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USING THE LAND EVALUATION SYSTEM TO ACHIEVE OPTIMAL INVESTMENT IN SOUTH EL-AMIRIA SOILS, ALEXANDRIA GOVERNORATE, EGYPT

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ABSTRACT: The study area is located between longitudes 29^{o} 47` 55``and 30$^{o}$ 30`05`` East and latitudes 29^{o}29`30`` and 30$^{o}$ 30` 05`` North and comprises an area of about 571168 Feddans. The current study is considered an attempt to achieve the optimal investment based on the Land Evaluation System. The study area was assessed based on existing and prospective conditions. Additionally, delineate the various limiting factors of each soil location. The viability of crops was assessed based on the specifications of different land units and by comparing the relative viability of the crops to one another. Soils of profiles 2 and 9 recorded high suitability index in both current and potential suitability index for lacustrine and windblown sand, respectively. The most suitable fruit crops were olives, followed by guava, and sesame was the most suited field crop. While the watermelon crop exhibits the highest suitability among vegetable crops. The study also included determining the water requirements for each crop separately by calculating reference evapotranspiration (ETo) and crop evapotranspiration (ETcrop). Evapotranspiration was calculated using standard conditions. Crop evapotranspiration is derived from meteorological and crop data through the Penman-Monteith equation. The annual water consumption was recorded at 1300.524 mm/year.

Keywords: Physiographic units, land evaluation, land suitability evaluation for crops, reference evapotranspiration (ET_o), water requirements.

INTRODUCTION

Subjugate of the soil taxa for land suitability classification is important to find out the soil limitations to choose the best methods for managing these soils. Also, choosing the most proper crops for each site and calculating the water consumptive use for promising crops are very necessary for agricultural investments.

Pedological studies were done by Zayed *et al.* (2020 and 2021) on soils of South El-Amiria soils, Alexandria governorate, Egypt. This area is located between longitudes 29^{o} 47` 55``and 30$^{o}$ 30`05`` East and latitudes29^{o}29`30`` and 30$^{o}$ 30` 05`` North and comprises an area of about 571168 Feddans. The visual analysis and interpretation of satellite images of this area indicate that it has two main physiographic units. The first one is the lacustrine plain unit, which has a texture between coarse and fine loamy. It is significantly affected by one or more of the following properties soluble salts, gypsum, and lime. The second is the windblown sand unit, which has a sandy texture with or without lime contents (Map, 1). In addition, these studies included two soil classifications according to Soil Survey Staff (2014) and WRB (2006) systems, and sedimentological properties.

Land evaluation is a vital link in the chain leading to sustainable management of land resources (FAO, 2007). Classification of soils for irrigation utilization aims at assessing the degree of limitation or suitability for agricultural use based on their permanent properties. In this context, several systems have been proposed to assess the agricultural constraints that influence land capability, as outlined by the FAO (1976). Some studies have shown that evaluation for the same land uses carried out using qualities and characteristics produces very similar results such as Sys and Verheye (1978), Sys *et at.* (1991) and (1993), and FAO (2007). According to the same previous reference, the delineation of land

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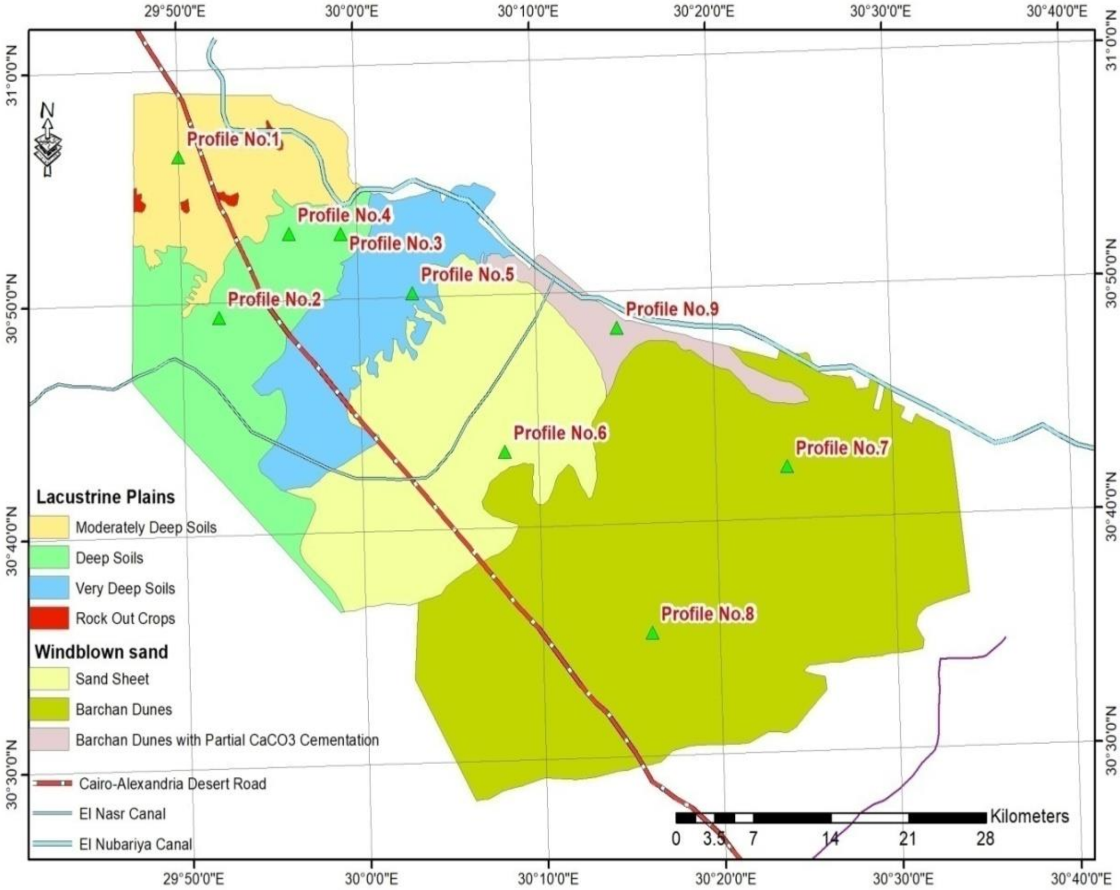
mapping units will be based in part on land characteristics, most readily frequently identified landforms, soils, and vegetation. However, at the stage of the resource survey, the land qualities believed to have significant effects on the types of land use under consideration have already been provisionally identified. Consequently, special attention should be given to those qualities during field surveys.



Map (1): Physiographic units, sub-units and representative soil profiles of South El-Amiria soils (after Zayed *et al.*, 2020).

Land evaluation for certain crops implies a matching of site conditions with the crop requirements, i.e., topography, wetness (irrigation & drainage), physical soil characteristics [texture/structure, coarse fragment (vol. %), soil depth (cm), $CaCO_3$(%) & Gypsum (%)], soil fertility [CEC (centimoles/kg clay), base saturation (%), sum of basic cations (centimoles/kg soil), pH (H_2O) & organic carbon] and salinity and alkalinity [EC_e (dS/m) & ESP (%)] according to Sys *et al.* (1993).

