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DISTRIBUTION OF SOME NUTRIENTS IN CERTAIN SOILS OF THE NEW VALLEY GOVERNORATE

Khalil, M. N*., I. R. Mohamed*., M. A. Metwally and M. A. Abdel-Khalik*.**

*** Soil Dept. Fac. Of Agric., Zagazig University.**

**** Desert Res. Center, Cairo, Egypt.**

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ABSTRACT: Twenty-seven profiles were dug at different locations in West El-Gidida region, El-Dakhla Oasis, the New Valley Governorate. Some physical and chemical properties were assessed. Total and available P, Fe, Mn, Zn and Cu were also determined. The results indicate that soil texture varies widely from coarse sand to Clay, $CaCO_3$ and OM contents are low. EC, pH and CEC ranged from 0.2 to 144.1 dSm^{-1}, 6.41 to 9.43 and 2.1 to 69 me/100g soil, respectively. Total P, Fe, Mn, Zn and Cu contents ranged from 202 to 876, 2371 to 3531, 80.7 to 894, 1.5 to 132.3 and 1.2 to 38 mg kg^{-1}, respectively. Available P, Fe, Mn, Zn and Cu contents ranged from 3.19 to 15.4, 1.77 to 13.7, 0.62 to 53.84, 0.0 to 1.49 and 0.0 to 0.98 mg kg^{-1}, respectively. Depthwise distribution of total and available P, Fe, Mn, Zn and Cu did not show any specific pattern with depth in most of the studied soil profiles. The data show that the content of Zn in all the studied soils were low, but about 59, 15, 52, 4 % of the studied soils contain adequate quantities of the available P, Fe, Mn and Cu, respectively.

INTRODUCTION

Generally, most desert soils are sandy in texture, poor in both OM and available nutrients content. Total P in Egyptian soils ranged from 234 to 1496 mg kg^{-1} as reported by Mohammed (1980). Total Fe, Mn, Zn and Cu content ranged from 1050 to 74400, 20 to 200, 5 to 74.9, and 5 to 84.4 mg kg^{-1} as reported by Salim et al. (2002). Plants need phosphorus as macronutrient in great quantities and micronutrients in traces. As reported by Jackson (1973) a general guide to crop response of Olsen's available-P below 5 mg P

kg^{-1} soil is low and response to phosphate application in likely. Values from 5 to 10 mg kg^{-1} are moderate and indicated response is probable and values over 10 mg kg^{-1} being adequate and response to fertilization in unlikely. Lindsay and Norvell (1978) found that soils containing available micronutrients below critical levels would not be able to provide growing plants with their nutritional requirements. Behiry et al. (2003) stated that available P content ranged from 2.0 to 19.5 mg P kg^{-1} soil in some soils of Tushka region. Tahoun et al. (1999) stated that DTPA-extractable Fe, Mn, Zn and Cu in some soils of Abu Hammad ranged from 1.5 to 47.9, 1.3 to 51.6, 0.1 to 28.2 and 0.2 to 13.3 mg kg^{-1}, respectively. Tolbah et al. (2002) reported that DTPA-extractable Fe, Mn, Zn and Cu in some Egyptian soils ranged from 45 to 220, 3.5 to 85, 2 to 35 and 4 to 10 mg kg^{-1}, respectively. The aim of this work is to study the distribution pattern of total and available P, Fe, Mn, Zn and Cu in soils of West El-Gidida region, El-Dakhla Oasis, the New Valley Governorate.

MATERIALS AND METHODS

1- **Field work:** Twenty-seven soil profiles were dug at different locations in West El Gidida –El Dakhla Oasis, New Valley Governorate. The studied area is about 55440 faddans. The samples were air-dried, crushed, passed through a 2 mm sieve and were kept dry for subsequent analysis.

2-**Laboratory analysis:** The particle size distribution of samples was measured using the international pipette method and grain size distribution of sand fractions was carried out using 5 sets of sieve diameter, according to Piper (1950). Organic matter content was determined by the Walkley & Black procedure as described by Piper (1950). Calcium carbonate content was determined using Collin's calcimeter, the pH value was determined in 1:2.5 (soil: water suspension) using a Beckman pH meter and the electrical conductivity of the 1:1 extract was determined by a conductivity salt bridge as described by Jackson (1973). Cation exchange capacity (CEC) was determined according to Richards (1954). Total phosphorus was determined according to Jackson (1973). Available phosphorus was determined as described by Page et al. (1982). Total trace nutrients were determined according to Hess (1971). The DTPA- extractable micronutrients content was prepared according to Lindsay and Norvell (1978), then determined using an atomic absorption spectrometer. The complete data concerning these soils are given by Abd El-Khalik (2004).

RESULTS AND DISCUSSION

1- Distribution of soil characteristics :

Table (1) shows some physical and chemical characteristics of the studied soil profiles. The soil profiles of the studied area were divided into four groups according to soil textures in the different layers for every profile and the depth of profiles. The first group was deep coarse to moderately coarse-textured soils, which was represented by profiles Nos. 4,8,10,11,12 and 13. This group of soils has 71 %, 8 % and 21 % Sand, loamy sand and sandy loam textures, respectively. The second group was deep coarse to moderately coarse texture with moderately fine intercalations, which were represented by profiles Nos. 3,14,19 and 21. This group of soils has 38 % loamy sand, 19 % medium sand, 19% sandy loam, 12 % clay loam, 6 % silt loam and 6 % sandy clay loam textures. The third group was deep moderately fine to fine-textured soils with coarser surface, which were represented by profiles Nos. 1,5,6,15,16,17,18,20,23 and 25. This group of soils has 53 % clay loam, 13 % clay, 13 % sandy loam, 5 % medium sand and 3 % sandy clay loam textures. The fourth group was deep moderately fine to fine-textured soils, which were represented by profiles Nos. 2,7,9,22,24,26 and 27. This group of soils has 36 % clay loam, 29 %clay, 25 % sandy clay loam, 7 % sandy loam and 3 % silt loam textures.

Organic matter content was very low, it ranged between 0.03 and 1.48 %. The lowest value was detected in the deepest layers of profiles Nos. 22 and 26 in the fourth soils group, which has deep moderately fine to fine -texture, while the greatest value was associated with the 10-40 cm layer of profile No. 18 in the third soils group, which has deep moderately fine to fine- texture with coarser surface. Depthwise distribution of organic matter content did not show any specific pattern with depth except for profiles Nos. 3,4, 5, 8,16,17, 22, 25 and 26 where it tends to decrease with depth, while in profiles Nos. 10 and 19 it tends to increase downward. The low content of organic matter may be attributed to high temperature and moisture deficiency.

CEC is correlated with clay content. Kandil et al. (1978) found that CEC values increase with decreasing particle sizes of the soil. It ranged from 2.1 to 69.2 me / 100g soil. The lowest value was detected in the subsurface layer of profile No. 4 in the first soils group, which has deep coarse to moderately coarse-texture. The highest value was recorded in the 70-110 cm layer of profile No. 1 in the third soils group, which has deep moderately fine to fine-texture with coarser surface.

$CaCO_3$ content varies from 0.00 to 10.9 % in the studied soil profiles. The lowest value was detected in the 60-100 cm layer of profile No. 7 in the fourth soils group, which has deep moderately fine to fine-texture. The greatest value was associated with the surface layer of profile No. 24 in the same soils group. Harga (1977) stated that $CaCO_3$ content varies between 1.0 and 13 %. $CaCO_3$ content tends to decrease downward in most soil profiles, this is attributed to its low solubility, except for profiles Nos. 3, 12, 14, 19 and 27 which did not portary any specific pattern with depth. Hanna (1969) found that $CaCO_3$ content tends to decrease downward.

Soil reaction (pH) in the studied soil profiles ranged from slightly acid (pH = 6.41) to very strongly alkaline (pH = 9.43) Baruah et al. (1997). The lowest value was associated with the subsurface layer of profile No. 7 in the fourth soils group, which has deep moderately fine to fine-texture. The greatest value was detected in the subsurface layer of profile No. 21 in the second soils group, which has deep coarse to moderately coarse texture with moderately fine intercalations. pH values did not show any specific pattern with depth in the studied soil profiles.

Soil salinity (EC) displayed great variation in its contents, where EC values ranged widely from 0.20 to 144.1 dSm^{-1}. The lowest value was detected in the subsurface layer of profile No. 21 in the second soils group, which has deep coarse to moderately coarse texture with moderately fine intercalations. The greatest value was recorded in the 50-95 cm layer of profile No. 25 in the third soils group, which has deep moderately fine to fine-texture with coarser surface. EC values tend to increase downward in the most of soil profiles except for profiles Nos. 2, 3, 4, 7, 9, 16, 18, 19 and 22 that tend to decrease downward, while profiles Nos. 1, 6, 21 and 27 did not show any specific pattern with depth.

2- Distribution of soil nutrients:

Table (2) shows the distribution of the total and available contents of some macro and micronutrients in the studied soil profiles.

