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Assessment of Land Suitability Index for the Wheat Crop Production by Using Sys's Method and ALES Program

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ABSTRACT

Land suitability index for the wheat cultivation is carried out in east of the Nile delta of Egypt. The present area occupies the southern part of Ismailia canal and is bounded by latitudes 30° 35' 10"–31° 05' 00" N and longitudes 31° 15' 0"–32° 22' 08" E. Seventeen soil profiles were dug and classified as Typic Torrifluvents, Vertic Torrifluvents, Lithic Torriorthents, Typic Torripssaments and Typic Haplosalids. The criteria of land suitability for wheat production were adopted from guidelines of FAO (1976) and were carried out using two methods (Sys's method and ALES program). Most of the soils under study were suitable for wheat crop production by using both two approaches. The Sys's method has three classes, highly suitable (S1): 30.75%, moderately suitable (S2): 60.55% and marginally suitable (S3): 8.15%. While the results obtained by using the ALES program also has three classes, highly suitable (S1): 25.50%, suitable (S2): 65.80% and permanently not suitable (NS): 8.15%. Marginally or not suitable areas occurred in lakebeds mapping unit and agree with the adverse soil physical and chemical qualities (very poor drainage, heavy soil texture, high EC, high ESP and high pH). The compare of the results of the two methods indicated that, high level of agreement between the Sys's method and the ALES program, whereas all mapping units have the same classes except for two mapping units. At the local level, this study may be utilized by farmers and decision-makers for maintaining food security and for achieving sustainable agricultural development.

Keywords: Land suitability, ALES-arid, GIS, and Nile Delta.

INTRODUCTION

The rapid growth of the world's population is a limiting factor to the agricultural lands, population growth requires increased utilization of land resources to meet the population needs to achieve the sustainable development (Ahmed, 2016). Worldwide, agriculture has proven the potential to increase food supplies (Dent, 1993) and many of the cultivation land has become unsuitable for food production (Verheye, 2008). Agriculture is one of the largest sectors of the Egyptian economy (CAPMAS, 2012). In Egypt, lands resources face threats from land deterioration and very rapidly of people number, so conservation of the natural resources is essential for sustainable land management. (Hamza and Mason, 2004). The horizontal agricultural expansion in new desert lands is the important aim of Egyptian agricultural policy to meet the population growth and to compensate for the successive loss of agricultural land (Aldabaa *et al*., 2010 and Ismail and Kotb, 2010).

Evaluation of land resources is the basis for sustainable development (Dumanski *et al*., 2010; Mohana e al., 2009). Estimation of land suitability is used to identify which land use is the best for increasing land productivity (Halder, 2013; Chen, 2014 and Bodaghabadi *et al*., 2015). The main product of land evaluation is a land suitability classification for specific land uses and prediction the limitations for production crops (FAO, 1993; Mu, 2006; FAO, 2008; Pan and Pan, 2011 and AbdelRahman *et al*., 2016). Assessment of land suitability depends on land quality and land productivity (Counsel, 1999). Agriculture suitability analysis using to identify the land resources to provide decisions on farming (Fekadu and Negese, 2020). FAO (1976 &1985) and Sys *et al.* (1991) were widely used for land suitability assessment according to physical and chemical properties of soils. In general, many parts of Egypt using different programs such as ALES, LECS, MicroLEIS and GIS for land suitability evaluation by many researchers (Sys *et al*., 1991 and Ganzorig, 1995; Khalifa, 2001; Ahmed, 2016 and Abd El-Aziz, 2018). ALES program is a type of land evaluation system according to the method presented in the FAO guidelines and is allows land decision-makers to build sustainable systems (Johnson and Cramb, 1991). Land suitability assessment is essential for improvement land productivity and development a sustainable land management (Taghizadeh-Mehrjardi *et al*., 2020). Land suitability maps provide the necessary information for agricultural planners and decreasing land degradation for sustainable land use (Bagherzadeh and Daneshvar, 2014). The wheat crop production in Egypt is one of the crops which tolerate different types of stress and is considered the important crop in the winter season (FAO, 2005).

