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Effect of Cultivation on the Soil Properties of El-Kharga Farm, New Valley, Egypt

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Abstract

Assiut University Farm, in El-Kharga Oasis, New Valley Governorate, is located in the Western Desert of Egypt between latitudes 25°30- and 25°31- N and longitudes 30°35- and 30°36- E. This farm was initiated in 2004 to be as experimental farm for the proposed New Valley Branch. Another area is added to the farm in 2014. The location of the farm is in El-Kharga depression which is filled with marine sediments covered with sand sheets. Cultivation of this area for ten years showed great changes in the soil properties. This study aimed to evaluate the capability and suitability of the new area before cultivation and the old cultivated area and to investigate the effect of cultivation on physical and chemical properties of the studied soils.

The results showed that Land Capability for irrigation of the new area was; 30% Marginally suitable, 43% Currently not suitable, 26% Permanently not suitable, while for the old cultivated area was; 11% Moderately suitable, 27% Marginally suitable, 27% Currently not suitable, 33% Permanently not suitable. With good water quality, the moderately and marginally suitable soils could be improved for agriculture production. The high soil salinity and alkalinity as ESP or SAR also the sandy texture reduced the capability. Correcting those factors will improve the land capability.

Keywords: *soil properties –El-Kharga –New Vally*

Introduction

As a result of population increase in Egypt and the urgent need for food, it is necessary to maximize the utilization of natural resources for agriculture production, utilizes land evaluation and its suitability for crop cultivation is the first step to utilize land resources.

One of the important zones for agricultural expansion is the New Valley governorate. The New Valley is the largest governorate in Egypt, it occupies the southern half of the western desert of Egypt, covering an area of 458,000 Km^2, or about 48 % of the total surface area of Egypt. Assiut University initiated experimental farm in El-Kharga Oasis, to be as experimental farm for the proposed New Valley University branch. Recently another area is being added to the farm. El-Kharga oasis is depression which is filled with marine shale sediments covered with sand sheets. Cultivation of land for ten years showed great changes in soil properties.

The climatological data of EL-kharga showed that mean annual temperature is 25-.42°C with great difference between summer and winter. The temperature during summer ranges between 22.69°C and 41.21°C, while in winter it varies between 7.52°C and 25.17°C. The lowest wind velocities recorded at EL-kharga in January was 7.87 km/hr, and highest velocities recorded was in June 12.54 km/hr, the annual mean of surface wind velocity was 10.51 km/hr. The prevailing wind in El-kharga is from north and north west. This wind cause harmful sand movement in the depression.

The relative humidity has a monthly mean value of 24.97 % recorded in June, and 49.79 % recorded in December and; the mean annual humidity in El-kharga Oasis is 35.26 %. The climatological data show that the dryness is prevailing most of the year and there are no wet periods, consequently it may be concluded that the climate of the area is extremely arid. According to the Soil Survey Staff (1999) the climate of the studied area falls into hypothermic temperature regime and torric moisture regime.

The groundwater considered the sole source for water in EL-kharga Oasis for all purposes. The Quaternary aquifer is only found in north El-Kharga depression. It is used from Ginah village to northward, where most of farmers drill hand dug wells. The Quaternary aquifer acts as a store for the drain water from the excess irrigation water. Taref Nubian sandstone aquifer is the only water resource used in the south from Ginah village until Gazair village, south of El-Kharga city (Ghoubachi and Baraka, 2006). According to El-Barkouky; (1979) the total dissolved salts in the groundwater samples vary from 810 to 1300 mg/L and the water quality is good for domestic and agricultural purposes.

Most soils of the area have been possibly formed during the past geological periods while characterized by wet climate, the late tertiary and early Quaternary. The climatic conditions during these periods have acted upon different kinds of parent materials, most important of which are;

- The alluvial deposits of the old terraces.
- The clay shale deposits.
- The sandstone that classified as the Nubian formation.
- The limestone rocks of the Eocene, Miocene and cretaceous ages.

The soils have mostly red and gray color and characterized by weak diagnostic horizons and shallow profiles, the color is mostly that of the parent material, one of the main characteristic is the presence of a vesicular A-horizon. In El-kharga Oasis area, the soils are either deep clay or deep sand; the deep clayey soils represent the old lacustrine deposits, which were laid out during the old geological wet periods in kharga and Beris, and those belonging to the Nubian sandstone mainly in Ginah and Boulaq. Soil textural variations and admixtures of sand with clay material are noticed this could possibly suggest that depressions were laid down under fluviatile Aeolian condition.

The objectives of this work are to study the changes in physical and chemical soils properties of the cultivated old area as compared to the new uncultivated area on.

Materials and Methods

El-Kharga Oasis lies in the southeast of the Western Desert of Egypt. It covers an area of about 4500 km^2. It is located at 140 km^2 to the east of El-Dakhla Oasis and 220

km^2 south of Assiut city. It is bounded by longitudes 30° 27' and 30° 47' E and latitudes 24° 30' and 26° 00' N. The experimental farm of Assiut University, at EL-kharga Oasis occupies two locations: the first (new uncultivated location) of about 136 feddans and the second (old cultivated location) is about 126 feddans.

Field studies and soil sampling

Sixty seven profiles were sampled to represent the study area (figure 1). Forty six profiles were chosen to represent the uncultivated (first location), (figure 2). and eighteen profiles were chosen to represent the cultivated (second location), (figure 3). Total of 167 Soil samples were collected from the profile layers, according to vertical morphological variations. The soil samples were air-dried, crushed and sieved through a 2 mm sieve and stored in plastic containers for physical, chemical analyses.

Physical and Chemical Analytical Methods

-Mechanical analysis was determined by the pipette method (Baver, 1963). Total carbonates were removed by sodium acetate, buffered at pH 5.0, as described by Jackson (1969).

-Soil Color: Color of soil samples was determined in both wet and dry samples using Munsell Color Charts, USDA, Soil Survey Staff (1951).

-Soil bulk density of soil samples was determined by the graduated cylinder method (Bodman, 1946), since the samples were friable sand.

-Soil particle density was determined by the pycnometer method (Blake and Hartge, 1986).

