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Soil Health Focus

Soil aggregate stability: What does it measure?

Soil aggregates are the building blocks of soil structure. Soil texture is the relative percentage of sand, silt, and clay in soil, but soil structure describes how those particles are arranged in the soil profile. Soil aggregates are glued together with soil organic matter, plant root exudates, and microorganisms like fungi.

We classify soil aggregates by their size: large macroaggregates (>2000 µm), macroaggregates (250-2000 µm), microaggregates (53-250 µm), and free particles (<53 µm). A large macroaggregate is bigger than a sand particle. A microaggregate has the thickness of one or two human hairs. A macroaggregate lies in between.

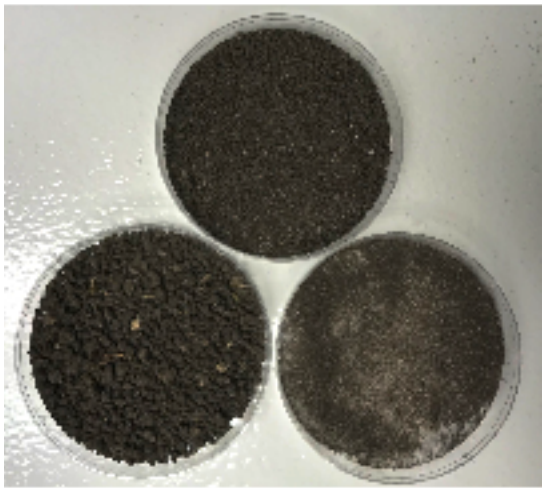

Figure 1. Grassland soil fractionated into water-stable aggregate size classes.

Multiple soil management practices come together to improve soil aggregate stability. These include reduced tillage or no-till, greater crop rotation diversity, more plant roots, greater earthworm and microbial activity, and more soil organic matter. This is what makes soil aggregate stability such an attractive soil health indicator. Stable soil aggregates take time to form, so you should consider measuring soil aggregate stability every 3 to 5 years.

Why is soil aggregate stability important?

Soil aggregate stability is a comprehensive soil quality measurement. Soil aggregates provide numerous soil ecosystem services:

- Resistance to water and wind erosion
- More pore space for air and water movement, allowing deep root exploration
- Faster water infiltration, reduced runoff
- Less surface crusting
- Improved equipment trafficability and reduced soil compaction, especially on wet soils
- Diverse habitat for soil microorganisms

Strong soil aggregates form naturally with plant root and microbial activity. However, disturbances like tillage quickly break soil aggregates apart. If soil aggregates are broken apart by tillage, the soil pores fill with small particles that can clog and restrict air and water movement. Loose soil particles can also plug the surface pore network to reduce water infiltration and cause surface crusting.

Cropping systems that include reduced tillage or no-till are necessary to improving soil aggregate stability (Figure 2). Tillage also reduces soil organic matter that is needed to bind soil particles into larger soil aggregates. Diversified crop rotations, cover crops, and manure help improve soil aggregate formation.