A- Macro nutrient (phosphorus):

Total phosphorus content ranged from 202 to 876 mg kg^{-1} in the studied soil profiles. The lowest value was detected in the surface layer of profile No. 1in the third soils group, which has deep moderately fine to fine-textured soils with coarser surface. The highest value was recorded in the 40-90 cm layer of profile No. 26 in the fourth soils group, which has deep moderately fine to fine-texture. Mohammed (1980) stated that total P ranged from 234 to 1496 mg kg^{-1} in some Egyptian saline soils having variable texture. Total P content did not show any specific pattern with depth in most of the studied soil profiles except for profiles Nos. 10 and 23 that tend to increase with depth. The weighted mean values of total P content ranged between 424 and 805 mg kg^{-1}. The lowest value characterized profile No. 18 in the third soils group, which has deep moderately fine to fine-texture with coarser surface. The highest value distinguished profile No. 26 in the fourth soils group, which has deep moderately fine to fine-texture. Table (3) shows that total P content is very significant positively correlated with CEC, clay % and silt+clay (%) and significant positively and negatively correlated with silt % and $CaCO_3$ %, respectively.

Available P content in the studied soil profiles ranged between 3.19 and 15.4 mg kg^{-1}. The lowest value was detected in the 50-80 cm layer of profile No. 11 in the first soils group, which has deep coarse to moderately coarse textured soils. The highest value was recorded in the surface layer of profile No. 20 in the third soils group, which has deep moderately fine to fine-textured soils with coarser surface. These data agreed with Ibrahim *et al.* (1980) who found that available P content ranged from 2 to 12 mg kg^{-1} in some desert sand and calcareous soil Available P content did not show any specific pattern with depth in most soil profiles except for profile No. 10 where available P tends to decrease downward and profiles Nos. 1,7 and 26 where it tends to increase with depth. As reported by Jackson (1973) a general guide to crop response of Olsen's available-P below 5 mg P kg^{-1} soil is low and response to phosphate application in likely. Values from 5 to 10 mg kg^{-1} are moderate and indicated that response is probable and values over 10 mg kg^{-1} being adequate and response to fertilization in unlikely. The weighted mean values of available P ranged from 4.73 to 13.9 mg kg^{-1}. The lowest value characterized profile No. 11 in the first soils group, which has coarse to moderately coarse texture. The greatest value distinguished profile No. 3 in the second soils group, which has coarse to moderately coarse texture with moderately fine intercalations. As shown in Fig. (1) and based on the weighted mean values of available-P and the guide to crop response of Olsen's available-P, the studied soil profiles were divided into three categories, low, moderate and adequate. Low category was represented by profile No. 11, however, moderate one was represented by profiles Nos. 5,6,10,12,13,14,15,16,22 and 23. Adequate one was represented by profiles Nos. 1, 2, 3, 4, 7, 8, 9, 17, 18, 19, 20, 21, 24, 25, 26 and 27. In other words the soils belong to 4% low (indicate that response to phosphate application in likely), 37% moderate (indicated probable response to phosphate application) and 59% adequate (their response to phosphate application is unlikely). Table (4) shows that available P content was significant negatively correlated with EC and CaCO3 %. While being highly significant positively correlated with CEC, clay % and silt+clay (%).

B- Micronutrients:

Iron

Total iron in the studied soil profiles ranged between 2371 and 3531 mg kg^{-1}. The lowest value was associated with the 45-75 cm layer of profile No. 10 in the first soils group, which has coarse to moderately coarse -texture. The highest value was detected in the 60-95 cm layer of profile No. 21 in the second soils group, which has coarse to moderately coarse texture with moderately fine intercalations. In this connection, Salim et al. (2002) stated that total iron content ranges between 1050 and 74400 mg kg^{-1} in different Egyptian soils having different texture. Depthwise distribution of total iron content did not show any specific pattern with depth in most soil profiles except for profile No. 6 where Fe tends to increase downward. The weighted mean values (Oretel & Giles, 1963) of total iron in the studied soil profiles ranged from 2466 to 3152 mg kg^{-1}. The lowest value characterized profile No. 25 in the third soils group, which has deep moderately fine to fine-texture with coarser surface. In contrast the highest content is distinguished in profile No. 7 of the fourth soils group, which has deep moderately fine to fine-texture. The slight variations in the total iron content in the different soil groups may reflect a homogenous soil parent material. To substantiate the role of some soil constituents in controlling total Fe content, the simple correlation coefficients between total Fe and each of these factors were computed, table (5). The obtained coefficients imply that total Fe is very significant positively correlated with CEC and silt+clay (%), and significant positively correlated with silt % and clay % but it is highly significant negatively correlated with $CaCO_3$ %.

Available iron content in the studied soil profiles ranged between 1.77 and 13.7 mg kg^{-1}. The lowest value was associated with the surface layer of profile 8 in the first soils group, which has coarse to moderately coarse-texture. The highest value was found in the 30-70 cm layer of profile No. 27 in the fourth soils group, which has deep moderately fine to fine- texture. These results are in harmony with Abd El-Razik and Samia (1999) who stated that available iron extracted by DTPA method ranged from 0.3 to 24 mg kg^{-1} in some Egyptian soils. Depthwise distribution of available iron content did not show any specific pattern with depth in all the studied soil profiles. According to Soltanpour and Schwab (1977), the index values used for iron extracted from soils by DTPA method are as follows: Low 0-2 mg kg^{-1}, marginal 2-4 mg kg^{-1} and adequate > 4 mg Fe kg^{-1} soil.

Lindsay (1978) and El-Gala (1986) reported that the critical Fe level, determined by the DTPA method, is about 4 mg kg^{-1}. The weighted mean values of available Fe ranged between 2.28 and 9.66 mg kg^{-1}. The lowest value distinguished profile No. 9 in the fourth soils group, which has deep moderately fine to fine-texture, while the highest value characterized profile No. 27 in the same soils group. According to Soltanpour and Schwab (1977), the studied soil profiles are marginal except for profiles 21,22,26 and 27, which have adequate level. Accordingly, the studied soils represent 85% and 15% marginal and adequate, respectively, Fig. (2). Table (6) shows the simple correlation coefficients between available Fe and some soil factors. The obtained correlation coefficients imply that available Fe is highly significant positively correlated with $CaCO_3$ % and pH, but it is very significant negatively correlated with EC.

Manganese

Total Mn in the studied soil profiles ranged from 80.7 to 894 mg kg^{-1}. The lowest value was recorded in the surface layer of profile No. 9 in the fourth soils group, which has deep moderately fine to fine -texture. The highest value was detected in the 10-35 cm layer of profile No. 16 in the third soils group, which has deep moderately fine to fine- texture with coarser surface. In this regard, Salim et al. (2002) reported that total Mn content in Egyptian soils ranged from 20 to 1200 mg kg^{-1}. Depthwise distribution of total Mn content did not show any specific pattern with depth in profiles Nos. 2, 11, 13, 14,19,20,21,23 and 25 while it tends to increase with depth in profiles Nos. 1, 5, 6, 7, 10, 15, 16, 17, 18, 22, 24 and 27, and it tends to decrease with depth in profiles Nos. 3, 4 and 8. The weighted mean values of total Mn in this group of soils range from 153 to 780 mg kg^{-1}. The lowest value characterized profile No. 21 in the second soils group, which has deep coarse to moderately coarse texture with moderately fine intercalations. The highest content distinguished profile 16 in the third soils group, which has deep moderately fine to fine -texture with coarser surface. Table (5) shows that total Mn is significant negatively correlated with pH and non-significant with the other soil factors.

The available Mn content in the studied soil profiles ranged from 0.62 to 53.84 mg kg^{-1}. The lowest value was recorded in the 10-55 cm layer of profile No. 5 in the third soils group, which has deep moderately fine to fine-texture with coarser surface. The highest value was detected in the 30-70 cm layer of profile No. 27 in the fourth soils group, which has deep moderately fine to fine-texture. Nearly similar results were reported by Abd El-Razik and Samia (1999) who stated that available Mn extracted by DTPA method ranged from 0.8 to 30 mg kg^{-1}. Depthwise distribution of available Mn content did not portary any specific pattern with depth except for profiles Nos. 20 and 24 that tend to decrease downward and profile No. 7 that tends to increase with depth. The weighted mean values of available Mn content in the studied soil profiles ranged from 0.93 to 40.8 mg kg^{-1}. The lowest value distinguished profile No. 6 in the third soils group, which has deep moderately fine to fine -texture with coarser surface. The highest value characterized profile No.27 that occur in the forth soils group, which has deep moderately fine to fine- texture. According to Soltanpour and Schwab (1977), the index values used for Mn extracted from soils by DTPA method are as follows: Low 0-1.8 mg kg^{-1}, and adequate > 1.8 mg Mn kg^{-1} soil. Based on the weighted mean values of DTPA-Mn and the critical level of available Mn which was proposed by Soltanpour and Schwab (1977), Fig. (3) shows that the studied soil profiles are divided into two divisions, low and adequate. Division low is represented by profiles 3,4,5,6,8,9, 10, 11,12,13,18,19 and 23, while adequate one is represented by profiles 1,2,7,14,15,16,17,20, 21, 22, 24, 25,26 and 27. Therefore, the studied soils belong to 48% and 52% low and adequate, respectively. Table (6) shows statistical analysis, which is represented by simple correlation coefficient between available Mn and some soil factors. The obtained numerical correlation coefficients imply that available Mn is highly significant positively and negatively correlated with EC and $CaCO_3$ %, respectively, while it is significant positively correlated with OM %, silt % and silt + clay (%).

