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STATUS OF SOME MICRONUTRIENTS IN SOME EGYPTIAN SOILS AS CORRELATED TO SOME SOIL PROPERTIES.

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ABSTRACT

This work aims at studding and evaluating the relation between total and DTPA- extractable Fe, Mn, Zn, and Cu and some soil variables, i.e., soil texture, CaCO3 content, OM content, EC and pH of thirty one surface soil samples representing the soils of Siwa, Al-Aksour, Shndaweel, Tushka, El-Mattanaa and South Sinai. Obtained results could be summarized as follows:

Total iron content ranged from 2232 to 49000µg g-1 with an average ranged from 450 to 35733.3 µg g-1 , whereas DTPA-extractable Fe varied between 1.3 to 4.5 µg g-1. The studied location can be arranged according to average values of total Fe as follows:
Tuski > El-Mattanaa > Shandaweel > West Tushki > > Al-Aksor > Tushki station > Siwa > South Sinai.

Total manganese content voried from 140 to 980 µg g-1 with an average ranged fromm 183.8 to 577.5 µg g-1, while DTPA-extractable Mn ranged from 0.6 to 10.9µg g-1. Total Mn can be arranged in the following order: El-Mattanaa > Shandwell > Tushki > West Tushki > South Sinai > Tushki Station > Siwa > Al- Aksour.

Total zinc content varied from 28 to 150µg g-1 with an average ranged from 40 to 140µg g-1, whereas DTPA- extractable Zn ranged between 0.45 and 0.46 µg g-1 the values of total Zn in the studied location ore arranged as follows:
West Tushki> Tushki Station > Tushki > South Sinai > Shandwell > El-Mattanaa > Al-Aksor > Siwa.

Total copper content ranged between 3.9 and 65 µg g-1 with an average varied from 15.0 to 84.3 µg g-1, while DTPA – extractable Cu ranged from 0.22 to 4.0 µg g-1.

Positively significantly correlation was found between available soil content of most of the studied elements and each of clay and silt, where as negatively significant correlation was found with coarse sand.

In most soil samples, the surface layers content of available Fe is considered to be marginal and low, while Mn element is considered to be adequate and low. Available Zn is high and medium whereas that of Cu is high and low.

INTRODUCTION

Nutrient elements (Fe, Mn, Zn and Cu) are used by higher plants in very small amounts there by justifying the name micronutrients. Such a designation dose not mean that they are lees essential than so called macro nutrients. In fact the micro nutrients are fundamentally just as important. Its contents of soils depends on the parent rock from which there soils are derived by weathering processes.

Iron is the most abundant micronutrient in the plant as a whole on the fourth most abundant element in earth crust. Nevertheless due to differences in soil parent material and formation process, total Fe content of soils is variable and range from as low as 0.02% to more than 50% (Bear .1977).

(Adrino, 1986 reported that manganese occurs in many primary rocks particularly in Ferro manganesian rock rich iron manganese has several functions. It activates many enzyme reactions involved in the metabolism of organic acids, phosphorus and nitrogen. It is also involved in photo synthesis. Manganese deficiencies have observer in various crops throughout the world.

Zinc is extremely important to nutritional health. The recommended daily allowance for Zn has been set to a 15 mg for adult (RDA1979). Zinc deficiency is more common than deficiency of any other micronutrient because of the low content of Zn in the soil and unavailability of Zn present in the plant, (Abd-Alla 2000) showed a positively significant correlation between Zn and each of clay and silt.

Copper is one of few metallic elements that occur in a native state metal in the earth's crust. Cooper in rocks of the earth's crust exhibits typical chaleophile behavior in that its abundance and stable forms are sulphides than silicate or oxides. The average concentration of Cu in the lithosphere is about 100ppm (Kovda et al.1964). As availability of any nutrient elements is not governed by total content alone, it is essential to determine the available content of micronutrients which is of fundamental importance for evaluating soils of Egypt have been studied by several investigators among them, Hassona et al (1996, Barakate (1998), Abd el Razik (2002) Khalil et al (2004) and Garis (2006).

