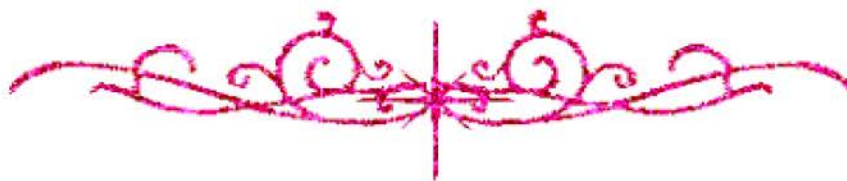


بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ





شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

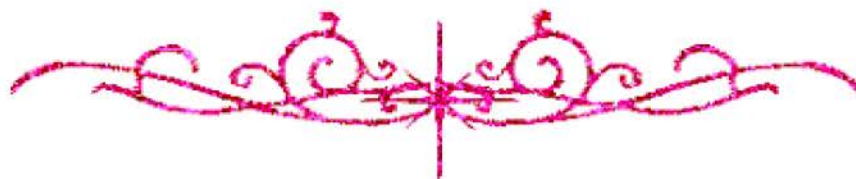
قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغييرات



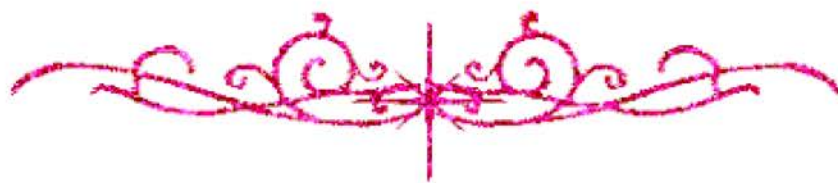
يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار





بالرسالة صفحات لم ترد بالأصل





بعض الوثائق الأصلية تالفة



B11019

STATUS OF SOME MICRONUTRIENTS IN SOME SOILS OF EGYPT



BY

Manal Abd El-Wahid Abd Alla

B.Sc., (Soil Sci.), Faculty of Agric., Ain Shams University (1980)

A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
Master of Science

In

Soil Science

Department of Soils and Agricultural Chemistry,
Faculty of Agriculture at Moshtoher
Zagazig University
(Banha Branch)

2000

APPROVAL SHEET

Name : Manal Abd El-Wahid Abd Alla
Title : Status of some micronutrients in some soils of
Egypt

This thesis has been approved by :

Prof. Dr. *H. H. Abbas*

Prof. Dr. *M. R. Sadek*

Prof. Dr. *M. H. Hassona*

Prof. Dr. *A. H. Abdel Hameid*

(Committee in Charge)

Date : / / 2000

ACKNOWLEDGEMENT

The author wishes to express his deep gratitude to Prof. Dr. M. K. Sadk and Dr. A. H. Abdel Hameid, professors of Soils Science, Faculty of Agriculture at Moshtoher Zagazig University for suggesting the problem, Supervision, continuous help and introducing all facilities needed through out the whole investigation and during writing the manuscript .

Thanks were also extended to Dr. Allae Mohammed Abdel-Kareim and all members of soils and water research Institute, Department of plant Nutrition, Micronutrients Research Unit., Ministry of Agriculture for their sincere help in providing all needed facilities .

Special thanks are also extended to my husband Mohamed for sincere help and co-operation .

CONTENTS

	Page
1- INTRODUCTION	1
2- REVIEW OF LITERATURE	2
2.1. Status of some micronutrient elemnt	2
2.1.1. Iron	2
2.1.2. manganese	5
2.1.3. Zinc	8
2.1.4. Copper	11
2.2. relationship between micro-elements and soils properties	14
3- MATERIALS AND METHODS	19
3.1. Sampling	19
3.2. Green-house experiment	19
3.3. Soil analysis	20
4- RESULTS AND DISCUSSION	23
4.1. Chemical properties of the studied soil samples	23
4.1.1. Soil reaction (pH)	23
4.1.2. Total salinity and soluble salts	23
4.2. Physical characteristics of the studied soil samples	27
4.2.1. Mechanical analysis	27
4.2.2. Calcium carbonate content	31
4.2.3. Organic matter content	31
4.3. Status of soil micronutrients	32
4.3.1. Total iron	32
4.3.2. Total manganese	35
4.3.3. Total zinc	39
4.3.4. Total copper	41
4.4. Extraction of available micronutrients	44