Zinc

The studied soil profiles have total Zn content that ranged between 1.5 and 132.3 mg kg^{-1}.

The lowest value was recorded in the surface layer of profile No. 24 that occur in the fourth soils group, which has deep moderately fine to fine- texture. The highest value was detected in the deepest layer of profile No. 2 in the same soils group. The results are partially agreed with Salim et al. (2002) who stated that total Zn content ranged between 5 and 74.9 mg kg^{-1} in some Egyptian soils. Depthwise distribution of total Zn content did not show any specific pattern with depth. The weighted mean values of total Zn in the studied soil profiles ranged from 2.97 to 91.3 mg kg^{-1}. The lowest value characterized profile No. 23 in the third soils group which has deep moderately fine to fine texture with coarser surface. The highest content distinguished profile No. 2 in the fourth soils group, which has deep moderately fine to fine texture. Table (5) indicates that total Zn content is highly significant negatively correlated with pH and $CaCO_3$ %, while, it is significant positively correlated with EC.

Available Zn content in the studied soil profiles ranged from 0.00 to 1.49 mg kg^{-1}. The lowest value was recorded in the surface layer of profile No. 13 in the first soils group, which has deep coarse to moderately coarse- texture. The highest value was detected in the surface layer of profile No. 3 in the second soils group, which has deep coarse to moderately coarse texture with moderately fine intercalations. These data agree well with Salim et al. (2002) who reported that available Zn content in some Egyptian soils ranged from 0.40 to 1.70 mg kg^{-1}. Depthwise distribution of available Zn content did not portary any specific pattern with depth except for profile No. 26 where Zn tends to decrease downward and profiles Nos. 15, 16 and 23 where Zn tends to increase with depth. According to Soltanpour and Schwab (1977), the index values used for Zn extracted from soils by DTPA method are as follows: Low 0-0.9 mg kg^{-1}, marginal 1-1.5 and adequate >1.5 mg Zn kg^{-1} soil. The weighted mean values of available Zn in the studied soil profiles ranged from 0.08 to 0.69 mg kg^{-1}. The lowest value characterized profile No. 13 in the first soils group, which has deep coarse to moderately coarse- texture. The highest content distinguished profile No. 3 in the second soils group, which has deep coarse to moderately coarse texture with moderately fine intercalations. Comparing the obtained weighted mean values of available Zn with the critical levels proposed by Soltanpour and Schwab (1977) these soils have low Zn content, i.e., these soils would not be able to provide growing plants with their nutritional requirement. Table (6) shows the statistical relationship as a simple correlation coefficient between available Zn and some soil factors. The obtained numerical correlation coefficients imply that available Zn is significant positively correlated only with OM %.

Copper

The studied soil profiles have total Cu content that ranged between 1.2 and 38 mg kg^{-1}. The lowest value was detected in the surface layer of profile No. 26 in the fourth soils group, which has deep moderately fine to fine-texture. The highest value was associated with the surface layer of profile No. 3 in the second soils group, which has deep coarse to moderately coarse texture with moderately fine intercalations. The data coincide well with Salim et al. (2002) who reported that total Cu content ranged between 5 and 84.4 mg kg^{-1}. Depthwise distribution of total Cu content did not show any specific pattern with depth except for profile 13 where it tends to increase with depth and profile No. 16 in which Cu tends to decrease downward. The weighted mean values of total Cu in the studied soil profiles ranged from 2.42 to 24.7 mg kg^{-1}. The lowest value characterized profile No. 26 in the forth soils group, which has deep moderately fine to fine- texture. The highest content distinguished profile No. 7 in the same soils group. Table (5) show that total Cu content is significant positively correlated with EC, but it is highly significant negatively correlated with pH and $CaCO_3$ %.

Available Cu content in the studied soil profiles ranged from 0.00 to 0.98 mg kg^{-1}. The lowest value was associated with the 40-70 cm layer of profile No. 4 in the first soils group, which has deep coarse to moderately coarse-texture. The highest value was associated with the subsurface layer of profile No. 3 in the second soils group, which has deep coarse to moderately coarse texture with moderately fine intercalations. Results of available Cu in the same range was obtained by Ahmed *et al.* (1999) who stated that available Cu content in some Egyptian soils ranges from 0.04 to 0.44 mg kg^{-1}.

Table (1): Physical and chemical properties of the studied soil profiles for West El-Gidida area.

Profile No.	Depth cm.	Texture class	Clay %	OM %	CEC me/100g soil	$CaCO_3$ %	pH	EC dSm^{-1}
The first group: Deep coarse to moderately coarse-textured soils								
4	0-15	SL	18.49	0.21	17.1	1.90	7.70	17.2
	15-40	MS		0.22	2.10	1.20	8.00	6.52
	40-70	CS		0.10	3.52	1.30	7.68	10.4
	70-120	CS		0.16	3.21	1.50	8.02	8.19
8	0-10	SL	18.14	0.61	16.5	1.40	8.09	12.3
	10-35	SL	18.14	0.35	19.1	0.60	7.87	29.5
	35-80	MS		0.12	3.42	0.80	8.41	30.2
	80-150	CS		0.14	3.10	0.70	7.81	71.2
10	0-10	MS		0.32	4.87	2.40	8.41	7.74
	10-45	MS		0.53	5.82	1.50	8.42	21.2
	45-75	CS		0.44	3.75	1.20	6.77	43.5
	75-130	CS		0.95	3.23	0.80	7.35	57.1
11	0-15	LS	13.41	0.61	11.4	6.70	8.02	9.00
	15-50	MS		0.61	2.49	2.40	7.33	66.0
	50-80	SL	16.22	0.21	13.2	2.70	7.38	75.5
	80-140	SL	16.22	0.44	18.4	3.20	7.64	48.5
12	0-12	MS		0.95	2.28	1.60	8.22	11.5
	12-35	MS		1.23	2.90	1.50	8.48	21.5
	35-85	MS		0.16	3.18	2.20	8.39	24.1
	85-120	MS		0.19	4.56	1.80	8.09	30.1
13	0-10	LS	11.48	0.12	10.6	3.40	7.98	12.6
	10-40	MS		0.22	4.76	1.30	8.63	17.2
	40-80	MS		0.61	3.84	1.20	8.41	38.1
	80-110	MS		0.43	3.26	2.10	8.45	44.6
The second group: Deep coarse to moderately coarse texture with moderately fine intercalations								
3	0-10	SL	18.61	0.71	16.4	2.40	7.68	78.2
	10-45	CL	40.25	0.20	38.4	2.20	8.36	17.3
	45-55	MS		0.18	23.4	4.40	8.42	3.90
	55-110	SL	19.61	0.06	17.3	0.40	8.31	5.08
14	0-8	LS	8.94	0.20	8.17	8.30	7.81	7.70
	8-25	LS	9.55	0.36	8.73	0.50	7.58	30.9
	25-75	SiL	26.11	0.49	24.3	2.40	7.17	29.6
	75-140	SL	13.46	0.27	11.3	1.20	7.05	32.2
19	0-15	LS	12.52	0.04	11.4	1.80	7.83	12.6
	15-50	CL	28.15	0.15	24.2	1.60	7.88	12.5
	50-85	LS	8.48	0.20	7.43	1.90	7.97	8.20
	85-120	LS	10.32	0.20	9.15	2.40	7.93	8.48
21	0-30	MS		0.53	2.22	6.60	8.40	0.47
	30-60	MS		0.32	2.15	6.80	9.43	0.20
	60-95	LS	5.82	0.37	5.48	6.20	9.28	0.60
	95-140	SCL	21.46	0.32	14.9	5.30	9.04	0.58

CS= Coarse sand
MS= Medium sand
LS= Loamy sand
SL= Sandy loam
SiL= Silt loam
SCL= Sandy clay loam
CL= Clay loam

Table (1) Cont.

