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Comparison of Methods for Determining Soil Hydraulic Characteristics

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- Full Text

An adequate description of soil moisture movement is necessary for solution of agriculturally oriented problems such as irrigation, drainage and runoff control. Three approaches for determining the hydraulic properties of soil are in situ measurements, laboratory measurements and theoretical models. Field measurements, though representative, have the disadvantages of being costly and time consuming. Laboratory and mathematical processes are more practical but require extensive comparison to field results for evaluation. The purpose of this study was to determine the principle hydraulic properties of a soil of the Norwood Series utilizing the three approaches and to compare the results.

The laboratory method selected was centrifugation (Alemi, et al., 1972). Soil cores were centrifuged and the redistribution of water was measured as change in weight with time. Inconsistent results and limited data obtained with this method, consequently, prevented adequate conclusions from being made.

Hydraulic conductivity was obtained by measurement of hydraulic head and moisture content of the soil profile in situ with tensiometers and neutron probe, respectively. The theoretical procedure utilized water retentivity curves in conjunction with values of saturated hydraulic conductivity for computing hydraulic conductivity as a function of water content. Saturated hydraulic conductivity was measured in the field using Bouwer's (1961) double-tube method. The pressure-water content curves were obtained with disturbed soil samples for 30 to 80 cm depths and with soil cores for O to 15 cm depths using pressureplate extractors. A combination of laboratory and field measured values for these curves was also used for comparison.

The field measurements yielded several relationships between hydraulic conductivity and water content, varying with soil depth. Comparison of calculated values with field data using only the laboratory water retention curves gave

mediocre results for the 30 to 80 cm soil depth. However, when the field and laboratory data were combined and the resulting water retention curve was used to calculate hydraulic activity, the correlation was greatly improved. The O to 20 cm soil depth showed good results with both curves. Thus, it appears that this theoretical technique is applicable to soils of the type studied, but the accuracy of the calculated values is quite sensitive to the shape of the water retention curve, the saturated water content value and the saturated hydraulic conductivity value. Thus, accurate measurement of these parameters is necessary for its successful use.

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