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CHARACTERESTICS, CLASSIFICATION AND EVALUATION OF SOME SOILS IN TOSHKA, EGYPT

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ABSTRACT: ***Ten profiles were selected from the southern part of Toshka to study the characteristics, classification and evaluation of these soils. This study is needed for proper planning of reclamation and amelioration of these soils.***

The elevation of the studied area is between 184 to 193 m above sea level. The soils are almost flat, nearly level to gently sloping topography. They are moderately deep to deep with well drainage status. They have mainly sandy texture with common fine to coarse gravels and/or fragments. The main structure is weak fine granular to medium subangular blocky. The consistence is soft to hard when dry and friable when moist. The main hue notation of the soils has reddish color mainly between 2.5YR to 7.5YR. The soils are non saline having alkaline reaction. Total carbonate contents ($CaCO_3$) are mostly low having narrow ranges in profile layers. Organic matter (OM) content is low, decrease generally with depth. The cation exchange capacity (CEC) is mainly correlated with fine fractions and organic matter contents. The exchangeable cations are generally dominated by Na^+ followed by Ca^{2+} then Mg^{2+} and few K^+ making alkaline effect in the most of profiles layers.

The morphological rating scale (RDH and RPD) indicates a slight distinctness between horizons which mainly attributed to the depositional pattern and /or regimes of soil materials more than development.

The studied soils haven't any diagnostic horizons and therefore, they are classified as Entisols order up to family level.

According to the land capability evaluation, the soils are categorized from II to V grades. Land suitability evaluation for growing major sixteen field, vegetable and fruit crops was achieved for the soils having grades from II to IV.

***Key words**: Toshka, characteristics, morphological rating scale, soil classification, land evaluation, capability classification, suitability.*

INTRODUCTION

The Western Desert occupies about 65% of Egypt's total area. Intensive works have been directed to the Western Desert which is considered to be the most important phase of the ambitious projects. It is considered the most potentially suitable agriculture land resources for future expansion and development in Egypt.

Recently, Egyptian government has launched several ambitious land development projects aiming to increase the inhabited area from 5% to 25% of the total area of Egypt over next 20 years. One of these main projects is Toshka project that throw it the proposed area to be cultivated will be about 540,000 feddans using the water received from Lake Nasser. Another area of about 135,000 feddans could be irrigated using ground water extracted from proposed 300 wells.

Some investigations have been conducted on this area (*Abdel-Ghaffar et al., 1997; El-Sayed, 2001; Mekhael, 2003; and Hussien, 2006)*.

Toshka project is one of the important national projects of 21st century in Egypt. The aim of the project is to go out from the Nile valley, and to set up new agro-industrial activities centers in the southern part of Western desert.

The aim of the current study is to get a recent and more information about the characteristics, classification and capability as well as suitability evaluation of Toshka soils aiming for proper planning and better agricultural use.

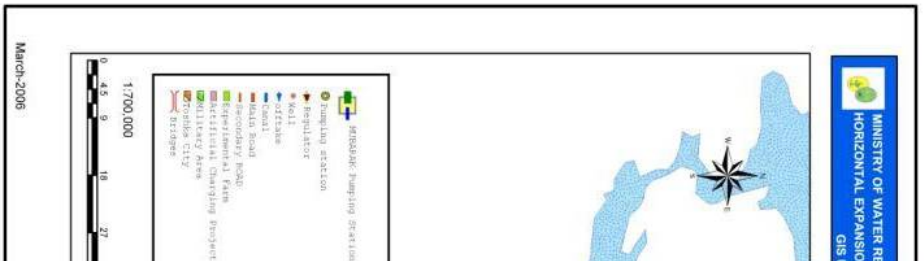
MATERIALS AND METHODS

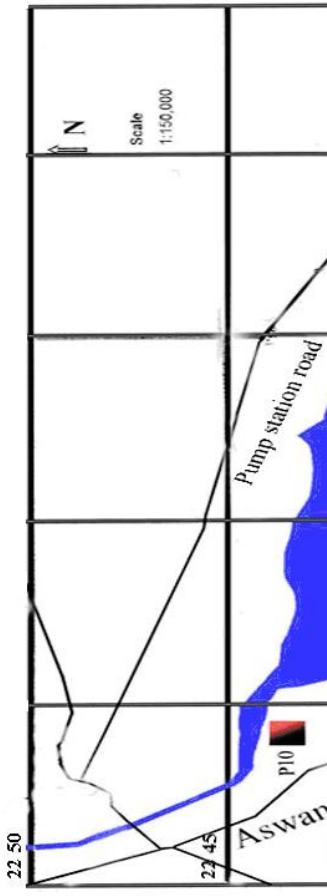
Ten soil profiles were selected representing the soils in southern part of Toshka. The general map of Toshka and location of studied profiles are shown in Fig's 1 and 2.

