THE RELATION OF CERTAIN PHYSICAL CHARACTERISTICS TO THE ERODIBILITY OF SOILS.

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It has been frequently observed in the field that some soils are very susceptible to erosion while others, occurring under similar conditions of climate, topography, and vegetative covering, are much more resistant to erosion. Such differences may be attributed largely to the physical make-up of the soils.

The relation of the physical and chemical properties of soils to their susceptibility to erosion has been investigated by a number of workers. Bennett (1) found the silica-sesquioxide ratio of humid-tropical and humid-temperate soils to be associated with resistance to erosion. Middleton (7) investigated the physical and chemical properties of soils which had been observed in the field to erode differently and found that soils which were comparatively resistant to erosion had low dispersion ratios, low silica-sesquioxide ratios, and high ratios of colloid to moisture equivalent. Middleton, Slater, and Byers (8, 9) made physical and chemical studies of the properties of soils from the erosion experiment stations together with erosion losses and run-off. They reported wide differences in physical properties of the different soils, and in the amount of erosion losses and run-off from them. It was noted that the quality of the colloidal material was more important as an indication of erodibility than the quantity. The ease with which fine textured soils became dispersed in water as indicated by the suspension percentage and dispersion ratio appeared to be a good qualitative index of their erodibility. Lutz (6) investigated the properties indicative of the difference in erodibility of Davidson, Iredell, and Putnam soils. The silt and clay of the relatively non-erodible Davidson was found to be aggregated into large water-stable granules while the fine material of the highly erodible Iredell was readily dispersed in water.

The relation of permeability of soils to susceptibility to erosion has been pointed out by Slater and Byers (15), Musgrave (11, 12), and Musgrave and Free (13), who found that soils which are readily permeable to water are relatively resistant to erosion.

It is the purpose of this paper to present the results of a preliminary investigation of the relation of the physical properties of certain soil types of the Southeast to their erodibility.

Procedure

Erosion losses and run-off from Cecil sandy loam, Cecil clay loam, and Madison clay loam were measured using field plots 0.01 acre in size, located on six percent slopes, and subjected to the same cropping systems. The Cecil sandy loam plots were approximately one mile from the Cecil clay loam plots and fifteen miles from the Madison clay loam plots. The results obtained from 50 rains which occurred between January 1 and December 1, 1936, are presented in Table 1.

Laboratory determinations of the physical properties of surface and subsoil samples collected from the run-off plots were made in an effort to determine what relations exist between the physical properties of the soils and the observed erosion and run-off. Mechanical analyses were made by the hydrometer method as outlined by Bouyoucos (2, 3). Settling volume was determined by the method proposed by Middleton and Byers (10); moisture equivalent by the centrifuge method of Briggs and McLane (4); saturation capacity and per cent swelling by the box method of Keen and Raczkowski (5). Permeability was determined by measuring the percolation rate through artificially packed tubes under an applied pressure using the method previously described.

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