

Diagnosis and evaluation of some soils in the northern-west coast of egypt

Magdy Abd El-Latif Mahmoud

SUMMARYThe present investigation was undertaken to study the diagnosis and evaluation of some soils in the North-western coast of Egypt. The studied area is bounded by longitudes 25° 10" and 29° 50" East and latitudes 30° 50" and 31° 10" North. It is characterized by the presence of five physiographic units namely:1-Marine sediments.2-Lacustrine sediments.3-Fluvio-lacustrine deposits.4-Aeolian plain.5-Miscellaneous land types.To get more soil information on such area, twenty soil profiles were chosen to represent the different physiographic units. The soil profiles were morphologically described and subjected to the physical, chemical and mineralogical analyses. The obtained results could be summarized as follows.1- Physical and chemical properties1. 1 Soils of marine sedimentsThese soils have variable texture, sandy clay to clay loam. CaCO₃ content varies widely from 6.43 % to 23.10 % indicates that these soils are slightly calcareous to calcareous. High percentage of these carbonates is due to the calcareous nature of the deposits from which the soils are formed. Organic matter content is very low and does not exceed 0.75 % and mostly decreases with depth. Soil reaction is mildly alkaline to moderately alkaline. Soil salinity is non saline to extremely saline EC values are in the range of 0.84-28.2 dSm⁻¹. Soluble cations are dominated by Na⁺ followed by Ca²⁺ and Mg²⁺ while K⁺ is the least abundant soluble cation. Soluble anions are mostly dominated by followed by 5042" and HCO₃⁻. C.E.C. values range generally from 3.74 to 7.85 me/100g. depending on clay content. Exchangeable Ca²⁺ dominates the exchangeable cations followed by Na⁺ and Mg²⁺, while K⁺ is the least. Gypsum content ranges from 0.19 to 2.84 %.1. 2 Soils of lacustrine sedimentsSoil texture varies from sand to sand clay loam. These texture variations are due to the modes of deposition together with aeolian sand carried in by wind activities. CaCO₃ content ranges between 12.1 to 30.3 % with a tendency of increase with depth. Organic matter content is very low, being in the range 0.10 to 0.60 %. Soil reaction is neutral to mildly alkaline as the pH values range from 7.2 to 7.6. EC values range from 0.41 to 7.89 dSm⁻¹, indicating that the soils are non saline to slightly saline. The cationic composition of soluble salts is dominated by Na⁺ followed by Ca²⁺ and Mg²⁺ while Cl⁻ ions is the predominant anions followed by SO₄⁼ and HCO₃⁻. C.E.C. values range from 5.56 to 11.68 me/100g soils. Exchangeable Ca²⁺ is the predominant cation followed by Mg²⁺, Na⁺ then K. Gypsum content is very low ranging from 0.11 to 0.21 %.1. 3 Soils of fluvio-lacustrine depositsSoil texture of this physiographic unit ranges from sandy loam to light clay. CaCO₃ content varies from 12.5 to 25.0 %. Organic matter content is very low and relatively decreases with depth. The analytical data of soil samples showed that, soil reaction is neutral to mildly alkaline according to the pH values rane from 7.1 to 7.8. EC values range from 0.69 to 2.56 dSm⁻¹ indicating that the soils are non saline. The cationic composition of the soil saturation extract are dominated by Na⁺ and / or Ca²⁺ followed by Mg²⁺ and K⁺, while the soluble anions have the descending order Cl⁻ > HCO₃⁻ > SO₄⁻. C.E.C. values vary from 1.99 to 11.83 me/100g. soil. Exchangeable cations are characterized by the dominance of Ca²⁺ followed by Mg²⁺, Na⁺ and K. Gypsum content is very low, ranges between 0.15 and 0.23 %.1. 4 Soils of aeolian plainSoil texture of this physiographic unit is restricted between sand to sand clay loam. CaCO₃ content varies from 7.9 • to 23.5 % with an irregular distribution pattern with depth. Organic matter and gypsum content is extremely low. The analytical data indicate that the soils are neutral to moderately alkaline as the pH values range from 7.0 to 7.9. The soils are non saline to extremely

saline as indicated by E_c values which range from 0.42 to 21.7 dSm-l. The soluble cations are dominated with Na^+ followed by Ca^{2+} , Mg^{2+} and K^+ , while the anions follow the order $Cl^- > SO_4^{2-} > HCO_3^-$. C.E.C. values range from 2.77 and 10.05 me/100g.soil. The exchangeable cations are dominated by Ca^{2+} followed by Mg^{2+} , Na and K .