Geographic Information Systems (GIS) and Remote sensing (RS) were used in several studies for mapping of land suitability for crop production (El Baroudy, 2011; Saleh and Belal, 2014 and Mishelia and Zirra, 2015). The GIS as a set of tools for the input, output, storage, analysis of spatial data and successful tools in processing, studying and mapping (Malczewski, 1996). The technique of GIS has

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been used to evaluate the land suitability (Abdel-Motaleb, 1997). Evaluation of soils and crops can be handily by using geographic information system (GIS) (Mohamed *et al*., 2013). The use of GIS and the ALES-arid model capable of analyzing many variables has better the land evaluation (Elsheikh *et al*., 2013). Advanced technologies, such as GIS and RS will help planners and decision-makers for analyzing information (Moghanm, 2014). GIS technique can provide a powerful tool in agricultural planning of an area for the land-use suitability (Yousif, 2014).

The aim of this study is to classify and compare the land suitability for the wheat crop production in the eastern Nile Delta area, Egypt using a GIS and two evaluation approaches (the Sys method and ALSE-arid program).

MATERIALS AND METHODS

Description of the study area

The investigated area is occupying the eastern Nile delta region and it extend towards the north edge of Ismailia Governorate. It is located between latitudes 30° 35' 10''–31° 05' 00'' N and longitudes 31° 15' 00''–32° 22' 08'' E, covering 112583 ha. (Figure 1). According to USDA (2010), the soil temperature regime and moisture regime of the current area are thermic and torric, respectively. The most important climate characteristics were collected from Ismailia metrological station. The annual rainfall is very low and reaching about 3.2 mm/year in the winter. The mean annual temperature of 24.1 °C (mean maximum temperature is recorded in July, reaching about 36.5 °C and the mean minimum temperature is recorded in January, reaching about 11.7 °C). The values of annual relative humidity 58.6%. The area was formed during the Holocene period (Mikhailova, 2001). The main geomorphological units in the east of the Nile delta, namely: flood plain, old deltic plain, aeolian plain and lacustrine plain (Mohamed, 2006). According to Belal (2001) and Salama (2015), the main cultivated plants in the studied area are wheat, maize, barley, rice, beans, clover, cotton, tomatoes, potatoes, eggplant, watermelon, banana guava, date palm trees and citrus.

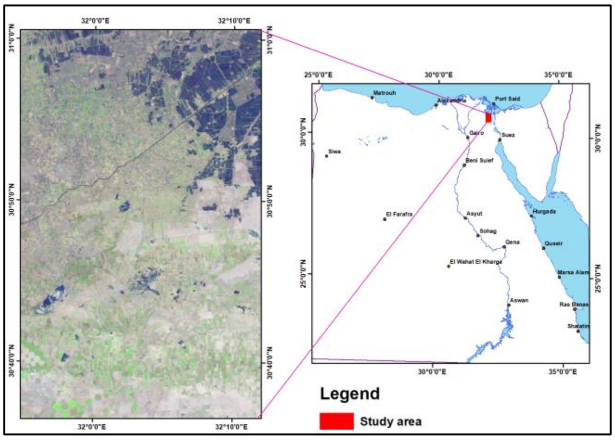

Figure 1. Location map of the study area.

Digital image processing and identifying the mapping units.

Digital image processing for Landsat-8OLI image acquired in 2020 (path 176 / row 39) was performed using ENVI 5.3 software and Arc-GIS 10.3 software. Digital Elevation Model (DEM), field interpretation and the data of the soil survey were successfully used to identify the different mapping units of the study area and to gain an appreciation of the slope gradient.

Fieldwork and laboratory analyses

Seventeen soil profiles were selected in the current study to represent the identified mapping units, the locations of these profiles were defined by using the GPS. A detailed morphological description of soil profiles was recorded based on the guidelines of FAO (2006) and they were classified according to USDA (2010). A total of 46 soil samples, representing the different soil horizons and stored for different laboratory analyses. Soil physical and chemical analyses were carried out according to the methods described by the Soil Survey Staff (2014).

Methods of land suitability index (LSI).

