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CHARACTERIZATION OF CERTAIN SOIL PROPERTIES RELATED TO THE FERTILITY STATUS OF SOILS – A CASE STUDY

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ABSTRACT

The present study aims to characterize the soil properties thought to be of close importance to the fertility status of the soil. This attempt was conducted in a sort of "a case study" on soils of the Experimental Farm of the Faculty of Agriculture of Sohag which covers an area of about 200 faddans being in two almost equal locations. Forty soil profiles, were selected with an average of 5 faddans for each profile. The soil samples (133 samples) were collected according to the morphological variations among the entire depth of the profiles and analyzed for the physical, chemical and fertility determinations.

Results was be summarized in the following :-

- Soils of both locations are mostly coarse in texture, which becomes finer with depth in some profiles.
- Most of soil samples moderately or strongly alkaline.
- Soil salinity showed to be variable being non-saline to very strongly saline.
- Soils of both locations are highly calcareous, being widely variable.
- Most of the soil samples contained O. M. of less than 1% and decreased with depth.
- Soil are characterized as being low and very low in nitrogen, indicating the need to apply more N through fertilization.
- The tested soils exhibit moderate to very high values of "available" P, indicating no need to apply more P.
- Soils of experimental sites contained low to high levels of extractable K.
- 35.71% and 61.90% of the collected samples are Fe-deficient, while 64.29% and 38.10% of those samples are Fe-marginal.
- 35.86% and 15.87% of all soil samples taken, represent Mn-deficiency depending on farming duration in both locations.
- All soil samples are Zn non – deficient.
- All studied soils contain more than 0.2 ppm DTPA-extractable Cu, indicating no Cu deficiency.

INTRODUCTION

Soil fertility can be looked upon as being concerned with the status of one or more of the nutrients essential to plants. This comprises the form or forms of these nutrients in the soil that are considered available to the growing plants. The level or quantity of one or more of those nutrients is also of special concern to any practical consideration of soil fertility. The differential potential of each of those nutrients at any time to be in reach to the growing plant (kinetics of nutrient availability) is also of vital importance. All of these aspects are governed by the conditions prevailing in the soil which are, in reality, defined by soil properties. Being as complicated as it seems, various approaches have been used to determine the fertility status of soils as follows:

* The chemical determination of nutrients present in the soil to be tested using standard procedures, most of which estimate the amount of nutrient that is available in the soil during the relatively short period of extraction. Evidently, this dose not reflect the real situation during plant growth which is often described as being a condition of nutrient association between the plant and the soil.

* The biological estimation of the fertility status of the soil through short-term techniques, pot experiments or field trials. Such procedures are always confronted by the relatively long period of time that is consumed before any result can be obtained, besides being rather expensive. However, those biological techniques are distinguished for their dependence on the living plant.

In either of those approaches, there must be, thorough consideration of the soil properties especially those related to the fertility status of that soil. Therefore, full knowledge of such properties is essential.

The present study aims to characterize the soil properties thought to be of close importance to the fertility status of a newly reclaimed sandy soil at Sohag Governorate. This attempt was conducted in a sort of "a case study".

MATERIALS AND METHODS

1- LOCATION:-

The experimental farm of the Faculty of Agriculture, at Sohag which represent the study case covers an area of approximately 200 feddans. The farm lies in the south eastern direction of Sohag city and El-Kawsar region which is a part of the eastern desert plateau (Figure, 1).

The farm occupies two almost equal locations. The first (new farm) is nearby the first industrial region and is cultivated with field crops and fruit trees and irrigated by sprinkler and drip irrigation systems. The second location (old farm) is located near to the second industrial area and is cultivated since more than 10 years with field crops, vegetables, fruit trees and floriculture crops. Both locations have received various amounts of Nile alluvium added to the surface in order to improve soil characters.

