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Land Suitability of the Soils Adjacent to Qarun Lake, Part (II)

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THE AREA adjacent Qarun Lake is about 56.8 Km^2 or 13632 feddan and represents 3.5% of total area of El- Fayoum. The soils developed under arid conditions and have different parent materials (lacustrine, aeoline and alluvial deposit). These soils have different textures and classified into three orders: Vertisols, Entisols and Arid soils. According to land evaluation system, the agriculture productivity of the area was very law due to many problems. The aim of this study is to classify the suitability of the studied area for crops. Ten land use types were selected and classified into three classes; the most suitable crops in the studied area are Wheat, Maize, Cotton, Rice, Olive, Date palm, Onion, Mango, Tomato and Alfalfa.

Keywords: Land suitability, El-Fayoum Depression Egypt.

The area adjacent to Qarun Lake (Fig. 1) has different geomorphic unit, soils of these units were developed many different landforms.

El-Fayoum is circular deep depression in the Western Desert of Egypt between 29° 02′ to 29° 34′ latitude and 30° 25′ to 31° 06′ longitudes. Qarun Lake is the deepest part of depression (-45 m.b.S1) with an area of about 200 Km^2. El- Fayoum characterized by long hot and dry summer, mild cold winters with scanty rainfall (CLAC, 2004). According to Younis (1963); Nirooz (1967); Abdel Razek (1998) and Abu El-Einane (1997). The most limiting factors, which decrease yields in the soils adjacent to Lake Qarun are soil texture, soil depth, salinity, alkalinity, high $CaCo_3$ content and drainage. The physicochemical characteristics of the area show that seven sediments occupy these landforms, aqueous media transports these sediments and Aeolian. The soils of this area can be classified as, Haplocalcids, Haplosalids, Haplotorrerts and Torrifluvents subgroups Soil Map of Egypt (1979).

The Automated Land Evaluation System (ALES) is computer system that computes the physical and economic suitability of land mapping units. This depends upon the rating produced by FAO (1976); Sys (1985); Rossiter & Van Wambeke (1995) and Sys & Van Rast system (1993) to evaluate the suitability of the soils for crops. The agriculture productivity was very law due to many problems. The most limiting factors decrease yields are: high $CaCo_3$ content,

alkalinity, salinity, texture, depth and poorly drained which decrease the crop productivity.

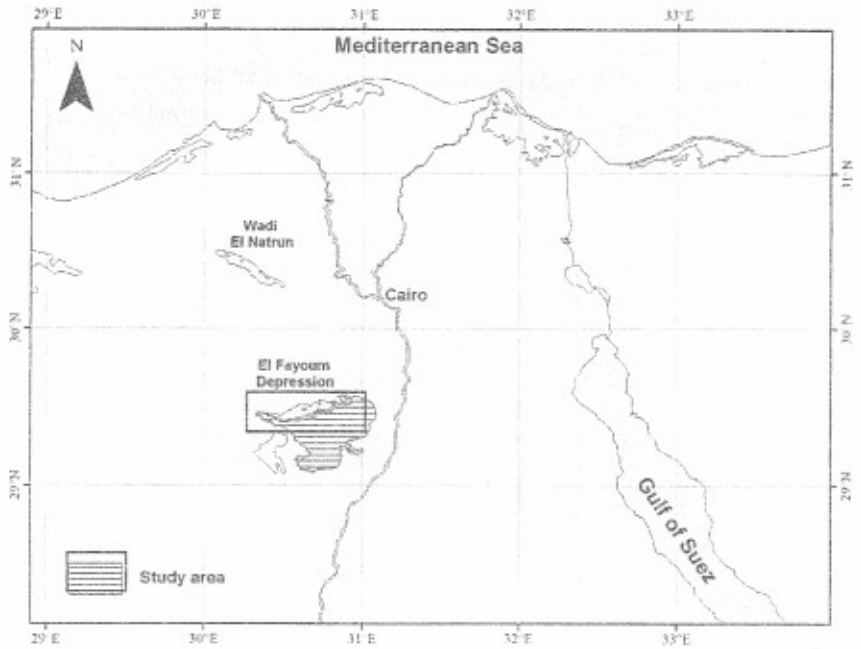

Fig.1 Location map of the study area .