4.4.1. Extraction of available iron	44
4.4.2. Extraction of available manganese	53
4.4.3. Extraction of available zinc	66
4.4.4. Extraction of available copper	76
4.5. Plant uptake and the methods used for its evaluation	85
4.5.1. Dry matter yield	86
4.6. Micronutrients in plants	86
4.6.1. Iron in plant	86
4.6.2. Manganese in plant	89
4.6.3. Zinc in plant	91
4.6.4. Copper in plant	93
5- SUMMARY	97
6- REFERENCES	103
ARABIC SUMMARY	

1- INTRODUCTION

During the last decades, the Egyptian population is increasing at a straggly rate. The area of arable land per capita is therefore decreasing. Thus, lateral and vertical agricultural expansion are considered the main pathways for tackling this dilemma.

In Arab Republic of Egypt, horizontal agricultural expansion aims at reclaiming and cultivating more than two millions feddan of barren lands situated in the east and west of the Nile valley and Delta fringes. The proposed areas include both alluvial and calcareous soils. Also, calcareous soils are repeatedly considered to be a suitable area for the extension of agricultural lands in the A.R.E.

One of the most interesting subjects for study is the problem connected with micronutrients in these soils. The deficiencies or unavailability of most micronutrients have been found in calcareous soils containing much calcium carbonate, these problems are the result of many physical, chemical and biological factors which rarely act individually or mostly large interactions.

The present work was carried out to study the status of Fe, Mn, Zn and Cu in some soils of Egypt. Also, the study has included evaluation of some methods used for determining available Fe, Zn, Mn and Cu.

2. REVIEW OF LIETRATURE

2.1. Status of some micronutrient elements:

The nutrient elements (Fe, Mn, B, Mo, Cu, Zn, Cl, and Co) are used by higher plants in very little amounts thereby justifying the name micronutrients. Such a designation does not mean that they are less essential than the so called macronutrients. In fact, the micronutrients are fundamentally just as important (Buckman and Brady, 1969). Their contents of soils depend on the parent rocks from which these soils are derived by weathering processes (Mitchell, 1955).

2.1.1.1. Iron

Total iron is the most abundant micronutrients in the plant as a whole and the fourth most abundant in rocks forming earth crust. Bear (1977) reported that Fe content in earth crust ranges from 0.1% to 7.0%. Nevertheless due to differences in soil parent material and formation processes, the total iron content of soils is variable from as low as 0.02% to more than 50%. Dixon and Weed (1977) reported that granite and basalt contain 27000 and 5000 mg Fe/kg rock, respectively, while sedimentary rocks (limestone, sandstone and shale) contain 17000, 29000 and 48000 ppm Fe, respectively.

The greatest part of soil's iron usually occurs in the crystal lattices of numerous minerals related to ferromagnesian silicates, such as olivine, augite, hornblende and biotite as well as primary Fe oxides including hematite (Fe_2O_3), ilmenite (FeTiO_2) and magnetite (Fe_3O_4). In sedimentary rocks, Fe oxides and siderite (FeCO_3) are usually the most common primary Fe forms. Iron also occurs in the lattice of some secondary minerals and is

considered as an essential element in large group of clay minerals (Mengel and Kirby 1978) .

Concerning iron status in the soils of Egypt , Labib (1970) found a considerable amount of total iron in the alluvial soils (3.96 to 11.48 %) with an average of 10 percent. El-Gala and Hendawy (1972) showed that the total iron ranged from 5400 to 34000 ppm with the lowest amount in the calcareous soil and the highest amount in the alluvial one. Abdel-Kader and Abu-Ghalwa (1973) reported that total iron content varied between 1.7 to 12.9%. The heavy clay soils contained the highest total iron percentage, while the saline soils contained a lower total iron content, and the calcareous soils showed the lowest total iron percentage. The results obtained by El-Rashidi et al, (1978), El-Sayad (1988) and Hegazy et al., (1991) showed that the total Fe content in some soils of Egypt ranged from 0.55 to 2.4%. The highest values were found in the alluvial soils (average of 2.05%) and the lowest values in the sandy soils (average of 0.07%). The calcareous soils came in between with an average of 0.37 % Fe.