Irrigation water is one of the limiting factors in agriculture investment. Prediction methods for crop water requirements are owing to the difficulty of obtaining accurate field measurements (Doorenboss and Pruitt, 1975 and 1977). Crop water requirements are defined here as the depth of water needed to meet the water loss through evapotranspiration (ET crop) of disease-free, well-fertilized crops, growing in large fields under optimum soil water conditions and achieving full production under the given climatic conditions. The reference evapotranspiration is determined utilizing the FAO Penman-Monteith methodology, which is endorsed as the exclusive approach for calculating reference evapotranspiration (ETo) due to its accurate approximation of grass ETo. The meteorological factors that influence evapotranspiration are weather parameters that provide energy for vaporization and remove water vapor from the evaporating surface (Allen et al., 1988).

Sandy and calcareous soils occupy large areas in the arid and semi-arid regions, especially in the Arab world. These soils are generally characterized by low fertility levels, easy volatilization of ammonia, low water retention capacity, and alkaline effect (El-Tapey *et al.*, 2019 and Gaafar *et al.*, 2021).

The current study aims to maximize the benefit of the use of the land evaluation system in the fields of investment and social-economic development of the agricultural sector.

MATERIALS AND METHODS

The current study aims to achieve the benefit of the land evaluation system, so, it will include three axes:

First: land suitability evaluation: Sys *et al.* (1991) system was selected for land suitability evaluation of the studied area, since it is valid for irrigation purposes in arid and semi-arid regions according to the following equation.

$$C_i = t x \frac{w}{100} x \frac{S1}{100} x \frac{S2}{100} x \frac{S3}{100} x \frac{Su}{100} x \frac{n}{100}$$

Where:

C_i = Suitability index,
t = Topography limitation,
w = Wetness limitation,
$S1$ = limitation regard to texture including stones,
$S2$ = limitation regard to soil depth,
$S3$ = limitation regard to $CaCo_3$,
Su = limitation regard to gypsum statues,
n = Salinity and alkalinity limitation.

Second: Land suitability for certain crops: Crop requirements were studied according to Sys *et al.* (1993) which involved climate, landscape, soil conditions, and soil fertility characteristics.

Third: Crop water requirements: From the original Penman-Monteith equation and the equations of the aerodynamic and canopy resistance, the crop reference evapotranspiration (ET_o) is calculated through the following equation according to Allen *et al.* (1998).

$$ET_o = \frac{0.408\,\Delta\,(R_n - G) + \Upsilon \frac{900}{T+273} U_2\,(e_s - e_a)}{\Delta + \Upsilon\,(1 + 0.34U_2)}$$

Where:

ET_o = reference evapotranspiration [mm day^{-1}],
R_n = Net radiation at the crop surface [MJ m^{-2} day^{-1}],
G = Soil heat flux density [MJ m^{-2} day^{-1}],
= Mean daily air temperature at 2 m height [°C],
U_2 = Wind speed at 2 m height [m s^{-1}],
e_s = Saturation vapor pressure [kPa],
e_a = Actual vapor pressure [kPa],
e_s-e_a = Saturation vapor pressure deficit [kPa],
Δ = Slope vapor pressure curve [kPa $^oC^{-1}$],
Υ = Psychrometric constant [kPa $^oC^{-1}$].

Crop evapotranspiration is calculated by the reference evapotranspiration using the equation below:

$ET_c = K_c\ ET_o$

Where:

ET_c = Crop evapotranspiration [mm d^{-1}],
K_c = Crop coefficient,
ET_o = reference crop evapotranspiration [mm d^{-1}].

RESULTS AND DISCUSSION

The evaluation of soil taxa considers an outgrowth of pedological studies for land suitability classification and appreciating kinds of proper management that are supposed to favor the long-term advantage. The classification of soils for evaluating their suitability for irrigation utilization aims at assessing the degree of limitation or suitability for agricultural use based on their parameter properties. Sys et al. (1991) showed that the system chosen for land suitability evaluation in the current study is more proper for irrigation in arid zones, as the study area aligns with these conditions.

Land suitability classes are indicated degrees of suitability. Within the order suitable, there are normally three classes i.e. highly, moderately and marginally suitable which indicated by symbols S1, S2 and S3 respectively. Land suitability subclasses reflect the kind of limitations, or the kinds of improvement measures required within classes (Sys *et al.*, 1991). Land suitability units are subdivisions of land suitability subclass that differ from each other in detailed aspects of their production characteristics or management requirements, they are numbered successively following a hyphen. There are no subclasses to class S1 (FAO, 1991 and 2007).

Not suitable (N) land which has qualities that appear to preclude sustained use of the kind under consideration which has two classes i.e. class N1: currently not suitable and class N2: permanently not suitable.

The different suitability units of the studied area are recorded in Table (1) and Map (2). These suitability units are described as follows:

A: Current land suitability

Soils of $S2_{s3}$-1

This unit aligns with a physiographic unit of a deep lacustrine plain, as depicted by profile 2. These soils have a moderately suitable class (S2) with a suitability index of 70.56. Its subclasses appear to be moderate intensity of lime limitation which is considered as a limiting factor for suitable crops. These soils are distinguished by unit $S2_{s3}$-1.

Soil of $S2_{s4}$-1

This unit is associated with the same physiographic unit as the previous unit, which is represented by profile 4. These soils have the same previous class (S2) but have a suitability index of 66.15. The subclass is $S2_{s4}$ which has a moderate intensity of gypsum limitation recording 75.0 which is considered a limiting factor in soil management and land use. These soils lie in unit $S2_{s4}$-1.

Soils of $S2_{s1}$-1

The current unit represents soils of a very deep lacustrine plain which are considered to have the deepest depth and is represented by profile 5. These soils have also the same previous class (S2), but its subclass is S2s1 which appears the lowest value of the suitability index of 52.65. This subclass (S2s1) shows a moderately intensity texture limitation since its rating value is 65.0. This reflects the importance of the application of modern irrigation systems (trickle or sprinkle), organic matter, and fertilizers. These soils could have belonged to the unit of $S2_{s1}$-1.

Soil of $S3_{s1}$-1

This unit is related to soils of sand sheets and barchan dunes of the windblown sand physiographic unit, which is represented by soil profiles 6, 7, and 8. These soils have a marginally suitable class (S3) with a suitability index of 27.0. Its subclass $S3s_1$ has a very severe intensity of texture limitation with a rating of 30.0. That means more interest in adding soil improvements such as natural and synthetic conditioners. So organic matter and fertilizers, soil erosion control and soil conservation, sand dune stabilization, and application of modern irrigation systems such as sprinkler, trickle or drip irrigation ... etc. These soils lie in units of $S3_{s1}$-1.

Soils of $S3_{s1}$-2

This unit belongs to Barchans dunes with partial $CaCO_3$ cementations which are considered as a subunit of windblown sand physiographic unit. These soils have the same subunit ($S3_{s1}$) as the previous subunit directly, with a suitability index of 40.50. The soils under consideration have severe texture limitations. These soils lie in $S3_{s1}$-2 units due to the rating of texture limitation (50.0) and a slight intensity of lime limitation (90).

All previous soils have belonged to a suitable soil.