According to the evaluation system, characteristics and limiting factors, alfalfa, wheat, cotton, tomato and maize are the best crops in this area. The soils need much careful management to decrease salinity, alkalinity, and CaCo3 content and enhance the drainage condition to improve the productivity classes and land properties.

To meet the requirements of agricultural expansion programe, the soils adjacent Qarun Lake are taken is one of the most important lands for agricultural expansion.

Procedures

Nine profiles (Fig. 2) have been studied morphologically in the field using FAO (1990) guidelines. The soil samples were analyzed using the Soil Survey Laboratory Methods Manual (USDA, 2004) .

The rating suggested by Sys and Van Rest (1993) were used to classify the soils according to its suitability for crops. The soils were classified based upon the limitations into five levels as the follow:

(S_1): as no to slight limitation, suitable soils.
(S_2): as moderate limitation, moderately suitable.
(S_3): as severe limitation, marginally suitable.
(N_1 and N_2): very severe imitation unsuitable.

ALES software was used for matching the soil characteristics and crops requirements. Suitability classes in the ALES are 1, 2, 3 and 4 which refers to the FAO (1976) suitability classes S1, S2, S3 and S4 degree of limitations. The suitability subclasses were denoted by a code reflecting the name of land characteristics.

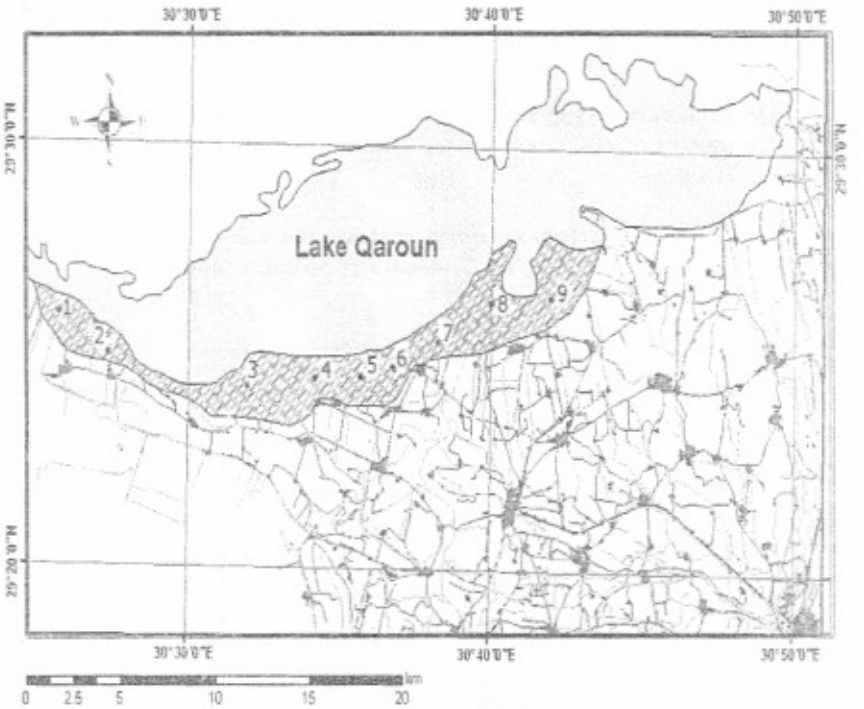

Fig. 2. Location of the studied soil profiles .

Results and Discussion

The automated land evaluation (ALES) was used with matching Sys and Van Rest rating to evaluate the suitability of the soils for cultivation by selected crops; the data input are illustrated in Table 1. The agriculture productivity in the area was law due to many problems; some of them related to water management, so ten land use types were selected based on the kind of production and the needed management.

The obtained data show that the suitability of the land for a specific land use types in the studied area are:

(S_2): moderately suitable lands including profiles no. (1,2,3,4,5 and 6) representing 18% of the total area and suitable for many corps such as wheat, cotton, maize, tomato and alfalfa .These soils with moderate limitation such as high $CaCo_3$, salinity and depth .

(S_3): marginally suitable including profiles no. (2, 3, 4, 5, and 6) representing 45% of the total area. These soils have severe limitation and give 50 to 70% of the optimum yield.

(N): not suitable including profiles (7,8 and 9) representing 37% of the total area. These soils contain much limitation such as high $CaCo_3$, high salinity, alkalinity; shallow profiles and poor drained. It requires much careful management to decrease salinity, alkalinity, high $CaCo_3$ content and a good drainage system.