Hassona et al (1996) in their study on the alluvial soils found that total iron content ranged from 15000 to 50000 ppm. The wide range of total iron seems to be associated with variations in soil texture and /or calcium carbonate content. Barakate (1998) indicated that total iron content ranged from 3583 to 85000 ppm, being dependent upon the clay + silt percentage rather than the clay content alone.

Available iron:

Concerning available iron, variable amounts have been reported by different investigators , depending on soil characteristics and the extracting solution. Holah (1977) indicated that the average values of available iron were

5.3 ppm in the Nile alluvial soils and 4.6 ppm in the sandy soils. These values reveal that such soils are marginal with respect to their iron content according to the limits proposed by Lindsay and Norvell (1978). El-Toukhy (1987); stated that the DTPA extractable Fe ranged from 2 to 15 ppm, with an average of 8.3 ppm. Also, Mohamed (1982) in his study of the DTPA extractable Fe of soils of five regions in Egypt found that these values of this element is relatively higher in the clay and silt fractions, compared to their values in sand fraction. He concluded that soil texture is the most important factor affecting the content and availability of this element. Mohamed (1990) found that the available Fe ranged between 6.0 and 2.0 ppm in alluvial soils and 1.4 to 7.6 ppm in the calcareous ones.

The difference in the amounts of extractable Fe manifests the effectiveness of extractants for the recovery of Fe from some calcareous soils. The results obtained by El-Demerdashe et al(1991) revealed that the extraction power of the employed extracts in most of the tested soil could be arranged in the following order

$$\text{HCl} > \text{NH}_4 \text{HCO}_3 + \text{DTP} > \text{EDTA} \geq \text{NH}_4\text{OAc} > \text{DTPA} > \text{H}_2\text{O}$$

As to the percentage of extracted Fe to total Fe, the extracted Fe forms 0.001 to 0.25, 0.01 to 0.4, 0.01 to 0.4, 0.01 to 0.21, 0.02 to 0.52 and 0.003 to 0.37% of total Fe when extraction was conducted by

DTPA, NH_4OAc , EDTA, $\text{NH}_4^+ \text{HCO}_3^- + \text{DTPA}$, HCl and H_2O , respectively.

Hegazy et al(1991) found that the extracting power of the employed reagents could be arranged in the following order:

Acid ammonium acetate + EDTA (AAAC + EDTA) > EDTA + CaCl₂ > ammonium bicarbonate + DTPA (AB + DTPA) > EDTA > NH₄OAc; pH 4.8 > Mg (NO₃)₂ > Ca (NO₃) > NH₄OAc – hydroquinone. Also they reported that the average values of extractable Fe as, a percentage of total Fe that acid ammonium acetate EDTA (AAAC + EDTA) solution extracted were about 1.1, 1.9 and 0.4% of total Fe from the calcareous, sandy and alluvial soils, respectively. Whereas, DTPA a solution extracted about 0.09, 0.3 and 0.07% of total Fe and ammonium bicarbonate + DTPA (AB + DTPA) extracted about 0.15, 0.3 and 0.1 % of total Fe from the previously mentioned soils, respectively.

Total Manganese:

Manganese occurs in many primary rocks, particularly in ferromagnesian rocks rich in iron. It may be present in soils in non-exchangeable, exchangeable and soluble form. The main part is present as insoluble oxides, the most common of which seems to be pyrolausite with tetravalent Mn, both in a hydrated and active forms, MnO₂ · 2H₂O, and in a crystallized and inert forms, MnO₂ (Wiklander, 1958).

The total Mn content in soils varies widely from traces to 10000 ppm, but most soils contain an average from 500 to 1000 ppm. The variations noticed can rarely be correlated with soil typology, but they are often high between soil of the same type in a given climatic region (Aubert and Pinta, 1977).

With respect to the soils of Egypt, Ghanem et al., (1971) studied the status of Mn in 30 soil samples representing different geographical areas and mode of formation. They recorded that total Mn ranged from 116 to 1300 ppm. Their data showed that the alluvial soils have the highest Mn content