

EASY DO-IT-YOURSELF (DIY) SOIL TESTS

Soil quality is simply defined as “the capacity of a specific kind of soil to function.” When measuring soil quality, it is important to evaluate the physical, chemical, and biological properties of the soil. By focusing more attention on soil health and the positive impact healthy soils can have on productivity and conservation, we can feed ourselves more profitably and sustainably – now and for generations to come.

Washington State University publication, [A Home Gardener’s Guide to Soils and Fertilizers](#), has a wealth of information on the topic of soil and soil health.

USDA Natural Resources Conservation Service (Baseline/Physical/Chemical): Your exact location is most likely mapped on the existing the [USDA Web Soil Survey](#). You can find your soil series, soil type (loam, sand, clay), pH, other physical and chemical attributes, plus reference data and management advice.

OBSERVATION

Tilth (condition of the soil)

When the soil is neither too wet nor too dry, dig a hole 6 to 10 inches deep. Separate an intact section about the size of a soup can and break it apart with your fingers. Determine whether the soil is cloddy, powdery, or granular. Ideally, your soil should be made up of different sized crumbs that will hold their shape under slight pressure. Crumbs, or aggregates, as soil scientists call them, that break apart only with difficulty mean your soil is too hard. Soil that's easy to work allows water to reach roots efficiently and is less prone to compaction.

Compaction

Plunge a wire irrigation flag or a straight piece of wire from a coat hanger vertically into the soil at different locations. Mark the depth at which the wire bends. The sooner it bends, the more compacted the soil. A foot or more of easily penetrable soil is ideal. Compacted soil inhibits root growth and water availability, and also keeps earthworms and other vital soil fauna from circulating freely.

Color

Dark soil color typically indicates high soil quality, good health, and abundant fertility. For a more research- based qualitative test, the Spokane County Master Gardener Plant Clinic has a Munsell Soil Color Chart available for in-clinic use. The Munsell System allows for direct comparison of soils anywhere in the world. The system has three components: hue (a specific color), value (lightness and darkness), and chroma (color intensity) that are arranged in books of color chips. Soil is held next to the chips to find a visual match and assigned the corresponding Munsell notation.

Root Development

With a shovel or hand trowel, gently dig around a selected plant, preferably a weed you won't miss. Once you've reached root depth, pull an annual plant up and check the extent of root development, searching for fine strands with a white healthy appearance. Brown, mushy roots indicate serious drainage problems—and a poor outlook for this year's harvest. Stunted roots might also indicate disease or the presence of root-gnawing pests.

Roots have the most immediate connection with and reliance on soil quality. Without air, water, biological activity, and crumbly soil to grow in, roots can't do their job.

TEXTURE/STRUCTURE

Soil Texture by Feel (Physical): Do you have sandy, clay, or loamy soil? This physical characteristic is one of the more useful and often the basis for future decisions regarding your soil.

Feel Test

Rub some moist soil between fingers.

- Sand feels gritty.
- Silt feels smooth.
- Clays feel sticky.

Squeeze Test

Take a handful of your slightly damp soil and squeeze it tightly. When the pressure is released the soil should hold together in that clump, but when poked with a finger that clump should fall apart.

- Coarse texture soils (sand or loamy sands) break with slight pressure.
- Medium texture soils (sandy loams and silt loams) stay together but change shape easily.
- Fine textured soils (clay or clay loam) resist breaking.

Ribbon Test

Squeeze a moistened ball of soil out between thumb and fingers.

- Ribbons less than 1 inch
 - Feels gritty = coarse texture (sandy) soil
 - Not gritty feeling = medium texture soil high in silt
- Ribbons 1 to 2 inches
 - Feels gritty = medium texture soil
 - Not gritty feeling = fine texture soil
- Ribbons greater than 2 inches = fine texture (clay) soil



