ADAPTATION OF THE HYDROMETER METHOD TO AGGREGATE ANALYSIS OF SOILS

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THE emphasis that has been placed upon soil aggregation as a significant factor in erosion control indicates the importance of developing suitable methods for studying this physical property of the soil. Among the methods in use for the determination of aggregate-size distribution and the natural structure of soils is the elutriation method used by Baver and associates (1, 2), the wet-sieve method used by Yoder (7), the sedimentation tube of Cole and Edlefsen (5), and the combination wet-sieve and hydrometer method proposed by Bouyoucos (3).

All of these methods are time consuming and limit the number of samples on which analyses may be made. Furthermore, although any of these methods will determine the aggregate-size distribution, none of them will determine the stability of these aggregates. Observations on the residual soils of southeastern Ohio indicate that aggregate stability may be as important as the amount or size-distribution of soil aggregates in any soil erosion investigation.

A method involving the use of the Bouyoucos hydrometer has been developed which permits the determination of certain properties of the soil aggregates. These properties are: (a) The percentage of clay in the aggregated state; (b) the energy required to obtain complete dispersion of the aggregates, or inversely the stability of the aggregates; (c) the dispersibility of the aggregated clay as a result of the application of increasing amounts of mechanical, or chemical and mechanical, energy; and (d) the proportion of the total silt and clay contained in aggregates greater than 0.05 mm.

This method can also be used to determine whether sheet erosion is taking place in the form of texture separates or as aggregates as reported by Yoder (7).

METHOD

A series of 50-gram aliquots are weighed out from each soil sample and permitted to slake under water for at least 30 minutes. On one aliquot the particle-size distribution is determined by the regular Bouyoucos method (4). Successive aliquots receive 2, 4, 6, 8, and 10 minutes' stirring in the Bouyoucos electric mixer without the addition of any dispersion reagent. If 10 minutes of stirring without the use of dispersing agents does not yield a reading of clay as large as that of the chemically dispersed aliquots, then a series of aliquots receiving a total of 2, 4, 6, or 8 cc of the dispersion reagents are each stirred for 10 minutes. The dispersing solutions, sodium silicate and sodium oxalate, are added in equal amounts. Some one of these treatments will result in complete dispersion of the aggregates.

Another aliquot is transferred to the hydrometer cylinder after slaking and is gently shaken for 2 minutes.

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3Figures in parenthesis refer to "Literature Cited", p. 110.