-Hydraulic Conductivity Coefficient was determined using undisturbed soil cores, using Darcy law (Richards, 1954).

-Porosity Total porosity was calculated using the real and apparent densities (Richards, 1954).

-Soil pH was measured by pH meter in 1: 2.5 (Soil: Water) suspension .

-Calcium Carbonate content was measured by Calcimeter.

-Soil paste extract: extract was prepared for each soil sample as 1:1 (soil: water.)

-The electrical conductivity of the soil paste extract (ECe) was calculated using electrical conductivity meter of 1:1 (soil: water extracts).

- Soluble cations: sodium and potassium were measured by flame photometer, while calcium and magnesium were determined volumetrically by EDTA titration method.

-Soluble anions: chlorides were titrated by of silver nitrate solution. Sulphates were measured using the turbidometeric method. Carbonates and bicarbonates were titrated by a standard solution of hydrochloric acid.

-Available phosphorus was extracted by (0.5 M) $NaHCO_3$ at pH 8.5 (Olsen *et al.*, 1954) then measured calorimetrically.

-Available potassium was extracted by (1 N) NH_4OAC at pH 7.0

- Cation Exchange Capacity (CEC) was measured by using (1 M) sodium acetate and replaced by NH_4^+ then sodium was measured by flame photometer

-Exchangeable sodium percentage (ESP)

-Sodium Adsorption Ratio (SAR) was calculated.

All the above tests were conducted according to Jackson, 1967 and 1973 except the referenced tests.

-Gypsum was measured by the acetone method (Nelson, 1982).

-Arc- GIS computer program was used to draw the map of the obtained data.

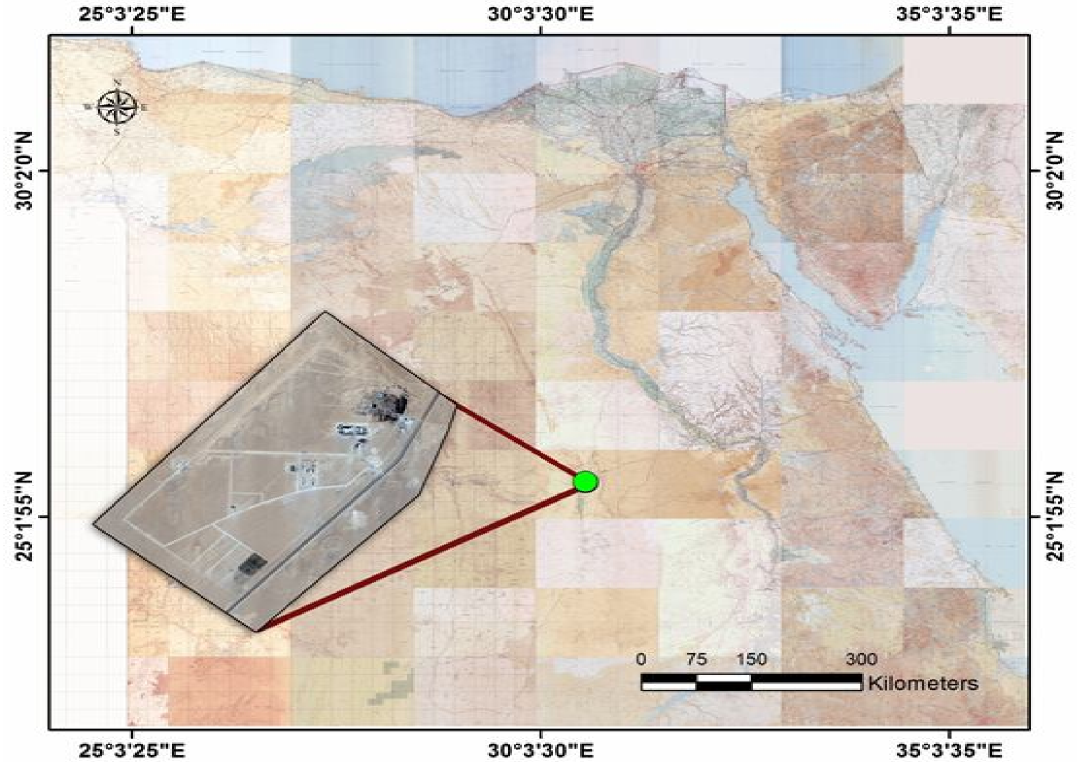


Fig. 1: Map of Egypt, showing university farm, at El-Kharga Oasis.

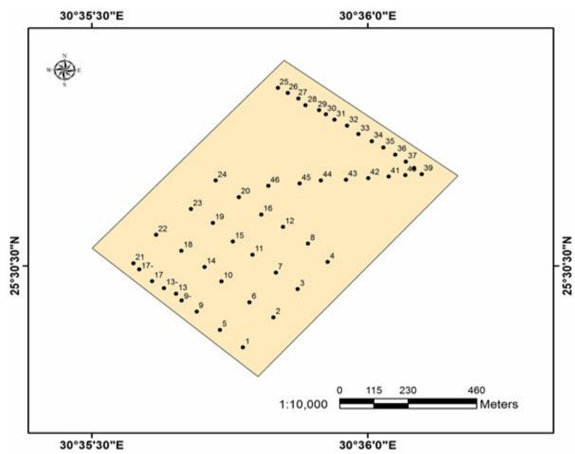


Fig.2: Map shows the new uncultivated location (first location)

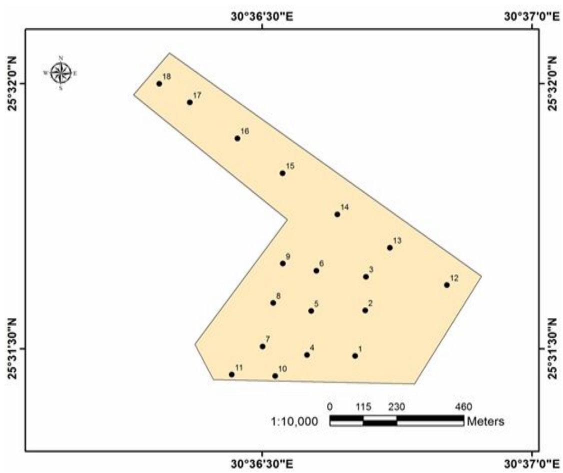


Fig.3: Map shows the old cultivated location (second location)

-Land capability using Sys and Verheye (1972) criteria:

Quantitative estimation of soil characteristics i.e., slope, drainage conditions (wetness), soil depth, texture, carbonate content, gypsum status, and salinity were used for evaluation. Capability indexes for irrigation were calculated according to Sys and Verheye (1972). The land capability index (Ci) for irrigation was calculated by the following equation:

$$\mathbf{Ci = A\times B/100 \times C/100 \times D/100 \times E/100 \times F/100 \times G/100}$$

Where:
Ci: Capability index

A: Texture B: Soil depth

C: Carbonate status D: Gypsum status

E: Salinity F: Drainage conditions

G: Slope

The rating of limiting factors and the category level according to Sys and Verheye (1972).

