Assessment of Soil Limiting Factors Effect on Land Productivity at Wadi El-Faregh Area, West of Delta, Egypt

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ABSTRACT

Agricultural expansion in Egypt is the central tool to maximize agrarian production. Generally, agricultural development has multiple mechanisms and sequent procedures in which land evaluation has the superiority. The major concept of land evaluation is to assess limiting qualities of land capability for maximum land utilization through land use planning. This study aimed at evaluating the influence of soil limiting characteristics on its productivity in a newly reclaimed area at Wadi El-Faregh area. Studied area which extends over 3000 feddans was surveyed by digging forty five soil profiles representing current farms and dominant problems. The soil could be classified as *Typic Torripsamments, Lithic Torripsamments* and *Typic Quartzipsamment* with differentiating seven soil mapping units differ in profile depth, soil salinity, lime content and soil texture. Field investigations showed that 66.3% of the studied area has deep profile, while shallow depth covers only 5.7% of the area. Sandy loam soil texture is dominant over 61.1% of the area, and the rest of area has either sand or sandy clay loam texture. Most of the area considered non to moderately saline, while only 10.7% is salt affected. The studied area is non calcareous to moderately calcareous over 83.6%, while 16.4% of the area has high lime content. Gravel content is negligible except for some limited sites over 3.5% of the area having moderate surfacial gravels. Well water samples have relevant quality for agricultural purposes except for well no. 6 and 7 which were affected slightly with salts. Limiting properties of land capability may be concluded as dominant sand content, shallow profile depth at some sites, salt and/or lime some affected sites and poor fertility status. The studied area is evaluated as order "Suitable" and classified into two capability classes; "Fair" representing 83.6% as productivity index ranged between 41.0 – 57.3%, and "Poor" extending over 16.4% of the area with productivity index varied from 29.5 – 35.9%. Best recommended winter crops are wheat, barely, alfalfa and faba bean, while in summer they are sorghum, sunflower and peanut. Seven different fruit trees are suitable in the studied area with the following sequence: date palm, olive, grape, apple, citrus, pummel and guava.

Keywords: Land Evaluation, Land Productivity, Limiting factor, Wadi El-Faregh.

INTRODUCTION

Land evaluation is the process in which the limitations of a given land are defined in association with particular degrees of land productivity and suitability, (FAO, 1976) Therefore, land evaluation is the basis for land use planning. Generally, the principal objective of land evaluation is to select the optimum land use for each defined land unit, taking into account both physical resources such as soil and climate, and socio-economic resources like availability of manpower and degree of mechanization, (Vink, 1975 and FAO 2001). Land capability describes the land potentiality or productivity without any damage occurs. Soil limiting factors describe the non-desirable characteristics which have bad effects on land productivity, (Sys, 1979). Limiting factors of land productivity affect the choice of the different alternatives for the most beneficial land use (Rossiter, 1995). Generally, there are two types of limitations; Permanent limitations which are very difficult to be removed or eliminated such as profile depth, rough topography,... etc.; Temporal limitations like salinity, fertility, alkalinity, ... etc., (Sys *et al.*, 1991-I). Land evaluation processes based mainly on evaluating limitation parameters of land capability, Vink (1975).

Great attention is paid by the Egyptian government towards the establishment of new settlements and associated land reclamation projects to overcome population increasing. Lots of efforts were focused on the natural depressions which scattered at different regions in the western desert, hollowing to depth of about 100 – 400 m of the Libyan plateau and extending in an almost north–south direction, (FAO, 2001). During the last decades, land reclamation projects extended to the southern west areas of Wadi El-Natrun at west of Nile Delta region, due to distinct location, mild weather, easy accessibility and the availability of water supplies. Wadi El–Faregh is one of the most important depressions which has recently received much concern due to many factors like its land and water potentialities, geographic location, physiographic setting in addition to vicinity to the old cultivated lands, which play significant role in attracting more investment, (Shokry, 1996).

According to groundwater development studies (Regwa Co., 1993) the total area available for cultivation at west of Wadi El-Faregh is 50,000 fed. while in the east of Wadi El-Faregh is 75,000 feddans, but the actual cultivated areas are about 15,000 and

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10,000 feddans, respectively. Four different land suitability classes were achieved at Wadi El-Faregh; moderate suitable, marginal suitable, temporal non suitable and permanent non suitable (Maher, 1996). According to the detailed soil survey carried out by Desert Research Center (1995) in El-Rabie farm at Wadi El-Faregh, soils were classified as marginally suitable due to the following limitations: rapid infiltration rate, weak soil structure, low nutrient levels, high salinity, shallow profile depth and rough topography.

Land evaluation process has many concepts and different measurements, but the land concept according to Marie *et al.* (1994) includes five main factors which are: soil physical and chemical characteristics, soil fertility status, environmental conditions, irrigation water quality and climatic data. The current investigation aims at giving complete information about limiting soil properties assessed by land evaluation and identifying their influence on land capability. Accordingly, expected results are limitation factors associated to each land productivity class with corresponding suitability degrees for different crops.