Profile No.	Depth cm.	Texture class	Clay %	OM %	CEC me/100g soil	$CaCO_3$ %	pH	EC dSm^{-1}
The third group: Deep moderately fine to fine-textured soils with coarser surface								
1	0-30	LS	4.08	0.16	2.33	5.30	8.82	0.43
	30-70	C	48.45	0.39	34.4	0.60	8.27	9.74
	70-110	C	73.62	0.20	69.2	0.50	8.83	7.36
	110-150	C	72.30	0.18	67.7	0.40	8.57	9.61
5	0-10	MS		0.22	2.64	7.50	7.86	42.3
	10-55	CL	38.66	0.28	36.1	0.40	7.60	59.3
	55-100	CL	37.71	0.78	36.5	0.10	7.04	94.1
6	0-15	LS	15.92	0.69	14.0	8.40	7.82	6.30
	15-50	CL	28.13	0.34	26.1	0.60	7.37	85.1
	50-100	SCL	32:44	0.79	31.9	0.20	7.12	74.9
15	0-15	SL	19.39	0.54	17.3	3.10	7.98	16.1
	15-45	CL	39.73	0.61	36.1	0.30	7.39	15.5
	45-80	CL	36.04	0.18	29.3	0.80	7.49	33.3
	80-130	CL	37.62	0.36	31.8	1.40	7.29	37.5
16	0-10	SL	7.83	0.93	6.27	2.60	7.60	45.7
	10-35	CL	30.48	0.44	26.7	2.40	6.94	42.9
	35-70	CL	27.54	0.20	21.6	1.30	7.57	38.9
	70-110	CL	30.41	0.17	23.9	1.50	7.26	36.4
17	0-20	SL	20.08	0.57	19.2	6.00	7.84	17.8
	20-45	CL	28.63	0.47	24.4	1.70	7.40	50.9
	45-90	CL	38.2	0.34	35.1	0.80	7.28	49.2
	90-130	CL	34.76	0.24	29.3	1.40	7.07	63.6
18	0-10	LS	9.44	1.42	8.82	5.30	7.17	76.9
	10-40	CL	27.74	1.48	24.2	2.60	7.60	65.2
	40-80	CL	39.61	0.06	37.5	2.00	7.79	54.7
	80-120	C	54.82	0.05	49.5	2.40	8.24	42.2
20	0-20	MS		0.86	5.83	5.40	7.77	2.02
	20-65	CL	39.76	0.54	34.1	5.00	7.95	2.58
	65-90	C	49.19	0.17	42.1	3.50	7.51	5.40
	90-150	CL	37.38	0.73	35.1	1.30	7.58	6.60
23	0-20	LS	7.19	0.14	6.71	7.10	8.05	7.02
	20-50	SL	18.07	0.59	16.9	2.50	7.97	9.03
	50-90	CL	38.53	0.14	36.4	0.90	7.90	18.0
	90-130	CL	30.04	0.30	26.7	1.10	7.92	24.4
25	0-15	SL	6.39	0.98	3.71	8.20	8.03	6.40
	15-50	LS	6.49	0.60	9.27	2.90	8.49	26.6
	50-95	CL	28.74	0.07	24.2	0.90	7.05	144.1
	95-150	CL	39.61	0.09	37.0	2.10	6.97	86.7

MS= Medium sand LS= Loamy sand
SL= Sandy loam SCL= Sandy clay loam
CL= Clay loam C= Clay

Table (1) Cont.

Profile No.	Depth cm.	Texture class	Clay %	OM %	CEC me/100g soil	$CaCO_3$ %	pH	EC dSm^{-1}
The fourth group: Deep moderately fine to fine –textured soils								
2	0-15	CL	36.25	0.47	32.6	2.20	6.93	40.9
	15-40	CL	38.13	0.39	37.0	0.30	6.62	19.3
	40-75	CL	39.15	0.18	38.1	0.30	7.29	19.0
	75-150	CL	35.64	0.58	33.8	2.40	7.35	13.5
7	0-20	CL	39.21	0.59	36.6	1.80	6.99	59.7
	20-60	C	43.38	0.84	43.3	0.30	6.41	43.9
	60-100	C	47.58	0.86	40.4	0.00	6.79	35.6
	100-140	C	48.31	0.75	36.1	0.40	7.09	30.5
9	0-12	CL	30.69	0.95	27.0	1.10	7.26	55.6
	12-40	SL	18.89	0.60	16.3	0.60	7.48	55.8
	40-75	SCL	26.43	0.40	25.7	1.60	7.03	46.7
	75-150	CL	36.24	0.53	36.2	1.20	6.82	63.4
22	0-15	SCL	27.99	0.73	19.1	2.60	8.23	7.07
	15-50	C	43.61	0.17	40.5	2.00	8.52	7.62
	50-90	CL	32.18	0.03	36.6	1.10	8.29	6.59
	90-130	C	59.62	0.03	54.6	1.40	8.29	6.00
24	0-10	SCL	22.34	0.71	15.8	10.90	8.34	3.84
	10-40	SCL	24.39	0.39	16.5	2.20	7.60	12.8
	40-85	CL	29.64	0.54	26.8	1.30	7.45	15.1
	85-130	SL	16.33	1.07	13.9	2.60	7.43	27.0
26	0-18	SCL	21.35	1.10	17.4	7.00	7.63	2.84
	18-40	CL	39.72	0.36	43.2	1.30	7.95	7.69
	40-90	C	48.31	0.17	45.9	1.80	8.04	6.26
	90-120	C	56.42	0.03	52.4	1.10	8.13	8.40
27	0-10	SiL	21.11	0.25	16.5	5.00	7.63	1.70
	10-30	C	48.98	0.86	42.1	4.20	8.52	0.50
	30-70	SCL	27.99	0.82	18.7	5.10	8.07	0.70
	70-110	SCL	23.55	0.37	16.8	3.90	8.08	1.00

SL= Sandy loam SCL= Sandy clay loam
SiL= Silt loam CL= Clay loam
C= Clay

Table (2): Total and available macro-and micro nutrients in the studied soil profiles (mg kg^{-1}).

Profile No.	Depth cm	Macroautrient		Micronutrients							
		P		Fe		Mn		Zn		Cu	
		total	Avail.*	total	Avail.*	total	Avail.*	total	Avail.*	total	Avail.*
The first group: Deep coarse to moderately coarse-textured soils											
4	0-15	621	12.9	2998	2.97	472	2.01	49.3	0.51	18.7	0.16
	15-40	487	13.2	2828	3.26	150	1.07	37.8	0.91	19.8	0.19
	40-70	681	14.7	2876	2.86	398	0.80	30.1	0.27	13.3	0.00
	70-120	412	11.4	2740	2.86	324	1.00	51.5	0.04	18.1	0.04
	Wm.*	521	12.8	2825	2.98	325	1.10	43.0	0.37	17.3	0.11
8	0-10	561	12.9	2923	1.77	626	1.32	47.7	0.19	22.3	0.09
	10-35	531	14.1	2917	3.17	399	1.62	37.5	0.18	27.1	0.33
	35-80	576	10.2	2892	2.57	357	1.72	47.9	0.13	16.1	0.28
	80-150	636	11.4	2516	3.08	288	1.32	31.7	0.15	10.1	0.24
	Wm.	596	11.6	2723	2.88	350	1.47	38.6	0.17	15.6	0.24
10	0-10	352	13.8	2513	2.87	179	1.84	31.8	0.50	15.2	0.41
	10-45	531	9.88	2424	2.54	222	1.24	18.3	0.06	12.8	0.21
	45-75	546	5.39	2371	2.71	331	1.50	32.4	0.67	25.2	0.31
	75-130	561	3.59	3272	3.11	315	0.88	61.0	0.95	14.1	0.60
	Wm.	534	6.48	2777	2.86	283	1.21	40.7	0.61	16.4	0.41
11	0-15	561	3.79	3094	3.09	518	1.17	41.4	0.11	35.4	0.37
	15-50	621	5.99	2489	1.86	208	1.13	31.6	0.09	10.1	0.00
	50-80	502	3.19	2617	2.88	616	1.27	39.7	0.18	25.0	0.25
	80-140	546	4.99	2781	2.51	409	1.49	27.8	0.23	9.9	0.30
	Wm.	574	4.73	2706	2.50	415	1.33	32.8	0.16	15.9	0.24
12	0-12	487	5.19	2881	2.24	300	0.82	24.6	0.10	14.1	0.32
	12-35	636	4.99	2602	2.04	333	1.02	17.1	0.36	8.2	0.27
	35-85	561	4.79	2879	3.30	383	1.16	23.1	0.76	14.2	0.41
	85-120	576	8.18	2949	2.79	343	0.86	27.1	0.13	16.5	0.31
	Wm.	573	5.86	2847	2.82	353	1.04	23.3	0.45	13.7	0.34
13	0-10	681	8.38	2467	2.27	438	0.99	31.9	0.00	12.8	0.56
	10-40	606	7.59	2919	3.93	219	0.88	32.4	0.05	13.0	0.28
	40-80	621	8.18	2467	2.85	446	1.02	24.7	0.00	14.8	0.30
	80-110	606	7.98	3033	3.26	398	1.12	48.0	0.15	18.8	0.51
	Wm.	619	7.98	2745	3.23	370	0.99	33.8	0.08	15.2	0.38
The second group: Deep coarse to moderately coarse texture with moderately fine intercalations											
3	0-10	502	11.4	2980	3.60	445	1.78	53.6	1.49	38.0	0.28
	10-45	546	14.1	3087	3.75	449	2.86	45.2	0.84	26.3	0.98
	45-55	397	12.0	3276	2.34	396	0.98	88.8	0.16	35.4	0.46
	55-110	621	14.7	2899	2.31	369	0.72	55.6	0.49	16.1	0.05
	Wm.	566	13.9	3001	2.89	404	1.54	55.1	0.69	23.1	0.44
14	0-8	502	5.39	2954	3.17	355	0.87	42.5	0.18	19.0	0.33
	8-25	576	7.34	3011	3.10	774	1.97	33.5	0.05	17.7	0.12
	25-75	517	5.78	3114	3.04	462	1.76	38.5	0.11	19.9	0.20
	75-140	546	9.41	3021	2.71	757	1.99	35.2	0.03	19.0	0.14
	Wm.	537	7.63	3049	2.92	631	1.86	36.6	0.11	19.2	0.15
19	0-15	636	9.58	2511	2.47	231	1.69	11.9	0.21	4.70	0.25
	15-50	502	12.0	2562	2.63	577	1.49	15.5	0.19	5.80	0.11
	50-85	591	13.4	2685	2.02	292	1.77	15.8	0.19	3.90	0.16
	85-120	756	12.6	2492	3.16	211	2.02	10.4	0.29	4.40	0.18
	Wm.	619	12.3	2571	2.62	344	1.76	13.7	0.23	4.70	0.18
21	0-30	666	9.78	2441	6.05	174	4.94	10.3	0.46	3.20	0.34
	30-60	337	10.6	2505	4.47	278	3.14	11.6	0.24	3.30	0.43
	60-95	397	13.0	3531	4.11	97.6	5.58	11.3	0.26	3.20	0.37
	95-140	531	9.38	2506	4.32	99.1	12.6	13.2	0.33	4.10	0.61
	Wm.	485	10.6	2748	4.68	153	7.19	11.8	0.34	3.51	0.46

