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STUDIES ON SOME SOILS OF SIWA OASIS Soil CLASSIFICATION AND LAND SUITABILITY EVALUATION OF EL-MARAQUI AND KHAMISA REGIONS

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ABSTRACT

Twenty five soil profiles representing El-Maraqui and Khamisa Regions in Siwa Oasis, were studied in the filed, seven out of them were selected to represent different soil mapping units. The soil profiles were classified and land suitability evaluation were estimated using Soil Taxonomy and Sys and Verheye system.

On the basis of soil morphological, physical, and chemical properties, the soils were classified into the following mapping units:

1- Pediplain soils: Calcic Aquisalids, fine loamy, moderatlly deep to shallow, undulating to gently undulating on pediplains. The soil are marginally suitable (S3nt) for irrigated agriculture.

2- Sandyplain soils: I. Calcic Aquisalids, sandy, very deep sandy or loamy sand through out the profiles, almost flat on sandy plains. The soil arenot suitable (N1nt) for irrigated agriculture.

II. Typic Haplo Calcic, sandy, very deep, loamy sand over sandy loam, almost flat on sandy plains. The soil are marginally suitable (S3nt) for irrigated agriculture.

3- Sabkha soils: Calcic Aquisalids, sandy, very deep, sandy or loamy sand through out the profiles, nearly level on Sabkha. The soils are not suitable (N1nt) for irrigated agriculture .

Keywords: Siwa soils, Classification, suitability.

INTRODUCATION

Siwa Oasis lies in the North Western part of Egypt. The investigated area, El-Maraqui and Khamisa Regions are lying in West of Siwa Oasis depression, between 29o 10\ South to 29o 18\ North latitudes and 25o 17\ West to 25o 27\ East longitudes.

Siwa Oasis consists of several major regions, lying beside to each others, called " Hatiyat ". The most important regions are:

1- El-Maraqui Region
2- Khamisa Region
3- Siwa Region
4- Aghormi Region
5- Qureshet Region
6- Abu-Shrouf Region
7- El-Zeitun Region

The Physiographic features

The physiographic features most important in Siwa depression, according to Abu Al-Izz (1971), are:

1-The Sea of sand: There are several types of sand formations in the Siwa Oasis depression, such as sand dunes, sand hills and sand deposits. The actual composition of this "sea" is waves of seif dunes separated by wadies.
The lakes: The Siwa Oasis depression includes a group of minor depressions. The centers of these small basins are occupied by akes or lagoons. The water of these lakes are highly saline because of the high evaporation. The most important lakes in the investigated area are: Al-Maraqui lake and Khamisa lake.

2- The hills and mountains: Beside the Northern scarp, there is a number of hills and mountains, which are formed from the same Miocene rocks chalk, marl, shale and limestone as the plateau to the north of the depression. This indicates that the hills and mountains were once part of the plateau and have been separated from it by erosion. The main hills are Um Al-Huwaymit, Qarat Al-Hamra, Qarat Al-Bayda and Qarat El-Cari, and the important Mountain in the studied area are Gabal Siwa (38 m), Gabal El-Mawta (42 m), Gabal El Kosha (36 m), Gabal Aghormi (16 m), Gabal El-Takrur (88 m), Gabal El-Girba (120 m) ,Gabal El-Migahhiz (1000 m), Gabal Western Migahhiz (120 m) and Gabal Umm Hiyus (90 m).

Geology of Siwa Oasis Depressions:

The Siwa Oasis has been studied geologically and how the depression formed by severa authors, such as Beadnell (1901), Ball (1927), Sandford and Arkel (1939), Ibrahim (1952), Parsons (1962), Said (1962), and Gindy and El-Askary (1969). Abu Al-Izz (1971),

Parsons (1962) pointed out that , the information about thgeological history of Siwa is as follows (Map 1).

1- The early geological history of Siwa Depression unknown.

2- Below the Miocene and during most Mesozoic (The Cretaceous Period). The Siwa Depression seems to be part of the great basin that included the modern Qattara Depression.

3- During the Eocene (Tertiary Era), the depression apears to have been covered with shallow sea. Middle Eocene sediments having nummulitic, organic and limestone faces are exposed on the south-East of the depression while the Upper Eocene sediments are in the form of shale faces.

4- In Oligocene (Tertiary Era), fluveatiale continental sediments were deposited in Siwa area.

5- During the Miocene (Tertiary Era), the sediments were followed upon Oligocene deposits by the marine transgression in lower Miocene. In this Era, Siwa was separated from the sea to the north by a reafal structure. A more calcareous unit was deposited during Middle Miocene and it is assumed to have uniform thickness over the whole area and many reefal structures were developed by the end of Middle Miocene, gentle northeast southwest trending uplifts has been developed in the whole area.

map1

Gindy and El-Askary (1969), suggested that during post Middle Miocene uplift, there occurred a hinge faulting and rejuvenation of old faults. This resulted in large tectonically controlled surface depressions, like that of siwa and its tectonical association indiced jointing. Water erosion within the the chemically vulnevale Miocene sediments of initial depression proceeded rapidly and greatly enlarged it. Wind deflation had a relatively late and minor role.