The soils and profiles were described according to the guidelines of *FAO* (2006). The abbreviations used in Table follow the *U.S. Dept. of Agric. (1974)*. Samples of representative soil profiles were collected according to the vertical morphological variations. The soil samples were air dried, crushed and sieved to get the fine earth fraction (< 2 mm) then used for different physical and chemical analysis.

The important morphological features such as soil color, texture, structure, consistence and the boundary between horizons were used for evaluating the pedological development according to *Bilzi and Ciolkosz (1977)*.

Particle-fractionation was achieved after the dispersion of soil particles according to *Klute (1986)* and data was presented as textural classes following *FAO (2006)*. Organic matter contents (OM) were determined using the wet oxidation procedure method described by Nelson and Sommers *(Page, 1982)*. Total carbonate contents were measured using the Collin's calcimeter and calculated as CaCO3 (*Page, 1982*). Cation exchange capacity (CEC) and exchangeable cation's were determined according to the procedures described in Page (1982) and the exchangeable sodium percentage (ESP) was calculated from the obtained results. The other chemical analyses were performed according to Page (1982).





Studid area

Fig. 1: location of Toska and studied area.

Fig. 2: Location of studied soil profiles in Toshka.

The studied soils were classified up to family level according to the system of *Soil Survey Staff, (2006)*.

The land capability classification was achieved following the system performed by *Storie (1964)* and *Sys et. al. (1991)*. Moreover, a suitability index for cultivation of 16 field, vegetable and fruit crops in studied soils was obtained using the suitability system of *Sys et. al. (1993)*.

RESULTS AND DISCUSSION

Soil morphology and morphological rating scale

The morphological features of the studied soils (Table, 1) showed that the elevation of studied area is varied between 184 and 193 m a.s.l from the south to the north. The relief of these soils is almost flat with undulating surrounding landform and gentle sloping. In situ examination of the most studied soils shows that all profiles are deep and characterized as freely well drained. Only profiles 5 and 6 have a relatively shallow depth with 50 – 60 cm at where there are slightly weathered extremely hard bedrocks. The main hue notation of studied soil color is around reddish yellow (2.5YR to 7.5YR). These soils have almost slightly gravelly sandy to sandy loam texture throughout their depths with mainly weak granular to subangular blocky structure. They are slightly calcareous having soft to hard (dry) and friable (moist) consistency. The most of studied soils are virgin without or with scanty vegetation. Others are having perennial field crops with irrigated cultivation.

Findings of Bilzi and Ciolkosz (1977) for the morphological rating scale can be used to compare adjacent horizons to give a comparison of the relative distinctness of horizons (RHD). Also, it can be used to compare horizons in the solum to the C horizon in order to give a relative profile development (RPD) evaluation. The morphological rating scale (RHD and RPD) presented in Table (2) showed a relatively moderate values indicating a slight distinctness between horizons and weak profile development. The relatively high values in surface and/or sub-surface layers are mostly corresponded with color and could be mainly attributed to the stratification and depositional pattern of soil materials more than development.

Physical and chemical properties

The analytical data of studied soils (Table 3) show that these soils have mainly slightly gravelly and/or gravelly sandy to sandy loam texture. They are not saline as indicated by their EC values which range between 0.18 to 1.44 dSm^{-1} calculated as a whole profile mean (WPM). Soil reaction is alkaline as indicated by pH values where they are more than 8.5 in all profile layers. Total carbonate ($CaCO_3$) content is mostly low and varies in relatively narrow ranges between 1.0 and 9.6 % (w.p.m.). Gypsum content is very low without specific distribution throughout profile depth in most of studied sites.

Table 1: Morphological description of studied soil profiles in Toshka.