The aim of the work is to study total and available micronutrients status in some selected soils of Egypt in relation to certain soil properties.

MATERIALS AND METHODS

Thirty one surface soil samples having different physical and chemical properties were taken from localities in different Governorates. Three soil samples from Siwa Oasis, four samples from El-Aksour, four samples from Shandaweel (Sohag Governorate), eight samples from Tushki (Aswan Governorate), nine samples from El-Mattanaa station (Qena Governorate) and two soil samples from South Sinai.

Soil samples were air dried, sieved to pass through 2mm sieve and analyzed for some physical and chemical properties (Page et al. 982).

Total content of micronutrients (Fe, Mn, Zn and Cu) were extracted by digestion in a mixtures of concentrated (HF+ 62% perchloric acid) as recommended by Hesse (1971).

Available Fe, Mn, Zn and Cu were extracted by a method described by (Soltanpour and Schwab 1977). Micronutrient contents of soils were determined using atomic absorption spectrophotometer (Page et al 1982). Statistical analyses of the data were determined for simple correlation at 95% and 99% confidence levels according to Paukhurst and Appleo (1999).

RESULTS AND DISCUSSION

To assess the relationships between soil locations and their contents of trace elements, the levels and distribution of total and DTPA- extractable Fe,Mn,Zn and Cu in the representative soil samples will be discussed. Moreover, on attempt is mode to shedding on their status and the factors controlling their behavior in the soil of Egypt.

1-Total content of Iron

Table (3) shows that, total Fe contents in the studied soils vary within a wide range from 2232 to 49000 µg g $^{-1}$with an average range from 4450 to 3596.5 mg g-1. The lowest values are detected in South Siwa and Siwa localties, these localties are characterized with the lowest values of total iron, this is may be attributed to the sandy texture of these soils (Table 2). The highest value is present in El-Mattanaa and Tushki localties. These soils are characterized by the highest content of clay (47%) as shown in Table (2) these results agree with those obtained by Rashad et al (1995), and Mohamed and Abd Alla (2001).

With respect to total Fe as an average vary from 4450 to 35733.3 µg g $^{-1}$, the lowest average value is detected in South Sinai location, while the highest one is present in Tushki. The studied locations can be arranged according to the average value of total Fe, as follows:

Tushki > El-Mattanaa > Shandaweel > west Tushki > Al-Aksour > Tushki Station > Siwa > South Sinai.

2- Available content of iron

Data illustrated in Table (3) show the amounts of DTPA – NH_4HCO_3 extractable iron from the studied soil samples. From the table, it is evident that available Fe varies from 1.3 to 4.5 µg g $^{-1}$. The lowest values are present in sample No.3 (Siwa). This location that contain the lowest amounts of total Fe characterized by very high values of electrical conductivity (Table1).The value of electrical conductivity located in Siwa range from 37.45 to 42.97 dS/m^{-1}, while the values of available Fe in Siwa samples vary from 1.2 to 1.3 µg g $^{-1}$. The lower values of available Fe may be affected the high values of EC. (Table 1)

The highest amounts of available Fe are located in samples No. 20 and 29. Samples No. 20 is located in west Tuskhi, this sample is selected from shale deposits and high amounts of Fe. Otherwise, El-Mattanaa location also, record highest amount of available Fe (sample No. 29), this site characterizes with very high amount of clay content 47% (Table 2). Relatively high amount of available Fe are recorded in Shandweel, Tushki playa and El-Mattanaa locations (samples 21,22,23,27 and 28), these sample, contain high amounts of clay contents (Table2). These results agree with that obtained by El-Touky 1987, Abd El-Kareem 1995 and Naida and Abd Alla 2001.

According to Soltanpour & Schwab (1977), the index values of DTPA – NH_4HCO_3 extractable Fe are as follows: low, 0-2 µg g^{-1}, marginal 2.1-4.0 µg g^{-1} of Fe.

