7. Slake Test

Examine Your Soil Structure

*How many times have you been told by expert gardeners to break up your dirt clods? Breaking up dirt clods to form loose, fluffy soil can look pleasing and feel good to the touch. But does it helpful for your soil? Dirt clods, also known as “aggregates,” are important building blocks in the structure of healthy soil. The Slake Test is a visual display of the structure of your soil’s aggregates as well as your soil’s resiliency to erosion and “slaking.”*

**What is an aggregate?**
Soil is not a random mixture of dirt. Beneath our feet, healthy soil is a very organized structure of clods, or aggregates, that form together like building blocks. Aggregates are pieces of grouped soil, bonded together with moisture and organic glues made by bacteria and fungi. Healthy soil is abundant with various shapes and sizes of aggregates. Tiny gaps and crevices between aggregates create necessary space for water drainage, air flow, and roots navigating deeper in the soil as they grow. Even tinier pores and pockets exist within aggregates, filling with water that will be retained for plants as well as housing biological cities of beneficial fungi and bacteria. Bacteria and fungi recycle nutrients within aggregates, which become available to plants as needed. Aggregates can take decades to centuries to develop! Both soil type and organic matter have an impact on aggregation. Clay soil tends to form aggregates quickly, while sandy soil tends to take much longer to form aggregates. Soils with high organic matter not only form aggregates more quickly, they also form more stable aggregates that are resilient to erosion and slaking.

**What is slaking and soil erosion, and how does it relate to soil aggregates?**
The stability of your soil is most important when it is wet from watering or rainfall. During a rainstorm, uncovered soil will break apart at the surface and erode, running off in thin sheets and collecting at a lower point in the garden. As water drains into the soil, aggregates will absorb water into pore spaces. If aggregates are weakly bonded, the pressure of absorbing water will break apart the aggregate and cause loose soil particles to slake away (pronounced s-lake). Slaking is the breakdown of aggregates into loose and unstable soil, allowing soil particles to flow freely and deeper into the soil profile. These loose soil particles plug pores spaces and air pockets, displacing air, reducing water retention, and causing compaction. Healthy soil depends on the stabilizing force of aggregates. Healthy soil structure is built with stable aggregates that holds soil in place when absorbing water and resists erosion and slaking.

**How do I affect my soil’s stability?**
No-till practices in the garden protect soil aggregates. Tilling soil is the act of breaking up dirt clods. Tilling degrades soil structure, breaks apart the bacterial and fungal connections within aggregates, and causes compaction underneath the till-zone due to slaking. Tilling also releases carbon dioxide from the soil, causing climate change. Avoid tilling and minimize disturbance to the soil in order to build healthy soil.
Slake Test

What is the objective?
By submerging a soil aggregate into water, you will observe how stable your soil remains and how much erosion occurs.

What materials do I need?
- wide-mouthed 64 oz or 42 oz mason jar with a lid ring
- ½ inch (or larger) hardware cloth or plastic netting
- wire cutters for hardware cloth or scissors for plastic netting
- gloves
- water
- shovel

Activity Guide
1. Cut out a 10x10 inch square of hardware cloth or plastic netting. Wear gloves if cutting hardware cloth with a wire cutter.

2. If using hardware cloth, cut a line from each side of the square towards the center of the square. Stop at an inch from the center for each cut.

3. Fold one set of opposite corners towards each other and wrap the arms into a hug to make a cylinder shape. Do the same with the next set of opposite corners, creating a cylinder with a closed basket at the bottom.

4. Place the folded hardware cloth into the mouth of the mason jar, basket first, as deep as it can go without letting it fall in. This should creating a basket within the jar. Gently fold the hardware cloth over the mouth of the jar, and twist the lid ring over the hardware cloth as best as it can fit. This step may take a few different attempts, depending on if the size of your cylinder needs to be adjusted.

5. If using plastic netting, cut a 10x10 inch square, shape the netting into a basket and lower it into the mason jar. Use the lid ring to secure the top of the netting around the mouth of the mason jar.

6. Completely fill the mason jar with water so that the basket is fully submerged, and place the jar on a flat surface.
7. Choose a central spot in your garden, and scoot aside the mulch. Use a shovel to dig deep into your soil, and lift the contents gently. Feel the lifted soil gently and find a soil aggregate or dirt clod. Gently break apart the aggregate into a size that is appropriate for your mason jar. Size, firmness, and ease of finding an aggregate will vary widely by your soil type. If you have sandy soil, you may be challenged to find a soil aggregate that holds its form within your hand unless your soil is highly amended with organic matter.

8. Gently lower the aggregate into the water and place it resting on the basket. The aggregate may break apart if dropped into the basket.

9. Observe the aggregate. Observations can vary widely depending on your soil. Consider the following:

- Does your soil initially hold together or does it fall apart as it absorbs water?
- If it held together, does the aggregate lose soil as it absorbs water? How quickly does the aggregate lose soil?
- Does the aggregate absorb water quickly, slowly, or not at all? Evidence of the porosity and ability to absorb water can be seen by the rate of bubbles that leave the soil. Does your aggregate bubble quickly, slowly, or not at all?
- Wait an hour or two and check on your soil again. Has the aggregate held together? Has it lost any soil? Does it continue to bubble? How about after 24 hours? Evidence of slaking, or soil particles breaking apart from the aggregate, can be found either settled at the bottom of the jar or suspended in the water.
- If your soil completely falls apart, try again with another aggregate. If you are unable to find an aggregate that holds its form, try this alternative. Fill ½ of a mason jar with moist soil, and observe your soil closely. What do the soil particles look like? Are soil particles flatly settled? Or do soil particles group into tiny crumbs with small gaps and open spaces in-between?

10. Reflect on your findings. Have aggregates formed in your soil? Are those aggregates stable and porous, as demonstrated when under water? What soil conditions may be impacting your aggregates and soil structure? If your aggregates failed to hold form, has the soil recently been disturbed by tilling? Do you have adequate organic matter in your soil?

11. Consider that soil compaction can create aggregates that seem stable, but are not porous or able to absorb water at all. This can be seen if your aggregate did not produce bubbles when underwater. Also consider if you have sections in your garden that are maintained or cultivated differently. The Slake Test can be used to compare two different soils samples from different parts of your garden!