5. SUMMARY

This study aims to identify the soil characteristics of Wadi Sudr and Wadi Wardan area in the south western part of Sinai for the soil classification and land evaluation purposes. This will be helpful in the planning for agricultural development.

An analysis of landsat TM image covers this area resulted in recognition of the following physiographic units : mountains, hills, and escarpments of sedimentary rocks, old and young alluvial terraces, upper and lower alluvial deltaic plain, playa, sabkhas, oolitic sand dunes and coastal sand beach.

Fifteen soil profiles were morphologically described, and fifty three soil samples were collected for physical and chemical analyses. Diagnostic horizons such as salic and gypsic horizons were identified for achieving the soil classification according to Soil Taxonomy System. Land suitability for irrigated agriculture was based on the Sys and Verheye and FAO systems.

The obtained data about the studied phsiographic units could be summarized as follows :-

1- Mountains, hills, and escarpment of sedimentary rocks:

This unit is located at the western part of El Tih plateau, elevation >600m a.s.l. with steep slope. It has rocky surfaces or very shallow soils forming badlands with no potentiality for agriculture. Its suitability class is permanenty not suitable (N2)

2-Old alluvial terraces :

They are about 3060 Fed., have undulating surface, covered with gravel and stones, soil texture is very gravelly to extremely gravelly

coarse sand, transported and deposited by water action, the soils are slightly to strongly saline, with dominant soluble cations of Ca^{+2} and /or Na^{+}, while dominant anions are Cl^{-} and /or $SO_4^{=}$. Soils also, are characterized by low organic matter content (<0.4%), high amount of $CaCO_3$ (13.92-48.29%), and considerable amount of gypsum reaches 28.36 which is enough to form gypsic horizon. CEC values range from 3.25 to 8.98 me/100g soil and the exchangeable cations follow the descending order: $Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}$.

Soils are classified as:

Typic Haplogypsids, sandy skeletal, gypsic, hyperthermic; and

Typic Haplogypsids, sandy ,carbonatic, hyperthermic.

The studied soils are marginally suitable, with limitations of texture, topography, gypsum, salinity and alkalinity.

3-Young alluvial terraces :

They are about 13310 Fed., have gently undulating surface, covered with gravel and stones, soil texture is gravelly to very gravelly coarse sand, transported and deposited by water action. The soils are moderately to strongly saline, with soluble cations dominated by Na^{+}, while soluble anions dominated by Cl^{-}. Organic matter is <0.4%, $CaCO_3$ range from 33.93 to 50.9% and gypsum reaches 17.2% which is enough to form gypsic horizon. CEC values range from 2.08 to 9.65 me/100g soil and the exchangeable cations follow the descending order: $Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}$.

Soils could be classified as :

Leptic Haplogypsids, sandy skeletal, carbonatic, hyperthermic, and

Leptic Haplogypsids, sandy, carbonatic, hyperthermic.

Soils are marginally suitable, with limitations of topography, texture, carbonate, gypsum and salinity and alkalinity.

4-Upper alluvial deltaic plain :

They are about 24470 Fed., have almost flat to gently undulating surface, covered with gravel and stones, desert shrubs and weeds.Soil texture is very gravelly to extremely gravelly coarse sand, soil materials are transported and deposited by water action. Soils commonly are non to slightly saline, and occasionally are strongly saline, O.M.(0.026-0.445%), $CaCO_3$ (26.75-51.33%), gypsum (0.31-0.56%), and occasionally reaches 27.34%. CEC values (1.71-9.44 me/100g soil), and the exchangeable cations follow the descending order: $Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}$.

Soils could be classified as :

Typic Torriorthents, sandy skeletal, carbonatic, hyperthermic; and Typic Haplogypsids, sandy skeletal, carbonatic, hyperthermic.

Soils are currently not suitable, with limitations of texture, $CaCO_3$, gypsum, and salinity and alkalinity.

5-Lower alluvial deltaic plain :

They are about 15540 Fed., have almost flat surface, most of the area is cultivated with olives using drip irrigation.