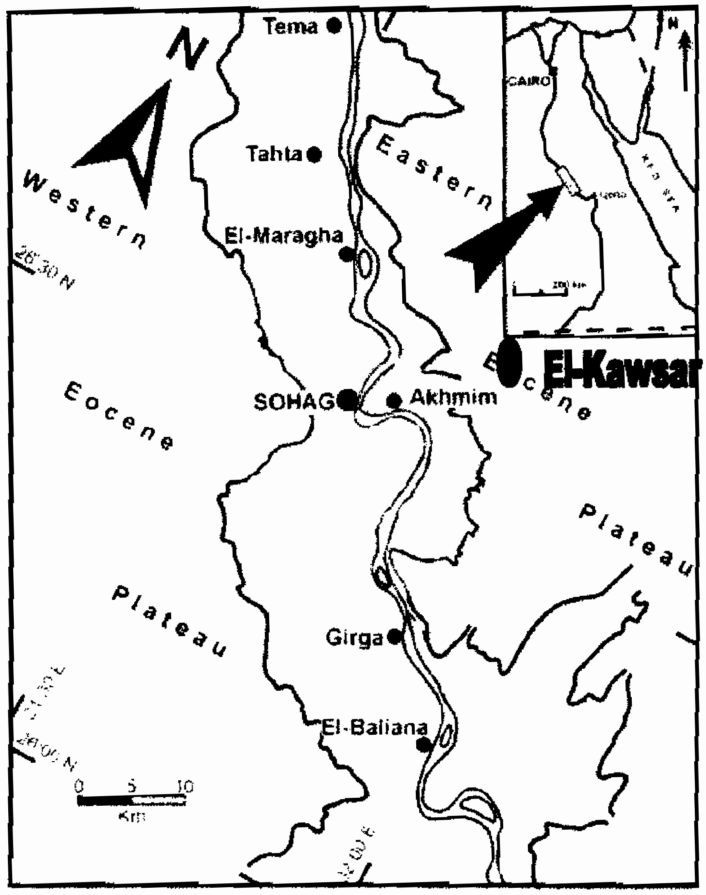

Fig. (1): **Map of Sohag Governorate showing El-Kawsar area (the experimental site).**

2-SOIL SAMPLING: -

Forty soil profiles, were selected to represent both locations with an average of 5 feddans for each profile. The soil samples (133 sample) were collected according to the morphological variations among the entire depth of the profiles.

The soil samples were air-dried, crushed, passed through a 2 mm sieve. Each sample was thoroughly mixed and gently ground by means of a plastic mortar and then stored for analysis. Standard methods of analysis were performed for the physical, chemical and nutrient determinations.

3-SOIL FERTILITY ANALYSIS: -

3-1-Total nitrogen: -

Total nitrogen content was carried out by the modified Kjeldahl procedure according to Jackson (1973).

3-2-Na-HCO_3 extractable-P: -

Available phosphorus was extracted by 0.5 M Na HCO_3 at pH 8.5 (Olsen *et al.*, 1954). Phosphorus was determined colorimetrically using the chlorostannous sulphomolybdic acid method (Jackson,1973) using Cecil 2/3000 spectrophotometer.

3-3-POTASSIUM: -

3-3-1-Exchangeable potassium was extracted with 1N NH_4 OAc at pH 7.0 as described by Jackson (1973).

3-3-2-Total potassium was measurd by digestion with a mixture of H_2SO_4 – $HClO_4$ as described by Lim and Jackson (1982).

Potassium in each digest was measured using Jenway PFP7 flamephotometer.

4-MICRONUTRIENTS: -

DTPA-extractable micronutrients:-

Available Fe, Mn, Zn and Cu were extracted from the soil samples by 0.005M DTPA at pH 7.3 according to Lindsay and Norvell (1978) where the filtrate was used for Fe, Mn, Zn and Cu determinations using (Buck Scintific 210 VGP) atomic absorption spectrophotometer.

The obtained data were statistically analyzed for the various parameters using the STATISTICA 5 for windows (1995) computer program distributed by Stat Soft Inc.

RESULTS AND DISCUSSION

1- Physico-chemicals properties of the studied soils :-

A summary of the statistical parameters of soil properties in the soils of the new and the old farms are given in Table (1).

Table (1): Summary of descriptive statistics for physical and chemical properties in soils of the new and old farms (n=63 and 70, respectively)