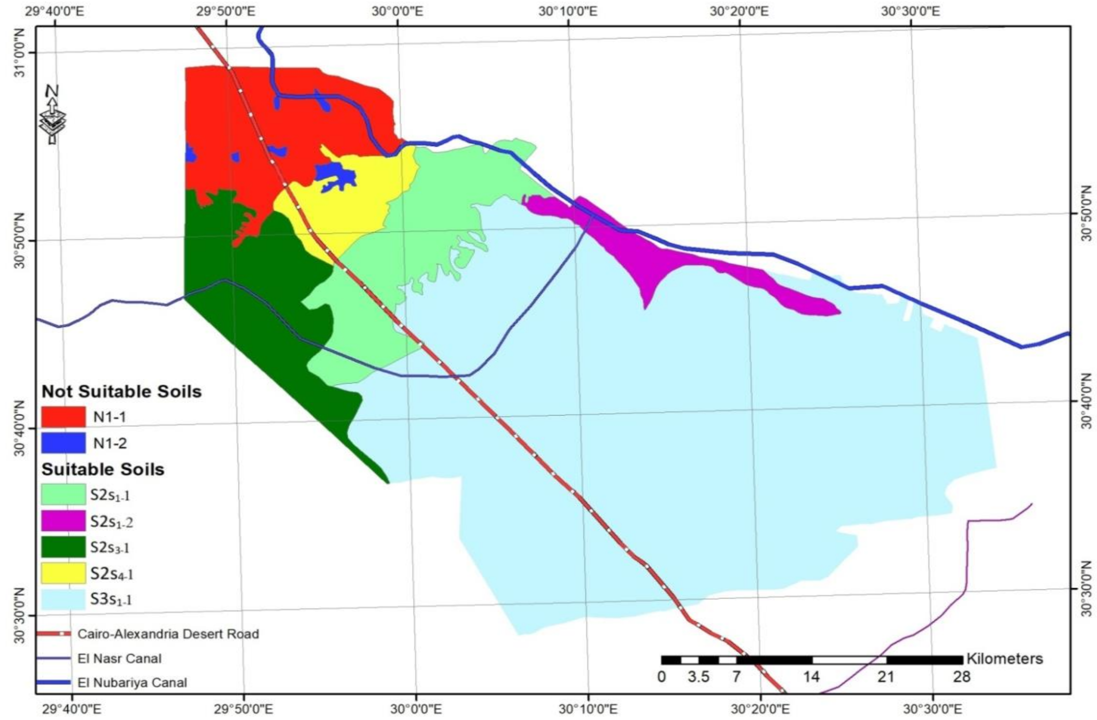
Soils of N1

The current unit has suitability indices of 12.24 and 21.87 in soil profiles l and 3, respectively. These soils could belong to the order of not suitable and class not suitable that can be corrected. These soils have very severe intensity of salinity and alkalinity limitation in both profiles which means that, the requirements to establish a drainage system to leach the soluble salts with the application of the gypsum requirements. Profile 1 appeared to moderate intensity of depth, lime, and texture limitations.

Table (1): Land suitability for irrigated agriculture (Sys *et al.*, 1991).

Physiographic Unit	Prof. No.	Topography (t)		Wetness (w)		Soil Physical Characteristics (s)					Salinity/alkalinity (n)		Current Suitability					Potential Suitability				
						Texture (s1)		Depth (s2)	Lime (s3)	Gypsum (s4)												
		CS	PS	CS	PS	CS	PS				CS	PS	Ci	Order	Class	Subclass	Unit	Ci	Order	Class	Subclass	Unit
Lacustrine Plain	1	100	100	100	100	85	90	60	80	100	30	85	12.24	N	N1	-	-	36.72	S	S3	$S3_{S2S3n}$	$S3_{S2S3}$ -1
	2	100	100	100	100	90	100	100	80	100	98	100	70.56	S	S2	$S2_{S3}$	$S2_{S3}$-1	80.00	S	S1	-	-
	3	100	100	90	100	90	100	100	90	100	30	85	21.87	N	N1	-	-	68.85	S	S2	$S2_n$	$S2_n$ -1
	4	100	100	100	100	100	100	100	90	75	98	100	66.15	S	S2	$S2_{S4}$	$S2_{S4}$ -1	67.50	S	S2	$S2_{S4}$	$S2_{S4}$ -1
	5	100	100	100	100	65	80	100	90	90	100	100	52.65	S	S2	$S2_{S1}$	$S2_{S1}$ -1	64.80	S	S2	$S2_{S1}$	$S2_{S1}$ -1
Windblown Sand	6	100	100	100	100	30	70	100	100	90	100	100	27.00	S	S3	$S3_{S1}$	$S3_{S1}$ -1	63.00	S	S2	$S2_{S1}$	$S2_{S1}$ -2
	7	75	100	100	100	30	70	100	100	90	100	100	27.00	S	S3	$S3_{S1}$		63.00	S	S2	$S2_{S1}$	
	8	60	100	100	100	30	70	100	100	90	100	100	27.00	S	S3	$S3_{S1}$		63.00	S	S2	$S2_{S1}$	
	9	100	100	100	100	50	80	100	90	90	100	100	40.50	S	S3	$S3_{S1}$	$S3_{S1}$ -2	64.80	S	S2	$S2_{S1}$	$S2_{S1}$ -1

CS: Current Suitability, PS: Potential Suitability, Ci: Suitability Index
S1: Highly Suitable (100 – 75), S2: Moderately Suitable (75 – 50), S3: Marginally Suitable (50 – 25)
N: Not suitable, N1: Not suitable that could be corrected.



Map (2): Current land suitability classification of South El-Amiria soils,

B: Potential land suitability

When the possible improvement operations are carried out and the possible soil limitations, the soils under study may show the following different suitability units according to Table (1).

Soils of $S3_{s2s3n}$-1

This unit belongs to the moderately deep-lacustrine plains physiographic unit which is represented by soil profile 1. These soils have a marginally suitable class (S3) with a suitability index of 36.72. Its subclass $S3_{s2s3n}$ has a moderate intensity of depth, lime content, and salinity/alkalinity limitations which means that the requirements of cultivation crops are consistent with this depth and contents of lime. The salinity of soil and irrigation water require drainage and irrigation systems on the other land application of the determine gypsum requirements, whereas these soils have permanent sources of salinity.

Soils of S1:

Soils of S1 are associated with the physiographic unit of the deep lacustrine plain represented by profile 2. These soils have a highly suitable class (S1) with a suitability index of 80.00 as potential suitability. There are no subclasses.

Soils of $S2_n$-1

This unit represents soils of deep lacustrine plains represented by the soils of profile 3. This land has a moderately suitable class (S2) with a suitability index of 68.65 as a potential suitability. The subclass $S2_n$ has moderate intensity of salinity and alkalinity limitations since its value is 85.0. Soil salinity needs the previous recommendation of the first unit.

Soils of $S2_{s4}$-1

The unit under consideration also belongs to the deep lacustrine plain and is represented by profile 4. This soil has a moderately suitable class (S2) as a previous unit, with a suitability index of 67.5 as a potential suitability. The subclass $S2_{s4}$ has a moderate intensity of gypsum contents of 75.0.

Soils of $S2_{s1}$-1

Data of potential suitability in Table (1) reveal soils of very deep lacustrine plains which are represented by Profile 5, as well as soils of barchans dunes with partial $CaCO_3$ cementations, which are represented by Profile 9. These soils have the same subclass $S2_{s1}$ with a suitability index of 64.8 as a potential suitability. This subclass has a moderate-intensity texture with a value of 80.0.

Soils of $S2_{s1}$ -2

This unit represents soils of sand sheets and barchan dunes of windblown sand. These soils have a moderately suitable class (S2) with a suitability index of 63.0 as a potential suitability. The subclass $S2_{s1}$ has a moderate intensity of texture limitation since its rate value is 63.0. These soils are represented by profiles 6, 7, and 8.

