EFFECT OF SOIL MOISTURE ON THE AVAILABILITY OF SOME MACRO AND MICRO-ELEMENTS IN CALCAREOUS SOILS OF EGYPT

By

Mahmoud Ismail Abd El-Rahman
(B.Sc. in Agriculture, Faculty of Agriculture, Ain Shams University, 1974)

A thesis submitted in partial fulfilment

of

the requirements for the degree of

MASTER OF SCIENCE

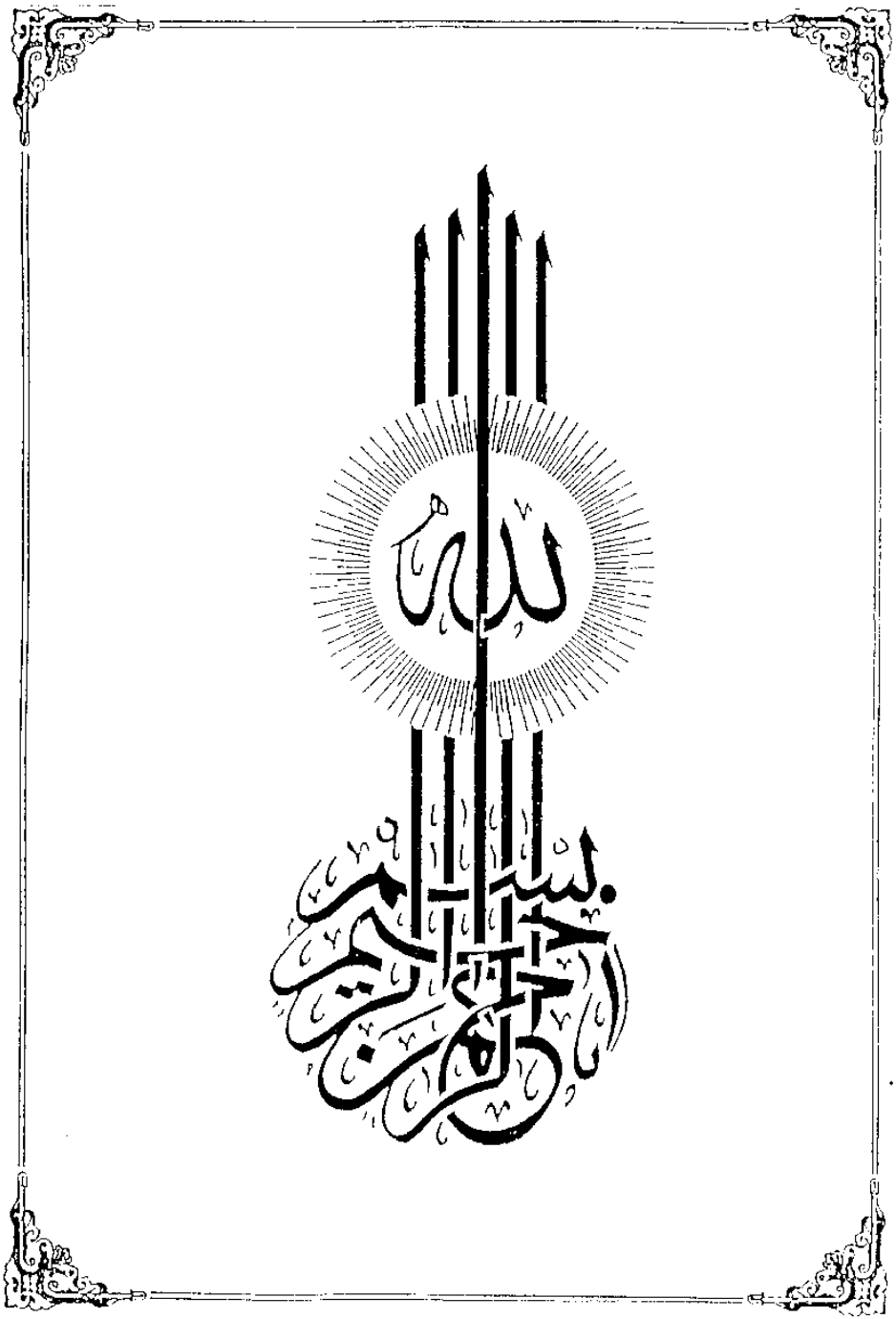
in

Agriculture

(Soil Science)

Department of Soil Science
Faculty of Agriculture
Ain Shams University

1996



APPROVAL SHEET

EFFECT OF SOIL MOISTURE ON THE AVAILABILITY OF SOME MACRO AND MICRO-ELEMENTS IN CALCAREOUS SOILS OF EGYPT

BY

Mahmoud Ismail Abd El-Rahman
B.Sc. Agriculture (Soil Science), Ain Shams Univ., 1974

This thesis for M.Sc. has been approved by:

Prof. Dr. Saad El-Demerdashe El-Kady
Prof. of Soil Science,
Desert Research Center

Prof. Dr. Abd El-Samad Salem Ismail
Prof. of Soil Science, Faculty of Agriculture,
Ain Shams University.