The studied soil locations display that the samples belonging to adequate level are 20 (West Tushki) and 29 (El-Mattanaa), while the locations that represent marginal level are Shandweel (samples 8,9,10 and 11), Tushki playa (Samples 16, 17 and 18), El-Mattanaa (samples 21,22,23,27 and 28) and West Tushki (Sample No. 19) and other samples characterized by low content of Fe (according to critical levels stated by Soltanpour & Schwab 1977).

Statistical analysis, shows a highly significant positive correlation between Fe available and Clay content ($r= 0.460^{**}$) and negatively correlation with sand content ($r=-0.371^{*}$). (Table 4) These results are in agreement with those obtained by Grais (2006). Data in Table (3) indicate that the values of available Fe as an average rang from 1.26 to 3.66 ppm. The highest value located in Tushki location while the lowest on present in Siwa.

3- Total content of Manganese

The results of total manganese of the studied soil location are given in Table (3). The data indicated that the values of total manganese ranged from 140 to 980 µg g^{-1}. The lowest value is located in Tushki station (Sample No.13) while the highest one is present in EL- Mattanaa (Sample No. 29) The data present in tables (2) and (3) indicate that variations in total manganese content due to variation in soil texture, the higher is the total manganese of the soil ,

the finer the texture, where the current data shown in tables (2) & (3) show that the higher values of total manganese accompanied by higher values of clay contents as shown in El . Mattanaa location (Samples No. 12, 22, 27, 28 and 29). Similar results were obtained by (El – Laboudi et al. (1971); Gaber (1979) ; Awadallah et al . (1982); Abd El kariem (1995); Mohamed and Abd Alla (2001).

With respect to total Mn as an average data indicate that the average values of total manganese in the studied samples vary from 183.8 to 577.5 µg g^{-1}. The highest value is present in El – Mattanaa while the lowest one is present in El – Aksour. The values of total Mn as an average in the studied locations can be arranged in the Following order: - Total Mn (El-Mattanaa) > (Shandwell) > (Tushki) > (west tushki) (South Sinai) > (Tushki station) (Siwa) > (Al – Aksour).

4- Available manganese

Available contents of Mn Data of extractable Mn with DTPA– NH_4 HCO_3 Solution are tabulated in Table (3). Amounts of extractable Mn in the studied soils vary considerably from 0.6 to 10.9 µg g^{-1}. The present data indicate that the highest value is detected in sample No. 20 (west Tushki) this site contains very high content of available Mn (10.9 µg g^{-1}) This site contain shale deposits this is may be explain very high of Mn. the lowest values of Mn are detected in EL – Mattanaa (Samples from No21 to 29) where the values of available Mn very from 0.60 to 0.59 µg g^{-1}According to Soltanpour and Schwab (1977) , the critical values of the DTPA – NH_4HCO_3 extractable Mn are as follow low 0-1.8 µg g^{-1} of Mn; adequate >1.8 µg g^{-1} of Mn. The results of the studied soil sites indicate that the samples belonging to adequate level are Siwa (samples No.1.2 ,and 3) , Shandaweel (samples No.10) , Tushki station (Sample No – 12) and west Tushki (Sample No 20) , while other samples characterized by low level of Mn (according to Soltanpour & Schwab 1977). Data in table (3) indicate that the values of a available Mn as an average vary from 0.78 to 5.95 µg $g^{-1}$the lowest value is present in El Mattanaa while the highest one is located in west Tushki. The values of available as an average in the studied locations can be arranged according to the following order west Tushki > Siwa >

shandaweel > Tushki station > Al-Aksour and Tushki >South Sinai >El-Mattanaa. Statistical analysis (Table 4) illustrate a highly significant positive correlation between available Mn and silt content ($r = 0.623^{**}$)

5- Total content of zinc.

