J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 5 (11): 1555 - 1570, 2014

PEDOLOGICAL STUDIES AND TREATED WASTEWATER REUSE FOR TIMBER TREES PRODUCTION IN EGYPT-EAST NEW CAIRO CITY

Elkholy,M. M.; A.M.A.Zayed and A.O.Abdel-Nabi
Soils, Water and Environ. Res. Institute, Agric. Res. Center, Giza, Egypt

ABSTRACT

The present investigation soils located at desert part of east New Cairo City , south of El Kattamia –El Ain El –Sokhna new high way . The area under consideration have three physiographic units:

Soil of fans and outwash plain which have three soil map units i.e. calcareous moderately deep and deepsoils, gypsiferous moderately deep to deep soils and calcigypsids moderately deep soils.

Miscellaneous (Rock Soils) appear three soil map units i.e. calcareous shallow and very shallow soils, gypsiferous shallow and very shallow soils and calcigypsids shallow and very shallow soils.

Miscellaneous (Rock land).

The soils are classified to family level according to USDA, 2010.

Current suitability study shows that soils under consideration have marginal level (S3) except soil profiles l and 6 which have moderately suitable level (S2) while soil profile 11 appear not suitable class (N1).

The potential suitability was moderately suitable (S2) except soil profiles 5,7,8,10 and 11 and have marginal level (S3), while soils profile 6 has highly suitable class (S1).

Concerning the available Fe, Mn, Zn, and Cu in soil are ranged between low to adequate except extractable Cu of calcigypsids soils have high level.

Treats sewage water have different limitation , so, it must be used in special cases like timber trees and drip irrigation or improved surface irrigation system is suggested system for irrigation.

Keywords: Pedological studies, treated wastewater, timber trees, East New Cairo.

INTRODUCTION

The studied area is located at the east of New Cairo City and south of El- Kattamia- El Ain EL Sokhna high way, Map(1), It Lies within latitudes 29^{o} 52^{-} 41.921$^{=}$& 29^{o} 54^{-} 32.187$^{=}$ N and longitudes 31^{o}37 50.253$^{=}$& 31^{o} 39^{-} 40.439$^{=}$ E.

According to Sandford and Arkell (1939) geology of the studied area belong to the tertiary era, which is mainly represented by Oligocene and middle Miocene formation . The Oligocene consist of gravelly and cobbly land, severely dissected by erosion and consequently it has a rather rolling or even hilly topography . The Miocene is represented mainly by soft yellow qypsiferous limestone (usually rich in fossils), shales , marles and sometimes sands and conglomerates.

The meteorological data of Cairo and Suez stations show the mean annual temperature are 21.4^{o}C and 22.8^{o}C , mean annual evaporation 11.8 mm/day and 8.8mm/day, mean annual relative humidity 53% and 54% and summation of rainfall 23.9mm and 31.1mm , respectively as well as soil moisture regime is arid or dry.

map1

The main source of water for Egypt is the Nile River, which represent 97% of the country fresh water. The annual per capita available water in 1960 was about 1550m^3; it has fallen by 40% to about 995m^3 today and expected to be abut 600m^3 in 2025. Egypt is one of the countries facing challenges increasing the demands for all socio –economic sectors requirements, in spite of, there are non- conventional water resources.

Egypt produces an estimated quantity of wastewater about 5.5 – 6.5 BCM/yr. The treated waste water is estimated of 2.97 BC/ yr and utilize of 0.7 BCM / Yr for agricultures mainly in direct reuse in desert areas, or indirect reuse through agricultures drainage canals.

Soil quality cannot be measured directly but must be inferred from soil quality indicators. Soil quality indicators are measurable soil attributes that influence the capacity of soil to perform crop production on environmental functions and are sensitive to change in land use management or conservation Practices, however, many soils attributes are highly correlated (Larson and Pierce,1991 and Seybold et al., 1997).

The aim of this study is delineate the morphological features, pedological characteristics and evaluation of the studied area, available micronutrients and permissible water. Another aim of this study is to present an ideal case to reuse treated sewage water to cultivate the desert area.

MATERIALS AND METHODS

The field studies are executed by application semi-detail soil survey system by topography map 1:10000 to delineate the soil map units. Ninety seven soil profiles are dug to 150cm depth, unless hindered by bedrock according to FAO (1994), while eleven representative soil profiles are chosen to represent different soil map unit. The mapping units are based for a large part on the geology of the upper one or two meters of the earth's crust and on the geomorphology of the terrain. The representative soil profiles have the following co-ordinate:

Profile No.	Longitude			Latitude		
1	31°	39′	39.381″ E	29°	52′	41.921″ N
2	31°	39′	37.724″ E	29°	52′	47.150″ N
3	31°	39′	40.349″ E	29°	53′	14.370″ N
4	31°	39′	40.269″ E	29°	54′	17.658″ N
5	31°	39′	9.102″ E	29°	54′	20.540″ N
6	31°	38′	37.257″ E	29°	54′	32.187″ N
7	31°	38′	15.257″ E	29°	53′	54.390″ N
8	31°	38′	56.819″ E	29°	53′	43.680″ N
9	31°	38′	27.936″ E	29°	53′	11.364″ N
10	31°	38′	45.007″ E	29°	53′	11.364″ N
11	31°	38′	45.007″ E	29°	53′	7.987″ N
12	31°	37′	50.253″ E	29°	53′	7.987″ N
13	31°	37′	50.253″ E	29°	52′	41.921″ N

The main physiographic units are obtained by aerial photo, interpretation by UNDP/FAO (1966).

The soil samples were collected, air dried, crushed, sieved through a 2mm sieve and subjected to physical and chemical analyses.

- Gravel contents were determined as percent by volume.
- Particle size distribution is carried out according to piper (1950) using sodium hexametaphosphate as a dispersing agent.
- Moisture characteristics curves were conducted on undisturbed soil samples according to the methods described by Black (1965) and Richard (1954). The moisture tension values were determined by using ceramic plates of the pressure cooker under 0.1 , 0.33 and 15 bar.
- Bulk density was determined using the core methods (Unland,1971).
- Values of soil pH were determined according to Jackson (1976) in soil water suspension (1:2.5).
- Total salinity (ECe) and soluble cations and anions in saturated soil paste extract were determined according to Jackson (1976) , except soluble sulphate anions which were calculated by subtracting total anions from total cations.
- Total carbonate contents were measured by Collin's Calciminer according to Piper (1950).
- Gypsum contents by precipitation with acetone according to Richards (1954).
- Soil classification which is applied follows up the USDA system (2010).
- Soil evaluation follows upSys and Varghese (1978).
- Determination and evaluation of micro – nutrients (Fe , Mn , Zn , Cu) are according to Soltanpour (1991).
- Chemical composition of used irrigation water including pH, EC, soluble cations and soluble anions except soluble sulphate ions are determined using the methods described by Jackson (1976) and evaluated according to Ayers and Westcot (1985).
- Faecal coliforms were counted using the same previous medium, but inoculated plates were incubated at 44.5 C0 for 48 hrs. Colonies with metallic – green sheen were counted (APHA, 1989).
- Salmonella and Shigella (S&S) bacteria were counted using SS Agar medium using the serial dilution poured plate method. The inoculated plates were incubated at 35-37C0 for 24 hrs .Black centered or mirror colonies were counted as salmonella and Shigella microorganisms (Mackie & Mc carteny 1953 and Difco Manual (1977).

Water requirement for selected trees and operation hours.

Irrigation scheduling was calculating according to Phocaides(2001) as follows:

- Net depth of irrigation dose (d) (mm) = (Sa x p) D

Where Sa : is the available water in millimeters per metre,
p : is the permissible depletion (fraction), and D is the root depth (m).

- In order to relate ET_0 to crop water requirement (Etc), the specific crop coefficient (kc) must be determined :Etc = ET_0x kc
- Another element to consider when estimating crop water requirements is the percentage of the field area (ground) covered by the cultivation. A reduction factor , expressed as kr , is applied to the conventional ET crop calculation. This factor is slightly higher, by about 15 percent , than the actual ground

covered by the crop. For example, if the actual ground cover is 70 percent kr= 0.70 x 1.15 = 0.80

- Irrigation application efficiency:

Ea = 198 x 100 ÷ 280 = 70.7% , or expressed as a fraction , 0.70. The remaning 30 percent of water applied is lost.

Cross irrigation application depth:

Given the irrigation efficiency as a fraction, ie .Ea= 0.60(60 percent), the gross depth of irrigation application application dose (dg) is calculated as follows:

Dg= d ÷ Ea (fraction)

The studied parameters are :

A:Soil Pedological.

B:Status of available macro & micronutrients.

C:Treated sewage water suitability for irrigation.

D:Water requirement for selected trees and operation hours.

RESULTS AND DISCUSSION

A:Soil Pedological studies:

Main physiographic units:

Three different landforms are observed in the studied area namely, Soils of fans and outwash plain.,Miscellaneous,(Residual soils) and Rock land.

All these landforms have a specific range of geographically related soils and are therefore good indications of the soil associations in the soil classification system.

Soils of fans and outwash plain;

The alluvial fans occupy a board zone of sloping land at the foot of Gable Alake. Numerous gullies discharging from the mountainous part have formed alluvial fan deposits. Most of these deposits are extremely stony ,being little more than debris fans with occasional rock outcrops .