Crop suitability

Predicting more suitable crops for different soil map units according to landscape and soil characteristics is considered one of the most important goals of pedological studies for obtaining the best investment of land resources. To achieve this goal, the system was applied, and the results were recorded in Table (2) according to Sys, *et al.* (1993). The following is a detailed statement of the most important of these crops.

Fruit Trees

Data from the current suitability evaluation reveals that olive trees are a highly suitable fruit crop for the soils of deep lacustrine plains (profile, 5). Whereas this fruit crop is considered moderately suitable for the soils of windblown sand (9,8,6, and 7). Guava trees record the second place in the soils of very deep lacustrine plain (profile 5). It is considered moderately suitable and marginally suitable in soils of barchans dunes with partial $CaCO_3$ cementation of windblown sand (profile 9) and deep lacustrine plain (profile 4) respectively. Mango trees appear in the marginal suitability class in soils of barchans dunes and barchans dunes with partial $CaCO_3$ cementation (profiles 8, 9, and 7) respectively as well as in soils of very deep lacustrine plain (profile 5). Citrus trees record the lowest marginal level of suitability in soils of deep lacustrine plain (profile 5) and soils of barchans dunes with partial $CaCO_3$ cementation (profile 9). Banana trees showed no suitable results.

Table (2): Suitability valuation of some selected crops for the studied area.
(Fruit crops)

Profile No.	Banana		Citrus		Guava		Mango		Olive	
	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS
Lacustrine Plain										
1	0.90	8.50	0.30	2.08	3.89	38.8	0.30	3.00	6.58	31.20
2	2.41	16.99	1.09	5.20	8.86	80.00	1.54	8.80	18.63	85.36
3	2.36	9.15	1.19	3.98	11.67	40.00	1.56	5.64	10.84	33.18
4	1.98	8.00	1.75	4.80	28.34	80.00	3.50	7.65	16.72	21.25
5	11.58	27.74	29.06	38.24	61.53	90.00	28.26	38.24	88.08	99.60
Windblown Sand										
6	6.00	30.51	12.41	26.16	18.45	64.00	23.61	41.17	58.30	75.81
7	8.36	52.00	20.79	46.30	24.75	80.00	30.87	65.59	54.96	75.89
8	8.97	46.44	22.68	41.36	21.83	64.00	38.18	65.10	60.43	75.96
9	13.45	35.84	26.17	37.32	38.90	80.00	31.72	48.51	71.52	90.36

CS: Current Suitability **PS**: Potential Suitability

Table (2): Cont. (Field crops)

Profile No.	Alfalfa		Barley		Beans		Cotton		Cowpea		Sesame	
	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS
Lacustrine Plain												
1	2.83	12.12	5.66	24.22	0.40	3.76	2.62	16.3	1.36	12.90	8.82	37.60
2	6.68	30.56	12.78	52.84	0.83	8.00	9.01	38.07	5.03	27.50	19.94	100.0
3	5.83	16.93	10.97	29.48	1.20	4.00	7.55	22.20	5.23	16.93	20.16	40.00
4	7.70	11.60	18.02	20.13	2.26	8.00	11.53	14.10	4.44	9.28	32.38	90.00
5	35.89	43.13	41.69	61.15	13.46	23.65	36.65	47.96	30.40	43.13	48.27	100.0
Windblown Sand												
6	33.56	69.52	28.48	66.61	6.07	30.01	36.09	73.87	24.73	62.56	21.12	80.00
7	34.17	75.27	25.65	63.68	4.35	34.15	29.83	76.91	24.77	75.27	19.84	80.00
8	37.17	75.12	30.25	68.32	5.82	35.09	40.67	76.83	28.64	75.12	24.07	80.00
9	51.05	77.46	43.84	76.28	15.17	39.47	37.28	73.23	45.23	77.46	34.09	90.00

Profile No.	Sorghum		Soya		Wheat		Maize		Sugarcane		Sunflower	
	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS
Lacustrine Plain												
1	5.27	25.75	0.38	3.76	7.44	24.22	1.82	12.12	2.38	18.51	1.25	9.67
2	13.78	57.78	2.23	10.00	9.47	47.56	3.22	24.45	9.43	45.62	5.44	26.89
3	10.61	29.48	1.08	4.00	10.21	29.48	5.93	16.93	7.23	24.43	4.06	14.39
4	16.25	20.50	6.18	10.00	7.24	16.10	2.09	9.28	8.75	15.59	5.35	9.86
5	58.83	71.01	13.54	22.9	37.59	61.15	30.81	38.82	37.49	57.71	24.25	38.82
Windblown Sand												
6	40.56	76.13	12.15	33.12	20.41	59.95	32.20	69.52	26.13	68.31	21.13	59.09
7	39.69	76.13	10.61	38.38	21.93	63.68	32.53	75.27	22.47	70.67	20.19	63.98
8	41.83	78.08	18.20	41.06	22.72	68.32	35.81	75.12	29.18	70.67	25.76	63.85
9	42.19	76.28	21.01	42.61	41.55	76.28	51.25	77.46	47.91	82.46	36.54	70.49

CS: Current Suitability **PS**: Potential Suitability

Table (2): Cont. (Vegetable crops).

Profile No.	Cabbage		Carrot		Green pepper		Onion	
	CS	PS	CS	PS	CS	PS	CS	PS
Lacustrine Plain								
1	1.83	12.9	0.51	3.40	0.56	3.76	0.63	4.00
2	8.03	30.56	1.31	8.00	2.33	9.00	1.08	8.00
3	5.74	16.93	1.34	6.64	2.20	6.64	1.97	6.64
4	6.76	10.44	2.59	8.00	4.10	8.00	3.08	8.00
5	36.77	43.13	18.72	38.24	29.48	38.24	26.65	38.24
Windblown Sand								
6	32.46	69.52	11.96	43.60	21.95	43.60	15.16	38.75
7	28.55	75.27	20.77	77.17	33.56	77.17	27.12	77.17
8	38.49	75.12	22.80	68.93	39.40	76.58	26.38	61.27
9	36.84	68.85	20.49	52.49	31.83	52.49	26.23	47.24

Profile No.	Pea		Potato		Sweet potato		Tomato		Water melon	
	CS	PS	CS	PS	CS	PS	CS	PS	CS	PS
Lacustrine Plain										
1	1.28	12.12	2.40	16.00	2.48	12.12	0.32	3.00	3.17	30.00
2	3.90	24.45	6.34	36.00	6.18	30.56	1.83	8.80	17.04	88.00
3	4.78	16.93	4.13	16.56	3.62	14.36	1.59	5.64	10.20	34.00
4	3.40	9.28	10.57	32.00	3.72	9.00	4.74	8.50	38.14	76.50
5	24.08	38.82	23.39	40.00	22.11	39.12	24.18	38.24	70.36	100.0
Windblown Sand										
6	16.61	55.61	20.46	61.56	21.18	69.52	13.85	36.60	36.54	76.50
7	23.32	75.27	24.70	78.00	24.72	75.27	18.93	58.30	31.56	76.50
8	25.30	67.60	26.20	77.28	23.84	75.12	24.67	57.86	40.89	76.50
9	39.65	77.46	33.43	70.38	35.68	77.46	22.90	43.66	50.65	91.00

CS: Current Suitability **PS**: Potential Suitability

Data of potential suitability evaluation shows that olive trees record highly suitable class in all soils of windblown sand and very deep and deep lacustrine plains (profiles 5, 9, 2, 8, 7, and 6) respectively. While the soils of moderately deep and deep lacustrine plains of profiles 3 and 1 record marginal levels for this fruit crop. Soils of deep lacustrine plains of profile 4 are not suitable for olive trees. Guava trees record highly suitable class in very deep and deep lacustrine plains (profiles 5, 2, and 4) respectively as well as barchans dunes and barchan dunes with partial $CaCO_3$ cementation (profiles 9 and 7) respectively. While the rest soils of windblown sand achieve moderately suitable levels for this crop. On the other hand, guava appears marginal level in moderately deep and deep lacustrine plains (profiles 3 and 1). Mango trees achieve moderately suitable classes in soils of Barchans dunes (profiles 7 and 8) and marginally level in soils of Barchans dunes with partial $CaCO_3$ cementation, sand sheets, and very deep lacustrine plains (profiles 9, 6, and 5) respectively. Banana trees are considered within the marginal class while citrus trees appear not suitable for these soils. Therefore, it could be not recommended to cultivate it in these soils.