***sp = saturation percent**

Soil property	Location	Gravel %	SP* %	Particle size analysis			pH 1:1	ECe, ds/m	O.M %	$CaCO_3$ %
				sand %	silt %	clay %				
Mean	New farm	37.50	29.67	77.26	11.72	10.91	8.33	9.37	0.80	70.78
Median		28.24	22.00	78.77	11.18	9.70	8.37	6.96	0.63	73.10
Minimum		0.00	19.00	49.04	2.55	2.42	7.13	0.63	0.12	51.20
Maximum		73.07	60.00	91.71	35.16	30.75	9.49	56.58	2.90	87.70
Sd .**		23.81	12.84	10.02	6.66	5.61	0.54	10.31	0.67	9.54
25% quartile		21.54	20.00	70.83	5.50	7.37	7.99	3.50	0.40	61.10
75?% quartile		55.49	41.00	86.35	15.92	12.39	8.70	10.65	0.81	77.40
Mean	Old farm	35.96	31.23	70.27	18.42	11.29	8.63	1.44	1.12	52.62
Median		39.00	23.30	77.33	13.93	7.81	8.71	0.99	0.70	52.80
Minimum		0.00	13.30	4.55	3.98	1.94	7.09	0.40	0.18	27.90
Maximum		72.06	89.70	91.51	58.60	89.70	9.78	7.30	3.20	88.20
Sd .**		24.80	15.00	20.22	14.72	12.09	0.48	1.28	0.90	16.22
25% quartile		2.33	20.00	61.92	8.15	4.57	8.30	0.68	0.54	38.00
75?% quartile		56.46	43.30	84.77	21.31	13.45	8.92	1.91	1.70	66.20

****sd = standard deviation**

1-1-soil texture: -

The results reveal that the texture of the samples representing the soils of the new farm is mostly coarse. The sandy loam texture dominates in most samples followed by loamy sand and sand Sandy clay loam texture, however, occurred in the surface layer of some profiles (data not shown). The obtained data and the field observations indicated that the sand fraction constitutes high percentage where it ranges from 49.04 to 91.71%. Almost similar situation was obtained in the soil samples of the old farm. As stated above, the studied soil profiles in both farms include two contrasted layers. The topsoil layer (about 30 cm thick) was transported by the natives from the Nile floodplain, whereas the subsoil layer is considered a natural extension of the adjacent eastern desert. The surface layers of both locations are fine in texture probably due to the previously added alluvium material to the topsoil layers, especially in the old farm.

The impact of land use being intensively cropped with wheat, sugarcane, alfalfa, fruit trees and vegetable crops for several years cannot be excluded. Most of these results are in good agreement with those obtained by Ibrahim *et al.*, 2001, Kotb *et al.*, 2002, Khalifa *et al.*, 2003 and Ali, 2005.

1-2-soil pH: -

Soils of the studied farms have soil pH values greater than 7.0, being in the range of 7.13 to 9.49 with an average of 8.33 and from 7.09 to 9.78 with an average of 8.63 for the new and old farms, respectively. This indicates that most soil samples of both farms are generally moderately or strongly alkaline. Furthermore, the subsoil layers possessed considerably higher pH values than the surface ones . Similar results were obtained by Abd El-Aziz, 1998 , Ibrahim *et al.*, 2001 , Kotb *et al.*, 2002 and Abd El-Aziz and Ghallab, 2002.

1-3-soil salinity: -

The soil salinity in the soils of the new farm showed to be variable, being non saline to very strongly saline (have ECe values higher than 30 dS/m), where it ranged between 0.63 and 56.58 dS/m with an average of 9.37 dS/m. However soils of the old farm ranged from 0.40 to 7.3 dS/m with an average of 1.44 dS/m (slightly to moderately saline). The high content of soluble salts, especially in the surface layers of most sites of the new farm, could be attributed to the absence of any leaching due to the scanty rainfall and irrigation systems used in both sites being either sprinkler or drip irrigation systems. On the other hand, the extremely lower salinity levels in the old farm compared to the new one, is possibly due to the agricultural practices applied for several years.

Similar results were obtained by Faragallah, 1995, Abd El-Aziz, 1998, Ibrahim *et al.*, 2001, Kotb *et al.*, 2002, Khalifa *et al.*, 2003, Khalil *et al.*, 2004 and Ali, 2005.

1-4-Total carbonates: -

All soil samples of both farms are highly calcareous and it varied from one site to another. The total carbonates contents of most studied soil sites in the new farm varied between 51.20 and 87.70 with an average of 70.78%. The highest values occured in subsurface layers, while the lowest values were found in the surface layers. This is possibly due to the added alluvial material (poor in lime content) to soil surface resulting in lowering $CaCO_3$% . In most cases, the increase in total carbonates with depth was noticed in both farms.

The situation in the old farm was similar to a certain extent, to that of the new farm (27.90-88.20 %). Generally, all soil samples in both farms are highly calcareous which may be due to the nature of parent material of these soils being limestone. Similar results were obtained by Abd El-Aziz,1998, Kotb *et al.*,2002 and Ali,2005.