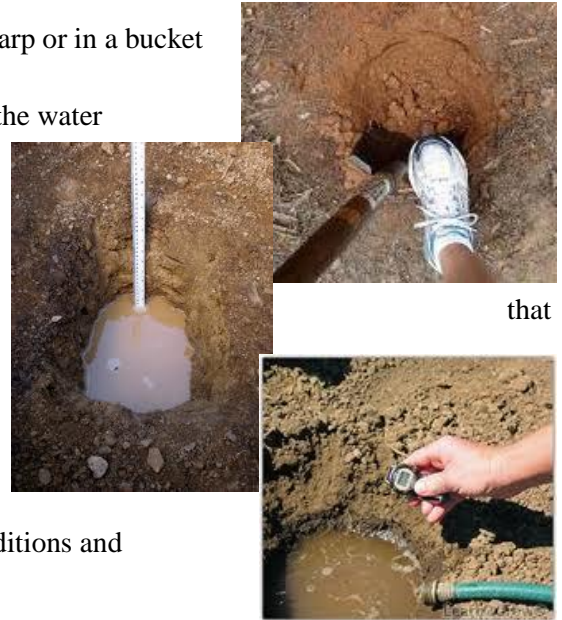
Photo by Andy Bary, WSU

DRAINAGE/PERCOLATION

A “perc” test is often done prior to construction, septic system installation, or for suspected poor drainage. Engineering firms may conduct professional perc tests to fulfill legal requirements. Here is a Do It Yourself version:

Dig a Hole

1. Dig a hole 1 foot square and 1 foot deep, set the soil aside on a tarp or in a bucket
 - a. fill the new hole with water, and allow to drain.
2. Immediately refill the hole with water and measure the depth of the water with a ruler.
3. 15 minutes later, measure the drop in water in inches. Multiply the number by 4 to calculate how much water drains in an hour
 - a. The ideal soil drainage is around 2” per hour, with readings between 1”- 3” generally OK for garden plants have average drainage needs.
 - b. If the rate is less than 1” per hour, your drainage is too slow, and you’ll need to improve drainage or choose plants tolerant of wet soil.
 - c. If drainage is more than 4” per hour, it’s too fast, and you should consider choosing plants that tolerate dry conditions and "droughty" soils.



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Drainage problems can be addressed following these tips:

1. Incorporate compost and organic matter into the soil. Organic matter helps heavy clay soil to drain and helps coarse sandy soil to hold moisture, so it’s a win-win no matter what your soil type!
2. Choose plants suited to your soil drainage.
3. Build raised beds for better control over the soil texture.

SOIL pH

The pH (acidity level) of your soil significantly affects how well your plants grow. Most plants grow best in soil with a fairly neutral pH, between six and seven. The U.S. Department of Agriculture says soil testing is an “essential” tool that provides information on fertility and pH. Testing also indicates what and how much you should add to perk up tired soil.

Purchase a home soil test/pH meter

You can buy DIY soil-testing kits and probes online, at hardware stores or at garden centers. Costs range from \$7 up to \$50 for more elaborate setups.

- pH meter (approx. \$23-\$50): Stick a probe into the soil, and it registers pH on an attached meter.
- pH soil tester (approx. \$5-\$15): Mix soil with water; pour into a plastic container, add powder from capsule, and shake. Compare the color of water to the adjacent color scale, which indicates the pH.

- Soil test kit (\$25-\$30): Same as the pH tester, only it adds three extra containers and capsules to measure nitrogen, phosphorus, and potash. (Note: no need to test for nitrogen because it moves in and out of soil so quickly that testing would be meaningless).

Home test your garden soil pH with vinegar and baking soda

1. Collect one cup of soil from the part of your garden you want to test.
2. Put one teaspoon of soil into each of two separate containers.
3. Add 1/2 cup of vinegar to one container of the soil. If it fizzes, you have alkaline soil, with a pH between 7 and 8. If it doesn't fizz after doing the vinegar test,
4. Add distilled water to the other container until the soil is muddy.
5. Add 1/2 cup baking soda. If it fizzes you have acidic soil, most likely with a pH between 5 and 6.
6. If your soil doesn't react at all it is neutral with a pH of 7 and you are very lucky!

The purchased kits and home test can tell you toward which end of the soil pH scale your soil is leaning, but for an exact measurement, you will need to send a soil sample out to a lab for testing.

SOIL AGGREGATE STABILITY (SLAKE)

Soil aggregate stability is widely recognized as a key indicator of soil quality and health. A valuable tool for quantifying soil stability, a stability kit can be inexpensively and easily assembled with minimal tools.