STUDY AREA

1- Location:

Studied area encompasses an area of about 3000 feddans at Wadi El-Faregh which lies in the north western portion of Egypt. The studied area is located 28 km south of Wadi El–Natrun by and apart by 30 km inland to the west of km 61 of Alex–Cairo desert road. It is bounded by latitudes 30° 10’ 10.1" and 30° 13’ 52.2" N and longitudes 30° 21’ 15.0" and 30° 24’ 25.5 E. (map1).

2- Climate:

The climate of the area is characterized by extreme aridity, long rainless summer and short cold winter with rare rains. The mean monthly maximum temperature ranges from 20.0 to 34.8?C while the mean minimum temperature ranges from 7.2 to 20.5?C. Rainfall is ranged from 53.7 to 65.8 mm / year and precipitations is strictly confined to winter season.

3- Geology

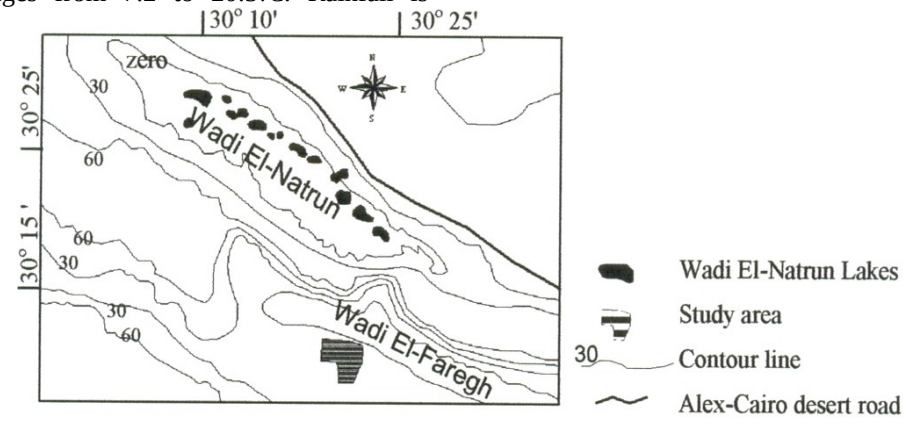
According to the geological survey and mining authority of Egypt (1981) the study area is covered by sedimentary rocks belonging essentially to late tertiary (Miocene and Pliocene) and Quaternary. Late tertiary sediments are exposed outside the area in the southwest directions, while Quaternary deposits occupy wide stretches formed mainly by Aeolian sand deposits which covered wide part of the area. However, Aeolian deposits are found in the lowland areas of the big depressions Wadi El–Natrun and Wadi El–Faregh. Surface exposures are locally covered with sand and gravels which belong to the Nile terraces west of Nile Delta.

4- Geomorphology:

According to Abu EL-Izz, (1971) the land surface of the area is almost flat to slightly undulating and generally sloped towards the Nile Delta. In the studied area and its surroundings two geomorphic units are recognized namely; the alluvial plains and the structural plains. The alluvial plains can be differentiated into young and old alluvial plains. The young alluvial plain occupies the cultivated flat areas while the old alluvial plain lies south of the young alluvial plain and is characterized by slight undulation with several low – lying hills. The structural plains occupy the wide area to the south of the old alluvial plain and have an extensive pavement plain, which consists of a number of alternating ridges and depressions.

5- Hydrogeology setting:

The water bearing formations in the southwestern portion of the Nile delta belong to the Tertiary era and the lower Miocene aquifer can be recognized Rigwa (1990). The lower Miocene sediments cover wide portions of the study area. These sediments are composed of sand, sandstone and clay interbeds.



Map1. Location map of the studied area at Wadi El-Faregh

From the flow system point of view, the lower Miocene aquifer is characterized by confined condition, where the depth from the ground surface to its piezometric surface varies from 51.5m (0.25 below sea level) in the western portion of Wadi El–Faregh to 138 (2 m above sea level) in the eastern of the study area Rigwa (1990). Concerning groundwater salinity it is evident that the lower Miocene aquifer is almost fresh.

MATERIAL AND METHODS

1- Field work:

The studied area extends over 3,000 feddans was surveyed using forty-five soil profiles were chosen to represent different farms and degraded portions of the studied area (Map2). Representative profiles were morphologically described according to FAO (2006), and sampled for further laboratory analyses. Fifteen artesian ground water samples were collected for water quality determinations.

2- Questionnaire:

Thirty questionnaires were collected from owners and farmers in the sampled area. Collected data were about farm acreage, crop production, and other environmental aspects based on field observations which significantly affect land evaluation. These conditions are: (1) Irrigation system (pattern, costs, and efficiency); (2) Drainage conditions (pattern, costs, and efficiency); (3) Communication status (roads, labor force, marketing, safety and distance from the main city) and (4) Managements status (agronomical processes, degree of mechanization and crop rotation).