Field crops

Current suitability evaluation shows that both beans and soya crops are not suitable for these soils. While alfalfa, maize and sorghum showed a moderately suitability evaluation in soils of barchans dunes with partial $CaCO_3$ cementations (profile 9, for alfalfa and maize) and very deep lacustrine plain (profiles 5) for sorghum. Wheat crops achieve marginally suitable evaluations in the previous locations. Soils of very deep lacustrine plains (profile, 5) appear marginally suitable class for each alfalfa, barley, cotton, cowpea, sesame, maize, and sugarcane. Soils of windblown sand show marginally suitable class too for barely, cotton, and sorghum. Also, these soils have marginal suitability for alfalfa (except soils of profile 9), sugarcane (except soils of profile 7), cowpea, and sunflower in soils of profiles 8 and 9, and sesame in soils of profile 9 only.

Data of potential suitability evaluation reveal that sesame crop records are highly suitable class in all the physiographic units except moderately deep and deep lacustrine plains of profiles 3 and 1 that appear marginally suitability level. Sorghum shows a highly suitable evaluation level for soils of windblown sand, moderately level in very deep and deep lacustrine plains of profiles 5 and 2, respectively. While soils of moderately deep and deep lacustrine plains of profiles 1 and 3 respectively show marginal levels for this crop. Alfalfa, cowpea, and maize have highly suitable classes for windblown sand except for soils of sand sheets (profile 6) which appear moderately level. Soils of very deep and deep lacustrine plains of profiles 5 and 2 have marginally suitable classes for these crops except for maize in profile 2 which show no subtility results. Barley and wheat show high subtility evaluation in soils of barchans dunes with partial $CaCO_3$ cementation (profile 9) and moderate subtility evaluation for the rest of windblown sand (profiles 6,7 and 8) and very deep lacustrine plains (profile 5). Soils of deep lacustrine plain (profile 3) appear at a marginal level for these crops. Whereas soils of deep lacustrine plain (profile 2) appear moderately level for barley and marginally level for wheat. Sugarcane crops show the same trend as wheat except in soils of profile 3 which is considered not suitable. Cotton appears highly suitable in barchan dunes (profiles 7 and 8), while the rest of the windblown sand soils show moderately suitable ones. Soils of very deep and deep lacustrine plains (profiles 5 and 2) have a marginal suitable class for this crop. Sunflower corresponds with a moderately suitable class in soils of windblown sand and a marginal one in very deep and deep lacustrine plains (profiles 5 and 2). Beans and soya crops are within a marginally suitable class for soils of windblown sand.

Vegetable crops

The current suitability evaluation for vegetable crops shows that watermelon is the only one that has a moderately suitable class in very deep lacustrine plain and barchans dunes with partial $CaCO_3$ cementations (profiles 5 and

9, respectively). While the rest soils of windblown sand and deep lacustrine plain (profile 4) appear a marginally suitable class. Cabbage has a marginal level in both windblown sand and very deep lacustrine plains. Green pepper and onion are marginally suitable in soils of barchans duns, barchans dunes with partial $CaCO_3$ cementation, and very deep lacustrine plains. Pea and potato appear marginally classed in soils of barchans dunes (profile 8) and barchans dunes with partial $CaCO_3$ cementation. Sweet potato has marginally class in soils of barchans dunes with partial $CaCO_3$ cementation only. Carrots and tomatoes are not suitable crops in these soils.

The potential suitability evaluation results show high suitability evaluation for watermelon in all soils of the study area except soils of moderately deep (profile 1) and deep lacustrine plain (profile 3) which appear marginally suitable class. Sweet potato has a highly suitable class in soils of barchans dunes and barchans dunes with partial $CaCO_3$ cementation. It shows moderate class in soils of sand sheet and marginal class in soils of moderately deep (profile 2) and very deep lacustrine plains (profile 5). Cabbage and potato appear as highly suitable classes in soils of barchans duns, moderately one in soils of sand sheets and barchans dunes with CaCO3 cementation. Both crops have marginally suitable classes in soils of very deep lacustrine plain (profile 5) and of moderately deep (profiles 2 and 4 for potatoes while for cabbage only in soils of profile 2). Green pepper shows a high suitability class in soils of barchans dunes and moderately one in soils of barchans dunes with partial $CaCO_3$ cementation. It has a marginal level in sand sheets and very deep lacustrine plains. Pea crops show a highly suitable class in soils of barchans dunes with partial $CaCO_3$ cementation and of barchans dunes (profile 7). This crop has moderately suitable levels in soils of barchans dunes (profile 8) and sand sheets (profile 6). While it has a marginal class in soils of very deep lacustrine plains (profile 5). Carrot and onion crops appear as highly suitable classes in soils of barchans duns (profile 7). Carrots appear moderately in the soils of barchans duns (profile 8) and soils of barchans duns with partial $CaCO_3$ cementation, while onion has a marginal level in these soils. The last category is observed for both crops which are recorded in soils of sand sheets and very deep lacustrine plains. Tomato has a moderately suitable class in soils of barchans duns and a marginally suitable class in soils of barchans duns with partial $CaCO_3$ cementation and of very deep lacustrine plains, as well as soils of the sand sheet.

Crop fertility requirements

According to Zayed *et al.* (2023), the soil of the two investigated physiographic units had low levels of nitrogen, phosphorus, potassium, iron, manganese, zinc, and copper, which were occupied at 63.49, 60.40, 48.68, 88.19, 88.19, 79.08, and 79.05% of the total area (571167.6 feddan), respectively. The Lacustrine plains unit that includes four sub-units, i.e., moderately deep soils, deep soils, very deep soils, and rock outcrops, contained low to medium level of macro and micronutrients, except for potassium element, which was at a medium to high level. This is mostly due to the variation in soil texture from coarse loamy to fine loamy. The windblown sand unit, which includes three sub-units, i.e. sand sheets soils, barchan dunes, and barchan dunes with partial $CaCO_3$ cementations, suffered from a deficiency of all macro and micronutrients due to coarse texture soils.

These soils have high pH values and calcium carbonate percentage, in addition to the soil's coarse texture, it is preferable to add organic matter, nitrogen, and potassium elements in sulfur form and phosphorus in the form of phosphoric acid through modern irrigation methods. Plants are also sprayed with microelements in chelate form to compensate for their deficiency. This agrees with El-Tapey *et al.* (2019) and Gaafar *et al.* (2021).