Classifications of land evaluation in the current study were undertaken according to the FAO (1976) system. The studied soils were evaluated for agriculture suitability for the wheat cultivation using two methods; the first method was based on Sys *et al*., (1993), while the second method was applying the Automated Land Evaluation System (ALES) program (Ismail *et al*., 2005).

Classification of LSI for the wheat crop according to Sys *et al*., (1993).

According to Sys *et al*., (1993), land suitability for the wheat crop is a qualitative and quantitative evaluation based on some indicators, which influence on growth of the wheat crop. Three factors were used including: soil chemical, soil physical, soil fertility qualities. To assess land suitability for the wheat crop in the current study there are seventeen parameters are drainage, texture, depth, topography, surface stoniness, hardpan, hydraulic conductivity, water holding capacity, EC, ESP, $CaCO_3$, pH, OM, N, P, K and Zn. The output results are display in maps that show the spatial distribution of each factor and final suitability map for the wheat crop. The following equation was used to calculate the land suitability index using ArcGIS 10.3 software:

$$LSI = (SFQI \times SCQI \times SPQI)^{1/3} \quad \text{...... Eq. (1)}$$

Where,

LSI is the land suitability index, SFQI is the soil fertility quality index, SCQI is the soil chemical quality index and SPQI is the soil physical quality index.

The physical quality index was calculated using the following formula:

$$SPQI = (P_D \times P_T \times P_E \times P_G \times P_N \times P_R \times P_L \times P_W)^{1/8} \quad \text{.... Eq. (2)}$$

Where,

SPQI is the soil physical quality index, P_D is the drainage, P_T is the texture, P_E is the soil depth, P_G is the topology, P_N is the surface stoniness, P_R is the hardpan depth, P_L is the hydraulic conductivity and P_W is the water holding capacity.

The chemical quality index was calculated using the following formula:

$$SCQI = (C_S \times C_E \times C_C \times C_H)^{1/4} \quad \text{....... Eq. (3)}$$

Where,

the SCQI is the soil chemical quality index, C_S is the EC, C_E is the ESP, C_C is the $CaCO_3$ content and C_H is the soil pH.

The fertility quality index was calculated using the following formula:

$$SFQI = (F_{OM} \times F_N \times F_P \times F_K \times F_{Zn})^{1/5} \quad \text{...... Eq. (4)}$$

Where,

SFQI is the soil fertility quality index, F_{OM} is the organic matter content, F_N the available-N, F_P is the available-P, F_K is the available-K and F_{Zn}, is the available-Zn.

Ratings of the different land qualities and the final LSI for the wheat crop.

The parameters were rated based on FAO (1976) and Sys *et al*., (1993). Rating is usually expressed in numerical terms; rates were assigned for each parameter with scores ranging from 1 = "the best value" to 0.2 = "the worst value" (Table 1). The land quality ratings for physical, chemical and fertility qualities were divided into four classes: high, moderate, low and very low. While the final suitability ratings were then divided into four classes: (S1) highly, (S2) moderately, (S3) marginally and (N) unsuitable (Table 2).

Table 1. Parameters, units and scores for different land qualities according to FAO (1976) and Sys *et al*. (1993).

Parameter	Unit	Score			
		1	0.8	0.5	0.2
Soil physical quality index (SPQI)					
Drainage	--	Well	Moderate	Poor	Very poor
Texture	%	L,SCL,SL,LS,CL	SC,SiL,SiCL	Si,C,SiC	C,S
Depth	Cm	>100	100-50	50-25	<25
Topography (slope)	%	<2	2-4	4-6	>6
Surface stoniness (>2mm)	%	<20	20-35	35-55	>55
Hard pan	Cm	>100	100-50	50-20	<20
Hydraulic conductivity	cm/h	<0.5	0.5-2	2-6.25	>6.25
Water holding capacity	%	>50	50-20	20-15	<15
Soil chemical quality index (SCQI)					
EC	dS/m	<4	4-8	8-16	>16
ESP	%	<10	10-15	15-20	>20
$CaCO_3$	g/kg	<50	50-100	100-150	>150
Soil Ph	--	5.5-7.0	7.0-7.8	7.9-8.5	>8.5
Soil fertility quality index (SFQI)					
OM	g/kg	>20	10-20	5-10	<5
N	mg/kg	>80	80-40	40-20	<20
P	mg/kg	>15	15-10	10-5	<5
K	mg/kg	>400	400-200	200-100	<100
Zn	mg/kg	>1	1-0.5	0.5-0.25	<0.25

Table 2. Classes of different land qualities and LSI evaluation according to Sys *et al*., (1993).