The slake test measures the stability of soil when exposed to rapid wetting, and should be measured on air-dried soil fragments or aggregates (peds).

There are affordable kits which allow for rapid data collection and easy field evaluation of relatively undisturbed soil samples.



Photo by Andy Bary, WSU

Equipment Needed:

- Two clear jars at least 32oz;
- Two 1/4" mesh wire screens cut to fit onto top of jars;
- Dried soil peds.

The slake test compares two chunks of topsoil in water to see how well and how long they will hold together. Here are the steps:

1. Collect a chunk of topsoil—a size that would fit in your hand—from an area where you don't till, like a fencerow, or a plot you've no-tilled or had in grass for many years.
2. Get a second spade-full or chunk of soil from a plot you've tilled consistently. It should be the same soil type as the first sample.

3. Find two clear jars large enough to hold the chunks of soil.
4. Put together some type of wire mesh that you can hook at the top of each jar that will allow the soil to be submerged in the water, yet be held within the top half of the jar.
5. Insert the wire meshes into each jar.
6. Fill the jars with water.
7. At the same time, submerge the tilled sample in one jar, and the untilled sample in the other.
8. Watch to see which soil holds together and which one falls apart. The soil with poor structure is the one that will begin to fall apart.



SOIL BIOLOGY TESTS

The soil is alive. In just one teaspoon of agricultural soil there can be one hundred million to one billion bacteria, six to nine feet of fungal strands put end to end, several thousand flagellates and amoeba, one to several hundred ciliates, hundreds of nematodes, up to one hundred tiny soil insects, and even earthworms. These organisms are essential for healthy growth of your plants.

Soil Organisms

Measure the animal life in your soil by digging down at least 6 inches and peering intently into the hole for 4 minutes. Tick off the number and species of each organism observed, such as centipedes, ground beetles, and spiders. Because most soil organisms spurn daylight, gently probe the soil to unearth the shy residents. If you count less than 10, your soil does not have enough active players in the food chain.

A thriving population of diverse fungi, bacteria, insects, and invertebrates is one of the most visible signs of soil quality. The more that creeps and crawls under your garden, the less opportunity there is for pests and disease. Each level of soil life does its part to break down plant residue and make more nutrients available for plant growth.

Smell Test

A lot of people love that fresh-dirt smell. The surprising thing, though, is that it isn't coming from the soil itself. Microbiologists have traced the pleasant odor to an organic chemical called geosmin. Geosmin is produced by the gram-positive bacteria *Streptomyces coelicolor*, and released. The human nose is extremely sensitive to geosmin and can detect it at concentrations as low as 5 parts per trillion.

Earthworms

[Worm Count](#) is an inexpensive method to assess biological activity. Abundant earthworms indicate a healthy soil food web. An absence of worms (except in the desert or alpine meadow) means that the soil is too acidic, too alkaline, lacks organic matter, is over tilled, or otherwise too unhealthy to support a vibrant soil food.



To do a worm test the right way, wait until the soil is at least 55 degrees Fahrenheit and is damp but not sopping wet. Then dig out one cubic foot of soil (make a square on top of the ground one foot on each side and dig down one foot deep). Put the dirt in your wheelbarrow or on a piece of cardboard and root through it, counting worms as you go. If you find at least ten worms, your soil passes the test, and more worms means better soil. For scientific results, repeat the worm test in several parts of your garden that have all been treated the same way and average your results.

Earthworm benefits go beyond aeration. These friendly critters leave behind secretions that improve tilth, as well as adding organic matter, bacteria, plant nutrients and enzymes via their casts.

Underwear Test

Burying 100% cotton briefs in the ground will help to show you the biologic activity. The higher the activity level, the less cotton will remain. Having high microbial activity is good for your soil.

Need a new pair of white 100% cotton briefs (no dyes or polyester blends), shovel and marker flags.

1. Dig a narrow trench and bury the underwear in the top six inches of soil
2. Leave the waistband showing a little and mark the place with a flag so you'll be able to find it again
3. Leave the underwear buried for about two months
4. Dig it up carefully and wash it in a bucket of water to remove the soil

After a couple months buried, there shouldn't be much left of your undies, if there is good biological activity in the soil. Healthy soil is full of living organisms, which sustain us and are the foundation of a thriving civilization.