2- A field morphological rating scale for evaluating pedological development The morphology rating scales was applied to determine the relative distinctness of horizons (RHD) and to determine the relative profile development (RPD). The determination of relative distinctness of horizons was made by a comparison of adjacent horizons, while the determination of the relative profile development was made by a comparison of the C horizon to the above horizons in the same profile. The data show that the high RHD and RPD rating in the studied area may be due to some environmental factors such as sedimentation pattern of recent materials and activity of cultivation processes in this area.

3- Trace elements studies Total contents of some trace elements "Fe, Mn, Zn and Cu" were determined in the subsequent layers of the studied soil profiles in a trial to assess their distribution. Moreover, statistical analysis is performed to evaluate the role of soil variables in controlling trace elements content. Data indicate that soil texture, mineral composition and $CaCO_3$ content are the most important factors that correlate with total content of such. elements. Furthermore, statistical measures of Oertel and Giles (1963) reveal the role of parent material and soil forming processes in affecting trace elements distribution.

4- Soil mineralogy

4. 1- Mineralogy of the sand fraction a) Light minerals: Data indicate that the light fraction is composed almost entirely of quartz which constitutes 95.0 —98.0 %. Other associated minerals are feldspars which are detected in minute amounts (2.0 -5.0 % of total light minerals). b) Heavy minerals: Heavy minerals are dominated by opaques. Non-opaque minerals are dominated by pyroxenes, amphiboles, zircon and epidote while tourmaline, rutile, staurolite, biotite, kyanite, garnet and monazite are present in moderate amounts and the remaining minerals are of less pronounced occurrence or even absent.

4. 2- Clay mineralogy Mineralogical identification of ten representative clay samples reveals that, the soils of marine sediments and fluvio-lacustrine soils dominated with palygorskite followed by kaolinite with less pronounced occurrence of smectite, illite, vermiculite, chlorite and interstratified minerals while kaolinite and / or palygorskite are the predominant clay mineral in the lacustrine soils. The identified accessory minerals are dominantly quartz and feldspars, while calcite and dolomite are detected in trace amounts. The mineralogical constitution of the clay fraction suggests the inheritance of clay minerals from parent materials, except of palygorskite which is either inherited or neo-genetically. formed under the prevailed soil formation processes, stimulated by the presence of higher contents of $CaCO_3$ and soluble salts.

5- Uniformity of soil parent material This was tackled through statistical size parameters and heavy minerals ratios, especially those related to the ultra stable minerals. Compilation of data of both approaches indicates the multi-origin of most soils.

6- Soil classification Application of the American system "Soil Taxonomy (1999)" indicates that most of the studied soils are related to the order Aridisols and Entisols. The obtained soil classification could be introduced as follows:-

1- order: Aridisols
Sub-order: Calcids
Great group: Haplocalcids.
Sub-group: Sodic Haplocalcids (as profiles 6 and 7).
Sub-group: Lithic Haplocalcids. (as profile 5).
Sub-order: Gypsisols
Great group: Haplogypsisols
Sub-group: Typic Haplogypsisols (as profiles 8, 16, 17, 18, 19, 20, 1, 2 and 4).

2- order: Entisols
Sub-order: Orthents
Great group: Torriorthents.
Sub-group: Typic Torriorthents. (as profiles 3, and 15).
Sub-order: Psamments
Great group: Torripsamments
Sub-group: Typic Torripsamments (as profiles 10, 11, 12, 13 and 14).

7- Land Evaluation On the bases of the previously mentioned presentation concerning the soil environments in addition to water and qualities, one can out-puts land capability information according to the different soil limitations. Application of the capability index for the studied soil profiles reveals that the studied soils are placed between (II) and (V) grades follows:

1- Grade (II) Good soils, represented by profile 8.

2- Grade (III) Fair soils, represented by profile 18 (marine sediments), profiles 1, 2 and 4 (fluvio-lacustrine) and profiles 3, 9, 11, 12 and 14 (aeolian plain).

3- Grade (IV) Poor soils, represented by profiles 10, 13 and 15 (aeolian plain) and profiles 17, 19 and 20 (marine sediments).

4- Grade (V) Very poor soils, represented by profile 5 (lacustrine) and profile 16 (marine).

The studied soil profiles related to the capability classification of grades (II) and (III) only are evaluated to determine their suitability for growing 18 crops (6 field crops, 6 vegetable crops and 6 fruit trees). Results reveal that the studied soil profiles include all the

suitable classes (S1, S2, S3 and N).