The outwash plain are often found in the some position as the fans, at the foot of hilly or mountainous land. A most characteristic zone of outwash soils is found at the transition between the rock land and the river terrace soils where the rock land is free from large complexes of gravel; the weathering of the more erodible material has produced large areas of outwash. There are a number of distinct alluvial fans. The soils are predominantly much limestone and generally very gypsiferous (UNDP/FAO,1966).

According to field observations of the studied area which are summarized and recorded in Table (1) and data of chemical and physical properties are illustrated in Tables2 &3, respectively.The soils of fans and outwash plain unit (Map 1) appear three soil map units ;

a) **Calcareous moderately deep and deep soils**;

Soils of representative profiles1&2 have slope gradient from gently sloping to sloping ,color from pale yellow to yellowish brown, nil to 50% gravel contents, sandy loam texture class ,calcic horizon, pH valuesfrom 7.22 to 8.2andextremely salinity class (17.66 to 47.2 dS/m) it can classify according to USDA (2010).

Typic Haplocalcids , coarse loamy ,mixed, hyperthermic (profile 1).
Typic Haplocalcids , loamy skeletal ,mixed, hyperthermic (profile 2).

b) Gypsiferous moderately deep to deep soils:

Soils of profiles 3 and 4 are the representative profiles.These soils show slope gradient from nearly level to gently sloping, color from very pale brown to grayish brown, nil to 10 % gravel contents, sandy loam to clay loam texture classes,gypsic horizon , pH values from 7.82 to 8.2 and extremely saline level (35.0 to 63.2 dS/m) which reveal to soil classification as follows:

Typic Haplogypsids , fine loamy ,mixed, hyperthermic (profile 3).
Typic Haplogypsids , coarse loamy ,mixed, hyperthermic (profile 4).

C. Calcigypsids moderately deep to deep soils:

The representative soil profiles of these units are profiles 5 and 6 . These soils appear slope gradient from gently sloping to sloping , color from yellow to brownish yellow , nil to 25% gravel contents, sandy loam to sandy clay loam texture classes, gypsic and calcic horizons in each soil profile and may be presence salic horizon under consideration, pH values ranged from 7.22 to 7.93 as well as the soil considered as strongly to extremely saline (25.6 to 102.0 dS/m) according to **USDA (2010),**the soil under consideration classify to:

- Typic Calcigypsids, fine loamy ,mixed, hyperthermic (profile 5).
- Gypsic Haplocalcids ,fine loamy ,mixed, hyperthermic (profile 6).

Miscellaneous:

a) Rock soils:

Two main types of rock soils can be distinguished , the areas west of wadi EL-Gafra and in the south east the mountainous area in the Kallalah mountains, with Gafra is characterized by gravel deposits of Oligocene origin often forming distinct hills or ridges , but mostly lying in the outwash sheets of the younger Miocene rocks which are mainly soft yellowish limestone , sandstone ,shale and marl. These outwash deposits show rather irregular relief as the result of east-west faulting. Although minor wadi beds occupy the depressions along the faults it is clear that the main drainage lines cross the faults at about right angels , draining into the so - called Heliopolis bay. The main drainage pattern was therefore probably initiated when the faulted substrata were completely covered with the gravel outwash (UNDP/ FAO.1966).The soils of rock show three soil map units.

1) Calcareous shallow and very shallow soils:

Soils of profiles 7 and 8 are the representative soil profiles which have slope gradient from gently sloping to sloping, colour from very pale brown to brownish yellow , 3 to 20 % gravel contents, sandy loam texture class, calic horizon, pH values form 7.83 to 7.87 and slightly saline class (5.20-6.79 dS/m). The soils under consideration can classify according to USDA (2010) as:

-Lithic Haplocalcids ,coarse loamy ,mixed, hyperthermic, shallow .

1

1

2

3

2) Gypsiferous shallow and very shallow soils :

The representative soil profiles of this unit are 9 and 10 . These profiles appear slope gradient from nearly level to gently sloping ,very pale brown colour , 7 to 10 % gravel contents , sandy loam to clay loam texture classes , gypsic horizon , pH values from 7.3 to 8.27 , extremely saline class (53.5-92.4 ds/m) . According to **USAD(2010)** the soil of this unit classify as :

- Lithic Haplogypsids , fine loamy , mixed , hyperthermic , shallow (profile 9)
- Lithic Haplogypsids , coarse loamy ,mixed , hyperthermic , shallow (profile 10)

3) Calcigypsids shallow and very shallow soils:

Soil profile 11 is the representative profiles . these soils have gradient sloping , pale yellow colour , 10% gravel content , loamy sand texture class , gypsic and calcic horizons , 7.76 pH value , moderately saline class (8.65 ds/m). According to USAD(2010), the **representative profile classify as :**

- -Lithic Calcigypsids , sandy , mixed , hyperthermic , shallow(profile11)

b) Miscellaneous (rock land)

Dissected cobble land have undulating relief.

