AGGREGATION STUDIES OF HOUSTON CLAY IN MISSISSIPPI

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HOUSTON CLAY, an important prairie soil type in northeast Mississippi, when first broken from sod is a difficult soil to handle. It does, however, appear to improve in workability with tillage. Under ordinary cultivation a layer from 2 to 4 inches thick of small water-stable fragments or aggregates develops at the surface, although the subsoil remains dense and impermeable. Other soils have been reported by Baver (1) to be in a most desirable condition from the standpoint of aggregation when sod of long duration is broken and to become less aggregated with continued cultivation.

McHenry and Russell (7) point out that aggregation may or may not be correlated with soil structure itself. Donet (3) states that aggregate analysis all too frequently brings about an unknown degree of destruction of natural orientation and may permit only a limited conclusion concerning soil structure. Browning, et al. (2), in recognition of this problem, say, “Soil structure by its very nature is most difficult to characterize. No method at present can give a complete measure of the differences in structure which are evident to the eye under field conditions or that affect air and water relationships in soils.”

The phenomenon of fragmentation, granulation, or aggregation in Houston clay is of particular importance in studies of tillage. Obviously, water-holding and conducting properties are greatly altered by a change from a dense impermeable state to small fragments. It was desired ultimately to be able to evaluate structure changes brought about by tillage practices on the basis of amount, size distribution, and stability of aggregates. It is the purpose of this paper to present results of a study of some factors which affect aggregation on Houston clay. Results from Susquehanna clay, Memphis silt loam, and Providence silt loam are presented for purposes of comparison or contrast.

PROCEDURE

Water-stable aggregate determinations were made by the principle outlined by Yoder (10). A laboratory built wet-sieving apparatus was used, emptying two sets of sieves moved in water baths at 35 strokes per minute through a 0.005 mm screen of a set and the wet sieving was done. The dispersed material were subtracted from the undispersed sample for determination of actual present.

In the study of the effect of size of clod in the study of the effect of pre-run shaking, air drying was used to prepare a sample for analysis.

In all of the studies of the effect of continued wetting cycles, oven drying was used. In the drying-studies a sample was placed on each of 12 dishes and were oven dried. All were then removed from the oven and wet and 10 were returned to the oven. A wet-sieving was made on the two following the one cycle wetting. The next day, this procedure was repeated and more were analyzed after having had two drying cycles. This was repeated until six cycles had been completed. In the freezing-thawing studies 12 samples at moisture content were placed in dishes and frozen in a cabinet. They were removed 24 hours later and thawed. Ten were then returned for freezing and 2 were made on two. This was repeated until six cycles of freezing and thawing had been completed.

In all of the studies except as noted otherwise, the procedure was to soak the dry sample weighing grams for 15 minutes. The material was then placed in a quart jar on the end of a shaft shaking apparatus and shaken end-over-end for 45 r.p.m. The shaken material was then transferred to a screen of a set and the wet sieving was done.

DESCRIPTION OF SOILS

Houston clay (Clay County, Miss.).—Houston clay is one of the most common of the “Black Prairie” soils, derived from the Selma chalk formation. It is generally moist and impermeable in nature. It will generally contain 50% or more of silts and clays, and 50% or more of silt and clay. The organic matter is usually fairly high.

Susquehanna clay (Winston County, Miss.).—Susquehanna soils are derived from beds of heavy clay loam and silt loam, and the results are as follows: “It would be very difficult to find any soil so completely undesirable for agriculture.” The sample used was subsoil. It was a mixture of calcium or organic matter.

Memphis silt loam (Carrol County, Miss.).—Memphis soils are derived from the Selma chalk formation, and are generally moist and dense. The organic matter is usually fairly high.

Providence silt loam (Webster County, Miss.).—Providence soils are derived from the Selma chalk formation, and are generally moist and dense. The organic matter is usually fairly high.