Contents of total zinc in the studied soils are present in table (3). The data indicated that, total zinc ranges from 28 to 150 µg g^{-1}. The highest content is located in west Tushki (sample No. 20) , while the lowest one is found in Siwa location (sample No . 2) Data in Table (3) indicate that west Tushki exhibits highest values of total Zn (150 and 130 µg g^{-1} of Samples 19 and 20 respectively finely) and from Table (1) the samples of this location characterized by the lowest values of pH so, the lowest values of total Zn may be attributed to the lowest values of pH. The data also reveal that all samples in the studied soils that characterized by day structure; Shandaweel (Samples No.11 and 12), Tushki playa (Samples No. 16,17 and 18) and El -Mattanaa (Samples No. 21, 22 ,23 ,27 , 28 and 29) are characterized by high amounts of total Zn . These results are agree with those obtained by (Abd El Karien 1995 and Mohamed and Abd Alla (2001).

According to Chapman (1965), the levels of total Zn content below 50 µg g^{-1} could be considered low and those above 100 µg g^{-1}could be considered high . The results indicated that the soil samples belonging to the high and medium level groups represent 12.90 and 64.51 % respectively while 22.58 % only belong to low level one.

Data in table (3) indicate that total content of Zn as an average vary from 40 to 140 µg g^{-1}. The highest value is detected in west Tushki, while the lowest one is detected in Siwa. The values of total Zn as an average in the studied soil locations are arranged as follows:- West Tushki > Tushki station > Tushki > south Sinai > Shandweal > El Mattnaa > Al-Aksour > Siwa.

Statistical analysis. (Table 4) show a significant negative correlation between total Zn and EC $r = 0.361^{*}$

6 – Available contents of Zn

The values of available Zn present in Table (3) illustrate that the lowest values of available Zn are detected in South Sinai location , where the value of Zn in this site are 0.45 and 0.46 μg g^{-1} in Samples No. 30 and 31, respectively. Also, El – Aksour , Tushki station , Tushki playa and El – Mattanaa locations characterized by relatively Small amounts of available Zn with respect to other locations. The highest contents of available Zn are present in sample No 20 (west Tushki) which represent shale deposits. According to Soltanpour & Schwab (1977), the index value used for Zn extracted form soils by DTPA – NH_4HCO_3 method are as follow: low 0 – 0.9 μg g^{-1} of Zn marginal, 1 -1.5 μg $g^{-1}$of Zn and adequate , >1.5 μg $g^{-1}$of Zn . The present results indicate that the soil samples belonging to adequate are detected only in two sites (Sample No . 10 located in Schandaweel site and sample No . 20 located in west Tushki site) , while marginal levels of Zn are present only in 2 locations (Siwa and Shandaweel samples No . 8 , 9 and 11) and low levels of available Zn according critical levels of Zn stated by Soltanpour and Schwab (1977) are found in Al – Aksour. Data in Table (3) indicate that the values of available Zn as an average vary form 0.45 to 1.53 μg g^{-1}. The lowest value is detected in south Sinai, while the highest one is present in west Tushki; the average values of available Zn can be arranged as follow: West Tushki > Shandaweel > Siwa > Tushki > El – Aksour > Tushki station > EL- Mattanaa > South Sinai. Tushki station, Tushki playa, EL-Mattanaa and south Sinai.

Statistical analysis (Table 4) illustrate a highly significant positive correlation between available Zn and silt ($r= 0.621^{**}$). These relations are in agreement with those of Hassona et al (1996), Barakat (1998) , Khalil et al (2004) and Grais (2006).

7- Total content of Cooper

Table (3) represents the total Cu content of the soils under investigation. The obtained data show that total Cu fluctuates between 3.9 and 65 μg g^{-1}. The Lowest values characterized Siwa location where this location exhibits very low amounts of total copper. The

highest amount of total Cu content was detected in Shandaweel location (Sample No. 10).

Results in Table (3) also reveal that Schandaweel location contains the highest average value of total Zinc (84.3 µg g^{-1}) followed by Siwa (46.3 µg g^{-1}) and then El-Mattanaa (46.1 µg g^{-1}), while the lowest average values are detected in South Sinai (15 µg g^{-1}) followed by West Tushki (25 µg g^{-1}).