Land suitability classes for the chosen crops are shown in Table 2 and Fig. 3. The percentages of each class for the different land uses in the studied area are found in Table 3.

The most limiting factors in the studied area are soil texture, soil depth, salinity and alkalinity, high $CaCo_3$ content and poor drainage.

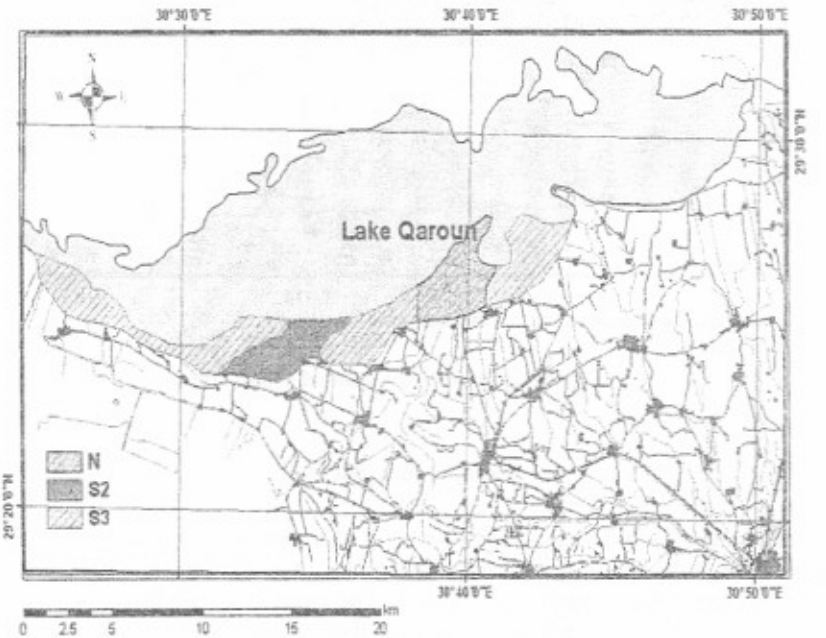

Fig. 3. Land suitability classes in the studied area .

TABLE 1. Some chemical analysis of the studied profiles.

Profile no.	Depth (Cm)	pH_{ex} (1:2.5)	EC (dS/m)	O.M %	$CaCO_3$ %	Texture class
1	0-10	7.49	2.00	1.95	22.00	Sandy
	10-45	7.55	4.00	1.40	21.00	Sandy
	45-60	7.41	3.75	0.65	20.35	Sandy
2	0-40	7.20	7.00	1.30	21.00	Silty Clay
	40-55	7.24	8.00	0.90	16.50	Silty Clay
	55 - 80	7.30	7.00	0.65	13.00	Silty Clay
3	0-50	7.89	2.00	1.90	17.50	Loamy Clay Sand
	50-75	7.60	2.00	1.30	8.00	Loamy Clay Sand
	75 - 90	7.50	2.00	0.85	6.00	Loamy Clay Sand
4	0-35	8.43	6.40	1.30	22.60	Clay
	35-60	8.48	4.00	1.10	9.00	Loamy Clay
	60-75	8.25	6.80	0.90	26.20	Loamy Clay
	75-105	8.28	7.00	0.65	31.10	Clay
5	0-30	7.98	4.30	3.67	16.00	Loamy Clay
	30-50	8.12	5.40	3.24	18.60	Loamy Clay
	50-90	8.00	5.20	2.10	24.50	Clay
6	0-30	7.92	3.40	6.15	16.00	Clay
	30-50	8.13	3.00	5.85	32.40	Clay
	50-90	8.03	5.00	3.12	7.00	Clay
7	0-20	7.83	17.00	6.35	11.30	Clay
	20-55	7.74	16.20	4.35	13.20	Clay
	55-90	7.72	12.00	3.12	11.00	Clay
8	0-15	7.92	8.20	5.15	15.60	Clay
	15 - 45	7.88	9.40	3.40	15.50	Clay
9	0-30	8.80	2.00	1.70	13.20	Loamy Clay
	30-55	8.54	1.70	0.98	12.00	Loamy Clay
	55-85	8.58	1.40	0.78	10.00	Loamy Clay

TABLE 2. Land suitability for wheat.