Land suitability classification :

The parametric system after Sys and verheye(1978) of land suitability classification for agriculture was applied to identify different limitations and suitability classes in the studied area. Data in Table(4) show that soils of fans and outwash plain are suffering from salinity effect and texture class . The current suitability was marginally suitable (S3), except soil profiles (1 1and 6) which have moderately suitable (S2) while , the potential suitability was moderately suitable(S2) except soils of profile (5) , have marginally suitable (S3) and soils of profile (6) appear highly suitable (S1). On the other hand , rock soil unit appear depth , texture and salinity hazard,which are the important limitation. Data of current suitability was marginally suitable (S3) except soils of profile 11 show not suitable class (N1) , On the other hand , the potential suitability was marginally suitable (S3) except soils of profile (9) have moderately suitable (S2).

B: Available micronutrients status

Data presented in Table (5) show contents of DTPA extractable(Fe , Mn , Zn and Cu) . According to Soltanpour (1991) , soils of fans and outwash plain have marginal level (2.05-2.4 mg/kg) of DTPA- extractable iron except Gypsiferous soils appear low level (1.87-1.96 mg/kg), low level of DTPA-extractable manganese (0.11-1.62mg/kg)except soil of profile 2 (Calcareous soils) and soils of profile (6) (Calcigypsids soils) show adequate level (2.09-3.24 mg/kg) , adequate level of DTPA- extractable zinc (1.59-2.23 mg/kg), except soils of profile 4 (Gypsiferous soils) and soils profile (5) (Calcigypsids soils) have marginal level and soils of profile(6). (Calcigypsids soils too) show low level (0.591 mg/kg), on the other hand DTPA- extractable copper was low level (0.070-0.303 mg/kg).

The rock soils have low level (1.71-1.89mg/kg) of DTPA extractable iron except Calcigypsids soils appear marginal level (2.69 mg/kg), low level (0.22-0.77 mg/kg) of DTPA-extractable manganese except Calcigypsids soils show adequate level , adequate level (1.71-2.46 mg/kg) of DTPA- extractable zinc and low level (0.076-0.330 mg/kg) of DTPA- extractable copper except soils of Calcigypsids soils too have high level (0.811 mg/kg). *It can be concluded that* the available (Fe , Mn , Zn and Cu) are ranged between low to adequate except of extractable – Cu in Calcigipsite soil have high level.

C: Suitability treated sewage water for irrigation.

Available irrigation water in the studied area will be sewage water. Data in Table(6) show the chemical analysis of this water . According to Ayers and Westcot (1985) , salinity of irrigation water (1.7 ds/m) is related to increasing problem level on soil salinity and no problem on soil permeability while adj. SAR value show increasing problem on soil permeability. Studying ion toxicity from root absorption reveal that sodium and chloride ions effect by increasing problem where adj SAR 7.71 and chloride concentration is 8.02 me/l . The previous two ion have the same effect of foliar absorption , where leaf areas wet by sprinklers may show a leaf burn due to sodium and chloride absorption under low humidity and high evaporation conditions . Value of pH is in a normal range. Bicarbonate contents (2.5 meq/l) appear increasing problem with overhead sprinkler. Irrigation may cause a white carbonate deposits to form on fruit and leaves . Value of pHc (7.32) indicate tendency to precipitate lime from water applied . Concerning , the population density of pathogenic bacteria data in Table (6) showed that , total and fecal coli forms of the effluent are higher than the recommended values by guidelines of WHO(1987) and non suitable for unrestricted irrigation (no more than 1000cfu/100ml) . *It can be concluded that*, suitability of treated sewage water for irrigation of New Cairo must be used in special cases like timber trees taking into account the preventive measures of workers.

The candidate trees are Camphor tree (*Cinnamomum camphora), Casuarina pp., Populus (Populus tremula) and Mahogany (Swietenia mahagoni (L.)*

D:Selection of irrigation system and crop water requirement for candidate trees:

Under normal conditions the selection type of irrigation system depend on water supply conditions, climate, soil, crops to be grown, cost of irrigation system, and the ability of the farmer to manage the system. However, when using treated waste water, other factors such as contamination of plants and harvested product, farm workers, the environment, salinity, and toxicity hazards should be considered. As for,the calculated water requirements and number of operating hours(h) for the candidate trees are shown in Table (7).

The choice of irrigation method in using treated waste water is governed by the following factors:

- Whether the foliage or aerial parts of the plant will be wetted by the recycled waste water.
- Distribution of water , soil salinity and contaminants in the soil.
- Soil water potential could be maintained (field capacity).
- Efficiency of application of irrigation water.
- Potential to contaminate farm workers, the environment, and crops.

So, drip irrigation or improved surface irrigation methods is the suggested systems for irrigation with treated wastewater.