Table 1. Soil grade and rating values according to Sys and Verheye (1972).

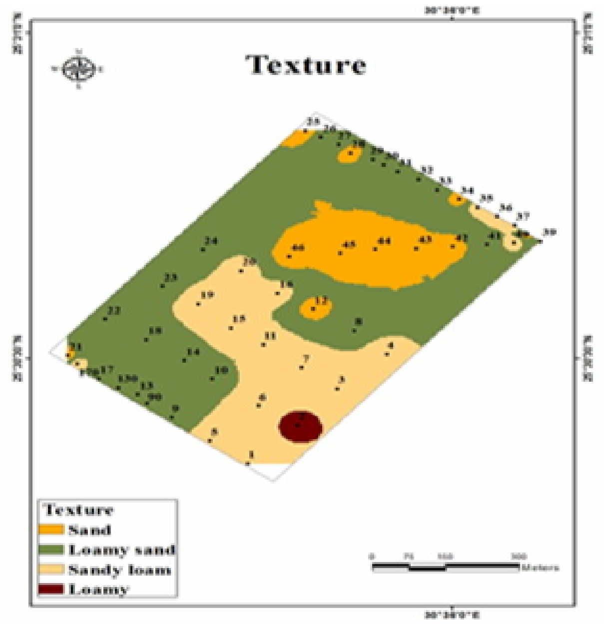
Soil grade	Class	Ci
Highly suitable	I	> 80 %
Moderately suitable	II	60-80 %
Marginally suitable	III	45-60 %
Almost unsuitable	IV	30-45 %
Unsuitable	V	20-30 %
Completely unsuitable	VI	< 20 %

Results and Discussion

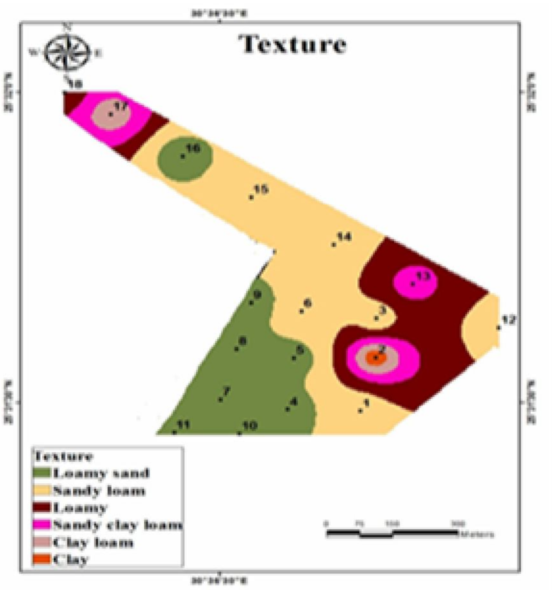
1-Particle-size distribution:

Particle size distribution of soil samples of the new uncultivated location and old cultivated location understudy were illustrated in figure 4: a-b, and in Tables 2&3.

The soils of the new uncultivated location are mainly coarse in texture (42.85 % loamy sand, 32.65 % sandy loam, 22.44 % sand. (These coarse textures reflect the effect of the sandy wind plowing from the north passing by the sand dunes line of Abo-Mohreek in the western desert. The old cultivated location soils were mostly fine to medium coarse in texture (44.44 % loamy sand, followed by 33.33 % sandy loam, fig.2-b and Table 2). Only profiles 2, 17, 18, and 13 were clay, clay loam, loam, and sandy clay loam, respectively. Which represented 22.23 % of the area can be due to the naturally alluvial deposits which were added from the surrounding areas.



(a) New uncultivated location



(b) Old cultivated locatio

Fig. 4: The particle-size distribution as average profile values in both locations

Table 2. Physical and chemical properties for the new uncultivated location (first location).

Profile No.	Depth (cm)	Particle size distribution (%)			Soil Texture grade	ECe(dS/m)
		Sand	Silt	Clay		
21	0-120	89.48	8.33	2.21	Sandy	7.94
1	0 -150	53.25	33.20	13.55	Sandy loam	40.94
2	0-150	40.45	38.40	21.15	Loamy	175.03
3	0-150	72.05	23.33	4.62	Sandy loam	24.56
4	0-120	60.38	29.16	10.44	Sandy loam	96.31
5	0-150	62.21	23.73	14.06	Sandy loam	39.64
6	0-150	55.60	34.26	10.14	Sandy loam	47.02
7	0-120	58.48	30.66	10.86	Sandy loam	181.40
8	0-120	82.55	14.33	3.11	Loamy sand	36.13
9	0-120	84.58	12.13	3.28	Loamy sand	82.04
9*	0-150	80.85	14.00	4.48	Loamy sand	35.83
10	0-150	82.37	11.86	5.66	Loamy sand	22.44
11	0-150	68.13	25.86	6.00	Sandy loam	152.13
12	0-100	89.12	8.00	2.08	Sandy	67.10
13	0-150	77.41	17.20	5.39	Loamy sand	79.14
13*	0-150	84.53	12.53	2.93	Loamy sand	47.03
14	0-120	82.32	10.66	7.01	Loamy sand	125.54
15	0-150	60.08	22.40	17.52	Sandy loam	16.39
16	0-150	70.64	12.40	17.12	Sandy loam	37.71
17	0-150	80.05	17.06	2.88	Loamy sand	25.46
17 *	0-100	75.44	15.80	8.76	Sandy loam	17.27
18	0-150	78.00	17.73	4.26	Loamy sand	19.11
19	0-150	63.89	18.26	18.90	Sandy loam	22.80
20	0-150	66.32	22.40	11.28	Sandy loam	19.51

Table 2. (continued) Physical and chemical properties for the new uncultivated location (first location).

