Physical, chemical and mineralogical studies on some calcareous soils of egypt

G.A. Abdel-kader

This study points to evaluation of the physical, chemical and mineralogical characteristics of some calcareous soils of Egypt to be classified and evaluated for agriculture purposes. Thus two localities were identified to represent the calcareous soils of Egypt, El-Nobariya area was selected to represent the first area in the western Desert and wadi Sannur area representing the second area in the Eastern Desert. Accordingly, twenty-three soil profiles were chosen to represent the study areas. These profiles were morphologically described and their physical, chemical and mineralogical properties were evaluated. The obtained data could be summarized in the following.1. Physical and chemical propertiesa) Soils of El-NobariyaThese soils have variable texture, loamy sand to sandy clay loam with an apparent increase of clay content with the soil profile depths. CaCO content is very high and varies widely from 23.04 to 53.18%. Depthwise distributions of CaCO3 does not portray any specific pattern with depth. Organic matter content is generally low and mostly decreases with depth.Soil reaction is generally moderately to strongly alkaline where pH values ranged from 7.9 to 8.85. Soil salinity is non saline to slightly saline as shown by EC, values which ranged from 0.65 to 5.3 dSrill. The soluble cations are in the order Ca++> Na+ > mg.+4>K+ in the investigated soils. Also, the solubleanions shows a general distribution pattern folio ing the order,SO4= and/or Cl- > FICO3-., while CO3= is abs nt in all the representative profiles.Cation exchange capacity of the soils of El- obariya is in the range of 4.2 and 25.5 meq/100g soil. b), Soils of wadi Santini.These soils are coarse textured class being in the surface and sandy downwards. Calcium ca from as low as 3.03% to 32.06% with does not sho pattern with depth. Organic matter content is extre exceeds 1.12%. Soil reaction is neutral to moderat shown by p1-1 values which ranged from 6.66 to 8. ranged from 0.41 to 141.9 dSm-I indicating that the saline to strongly salMe.Soluble cations are dominated by Mg++ followed by Ca”-, while K+ ion is the least abun anions are dominance of SO4- followed by CI-Cation exchange capacity values are quite low and 3.04 to 6.65 meq/100 g soils. 2- CaCO3 distributionn sandy loam bonate varies any specificely low not ly alkaline as . EC, values soils are nonnd /or Na+ ant. Soluble and HCO3-. ranged fromThe soils of El-Nobariya area are characterized by high content of CaCO; whereas these soils are formed of calcareous parent materials. It occurs mainly witl in the sand fraction, exception being the surface layer of pr file 1, thedeepest layers of profile 11 and profile 12 which is concentrated in the fine fraction (silt +clay).Also, the particle size distribution of carbonate in the soils of wadi Sannur indicates that the main portion occurs within the sand subfractions. 3-Grain size parametersAppling sorting and skewnes indices on the soil profiles representing El-Nobariya area and wadi Sannur.Sorting values indicate that the sediments of the soil of El-Nobariya are poorly and moderately sorted sediments and skewed towards coarse fractions suggesting that soils of El-Nobariya transported and deposition of parent material by water and wind or both actions. 4-Trace elements studiesTotal and chemically extractable 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 shed light on their depthwise and tateral distribution. Moreover, statistical analysis is performed to evaluate the role of soil variables in controlling trace elements content. Data indicate that soils of El-Nobariya are characterized by the highest content of total and DTPA-extractable Fe, Mn, Zn and Cu, while the lowest content are found in wadi Sannur soils. Also, soil texture, CaCO1, and are the

most important factors that correlate with total and available content of such elements. Furthermore,statistical measures of Qertel and Glies (1963) rev al the role of parent material and soil forming processes in a fecting trace elements distribution. 5- Mineralogy of the sand fraction a) Light mineralsMineralogy of the .sand fraction reveals t at the light fraction is generally dominated by quartz which constitutes 93-96.7%. other associated minerals are feldspars (orthoclase, plagioclase and microcline) which are detectes with less pronounced amounts. b) Heavy minerals,.The results indicate that opaque minerals re the most common minerals. The non-opaques are mainly dominated by pyroboles (pyroxene and amphiboles), followed b ultrastable minerals (zircon, ruffle and tourmaline) and para etamorphic minerals (garnet, sturolite, kyanite and silimanite), while the rest of minerals are detected in less pronounced a ounts. The data of frequency distribution of resistant m nerals and weathering, ratios leads to the conclusion that the tudied soils are heterogeneous either due to their multi-origi or due to multi-depositional regimes 6- Mineralogy of the clay fraction.Mineralogical identification of the clay fraction sparated from the soils of H-NObariya area using x-ray diffraction reveals,the dominancy of kaolinite followed by palygroskite with less pronounced of smeitite, illite, interstratified minerals and chlorite. In case of wadi Sannur soils, kaolinite is to be predominant minerals followed by smeitite. The identified accessory minerals are dominantly quartz followed by feldspars, calcite and apatite.llly mineralogical constitution of the clay fraction suggests the inheritance of clay minerals from parent materials, except for palygorskite which is either inherited or neo-genstically formed under soil forming processes stimulated by the presence of higher contents of CaCO; and soluble salts. 6-Soil classificationApplication of the key of Soil Taxonomy (2001) indicates that most of the studied soils are related to the order Aridisols, Suborder Caleids, Gypsids and Solids, whereas few profiles have no evidence of development of pedogenic horizon that lead to their placement in the order Entisols, sub order Psamments. On basis of particle size class within the profile control section, mineralogy, soil moisture and temperature regimes, soils belonging to the former taxonomic units are differentiated into eight families. 7- Land EvaluationApplication of the capability index for the studied soilprofiles reveals that the studied soil profiles are placed between (11) and (V) grads as follows:1-Grade (II): Good soils, represented by profiles 22-Grade (III): Fair soils, represented by profiles land 3 to 173-Grade (IV): poor soils, represented by profiles 18,19 and 214-Grade (V): very poor soils, represented by profiles 20, 22 and 23.The studied soil profiles related to the capability classification of grades (11) and (Ill) only are evaluated todetermine its suitability for growing 16 crops (6 field crops, 6 vegetables crops and 4 fruits t•ees). Results reveal that thestudied soil profiles include all the suitable classes (SI, S,, S3 and N).