3- Soil and water analyses:

Collected soil samples were analyzed to determine (1) physical properties (Page *et al.* 1982) such as: soil texture, available water and hydraulic conductivity, (2) chemical properties such as: electrical conductivity (EC), soluble cations and anions and soil reaction (pH) according to Page *et al.* (1982), total calcium carbonate and gypsum contents (Jackson, 1973), (3) fertility properties such as: organic carbon (Jackson, 1973), total nitrogen (Black, 1983), available phosphorus and potassium (Soltanpour, 1985), available micro elements (Lindsay and Norvel, 1978). Water samples were analyzed according to Page *et al.* (1982) to determine water salinity, soluble cations & anions, pH, boron, nitrate and trace elements.

4- GIS processing:

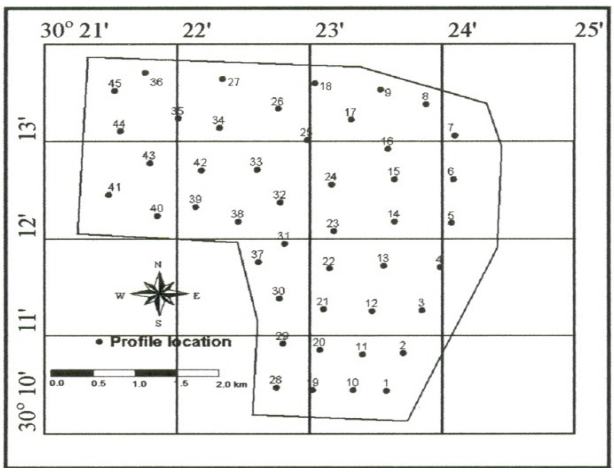
Observation sites and associated resultant data were georeferenced using UTM coordinate system and exported to ARC-GIS, 9.0 (ESRI, 2006) for soil mapping. Land productivity and suitability maps were generated and processed using GIS. Surface slops were calculated using studied area digital elevation model (DEM).

5- Land evaluation:

Land evaluation was carried out using Applied System of Land Evaluation (Marie *et al.*, 1994) where soil (S.I), fertility (F.I), environmental (E.I), water (W.I) indices were calculated using empirical equations based on El-Fayoumy (1989). The final index of land evaluation described as percentage to characterize the land capability of the area according to the following equation:

$$F.I.L.E. = \frac{4}{\frac{1}{S.I} + \frac{1}{E.I} + \frac{1}{W.I} + \frac{1}{F.I}}$$

Land capability was achieved by classifying the land under consideration into a class of productivity based on the final index value of land evaluation as shown in table (1).



Map 2. Locations of soil profiles in the studied area at Wadi El-Faregh

Table 1. Land capability classification

Capability class	Suitability for agricultural use	F.I.L.E (%)
C1	Excellent	100 - 80
C2	Good	79 - 60
C3	Fair	59 - 40
C4	Poor	39 - 20
C5	Very poor	19 - 10
C6	Non-agricultural	< 10

Land suitability classes for several field, forage, vegetables and fruit crops were identified for each soil unit according to the fitness of crop requirements (Sys *et al.*, 1993-III) with soil properties and climate conditions.

RESULTS AND DISCUSSION

1- General description of the studied area:

The studied area has level to nearly level land surface except for some few undulated sites. Elevations ranged gradually between 65 and 100m A.S.L with different slope degrees towards western east direction. Studied area was partially cultivated with field crops, forages and some fruit trees. Rest of the area covered with drift sand which mixed sometimes with varisized gravels and/or weathered rock grits.

2- Land characteristics:

2.1- Soil properties

2.1.1- Physical properties: Effective soil depth ranged widely from 45 cm (shallow) to 150 cm (deep), where deep profile occupy 66.3% of the studied area, while moderately deep and shallow depths cover 27.8 and 5.7 %, respectively (map3-C). Soil texture in general is sandy loam over 61.1% of the area, while rest of area has sand or sandy clay loam texture (map3-D). Available water was low and varied in a narrow range between 4.5% and 6.8%. Saturated hydraulic conductivity was moderate to relatively high and ranged between 0.70 and 2.40 cm/hr. The entire studied soils were non-gravely, except for some limited areas which have moderate gravels in some layers. Table (2) summarized soil properties of the area.

2.1.2- Chemical properties: As shown in table 2, most of the studied area soils are non-saline to slightly saline where electric conductivity (EC) varied between 0.90 and 3.58 dS/m, while some studied profiles were salt affected and have saline EC values ranged between 8.34 and 15.20 dS/m, where the most dominant soluble salts were sodium chloride and sodium sulfate (map3-A).. Soil reaction values were neutral with relatively alkaline tendency, where pH ranged from7.8 to 8.1 for the whole area. Most of the studied area was non alkaline except for some limited sites, however, exchangeable sodium percent (ESP) does not exceeds 15 and varied in a wide range from 3.8 to 14.5. Soil calcium carbonate varied widely from 5.5% to 24.9% with irregular depth wise increase (map3-B).. Soil gypsum content was low to moderate and ranged between 3.5 and 12.4 %.