Profile No.	Depth (cm)	Particle size distribution (%)			Soil Texture grade	ECe(dS/m)
		Sand	Silt	Clay		
22	0-250	83.78	12.13	4.08	Loamy sand	32.45
23	0-30	78.18	18.66	3.14	Loamy sand	8.53
24	0-150	81.28	14.40	4.48	Loamy sand	19.07
25	0-120	87.25	10.66	2.08	Sandy	55.38
26	0-110	85.06	7.75	7.18	Loamy sand	108.80
27	0-120	86.56	7.14	6.29	Loamy sand	83.63
28	0-120	87.66	7.33	5.00	Sandy	134.47
29	0-110	77.81	15.63	6.54	Loamy sand	84.29
30	0-150	85.80	7.80	6.40	Loamy sand	29.00
31	0-120	84.16	10.83	5.00	Loamy sand	16.81
32	0-150	86.26	9.73	4.00	Loamy sand	13.00
33	0-150	85.76	7.93	6.30	Loamy sand	21.90
34	0-150	88.46	7.26	4.53	Sandy	20.88
35	0-120	77.00	15.00	8.00	Sandy loam	30.23
36	0-120	69.66	22.33	8.00	Sandy loam	64.24
37	0-120	74.50	17.16	8.33	Sandy loam	40.64
38	0-120	87.66	7.66	4.66	Sandy	29.23
39	0-120	82.75	8.91	8.33	Loamy sand	41.21
40	0-120	77.50	15.16	7.91	Sandy loam	158.00
41	0-130	86.30	7.00	6.69	Loamy sand	110.41
42	0-120	87.83	7.00	5.16	Sandy	80.29
43	0-130	87.23	6.76	6.00	Sandy	47.56
44	0-120	88.33	7.66	4.00	Sandy	47.35
45	0-130	86.30	7.00	6.07	Sandy	107.04
46	0-150	87.66	6.33	6.00	Sandy	75.53
First site		77.73	15.08	7.18	Loamy sand	58.74
Overall avg.		74.77	16.63	8.60	Sandy loam	46.76

Table 3. Physical and chemical properties for the new cultivated location (second location).

Profile No.	Depth (cm)	Particle size distribution (%)			Soil Texture grade	ECe(dS/m)
		Sand	Silt	Clay		
1	0-150	73.12	9.93	16.94	Sandy loam	1.01
2	0-100	32.32	20.00	47.68	Clay	4.92
3	0-100	46.32	47.00	6.68	Sandy loam	10.85
4	0-100	85.12	11.30	3.58	Loamy sand	2.24
5	0-80	87.82	4.76	7.42	Loamy sand	3.04
6	0-100	56.52	35.30	8.18	Sandy loam	10.90
7	0-120	78.15	17.33	4.52	Loamy sand	28.85
8	0-100	84.92	12.90	2.18	Loamy sand	16.39
9	0-100	85.52	11.60	2.88	Loamy sand	27.85
10	0-100	80.72	14.00	5.28	Loamy sand	29.76
11	0-100	85.92	11.40	2.68	Loamy sand	17.85
12	0-150	64.72	19.20	16.08	Sandy loam	11.45
13	0-120	65.32	10.08	24.60	Sandy clay loam	5.19
14	0-150	70.58	20.00	9.42	Sandy loam	18.00
15	0-120	71.65	19.33	9.01	Sandy loam	1.56
16	0-150	80.98	15.33	3.69	Loamy sand	36.86
17	0-150	22.32	50.00	27.68	Clay loam	7.15
18	0-150	28.72	45.60	25.68	Loamy	20.87
Second site		66.71	20.84	12.45	Sandy loam	14.15
Overall avg.		74.77	16.63	8.60	Sandy loam	46.76

2-Total soluble salts (ECe)

The electrical conductivity of the saturated soil extracts (ECe) of the studied soil samples is shown in Tables 2 & 3. Distribution pattern of soil salinity levels in the studied profiles is illustrated in figure 5: a-b, as profile average ECe.

The profile average electrical conductivity (ECe) values of the new uncultivated location (first location) varied between 7.94 and 158.00 dS/m. Most of soil samples for this location are very strongly saline (Fig ٥-a). The highest ECe profile average values were found in profiles 2, 7 (175.03–181.40 dS/m). Few numbers of profiles have ECe Less than 16 dS/m such as profiles 21, 23, 32. Only 6.21 % of the profiles consider high saline, and 93.87% are very high saline according to the salinity classification by Richards (1954). However, the ECe of soil samples reached values of 414.30 dS/m at depth of 10-30 cm of profile 2, and 306.50 ds/m at the surface and 124.20 dS/m at the bottom layers. This was not the only case but it was the highest, since ECe values over 50 dS/m were shown in 57 samples out of 127 which represent 45 % of the samples, also 21 % of these samples have ECe> 100 dS/m and 6.3 % of those samples have ECe more than 200 dS/m.

The field observations showed salt layers of NaCl at depths varied from 20 to 50 cm in profile 1, and from 0 to 150 cm in profile 2. These salty layers were associated with dark brownish soil color which was suspected to be shales. This dark brownish layer is extended in all the study area but at variable depths starting from 10 cm to 150 cm. The salt layers usually appeared on the border line between the sandy sheet on the top surface layer and the brownish layer as the second layer it was shown as clear crystals of NaCl. However, in some location the salt was white niddle crystals of gypsum insertedin the dark brown or the green or gray shales. The area seems to be as basin of old sea which dried and deposited shales and NaCl, SO_4^{-2} this proposed basin in drawn in Figure-5 to represent the shales layer which is excepted to be as hard bane and would cause submerged and will be soon filed with irrigation water and cause salinity and sodicity in near future.