1-5-Soil organic matter:-

Data obtained indicate that the O.M content of the studied soils of both farms ranged between 0.12 and 2.90 % with an average of 0.80%, in the new farm and from 0.18 to 3.20 % with an average of 1.12% in the old one. Most soil profiles showed a clear decrease of O.M with depth. Similar results were obtained by Abou El-Khir, 2000 , Ibrahim *et al.*, 2001 , Kotb *et al.*, 2002 , Khalil, 2004 and Ali, 2005.

2- STATUS OF SOME MACRONUTRIENTS IN SOILS:-

2-1-Nitrogn

A summary of descriptive statistics of total nitrogen contents of the examined soil samples is listed in table (2).

The total nitrogen content in the studied soils are widely variable where, it ranged from 0.007 to 0.52 % with an average of 0.09 % and from 0.007 to 0.58 % with an average of 0.07 % for the new and old farms, respectively. It may be noticed that the total nitrogen decreased with depth in all profiles in both farms. This may be attributed to the relationship between total nitrogen and organic matter content. Soil fertility was evaluated for N according to the method of Metson (1961). Soils characterized as very low fertile in N comprised about 69.84 % and 75.71% of the tested soils in the new and old farms, respectively and those characterized as low fertile constituted the rest.

Table (2): Summary of descriptive statistics for total nitrogen % in the old and new farms (n=70 and 63, respectively)

Statistical parameters	New farm	Old Farm
Mean	0.09	0.07
Median	0.02	0.02
Minimum	0.007	0.007
Maximum	0.52	0.58
Sd.*	0.13	0.09
25% quartile	0.01	0.01
75% quartile	0.19	0.09

* Sd=Standard deviation

2-2 Na HCO_3 –extractable –P.

A summary of descriptive statistics of the obtained Na HCO_3 extractable –P in the studied soils is shown in table (3)

Values of the Na HCO_3 –extractable –P ranged from 5.10 to 96.30 ppm with an average of 19.98 ppm in soils of the new farm, while it varied between

4.60 and 69.10 ppm with an average of 17.36 ppm in the soils of old one. The highest values were found in the surface layers, while the lowest values were exhibited in the subsurface layers. This reflects the effect of soil management "such as fertilization, agricultural practices and crop type" (Abd El-Galil and Ibrahim, 2001). Meanwhile, the lowest concentration was governed by the high content of total carbonate in the subsurface layers, where the surface adsorption and precipitation are the major processes depressing the availability of soil phosphorus. According to the limits of Cooke (1967) most of these soils exhibit moderate to very high levels of P (>21 ppm) indicating no need to apply more P through fertilization. Similar results were obtained by Faragallah, 1995 and Abd El-Galil and Ibrahim, 2001.

Table (3): Summary of descriptive statistics for Na HCO_3–extractable –P content (ppm) in the new and old farms (n=63 and 70, respectively).

Statistical parameters	New farm	Old Farm
Mean	19.98	17.36
Median	12.60	12.65
Minimum	5.10	4.60
Maximum	96.30	69.10
Sd.*	17.24	13.95
25% quartile	9.60	8.60
75% quartile	23.80	19.90

* Sd=Standard deviation.

2-3-Potassium

2-3-1- Water soluble potassium

A summary of descriptive statistics for potassium forms throughout the studied soils are listed in table (4)

According to the obtained data, the soluble K values in the studied soils ranged from 1.12 to 32.09 ppm with an average of 5.87 ppm and from 0.09 to 45.45 ppm with an average of 6.02 ppm in the old and new farms, respectively. No consistent trend could be detected with respect to depth. These results are in good harmony with those reported by Kotb *et al.*,2002 and Khalifa *et al.*,2003.

2-3-2- Exchangeable potassium

Data of exchangeable K in soils of the old farm shows that the concentration of exchangeable K ranged from 65.82 to 470.19 ppm with an average of 197.28 ppm and from 101.68 to 985.91 ppm with an average of 413.57 ppm in the soil of the new farm. According to Metson (1961) most soils of the old farm contain low to high levels of extractable K. Meanwhile, the soils of the new farm contain very high levels of extractable K.

2-3-3- Total potassium :-

The total potassium content of the soil samples ranged from 0.02 to 1.57 % with an average of 0.65% and from 0.04 to 1.97 % with an average of 0.95% in the soils of the old and new farms ,respectively. The highest values were found in the fine texture, while the coarse texture exhibited the lowest values. These results are in good harmony with those obtained by Abd El-Hamid,1983 , El-Toukhy,1987, Abd El-Maksoud *et al.*, 2000, Shaker, 2001 and Khider *et al.*, 2004.