2.1.3-Soil classification: According to Soil Taxonomy (Soil Survey Staff, 1998) most of the study area is following order Entisols without any diagnostic horizons, and classified as *Typic Torripsamments*, *Lithic Torripsamments* and *Typic Quartzipsamments*.

2.1.4- Soil mapping units: Based on soil analyses, seven soil mapping units in the study area were differentiated according to soil texture, profile depth, gravels, lime content and soil salinity which considered the most effective soil attributes in the study area (map 4 and table 3).

2.2- Soil fertility status

Fertility properties as listed in table (2) include organic matter and macronutrients. Organic matter was low and ranged from 0.75-1.22% at topsoil while from 0.45 to 0.88 % in subsoil. Regarding macronutrients; nitrogen was low and decreases with depth, as it ranged from 2.3 to 4.9 ppm for topsoil and from 2.0 to 4.2 ppm for subsoil, phosphorus was very low at both surface (1.25-1.45 ppm) and subsurface (0.95-1.12 ppm), potassium was also very low and varied from 15.7 to 18.5 ppm in the topsoil, while it ranged from 10.4 to 13.8 ppm at subsoil.

2.3- Environmental conditions

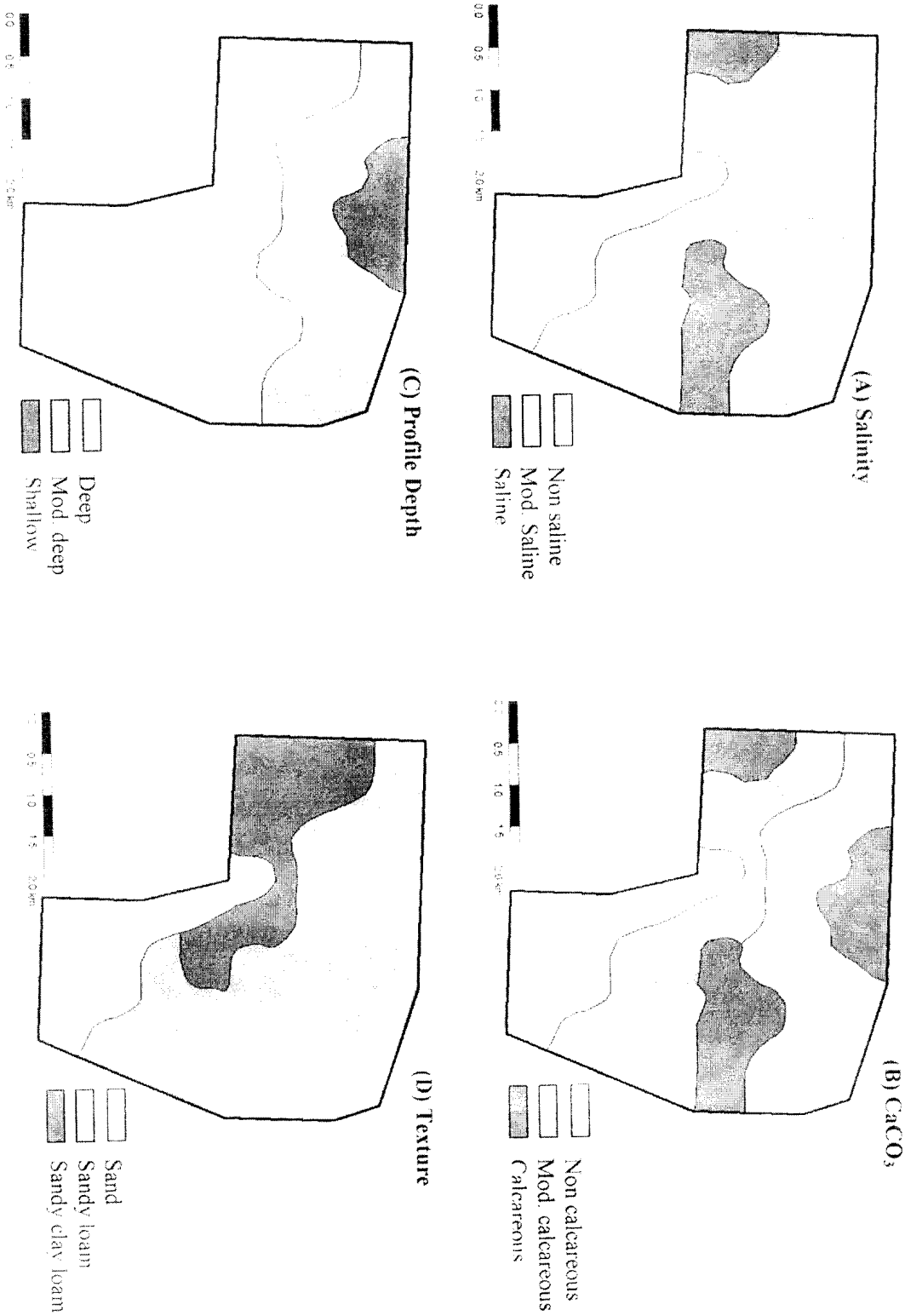
Drip irrigation system through pumped artesian wells water is the dominant obligatory option in the studied area due to water scarcity, where each well is enough to irrigate about 100 feddans with approximately 100 m^3/hr discharge rate. The studied area has no drainage system due to limited water supplements. Roads in the studied area are mainly tracks crossed with relevant paved one. Studied area is located far from the desert road by 30 km with growing communication status. Labor force is available outside the area and transported from El-Natrun city. The area has high degree of safety. Agronomical processes status