Crop water requirements

Consumptive use is considered an effective tool in the irrigation water requirements, irrigation planning, and water management decisions. Consumptive use represents the amount of water needed by plants being irrigated.

Weather parameters that supply energy for vaporization and extract water vapors from the evaporating surface are the meteorological factors that determine evapotranspiration. The solar radiation absorbed by the atmosphere and the heat emitted by the earth increases the air temperature. The sensible heat of the surrounding air transfers energy to the crop and exerts as such a controlling influence on the rate of evapotranspiration. In sunny, warm weather the loss of water by evapotranspiration is greater than in cloudy and cool weather. The high humidity of the air will reduce the evapotranspiration demand. In such an environment, the air is already close to saturation, so less additional water can be stored and hence the evapotranspiration is lower than in the arid region. The process of vapor removal depends to a large extent on wind and air turbulence which transfers large quantities of air over the evaporating surface (Allen *et al.*,1998). The principal weather parameters are presented in Table (3).

Data in Table (3) and Figure (1) reveal that the seasonal consumptive use or reference crop evapotranspiration differs from 2.258 to 4.443mm/day. Data reflects the effect of climate status i.e. a gradual increase from January to May and, in general, tend to decrease up to December. May, June, July, and August months record the largest amounts of reference crop evapotranspiration i.e. 4.443, 4. 387, 4.328, and 4.349 mm/day, respectively. The total consumptive use was 1300.524 mm/year. So, planning of irrigation water supply must be designed to meet these requirements cautiously.

In the current study, the crop is a coefficient approach for calculating the crop evapotranspiration under standard conditions (ET_c). According to (Allen *et al.*, 1998) the standard conditions refer to crops grown in large fields under excellent agronomic and soil water conditions. The crop evapotranspiration differs distinctly from the reference evapotranspiration (ET_o) as the ground cover, canopy properties and aerodynamic resistance of the crop are different from grass. The effects of characteristics that distinguish field crops from grass are integrated into the crop coefficient (K_c).

Crop evapotranspiration derived from meteorological data and crop data by the Penman-Monteith equation according to (Allen *et al*, 1998) are illustrated in Table (4).

Fruit trees, as more suitable crops, are represented by olive and guava trees. Olive trees appear at length of growth stages about 270 days and require about 3085 m^3/feddans evapotranspiration (ET_c). Guava trees have 270 days length of growth stages and also need about 3647 m^3/feddans ET_c.

The current study shows that there are eight more suitable vegetable crops for the study area. The watermelon crop is considered the best. It has a 110-day length of growth stages and records 1488 m^3/feddans evapotranspiration. Potato crops need about 115 days as a length of growth stages and consume about 1244 m^3/feddans as evapotranspiration. Sweet potato crop remains about 150 days as the length of growth and requirements of evapotranspiration are about 2290 m3/feddans. Carrot crops need about 120 days as the length of growth stages. The consumptive use as ET_c is 1167 m^3/feddan. Cabbage as a vegetable crop has 165 days of growth stages and consumes about 1742 m^3/feddans as evapotranspiration. The onion crop in three cases differs widely i.e. seeds, dry, and green. The length of the growth stages is 275, 210, and 95 days, respectively. On the other hand, the consumptive use is 3702, 2511, and 1015 m^3/feddans, respectively. Green pepper stays about 210 days in the field and needs about 2525 m^3/feddans as evapotranspiration. Pea crops have about 100 days as length stages and need about 1775 m^3/feddans as ET_c.

Field crops are represented by nine more suitable crops. Sesame crops are the highest ones. It stays about 110 days as the length of growth stages and needs about 1383 m^3/feddans for evapotranspiration. Maize crop remains about 180 days as a total length of growth stages and requires about 2355 m^3/feddans as evapotranspiration. Sorghum crops show a length

Table (3): Important parameters for computation reference of evapotranspiration (ETo) according to Allen *et al.* (1998).

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T max (°C)	18.40	19.30	21.30	23.50	26.60	28.60	29.70	30.60	29.60	27.60	24.20	20.30
T max (°C)	9.10	9.30	10.80	13.10	16.40	20.20	22.00	22.70	21.10	17.60	14.40	10.80
T max (°C)	13.75	14.30	16.05	18.30	21.50	24.40	25.85	26.65	25.35	22.60	19.30	15.55
U_2 (ms^{-1})	3.97	3.97	4.11	3.86	3.58	3.58	3.92	3.58	3.28	2.81	3.08	3.69
Δ ($kP_a{}^oC^{-1}$)	0.104	0.107	0.116	0.133	0.157	0.184	0.199	0.204	0.194	0.165	0.141	0.113
Υ ($kP_a{}^oC^{-1}$)	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067
e_s(kP_a)	1.639	1.727	1.939	2.197	2.670	3.115	3.384	3.546	3.305	2.836	2.318	1.863
e_a(kP_a)	1.148	1.187	1.313	1.498	1.877	2.338	2.644	2.726	2.487	2.000	1.651	1.313
$e_s - e_a$(kP_a)	0.491	0.540	0.626	0.699	0.793	0.777	0.740	0.820	0.818	0.836	0.667	0.550
R_a($MJm^{-2}day^{-1}$)	21.10	25.80	31.40	36.80	40.00	41.20	40.60	38.00	33.40	27.60	22.20	19.80
R_s($MJm^{-2}day^{-1}$)	11.80	13.10	16.30	19.00	20.40	19.10	18.00	17.10	15.60	14.00	11.10	9.80
R_{so}($MJm^{-2}day^{-1}$)	15.90	19.40	23.60	27.70	30.10	31.00	30.50	28.60	25.10	20.80	16.70	14.90
R_s / R_{so}	0.74	0.68	0.69	0.69	0.68	0.62	0.59	0.60	0.62	0.67	0.66	0.66
R_{ns}($MJm^{-2}day^{-1}$)	9.09	10.09	12.55	14.63	15.71	14.71	13.86	13.17	12.02	10.78	8.55	7.55
R_{n1}($MJm^{-2}day^{-1}$)	4.103	3.561	3.611	3.485	3.113	2.357	1.962	1.720	2.256	2.958	3.108	4.197
R_n ($MJm^{-2}day^{-1}$)	4.987	6.529	8.939	11.145	12.597	12.353	11.898	11.450	9.764	7.822	5.442	3.353
ET_o	2.258	2.772	3.425	3.985	4.443	4.387	4.328	4.349	3.952	3.549	2.598	2.656

U_2 : Wind speed
e_s : Saturation vapor pressure
R_a : Daily extraterrestrial radiation
R_s/ R_{so} : Relative shortwave radiation
R_n : Net radiation
Δ: Slope vapor pressure
e_a: Actual vapor pressure
R_s : Incoming solar radiation
R_{ns}: Net short wave radiation
ET_o : evapotranspiration
Υ : Psychometric constant
$e_s - e_a$: Saturation vapor pressure
R_{so}: Clear-sky radiation
R_{n1} : Net long wave radiation

Table (4): Crop water requirements according to Penman-Monteith method (Allen *et al.*, 1998).