Table (4) : Rating of Suitability index after Sys and Verheye (1978) For investigated soils.

Physiographic Units	Profile NO.	Topography		Wetness		Texture	Depth	$CaCO_3$	Gypsum	Salinity and Alkalinity		Suitability index (Ci)		Suitability Class	
		C	P	C	P	(S1)	(S2)	(S3)	(S4)	C	P	C	P	C	P
Soils of fans and outwash plain	1	95	100	100	100	75	90	100	100	85	100	54.5	67.5	S_2	S_2
	2	90	100	100	100	65	100	90	100	80	100	42.1	58.5	S_3	S_2
	3	95	100	100	100	100	75	95	80	80	100	43.3	57.0	S_3	S_2
	4	100	100	100	100	75	100	95	80	80	100	45.6	57.0	S_3	S_2
	5	90	100	100	100	85	75	90	80	85	100	41.3	45.9	S_3	S_3
	6	95	100	100	100	90	90	100	100	80	100	61.6	81.0	S_2	S_1
Rock Soils	7	90	100	100	100	75	55	100	100	98	100	36.4	41.3	S_3	S_3
	8	95	100	100	100	65	55	90	100	98	100	30.0	32.2	S_3	S_3
	9	95	100	100	100	100	55	95	100	80	100	39.7	52.3	S_3	S_2
	10	100	100	100	100	75	55	95	80	80	100	31.4	39.2	S_3	S_3
	11	90	100	100	100	55	55	100	100	90	100	24.5	30.3	N1	S_3

C = Current Suitability **P = Potential Suitabilit**
S1 = Highly Suitable **S2=Moderately Suitable**
N1 = Not suitable **S3=Marginally suitable**

Table (5): Available micronutrients (mg /kg) in the surface layer of representative profile.

Physiographic Units	Profile NO.	Fe	Mn	Zn	Cu
Soils of fans and outwash plain	1	2.05	0.11	1.80	0.087
	2	2.39	3.24	2.23	0.303
	3	1.96	0.48	1.59	0.087
	4	1.87	0.49	1.27	0.287
	5	2.40	1.62	1.00	0.070
	6	2.39	2.09	0.591	0.141
Rock Soils	7	1.89	0.52	2.01	0.330
	8	1.71	0.77	1.79	0.341
	9	1.73	0.22	1.75	0.076
	10	1.83	0.27	1.71	0.303
	11	2.69	3.14	2.46	0.811

Table (6) : Chemical & Biological analysis of the investigated irrigation water .

pH	Salinity EC		Anions (meq / l)				Cations (meq / l)				PH_C	SAR	Adj SAR
1:2.5	ds/m	ppm	$CO^{=}_3$	HCO^-_3	Cl^-	$SO^{=}4$	Ca^{++}	Mg^{++}	Na^+	K^+			
7.91	1.7	1088.0	0.0	2.5	8.05	5.38	4.72	3.03	7.30	0.85	7.32	3.71	7.71

Pathogenic indicator bacteria (Cfu /100ml)			
Total Coliforms	Fecal Coliforms	Salmonella & Shebelle	
60×10^2	36×10^2	-	0.0

Table(7):Calculated water requirements and number of operating hours(h) for the candidate trees.

Month		Jan	Feb	March	April	May	June	July	August	Sep	Oct	Nov	Dec
Water Requirement (Lit/ tree/ day)	Shrubs	14.2	18.7	21.9	31.0	34.9	34.9	34.9	33.6	29.1	22.6	16.1	14.2
Operating hours (hour / day)		1.2	1.6	1.8	2.6	2.9	2.9	2.9	2.8	2.4	1.9	1.3	1.2
Water Requirement (Lit/ tree/ day)	Middle aged trees	45.4	59.8	70.0	99.0	111.4	111.4	111.4	107.3	92.8	72.2	51.6	45.4
Operating hours (hour / day)		3.8	5.0	5.8	8.3	9.3	9.3	9.3	8.9	7.7	6.0	4.3	3.8
Water Requirement (Lit/ tree/ day)	Mature trees	73.8	97.3	114.0	161.0	181.1	181.1	181.1	174.4	150.9	117.4	83.8	73.8
Operating hours (hour / day)		6.1	8.1	9.5	13.4	15.1	15.1	15.1	14.5	12.6	9.8	7.0	6.1

Such study may be helpful for identifying the best soil management to achieve the highest production. Moreover, such situation demands to do serious rethinking in the agricultural research and extension with a view to evolve a “New Agricultural Strategy” to utilize the reuse of low quality water as an irrigation water source on a large scale for both marginal desert soil cultivated with timber trees and be environmentally safe. Disposing a treated waste water by safely way (irrigation of timber trees) as well as maximizing use of treated sewage water. As well, raise community awareness on preventing land degradation and sustainable use of sewage water discharges.