was good for some of them and excellent for others, with partial mechanization. The dominant crops are Fruit and vegetables (winter and summer).

Table 2. Summarized soil properties data of representative profiles in the studied area

Mapping Unit	A				B			C		D			E		F				G		
Profile No.	28				3			7		40			27		41				14		
Depth to - cm	20	50	100	150	30	80	130	30	80	40	100	130	10	40	20	60	100	150	30	80	120
Physical properties																					
A.W %	4.5	5.1	5.2	5.6	5.3	5.9	6.2	5.1	5.9	5.5	6.3	6.8	5.2	5.8	5.4	5.8	6.3	6.7	6.1	6.4	6.8
Kh m/hr	2.4	2.3	2.0	2.0	1.4	1.2	1.0	1.3	1.2	1.3	0.9	0.7	0.8	0.7	1.7	1.2	1.0	0.8	1.2	0.9	0.9
Sand %	91.2	90.5	86.7	85.1	69.2	65.1	62.5	59.5	55.4	66.8	61.2	58.4	55.4	55.0	67.4	66.0	59.4	57.4	65.8	60.2	58.7
Silt %	4.3	4.8	8.3	9.1	22.1	24.4	26.1	22.3	25	7.8	11.0	13.6	27.8	26.8	7.2	6.9	10.6	11.4	9.8	13.0	12.9
Clay %	4.5	4.7	5.0	5.8	8.7	10.5	11.4	18.2	19.6	25.4	27.8	28.0	16.8	18.2	25.4	27.1	30.0	31.2	24.4	26.8	28.4
Texture	S	S	S	S	SL	SL	SL	SL	SL	SCL	SCL	SCL	SL	SL	SCL	SCL	SCL	SCL	SL	SL	SL
Chemical properties																					
pH	7.8	7.8	7.9	8.0	8.0	8.1	8.1	7.8	7.9	7.9	8.0	8.1	8.1	8.1	8.0	8.1	8.1	8.1	7.9	8.1	8.1
EC dS/m	2.80	2.06	1.96	1.90	1.02	0.96	0.90	2.54	2.14	3.11	2.90	2.14	3.02	2.84	8.34	9.18	10.25	9.02	16.00	15.20	15.35
Ca^{++} meq/l	5.0	3.7	3.5	3.5	1.8	1.7	1.7	4.6	3.9	5.6	5.2	3.9	5.4	5.1	15.0	16.5	18.5	16.2	28.8	27.4	27.6
Mg^{++} meq/l	7.6	5.6	5.3	5.3	2.8	2.6	2.5	6.9	5.8	8.4	7.8	5.8	8.2	7.7	22.5	24.8	27.7	24.4	43.2	41.0	41.4
Na^{+} meq/l	12.0	8.9	8.4	8.8	4.4	4.1	4.0	10.9	9.2	13.4	12.5	9.2	13.0	12.2	35.9	39.5	44.1	38.8	68.8	65.4	66.0
K^{+} meq/l	3.4	2.5	2.4	1.0	1.2	1.2	1.2	3.0	2.6	3.7	3.5	2.6	3.6	3.4	10.0	11.0	12.3	10.8	19.2	18.2	18.4
HCO_3^- meq/l	6.7	4.9	4.7	5.1	2.4	2.3	2.3	6.1	5.1	7.5	7.0	5.1	7.2	6.8	20.0	22.0	24.6	21.6	38.4	36.5	36.8
Cl^- meq/l	15.7	11.5	11.0	9.9	5.7	5.4	5.1	14.2	12.0	17.4	16.2	12.0	16.9	15.9	46.7	51.4	57.4	50.5	89.6	85.1	86.0
SO_4^{--} meq/l	8.4	6.2	5.9	4.6	3.1	2.9	2.8	7.6	6.4	9.3	8.7	6.4	9.1	8.5	25.0	27.5	30.8	27.1	48.0	45.6	46.1
ESP	6.2	5.4	5.1	5.2	3.9	3.8	3.9	5.7	5.4	6.5	6.4	5.4	6.5	6.3	11.3	11.7	13.4	11.2	14.5	14.3	14.4
$CaCO_3$ %	12.2	15.7	18.5	20.6	5.5	6.4	10.4	6.4	10.2	15.4	18.4	20.5	22.4	24.9	21.4	22.4	23.8	24.0	18.5	21.4	20.1
$CaSO_4$ %	8.7	9.8	7.4	5.5	4.5	5.4	3.6	5.5	5.0	11.7	12.4	10.0	4.7	6.8	3.7	4.8	4.5	4.0	5.7	5.9	5.0
Fertility properties																					
O.M %					1.22	0.88		1.04	0.64	0.94	0.74		0.94	0.68	0.85	0.55			0.94	0.56	
N ppm	3.4	2.8			4.4	4.2		4.2	4.1	3.5	3.0		3.8	3.5	2.3	2.1			3.2	2.8	
P ppm	1.42	1.10			1.45	1.12		1.40	0.95	1.32	1.08		1.18	0.98	1.25	0.98			1.18	1.02	
K ppm	17.2	12.4			18.7	13.8		18.6	13.0	15.8	10.8		16.8	11.4	15.7	10.4			16.9	12.5	