Prof. No.	Depth cm.	Texture	Ec	PH	$CaCo_3$	O.M.	Drainage	Class
1	2	3	1	1	1	1	3	3
2	1	1	3	1	1	1	2	3
3	1	2	1	1	1	1	2	2
4	1	2	3	2	1	1	1	3
5	1	2	2	2	1	1	1	2
6	1	1	2	2	1	1	1	2
7	1	1	N	1	1	1	1	N
8	3	1	N	1	1	1	2	N
9	1	2	1	2	1	1	2	2

TABLE 2. Land suitability for maize (contd.) .

Prof. No.	Depth	Texture	E c	PH	$CaCo_3$	O.M.	Drainage	Class
1	2	3	1	1	2	1	3	3
2	1	1	2	1	1	1	2	2
3	1	2	1	1	1	1	2	2
4	1	2	2	3	2	1	1	3
5	1	2	2	3	2	1	2	3
6	1	1	1	3	2	1	2	3
7	1	1	N	1	1	1	2	N
8	N	1	3	2	2	1	2	N
9	1	1	1	1	1	1	2	3

TABLE 2. Land suitability for cotton (contd.).

Prof. No.	Depth	Texture	E c	PH	$CaCo_3$	O.M.	Drainage	Class
1	2	3	1	2	2	1	2	3
2	1	1	1	2	1	1	2	2
3	1	1	1	2	1	1	2	2
4	1	1	1	3	2	1	2	3
5	1	1	1	3	1	1	2	3
6	1	1	1	2	1	1	1	2
7	1	1	3	1	1	1	2	3
8	N	1	2	2	1	1	2	N
9	1	1	1	N	1	1	2	N

TABLE 2. Land suitability for rice (contd.).

Prof. No.	Depth	Texture	E c	PH	$CaCo_3$	O.M.	Drainage	Class
1	3	N	2	3	3	1	3	N
2	1	1	N	3	2	2	2	N
3	1	2	1	3	2	1	2	3
4	1	2	N	3	3	1	3	N
5	1	2	3	3	2	1	2	3
6	1	1	2	3	3	1	2	3
7	1	1	N	3	2	1	3	N
8	N	1	N	3	3	1	3	N
9	1	2	1	3	2	1	2	3

TABLE 2. Land suitability for olive (contd.).

Prof. No.	Depth	Texture	E c	PH	CaCo3	O.M.	Drainage	Class
1	N	3	1	1	2	1	2	N
2	3	1	1	1	1	1	2	3
3	3	2	1	N	-	1	2	N
4	2	2	1	3	2	1	2	3
5	3	1	2	3	2	1	2	3
6	3	1	1	2	2	1	3	3
7	3	1	2	1	2	1	2	3
8	N	1	1	1	2	1	2	N
9	3	2	1	3	2	1	2	3

TABLE 2. Land suitability for onion (contd.).

Prof. No.	Depth	Texture	E c	PH	CaCo3	O.M.	Drainage	Class
1	2	3	2	1	N	1	2	N
2	1	1	3	1	2	2	2	3
3	1	2	1	1	3	1	2	3
4	1	2	3	3	N	2	2	N
5	1	2	3	2	3	1	2	3
6	1	1	2	2	3	1	1	3
7	1	1	N	1	3	1	1	N
8	N	1	N	2	3	1	2	N
9	1	2	1	N	3	1	2	N

TABLE 2. Land suitability for mango (contd.).

Prof. No.	Depth	Texture	E c	PH	$CaCo_3$	O.M.	Drainage	Class
1	N	3	1	1	3	1	2	N
2	2	1	3	1	2	2	2	3
3	2	2	1	1	3	1	2	3
4	1	2	3	3	3	1	2	3
5	2	2	2	2	3	1	1	3
6	2	2	1	2	3	1	2	3
7	2	2	N	1	3	1	2	N
8	N	2	N	2	3	1	2	N
9	2	2	1	N	3	1	2	N

TABLE 2. Land suitability for date palm (contd.).

Prof. No.	Depth	Texture	E c	PH	$CaCo_3$	O.M.	Drainage	Class
1	N	3	1	1	3	1	2	N
2	3	1	3	1	2	2	2	3
3	3	2	1	1	3	1	2	3
4	2	2	3	3	3	2	2	3
5	3	2	2	2	3	1	2	3
6	3	2	1	2	3	1	2	3
7	3	2	N	1	3	1	2	N
8	N	2	N	1	3	1	3	N
9	3	1	1	N	3	2	3	N

TABLE 2. Land suitability for Tomato (contd.).