Land quality evaluation							Land suitability evaluation		
Description	Physical quality index (PI)		Chemical quality index (CI)		Fertility quality index (FI)		Description	Land Suitability Index (LSI)	
	Class	Range	Class	Range	Class	Range		Class	Range
High quality	P1	> 0.75	C1	> 0.90	F1	> 0.90	Highly suitable	S1	1 – 0.8
Moderate quality	P2	0.75 - 0.50	C2	0.90 - 0.70	F2	0.90 - 0.70	Moderately suitable	S2	0.8 – 0.6
Low quality	P3	0.50 - 0.25	C3	0.70 – 0.50	F3	0.70 - 0.50	Marginally suitable	S3	0.6 – 0.4
Very low quality	P4	< 0.25	C4	< 0.50	F4	< 0.50	Unsuitable	N	<0.4

Classification of LSI for the wheat crop using ALES program.

Classification of agriculture suitability for the wheat production by using the ALES program was according to Ismail *et al*. (2005). The ALES model is a type of soil suitability evaluation that indicates the degree of suitability for a specific land use. The soil parameters used for estimating the suitability index for the wheat crop were, climate, slope, drainage, texture, soil profile depth, calcium carbonate, gypsum status, pH, salinity and sodicity. The suitability classes according to ALES program were includes six classes are: highly suitable (S1), suitable (S2), moderately suitable (S3), marginally suitable (S4), currently not suitable (NS1) and permanently not suitable (NS2) (Table 3). The calculation of the land suitability for the wheat crop is integrated with the ArcGIS 10.3 software.

Table 3. LSI classes and ratings using ALES program.

LSI class	Description	Rating (%)
S1	Highly suitable	>80
S2	Suitable	80-60
S3	Moderately suitable	60-40
S4	Marginally suitable	40-20
NS1	Currently not suitable	20-10
NS2	Permanent not suitable	<10

RESULTS AND DISCUSSION

Physiographic map and soils of the study area

The physiographic units of the studied area have been identified based on a Landsat-8 image, the field investigation and the DEM. The obtained results reveal that the main landforms in the study area are flood, lacustrine and aeolian plains as shown in Table 4 and Figure 2. The flood plain is the main landform in the present area and covering 45986 ha. (40.70% of the total area). This landform resulted from the Nile deposits during the flooding periods. The different mapping units of the flood plain are old river terraces, recent river terraces, decantation basins and overflow basins, with areas of about 11246, 15325, 13467 and 5948 ha., respectively. The lacustrine plain dominates the northern part of the area, these soils developed by sea and Nile river actions. The included mapping units in this landform are sabkha (13328 ha.) and lake beds (9185 ha.). The aeolian plain dominates the middle parts of the area, as represented by the mapping units of sand sheets (12842 ha.) and sand plains (30897 ha.). Also, the distribution of soil profiles on the studied area is illustrated in Figure 2. Results indicated that the main soil sub great soil groups in the study area according to USDA (2010) are Typic Torrifluvents, Vertic Torrifluvents, Lithic Torriorthents, Typic Torripssaments and Typic Haplosalids. These sub great groups represent 23.80%, 13.60%, 9.95%, 44.13% and 8.15% of the total area, respectively as shown in Table 5 and Figure 3.

Table 4. Physiographic units, percentages of the total area and representative soil profiles.

Landscape	physiographic unit	Number of soil profile	Area ha.	%
Flood plain	Old river terraces	1, 2 and 3	11246	9.95
	Recent river terraces	4 and 5	15325	13.60
	Decantation basins	6 and 7	13467	11.90
	Overflow basins	8 and 9	5948	5.25
Lacustrine plain	Sabkhas	10, 11 and 12	13328	11.80
	Lakebed	13	9185	8.15
Aeolian plain	Sand sheets	14 and 15	12842	11.40
	Sand plains	16 and 17	30897	27.40
Water body			645	0.55
Total area			112583	100.00

Table 5. Soil taxonomy according to USDA (2010) of the studied area.