A.W=Available Water Kh=Hydraulic conductivity S=Sand SL=Sandy Loam SCL=Sandy Clay Loam

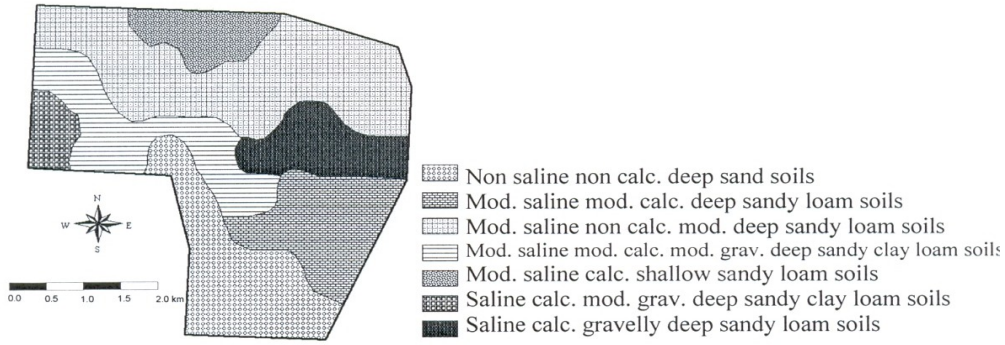


Map 3. Soil limiting factors of the studied area at Wadi El-Faregh

Table 3. Description of dominant soil mapping units in the studied area

Mapping Unit	R.S.P	Description	Area (%)
A	28	Non saline non calcareous deep sand soils	23.5
B	3	Mod. saline slightly calcareous deep sandy loam soils	20.5
C	7	Mod. saline non calcareous mod. deep sandy loam soils	27.8
D	40	Mod. saline mod. calcareous mod. gravelly deep sandy clay loam soils	11.8
E	27	Mod. saline calcareous shallow sandy loam soils	5.7
F	41	Saline calcareous mod. gravelly deep sandy clay loam soils	3.5
G	14	Saline calcareous gravelly deep sandy loam soils	7.2

R.S.P= Represented Soil Profile



Map 4. Dominant soil mapping units of the studied area at Wadi El-Faregh

4- Irrigation water quality

Table 4 shows the chemical analyses of collected samples from representative wells. Results indicated that all samples are considered suitable for irrigation purposes. No salinity hazard was observed. pH values were relatively high toward the alkaline range, but they tend to be buffered by soil. Concerning sodium hazard, one can conclude that the studied water samples have low SAR values without sodium hazardous effect. Nitrate ranged between 0.88 and 2.08 ppm, and generally, water with low concentration of nitrate salt (less than 5 ppm) has no toxic effect on grown irrigated plants. Analyzed water samples have a safe level of trace elements and lie within the non toxic range for plant growth.

3- Land evaluation

3.1- Limitation factors of land productivity: Without exception, the dominant parent materials forming the successive layers of soil profile are the aeolian and/or the fluviomarine deposits. Accordingly, the soil matrix is either sandy or sand with variable amounts of gravels,