Profile No.	Location	Elevation m ASL	Depth, cm	Color		Texture*	Structure[1]	Consistence[2]		Boundary[3]
				Dry	Moist			Dry	Moist	
1	15 km N Abu Simple	+ 184	0- 20 20- 45 45- 75 75- 150	5YR 6/4 5YR 5/5 2.5YR 6/4 2.5YR 5/4	4/4 4/4 4/4 4/2	L. sand L. sand Sg L. sand L. sand	1 v f gr 1 f gr 1 f sbk 1 m spk	soft soft soft hard	v friable v friable v friable friable	gradual s gradual s gradual s -
2	20 km N Abu Simple	+ 185	0- 15 15- 30 30- 40 40- 70	5YR 6/4 5YR 5/4 2.5YR 6/4 2.5YR 5/5	4/4 4/4 4/4 4/5	Sg L. sand Sg L. sand Sg L. sand Sg L. sand	1 f gr 1 f sbk 1 m spk 1 m spk	soft soft s hard hard	v friable v friable friable friable	gradual s gradual s gradual s -
3	25 km N Abu Simple	+ 186	0- 15 15- 40 40- 80 80- 100	7.5YR 7/4 7.5YR 6/5 5YR 6/5 5YR 6/4	5/4 5/4 4/4 4/4	Sg Sand g Sand Sg Sand Sg Sand	1 f gr 1 f gr 1 f sbk 1 m spk	soft soft s hard s hard	v friable v friable friable friable	gradual s diffuse diffuse -
4	25 km N Abu Simple	+ 186	0- 20 20- 50 50- 80 80- 150	7.5YR 7/5 5YR 6/5 5YR 7/6 5YR 7/4	4/4 4/4 5/4 5/4	Sg L. sand Sg L. sand Sg L. sand Sg L. sand	1 f gr 1 f sbk 2 m spk 2 m spk	soft s hard s hard s hard	v friable friable Friable friable	diffuse diffuse gradual s -
5	30 km N Abu Simple	+188	0- 10 10- 25 25- 55	7.5YR 7/6 7.5YR 6/6 7.5YR 6/6	4/6 5/6 4/6	Sg L. sand Sg L. sand g L. sand	1 f gr 1 m sbk 1 f spk	soft s hard s hard	v friable friable friable	diffuse diffuse -
6	35 km N Abu Simple	+189	0- 10 10- 30 30- 45 45- 60	7.5YR 6/4 7.5YR 7/6 5YR 6/4 10YR 6/6	5/4 4/6 4/4 5/6	G Sand G Sand G Sand Vg Sand	1 f sbk 1 f sbk 1 m spk 1 m spk	hard v hard ex hard ex hard	friable firm v firm v firm	clear clear clear -
7	40 km N Abu Simple	+190	0- 20 20- 50 50- 80 80- 150	7.5YR 6/6 5YR 5/6 2.5YR 5/5 2.5YR 5/6	4/6 4/6 3/5 3/6	Sg L. sand g L. sand Sg L. sand Sg L. sand	1 m gr 1 f gr 1 f spk 2 m spk	soft soft s hard v hard	v friable v friable Friable friable	gradual s diffuse diffuse -
8	45 km N Abu Simple	+190	0- 25 25- 55 55- 90 90- 150	7.5YR 6/6 5YR 5/6 5YR 5/6 5YR 5/6	5/6 4/6 4/6 4/6	Sg L. sand Sg S. loam Sg S. loam sgS. loam	1 m gr 1 f sbk 1 f spk 1 m spk	soft s hard hard hard	v friable friable Friable friable	gradual s diffuse diffuse -
9	45 km N Abu Simple	+191	0- 20 20- 50 50- 90 90- 150	7.5YR 6/4 7.5YR 6/6 5YR 5/6 7.5YR 6/6	5/4 5/6 4/6 4/6	Sg S. loam Sg S. loam Sg S. loam Sg S. loam	2 co spk 1 m spk 1 f gr 1 m spk	s hard s hard soft s hard	friable friable friable friable	gradual s gradual s diffuse s -

10	50 km N Abu Simple	+193	0- 15 15- 45 45- 60 60- 90	7.5YR 7/6 7.5YR 6/6 5YR 6/6 5YR 5/4	5/6 4/6 4/6 4/6	Sg L. sand L. sand g L. sand g L. sand	1 f sbk 1 f sbk 2 m spk 2 co spk	soft soft v hard ex hard	v friable v friable firm ex firm	diffuse gradual s gradual s -

Abbreviations: Texture*: L=loamy, S= sandy, s g=slightly gravely, g=gravely; Structure[1]: 1=weak, 2 =moderate, v = very, f= fine, m= medium, co=coarse, gr= granular, sbk= subangular blocky; Consistence[2]: s= slightly, v = very, x =extremely; Boundary[3]: s= smooth.

Table (2): Morphological rating scale (RHD and RPD) for studied soil profiles.