Soil order	Soil sub-order	Soil great group	Soil sub-great group	Area (ha.)	%
Aridisols	Salids	Salorids	Typic Haplosalids	9185	8.15
Entisols	Orthents		Lithic Torriorthents	11246	9.95
	Fluvents	Torrifluvents	Vertic Torrifluvents	15325	13.60
			Typic Torrifluvents	26795	23.80
	Psamments	Torripsaments	Typic Torripsaments	49687	44.13

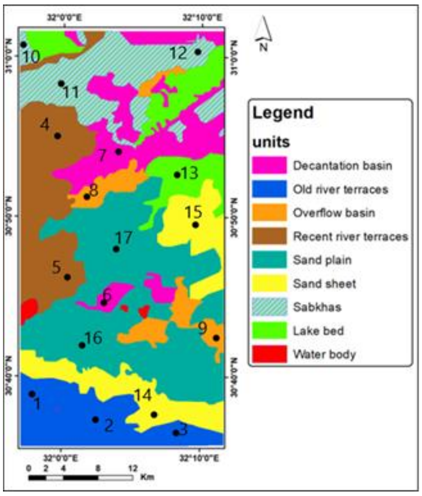

Figure2.Physiographic map and distribution of soil profiles on the eastern Nile delta.

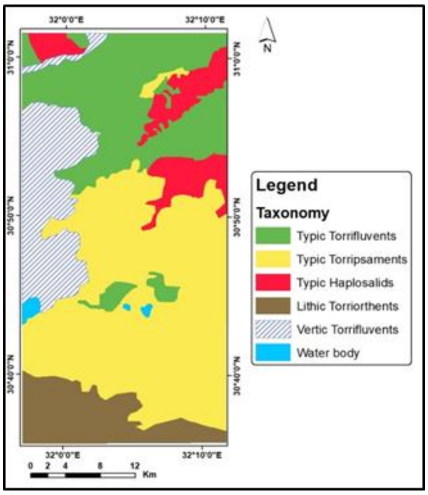

Figure 3. Soil taxonomy of the eastern Nile delta.

Assessment of LSI for the wheat crop production.

The soil profiles in the present study area were evaluated to classify their agriculture suitability for the wheat crop cultivation according to two approaches, namely Sys's method according to Sys *et al*. (1993) and the ALES program.

Assessment of LSI for the wheat crop according to Sys *et al*. (1993).

This method was using the three factors: soil physical, chemical and fertility qualities as the following:

-Soil physical quality index (SPQI)

Factors of physical land suitability that considered as one of the important methods, which evaluating the land suitability for a specific type of land use (Motuma *et al*., 2016). Results of SPQI showed that 15.20%, 64.30% and 19.95% of the area were high, moderate and low quality, respectively as shown in Table 6 and Figure 4.

Table 6. SPQI classes, mapping unit and area in the eastern Nile delta area.

SPQI class	Grade	Range	Mapping unit	Area ha.	%
High quality	P1	> 0.75	Old river terraces and Overflow basins,	17194	15.20
Moderate quality	P2	0.75 - 0.50	Recent river terraces, Decantation basins, Sand sheets and Sand plains	72531	64.30
Low quality	P3	0.50 - 0.25	Sabkha and Lakebed	22513	19.95
Very low quality	P4	< 0.25	------	------	------

The lowest SPQI occurred in sabkha and lakebed mapping units, those values being a result of adverse hydraulic conductivity and very poor drainage and the heavy clay texture soil.

-Soil chemical quality index (SCQI).

The soil chemical characteristics such as salinity, sodicity and pH are affecting the the production of crops (Eugène *et al*., 2010). The data illustrated in Table 7 and Figure 5 showed that the SCQI in the current area is as follows; 79.50% is high quality, 11.80% is low quality. About 8.15% of the study area is classified as very low quality, due to some limiting factors such as high EC, high ESP and high pH.