Back to Table 2 to compare the texture of the samples and correlate it with the ECe, it will be shown clearly that the high ECe layer usually is above or in loamy or sandy loam or clay loam texture.

For the old cultivated location the ECe range between 1.01 and 36.86 dS/m, the data show that 11.11 % were very low ECe, 11.11 % were low, 16.66 % were medium, 16.66 % were high, and 44.44% were very high saline according to the salinity classification by Richards (1954), except some profiles such as 7, 8, 9, 10, 11, 14, 16 and 18 are very strongly saline (>16 dS/m). The lowest values of ECe were found in some soil samples of profiles 1and 15 (1.01–1.56 dS/m).

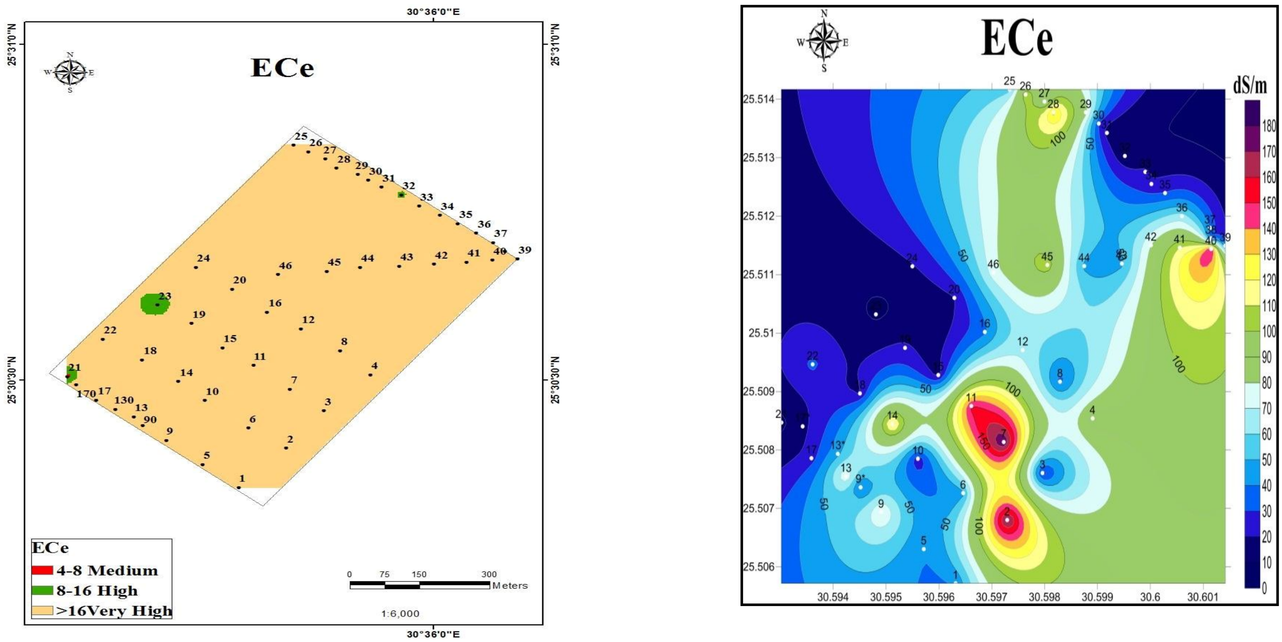
Generally, the high content of soluble salts, especially in the surface layers of most profiles of the new uncultivated location (first location), could be attributed to the absence of any leaching due to the scanty rainfall received and the barren nature of the soils. On other hand, lower salinity levels in the old cultivated location (second location) compared to the first one (new uncultivated location) that may possibly due to the effect of irrigation water and agricultural activities practiced in this location. It is noticeable that the surface layer had higher ECe than the subsurface layers which may be due to the deposits which maintain salts upward movement of the salts with the hyper arid weather in El-Kharga. That was shown in profiles 7, 8, 9, 10, 11, 14, and 16.

Profile14 have ECe of 126.61 dS/m at the surface, while the next layer at 20 cm depth have ECe of only 27.62 dS/m both layers have sandy loam texture. In that profile the upward movement of salts may be the cause. Profile 16 had irregular ECe of layers 2, 3, 4 and 5 since the ECe were 242.07, 16.97, 75.29, and 19.04 dS/m, respectively. The texture of the respective layers were sandy loam (39.68 % fine fraction), sandy (11.68 % fine fraction), sandy loam 37.68 % fine fraction), and sandy (11.68 % fine fraction). The fine fraction associated well with the salinity level. This fine fraction is manly shales, which is marine sediments.

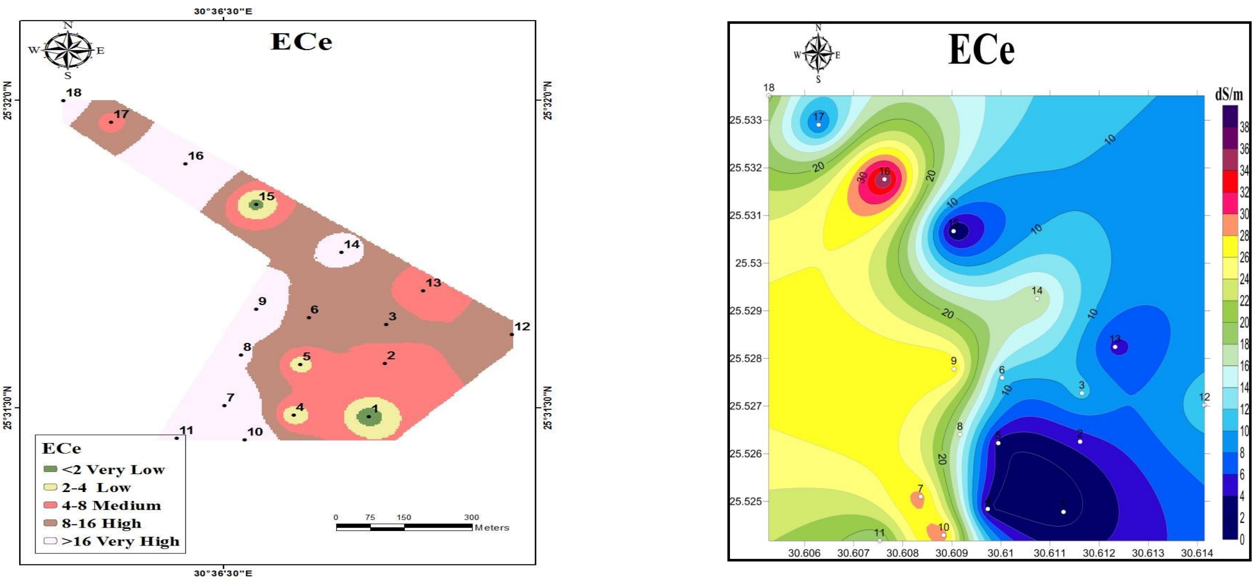
The average ECe of the uncultivated area was 58.74 dS/m, while that of the cultivated area was 14.15 dS/m. However, the whole studied soil samples (167 samples and 67 profiles) average was 46.76 dS/m.