Crops / Stages	Fruit trees								Vegetable crops							
	Olive				Guava (Orchard)				Watermelon				Potato			
	Plant date		Kc	ETc	Plant date		Kc	ETc	Plant date		Kc	ETc	Plant date		Kc	ETc
	Month	Period length			Month	Period length			Month	Period length			Month	Period length		
Initial	Mar	30	0.65	66.788	Mar	20	0.45	30.825	Apr	20	0.40	31.880	Jan	25	0.50	28.225
Development	Apr	30	0.70	83.685	Apr	30	0.90	107.595	May	30	0.70	93.303	Feb	28	0.70	54.331
	May	31		96.413	May	31		123.960					Mar	2		4.795
	Jun	29		89.056	Jun	9		35.535								
Mid	Jun	1	0.70	3.071	Jun	21	0.90	82.914	May	1	1.00	4.443	May	29	1.15	114.224
	Jul	31		93.918	Jul	31		120.751	Jun	29		127.223	Apr	1		4.583
	Aug	28		85.240	Aug	31		121.337								
					Sep	30		106.704								
					Oct	7		22.359								
Late	Aug	3	0.70	9.133	Oct	24	0.65	55.364	Jun	1	0.75	3.246	Apr	29	0.75	86.674
	Sep	30		82.992	Nov	30		50.661	Jul	29		94.134	May	1		3.332
	Oct	31		77.013	Dec	6		10.358								
	Nov	26		47.284												
Total period of stages		270				270				110				115		
Total ET_C (mm)				734.593				868.363				354.229				296.164
Total ET_C (m^3/fed.)				3085				3647				1488				1244

Table (4): Cont.

Crops / Stages	Vegetable crops															
	Sweet potato				Carrot				Cabbage				Onion (Seed)			
	Plant date		K_c	ET_c	Plant date		K_c	ET_c	Plant date		K_c	ET_c	Plant date		K_c	ET_c
	Month	Period length			Month	Period length			Month	Period length			Month	Period length		
Initial	Apr	20	0.50	39.850	Oct	20	0.70	49.686	Sep	10	0.70	27.664	Sep	20	0.70	55.328
									Oct	30		74.529				
development	May	30	0.70	93.303	Nov	30	1.05	81.837	Oct	1	1.05	3.726	Oct	31	1.05	115.520
									Nov	30		81.837	Nov	14		38.191
									Dec	29		80.875				
Mid	May	1	1.15	5.109	Dec	31	1.05	86.453	Dec	2	1.05	5.578	Nov	16	1.05	43.646
	Jun	30		151.352	Jan	19		45.047	Jan	31		73.498	Dec	31		86.453
	Jul	29		144.339					Feb	17		49.480	Jan	31		73.498
													Feb	28		81.497
													Mar	31		111.484
													Apr	28		117.159
Late	Jul	2	0.65	5.626	Jan	12	0.30	8.129	Feb	11	0.40	12.197	Apr	2	0.80	6.376
	Aug	31		87.632	Feb	8		6.653	Mar	4		5.480	May	31		110.186
	Sep	7		17.982									Jun	12		42.115
Total period of stages		150				120				165				275		
Total ET_C (mm)				545.193				277.805				414.864				881.453
Total ET_C (m^3/fed.)				2290				1167				1742				3702

Table (4): Cont.

Crops / Stages	Vegetable crops															
	Onion (Dry)				Onion (Green)				Green pepper				Peas			
	Plant date		Kc	ETc	Plant date		Kc	ETc	Plant date		Kc	ETc	Plant date		Kc	ETc
	Month	Period length			Month	Period length			Month	Period length			Month	Period length		
Initial	Oct	20	0.70	49.686	Oct	20	0.70	49.686	Oct	30	0.60	63.882	Mar	20	0.50	34.250
Development	Nov	30	1.05	81.837	Nov	30	1.00	77.940	Oct	1	1.05	3.726	Apr	30	1.15	137.483
	Dec	5		13.944	Dec	15		39.840	Nov	30		81.837				
									Dec	9		25.099				
Mid	Dec	26	1.05	72.509	Dec	16	1.00	42.496	Dec	22	1.05	61.354	May	31	1.15	158.393
	Jan	31		73.498	Jan	4		9.032	Jan	31		73.498	Jun	4		20.180
	Feb	28		81.497					Feb	28		81.497				
	Mar	25		89.906					Mar	29		104.291				
Late	Mar	6	0.75	15.413	Jun	10	1.00	22.580	Mar	3	0.90	9.248	Jun	15	1.10	72.386
	Apr	30		89.663					Apr	27		96.836				
	May	9		29.990												
Total period of stages		210				95				210				100		
Total ETc (mm)				597.943				241.574				601.268				422.692
Total ETc (m^3/fed.)				2511				1015				2525				1775

Table (4): Cont.

Crops / Stages	Field crops															
	Sesame				**Maize**				**Sorghum**				**Wheat**			
	Plant date		**K_C**	**ET_C**	**Plant date**		**K_C**	**ET_C**	**Plant date**		**K_C**	**ET_C**	**Plant date**		**K_C**	**ET_C**
	Month	**Period length**			**Month**	**Period length**			**Month**	**Period length**			**Month**	**Period length**		
Initial	Jun	20	0.35	30.709	Apr	30	0.30	35.865	Mar	20	0.30	20.550	Nov	30	0.70	54.558
development	Jul	30	0.70	90.888	May	31	0.70	96.413	Apr	30	0.70	83.685	Dec	31	0.70	57.635
					Jun	19		58.347	May	5		15.551	Jan	31		48.999
													Feb	28		54.331
													Mar	31		74.323
													Apr	19		53..001
Mid	Jul	1	1.10	4.761	Jun	11	1.2	57.908	May	26	1.00	115.518	Apr	11	1.5	50.410
	Aug	31		148.301	Jul	31		161.002	Jun	19		83.353	May	29		148.174
	Sep	8		34.778	Aug	18		93.938								
Late	Sep	20	0.25	19.760	Aug	13	0.35	19.788	Jun	11	0.55	26.541	May	2	0.40	3.554
					Sep	27		37.346	Jul	19		45.228	Jun	28		49.134
Total period of stages		110				180				130				240		
Total ET_C (mm)				329.197				560.607				390.426				594.119
Total ET_C (m^3/fed.)				1383				2355				1640				2495

Table (4): Cont.

Crops / Stages	Field crops																			
	Barley				Cowpea				Cotton				Alfa alfa				Sugar Can			
	Plant date		Kc	ETc	Plant date		Kc	ETc	Plant date		Kc	ETc	Plant date		Kc	ETc	Plant date		Kc	ETc
	Month	Period length			Month	Period length			Month	Period length			Month	Period length			Month	Period length		
Initial	Nov	15	0.30	11.961	Mar	20	0.40	27.400	Mar	30	0.35	35.963	Jan	10	0.40	9.032	Sep	25	0.40	39.520
Development	Dec	25	1.15	76.360	Apr	30	1.05	125.528	Mar	1	1.15	3.939	Feb	20	1.20	66.528	Oct	31	1.25	137.524
									Apr	30		137.483					Nov	30		97.425
									May	19		97.080					Dec	9		29.880
Mid	Dec	6	1.15	18.326	May	30	1.05	139.955	May	12	1.15	61.313	Feb	8	1.20	26.611	Dec	22	1.25	73.040
	Jan	31		80.500					Jun	30		151.352	Mar	12		49.320	Jan	31		87.498
	Feb	13		41.441					Jul	18		89.590					Feb	28		97.020
																	Mar	31		132.719
																	Apr	23		114.569
Late	Feb	15	0.25	10.395	May	1	0.60	2.666	Jul	13	0.50	28.132	Mar	10	1.15	39.388	Apr	7	0.75	20.921
	Mar	15		12.844	Jun	19		50.012	Aug	31		67.410					May	31		103.300
									Sep	11		21.736					Jun	1		39.483
Total period of stages		120				100				195				60				280		
Total ETc (mm)				251.827				345.561				675.998				190.879				972.899
Total ETc (m^3/fed.)				1058				1451				2839				802				4086