Avail.*= Available (DTPA extractable)
Wm. * = Weighted mean.

Table (2) Cont.

Profile No.	Depth cm	Macro nutrient		Micro nutrients							
		P		Fe		Mn		Zn		Cu	
		total	Avail.*	total	Avail.*	total	Avail.*	total	Avail.*	total	Avail.*
The third group: Deep moderately fine to fine-textured soils with coarser surface											
1	0-30	202	7.87	2763	3.61	233	1.07	23.3	0.72	21.2	0.31
	30-70	696	7.19	3094	3.92	274	2.50	61.8	0.57	27.5	0.09
	70-110	726	14.7	2936	3.07	207	2.19	41.8	0.30	23.4	0.11
	110-150	546	15.3	3107	3.24	501	2.19	55.8	0.40	16.7	0.16
	Wm.*	592	11.5	2989	3.47	308	2.06	47.2	0.49	22.3	0.17
5	0-10	337	9.88	2754	2.41	168	1.14	58.4	0.52	16.9	0.00
	10-55	531	10.2	3132	2.63	272	0.62	60.2	0.16	21.4	0.42
	55-100	517	9.58	3115	2.78	207	1.39	65.8	0.44	18.3	0.41
	Wm.	503	9.93	3082	2.65	237	0.95	62.0	0.34	19.8	0.35
6	0-15	427	8.38	2739	1.96	163	1.11	61.6	0.70	19.3	0.34
	15-50	621	5.09	3057	2.89	260	0.91	59.5	0.29	20.9	0.28
	50-100	591	10.5	3075	3.24	277	0.91	61.1	0.84	17.3	0.50
	Wm.	577	8.27	3018	2.92	254	0.93	60.6	0.61	18.9	0.40
15	0-15	576	7.78	3177	2.85	594	1.57	26.7	0.02	11.8	0.29
	15-45	546	7.19	3019	2.56	103	2.32	28.1	0.12	25.7	0.31
	45-80	591	9.98	2905	3.19	771	1.81	25.9	0.16	15.1	0.26
	80-130	531	6.99	2997	2.48	872	1.93	26.2	0.24	14.9	0.06
	Wm.	556	7.93	2998	2.76	635	1.93	26.6	0.20	17.1	0.22
16	0-10	606	6.79	2676	2.80	402	1.23	19.7	0.38	17.4	0.79
	10-35	517	8.18	2672	2.18	894	2.07	54.8	0.50	16.4	0.57
	35-70	517	6.99	2730	3.79	894	2.41	21.5	0.43	15.9	0.82
	70-110	651	7.19	2752	3.99	592	2.19	13.3	0.92	9.50	0.77
	Wm.	597	7.63	2844	3.59	780	2.26	26.9	0.62	14.6	0.79
17	0-20	666	6.99	2778	2.55	521	1.43	25.1	0.14	12.7	0.29
	20-45	487	13.0	2776	3.07	689	2.12	22.0	0.12	11.0	0.11
	45-90	756	11.0	2802	2.84	930	2.31	24.8	0.48	11.2	0.15
	90-130	531	11.4	2787	2.96	342	1.94	22.3	0.22	10.2	0.11
	Wm.	625	10.9	2789	2.92	640	2.03	23.5	0.28	11.1	0.17
18	0-10	367	11.6	2613	2.51	188	0.77	14.4	0.27	8.00	0.29
	10-40	397	9.97	2505	2.54	228	1.24	17.4	0.50	9.80	0.37
	40-80	487	8.18	2793	2.22	231	1.30	19.0	0.20	12.9	0.51
	80-120	397	11.9	2893	3.18	577	1.58	15.8	0.28	8.20	0.30
	Wm.	424	10.2	2739	2.63	342	1.35	17.2	0.32	10.2	0.39
20	0-20	531	15.4	2598	4.73	216	6.45	12.7	0.46	4.40	0.32
	20-65	352	12.8	2528	4.24	246	6.25	15.3	0.32	5.10	0.27
	65-90	591	11.2	2757	3.58	167	4.84	16.4	0.35	4.40	0.24
	90-150	576	14.8	2868	2.79	169	3.92	13.3	0.22	5.40	0.22
	Wm.	489	13.7	2712	3.64	198	5.17	14.3	0.30	5.01	0.24
23	0-20	636	10.6	2638	3.71	260	1.74	4.5	0.29	4.30	0.49
	20-50	696	10.4	2721	2.47	497	2.32	2.8	0.32	5.20	0.29
	50-90	711	11.6	2709	3.65	296	1.49	3.3	0.47	3.10	0.39
	90-130	771	5.39	2689	4.10	283	1.64	2.0	0.48	6.00	0.34
	Wm.	715	9.24	2695	3.55	333	1.76	2.97	0.42	4.66	0.36
25	0-15	636	10.8	2586	3.24	587	1.38	10.5	0.38	3.90	0.39
	15-50	487	11.4	2428	2.90	403	1.25	8.5	0.24	2.70	0.40
	50-95	621	11.8	2531	2.83	214	1.94	13.1	0.53	5.20	0.44
	95-150	636	11.2	2405	3.74	578	2.06	10.9	0.52	2.30	0.48
	Wm.	603	11.4	2466	3.19	429	1.81	11.0	0.44	3.42	0.44

Avail. *= Available (DTPA-extractable).

Wm. * = Weighted mean.

Table (2) Cont.