P. N°	Transition	Texture	Structure	Color		Consistence		Boundary	RHD	Transition	Texture	Structure	Color		Consistence		Boundary	RPD
				Dry	Moist	Dry	Moist						Dry	Moist	Dry	Moist		
1	1st/2nd	0	1	2	0	0	0	1	4	1st/Last	0	2	2	3	1	1	1	10
	2nd/3rd	0	1	3	1	0	0	1	6	2nd /Last	0	2	2	3	1	1	1	10
	3rd/4th	0	1	1	2	1	1	1	7	3rd /Last	0	1	1	2	1	1	1	7
2	1st/2nd	0	1	1	0	0	0	1	3	1st / Last	0	2	3	2	2	1	1	11
	2nd/3rd	0	1	2	1	1	1	1	7	2nd / ast	0	1	2	2	2	1	1	9
	3rd/4th	0	0	2	1	1	0	1	5	3rd/Last	0	0	2	1	1	0	1	5
3	1st/2nd	0	0	2	1	0	0	1	4	1st / Last	0	2	2	2	1	1	1	9
	2nd/3rd	0	1	1	2	1	1	0	6	2nd /Last	0	2	2	2	1	1	0	8
	3rd/4th	0	1	1	0	0	0	0	2	3rd /Last	0	1	1	0	0	0	0	2
4	1st/2nd	0	2	2	2	1	1	0	8	1st / Last	0	3	2	2	1	1	0	9
	2nd/3rd	0	1	2	3	0	0	0	6	2nd /Last	0	1	2	1	0	0	0	4
	3rd/4th	0	0	2	2	0	0	1	5	3rd /Last	0	0	2	2	0	0	1	5
5	1st/2nd	0	2	1	1	1	1	0	6	1st / Last	0	1	1	0	1	1	0	4
	2nd/3rd	0	1	0	1	0	0	0	2	2nd /Last	0	1	0	1	0	0	0	2
6	1st/2nd	0	0	3	3	1	1	2	10	1st / Last	1	1	3	3	2	2	2	14
	2nd/3rd	0	1	4	3	1	1	2	12	2nd /Last	1	1	2	2	1	1	2	10
	3rd/4th	1	0	4	5	0	0	2	12	3rd /Last	1	0	4	5	0	0	2	12
7	1st/2nd	1	1	2	1	0	0	1	6	1st/ Last	0	2	3	3	3	1	1	13
	2nd/3rd	1	1	2	3	1	1	0	9	2nd/Last	1	3	1	2	3	1	0	11
	3rd/4th	0	2	1	1	2	0	0	6	3rd /Last	0	2	1	1	2	0	0	6
8	1st/2nd	1	1	2	2	1	1	1	9	1st / Last	1	1	2	2	2	1	1	10
	2nd/3rd	0	0	0	0	1	0	0	1	2nd/ Last	0	1	0	0	1	0	0	2
	3rd/4th	0	1	0	0	0	0	0	1	3rd/ Last	0	1	0	0	0	0	0	1

9	$1^{st}/2^{nd}$	0	2	2	2	0	0	1	7	1^{st}/ Last	0	2	2	3	0	0	1	8
	$2^{nd}/3^{rd}$	0	2	3	2	1	1	1	10	2^{nd}/Last	0	0	0	1	0	0	1	2
	$3^{rd}/4^{th}$	0	2	2	1	1	1	0	7	3^{rd} /Last	0	2	2	1	1	1	0	7
10	$1^{st}/2^{nd}$	1	0	1	1	0	0	0	3	1^{st}/Last	1	3	3	2	4	4	0	17
	$2^{nd}/3^{rd}$	2	2	1	1	3	2	1	12	2^{nd}/Last	2	3	2	1	4	4	1	17
	$3^{rd}/4^{th}$	0	1	1	0	1	2	1	6	3^{rd}/ Last	0	1	1	0	1	2	1	6

Table 3

Table 3

Organic matter is very low owing to the prevailing aridity of the region and its scanty vegetation. The cation exchange capacity (CEC) is mainly dependent on the fine fractions and organic matter contents. Data of the exchangeable cations show a dominance of Na^{+} followed by Ca^{++} then both of Mg^{++} and K^{+} in most of studied profiles. The ESP values are more than 15 indicating prevailing sodicity condition in all studied soils.

Soil classification

The studied soils were classified on the basis of morphological descriptions, physical and chemical properties with respect to the meteorological data of the studied area. The dominant soil moisture regime in this area is *Torric* with *Hyperthermic* soil temperature regime. All the soils haven't any diagnostic horizon within 1m from the surface. These soils have slightly weathered siliceous minerals.

