SOIL HEALTH PRINCIPLES

1. Keep the soil covered
2. Minimize soil disturbance
3. Increase crop diversity
4. Keep living roots in the soil
5. Integrate livestock

Soil Health Toolkit

Test Directions

Introduction

Welcome to the Conservation Connections Soil Health Toolkit! This kit contains directions and materials needed to perform and record four soil health tests you can do on your farm to assess the physical and biological qualities of your soil. It is not intended to be a replacement for lab testing, however these tests can provide a high level understanding of your soil and, using the report card, you can track the effectiveness of conservations practices and Soil Health Principles over time. The four tests included in these directions are the **infiltration test**, the **slake test**, the **earthworm test**, and the **pH test**.

This kit is meant to be adapted to your needs. You can pick and choose which test(s) are best suited to your situation. The more information and detailed records you keep, the better idea you will have of soil conditions over time. Feel free to add, subtract or change any tests or recording fields.

Test #1: Infiltration Test

The first soil health test is the infiltration test. This test helps determine how long it will take for 1 inch of water to be absorbed by the soil, and is a good measure of soil function—especially related to soil structure.

To complete this test you will need:

- A cylinder shaped tube (a soup can with both ends cut off will do, but you can also use a 6 inch PVC pipe. As long as you are consistent you can use whatever you have on hand).
- A measuring device (I use a Pyrex 1 cup measuring cup).
- A timer/stopwatch
- A board and mallet (to pound in the cylinder)
- Soil Health Report Card to record data

1Measured water and ring pounded into ground ready to pour and time

Method:

Calculate how much water you need to fill 1 inch of your cylinder. For a soup can, this is about 125 ml. To calculate the volume for other vessels, find the area of the circle and then x1 for 1 inch of water. The important thing is to use the same vessel and amount of water each time.

Do the Math: volume of a cylinder = π x radius^2 x height

Choose your testing location. Try to do the test on a day when the ground is not already saturated. It is helpful to make a soil test sample map so you can mark where each sample comes from.

Pound the ring in to a depth of 3 inches (mark this level on the outside of the ring). You may want to place a board over the ring and hammer with a mallet to insert to the marked level. Firm the soil around the inside edges of the ring. Quickly pour the measured amount of water into the ring and record time in seconds or minutes (usually this data is converted to inches/hour) for the water to be fully absorbed. Repeat the test (about 6 hours later if possible) with a second inch of water (unless the soil is already at moisture capacity). Record this second test in the Soil Health Report Card.

Test #2: Slake Test

The second soil health test in the report card is the Slake Test. This is another good test of soil structure, and gives a visual sense of what happens to the soil during a heavy rain event. It is also an indication of biological activity and energy flow.

To complete this test you will need:

- Hardware cloth
- Wire cutter and pliers
- Mason Jar
- Soil Sample(s) (dry) with location and date label(s)
- Camera
- Water
- Soil Health Report Card to record data
- Alternate method: use a plastic bottle instead of hardware cloth and mason jar

Method:

Collect the soil sample in advance (sample should be completely dry). You may want to collect several location samples to compare—just make sure to mark location info when collecting and label the samples. Make a hardware cloth or mesh basket that fits into your mason jar or other vessel using the wire cutter and pliers. (You can also cut off the top of a plastic bottle and invert it so the opening points down into the bottle, and then tape or connect the two pieces.) Fill the mason jar container with water so the soil sample will be totally submerged.

Submerge the soil sample and set a timer for 5 minutes. At the 5 minute mark, take a photo of the slake test results. If desired, continue the test by re-dipping the sample several times. You may want to take photos along the way to help assess stability class. Use the Slake test Stability Class Criteria table (below) to determine the stability class for the sample and record it in the table.

2Soil sample after 5 minutes

Slake Test Stability Class Criteria

Stability Class	Criteria for assignment to stability class
0	Soil too unstable to sample
1	50% structural integrity lost within 5 seconds after insertion in water
2	50% structural integrity lost within 5-30 seconds of insertion of water
3	50% structural integrity lost within 30-300 seconds of insertion in water or less than 10% of soil remains after 5 dipping cycles
4	10-25% of soil remaining on sieve after 5 dipping cycles
5	25-75% of soil remaining on sieve after 5 dipping cycles
6	75-100% of soil remaining on sieve after 5 dipping cycles

Test #3: Earthworm Test

The third soil health test in the report card is the Earthworm Test. This is a test of biological activity and can also be an indicator of soil structure.

To complete this test you will need:

- Bucket or bucket lid to use as a stencil
- Tarp
- Shovel
- Soil Health Report Card to record data

Method:

Choose your location(s) and mark this in your records. You may want to test different areas of your fields. You might consider doing this test in the spring or fall when earthworms are the most active. Place a bucket lid on the ground and dig in a circle around it. Once the outline is made, dig down about 1 ft. When digging, make sure to put all the soil from the hole on a tarp. The important thing is to keep the size of the hole consistent every time you do the test. Taking photos for reference might be helpful.

Count the earthworms in the soil sample on the tarp as accurately as possible. This is a good time to make other observations about soil structure, scent, biological activity, etc. Record the date, location, and number of earthworms in the soil health report card. Generally speaking, 30 earthworms per square foot is good.

Test #4: pH Test

The fourth soil health test in the report card is the pH Test. This is a test of the chemical properties of your soil, but the pH also affects physical and biological properties of soil and plant growth.

To complete this test you will need:

- Soil Samples
- A pH meter
- Buffer solutions
- Distilled water

For the alternate method:

- Soil Samples
- Vinegar
- Baking soda
- Distilled water

Method:

Collect multiple soil samples. They can either be tested individually or mixed together to get an average across the sample area. Make a slurry by combining 1 part soil to 2 parts distilled water in a container. There should be enough of this slurry so the pH meter's probe can be completely submerged. Wait 15 minutes for sample to settle. At this point, use the buffer solutions to calibrate your pH meter if needed according to directions. My pH meter uses a small screw driver to adjust the pH on the side to calibrate. Rinse the pH meter between calibrating solutions and after calibrating. Insert probe completely into water and soil mixture and wait for a reading to appear and stabilize. Record this pH in the Soil Health Report Card.

2Using buffer solutions to calibrate pH meter

Alternate Method:

I decided to try another method of pH testing that does not require a pH meter. Gather a soil sample from different locations in your fields and either test them individually or mix them together to get an average. Place equal amounts into two separate containers (about ½ cup per container). Add one-half cup of vinegar to the soil and check for a reaction. If the soil fizzes, your soil is likely alkaline and has a pH level of 7-8.
If the soil does not fizz after adding vinegar, combine the soil in the other container with distilled water and one-half cup of baking soda. If there is fizzing, your soil is likely acidic with a pH level of 5-6.
If there's still no reaction, your soil pH is probably neutral, about 6.5

pH descriptions

Soil pH	Plant Growth
>8.3	Too alkaline for most plants
7.5	Problem with iron availability
7.2	
7	6.0-7.5 is acceptable for most plants
6.8	6.8-7.5 is nearly neutral
6	
5.5	Reduced soil microbial activity
<4.6	Too acidic for most plants

References

USDA. (2020, May) *Soil Quality Test Kit.* Retrieved from USDA Natural Resources Conservation Service: nrcs.usda.gov