Table (4) : Summary of descriptive statistics for the forms of potassium in the new and old farms (n=63 and 70, respectively).

Statistical Parameters	Site	Total-K % K_2O	Exchangeable (ppm)	Soluble-K (ppm)
Mean	New farm	0.95	413.57	6.02
Median		0.98	384.42	3.52
Minimum		0.04	101.68	0.09
Maximum		1.97	985.91	45.45
Sd .		0.38	215.24	7.96
25% quartile		0.71	242.28	1.18
75% quartile		1.20	551.77	6.58
Mean	Old farm	0.65	197.28	5.87
Median		0.63	151.39	3.66
Minimum		0.02	65.82	1.12
Maximum		1.57	470.19	32.09
Sd .		0.39	115.23	5.69
25% quartile		0.37	112.73	2.43
75%quartile		0.84	292.42	6.58

* Sd=Standard deviation.

3- STATUS OF SOME MICRONUTRIENTS IN SOILS: -

Data obtained for DTPA- extractable Fe, Mn, Zn, and Cu throughout the studied soils are given in tables (5,6).

Table (5): Values of DTPA-extractable micronutrients in the New farm soils.

Sample no.	Transect/ Profile	Depth (cm)	DTPA – Micronutrients (ppm)			
			Fe	Mn	Zn	Cu
1	1/1	0-20	9.49	48.50	2.45	1.03
2		20-50	3.72	6.50	0.84	0.63
3		50-100	4.43	3.52	0.66	0.68
4	1/2	0-30	4.92	13.70	1.06	0.98
5		30-70	0.70	1.05	0.77	0.61
6		70-100	1.03	0.95	0.67	0.61
7	1/3	0-20	6.97	37.00	2.63	0.02
8		20-60	1.08	1.39	0.68	0.47
9		60-100	0.98	1.50	0.66	0.52
10	1/4	0-15	6.04	47.40	2.94	0.58
11		15-50	1.57	1.79	0.67	0.55
12		50-100	1.13	0.95	0.61	0.57
13	2/1	0-30	8.54	46.80	1.80	1.43
14		30-50	1.31	1.87	1.02	0.82
15		50-100	1.01	1.31	0.67	0.60

Table (5) : Continued.

Samples No.	Transect/ profile	Depth (cm)	DTPA – Micronutrients (ppm)			
			Fe	Mn	Zn	Cu
16	2/2	0-5	5.24	47.00	1.84	1.44
17		5-20	1.20	1.48	0.65	0.79
18		20-50	0.86	0.50	0.73	0.66
19		50-100	0.72	0.56	0.88	1.20
20	2/3	0-15	4.55	45.40	1.65	0.09
21		15-40	1.31	0.93	0.73	0.62
22		40-100	2.34	0.96	0.66	0.55
23	2/4	0-30	4.77	20.70	1.87	0.88
24		30-70	4.42	1.53	0.66	0.47
25		70-100	3.26	1.22	0.77	0.41
26	2/5	0-10	6.08	67.30	2.52	1.43
27		10-50	1.70	6.62	0.82	0.62
28		50-100	2.48	2.47	0.69	0.70
29	2/6	0-20	10.21	37.90	1.65	1.44
30		20-70	1.21	2.49	0.80	0.59
31		70-100	0.84	1.56	0.78	0.57
32	3/1	0-20	2.31	21.40	2.83	0.87
33		20-70	0.67	0.81	0.65	0.59
34		70-100	0.60	0.51	0.70	0.54
35	3/2	0-20	4.99	22.80	1.45	1.32
36		20-60	1.43	1.13	0.77	0.75
37		60-100	0.88	0.46	0.63	0.70
38	3/3	0-20	5.35	21.80	2.46	1.09
39		20-60	1.43	2.81	0.71	0.71
40		60-100	2.52	2.72	0.75	0.89
41	3/4	0-20	5.67	31.80	1.93	0.42
42		20-40	5.78	4.56	0.79	0.75
43		40-60	3.41	6.68	0.92	0.72
44		60-100	3.99	4.64	0.69	0.83
45	3/5	0-20	1.67	10.90	0.81	0.23
46		20-60	0.91	1.29	0.41	0.33
47		60-100	0.73	2.02	0.63	0.24
48	3/6	0-20	3.16	16.90	1.05	0.85
49		20-30	2.26	11.20	2.11	0.74
50		30-60	1.04	3.46	0.71	5.74
51		60-100	1.51	2.03	0.67	0.79
52	3/7	0-30	1.94	20.20	1.70	0.78
53		30-50	1.00	2.41	0.77	0.58
54		50-100	1.75	0 83	0.91	0.62
55	3/8	0-10	1.75	80.00	0.83	0.37
56		10-100	1.22	3.37	0.83	0.48
57	3/9	0-15	7.16	55.60	1.03	7.52
58		15-40	2.46	7.41	0.95	0.46
59		40-60	1.31	4.36	0.76	0.61
60		60-100	1.85	5.12	0.72	0.18
61	3/10	0-25	7.06	90.60	3.18	0.92
62		25-55	1.00	3.08	0.72	0.40
63		55-100	1.19	1.81	0.91	0.50