Table 7. SCQI classes, mapping unit and area in the eastern Nile delta area.

SCQI class	Grade	Range	Mapping unit	Area ha.	%
High quality	C1	> 0.90	Recent river terraces, decantation basins, old river terraces, overflow basins, sand sheets and sand plains	89725	79.50
Moderate quality	C2	0.90 - 0.70	-------	-------	------
Low quality	C3	0.70 - 0.50	Sabkhas	13328	11.80
Very low quality	C4	< 0.50	Lakebeds	9185	8.15

-Soil fertility quality index (SFQI).

Cation exchange capacity (CEC), organic matter (OM) and available nutrients are used as a measure of soil fertility and productivity (FAO, 2005). The results which are illustrated in Table 8 and Figure 6 indicate that, the SFQI of the investigated soils were located within four classes, which are high, moderate, low and very low. These qualities represent 45.45%, 5.25%, 21.40% and 27.40% of the total area, respectively. The low and very low-quality classes occurred in the old river terraces, sand sheets and sand plains mapping units due to decreased organic matter content and available N-P-K.

Table 8. SFQI classes, mapping unit and area in the eastern Nile delta area

SFQI class	Grade	Range	Mapping unit	Area	
				ha.	%
High quality	F1	> 0.90	Recent river terraces, decantation basins, sabkhas and lakebeds	51305	45.45
Moderate quality	F2	0.90 - 0.70	Overflow basins	5948	5.25
Low quality	F3	0.70 - 0.50	Old river terraces and sand sheets	24088	21.40
Very low quality	F4	< 0.50	Sand plains	30897	27.40

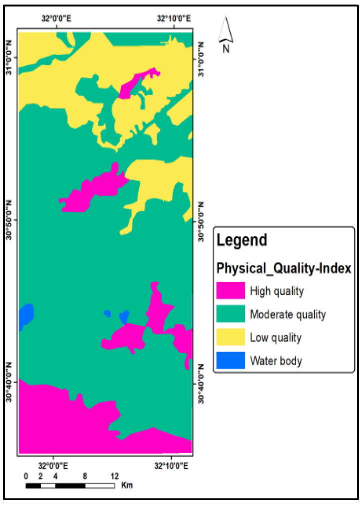

Figure 4. PCQI map of the eastern Nile delta.

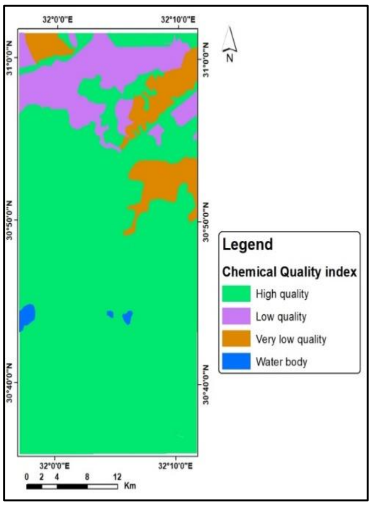

Figure 5. SCQI map of the eastern Nile delta.

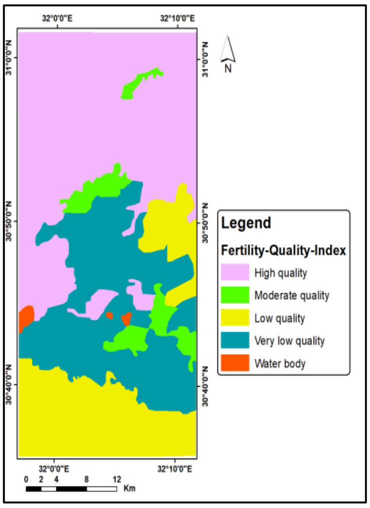

Figure 6. SFQI map of the eastern Nile delta.

Combining three land qualities and determining the final of LSI in the eastern Nile delta.