Previous studies of Siwa Oasis soils: The soils of Siwa Oasis has been studied by several authors such as: Zein El-Abdien (1952), Saleh (1970) Gomha (1976), Haraga (1974), Fanous (1979) and Sherif (1979).

Sherif (1979) reported that in his studies on siwa Oasis;

1- most of the soils in siwa Oasis are highly calcareous and light in text0ure.
2- Siwa soils are characterized by their saline nature, they contain soluble salts ranging from 4.03 to 35.30 mmohs/cm for the cultivated areas and 11.93 to 89.76 mmohs/cm at 25oc for the virgin ones.
3- Siwa soils are relatively poor as they have low organic matter and relatively low clay content besides its high content of free calcium carbonate.
4- Siwa soils contain high amounts of soluble and exchangeable potassium.
5- The quality of irrigation water flowing from the different springs tested, is unsuitable for many plants of low salt tolerance due to its high content of soluble salts (2.67 to 20.4 mmhos/cm at 25o c).

Climate: The meteorological records of Siwa Oasis (Table 1) convering a period of about 30 years show that the prevailing climatological conditions are as follows :-

table1 من الأصل

- The mean rainfall is 0.8 ml/annual .
- The mean relative humidity is 41.66 %.
- Evaporation ranges from16.8 ml / day in Jully to 5.2 ml/day in December.
- Monthly main temperature ranged between 19.7o C in January to 39.9oC in Jully.
- The prevailing wind blows is the north west, north and north east.

The study aims to estimate: the soil calssification and produce the soil map of some soils of Siwa Oasis according to soil taxonomy (USDA 1999). 2 –and produce the soil suitability map for the selected area, according to Sys and Verheye (1978).

MATERIALS AND METHODS

A reconnassance soil survy of the selected area (El Marqui and Khamisa regions) of Siwa Oasis depression (25803 fd.) was carried out. Contour map at scale of 1:25000 was used to produce a soil map during the filed work. Information of landscape was carefully observed, in addition to soil morphological characteristics.

Twenty five profiles were examined and seven out of them were chosen to represent the different soil mapping units which were identified and delineated within the filed work, Table (2) show the locations of the representing profiles according to longitudes and latitudes lines. The profiles were dug to 150 cm or less according to the hard pan or rocks. Morphologically described carried out according to FAO system (1977), Table (3).

table 2من الأصل

@Soil samples representing the subsequent morphological variations within the entire depth of each profiles were collected for laboratory analysis. The samples were air dried and subjected to physical and chemical analysis including soluble cations and anions , in addation to EC , pH , CaCO3 and SO4-2H2O if appears , according to the methods of Richards (1954) . Particals size distributions determined pipette according to Richards (1954) . ESP values were calculated according to Balbaa , 1979 , (Table 4) .

Soil calssification was carried out according to Soil Taxonomy USDA (1999) .

Soil evaluation was estimated using Sys and Verhey , 1978 , (Table 5).

RESULTS AND DISCUSSION

Based on the field studies and the interpretations of the topographic map (scale 1:25000) seven physiographic units were recognized and may be classified as follows : Pediplains , sand plains , sand dunes , lakes and sabkha and mountains & plateau (Map 2) .

The mapping units may be composed of one or more dominant soils, they are then called consociations and associations respectively . The components of an association can note be sperated at scale which this soil survey was made. Each major component of an association is described separately. The relative proportion of the componants of each mapping unit is estimated according to the interpretation of filed examination and observations. The areas under the study are :

1-El-Maraqui region: It is borders the Oasis from the west at about 10.85 Km long ,and has many gardens and pastures . It lyes between 29o 12\ and 29o 18\ N long. and 25o 17\ and 25o 22\ E Lat. (map 2) .

2-Khamisa Region : It is 8 Km , and its famous for the scared Khamisa mountain and it has many springs and fruits trees such as Olive , dates , apples , nabk , grapes and lemon . It lyes between 29o 10\ and 29o 15\ N Long. and 25o 22\ and 25o 27\ Lat. (map 2) .

Soil classification : Soil classification was carried out on the basis of Soil Taxonomy System of the USDA (1999) , the soils of the studied area were classified to one order only " Aridisols " , Table (5) shows the soil taxonomy calssification up to the family level .

Table (3) shows the morphological description of the studied profiles , while physical and chemical analyses data are presented in Table (4) .

Climatic data indicated that the soil moisture regime is usually dry in most years in all parts of soils (Torric moisture regime) and soil temperature regime of these area is thermic . (the mean annual temperature is < 22o c with great difference between summer and winter > 5oo c , this indicated that , the soil temperature regime is thermic) .

map2

4

table5من الأصل

Mapping units description :
A – Pediplain ;
Calcic Aquisalids , fine loamy , moderatly deep to shallow , 2-3 % slope .

This mapping unit is represented by profiles No 1 and 2 ; and consistes of undulating to gently undulating surface on pediplain and areas of rock out crops . It occupies an area of 3923.9 fed. , representing about 15 % of the total studied area . About 90 % of this area mapping unit are Calcic Aquisalids , fine loamy , mixed thermic ; and the remaining 10 % rock out crops .