Profile No.	Depth cm	Macro nutrient		Micro nutrients							
		P		Fe		Mn		Zn		Cu	
		total	Avail.*	total	Avail.*	total	Avail.*	total	Avail.*	total	Avail.*
The forth group: Deep moderately fine to fine-textured soils											
2	0-15	397	14.1	2976	3.06	150	0.72	48.1	0.54	23.2	0.13
	15-40	531	15.0	3048	1.90	424	1.07	49.4	0.60	12.1	0.00
	40-75	621	11.4	3148	3.47	157	1.11	51.8	0.36	27.2	0.22
	75-150	571	13.8	2631	2.57	120	0.93	132	0.42	25.0	0.05
	Wm.*	559	13.4	2856	2.74	182	5.01	91.3	0.45	23.2	0.11
7	0-20	576	9.88	3047	2.74	231	1.06	73.3	0.46	17.6	0.44
	20-60	666	11.1	3112	3.02	353	1.70	74.5	0.50	20.7	0.11
	60-100	636	12.1	3251	2.45	552	1.94	83.1	0.49	37.0	0.13
	100-140	591	14.7	3144	2.26	429	2.37	67.5	0.19	20.0	0.22
	Wm.	623	12.2	3152	2.66	414	1.90	74.8	0.41	24.7	0.19
9	0-12	576	12.6	2649	2.31	80.7	1.56	37.3	0.21	11.4	0.16
	12-40	547	9.28	2587	2.14	81.4	1.42	54.3	1.03	18.1	0.45
	40-75	531	11.1	2766	2.09	126	1.16	37.1	0.21	21.8	0.35
	75-150	681	12.9	2942	2.38	324	1.52	44.0	0.53	12.7	0.33
	Wm.	613	11.8	2811	2.28	213	1.41	43.8	0.52	15.7	0.35
22	0-15	621	7.39	2937	6.68	114	3.75	8.40	0.33	5.20	0.28
	15-50	696	7.98	2855	4.16	164	1.69	16.2	0.44	4.50	0.36
	50-90	621	10.6	2662	3.40	444	1.99	6.70	0.33	3.90	0.00
	90-130	681	9.98	2771	3.71	104	1.59	5.00	0.45	6.30	0.03
	Wm.	660	9.33	2745	4.09	226	2.00	8.93	0.39	4.95	0.17
24	0-10	801	7.98	2564	4.34	250	1.49	1.50	1.06	3.80	0.49
	10-40	786	12.8	2676	3.04	319	2.63	2.50	1.08	4.70	0.10
	40-85	636	13.4	2658	2.93	239	3.38	10.9	0.33	3.20	0.00
	85-130	756	9.78	2611	2.77	403	3.03	7.50	0.36	5.20	0.09
	Wm.	725	11.6	2639	3.05	315	2.97	7.06	0.58	4.28	0.10
26	0-18	756	7.30	2503	10.3	663	43.1	8.30	0.53	1.20	0.44
	18-40	711	12.0	2626	3.46	398	4.27	8.50	0.38	3.30	0.34
	40-90	876	12.0	2622	3.99	336	6.35	9.30	0.23	3.20	0.30
	90-120	786	12.2	2610	3.20	220	2.37	9.10	0.21	1.20	0.37
	Wm.	805	11.3	2602	4.65	367	10.5	8.95	0.28	2.42	0.36
27	0-10	756	9.98	2891	6.87	261	50.5	3.50	0.47	6.90	0.39
	10-30	546	9.38	2727	7.22	283	53.8	39.9	0.88	3.80	0.44
	30-70	786	11.8	2899	13.7	242	51.3	21.7	0.48	5.10	0.34
	70-110	711	11.6	2910	7.34	304	21.4	42.9	0.39	4.00	0.25
	Wm.	712	11.1	2526	9.66	274	40.8	31.1	0.54	4.63	0.38

Avail. *= Available (DTPA-extractable).
Wm. * = Weighted mean.

Table (3): Simple correlation (r) between total-P, and some soil variables in the studied soil profiles.

Soil phosph-orus	Soil variables							
	EC dSm^{-1}	pH	CEC(me/ 100g soil	OM %	$CaCO_3$ %	Silt %	Clay %	Silt + clay (%)
Total P	-0.12	-0.08	0.25^{**}	-0.04	-0.17^{*}	0.17^{*}	0.27^{**}	0.26^{**}

* = Significant at 5% level ** = highly significant at 1% level

Table (4): Simple correlation (r) between available P, and some soil variables in the studied soil profiles.

Soil phosph-orus	Soil variables							
	EC dSm^{-1}	pH	CEC(me/ 100g soil	OM %	$CaCO_3$ %	Silt %	Clay %	Silt + clay (%)
Available P	-0.17^{*}	-0.004	0.32^{**}	-0.14	-0.17^{*}	0.10	0.38^{**}	0.25^{**}

* = Significant at 5% level ** = Highly significant at 1% level

Table (5): Simple correlation (r) between total forms of Fe, Mn, Zn and Cu, and some soil variables in the studied soil profiles.

Total trace nutrients	Soil variables							
	EC dSm^{-1}	pH	CEC(me /100g soil	OM %	$CaCO_3$ %	Silt %	Clay %	Silt + clay (%)
Fe	0.080	-0.13	0.23**	-0.06	-0.28**	0.19*	0.22**	0.24**
Mn	0.110	-0.21*	0.03	-0.08	-0.12	0.02	0.05	0.04
Zn	0.214*	-0.30**	0.12	-0.08	-0.25**	0.10	0.11	0.12
Cu	0.210*	-0.24**	0.01	-0.01	-0.25**	0.02	0.001	0.01

* = Significant at 5% level ** = Highly significant at 1% level

Table (6): Simple correlation (r) between available forms of Fe, Mn, Zn and Cu, and some soil variables in the studied soil profiles.

Available trace nutrients	Soil variables							
	EC DSm^{-1}	pH	CEC(me/ 100g soil	OM %	$CaCO_3$ %	Silt %	Clay %	Silt + clay (%)
Fe	-0.32**	0.24**	0.02	0.12	0.35**	0.03	0.08	0.07
Mn	-0.29**	0.11	0.06	0.19*	0.28**	0.17*	0.11	0.16*
Zn	0.09	-0.10	0.08	0.16*	0.11	0.14	0.11	0.14
Cu	0.10	0.16*	-0.09	0.07	0.24**	0.03	-0.08	-0.04

* = Significant at 5% level ** = Highly significant at 1% level

Fig. (1): Distribution of available P in soils of West El-Gidida area.

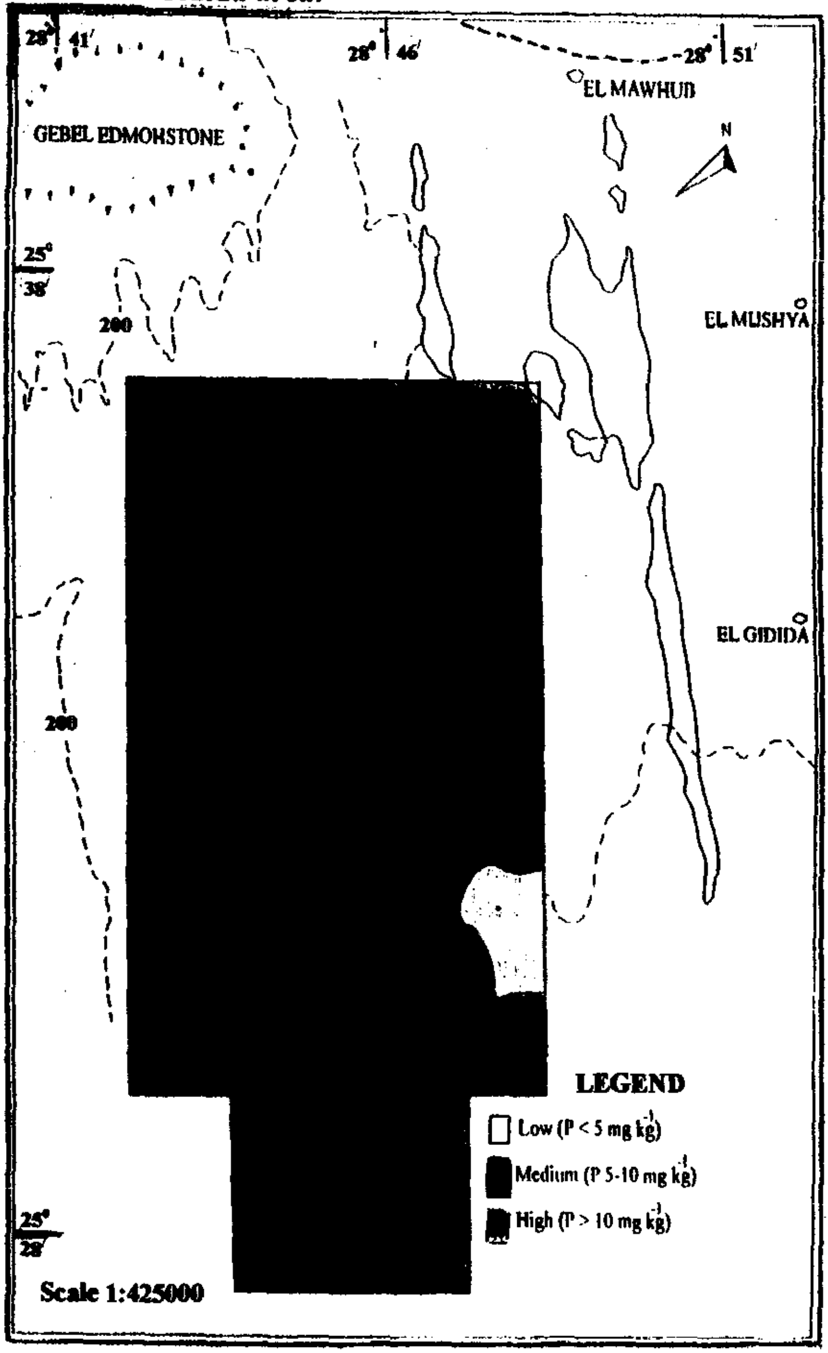
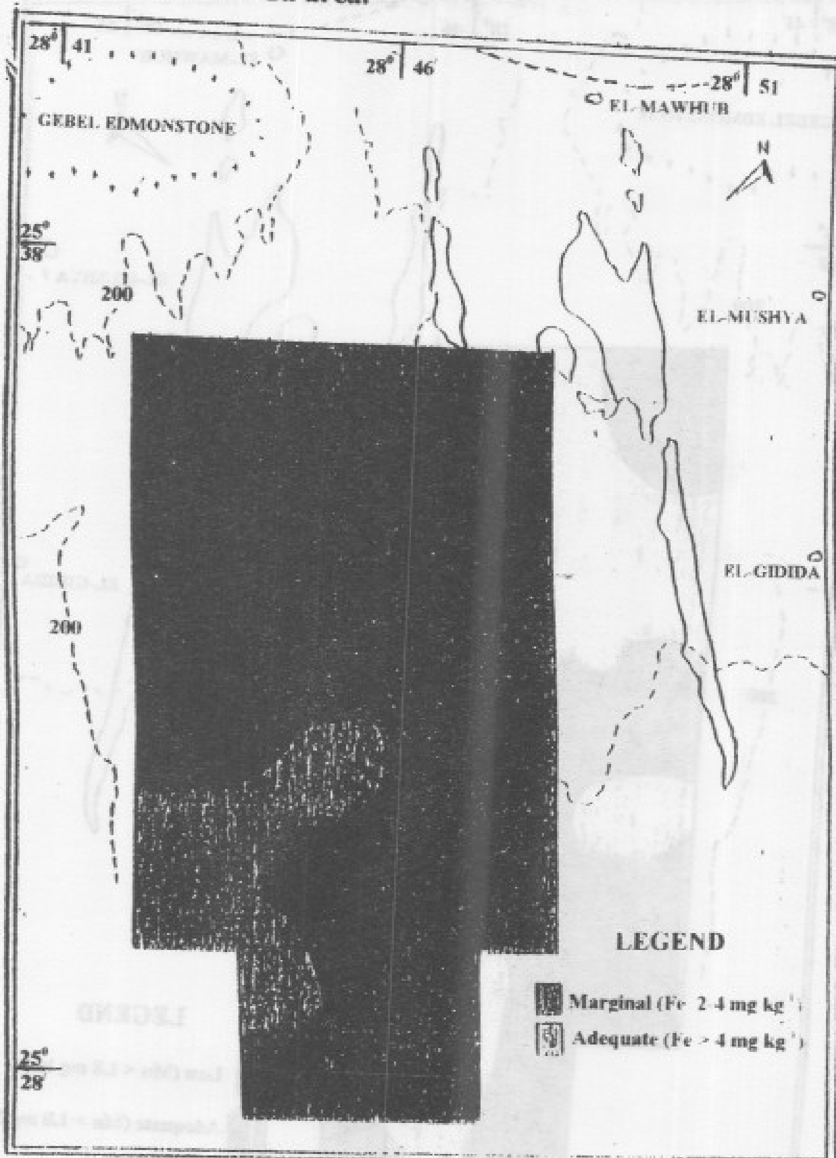