REFERENCES

(APHA) American Public Health Association (1989). Standard Methods for Examination of Wastewater., 17th ed, Washington. D.C., USA.

Ayers, R. and D.W.West cot (1985): Water quality for agriculture (FAO Irrigation and Drainage paper 29, Rev.1) Rome: FAO 164 PP.

Black, C.A. (1965). “Methods of Soil Analysis”. Amer. SOC. Agron. Inc. Puplisher. USA.

Difco Manual and Dehydrated Culture Media and Reagents 8thedition (1977). Difco Laboratories Detroit. Michigan.

FAO (1994):”Guideline For Soil Profile Description” FAO ISRIC publication, Rome.

Jackson, M.L. (1976): “Soil Chemical Analysis”, Prentice hall of India private ltd., New Delhi.

Larson, W. E. And F. G. Pierce (1991). Conservation and enhancement of soil quality. In: " Defining soil quality for a sustainable Environment," J.W. Doran. D.C. Coleman ; D.F. Bezdicek and B.A. Stewart (Ed.), PP. 175 -203, Soil Sci. Soc. Am Spec. Pub.

Mackie, T.J. and J.E. Mc carteny (1953). Hand book of practical bacteriology. A guide to bacteriological Laboratory Work. 9th ed., E & S. Living-stone Ltd., Edinburgh and London.

Phocaides , A. (2001). Irrigation scheduling ,Handbook on Pressurized irrigation techniques . Food and Agriculture Organization (FAO) OF THE UNITED NATIONS Rome,2001.

Piper, C.S. (1950): " Soils and plant Analysis." Inter. Science pupl. Inc. New York , USA.

Richard , L.A.(ed) (1954):"Diagnosis Improvement of Saline and Alkali Soils" U.S. Dept . Agric., Handbook No.60, Washington , Dc , USA.

Sandford, K.S. and Arkell, W.J.(1939)" Paleolithic Man and the Nile valley in lower Egypt (With some notes upon a part of the Red sea Littoral). Chicago Univ. Oriental Inst it . Puple., Vol. XLVI.

Seybold,C.A.; M.J. Mausbach; D.L. karlen and H. Rogeers (1997) Quantification of soil quality. Cited from karlen, D.L. 1999 rotation and reduced tillage : Practices for improving soil quality www. Mandakzerotill. Org/book 20 / douglas, 20% kalen . ht

Soltanpour, P.N. (1991). Determination of nutrient availability element toxicity by AB. DTPA. Soil test and ICPS. Advanced in soil Sci., 16, pp. 165-190.

Sys and W. Varghese (1978): An attempt to the evaluation of physical land characteristics for irrigation according to the FAO framework for land evaluation . Int . Train Cent. Post Grade Soil Sci. Ghent , Belgium pp 66-78.

UNDP / FAO (1966):" High Dam Soil Survey " United Arab Republic, volume II , FAO /SF : 16/UAR.

Unland , R.E. (1971). Soil permeability determination for use in soil and water conservation USDA Soil Conservation Service SCS, TP. 11a.

USDA (2010) :" Keys to soil Taxonomy". 11^{th} (Ed), NRCS; USA.

WHO (1987): Waste stabilization pond. WHO EMRO Technical Publication, NO.10, AlexandriaWinters, D.K.,A.E.,Leary and M.FmSlavik (1998).Polymers chain reaction for rapid detection of campylobacter jejuni artificially contaminated foods.Lett. Appl. Microbial 27:163-167.

دراسات بيدولوجية وإعادة استخدام مياه الصرف المعالج فى إنتاج الأشجار الخشبية فى بعض الأراضى شرق القاهرة الجديدة – مصر

محمد محسن الخولى،عادل محمد عبد الرحمن زايد و أحمدعثمان عبد النبى
معهد بحوث الاراضى والمياة- مركز البحوث الزراعية -الجيزة - مصر

تقع الأرض موقع الدراسة شرق مدينة القاهرة الجديدة وجنوب الطريق السريع الجديد القطامية – العين السخنة وقد تميزت هذه الأراضى بوجود ثلاثة وحدات فيزيوجرافية هى :-

- Soil of Fans and outwash Plain والتى تميزت الى ثلاثة وحدات تربة خرائطية.
هى calcareous moderately deep and deep soil
و gypsiferous moderately deep and deep soil
و calcigypsids moderately deep soils
- Miscellaneous (Rock soils) والتى أظهرت وجود ثلاثة وحدات تربة خرائطية هى:
calcareous shallow and very shallow soils
و gypsiferous shallow and very shallow soils
و calcigypsids shallow and very shallow soils
- Miscellaneous (Rock land)

كما تم تقسيم هذه الأراضى حتى مستوى العائلة حسب التقسيم الأمريكى ٢٠١٠. تم تقييم هذه الأراضى على حالتها فتبين انها هامشية الصلاحية (S3) عدا القطاعان ١ و٦ فقد أظهرا مستوى متوسطة الصلاحية (S2) بينما كان القطاع ١١ غير ملائم فى صلاحيته (N1).