This study revealed that salinity would be the worst problem facing cultivation of this area either the new or the old site. Recently digging to 4 meters in the old cultivated site revealed very highly saline drainage water at depth of 3-4 meters which under lined by shales layer which consider the base of dish will be field by saline drainage water and deteriorate the soil. Building drainage system is very necessary to continue cultivation of this farm.

These results agree with those of obtained by (Salama, 1965, Harga, 1977, Harga, 1979, El-Hamdi 1990, Hammad and Hussein, 1993, Abd-Aallah, 2002, Selmy 2005).



(a) New uncultivated location



(b) Old cultivated location

Fig.5 (a-b): The distribution of salinity (ECe as dS/m) as average profiles value in both locations.

3 -Land capability evaluation

The estimated rating and calculated soil index of the studied soil profiles are shown in (Tables 4, 5) as illustrated in figure 6: a-b, for both locations.

The results of new uncultivated location (first location), showed that most of soils are unsuitable to marginally suitable; as their rates values (Ci) range between 20.52–57.00 %. Few profiles were completely unsuitable such as 12,25,28, and 46 which have Ci values of 15.83, 19.95, 18.52, and 19.95%, respectively.

Also the old cultivated location (second location) was mostly unsuitable to marginally suitable; as their rates values (Ci) range between 23.70–54.15 %, except some profiles were moderately suitable such as in profiles15 and 1 of 60.91 and 67.68 %, respectively.

Generally, land capability for irrigation of the new uncultivated location (first location) was; 28.57 % of the profiles were marginally suitable (III), 46.93 % were almost unsuitable (IV), 16.32 % were unsuitable (V), 8.16 % were completely unsuitable (VI). While, land capability for the old cultivated location (second location) was; 11.11 % of the profiles were moderately suitable (II), 27.77 % were marginally suitable (III), 27.77 % were almost unsuitable (IV), and 33.33 % were unsuitable (V).

Most profiles for the new uncultivated location (first location), and the old cultivated location (second location) are considered unsuitable to marginally suitable for irrigation, under good conditions of water availability for agricultural purposes; the moderately and marginally suitable soils for irrigation could be safely used in agriculture.

Table 4. Land capability indexes for irrigation of the new uncultivated location (first location), as calculated according to Sys and Verheye (1972).

Ci = A× B/100 × C/100 × D/100 × E/100 × F/100 × G/100

Profile No.	A Texture	B Depth	C Carbonate	D Gypsum	E Salinity	F Drainage	G Slope	Ci Capability index	Class	Sub Class	Major problem	Proposed managements
1	75	100	95	100	70	100	100	49.87	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
2	90	100	95	100	65	85	100	47.23	III	Snw	Salinity, Drainage	leaching, Tolerant crops, Improvement of the drainage
3	75	100	95	100	80	100	100	57.00	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
4	75	100	95	100	65	100	100	46.31	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
5	75	100	95	100	65	100	100	46.31	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
6	75	100	95	100	70	100	100	49.87	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
7	75	100	95	100	65	100	100	46.31	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
8	55	100	95	90	65	100	100	30.56	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
9	55	100	100	100	65	100	100	35.75	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
9*	55	100	95	100	70	100	100	36.57	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
10	55	100	95	100	80	100	100	41.80	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
11	75	100	95	85	65	100	100	39.36	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
12	30	90	95	100	65	95	100	15.83	VI	Snw	Texture, Salinity	Irrigation management, leaching, Tolerant crops
13	55	100	95	100	65	100	100	33.96	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
13*	55	100	95	100	65	100	100	33.96	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
14	55	100	95	100	65	100	100	33.96	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
15	75	100	95	100	80	100	100	57.00	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
16	75	100	95	90	70	100	100	44.88	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
17	55	100	95	90	75	100	100	35.26	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
17*	75	90	95	90	80	95	100	43.86	IV	Snw	Texture, Salinity	Irrigation management, leaching, Tolerant crops
18	55	100	95	100	80	100	100	41.80	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
19	75	100	95	90	80	100	100	51.30	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
20	75	100	95	90	75	100	100	48.09	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
21	30	100	95	90	95	100	100	24.36	V	Sn	Texture	Irrigation management

(**S**= A, B, C, D) (**n**= E) (**W**= F), (III= Marginally suitable, 45-60%), (IV= Almost unsuitable, 30-45%), (V= Unsuitable, 20-30%), (VI= Completely unsuitable, < 20 %)

Table 4. (Continued) Land capability indexes for irrigation of the new uncultivated location (first location), as calculated according to Sys and Verheye (1972).