The Calcic Aquisalids and similar soils are shallow to moderatly deep , sandy over clay loam or clay loam over loam . Very strong saline soils Ec > 16 dSm-1 (EC ranged between 21.8 to 184.6 dSm-1) with slightly alkaline reaction (pH value 8.25 – 8.60) , and CaCO3 content ranged from 15.2 to 70.0 % .
According to Sys and Verheye (1978) , this mapping unit is (S3) marginly suitable for irrigated agriculture , with one sever limitations in this mapping unit is salinity of soils , Table (6) .

table6من الأصل

B – Sandy plain :

1 - This mapping unit is represented by profiles Nos. 3 & 4 (Under-reclamation land) classified as Calcic Aquisalids , sandy , very deep , 1% slope , and consists of almost flat surface on sandy plains . It occupies an area of 6767 fed. representing about 26.2 % of total studied area . About 50 % of this mapping unit are Calcic Aquisalids , sandy , mixed , thermic ; and remaining 50 % are Typic Haplocalcids , sandy , mixed , thermic .

The calcic and similar soils are very deep , sandy thrghout the profiles or sandy loam , very strong to moderatly saline soils (Ec ranged from 10.5 to 182.25 dSm-1 with slightly alkaline reaction (pH value 8.55 – 8.86) . and CaCO3 content ranged from 4.8 to 65.6 % .

According to Sys and Verheye (1978) , this mapping unit is not suitable (N1 nt) , due to that saline and texture are very sever limitation (Table 6) .

2 – Calcic , loam over sandy loam , very deep , 0.5 – 1% slope (Cultivated land) ; This mapping unit is represented by profile No. 5 and consists of almost flat surface on sandy plains . It occupies an area of 403.8 fed. representing about 1.56 % of total studied area This mapping unit is Typic Haplocalcic , sandy , mixed , thermic . This soil is very deep , loamy sand over sandy loam , non saline soils (EC ranged between 2.12 – 4.66 dSm-1) with neutral reaction (pH value 7.6 – 7.7) , and CaCO3 content ranged from 23.46 to 69.99 %

According to Sys and Verheye (1978) , this mapping unit is maginally suitable (S3 nt) due to that saline and texture are sever limitations , (Table 6)

C – Sabkha :

This mapping unit consists of nearly level soil on sabkha plains . Profiles Nos. 6 & 7 represents this unit , which covers an area about 5831 fed. and representing about 22.23 % of total studied area . This mapping unit are Calcic Aquisalids , sandy mixed , thermic .

The dominent soil in this unit is very deep sandy or loamy sand through out the profile , Ec ranged from 13.46 to 475 dSm-1 with mild alkaline reaction (pH value 7.6 – 8.82) . Calcium carbonate content ranged from 3.84 to 39.88 %.

According to Sys and Verheye (1978) this mapping unit is not suitable (N1 nt) , due to that saline and texture are very sever limitations .

CONCLUSION

The Soils of Khamisa and El-Maraqui regions in Siwa Oasis are classified according to (USDA 1999) into one order “Aridisols” , two suborder and two great groups “Aquisalids and HaploSalids , and two subgreat groups “Calcic Aquisalids” and “Typic HaploCalcic”.

According to Sys and Verheye (1978) it classified into four classes ; the marginlly suitable soils (S3) covered 4327.7 fed. and representing about 16.77 % of total studied area . The not suitable soils (N1) , covered 15298 fed. which represent about 48.8 % of the total studied area .

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دراسات على بعض أراضى واحة سيوه تقسيم وتقييم صلاحية أراضى أقليمى المراقى وخميسه

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درس حقليا ٢٥ قطاع أرضى يمثلوا أقليمى المراقى وخميسه فى واحه سيوه ، ٧ قطاعات منهم أختيرت لتمثيل الوحدات الخرائطية للتربه . وقد قسمت هذه القطاعات الرضية وقيمت صلاحيتها بناء على الخصائص المورفولوجيه والطبيعيه والكيميائيه واظهرت الوحدات الخرائطية التالية :

١- أراضى حواف الهضاب pediplain وهى أراضى جيرية ملحية Calcic Aquisalids ، طمييه ناعمة ، متوسطة العمق الى ضحلة ، متموجة الى بسيطة التموج . وهى أراضى هامشية الصلاحية S3nt للزراعات المرورية

٢-أراضى السهول الرملية Sandy plain وهى أراضى جيرية ملحية Calcic Aquisalids ، رملية القوام ، عميقة القطاع ،مستوية تقريبا . وهى أراضى غير صالحة N1nt للزراعات المروية.

٣- أراضى السهول الرملية Sandy plain وهى أراضى جيرية Typic Haplo Calcic ، رملية القوام (رملية طميية فوق طميية رملية) ، مستوية فى الغالب ، وهى هامشية الصلاحية S3nt للزراعات المروية.

٤- أراضى السبخات Sabkha وهى أراضى جيرية ملحية Calcic Aquisalids رملية القوام (رملية أو رملية طمييه) عميقه جدا ، مستويه تقريبا وهى أراضى غير صالحه فى الوقت الحالى N1nt للزراعات المروية.

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