Other locations (El-Aksour, Tushki station and Tushki playa) have a very narrow range of average total Cu (range from 30 to 33.80 µg g^{-1}).

8- Available contents of Cu

Table (3) shows that the DTPA- NH_4HCo_3 extractable Cu in the studied soils vary from 0.22 to 4.0 µg g^{-1}. The lowest value is detected in sample No. 3 (South Sinai location), while the highest value is present in sample No. 19 (West Tushki).

According to Soltanpour and Schwab (1977) the critical values of available Cu extracted by DTPA - NH_4HCo_3 solution are as follow; low 0-0.5 µg g^{-1} of Cu high > 0.5 µg g^{-1} of Cu. The results of the studied soil locations indicate that the high amounts of available Cu (according to Soltanpour & Schwab 1977) are detected in Shandaweel location (Sample, No. 8, 9, 10, 11 and 12), El-Mattanaa location (Samples No. 22,23,24,25,26,27,28 and 29) and West Tushki location (Sample No. 19 and 20), this location contains very high amounts of Cu, while the locations of Siwa, El-Aksour, Tushki station, Tushki playa and South Sinai contain, low amounts of available Cu.

Data in Table (4) indicate that the average values of available Cu in the studied locations vary from 0.23 to 3.4 µg g^{-1}. The lowest value is present in south Sinai ,while the highest one is present in west Tushki. The studied locations can be arranged according to the average values of available Cu as follows:

West Tushki > Shandaweel > El-Mattanaa > Tushki > Siwa > Tushki station and El-Aksour > Soth Sinai.

Statistical analysis (Table 4) indicate that, there is a significant positive correlation between available Cu and both of Clay ($r= 0.351^{*}$)

and silt (r=0.356*). These results are in agreement with those obtained by Khalil et al (2004) and Grais (2006).

Table (1) Chemical properties of the studied soil samples.

Locations	Sample No.	Depth Cm	EC dS/$^{-1}$	pH	Soluble Ions meq/L							
					Cations				Anions			
					Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$
Siwa	1	0-15	42.97	7.87	50.22	36.30	335.06	6.38	0.0	2.2	407	6.00
	2	0-20	37.45	8.32	41.86	30.71	300	5.28	0.0	2.64	338	37.21
	3	0-20	41.82	8.31	40.22	36.02	347.6	5.28	0.0	1.76	382	45.36
El-Aksour	4	0-15	6.96	8.36	40.96	4.48	21.56	2.2	0.0	1.76	7.04	60.4
	5	0-15	5.99	8.34	40.12	6.05	12.54	1.87	0.0	2.2	17.6	4078
	6	0-15	0.72	8.67	2.50	1.14	3.21	0.37	0.0	1.20	5.6	0.42
	7	0-15	1.93	9.59	1.67	1.25	16.06	0.17	0.0	2.4	6.4	10..35
Shandaweel	8	0-20	0.39	8.46	1.51	1.23	1.25	0.22	0.0	1.06	2.4	0.25
	9	0-20	1.13	8.43	6.54	0.35	3.17	1.14	0.0	2.4	5.4	3.4
	10	0-20	0.72	8.36	2.18	0.19	4.95	0.04	0.0	1.4	5.4	0.56
	11	0-20	0.58	8.35	3.34	0.41	2.02	0.04	0.0	1.52	3.8	0.49
Tushki Station	12	0-15	0.43	8.17	1.045	0.66	1.16	0.88	0.0	1.52	2.4	0.23
	13	0-15	0.76	8.68	3.08	0.57	3.82	0.26	0.0	2.64	4.4	0.69
	14	0-15	0.57	8.83	2.46	0.46	2.64	0.06	0.0	1.20	4.4	0.02
	15	0-15	0.68	8.48	3.35	1.07	2.28	0.06	0.0	2.20	4.4	0.11
Tushki Playa	16	0-15	6.70	8.13	13.44	5.41	48.4	0.92	0.0	1.76	8.8	56.69
	17	0-15	14.80	8.16	29.26	1.51	112.2	1.01	0.0	3.96	66	74.02
	18	0-15	12.96	8.09	30..93	9.39	86.9	1.10	0.0	3.08	55	70.28
West Tushki (shale)	19	0-15	7.66	6.82	48.55	3.30	21.8	2.66	0.0	2.2	17.6	56.51
	20	0-15	5.27	6.64	10.06	5.5	36.1	0.99	0.0	0.06	15.4	37.14
El-Mattanaa	21	0-15	0.99	8.73	2.50	0.41	6.68	0.04	0.0	2.72	6.6	0.31
	22	0-15	1.18	9.36	2.50	0.41	7.17	0.04	0.0	3.4	6.6	0.12
	23	0-15	1.70	8.97	5.01	4.38	7.18	0.04	0.0	1.16	6.4	6.05
	24	0-15	1.13	8.22	7.52	1.25	2.38	0.91	0.0	1.08	6.4	4.58
	25	0-15	0.59	8.43	3.34	0.30	1.9	0.36	0.0	1.08	4.4	0.36
	26	0-15	0.84	8.40	3.34	1.03	2.28	1.88	0.0	2.2	4.4	1.93
	27	0-15	3.84	7.98	9.06	5.7	20.2	3.74	0.0	1.76	13.2	23.74
	28	0-20	4.54	7.84	19.26	12.66	11.5	1.84	0.0	1.76	15.4	28.1
	29	0-20	3.89	7.86	11.72	9.05	14.9	3.93	0.0	1.32	22	16.28
South Sinai	30	0-15	0.88	8.37	4.18	0.19	4.18	0.24	0.0	1.76	4.4	2.63
	31	0-15	1.15	8.71	5.66	4.25	0.9	0.37	0.0	2.64	4.4	4.14