Prof. Dr. Mohamed Ahmed Mostafa
Prof. of Soil Science, Faculty of Agriculture,
Ain Shams University.

Date of examination: 13/12/1995

EFFECT OF SOIL MOISTURE ON THE AVAILABILITY OF SOME MACRO AND MICRO-ELEMENTS IN CALCAREOUS SOILS OF EGYPT

By

Mahmoud Ismail Abd El-Rahman
(B.Sc. in Agriculture, Faculty of Agriculture, Ain Shams University, 1974)

Under the supervision of:

Prof. Dr. M. A. Mostafa
Prof. of Soil Science,
Ain Shams University

Prof. Dr. M.H. El-Desouky
Prof. of Soil Science,
Desert Research Center

ABSTRACT

EFFECT OF SOIL MOISTURE ON THE AVAILABILITY OF SOME MACRO AND MICRO-ELEMENTS IN CALCAREOUS SOILS OF EGYPT. Unpublished Master of Science in Agriculture, University of Ain Shams, 1995.

The work is undertaken to investigate, the effect of soil moisture depletion on the yield and elemental composition of tomato and barley plants grown on calcareous soils. For this purpose three pot experiments were carried out under controlled conditions.

The experiments dealt with tomato plants involved the effect of soil depletion and mineral fertilization or organic manuring along with the effect of method of irrigation, while the third experiment was cultivated with barley and treated with sludge manuring and irrigated with tap water or sludge effluents under three different moisture regimes.

From the obtained results, one can figure out that:

1. Increasing soil moisture depletion induced significant decreases on the yields of tomato and barley.
2. Application of mineral fertilizer, organic manure and sewage sludge led to significant increases in the yield of both tomato and barley.
3. Fertilization and manuring increased most plant elements in various magnitudes.
4. The combined treatments including soil moisture depletion, fertilization or manuring and irrigation method induced variable patterns of increase or decrease in macro and micro-nutrients concentrations and uptake in both plants, depending on the parameters included in such treatments.
5. The chemical extractable amounts of soil elements varied according to treatments.

From the foregoing results, it can be said that the maintenance of proper soil moisture is of profound importance for growing plants. This proper moisture furnishes the most favourite media for water availability to plants, elements reactivity, mobility and solubility, activity and population of microorganisms which accelerate the biodegradation of organic wastes and their contribution to elements chelation and release, all of which is reflected on the grown plants composition and yield. In the current

investigation, 25% soil moisture depletion was shown to be the most appropriate soil moisture level. Mineral fertilization is undoubtedly more effective on plant growth especially at the early stages and usually overcomes organic manuring from different sources (chicken or sewage sludge) due to the readily soluble nutrients from mineral fertilizers against the slow decay of organic matter and release of nutrients. This is reflected on the grown plants where the effect, of organic manuring is more indicated at the latter stages of growth. Nevertheless, combination of both organic manuring and mineral fertilization is the most recommended. Drip irrigation is shown to be the most effective method for irrigating tomato plants. This is expected due to the uniformity of water distribution in the root zone as well as the water use efficiency of the drip system.

In conclusion, the present investigation indicates that the best combined treatment is 25% soil moisture depletion with mineral fertilization (3rd rate) or organic manuring (2% of chicken manure or sewage sludge) under drip irrigation for tomato or sludge effluent irrigation for barley.

Key words: Tomato shoot, tomato fruits, organic manure, mineral fertilization, moisture depletion, irrigation method, barley plants, sewage sludge, sludge efluent, available macro and micro nutrient, calcareous soils.

ACKNOWLEDGEMENT

The author wishes to express his deep thanks, gratitude and appreciations to Prof. Dr. M. El-Nennah, Prof. of Soils, Fac. Agric., Ain Shams Univ., Prof. Dr. M. Mostafa, Prof. of Soils, Fac. Agric., Ain Shams Univ. and Prof. Dr. M. El-Desouky, Prof. of Soils, Desert Research Center, for suggesting the problem, supervision, guidance and constructive criticism throughout the course of study. Thanks are extended ot Dr. M.S.A., Dahdoh and Dr. B.I.M. Moussa, Ass. Prof. of Soil Fertility and Plant Nutrition, Desert Research Center for sincere guidance and continual follow-up during such study.

Special thanks to Prof. Dr. M.Y. Afifi, *Head of Soil Chemistry and Physics Department, Desert Research Center, for big valuable guidance and assistance.*

The author is also indebted to the staff members of the Desert Research Center whose cooperation, assistance, advise and facilities provided are deeply appreciated.

CONTENTS

CONTENTS (Cont.)