QUANTITATIVE RELATIONSHIP BETWEEN MASS WATER CONTENT, PRESSURE HEAD AND BULK DENSITY IN DETERMINATION OF SOIL WATER RETENTION CHARACTERISTICS

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Abstract Generally, in an experiment oriented to determine soil water retention characteristics, just one soil sample is used continuously. During the experiment, the soil would not change much in organic mater content, clay mineral type and cation exchange capacity, but would in bulk density because of hydraulic and mechanical pressures in combination. Therefore a hypothesis is put forth that soil water retention characteristic should be a surface consisting of mass water content, pressure head and bulk density instead of a curve of two variables, pressure head and water content. In the first part of this study, one soil three-variable characteristic surface model was proposed based on the Brooks-Corey soil water retention curve model. In the second part of this study, soil three-variable surfaces measured for both packed and undisturbed soil samples through centrifuging and controlling bulk density were used to verify the proposed models. Four soil textures, ranged from loam to clay, were involved. Effects of soil disturbance on the three-variable surfaces were also analyzed in the second part of this study. Results showed that the hypothesis of three-variable characteristic surface is reasonable. The proposed model based on the Brooks-Corey power function fit the measured data well for both packed and disturbed samples. Soil disturbance obviously changed the soil three-variable surfaces. The bigger the differences in initial bulk density between packed and undisturbed soils, the greater the effects of soil disturbance on the surface. The differences in model parameters between the two treatments demonstrate the effects of soil disturbance on the three-variable surfaces. The findings of this research could be cited as a new method in verifying the effect of bulk density on soil hydraulic parameters.

Key words Soil three-variable surface model; Model; Packed soils; undisturbed soils