- **The soils of profiles 8 and 9 have slightly gravelly sandy loam texture. Therefore, they classified as *Typic Torriorthents, slightly gravelly sandy loam, siliceous, hyperthermic*.**
- **The soils represented by profiles 1, 2, 3, 4, 7 and 10 have slightly gravelly loamy sand and they could be affiliated to Typic Torripsamments, slightly gravelly loamy sand, siliceous, hyperthermic.**
- **The soils of profiles 5 and 6 have gravelly sand texture in addition to slightly weathered bedrock lithology at 50 – 60 cm under the profile solum. Thus they are classified as Lithic Torripsamments, gravelly sand, siliceous, hyperthermic.**

Land Evaluation

Land capability classification

Land capability index was calculated for each profile according to the system described by *Sys et. al. (1991)* and the studied soils are classified into their suitable grade according the ratings of *Storie (1964)*. The capability index (Ci) of the studied soils and their grades are presented in Table (4).

The data in Table (4) reveal that the studied soils could be affiliated to grades from II down to V corresponding to estimated capability index (Ci) which vary with land characteristics and abundance of specific limitation rates in each site. Accordingly, the capability grades of studied soils are named as follows:

Grade II: **Soils represented by profiles 1, 4 and 9 which affected by few moderate limitations with Ci 60.0, 70.3 and 51.3 respectively.**

Grade III: **Soils affected by many moderate to severe limitations and have Ci between 41.4 and 48.8. They are represented by profiles 3,7,8 and 10.**

Grade IV: **Soils having Ci 27.7, affected by many severe limitations and represented by profile 2.**

Grade V: **Soils represented by profiles 5 and 6 which affected by many very severe limitations and having Ci 12.8 and 18.3 respectively.**

Table (4): Capability indexes and grades of the studied soils.

Profile No.	Availability and quality of irrigation water	Texture grade	Profile depth (cm)	Wetness	Salinity level E.C	Sodicity ESP %	CaCo3 %	Gypsum %	Slope %	Erosion	Capability index Ci	Grade
1	90	100	100	100	100	70	100	95	100	100	60.0	II
2	90	85	77	90	100	55	100	95	100	100	27.7	IV
3	90	70	94	100	100	78	100	95	100	100	48.8	III
4	90	100	100	100	100	74	100	95	100	100	70.3	II
5	90	70	65	60	100	55	100	95	100	100	12.8	V
6	90	70	70	90	100	54	90	95	100	100	18.3	V
7	90	100	100	100	100	52	100	95	100	100	44.5	III
8	100	100	100	100	100	52	95	95	100	100	46.9	III
9	100	100	100	100	100	54	100	95	100	100	51.3	II
10	100	85	90	100	100	60	95	95	100	100	41.4	III

Land suitability evaluation

Based on the system described by *Sys et. al. (1993),* the studied soils having grades II to IV are used to evaluate their suitability for cultivation of 16 field, vegetable and fruit crops. The soil parameters used to estimate suitability index (S_i) for the different crops were climate, slopes, profile depth, drainage, gravels, texture, $CaCO_3$, gypsum, salinity, alkalinity and soil fertility (pH, CEC and OM). The quantitative estimation of suitability index (Si) for growing of each crop in these studied soils is given in Table (5).

Data in Table (5) reveal that alfalfa, barley, onion and wheat crops are moderately (S_2) to marginally (S_3) suitable for growing in the soils of profiles 1, 2, 4, 7, 8, 9 and 10. Sunflower is marginally suitable (S_3) for growing in the soils of profiles 1, 3, 9, and 10, whereas; groundnut is marginally suitable (S_3) in the soil of profile 3 only. All studied soils are suitable (varied between S_1 to S_3) for growing potato and tomato vegetable crops. Watermelon is marginally suitable (S_3) for growing in soils of profiles 1, 3, 8, 9 and 10. Pea is marginally suitable (S_3) for growing in soils of profiles 1, 2, 3 and 10. Green pepper is only marginally suitable (S_3) for growing in soils of profiles 2 and 9. Most of studied soils are moderately (S_2) to marginally (S_3) suitable for growing olives (except soils of profile 2). Citrus and guava are only suitable (S_3) in soils of profiles 1 and 9 respectively. Mango is suitable (S_3) for

growing in soils of profiles 1, 3 and 9. The soils considered currently not suitable (N_1) which having S_i between 15 and 25 for studied crops could be improved by achieving a proper fertilization and management.

Table (5): Suitability of studied soils for certain crops.