Table 4. Water quality measurements for representative wells in the studied area

Mapping Unit	A	B	C	D	E	F	G
Well No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
pH	8.22	8.41	8.32	8.54	8.32	8.30	8.42
EC dS/m	0.86	0.96	1.22	1.06	0.88	2.12	2.52
Ca^{++} meq/l	1.55	1.73	2.20	1.91	1.58	3.82	4.54
Mg^{++} meq/l	2.32	2.59	3.29	2.86	2.38	5.72	6.80
Na^{+} meq/l	3.70	4.13	5.25	4.56	3.78	9.12	10.84
K^{+} meq/l	1.03	1.15	1.46	1.27	1.06	2.54	3.02
HCO_3^{-} meq/l	2.06	2.30	2.93	2.54	2.11	5.09	6.05
Cl^{-} meq/l	4.82	5.38	6.83	5.94	4.93	11.87	14.11
SO_4^{--} meq/l	2.58	2.88	3.66	3.18	2.64	6.36	7.56
SAR	2.66	2.81	3.17	2.95	2.69	4.17	4.55
Nitrate ppm	1.02	1.12	1.34	0.88	1.24	2.04	2.08
Boron ppm	0.24	0.22	0.16	0.34	0.28	0.18	0.18
Fe ppm	0.84	0.68	0.48	1.02	0.84	0.64	0.48
Cu ppm	0.06	0.04	0.00	0.08	0.06	0.02	0.02
Zn ppm	0.00	0.02	0.02	0.00	0.02	0.04	0.02
Mn ppm	0.42	0.36	0.54	0.62	0.22	0.34	0.44

having different profile depth. The sand particles are mineralogically quartizic with variable lime intrusions. The quartizic nature of sand, under torric-hyperthermic soil moisture regime, renders the soils poor from fertility point of view. Subsequent low water holding capacity and relatively rapid infiltration rate occurred. However, results indicated that limitations for land capability were: shallow profile depth at some limited sites, weak unstable soil structure (especially for the southern part of the area), low percentage of clay content, relatively high soil permeability, low available water, high calcium carbonate in some limited sites, high soil salinity in

some limited sites, low levels of soil organic matter and macronutrients, moderate ground water salinity for some wells.

3.2- Land Capability classification: Results indicated that, the studied area was classified as order "Suitable" (S) for agriculture since the final index of land evaluation "FILE" ranged from 29.5% to 58.2% (table 5). This order was further classified into two land capability classes; Class(3) having 83.6% of the total acreage which reflects Fair land capability and Class (4) over 16.4% of the total area which reflects the Poor land capability (map 5).

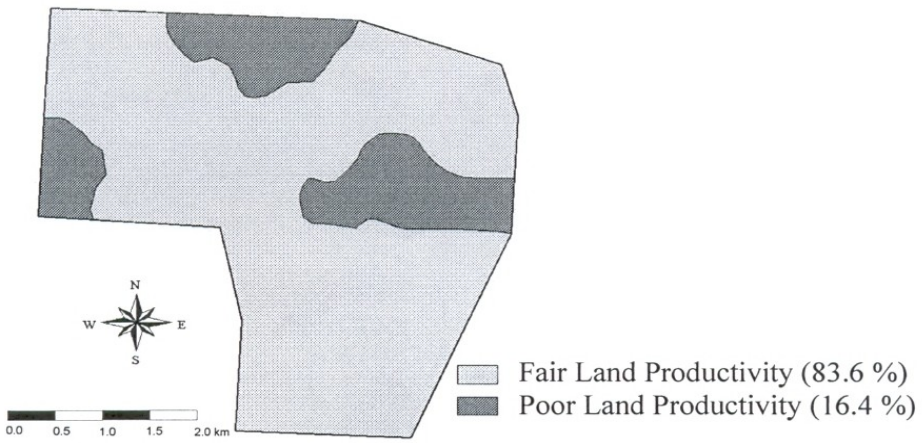
Results listed in table(5) shown that units E, F and G which have poor land productivity were degraded in affection by shallow profile depth, soil salinity and high lime content, respectively. Fair land productivity, which characterizes most of the studied area at units A, B, C and D, is affected mainly by low fertility status. Generally, Soil limitation like alkalinity and toxicity are not encountered while salinity limitation could easily be corrected by effective leaching. Concerning soil fertility as an agricultural limitation, the proper soil management practices and adequate fertilization programs for different crops can maximize crop productivity of studied area soils.

Regarding land suitability, the integration between field investigation and soil analyses indicated that there are three successful crop rotations in the studied area; (1)wheat or barely + alfalfa in winter and forage crop like sorghum which considered highly salt tolerant plant in summer, (2)Faba bean in winter and oil crop like sunflower in summer, (3)wheat or barely in winter and peanut in summer. It is recommended to extend pancum grass or forage beat as an annual fodder at salt affected sites. Seven different fruit trees are suitable in the studied area with the following sequence: date palm, olive, grape, apple, citrus, pummel and guava.