Table (6) : Values of DTPA-extractable micronutrients in the Old farm soils.

Sample no.	Transect / Profile	Depth (cm)	DTPA – Micronutrients (ppm)			
			Fe	Mn	Zn	Cu
1	A/1	0-30	1.63	1.71	0.64	0.47
2		30-55	1.26	1.20	0.66	0.50
3		55-70	0.98	1.12	0.67	0.54
4		70-110	1.48	1.17	0.81	0.65
5	A/2	0-30	6.81	29.20	1.20	1.27
6		30-60	1.21	1.94	0.64	0.38
7		60-90	0.73	1.13	0.61	0.43
8		90-100	1.28	0.97	0.65	0.53
9	A/3	0-30	9.89	21.20	0.95	1.80
10		30-60	0.86	0.88	0.73	0.47
11		60-80	0.98	1.22	0.74	0.48
12		80-100	0.92	1.65	0.81	0.50
13	A/4	0-25	4.87	79.20	1.99	2.52
14		25-65	3.17	0.73	0.69	0.71
15		65-100	2.90	0.93	0.66	0.64
16	A/5	0-10	4.28	4.26	1.49	2.65
17		10-30	2.64	0.48	0.83	0.69
18		30-50	3.36	0.32	0.65	0.73
19		50-100	2.39	0.30	0.69	0.70
20	A/6	0-20	9.63	82.80	1.38	2.64
21		20-70	4.22	0.62	0.61	0.71
22		70-100	5.17	0.30	0.80	0.91
23	A/7	0-20	9.15	2.95	2.43	2.38
24		20-35	4.10	0.84	0.94	1.55
25		35-55	2.07	0.14	1.04	0.71
26		55-100	2.57	0.40	0.80	0.90
27	A/8	0-30	7.44	44.80	1.97	2.34
28		30-50	3.87	1.18	1.21	0.88
29		50-80	4.31	0.80	0.85	0.86
30		80-100	4.02	0.80	0.98	0.88
31	B/1	0-30	7.35	3.58	2.23	1.96
32		30-60	1.83	4.34	0.75	0.67
33		60-80	3.84	2.47	0.69	0.73
34		80-100	1.07	1.47	0.67	0.46
35	B/2	0-25	5.34	63.10	2.53	0.82
36		25-60	3.50	0.53	0.89	0.51
37		60-80	1.28	1.45	0.61	0.44
38		80-100	1.04	1.65	0.63	0.46
45	B/5	0-30	7.68	3.54	1.57	1.40
46		30-80	2.06	2.72	0.71	0.55
47		80-100	2.04	3.43	0.77	0.71

Table (6) : Continued.

Sample no.	Transect / Profile	Depth (cm)	DTPA – Micronutrients (ppm)			
			Fe	Mn	Zn	Cu
48	B/6	0-30	8.93	3.44	1.25	1.64
49		30-60	1.99	1.87	0.73	0.57
50		60-100	2.01	2.00	0.62	0.82
51	C/1	0-25	7.82	60.90	4.17	2.18
52		25-45	4.43	0.38	1.04	0.79
53		45-100	3.01	0.46	0.68	0.51
54	C/2	0-40	8.25	49.40	3.08	1.96
55		40-70	3.48	4.38	0.81	0.82
56		70-100	2.92	3.25	0.72	0.72
57	C/3	0-15	9.14	3.58	1.48	1.93
58		15-60	1.30	2.63	0.69	0.45
59		60-100	2.83	0.53	0.81	0.94
60	C/4	0-20	7.21	3.25	0.90	0.88
61		20-40	2.11	0.47	0.78	0.65
62		40-60	2.77	0.45	0.80	0.59
63		60-100	2.18	3.28	0.75	0.63
64	C/5	0-15	7.63	51.80	1.32	2.31
65		15-40	2.67	2.95	0.58	0.62
66		40-80	3.35	3.96	0.70	0.66
67		80-100	2.71	0.50	0.74	0.79
68	C/6	0-20	8.72	89.20	4.38	2.05
69		20-40	2.64	0.61	0.83	1.06
70		40-100	3.27	0.36	0.66	1.17

A summary of descriptive statistics for the DTPA-extractable micronutrients in the studied soils is shown in table (7).