Table (2) Particle size distribution of the studied soil samples.

Location	Sample No.	Depth Cm	Particle size distribution				Texture
			Clay	Silt	Coarse Sand	Fine Sand	
Siwa	1	0-15	7	10	76.70	6.3	Sandy
	2	0-20	7	10	76.41	6.59	Sandy
	3	0-20	7	5	81.41	6.59	Sandy
El-Aksour	4	0-15	12	15	58.59	14.41	Sandy Loam
	5	0-15	7	10	70.40	12.6	Sandy Loam
	6	0-15	7	5	84.65	3.35	Sandy
	7	0-15	12	5	74.90	8.10	Sandy Loam
Shandaweel	8	0-20	22	15	18.38	44.62	Loamy
	9	0-20	32	20	8.64	39.36	Clay Loam
	10	0-20	37	20	3.19	39.81	Cly
	11	0-20	27	20	47.33	15.67	Clay
Tushki Station	12	0-15	7	5	58.74	19.26	Sand
	13	0-15	12	5	62.23	20.77	SL
	14	0-15	12	4	3.48	80.52	SL
	15	0-15	12	5	76.42	6.58	SL
Tushki playa	16	0-15	42	10	31.22	16.78	Clay
	17	0-15	42	10	8.85	39.15	Clay
	18	0-15	37	15	8.14	39.86	Clay
West Tushki (shale)	19	0-15	7	10	77.35	5.65	sand
	20	0-15	17	15	45.05	22.9	SCL
El-Mattanaa	21	0-15	37	10	5.00	48.0	Clay
	22	0-15	27	35	5.05	34.95	Clay
	23	0-15	32	25	3.0	40.0	Clay Loam
	24	0-15	12	10	73.96	4.04	SL
	25	0-15	12	2	73.93	12.07	LS
	26	0-15	12	5	77.11	5.89	LS
	27	0-15	42	15	4.77	38.23	Clay
	28	0-15	46	5	9.26	38.74	Clay
	29	0-15	47	5	15.86	32.14	Clay
South Sinai	30	0-20	12	2	73.91	12.09	SL
	31	0-20	7	5	74.21	13.09	Sand

Table (3): Total and available Fe,Mn,Zn and Cu µg g $^{-1}$ of the studied soil samples.