Table 5. Calculated land capability indices for different soil mapping units

Soil Mapping Unit	Soil Index	Fert. Index	Water index	Env. index	Final index	Capability class*
A	85.4	19.6	95.7	90.5	47.5	C3 (Fair)
B	88.5	26.5	97.2	95.6	57.3	C3 (Fair)
C	72.4	20.6	94.9	82.9	47.1	C3 (Fair)
D	65.2	16.6	96.7	84.2	41.0	C3 (Fair)
E	50.1	14.5	88.5	90.1	35.9	C4 (Poor)
F	40.1	12.5	68.5	92.5	30.7	C4 (Poor)
G	28.1	13.5	65.5	94.5	29.5	C4 (Poor)

* C1 (80-100%) – C2 (60-80%) – C3 (40-60%) – C4 (20-40%) – C5 (0-20%)



Map 5. Land Productivity classes in the studied area at Wadi El-Faregh

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الملخص العربي

تقييم تاثير صفات التربة المحدة على قدرة الأراضى الإنتاجية بمنطقة وادى الفارغ غرب الدلتا– مصر

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التوسع الزراعى بشقيه الأفقى والرأسى يعد الركيزة الأساسية لزيادة الإنتاج الزراعى، وللتنمية الزراعية آليات متعددة وإجراءات تنفيذية متتالية، حيث يأتى تقييم التربة فى مقدمه هذه الخطوات التنفيذية والذى يعمد إلى تقدير قدرة التربة الإنتاجية وتحديد محدات إستغلالها زراعيا تمهيدا لتخطيط إستغلالها لتحقيق أقصى إنتفاع ممكن. ويهدف هذا البحث إلى تقييم تأثير صفات التربة المحدة أو المتدنية فى جودتها على قدرتها الإنتاجية بمنطقة وادى الفارغ كأحد مناطق الإستصلاح الواعدة والتى أدرجت ضمن برامج وخطط الدولة الخمسية المتعاقبة حتى ٢٠١٧. وقد تم حصر أراضى منطقة الدراسة والتى تمتد على مساحة ٣٠٠٠ فدان بإستخدام ٤٥ قطاع أرضى ممثل لنماذج مزارع المساحة والمشاكل السائدة بها، إضافة لعينات مياة الرى الجوفى الممثلة للمساحة. وبناءا على التحليل المعملى تبين إنتماء تربة المنطقة إلى تحت مجموعة *Typic & Lithic Torripsamments* و *Typic Quartzipsamments* مع إمكانية تمييز عدد سبع وحدات أرضية تباينت فى صفات عمق القطاع الأرضى والملوحة ونسبة الجير وقوام التربة. تبين أن ٦٦,٣% من المساحة المدروسة ذات قطاع أرضى عميق بينما إنحصرت المساحات الضحلة فى ٥,٧% من إجمالى المساحة. ساد المنطقة قوام التربة لوم رملى على مساحة ٦١,١% بينما إختلف قوام التربة فى المساحات المتبقية ما بين رملى لا سيما فى الجزء الجنوبى ولوم رملى طينى. معظم المساحة المدروسة تعد هينة الملوحة أو غير ملحية بينما إنحصرت المواقع المتأثرة بالملوحة على مساحة ١٠,٧%. كما أن تربة المنطقة تعد غير جيرية إلى متوسطة المحتوى الجيرى على مساحة٨٣,٦% بينما تأثرت بقية المساحة على ١٦,٤% بإرتفاع المحتوى الجيرى نسبيا. تواجد الحصى محدود على مساحة ٣,٥% وغالبا على السطح. بينما تدنت خصوبة التربة بشدة لكافة المساحة. أبدت نوعية مياة الآبار الجوفية المدروسة درجة مناسبة من الجودة عدا البئرين٦ و٧ والذين تأثرا قليلا بالملوحة نتيجة إرتفاع تركيز كاتيون الصوديوم فى تقابل مع أنيون الكلوريد. مع وهكذا تركزت أهم محدات الإستزراع بالمنطقة فى سيادة المكون الرملى لقوام التربة– ضحالة عمق القطاع الأرضى لبعض المساحات–تأثر بعض المساحات بإرتفاع الملوحة أو الجير أو كليهما– تدنى نسب الكربون العضوى ومغذيات التربة. وبتقييم صفات التربة تبين وقوع منطقة الدراسة تحت رتبة الأراضى الصالحة للإستغلال الزراعى ضمن قسمين من أقسام القدرة الإنتاجية: إنتاجية "متوسطة" على مساحة ٨٣,٦%حيث تراوح دليل الإنتاجية ما بين ٤١,٠ و٥٧,٣%، وإنتاجية "فقيرة" على مساحة ١٦,٤% حيث تراوح دليل الإنتاجية ما بين ٢٩,٥ و٣٥,٩%. ويوصى بتطبيق أحد ثلاث دورات زراعية بالمنطقة: (١) الشعير أو القمح إضافة للبرسيم شتاءا تبادلا مع السورجم كمحصول علف يتحمل للملوحة بالصيف، (٢) الفول شتاءا تعاقبا مع محصول زيتى كعباد الشمس بالصيف، (٣) شعير، أو قمح شتاءا تعاقبا مع الفول السودانى صيفا. أشجار الفاكهة الأكثر نجاحا والموصى بإستزراعها هى بالترتيب نخيل البلح–الزيتون–العنب–التفاح–الموالح–الرمان–الجوافة، على أن يستبعد إستزراع أشجار الفاكهة عموما بالوحدة الأرضية الضحلة.