Ci = A× B/100 × C/100 × D/100 × E/100 × F/100 × G/100

Profile No.	A Tex-ture	B Depth	C Carbonate	D Gypsum	E Salinity	F Drainage	G Slope	Ci Capability index	Class	Sub Class	Major problem	Proposed manage-ments
22	55	100	95	90	70	100	100	32.91	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
23	55	60	95	90	90	95	100	24.12	V	Snw	Texture, Depth	Irrigation management, deep plowing
24	55	100	95	90	80	100	100	37.62	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
25	30	100	95	100	70	100	100	19.95	VI	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
26	55	100	95	100	75	100	100	39.18	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
27	55	100	95	100	75	100	100	39.18	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
28	30	100	95	100	65	100	100	18.52	VI	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
29	55	100	95	90	65	100	100	30.56	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
30	55	100	95	90	80	100	100	37.62	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
31	55	100	100	90	85	100	100	42.07	IV	Sn	Texture	Irrigation management
32	55	100	95	90	85	100	100	39.97	IV	Sn	Texture	Irrigation management
33	55	100	95	100	75	100	100	39.18	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
34	30	100	95	90	80	100	100	20.52	V	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
35	75	100	95	90	80	100	100	51.30	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
36	75	100	95	100	75	100	100	53.43	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
37	75	100	95	100	80	100	100	57.00	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
38	30	100	95	90	85	100	100	21.80	V	Sn	Texture	Irrigation management
39	55	100	95	100	70	100	100	36.57	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
40	75	100	95	100	65	100	100	46.31	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
41	55	100	95	100	75	100	100	39.18	IV	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
42	30	100	95	100	75	100	100	21.37	V	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
43	30	100	95	100	80	100	100	22.80	V	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
44	30	100	95	90	80	100	100	20.52	V	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
45	30	100	95	90	80	100	100	20.52	V	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
46	30	100	95	100	70	100	100	19.95	VI	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops

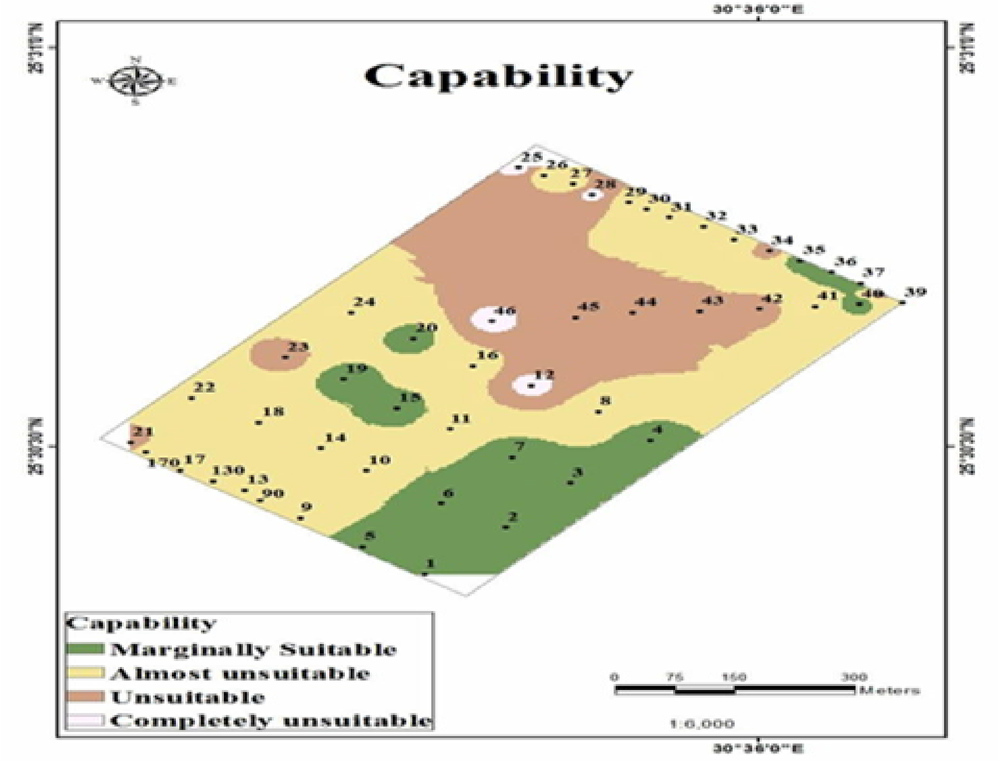
(**S**= A, B, C, D) (**n**= E) (**W**= F), (III= Marginally suitable, 45-60%), (IV= Almost unsuitable, 30-45%), (V= Unsuitable, 20-30%), (VI= Completely unsuitable, < 20 %)

Table 5. Land capability indexes for irrigation for the old cultivated location (second location), as calculated according to Sys and Verheye (1972).

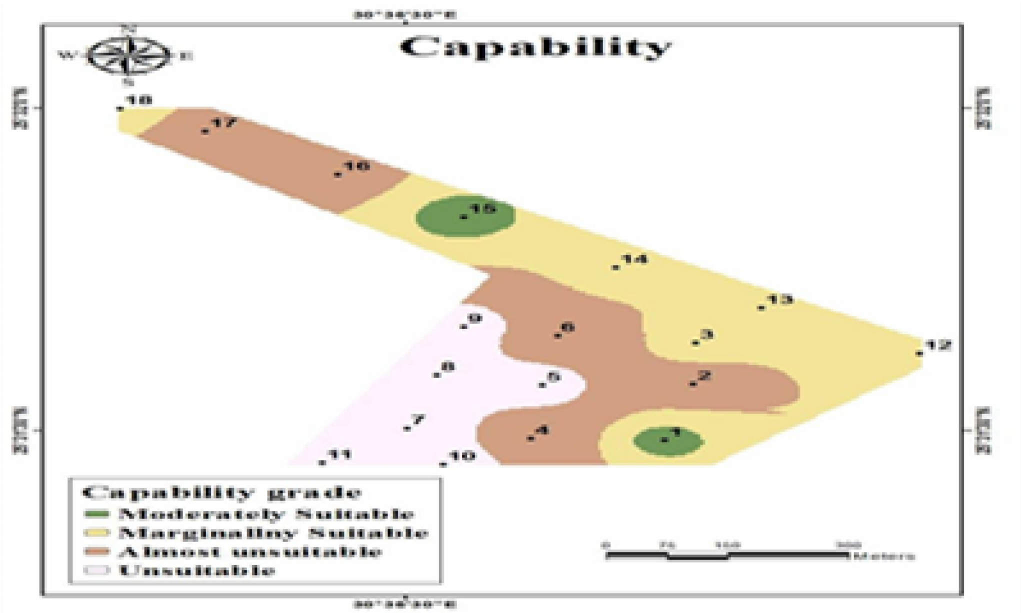
Ci = A× B/100 × C/100 × D/100 × E/100 × F/100 × G/100