Profile No.	Suitability index for different crops (Si)*								
	Field crops	Rate%	Si	Vegetables	Rate%	Si	Fruits	Rate%	Si
1	Alfalfa	61.20	S2	Potato	51.00	S2	Olives	34.2	S3
	Barley	43.95	S3	Tomato	32.30	S3	Citrus	38.0	S3
	Onion	48.45	S3	Watermelon	28.90	S3	Guava	22.8	N1
	Wheat	36.00	S3	Pea	32.30	S3	Mango	34.2	S3
	Sunflower	32.30	S3	Beans	18.22	N1			
	Groundnut	21.25	N1	Green pepper	21.25	N1			
2	Alfalfa	55.75	S2	Potato	55.42	S2	Olives	24.7	N1
	Barley	37.16	S3	Tomato	37.17	S3	Citrus	15.5	N1
	Onion	61.94	S2	Watermelon	16.30	N1	Guava	18.4	N1
	Wheat	41.54	S3	Pea	29.15	S3	Mango	23.3	N1
	Sunflower	15.49	N1	Beans	15.62	N1			
	Groundnut	19.17	N1	Green pepper	29.15	S3			
3	Alfalfa	41.42	S3	Potato	28.90	S3	Olives	29.1	S3
	Barley	19.18	N1	Tomato	43.73	S3	Citrus	16.3	N1
	Onion	41.18	S3	Watermelon	43.73	S3	Guava	12.9	N2
	Wheat	20.19	N1	Pea	30.87	S3	Mango	29.2	S3
	Sunflower	27.62	S3	Beans	12.22	N2			
	Groundnut	29.07	S3	Green pepper	46.03	S3			
4	Alfalfa	46.03	S3	Potato	43.35	S3	Olives	34.2	S3
	Barley	29.07	S3	Tomato	30.69	S3	Citrus	21.4	N1
	Onion	46.03	S3	Watermelon	20.19	N1	Guava	14.3	N2
	Wheat	30.78	S3	Pea	19.18	N1	Mango	18.2	N1
	Sunflower	19.18	N1	Beans	17.31	N1			
	Groundnut	18.06	N1	Green pepper	19.18	N1			
7	Alfalfa	54.15	S2	Potato	48.45	S3	Olives	51.0	S2
	Barley	29.07	S3	Tomato	51.44	S2	Citrus	22.6	N1
	Onion	51.44	S2	Watermelon	22.56	N1	Guava	19.2	N1
	Wheat	34.20	S3	Pea	20.19	N1	Mango	21.4	N1
	Sunflower	19.18	N1	Beans	15.49	N1			
	Groundnut	21.25	N1	Green pepper	22.56	N1			
8	Alfalfa	69.04	S2	Potato	65.21	S2	Olives	51.0	S2
	Barley	41.18	S3	Tomato	39.12	S3	Citrus	19.2	N1
	Onion	61.95	S2	Watermelon	25.00	S3	Guava	19.2	N1
	Wheat	48.45	S3	Pea	18.22	N1	Mango	18.2	N1
	Sunflower	18.22	N1	Beans	16.44	N1			
	Groundnut	21.25	N1	Green pepper	20.19	N1			
9	Alfalfa	72.68	S2	Potato	76.71	S1	Olives	51.0	S2
	Barley	41.18	S3	Tomato	46.03	S3	Citrus	22.6	N1
	Onion	72.88	S2	Watermelon	38.00	S3	Guava	32.3	S3
	Wheat	45.45	S3	Pea	19.18	N1	Mango	25.0	S3
	Sunflower	30.65	S3	Beans	18.22	N1			
	Groundnut	21.25	N1	Green pepper	36.10	S3			
10	Alfalfa	55.27	S2	Potato	41.18	S3	Olives	35.0	S3
	Barley	36.85	S3	Tomato	35.00	S3	Citrus	16.3	N1
	Onion	49.59	S3	Watermelon	27.46	S3	Guava	19.4	N1
	Wheat	43.35	S3	Pea	41.18	S3	Mango	23.3	N1

	Sunflower	27.46	S3	Beans	16.30	N1			
	Groundnut	18.06	N1	Green pepper	24.57	N1			

***(Si rates%) S1=75-100, S2=50-74, S3=25-49, N1=15-24, N2=<15.**

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خصائص وتقسيم وتقييم بعض أراضي توشكى ، مصر

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الملخص العربي

أختيرت عشر قطاعات أرضية لتمثل الجزء الجنوبي من منطقة توشكى وذلك لدراسة الخصائص المورفولوجية والطبيعية والكيميائة وتقسيم وتقييم هذه الأراضي ، قد تفيد نتائج هذه الدراسة عند استصلاح هذه الأراضي لاستغلالها زراعيا.