Location	Sample No.	Depth Cm	Fe		Mn		Zn		Cu	
			T.	Av.	T.	Av.	T.	Av.	T.	Av
Siwa	1	0-15	6110	1.3	235	3.0	45	1.40	39	0.50
	2	0-20	2232	1.3	242	1.9	28	1.30	54	0.38
	3	0-20	6730	1.2	147	1.9	47	1.10	46	0.32
Average			**5024**	**1.26**	**208**	**2.26**	**40**	**1.26**	**46.3**	**0.4**
El-Aksour	4	0-15	10800	1.5	195	1.2	53	0.65	51	0.32
	5	0-15	9820	1.6	180	1.5	46	0.65	35	0.43
	6	0-15	9800	1.5	175	1.3	40	0.85	25	0.35
	7	0-15	10200	1.6	185	1.2	45	0.65	30	0.49
Average			**10167.5**	**1.55**	**183.80**	**1.30**	**46**	**0.7**	**35.3**	**0.39**
Shandaweel	8	0-20	21400	2.1	180	1.1	63	1.00	31	1.40
	9	0-20	1990	3.0	185	1.7	70	1.30	35	1.60
	10	0-20	40200	3.2	420	2.3	85	1.70	65	0.95
	11	0-20	45300	2.8	520	1.4	90	1.20	62	1.00
Average			**31700**	**2.77**	**326.3**	**1.62**	**78.3**	**1.30**	**48.3**	**1.23**
Tushki Station	12	0-15	7100	1.5	220	1.9	80	0.66	40	0.50
	13	0-15	9200	1.5	140	1	115	0.65	15	0.30
	14	0-15	11500	1.4	275	1.5	120	0.68	30	0.35
	15	0-15	11990	1.45	255	1	70	0.67	50	0.41
Average			**9947.5**	**1.46**	**222.5**	**1.35**	**96.3**	**0.66**	**33.8**	**0.39**
Tushki playa	16	0-15	32000	3.9	320	1.3	86	0.66	32	0.46
	17	0-15	43000	3.9	310	1.3	85	0.66	25	0.43
	18	0-15	32200	3.2	310	1.3	92	0.86	33	0.46
Average			**35733.3**	**3.66**	**313.3**	**1.3**	**90.7**	**0.72**	**30**	**0.45**
West Tushki (shale)	19	0-15	15000	2.50	310	1.0	130	0.96	25	4.00
	20	0-15	15000	4.50	270	10.9	150	2.10	25	2.80
Average			**15000**	**3.5**	**290**	**5.95**	**140**	**1.53**	**25**	**3.40**
El-Mattanaa	21	0-15	45200	3.3	910	0.8	95	0.60	45	0.55
	22	0-15	47100	2.8	470	0.85	80	0.50	49	1.30
	23	0-15	39260	3.0	520	0.6	81	0.55	46	1.60
	24	0-15	12500	1.6	155	0.95	46	0.58	27	0.56
	25	0-15	10800	1.34	195	0.9	53	0.54	46	1.50
	26	0-15	12300	1.5	145	0.7	45	0.59	39	0.62
	27	0-15	44000	4.0	940	0.6	97	0.56	49	1.10
	28	0-15	47000	4.0	950	0.95	85	0.60	56	0.97
	29	0-15	49000	4.5	980	0.68	90	0.56	62	0.76
Average			**34317.5**	**2.86**	**577.5**	**0.78**	**74.9**	**0.56**	**46.1**	**0.99**
South Sinai	30	0-20	7000	1.4	155	1.1	55	0.45	15	0.22
	31	0-20	1900	1.45	320	1.0	120	0.46	15	0.24
Average			**4450**	**1.42**	**237.5**	**1.05**	**87.5**	**0.45**	**15**	**0.23**

Table (4) Correlation coefficient between total and DTPA – extractable trace elements and some soil variables of the studied soils.