بينما كانت الصلاحية الكامنة فى حالة تحسين مايمكن تحسينة ان تحسنت معظم الأراضى الى مستوى متوسطة الصلاحية (S2) عدا القطاعات ٥ و ٧ و ٨ و ١٠ و١١ فقد سجلت مستوى هامشية الصلاحية (S3) بينما ارتفع القطاع ٦ الى عالى الصلاحية (S1).

دلت دراسة المحتوى الميسر من العناصر الصغرى والتى شملت الحديد والمنجنيز والزنك والنحاس وقد تبين ان مستواها يتأرجح بين المنخفض الى الملائمعدا النحاس المستخلص من Calcigypsids soils فقد كان محتواها عاليا.

تبين من دراسة مياه الصرف المعالجة انها ذات محددات مختلفة وتم التوصية باستخدامها فى رى الأشجار الخشبية على أن يكون نظام الرى بالتنقيط أو بالرى السطحى المطور.

Table (1):Field observations and morphological description of the representative soil profiles.

Physiographic Units	Profile NO	Slope Gradient	Depth (cm)	Soil Color (dry)	*gravel %*	*Soil Texture*	*Secondary Formation*				Effervescence	The soil over
							Abundance	*Hardness*	*Type*	*Nature*		
Soils of fans and outwash plain	1	Gently sloping	0-40	2.5Y8/4	0.0	S L	moderate	soft	concretion	Lime	+++	Stones
			40-100	2.5Y8/4	0.0	S L	few	"	"	"	++	-
	2	sloping	0-30	10YR6/6	15.0	S L	few	Soft &hard	"	"	+++	-
			30-85	10YR7/6	50.0	S L	moderate	" "	"	"	+++	-
			85-130	10YR7/6	25.0	S L	many	" "	"	"	+++	-
	3	Gently sloping	0-30	10YR7/4	0.0	C L	-	-	-	-	++	shale
			30-70	10YR7/4	0.0	C L	many	Soft &hard	crystal	Gypsum	++	
	4	Nearly level	0-15	10YR6/8	10.0	S L	moderate	Soft &hard	spongy	"	Non	-
			15-30	10YR6/6	0.0	S L	many	soft	"	"	Non	-
			30-90	10YR7/2	0.0	S L	many	"	"	"	Non	-
			90-140	10YR5/2	0.0	S L	moderate	"	"	"	Non	-
	5	Sloping	0-30	10YR7/6	20.0	SCL	many	Soft &hard	concretion	Lime gypsum	+++	Stones
			30-70	10YR7/6	25.0	SCL	"	" "	"	Lime gypsum	+++	

Table (1): Continue of the representative soil profiles.

Physiographic Units	Profile NO.	Slope gradient	Depth (cm)	Soil Color (dry)	gravel %	Soil Texture	Secondary Formation				Effervescence	The soil over
							Abundance	Hardness	Type	Nature		
	6	Gently sloping	0-20	10YR7/6	2.0	S L	moderate few	Soft Soft &hard	"	Lime gypsum	+++	-
			20-55	10YR6/6	0.0	SCL	few moderate	Soft &hard Soft &hard	"	Lime gypsum	+++	-
			55-90	10YR6/6	3.0	SCL	few moderate	Soft Soft &hard	"	Lime Gypsum	+++	-
Rock Soils	7	Sloping	0-35	10YR8/3	3.0	S L	moderate	Soft	"	Lime	+++	Stones
	8	Gently sloping	0-20	10YR6/6	20.0	S L	-	-	-	-	+++	Calcareaus sandy stone,
			20-40	10YR7/6	10.0	S L	moderate	Soft	concretion	Lime	+++	
	9	Gently sloping	0-30	10YR7/4	7.0	C L	moderate	Hard	rystal	Gypsum salt	++	Gypsy shale
	10	Nearly level	0-20	10YR7/4	10.0	S L	"	Soft	concretion	Gypsum	++	Gypsy shale
	11	Sloping	0-20	10YR8/6	10.0	L S	"	Soft &hard	"	Lime Gypsum	+++	Calcareous sandy stone

Table (2) : Some Physical Properties of the representative soil profiles.