The overall LSI map according to Sys's method for the wheat crop was produced based on three layers of physical, chemical and fertility qualities. The weighted overlay process was applied to different thematic layers. The results of the Sys's method for the wheat crop production as shown in Table 9 and Figure 7 indicate that, the most units fall under the highly class (S1) which represents 30.75% of the total area (34740 ha.) in the recent river terraces, decantation basins and overflow basins mapping units. The moderately class (S2) represents 60.55% of the total area (68313 ha.) in the old river terraces, sabkhas, sand sheets and sand plains mapping units. About 8.15% of the study area (9185 ha.) in the lake beds mapping unit was marginally class (S3) and those areas have adverse physical and chemical properties of the soil.

Table 9. LSI classification for the wheat crop according to Sys *et al.* (1993) in the eastern Nile delta.

Description	Grade	Range	Mapping unit	Area	
				ha.	%
Highly suitable	S1	1 – 0.8	Recent river terraces, Decantation basins and Overflow basins	34740	30.75
Moderately suitable	S2	0.8 – 0.6	Old river terraces, Sabkhas, Sand sheets and Sand plains	68313	60.55
Marginally suitable	S3	0.6 – 0.4	Lakebeds	9185	8.15
Unsuitable	N	<0.4	-------	--------	--------

Finally, all the data obtained were input into ArcGIS 10.3 software to map the spatial distributions of the different suitability classes. The results of this method were then compared with the results of the ALES program.

Assessment of LSI for the wheat crop according to ALES program.

The ALES program was used to predict agriculture suitability for the wheat cultivation in the study area. The soil suitability class data are presented in Figure 8 and Table 10,

Table 10. LSI classification for the wheat crop using ALES program.

Description	Grade	Range (%)	Mapping unit	Area	
				ha.	%
High suitable	S1	>80	Recent river terraces, decantation basins	28792	25.50
Suitable	S2	80-60	Old river terraces, overflow basins, sabkhas, sand sheets and sand plains	74261	65.80
Moderate suitable	S3	60-40	-------	-------	-------
Marginal suitable	S4	40-20	-------	-------	-------
Currently not suitable	NS1	20-10	-------	-------	-------
Permanently not suitable	NS2	<10	Lakebed	9185	8.15

which indicates the distribution of suggested cultivated wheat crop for each soil mapping unit in the studied area. The obtained results can be indicated that, the suitability map for the wheat crop production has three suitability classes, namely as follows:

1- **S1:** represented 25.50% of the total area (28792 ha.) is highly suitable and found in these mapping units: the recent river terraces and decantation basins.
2- **S2:** represented most of the studied area about 74261 ha. (65.80%) is suitable and found in the following mapping units**;** old river terraces, overflow basins, sabkhas, sand sheets and sand plains.
3- **NS2:** represented a small area about 9185 ha. (8.15%) is permanently not suitable for growing wheat (NS) and found in the lakebeds mapping unit.

Comparison between LSI classification by the Sys's method and ALES program.

When comparing the results of LSI classification for the wheat cultivation given by the Sys's method and the ALES program all units have the same classes with the two exceptions of soils, the first exception in the overflow basins mapping unit which is the highly suitable class (S1) in the Sys's method but is the suitable class (S2) in the ALES program. The second exception is the lake beds mapping unit which is the marginally suitable (S3) in the Sys's method but is the permanently not suitable (NS) in the ALES program (Figure 9).

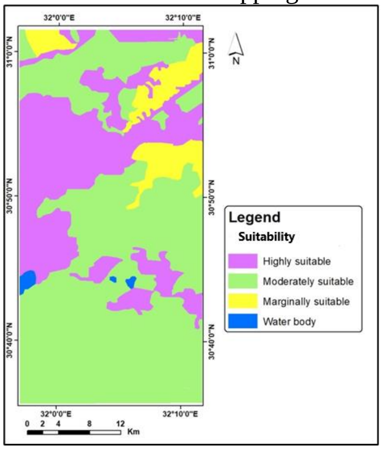

Figure 7. LSI map using Sys's method.

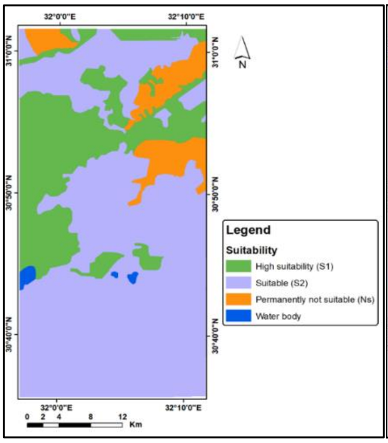

Figure 8. LSI map using ALES program.

