AGGREGATE STABILITY

Soil Science Factsheet: Indicators of Soil Health

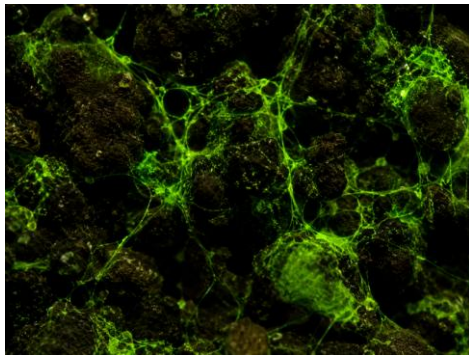
Soil aggregates are small groups of soil particles that stick together. Chemical and physical forces help form them, but soil life does most of the building: roots and fungal hyphae hold particles together, while sticky substances from soil organisms help glue them into stable aggregates.

Aggregate stability describes how well these groups stay together when soil is disturbed by rain or wind. Stable aggregates help water enter the soil, reduce runoff and erosion, support root growth, and create pore spaces for air, water, nutrients, and soil organisms.

Why does it matter?

Poor aggregate stability can create many problems. When weak aggregates break apart during rain, fine soil particles can plug soil pores. This can cause surface crusting, reduce water entry, increase runoff and erosion, and limit root and seedling growth.

Poor aggregate stability can also slow nutrient cycling. Soil organisms need air and plant-available water to function well. Without good aggregates, air and water movement are limited. This creates a vicious cycle: weaker soil life leads to weaker aggregates, and weaker aggregates make it harder for soil life to thrive.



Glomalin-related material, or GRM, is one of the sticky "glues" that helps hold soil particles together. In soils where it is present, it can play a key role in building stable soil aggregates. GRM is linked mainly to arbuscular mycorrhizal fungi, helpful fungi that grow with plant roots. The green colour often seen in pictures of GRM comes from a lab stain used to make the material visible; it is not the natural colour of glomalin.

What can farmers do?

Aggregate stability is strongly linked to soil biological activity. Practices that protect or feed soil life can improve it over time. These include keeping soil covered, growing cover crops, adding organic amendments, using rotations with pasture or forage crops, reducing tillage, and leaving crop residues on the field.

In pastures, good grazing and fertility practices keep plants dense, reduce bare soil, and support the roots and soil life that build stable aggregates.

Aggregate stability can decline quickly when soil is left bare, heavily tilled, or low in organic matter. Building it back usually takes several growing seasons or more. Protecting soil structure is therefore important for sustainable crop production.

Assessing aggregate stability

Aggregates often respond to changes in soil management practices, so aggregate stability can be a useful indicator of soil improvement or decline. Many methods are used to assess it. Some are costly, complex, and mostly suited for research or laboratory testing.

Slake testing (see B.C. Ministry of Agriculture soil health assessment resources below) is an easy-to-do test that has shown promise as a low-cost option. Some studies found that it can give results similar to more complex tests, but results should be interpreted with care.

Important limitations

- Soil type and climate matter: Aggregate stability is not controlled only by soil life or management. Soil texture, clay type, organic matter, and climate can all affect results. Freezing, thawing, wetting, and drying can also affect how aggregates form and break apart.
- Do not compare very different soils: Aggregates in sandy soils may be smaller and harder to maintain than in clay soils. It is usually better to track changes over time in the same field than to compare very different fields or to use benchmark values.
- Low aggregate stability does not identify the cause. It may be linked to tillage, low organic matter, compaction, poor drainage, sodicity, or other factors. More information is needed to understand the problem.
- Methods differ: Different tests can give different results, so results from different methods or labs may not be directly comparable. To track changes over time, use the same test method each time.
- Use with other indicators: Aggregate stability is useful, but it does not give a complete picture of soil health. A soil can have relatively good aggregate stability and still have problems such as compaction, salinity, nutrient imbalance, or poor drainage.

Find more information:

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Soil Health Assessment Protocols

Soil Health Assessment
B.C. Ministry of Agriculture and Food

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Nutrient Management

Nutrient Management, Tools and Programs
B.C. Ministry of Agriculture and Food

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Why Compost?

Compost Management
B.C. Ministry of Agriculture and Food

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Cover Cropping

Cover Crops
B.C. Ministry of Agriculture and Food

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Other resources and references

Aller, D., Amsili, J. P., & van Es, H. M. 2024. Cross-correlating soil aggregate stability methods to facilitate universal interpretation. Agricultural & Environmental Letters, 9, e20145. DOI: 10.1002/ael2.20145

B.C. Ministry of Agriculture and Food. 2026. B.C. Soil Health Assessment Laboratory Procedures (SHAP, laboratory). Aggregate Stability sections. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/soil-nutrients/soil_health_laboratory_procedures_for_bc.pdf

B.C. Ministry of Agriculture and Food. 2026. B.C. Field Sampling Protocol (SHAP sampling procedure). https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/soil-nutrients/field_sampling_protocol.pdf

Lavergne, S., Halde, C., & Lynch, D. H. 2025. Cropping diversity is a main driver of soil health under intensive organic cropping systems. Geoderma, 461, 117441. DOI: 10.1016/j.geoderma.2025.117441

Poeplau, C., Riefling, T., Schiedung, M., & Anlauf, R. 2024. Land use and soil property effects on aggregate stability assessed by three different slaking methods. European Journal of Soil Science, 75, e13549. DOI: 10.1111/ejss.13549

Rieke, E. L., Bagnall, D. K., Morgan, C. L. S., et al. 2022. Evaluation of aggregate stability methods for soil health. Geoderma, 428, 116156. DOI: 10.1016/j.geoderma.2022.116156

Van Eerd, L. L., DeBruyn, A. H., Ouellette, L., Hooker, D. C., & Robinson, D. E. 2018. Quantitative and qualitative comparison of three wet aggregate stability methods using a long-term tillage system and crop rotation experiment. Canadian Journal of Soil Science, 98, 738–742. DOI: 10.1139/cjss-2018-0101

Weil, R. R., & Brady, N. C. 2017. The Nature and Properties of Soils. 15th ed. Pearson, Upper Saddle River, NJ.

A useful French-language resource entirely dedicated to soil structure and aggregates is:

Baize, D., Duval, O., and Richard, G. 2013. Les sols et leurs structures : observations à différentes échelles. Éditions Quæ, Versailles.

Sustainable Canadian Agricultural Partnership

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