CORRELATION OF HYDRAULIC CONDUCTIVITY WITH SELECTED SOIL PHYSICAL AND CHEMICAL PROPERTIES

Thesis by

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ABSTRACT

The saturated hydraulic conductivity is an important parameter for all aspects of water and solute movement in the soil. Methods to determine the saturated hydraulic conductivity above the water table are applicable to a wide range of problems like drainage and reclamation of agricultural land, artificial recharge, impoundment seepage, and hazardous waste disposal. The current methods available for measuring or calculating conductivity are costly, time consuming, or technically complex. Six representative soil series of Pakistan were studied to determine the effect of selected soil physical and chemical properties on saturated hydraulic conductivity. The main objective was to identify a few simple easily measurable parameters which can be used to predict hydraulic conductivity of the soil.

The soil physical parameters like sand and clay content, geometric mean diameter, bulk density, porosity and void ratio showed significant correlations with saturated hydraulic conductivity. The increase in hydraulic conductivity was associated with decrease in clay content and bulk density of the soil. As for the effect of soil chemical parameters, only salinity indicating parameters like electrical conductivity, exchangeable sodium percentage, and soluble ions such as sodium, chloride, and sulfate showed some considerable correlation with hydraulic conductivity. Such parameters were having significant inverse correlations with hydraulic conductivity.

Keeping in view the strength of correlation, effect of multicollinearity, and ease of determination, a few soil parameters were chosen to develop statistical models. The Stepwise Procedure was used to develop regression equations for predicting saturated hydraulic conductivity through simple models. These models reasonably predicted the hydraulic conductivity of sandy loam, loam, and silt loam soils.

Two methods of hydraulic conductivity measurement were attempted in the study. The constant head method for laboratory and field permeameter for in-situ measurement were adopted and results were compared statistically. Both these methods presented a good agreement with a significant direct correlation coefficient of 0.982.