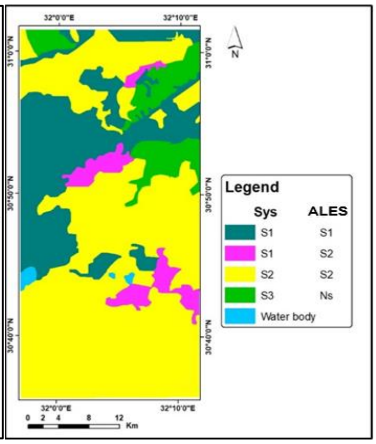

Figure 9.Comparison between LSI classification by the Sys's method and ALES program.

CONCLUSION

The purpose of this study was to define the indicators that hinder the production of the wheat crop. The various parameters used to analyze the suitability of the wheat crop in the investigated area, were soil texture, slope, drainage, hydraulic conductivity, water holding capacity, pH, EC, ESP, calcium carbonate content, gypsum content, organic matter content and available N, P, K and Zn. GIS is an available tool to compute and map for land suitability indices, which are resulted from applying two methods (Sys's method and ALES program). These methods were found to be suitable for use under Egyptian conditions, where wheat crop is recommended to be grown in the present area. Most of mapping units in the current study fall under the highly suitable class and the moderately suitable class for the wheat cultivation. On the other hand, the different soil maps produced for agricultural suitability in this work can help carry out the management practices.

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تقييم دليل ملائمة التربة لإنتاج محصول القمح باستخدام طريقة Sys's وبرنامج ALES

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دليل ملائمة الأراضي لزراعة محصول القمح في شرق دلتا النيل من مصر. المنطقة المدروسة تحتل الجزء الجنوبي من ترعة الإسماعيلية وتقع ما بين دائرتي عرض 30° 35' 10''–31° 05' 00'' شمالا وخطى طول 31° 15' 00''–32° 22' 08'' شرقا. تم حفر 17 قطاع أرضى وتم تصنيفهم الى رتبتين وهما رتبة الأراضي الجافة ورتبة الأراضي الحديثة وتصنف كالتالي: Typic Torrifluvents, Vertic Torrifluvents, Lithic Torriorthents, Typic Torripsamments, Typic Haplocalcids. وتم تصنيف ملائمة التربة باستخدام طريقتين هما طريقة Sys's وبرنامج ال ALES تبعا للقواعد الارشادية لل FAO (1976). معظم أراضي منطقة الدراسة تكون ملائمة لنمو محصول القمح تبعا لتلك الطريقتين. طريقة Sys's تصنف منطقة الدراسة إلى ثلاثة اقسام وهي: عالية الملائمة:S1 (30.75%) ومتوسطة الملائمة:S2 (60.55%) وحدية الملائمة:S3 (8.15%) وكذلك النتائج المتحصل عليها ببرنامج ال ALES تصنف الأراضي الى ثلاثة اقسام وهي: عالية الملائمة:S1 (25.50%) وملائمة:S2 (65.80%) وغير ملائمة بشكل دائم:NS (8.15%). والمناطق الحدية او غير الملائمة بشكل دائم تكون في الوحدة الخرائطية Lakebed وتحدث نتيجة لتدهور الخصائص الطبيعية والكيميائية للتربة (سوء الصرف، القوام الطيني الثقيل، ارتفاع نسبة الملوحة والصودية وارتفاع رقم ال pH). المقارنة ما بين الطريقتين توضح ان طريقة Sys's تمتلك مستوى عالي من التوافق مع برنامج ال ALES حيث ان كل الوحدات الخرائطية تمتلك نفس التصنيف ما عدا استثنائين فقط. على المستوى المحلى، هذه الدراسة من الممكن الاستعانة بها من قبل المزارعين وصناع القرار من اجل حفظ الأمن الغذائي وتحقيق التنمية الزراعية المستدامة.