Fig. (2): Distribution of available Fe in soils of West El-Gidida area.



Scale 1:425000

Fig. (3): Distribution of available Mn in soils of West El-Gidida area.

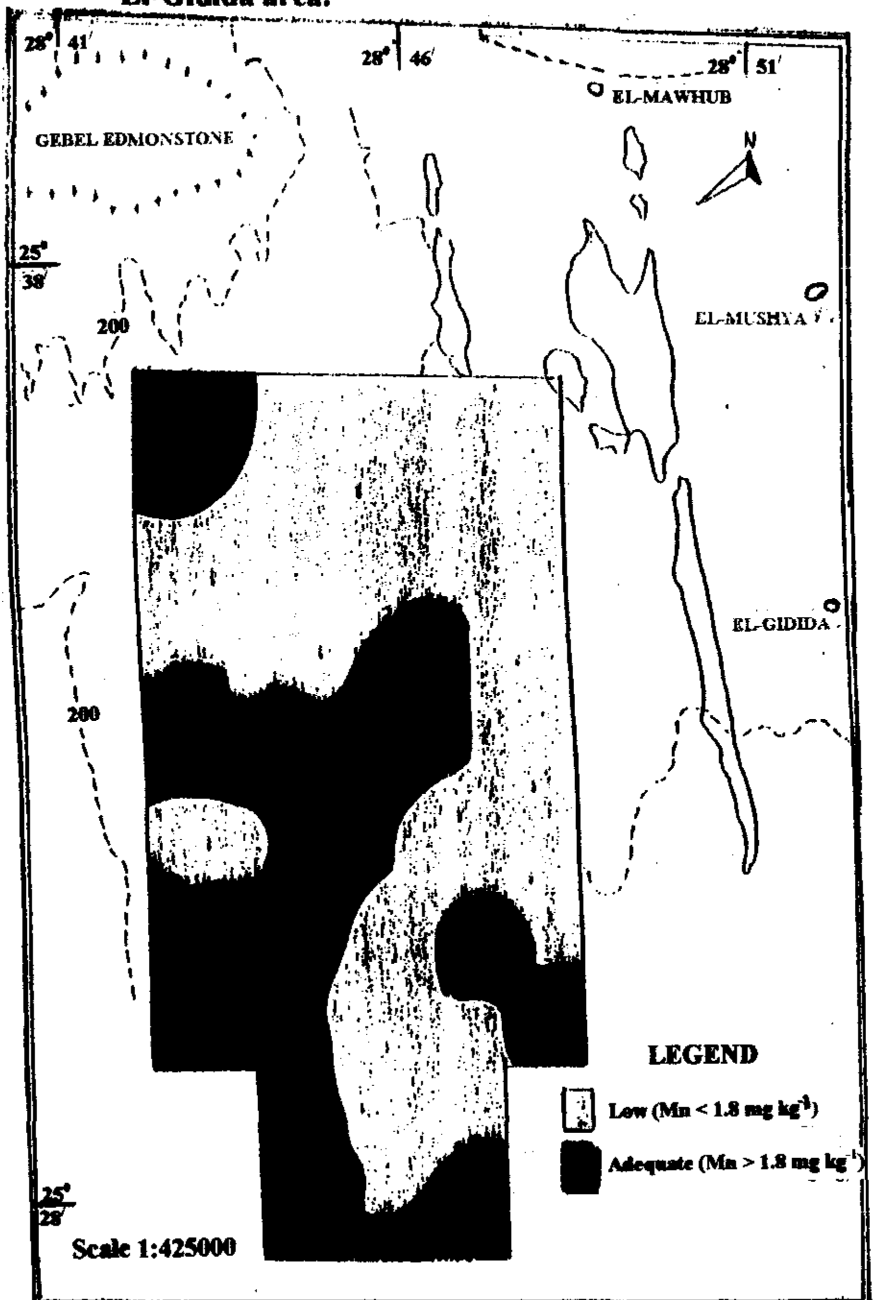


Fig. (4): Distribution of available Zn in soils of West El-Gidida area.