Prof. No.	Depth	Texture	E c	PH	CaCo3	O.M.	Drainage	Class
1	N	N	1	1	3	1	2	N
2	2	1	2	2	2	2	2	2
3	2	2	1	2	3	1	2	3
4	1	2	2	N	3	2	1	N
5	2	2	1	3	3	1	2	3
6	2	1	1	3	3	1	2	3
7	2	1	N	2	3	1	2	N
8	N	1	3	2	3	1	2	N
9	2	2	1	N	3	2	2	N

TABLE 2. Land suitability for alfa alfa (contd.).

Prof. No.	Depth	Texture	E c	PH	CaCo3	O.M.	Drainage	Class
1	3	3	1	1	2	1	2	3
2	1	2	2	1	1	2	2	2
3	1	1	1	1	1	1	1	1
4	1	1	2	2	2	2	1	2
5	1	1	1	2	2	1	1	2
6	1	1	1	2	2	1	2	2
7	1	1	N	1	1	1	2	N
8	N	1	2	1	2	1	2	N
9	1	1	1	2	1	1	2	1

TABLE 3. Distribution of suitability classes for different land uses in the studied area.

Crops	Classes			
	S_1	S_2	S_3	N
Wheat	-	44.4%	33.3%	22.2%
Maize	-	33.3%	44.4%	22.2%
Cotton	-	33.3%	44.4%	22.2%
Rice	-	-	44.4%	55.5%
Olive	-	-	66.6%	33.3%
Onion	-	-	44.4%	55.5%
Mango	-	-	55.5%	44.4%
Date palm	-		55.5%	44.4%
Tomato	-	11.1%	33.3%	55.5%
Alfa Alfa	-	66.6%	11.1%	22.2%
Total%	-	18%	45%	37%

Conclusion

The government shows that, cotton is the national crop and wheat is the main food crop followed by rice but formers show that onion, olive, mango and vegetables are the main crops even if it is not physically suitable for land, but after the evaluation studies A plan can be made for land use according to their characteristics, limitation and needs for each lad. Studies show that physical and chemical properties of land determined the more suitable crops for every kind of land and careful management improve the productivity and land properties .

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ملائمة الأراضى المتاخمة لبحيرة قارون لزراعة بعض المحاصيل

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قسم الأراضى واستغلال المياه – المركز القومى للبحوث – القاهرة – مصر .

تعتبر الأراضى المتاخمة لبحيرة قارون مهمة للمساهمة فى احتياجات برنامج التوسع الزراعى ، حيث تبلغ مساحتها حوالى ٥٦,٨ كم^2 (١٣٦٣٢ فدان) تمثل ٣,٥٪ من المساحة الكلية للفيوم . تم اختيار ودراسة تسعة قطاعات أرضية ممثلة للوحدات الارضية المختلفة لهذة المساحة بتطورت هذه الأراضى تحت الظروف المناخية الجافة وتحت مواد أصل مختلفة (بحيرية ، سافية ورسوبية) وتشمل هذه الأراضى وحدات جيومورفولوجية مختلفة . وتحتوى هذه الأراضى أنواع مختلفة من القوام ، وتم تقسيمها الى ثلاث رتب (Vertisols , Entisols and Arid soils) . وتبعا لنظام تقييم الأراضى ، وجد أن الانتاجية الزراعية لهذه الأراضى منخفضة جدا وهذا راجع إلى مشاكل عديدة ، وأكثر هذه العوامل المحددة لإنتاجية المحاصيل هى إرتفاع محتوى كربونات الكالسيوم ، القلوية ، الملوحة ، القوام ، عمق القطاع الارضى والصرف الردىء .

وتم دراسة عشرة محاصيل هى : القمح ، الذرة ، القطن ، الارز ، الزيتون ، البلح ، البصل ، المانجو ، الطماطم والبرسيم .وباستخدام أكثر من نظام لتقييم هذه الأراضى تم تقسيمها الى ثلاثة درجات هى : S_1, S_2, S_3 and N

ووجد أن أنسب المحاصيل لهذه الأراضى هى: البرسيم ، القمح ، القطن ، الطماطم والذرة . ولتحسين خواص هذه الأراضى وزيادة إنتاجيتها يجب العناية بالإدارة الزراعية لتقليل الملوحة ، القلوية ، كربونات الكالسيوم وتحسين نظام الصرف .