Soil variable	Correlation coefficient							
	Fe		Mn		Zn		Cu	
	T	A	T	A	T	A	T	A
EC	- 0.295	-0.288	- 0.213	0.096	- 0.361	0.292	0.107	-0.275
pH	- 0.034	0.233	0.055	0.312	- 0.297	0.314	- 0.030	0.305
Clay	0.320	0.460**	0.116	0.012	0.115	0.104	- 0.043	0.356*
Silt	0.029	0.320	0.009	0.623**	0.263	0.621**	- 0.063	0.351*
C.Snd	- 0.153	- 0.371*	- 0.034	- 0.196	- 0.278	- 0.250	0.174	-0.415*
F. Sand	0.046	0.191	- 0.015	0.096	0.305	0.144	- 0.228	0.331

* Significant at the 5% level (r = 0.349)
** Highly Significant at the 1% level (r= 0.449)

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حالة بعض المغذيات الصغرى فى بعض الاراضى المصرية وعلاقتها ببعض متغيرات التربة

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يهدف البحث الى دراسة وتقييم الكمية الكلية والميسرة لبعض المغذيات الصغرى من عناصر الحديد والمنجنيز والزنك والنحاس وعلاقتها بخواص التربة فى بعض الاراضى المصريةز ويمكن تلخيص النتائج المتحصل عليها فيما يلى:-

1- تراوحت الكمية الكلية من الحديد ما بين 2232 الى 49000 مليجرام / جرام وبمتوسط يتراوح ما بين 4450 الى 35733.3 ملليجرام/ جرام بينما تراوح تركيز الحديد المستخلص بالـ DTPD بين 1.3 الى 4.5 ملليجرام/ جرام والحديد الكلى فى مناطق الدراسة المختلفة اخذ الترتيب التالى:-
توشكى > المطاعنة > شندويل > غرب توشكى > الاقصر > محظة توشكى > سيوة > جنوب سيناء.

2- تراوح تركيز المنجنيز الكلى فى الاراضى تحت الدراسة ما بين 140، 980 ملليجرام/جرام وبمتوسط يتراوح ما بين 183.8 الى 577.5 ملليجرام/جرام بينما تراوح تركيز المنجنيز المستخلص بالـ DTPA بين 0.6 ، 10.9 ملليجرام والمنجنيز الكلى فى مناطق الدراسة المختلفة اخذ الترتيب التالى:-
المطاعنة > شندويل > توشكى > غرب توشكى > جنوب سيناء > محطة توشكى > سيوة > الاقصر .

3- تراوح تركيز الزنك الكلى فى الاراضى تحت الدراسة ما بين 28 الى 150 ملليجرام وبمتوسط يتراوح ما بين 40 الى 140 ملليجرام / جرام اما الزنك الميسر فقد تراوح ما بين 0.45 الى 0.46 ملليجرام/جرام والزنك الكلى فى مناطق الدراسة اظهر التوزيع التالى:
غرب توشكى > محطة توشكى > توشكى > جنوب سيناء > شندويل > المطاعنة > الاقصر > سيوة.

4- تراوح تركيز النحاس الكلى ما بين 3.9 الى 65 ملليجرام/جرام وبمتوسط يتراوح ما بين 15 الى 84.3 ملليجرام بينما النحاس الميسر فقد تراوح ما بين 0.22 الى 4.0 ملليجرام/جرام.

5- اظهر التحليل الاحصائى وجود ارتباط معنوى وموجب بين محتوى التربة من معظم العناصر تحت الدراسة ومحتوى التربة من كل من الطين والسلت بينما وجدت علاقة سالبة مع الرمل الخشن.

6- وجد ان معظم الطبقات السطحية فى المناطق تحت الدراسة تحتوى على عنصر الحديد بكمية ناقصة وقليلة والمنجنيز بكمية كافية الى منخفضة اما الزنك فقد وجد بكميات عالية الى متوسطة اما النحاس فقد وجد بتركيز من عالية الى منخفضة.