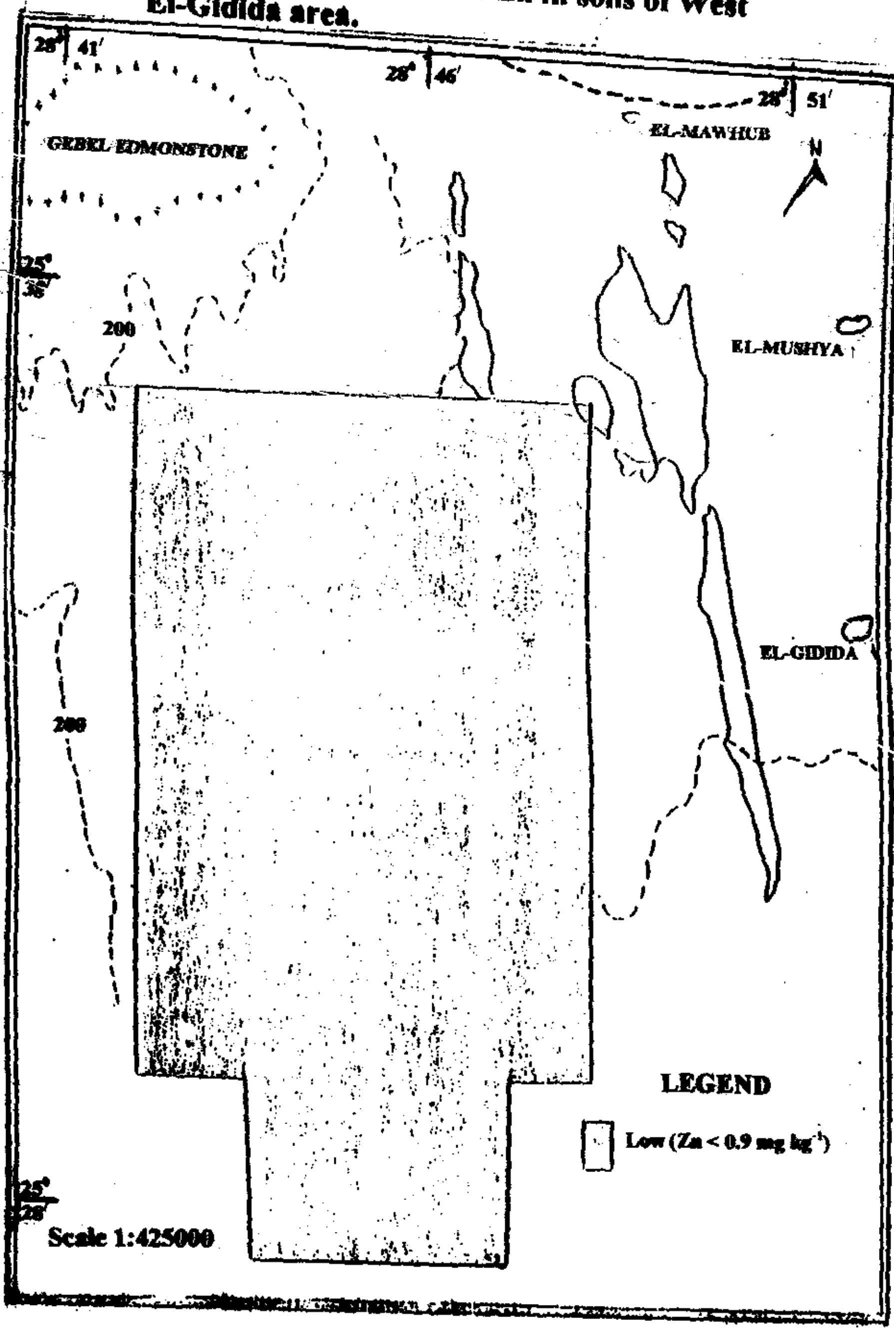
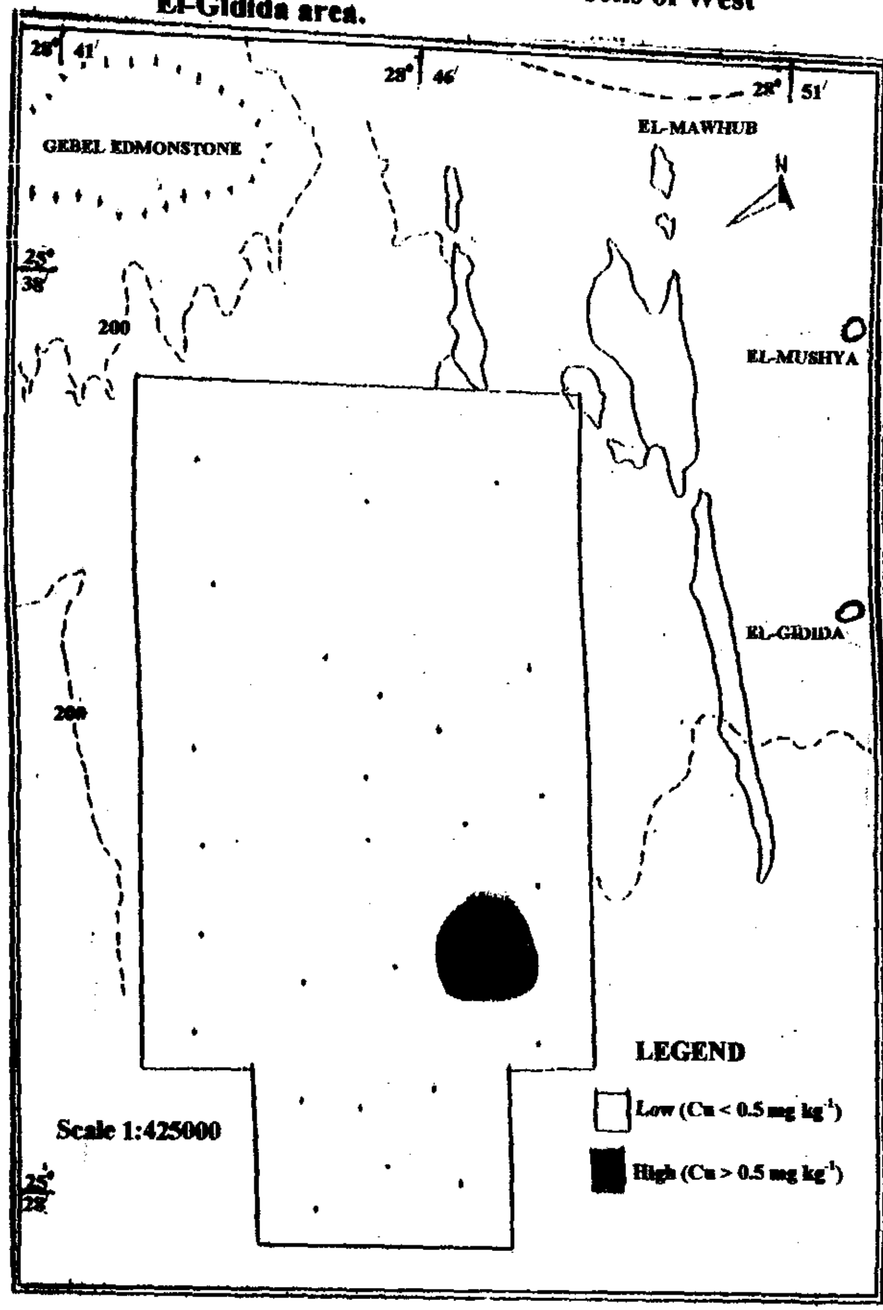


Fig. (5): Distribution of available Cu in soils of West El-Gidida area.



Depthwise distribution of available Cu content did not portary any specific pattern with depth. According to Soltanpour and Schwab (1977), the index values used for Cu extracted from soils by DTPA method are as follows: Low 0-0.5 mg kg^{-1} and high >0.5 mg Cu kg^{-1} soil. The weighted mean values of available Cu in the studied soil profiles ranged from 0.10 to 0.79 mg kg^{-1}. The lowest value characterized profile No. 24 in the fourth soils group which has deep moderately fine to fine-texture. The highest content distinguished profile No. 17 in the third soils group, which has deep moderately fine to fine- texture with coarser surface. Based on weighted mean values of available Cu and the critical levels proposed by Soltanpour and Schwab (1977), Fig. (5), shows that all profiles of the studied soils have low content of available Cu except for profile 16, which has high content. In other words, the studied soils represent 96% and 4% low and high Cu, respectively. Table (6) shows the relationship between available Cu and some soil factors, which is expressed by simple correlation coefficient. The obtained numerical correlation coefficients imply that available Cu is significant and highly significant positively correlated with pH and $CaCO_3$%, respectively.

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توزيع بعض العناصر الغذائية في بعض أراضي محافظة الوادي الجديد

محمود نبيل خليل*، إبراهيم رمضان محمد*، محمد عبد المنعم متولي**،
مصطفى عبد السميع عبد الخالق*

*قسم علوم الأراضي – كلية الزراعة – جامعة الزقازيق

**مركز بحوث الصحراء – القاهرة – مصر

أجريت دراسة على الأراضي الواقعة غرب منطقة الجديدة بالواحات الداخلة- محافظة الوادي الجديد لتحديد محتواها من الفوسفور و الحديد و المنجنيز و الزنك و النحاس، حيث تم حفر ٢٧ قطاع أرضي، تم تقسيمهم إلى ٤ مجموعات أرضية بناءً على قوام التربة بالطبقات المختلفة لكل قطاع أرضي وأعماق القطاعات الأرضية. قدرت بعض الصفات الطبيعية والكيميائية و كذلك المحتوى الكلي والميسر من الفوسفور والحديد والمنجنيز والزنك والنحاس.

أظهرت النتائج أن قوام هذه الأراضي يتراوح بين القوام الرملي الخشن و القوام الطيني، و أن محتوى المادة العضوية و كربونات الكالسيوم كان منخفضاً، أما الملوحة فكانت شديدة التباين من مكان إلى آخر حيث تراوحت بين عديمة و مفرطة الملوحة، كما أوضحت النتائج أن المحتوى الكلي من الفوسفور و الحديد و المنجنيز و الزنك و النحاس يتراوح من ٢٠٢ إلى ٨٧٦، ٢٣٧١ إلى ٣٥٣١، ٨٠,٧ إلى ٨٩٤،١,٥ إلى ١٣٢,٣، ١,٢ إلى ٣٨ مجم / كجم تربة على الترتيب. وكان المحتوى الميسر لكل من الفوسفور و الحديد و المنجنيز و الزنك و النحاس يتراوح من ٣,١٩ إلى ١٥,٤، ١,٧٧ إلى ١٣,٧، ٠,٦٢ إلى ٥٣,٨٤، صفر إلى ١,٤٩، صفر إلى ٠,٩٨ مجم / كجم تربة على الترتيب.

و طبقاً للمعدلات المقترحة عالمياً لكفاية العناصر بالنسبة لحاجة النبات غذائياً وجد أن محتوى الأراضي المدروسة من الزنك الميسر كان أقل من الحد الحرج بينما حوالي ٥٩%، ١٥%، ٥٢%، ٤% من الأراضي المدروسة تحتوي قدر كافي ميسر من الفوسفور والحديد و المنجنيز و النحاس على الترتيب.