Soil moisture characteristics of some soils in' kalubia governorate

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To study the moisture characteristics of some soills in Kaliobiagovernorate, twenty soil profiles were selected from governorate soils torepresent the different geomorphological units, .namely., natural levee,sedimentary basin, river terrace, overlapping and saline soils. The fieldmorphological description as well as chemical and physical measurementswere carried out using undisturbed and disturbed soil samples.The soil chemical analysis show that the soils under investigationare generally neutral to slightly alkaline. The soils are generally non salinewith one exceptional cases which represent some patches of saline soils.The data of soluble salts show that calcium and sodium are thedominant soluble cations while the sulphates and chlorides are thedominant soluble anions.The cation exchange capacity of the investigated soils are widelydifferent and mainly related to soil texture. The data show that eachlandform type is characterized by a special type of sedimentation andtherefore the particle size distribution diners quite considerably.The organic matter content of the investigated soils is generally lowwith one exceptional case of El-Gabal El-Asfar soils which exhibitrelatively high content of organic matter. Also the soils underconsideration exhibit low content of carbonates with a maximum value of6.0%.The aggregate states of the investigated soils are proportionallyrelated to exchangeable calcium and magnesium, clay, and silt fractionsand inversely related to tine and coarse sand tract ions. Regressionequation is:A.S.= - 16.7431-0.6156 ESP + 1.3055 clay, with multiple R= 0.92.Also the mean weight diameter is affected by thc same soil propertiesaffect the aggregate state, unless the effect of organic matter content on themean weight diameter is dependent on the clay content .Thc multipleregression equation is :M.W.D =- 0.4923 + 0.0546 ECa, with multiple R ~-~0.82The soil bulk density shows negative and significant correlationswith clay; silt; carbonate; and organic matter content. The multipleregression Equation is :B.D = 1.3636-0.0343 a.M. + 0.0058 C.S., with multiple R= 0.9The soil porosity is positively or negatively related to many soilproperties. However, only exchangeable calcium, sodium adsorption ratio(SAR), organic matter content (O.M.), silt + clay; and tine sand areconsidered for multiple regression. The relationship can be summerized :TP. = 27.9136 + 0.2658 ECa + 0.4498 SAR -+- 0.9694 OM+ 0.2266 Si + Cl + 0.1330 F.S.; with multiple R = 0.95The pore size are classified to four categories, .narnely., quicklydrainable, slowly drainable, water holding and fine capillary pores ~?~onuseful pores. The data show that the quickly drainable pores are mainlyaffected by soil texture and to considerable extent by aggregate state andorganic matter content. However only two variables are considered torstepwise regression, namely, aggregate state and fine and coarse sandfractions to provide the following equation:Q.D.P. = 1.7176 + 0.0622 A.S. + 0.1535 (C.S.+F.S.),with multiple R = 0.73However, another variables of exchangeable calcium, carbonate andsilt + clay content are considered for slowly drainable pores. Theregression equation can be written as :S.D.P. ~ 9.0763 -I- O.I048 ECa + 0.3506 CaC03 - 0.1113 (Si. Cl)with multiple R = 0.75The results show that the water holding pores (W.H.P.) are mainlyaffected by organic matter content and partially by soil texture. The effectof soil texture is more evident in the subsurface and deeper layers whichhave less organic matter content. The multiple regression describes thisrelation in the following equation :W.H.P. = 12.048 + 0.2683 ECa + 0.9072 OM. - 0.1086 C.S., R = 0.91The non useful pores (N.D.P.) are mainly affected by soil texture as wellas exchangeable cations. The multiple regression equation may formulatedas: N.U.P. = - 0.7592 +

0.1938 EMg I· 0.8435 ENa I 0.701 (Si I CI)+ 6.0602 F.S., with multiple R' 0.96The moisture retention curves of the investigated soils show that theamount of water retained at relatively low matric suction dependsprimarily upon the capillary effect and the pore-size distribution. On theother hand , water retained at high suction range is due increasingly toadsorption and is thus influenced less by the pore-size distribution andmore by the texture and specific surface of the soil material. As generally,the fine-textured soils exhibit greater water retention at any given suctionand more gradual the slope of the curves. On the other hand, the coarsetextured soils exhibit less water retention and more sharp and distinctcurves.The results show that the values of soil moisture content at fieldcapacity and wilting point are mainly related to the soil texture and soilsalinity. Since the retained water at field capacity occupies two differenttypes of soil porosity, "namely" water holding and non useful pores, itsvalue is mainly affected by the distribution pattern of the two types ofporosity. The statistical analysis show many significant correlationbetween field capacity and soil components, unless only two them areconsidered for the step wise regression, .namely, silt + Clay andexchangeable sodium. The regression equation can be summerized as :F.C. = 6.3081 + 0.5494 ENa + 0.5201 (Si + CI), with multiple R= 0.95The available water is mainly affected by both soil texture and organicmatter content and partially by salt contents.One of the most soil properties related to saturated hydraulicconductivity is the particle size distribution. The coarser textured soils are,in the same time, the faster factors such as compaction and salinity aresubsidiary affect the saturated hydraulic conductivity. The relationshipbetween different soil properties and saturated hydraulic conductivity(Ksat) is statistically studied and provided the following multipleregression equation:Ksat = 9.0730 - 6.7031 OM + 1.5952 C.S., with multiple R = 0.84The Van Genuchten equation reduced to four parameters, .namcly.Os, er , a and n, is used to predict the moisture retention characteristic ofthe soils under consideration. Principal factor analysis was used to revealthe structure in the data and to examine the relation between moistureretention characteristic (MRC) parameters and selected measured soilproperties, .namely, bulk density, organic carbon, silt, clay, and meanweight diameter. Regression equations arc established between theseMRC parameters and measured soil properties. It may be conclude that themoisture retention characteristic (MRC) can be estimated at a reasonablelevel of accuracy from simple soil properties such those mentioned above.The study further shows that for the prospected horizons the VanGenuchten model gives a good description over the entire range of theMRC.Finally the data show that the transition from saturation tounsaturation water flow entails a steep DROP in hydraulic conductivity. Thedecrease in hydraulic conductivity is steeper for coarse textured soils thanthe fine textured ones.