Table (7): Summary of descriptive statistics for the DTPA-extractable micronutrients in the studied soils.

Statistical parameters	Site	DTPA – Micronutrients (ppm)			
		Fe	Mn	Zn	Cu
Mean	Nw farm	2.92	14.25	1.12	0.87
Median		1.75	3.37	0.79	0.62
Minimum		0.60	0.46	0.41	0.02
Maximum		10.21	90.60	3.18	7.52
Sd. *		2.93	21.14	0.69	1.11
25% quartile		1.08	1.39	0.69	0.52
75% quartile		4.55	20.7	1.45	0.85
Mean	Old farm	3.88	11.05	1.21	1.02
Median		2.97	1.79	0.80	0.73
Minimum		0.73	0.14	0.58	0.38
Maximum		9.89	89.20	9.24	2.65
Sd .		2.59	22.15	1.24	0.65
25% quartile		2.01	0.80	0.69	0.57
75% quartile		5.34	3.81	1.20	1.17

* Sd= Standard deviation.

3-1. DTPA-extractable Iron:

The obtained data show that values of DTPA-extractable Fe ranged from 0.60 to 10.21 ppm with an average of 2.92 ppm and from 0.73 to 9.89 ppm with an average of 3.88 ppm in the soils of new and old farms, respectively. The high values were found to be related to the high contents of clay and O.M. Meanwhile, the low values seem to be governed by the high content of total carbonates and sand fraction. These results are in harmony with that of where they reported that total and available iron were positively correlated with the clay, silt+clay contents, while negatively correlated with $CaCO_3$ contents. (Attia, 1988; Khalil *et al.*, 2004 and Ali, 2005). Vites and Lindsay (1973) reported the levels used in Colorado to differentiate between the Fe-deficient, marginal and non deficient soil according to their contents of DTPA-extractable Fe. Soils containing less than 2.5 ppm are described to be Fe-deficient, those containing 2.5 - 4.5 ppm Fe are marginal and others containing more than 4.5 ppm Fe are considered non deficient. Examination of individual values (tables 5 & 6) reveals that 35.71% and 61.90% among total samples collected from both old and new farms, respectively are Fe-deficient, while 64.29% and 38.10% are Fe-marginal or in the non-deficient range.

3-2. DTPA-extractable manganese:-

Values obtained for DTPA-extractable manganese (Table 7) ranged from 0.46 to 90.60 ppm with an average of 14.25 ppm, and from 0.14 to 89.20 ppm with an average of 11.05 ppm in soils of new and old farms, respectively. According to the levels set by Viets and Lindsay (1973), soils containing less than 1 ppm are described to be Mn-deficient, those containing 1 to 2 ppm Mn are marginal and others containing more than 2 ppm Mn are considered non deficient. If this system is adopted, one will see that only 35.86% and 15.87% of all soil samples taken from the old and new farms, represent Mn-deficiency. In other words most soils of these farms are rich in extractable Mn. Similar results were obtained by Abd ElRazek *et al.*(1984) who found that all soils of Sohag and Quena governorates contained adequate to high levels of extractable Mn.

3-3. DTPA-extractable Zinc:

The content of DTPA-extractable Zn estimated in the studied soils ranged from 0.41 to 3.18 ppm with an average of 1.12 ppm for soils of the new farm and from 0.58 to 9.24 ppm with an average of 1.21 ppm for those of the old farm. This is in accord with those reported by Ghoneim *et al.*, 1984a, Attia, 1988, Abou El-Khir, 2000, Ibrahim *et al.*, 2001 Salim, 2002 Khalil *et al.*, 2004 and Ali, 2005. Referring to the levels defined by Viets and Lindsay, 1973, soils containing less than 0.5 ppm are Zn-deficient, those containing 0.5 to 1.0 ppm are marginal and those containing more than 1.0 ppm Zn are Zn-non deficient. Examination of the individual values (shown in tables 5 & 6) reveals that all soil samples collected from both farms are Zn non- deficient, except one sample taken from soils of the new farm that is Zn-deficient (the surface layer of profile ⅓).