Profile No.	A Texture	B Depth	C Carbonate	D Gypsum	E Salinity	F Drainage	G Slope	Ci Capability index	Class	Sub Class	Major problem	Proposed managements
1	75	100	95	100	100	95	100	67.68	II	Sw	Texture	Irrigation management
2	85	90	95	100	70	75	100	38.15	IV	Snw	Salinity, Drainage	leaching, Tolerant crops, Improvement of the drainage
3	75	90	95	100	85	95	100	51.78	III	Snw	Texture	Irrigation management
4	55	90	95	90	100	95	100	40.2	IV	Sw	Texture	Irrigation management
5	55	90	95	90	95	70	100	28.14	V	Snw	Texture, Drainage	Irrigation management, Improvement of the drainage
6	75	90	95	90	90	70	100	36.35	IV	Snw	Texture, Drainage	Irrigation management, Improvement of the drainage
7	55	100	95	100	75	70	100	27.43	V	Snw	Texture, Salinity, Drainage	Irrigation management, leaching, Tolerant crops, Improvement of the drainage
8	55	90	95	90	80	70	100	23.7	V	Snw	Texture, Salinity, Drainage	Irrigation management, leaching, Tolerant crops, Improvement of the drainage
9	55	90	95	90	80	70	100	23.7	V	Snw	Texture, Salinity, Drainage	Irrigation management, leaching, Tolerant crops, Improvement of the drainage
10	55	90	95	100	80	70	100	26.33	V	Snw	Texture, Salinity, Drainage	Irrigation management, leaching, Tolerant crops, Improvement of the drainage
11	55	90	95	100	80	70	100	26.33	V	Snw	Texture, Salinity, Drainage	Irrigation management, leaching, Tolerant crops, Improvement of the drainage
12	75	100	95	90	80	100	100	51.3	III	Sn	Texture, Salinity	Irrigation management, leaching, Tolerant crops
13	95	100	95	100	80	75	100	54.15	III	Snw	Salinity, Drainage	leaching, Tolerant crops, Improvement of the drainage
14	75	100	95	100	80	95	100	51.15	III	Snw	Texture, Salinity	Irrigation management, leaching, Tolerant crops
15	75	100	95	90	100	95	100	60.91	II	Sw	Texture	Irrigation management
16	55	100	95	100	70	95	100	34.74	IV	Snw	Texture, Salinity	Irrigation management, leaching, Tolerant crops
17	100	100	95	90	70	75	100	44.88	IV	Snw	Salinity, Drainage	leaching, Tolerant crops, Improvement of the drainage
18	90	100	95	100	75	75	100	48.09	III	Snw	Salinity, Drainage	leaching, Tolerant crops, Improvement of the drainage

(**S**= A, B, C, D) (**n**= E) (**W**= F), (II= Moderately suitable, 60-80%), (III= Marginally suitable, 45-60 %), (IV= Almost unsuitable, 30-45 %), (V= Unsuitable, 20-30 %)



(a) New uncultivated location



(b) Old cultivated location

Fig.6: The distribution of capability indexes for irrigation as calculated according to Sys and Verheye (1972), for both locations**.**

Recommendations

The land capability can be improved by applying, these soil management practices;

- Improving drainage.
- Leaching salt using modified surface irrigation, cultivate salt tolerant crops.
- No deep plowing because salts are in subsurface.
- Improve soil permeability some time applying sand to the soil may help.
- Organic fertilization to improve permeability, CEC and nutrient availability.
- Applying modern irrigation systems.
- Reducing the irrigation periods to avoid the soil surface salt crust formation.
- Application of non-saline dredged clay or sand materials to improve the physical properties of the sandy soils or to increase permeability of heavy clay soils.
- Improved the soil fertility by precise fertilization managements.

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تأثير الزراعة علي خواص التربة بمزرعة الخارجة، بالوادي الجديد

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الملخص

تقع مزرعة جامعة اسيوط فى واحة الخارجة بمحافظة الوادى الجديد فى قلب الصحراء الغربية المصرية بين خطي عرض 30°25-N '31°25 وخطى طول '35°30-.E '36°30. وانشئت المزرعة فى عام ٢٠٠٤ كمزرعة تجارب لفرع جامعة اسيوط المقترح الوادى الجديد وفى عام ٢٠١٤ تم اضافة موقع جديد فى المنطقة. ان موقع الجامعة فى منخفض الخارجة وهذا المنخفض عبارة عن رواسب بحرية تغطي بطبقة من الرمال. زراعة المساحة الاولى لمدة عشر سنوات اظهرت تغيير كبير فى صفات التربة. الهدف من الدراسة تقييم ملائمة وصلاحية التربة للزراعة المروية والمحاصيل المختلفة. كما تهدف الى دراسة التغير فى صفات التربة الطبيعية والكيميائية بعد الزراعة. وتم الاستعانة ببرامج الحاسوب فى رسم خرائط توضح خواص التربة وملائمتها للزراعة.

واظهرت الدراسة أن مؤشرات تقييم الأراضي للري فى الموقع الجديد كانت ؛ ٣٠٪ هامشية الصلاحية ، ٤٣٪ غير مناسبة في الوقت الراهن ، ٢٦٪ ليست مناسبة بشكل دائم. أما بالنسبة للموقع القديم المزروع منذ عشر سنوات فكانت؛ ١١٪ متوسطة الصلاحية، ٢٧٪ هامشية الصلاحية ، و٢٧٪ غير مناسبة في الوقت الراهن ، و ٣٣٪ ليست مناسبة. بشكل دائم. في ظروف توافر مياه جيدة الصفات فان الأراضى المتوسطة والقليلة الصلاحية للري يمكن استخدامها للزراعة. اتضح ان سبب انخفاض الصلاحية الاراضى الهامشية ارتفاع ملحية وقلوية التربه والقوام الرملي. ازالة هذة المعوقات سوف يزيد من قابلية الاراضى للزراعة

الكلمات الدالة: *خواص التربة – الخارجة – الوادي الجديد.*