What is Wet Aggregate Stability?

Before explaining wet aggregate stability, it is necessary to first explain soil aggregates and describe what is meant by the term aggregate stability.

A soil aggregate is a soil structure unit formed by biological and physical agents in which soil primary particles (i.e., sand, silt, clay), along with colloidal and particulate organic and inorganic materials, are grouped together to form larger secondary particles that behave mechanically as a discrete unit.[1]

Aggregate stability is the ability of the soil aggregates to resist rearrangement and breakdown into their primary particles by various disruptive forces.[1] Naturally, when it comes to wet aggregate stability, the primary disruptive force is the effects of water.[1,2]

Wet aggregate stability is a measure of how well soil aggregates resist falling apart when they're wetted either through irrigation or being impacted by falling rain drops.[2] The process of soil aggregates falling apart and breaking down into their primary particle constituents due to the addition of water is called slaking.[1]

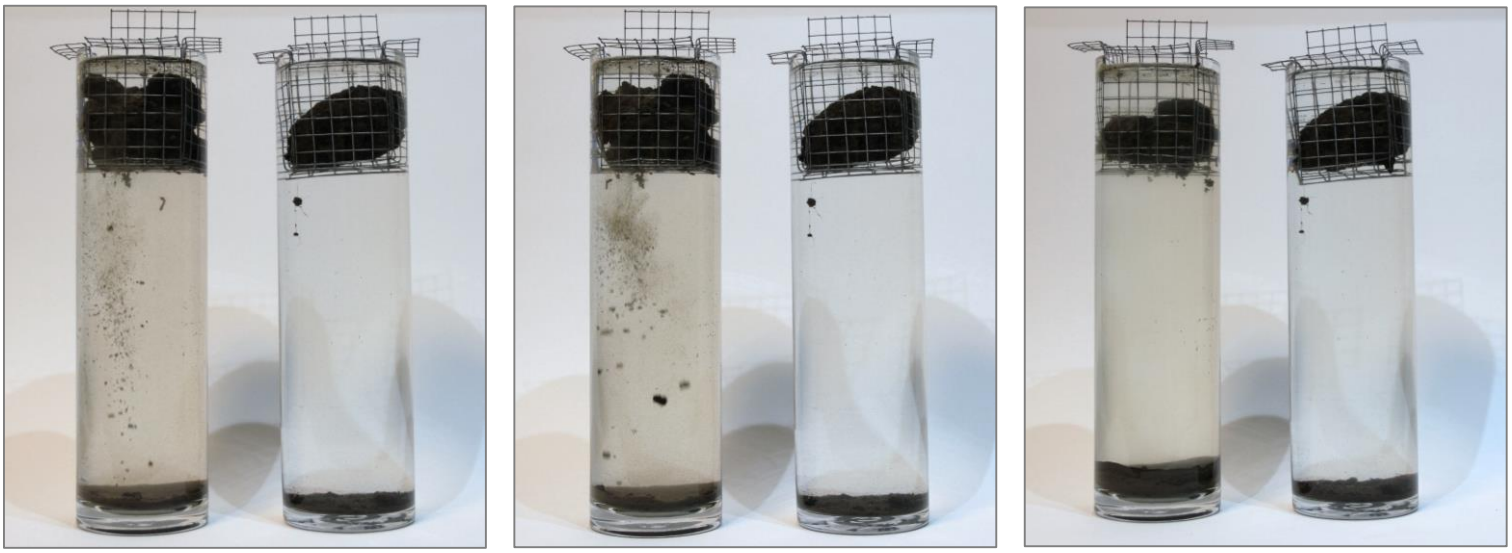
Slaking of soil aggregates is largely connected to soil particle size distribution, the kind and amount of organic matter present, and the nature of the microbial population.[1]

There are different methods and pieces of equipment that can measure wet aggregate stability but fundamentally every method is testing the ability of soil aggregates to resist breaking apart when wetted. Basically, soil is placed in a container and wetted and filtered or sieved. Soil that has poor aggregate stability will breakdown and fall apart. What may have appeared to be solid clumps of soil may disintegrate into sand, silt, and clay when wetted.

Soils with good aggregate stability have better overall soil structure which benefits gas exchange, water infiltration and storage capacity, and promotes robust root development.[3] Soils that have better aggregate stability are also more resistant to wind and water erosion, resistant to soil compaction, and are unlikely to crust when hit by a pounding rain.[2,3]

Soil erosion is a serious problem and it can drastically compromise the sustainability of soil.[3] Aside from the physical loss of topsoil there is the accompanying loss of soil nutrients.[3] Eventually all rivers run to the sea – in the case of Southern Ontario – all rivers run to the Great Lakes, where excessive fertilizer runoff is contributing to toxic algae blooms that impact water quality and degrade riparian ecosystems.

1 Minute | 3 Minutes | 30 Minutes



We use this demonstration to show the process of slaking. The soil aggregates were collected from two zones within the same field. Both samples were collected at a depth of between 6 to 8 inches. Soil submerged in the left column was collected from a zone that has no cover cropping and is exposed to conventional ammonium-based fertilizer. Soil submerged in the right column is "healthy soil" that was collected from a zone that has regular crop rotation and no chemical fertilizer applications. Immediately after submersion, the slaking process starts on both samples and the aggregates start to breakdown into their constituent particles. However, very quickly the slaking process has stopped on the healthy soil sample. The aggregate stability differences between these two samples is apparent.

References:

1. Gregorich, E.G., et al. (Eds.). *Soil and Environmental Science Dictionary*. Canadian Society of Soil Science. CRC Press, 2001.
2. Brown, Christine et al. (Eds). Agronomy Field Guide for Crops Publication 811. Ontario Ministry of Agriculture, Food, and Rural Affairs. Queen's Printer for Ontario, 2017.
3. Weil, Ray R., and Brady, Nyle C. *The Nature and Properties of Soils, Fifteenth Edition*. Pearson Education, 2017