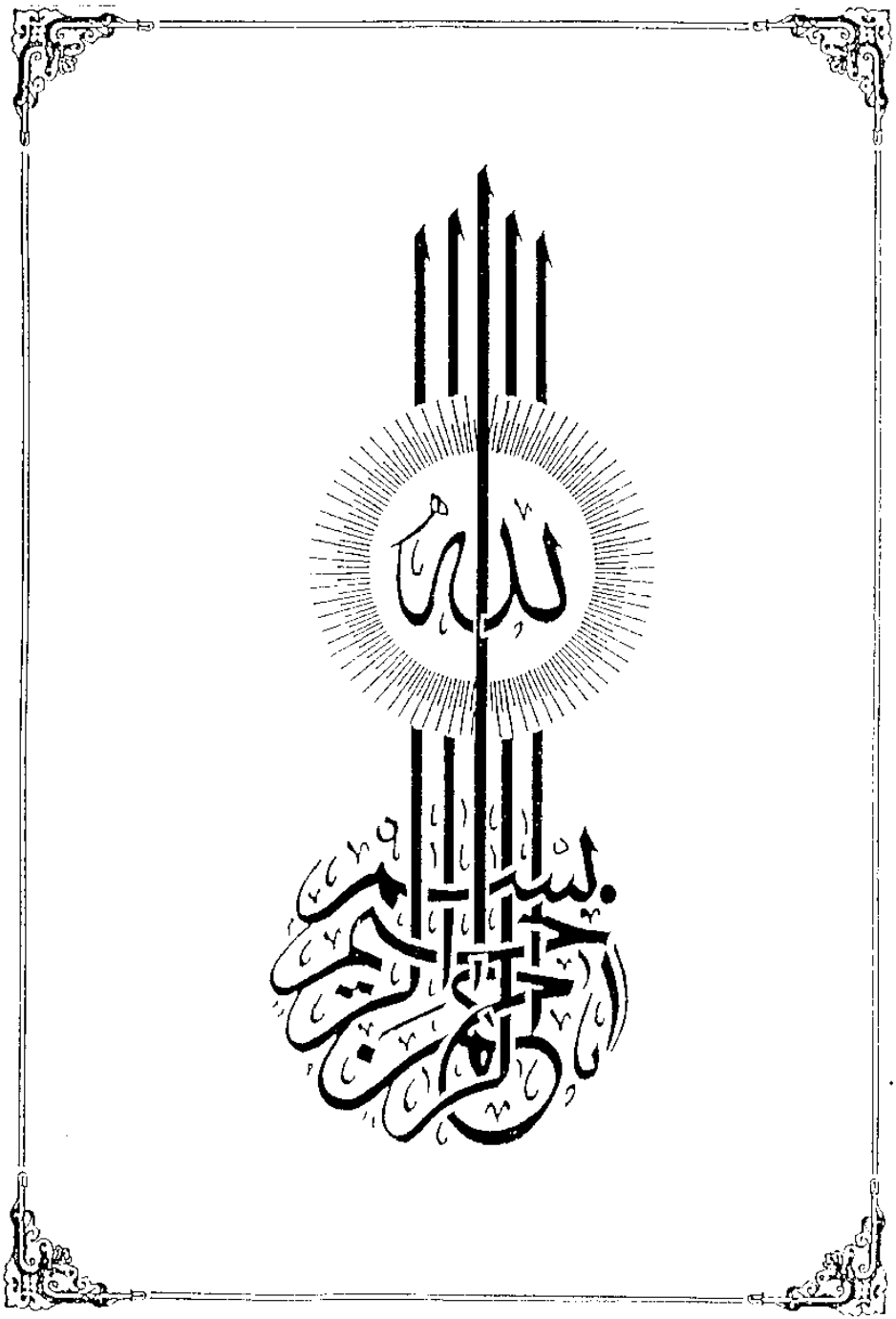
Faculty of Agriculture

Ain Shams University

1989

بسم الله الرحمن الرحيم

وقل رب زدني علما



APPROVAL SHEET

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ABSTRACT

The present investigation was carried out to study the possible modification of Zn availability in the rhizosphere by means of plant root exudates. Root exudates, of corn; Giza 2 and Hagin 202 v., tomato; Uc 82 and UC 97 v. and wheat; Horizont v. were collected by growning plants for different periods under controlled environmental conditions using split medium and solution culture techniques. The total and type of amino acids and organic acids were evaluated. Zn availability in soil and its level in plant as affected by certain soil properties and Zn adsorption-desorption by alluvial soil clays as affected by pH. $CaCO_3$ and phosphate were studied. Mathematical and statistical models which can predict Zn availability were also developed using computer.

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Results indicated that Zn absence from root growth medium led to a pronounced increase in total amounts of released amino acids and organic acids by corn and tomato plants roots using split medium technique and a high significant increase was recorded only for total amino acids in the root exudates of corn and wheat plants using solution culture technique. Corn and wheat root exudates significantly increased solubilized Zn from ZnO by the action of amino acids and organic acids as well as lowering pH of the rhizosphere as indicated by increasing H ions released to root growth medium of Zn deficient plants.

Zn adsorption-desorption was principally governed by the effect of pH followed by $CaCO_3$ treatments, while phosphate treatment showed no significant effect. Applying a developed mathematical model to results of 83 soil samples showed a very good agreement of the predicted values with the experimental values of available Zn. The multiple linear regression revealed that pH, $CaCO_3$ and organic matter content of the soils were the most important factors affecting Zn availability with R^2 value of 0.37**.

It could be concluded that absence of Zn from rhizosphere led to increasing total amino acids, organic acids and H ions released by plant roots and this caused an increase in the solubility of relatively insoluble sources of Zn. In addition, modeling Zn availability was done through mathematical and statistical equations which can predict amount of available Zn by means of some soil properties such as pH, $CaCO_3$, organic matter, clay content and phosphate.

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