ولقد أوضحت النتائج أن هذه الأراضي تقع على منسوب يتراوح بين ١٨٤ – ١٩٣ متراً فوق سطح البحر ، سطح الأرض شبه مستوى على طبوغرافيا بسيطة الميول ، والقطاع الأرضي عميق إلى متوسط العمق ، والأراضي جيدة الصرف ، ذات قوام رملي إلى رملي طميي مع وجود بعض الحصى والقطع الصخرية ، بناؤها حبيبي إلى كتلي ضعيف ، ذات صلابة متغيرة من هشة إلى قوية ، يميل لونها إلى الأصفر المحمر ، والأراضي غير ملحية ، قلوية التأثير ، قليلة المحتوى من الكربونات الكلية ، منخفضة في محتواها من المادة العضوية ، السعة التبادلية تتوقف على محتوى الأرض من الحبيبات الدقيقة والمادة العضوية وغالباً ما يسود الصوديوم المتبادل المعقد الغروي الضئيل مما يسبب التأثير الصودي.

تدل المقاييس التصنيفية المورفولوجية على قلة التمايز بين الطبقات ، وتعزى الاختلافات في القيم أساساً إلى اختلاف ظروف ونوعية ونظم الترسيب أكثر من عزوها إلى التطور.

لم يتضح بالأراضي أي نوع من الآفاق الوراثية ولذلك قسمت الأراضي طبقاً للنظام الأمريكي (٢٠٠٦) تبعاً لرتبة Entisols حتى مستوى العائلة.

أوضح تقدير معامل القدرة الإنتاجية للأراضي أنها تتبع الدرجات من الثانية إلى الخامسة ، ولقد قيمت الأراضي ذات الدرجات من الثانية إلى الرابعة لمدى ملائمتها لزراعة ستة عشر محصولاً من محاصيل الحقل والخضر والفاكهة.

Table (3): Some physical and chemical properties of studied soil profiles.

Profile N°	Depth cm	Gravels %	Particle size distribution %			Texture class	pH 1:2.5	EC dSm^{-1}	CEC meq/100 g soil	ESP	$CaCO_3$ %	Gypsum %	OC %
			Sand	Silt	Clay								
1	0- 20	1.8	79.2	13.1	7.7	L. sand	8.8	0.60	8.0	42.6	2.5	0.41	1.51
	20- 45	2.1	79.9	11.5	8.6	L. sand	9.2	0.51	9.0	49.2	3.1	0.15	1.34
	45- 75	7.6	77.3	14.5	8.2	Sg L. sand	9.3	0.42	8.3	49.7	1.8	0.10	1.15
	75- 150	1.0	84.4	9.9	5.7	L. sand	9.4	0.30	4.4	31.8	0.5	0.08	0.80
	w p m	2.5	81.6	11.5	6.9	Sg L. sand	-	0.40	6.4	39.7	1.4	0.14	1.05
2	0- 15	3.8	89.0	5.0	6.0	Sg L. sand	9.4	0.28	5.5	32.9	1.3	0.04	1.01
	15- 30	6.3	82.3	12.2	5.5	Sg L. sand	9.5	0.16	4.7	34.1	1.1	0.04	1.00
	30- 40	4.1	80.0	13.0	7.0	Sg L. sand	9.4	0.18	6.6	52.0	0.5	0.19	0.87
	40- 70	2.8	82.6	11.5	5.9	Sg L. sand	9.5	0.15	5.3	48.2	1.1	0.03	0.84
	mean	4.0	82.9	11.0	6.1	Sg L. sand	-	0.18	5.4	42.4	1.0	0.06	0.92
3	0- 15	12.9	89.1	5.3	5.6	Sg Sand	9.2	0.44	5.7	28.2	1.3	0.16	1.18
	15- 40	25.6	88.9	6.1	5.0	g Sand	8.9	0.39	3.2	22.4	1.5	0.07	1.18
	40- 80	8.7	88.9	6.8	4.3	Sg Sand	8.6	0.47	3.1	20.3	1.6	0.10	0.92
	80- 100	10.9	88.7	6.2	5.1	Sg Sand	8.9	0.26	6.0	34.6	1.2	0.03	0.76
	mean	14.0	88.9	6.3	4.8	Sg Sand	-	0.40	4.1	24.8	1.4	0.09	0.99
4	0- 20	12.8	78.9	14.2	6.9	Sg L. sand	9.2	1.08	10.4	37.2	1.6	0.09	0.84
	20- 50	3.2	79.0	13.5	7.5	Sg L. sand	8.8	0.61	11.0	37.9	2.0	0.31	0.76
	50- 80	3.5	77.6	14.7	7.7	Sg L. sand	8.7	1.80	8.3	25.1	2.8	0.54	0.68
	80- 150	7.8	81.0	12.9	6.1	Sg L. sand	8.5	1.75	7.1	25.4	6.0	0.50	0.63
	mean	6.7	79.7	13.5	6.8	Sg L. sand	-	1.44	8.6	29.4	4.0	0.42	0.69
5	0- 10	14.7	86.5	9.5	4.0	Sg L. sand	9.3	0.15	4.2	34.5	3.4	0.04	1.51
	10- 25	4.0	87.0	8.8	4.2	Sg L. sand	9.6	0.40	4.4	44.4	0.9	0.03	1.45
	25- 55	20.0	90.0	6.3	3.7	g L. sand	9.1	0.22	4.0	52.5	0.9	0.12	1.34
	mean	14.7	88.6	7.5	3.9	Sg L. sand	-	0.26	4.1	47.5	1.4	0.08	1.40