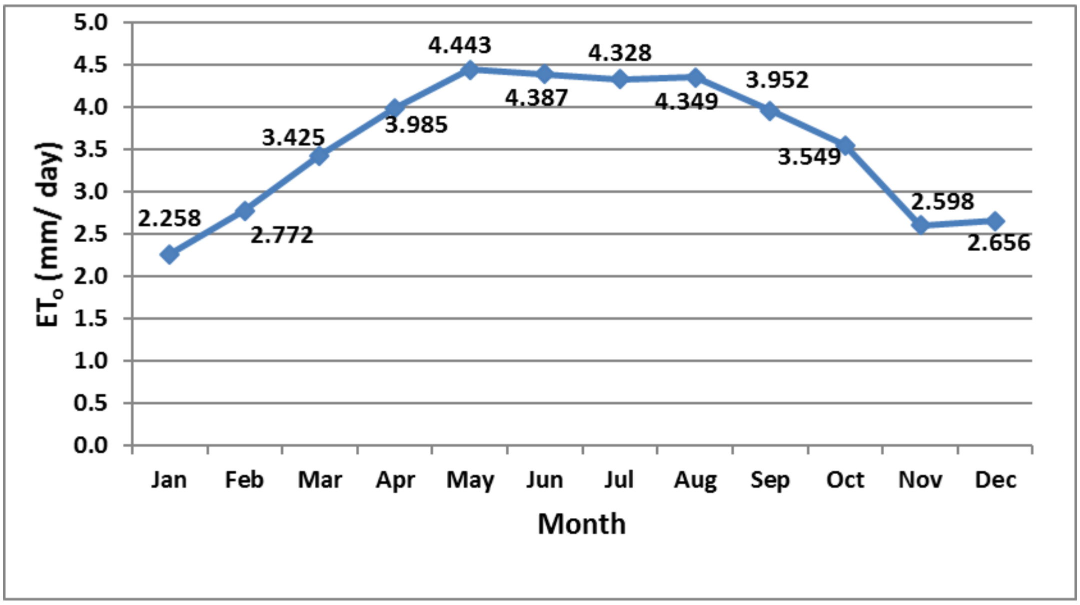


Fig (1): Reference evapotranspiration (ET_o) according to Allen *et al.* (1998).

of growth stages of about 130 days. The evapotranspiration for it is about 1460 m^3/feddans for this period. Wheat crops last for 240 days which represents as length of growth stages. It requires 2495 m^3/feddans as evapotranspiration. Barley crops have a length of growth stage of about 120 days. The consumptive use of irrigation water is about 1058 m^3/feddans. Cowpea crop takes about one hundred days as the length of growth stages and needs about 1451 m^3/feddans water as evapotranspiration. Cotton crops show about 195 days period of length for growth stages which consume about 2839 m^3/feddans of water as evapotranspiration. Alfalfa crops appear about 60 days length of growth stages for individual cutting periods and needs about 802 m^3/feddans evapotranspiration in this period. Sugar cane crops have about 280 days period of growth stages and require about 4086 m3/feddans of water for evapotranspiration.

Soils under consideration have coarse texture especially the part located in the south area. So, water management of these soils coupled with the fact that sprinkler and trickle irrigation systems with light frequent water application rates will likely be the best irrigation ones to limit irrigation water. To determine the irrigation water requirement for different suitable crops, the water application efficiency should be taken into consideration. Solomon (1988) reported that attainable water application efficiencies vary greatly with irrigation system type and management. It seems that center pivot sprinkle and trickle irrigation systems have attainable efficiencies between 70-90% and 75-90 %, respectively. The efficiency is the percentage ratio between the theoretical consumptive water use and actual irrigation requirements.

Conclusion

The profitable fruit crop is olive, which recorded the highest suitability index and low water consumption. Onion appeared to be used with low water consumption, but it wasn’t a suitable vegetable crop. Watermelon recorded more suitability than potato and carrot. Alfalfa is considered a more suitable field crop in soils of windblown sand due to its long period of first cutting which is up to 60 days, while the other cutting cycle needs about half this period. On the other hand, this crop needs lower water requirements. Generally, the sesame crop was considered a more suitable field crop in all studied physiographic units which corresponded with soil characteristics and water consumptive use.

Excess salt must be disposed of, through appropriate drainage systems. Adding organic matter to the studied soils is very important to protect these soils from erosion, improve their physical properties, increase the availability of nutrients, and thus increase their fertility. Also, adding nitrogen and potassium in the form of sulfate and phosphorus in the form of phosphoric acid. Compensates the deficiency of micronutrients on the plant by spraying them in the form of chelates. Applying modern irrigation systems, such as drip and sprinkler irrigation, to adjust the water requirements of the crops under study. It must consider the salt leaching requirements.

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استخدام نظام تقييم الأراضي لتحقيق الاستثمار الأمثل في أراضي جنوب العامرية – محافظة الإسكندرية – مصر

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الملخص العربي

تقع منطقه الدراسة بين خطي طول ٢٩°٤٧/٥٥″ و ٣٠°٣٠/٠٥″شرقا وخطي عرض ٢٩°٢٩/٣٠″و ٣٠°٣٠/٠٥″ شمالاً والتي قد سبق دراستها من الوجهة البيدولوجيه.

تعد الدراسة الحالية محاوله لتحقيق الاستثمار الامثل على اساس نظام تقييم الأراضي، وفي هذا السياق فقد تم تقييم منطقه الدراسة على حالتها، وكذا بعد احتمال تحسين معوقاتها القابلة للتحسين، ومن ناحية أخرى فقد تم تحديد معوقات كل موقع، وبنفس الاسلوب تم تحديد مدى صلاحية المحاصيل طبقا لمواصفات مختلف الوحدات الأرضية ومقارنة مدى صلاحية المحاصيل بالنسبة لبعضها، كما اشتملت الدراسة على تقدير الاحتياجات المائية لكل محصول على حدة من خلال حساب البخر فتح المرجعي (الخاص بالحشائش) ET_o والبخر نتح الخاص بكل محصول ET_{crop}، ولقد تم حساب البخر نتح على أساس الظروف القياسية، ولقد سجلت منطقتي قطاعي التربة ٢ و٩ أعلى تقييم ملائمه في الظروف الحالية وكذلك أعلى تقييم ملاءمة مستقبلية بعد تطبيق صلاح وتحسين التربة في من أراضي السهول البحيرية والرملية الريحية على التوالي.

وقد كان محصول الزيتون ثم الجوافة أعلى محاصيل الفاكهة ملائمه في هذه الأراضي، بينما كان محصول السمسم أكثر محاصيل الحقل ملائمه، وقد كان محصول البطيخ أكثر محاصيل الخضر ملائمه،

ولقد تم حساب البخر نتح الخاص بالمحصول باستخدام البيانات المناخية والبيانات الخاصة بالمحصول عن طريق معادله Penman-Monteith. ولقد سجل الاستهلاك المائي السنوي ١٣٠٠,٥٢٤ مم/ سنة.

الكلمات المفتاحية: الوحدات الفيزيوجرافية، تقييم الأراضي، تقييم مدى ملاءمة الأراضي للمحاصيل، البخر نتح المرجعي (ETo)، الاحتياجات المائية.