Influence of Clay on Water Movement in Coarse-Textured Soils

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Abstract: Effects of clay content on saturated hydraulic conductivities (k) of two coarse textured soils, Vista (mixed thermic Typic Xerochrepts) and Hanford (mixed nonacid Typic Xerorthents), and a medium textured soil, Wyo (thermic Mollic Haploxeralfs) series, were investigated. The clay and combined sand + silt fraction extracted from each of the soils were mixed with the respective soils to yield mixtures ranging from 0% clay to clay levels exceeding those in the natural soils. Rates of water movement through prepared columns of the mixtures were compared to rates through unfractionated soils.

Hydraulic conductivities for unfractionated soil and prepared mixtures were high for the Vista (maximum k = 100) compared with the Hanford (maximum k = 30) and Wyo (maximum k = 20) samples. These conductivities suggest that the relatively even distribution of particles among fractions of sand, silt, and clay gave rise to a greater proportion of larger conducting pores in the Vista sample, whereas the preponderance of particles in the fine sand and very fine sand and coarse silt fractions of the Hanford soil and in the medium silt or fine silt and clay fractions of the Wyo soil limited the proportions of larger conducting pores. Marked differences in k were measured for mixed-fraction systems for all soils. The largest k values for the Hanford soil were from systems containing proportions of the different size fractions similar to that of the natural soil. The highest k values for the Vista soil were from systems containing a clay content slightly less than or greater than that of the natural soil. Additions of clay to Wyo soil increased k values.

Key Words: Clay fraction • Hydraulic conductivity • Particle size • Soil • Water movement

Clays and Clay Minerals; April 1990 v. 38; no. 2; p. 144-150; DOI: 10.1346/CCMN.1990.0380205

Clay Minerals Society (www.clays.org)