Table (3): Continued.

Profile N°	Depth cm	Gravels %	Particle size distribution %			Texture class	pH 1:2.5	EC dSm^{-1}	CEC meq/100 g soil	ESP	$CaCO_3$ %	Gypsum %	OC %
			Sand	Silt	Clay								
6	0- 10	17.2	89.9	6.0	4.1	G Sand	8.9	0.33	4.0	30.8	9.0	0.11	1.01
	10- 30	43.6	92.5	5.1	2.4	G Sand	9.6	0.34	3.0	40.0	4.6	0.12	1.00
	30- 45	45.1	90.7	6.1	3.2	G Sand	9.5	0.37	3.1	54.8	10.6	0.12	0.73
	45- 60	74.3	90.0	6.2	3.8	Vg Sand	8.5	1.35	3.7	53.4	15.6	0.99	0.67
	mean	47.2	91.0	5.8	3.2	G sand	-	0.60	3.4	49.5	9.6	0.34	0.85
7	0- 20	9.5	82.8	11.1	6.1	Sg L. sand	8.5	0.57	7.4	46.8	4.6	1.86	1.60
	20- 50	18.2	81.6	12.2	6.2	g L. sand	9.8	0.39	7.8	41.5	1.4	0.16	1.51
	50- 80	6.6	81.6	11.2	7.2	Sg L. sand	8.7	0.42	7.8	51.8	1.6	0.21	1.34
	80- 150	9.2	83.0	9.5	7.5	Sg L. sand	8.6	0.39	8.0	51.9	1.8	0.06	0.59
	mean	10.5	82.5	10.6	6.9	Sg L. sand	-	0.42	7.9	49.2	2.1	0.35	1.06
8	0- 25	11.6	78.3	12.5	9.2	Sg L. sand	9.4	0.44	6.3	41.8	12.9	0.06	1.01
	25- 55	11.7	70.2	17.2	12.6	Sg S. loam	8.7	0.78	7.2	46.3	3.8	0.15	0.87
	55- 90	9.5	71.5	15.4	13.1	Sg S. loam	8.5	0.78	8.1	45.0	2.0	0.20	0.84
	90- 150	5.3	73.1	14.0	12.9	sgS. loam	8.7	0.51	7.8	45.0	1.4	0.06	0.71
	mean	8.6	73.0	14.7	12.3	Sg S. loam	-	0.62	7.5	44.7	3.9	0.11	0.82
9	0- 20	11.7	66.7	15.3	18.0	Sg S. loam	9.0	0.21	11.3	43.4	2.1	0.03	0.94
	20- 50	5.9	71.4	13.2	15.4	Sg S. loam	9.4	0.14	9.9	44.2	3.7	0.06	0.81
	50- 90	6.0	73.2	12.6	14.2	Sg S. loam	9.4	0.27	10.9	43.4	2.1	0.05	0.80
	90- 150	11.7	68.1	13.5	18.4	Sg S. loam	9.5	0.22	10.5	47.8	5.3	0.10	0.67
	mean	9.0	69.9	13.5	16.6	Sg S. loam	-	0.22	10.8	45.3	3.7	0.07	0.77
10	0- 15	6.5	84.5	8.5	7.0	Sg L. sand	9.2	0.24	7.0	42.7	9.0	0.06	1.03
	15- 45	1.6	82.6	11.3	6.1	L. sand	8.5	0.28	5.0	25.1	5.2	0.11	0.97
	45- 60	50.1	81.1	12.0	6.9	g L. sand	9.2	0.24	5.5	33.2	3.6	0.03	0.92
	60- 90	42.2	80.0	12.5	7.5	g L. sand	8.6	0.29	8.6	42.9	3.7	0.05	0.84
	mean	24.1	81.8	11.3	6.9	g L. sand	-	0.27	6.6	35.3	5.1	0.07	0.93