Physiographic Units	Profile NO.	Slope gradient	Depth (cm)	Particle size distribution (%) sand	Silt	Clay	Texture class	$CaCO_3$ %	Gypsum %
Soils of fans and outwash plain	1	Gently sloping	0-40	73.5	15.7	10.8	Sandy loam	15.50	4.85
			40-100	74.5	16.0	9.5	Sandy loam	10.44	2.79
	2	sloping	0-30	76.6	14.8	8.6	Sandy Loam	43.50	1.71
			30-85	76.7	15.9	7.4	Sandy Loam	45.2	2.66
			85-130	73.8	16.7	9.5	Sandy Loam	64.4	1.46
	3	Gently sloping	0-30	44.4	22.0	33.6	Clay Loam	5.22	2.36
			30-70	38.5	23.7	37.8	Clay Loam	13.05	19.11
	4	Nearly level	0-15	75.0	16.5	8.5	Sandy Loam	3.50	11.57
			15-30	72.9	17.7	9.4	Sandy Loam	2.90	10.5
			30-90	77.0	15.0	8.0	Sandy Loam	1.80	23.18
			90-140	77.9	14.5	7.6	Sandy Loam	1.90	9.46
	5	Sloping	0-30	70.3	8.2	21.5	Sandy Clay Loam	50.5	5.59
			30-70	67.7	12.0	20.3	Sandy Clay Loam	39.1	14.26
	6	Gently sloping	0-20	72.7	16.8	10.5	Sandy Loam	17.40	1.54
			20-55	65.7	11.9	22.4	Sandy Clay Loam	6.01	6.05
			55-90	60.2	16.3	23.5	Sandy Clay Loam	12.2	11.26
Rock Soils	7	Sloping	0-35	68.7	19.6	11.7	Sandy Loam	15.90	3.90
	8	Gently sloping	0-20	61.3	23.5	15.2	Sandy Loam	26.90	2.39
			20-40	63.0	22.7	14.3	Sandy Loam	32.6	1.34
	9	Gently sloping	0-30	43.6	27.3	29.1	Clay Loam	6.96	9.19
	10	Nearly level	0-20	69.0	19.4	13.8	Sandy Loam	6.96	10.44
	11	Sloping	0-20	73.2	24.0	2.8	Loamy sand	18.30	9.44

Table (3) : Some Chemical Properties of the representative soil profiles.

Physiographic Units	Profile NO.	Depth (cm)	pH	EC	Anions (meq. / L)				Cations (meq. / L)			
			1:2.5	dS/m	$CO^{=}_3$	HCO^-_3	Cl^-	SO4	Ca^{++}	Mg^{++}	Na^+	K^+
Soils of fans and outwash plain	1	0-40	7.93	23.5	-	5.4	200.0	70.4	42.1	34.3	192.0	7.4
		40-100	7.96	17.66	-	5.2	152.0	47.2	43.0	31.2	127.0	3.2
	2	0-30	7.25	47.2	-	5.7	381.0	177.0	127.0	99.5	334.0	3.2
		30-85	7.32	40.9	-	5.6	315.0	159.4	113.0	86.2	278.0	2.8
		85-130	7.42	36.3	-	6.2	305.0	122.7	179.0	55.0	198.0	1.9
	3	0-30	8.05	58.6	-	5.1	782.0	84.5	48.2	36.1	612.0	6.3
		30-70	8.20	63.2	-	6.2	621.0	128.6	52.1	34.2	663.0	6.5
	4	0-15	7.91	35.0	-	3.8	399.0	17.0	20.3	18.2	376.0	5.3
		15-30	7.99	54.0	-	3.9	600.0	43.7	27.2	24.3	590.0	6.1
		30-90	7.95	49.3	-	4.5	430.0	243.6	50.3	25.1	507.0	5.7
		90-140	7.82	38.5	-	5.3	422.0	28.4	40.2	16.2	395.0	4.3
	5	0-30	7.44	30.0	-	6.4	271.0	82.4	69.2	43.1	244.0	3.5
		30-70	7.53	25.6	-	6.3	200.0	93.8	58.1	45.9	193.0	3.1
	6	0-20	7.22	100.7	-	3.6	720.0	376.4	152.1	94.2	946.0	7.7
		20-55	7.30	102.0	-	4.3	860.0	359.5	155.2	89.1	973.0	6.5
		55-90	7.93	98.6	-	4.5	920.0	258.6	142.9	84.2	949.0	7.0
Rock Soils	7	0-35	7.86	5.56	-	4.6	30.1	16.3	15.1	9.2	23.0	3.7
	8	0-20	7.83	5.20	-	3.8	35.2	11.0	16.8	11.2	20.1	1.9
		20-40	7.87	6.79	-	3.6	42.2	18.2	13.1	11.2	37.9	1.8
	9	0-30	7.30	92.4	-	7.0	770.0	327.5	35.1	32.9	1029.0	7.5
	10	0-20	8.27	53.5	-	5.3	588.0	42.7	33.1	26.2	573.0	3.7
	11	0-20	7.76	8.65	-	6.3	50.2	25.5	22.1	20.2	37.6	2.1