FACTORS AFFECTING THE PERCOLATION OF WATER THROUGH A LAYER OF LOESSIAL SOIL

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The soils derived from loess cover the principal cultivated areas of Nebraska and are generally fertile. Surface factors influencing infiltration on some of these soils have been studied (3, 4, 5). It has been found that soil type did not influence water intake as much as did a cover of crop residues.

The Peorian loess has been used for determining the influence of various biological, physical, and chemical factors on structure stability to water drops (3, 8, 9, 10). The differences obtained in the stability of loessial soil structure to water drops may influence the rate at which water will percolate through irrigated or mulched soil. The organic matter characteristics of the loessial soil and conditions of testing for percolation rates may also influence the data obtained and their interpretation. The purpose of this investigation, therefore, was to determine the influence of the presence or absence of organic matter and the conditions of testing that might have an influence on water percolation through a 6-inch layer of loessial soil.

DESCRIPTION OF THE SOILS USED

The Peorian loess was obtained in a road cut through a river bluff at Plattsmouth, Nebr., near the Missouri River at a depth of 10 to 20 feet below the original surface (Fig. 1). For comparison, subsoil and surface soil samples of Marshall and Knox were taken at sites farther away from the river. Comparisons were made with the unweathered parent material (Peorian loess), with somewhat more weathered material (subsoil) and with the material weathered considerably and mixed with organic matter (surface soil). The loessial soils are generally considered highly erodible although receptive to water. The Peorian loess is uniformly yellow in color. The mechanical analysis by the hydrometer method showed 14% sand, 66% silt, and 20% clay. The mechanical analysis of the loam surface soil just above the Peorian loess was approximately the same. The percentage of aggregates greater than 0.25 mm in the Peorian loess and Knox surface soil were 10.4 and 15.4, respectively.

The Peorian loess and Knox surface soil are generally supplied with sufficient calcium and phosphorus for crop growth, although the Knox surface soil is deficient in total nitrogen. The surface soil has a pH of 6.8. The Knox surface soil is generally considered to be fertile and adequately supplied with plant nutrients.

Other samples of Peorian loess, Marshall silt loam and Hastings silt loam were used. Samples of Marshall surface soil taken at locations in eastern Nebraska west and southwest of Plattsmouth. Samples of the Havighurst subsoil were taken at the Soil Conservation Service Hydrologic Project located south of Hastings. Marshall and Hastings surface soils are well textured Peorian loess. The Peorian loess obtained from the river were finer textured, and the Peorian loess was silty clay loam. The surface soil was silt loam. The subsoil was a silt loam.

RESULTS

The method of measuring percolation was usually accomplished as follows: A square metal container 23.5 cm on a side and 28 cm in height, with a drainage tube in one corner of the container from an automatic discharge tube at a depth of 4 inches with a layer of gravel and sand. On top of this was placed a cheesecloth and then a 6-inch layer of 3-inch board 3 feet long a distance of 6 inches a 3-inch layer of the soil. This was covered with another 3-inch layer. Water was applied to the corner of the container from an automatic discharge tube which maintained a constant head. Water was spread out gently over the soil until the entire surface was covered. The rate of application would be somewhat slower than the rate of application with water as with irrigation, and to growing plants on the surface of the soil. It was used as a mulch and break the impact of water. Percolation was measured every hour for a 3-hour period and the results were recorded. The results obtained were the mean of triplicate tests, unless otherwise stated. A mean variation of about 5 to 15% was common among replicates.