Soil texture is sand and sandy loam, soil materialsare transported and deposited by water and wind action. Soils are non to strongly saline, O.M.(0.053-0.483%), $CaCO_3$ (43.72-54.38%), gypsum (0.37-0.72%). CEC values (2.68-7.96 me/100g soil) and the exchangeable cations dominated by Ca^{+2} and /or Mg^{+2} followed by Na^{+} and K^{+}.

Soils could be classified as :

Typic Torrifluvents, coarse loamy, carbonatic, hyperthermic; and

Typic Torrifluvents, sandy, carbontic, hyperthermic; and

Typic Torripsamments, carbonatic, hyperthermic.

Soils are marginally suitable, with limitations of texture, carbonate, and salinity and alkalinity.

6-Playa :

This unit is about 540 Fed., has almost flat surface, covered with white gravel.

Soil texture is sandy clay loam or sandy loam, soil materialsare transported and deposited by water action. Soils are strongly to extremely saline, O.M.(0.284-0.372%), $CaCO_3$ (13.05-54.38%), and gypsum (1.89-27.11%) with gypsic horizon. CEC values (4.44-13.89 me/100g soil)and the exchangeable cations follow the descending order: $Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}$.

Soils could be classified as :

Leptic Haplogypsids, fine loamy, mixed, hyperthermic.

They are marginally suitable, with limitations of texture, gypsum, salinity and alkalinity.

7-Sabkhas :

They are about 700 Fed., have almost flat surface, covered with thin to thick salt crust and pseudosands, common hummocks and many halophytes. Texture is clay loam or silty clay loam, soil materialsare transported and deposited by water and wind actions, soils are extremely saline and salinity is enough to form salic horizon, O.M.(0.29-2.2%), $CaCO_3$ (40-54%) and gypsum (1.0-2.68%). CEC values (10.45-12.78 me/100g soil) and the exchangeable cations follow the descending order: $Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}$.

Soils could be classified as :

Typic Haplosalids, fine loamy, carbontic, hyperthermic.

They are marginally suitable with limitations of microrelief, wetness, carbonate, salinity and alkalinity.

8-Oolitic sand dunes :

They are about 1555 Fed., have undulating to rolling surface. Soil texture is sand and soil materials are transported and deposited by both water and wind actions. Soils are strongly saline, EC(22.68-36.28dS/m), O.M.(0.24-0.55%), $CaCO_3$ (94-97%) and gypsum (0.35-0.6%). CEC values (2.41-3.62 me/100g soil) and the exchangeable cations follow the descending order: $Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}$.

Soils could be classified as :

Typic Torripsamments, carbonatic, hyperthermic.

They are currently not suitable, with limitations of topography , texture, carbonate, gypsum, salinity and alkalinity.

9-Coastal sand beach :

This unit is about 4970 Fed., has almost flat surface with thin layer of salt crust, soil texture is sand and soil materialsare transported and deposited by both water and wind actions, soils are moderately to strongly saline (EC 13.77-27.54) O.M.(0.053-0.067%) $CaCO_3$ (54.38-84.83), and gypsum (0.4-0.61%). Soils have saline water table at a depth of 70 cm from the soil surface. CEC values (2.99-5.78 me /100g soil) and the exchangeable cations follow the descending order: $Mg^{+2} > Ca^{+2} > Na^{+} > K^{+}$.

Soils could be classified as :

Typic Torripsamments, carbonatic, hyperthermic.

They are currently not suitable, with limitations of wetness, texture, carbonate, gypsum and salinity and alkalinity.

The obtained results indicated that the studied soils are marginally suitable, currently not suitable or permanently not suitable for

irrigated agriculture, this is due to the presence of limitations with different degrees of intensities. The defined limitations are topography, wetness, texture, soil depth, calcium carbonate, gypsum, salinity and alkalinity.

Improvement of such soils needs beneficial changes including stone clearance, land leveling, subsoil ploughing, construction of perfect system for both irrigation and drainage, reclamation of salinity and alkalinity, application of chemical and organic fertilizers and soil conditioners. The performance of the above mentioned land improvements hopefully will increase the suitability of the studied soils.