3-4. DTPA-extractable Copper:-

DTPA-extractable Cu ranged from 0.38 to 2.65 ppm in soils of the old farm, whereas it was from 0.02 to 7.52 ppm in soils of the new farm. The average values obtained for soil samples of the old farm was much highe than that for soils of the new farm (1.02 ppm compared to 0.87 ppm). This is most probably due to local addition of Cu containing materials. Similar results were obtained by Ghoneim *et al.*, 1984b , Attia,1988 , Ahmed *et al.*,1995 , Abou El-Khir,2000 , Ibrahim *et al.*,2001 , Khalil *et al.*, 2004 and Ali,2005. Using the levels reported by Viets and Lindsay (1973), soils containing less than 0.2 ppm are considered Cu-deficient, while those containing more than 0.2 ppm are non deficient. According to this criteria, all studied soils in the old and new farms contain more than 0.2 ppm DTPA-extractable copper, except two soil samples in the new farm (0.02 and 0.088 ppm in the surface layer of profiles 1/3 and 2/3, respectively). This is in agreement with the data reported by Ghoneim *et al.*,1984b , Attia,1988 and Faragallah,1995.

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التعرف على خصائص التربة المتعلقة بحالة خصوبة التربة "دراسة حالة"

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الدراسة الحالية تهدف إلى التعرف على خصائص التربة المتعلقة بحالة خصوبة التربة – أجريت هذه المحاولة ضمن حزمة " حالة دراسة " على أراضى المزرعة التجريبية بكلية الزراعة بسوهاج والتى تغطى مساحة قدرها حوالى ٢٠٠ فدان . تتكون المزرعة من موقعين متساويين فى المساحة تقريباً . ولهذا تم أخذ أربعون قطاعاً أرضياً بواقع قطاع لكل خمسة أفدنة . وقد بلغ عدد العينات المأخوذة من المزرعين ١٣٣ عينة تربة أختيرت حسب الاختلافات الظاهرية خلال عمق القطاع وأجريت عليها التحليلات الطبيعية والكيماوية والخصوبية. ويمكن تلخيص النتائج كما يلى :

- معظم أراضى المزرعتين خشنة القوام ووجد أن خشونة القوام تقل مع العمـق فـى بعـض القطاعات .
- معظم عينات التربة ما بين متوسطة إلى عالية القلوية .
- تتراوح قيم الملوحة ما بين غير ملحية إلى شديدة الملوحة .
- يتضح من نتائج تقدير الكربونات الكلية أن أراضى المزرعتين جيرية وتختلف بشكل كبير مـن موقع لآخر.
- معظم عينات التربة تحتوى على مادة عضوية أقل من ١% وتقل مع العمق .
- أراضى المزرعتين يمكن توصيفها بأنها منخفضة الخصوبة فى عنصر النيتروجين ويتضح معه مدى حاجة هذه الأراضى لإضافة عنصر النيتروجين فى صورة أسمدة .
- الأراضى المدروسة تحتوى على كميات متوسطة إلى عالية من الفوسفور الميسر مما يدل على أنه ليس هناك حاجة لإضافة مزيد من الأسمدة الفوسفاتية .
- أراضى المزرعتين تحتوى على كميات منخفضة إلى عالية من البوتاسيوم المتبادل .
- وجد أن حوالى ٣٥,٧١ ، ٦١,٩٠% من العينات المأخوذة تعانى من نقص الحديد و ٦٤,٢٩ ، ٣٨,١٠% من هذه العينات المأخوذة على التوالى فى الحدود الحرجة.
- وجد أيضاً أن حوالى ٣٥,٨٦ ، ١٥,٨٧% من كل العينات المأخوذة تعانى من نقص المنجنيز مرتبطة بـــ فترات الزراعة لكلا المزرعتين .
- كل عينات التربة لا تعانى نقص الزنك .
- كل الأراضى المدروسة تحتوى على قيم أعلى من ٠,٢ جـزء فـى المليـون مـن النحـاس المستخلص بالـــ DTPA موضحاً أن هذه الأراضى لا تعانى من نقص النحاس .

reported that sown wheat in cross rows 22.5 cm apart gave the highest grain yield of 3.13 t/ha compared with 2.81 and 1.84 t/ha in rows 15 cm apart and