USDA United States Department of Agriculture

Testing for Soil Health

The soil health card lists ten tests and provides space for you to rate your soils. By testing regularly and keeping these cards, you can build a record of your soil's health and understand the effect of management practices on soil health. Regular testing will show improvements in response to more sustainable management, such as reducing tillage disturbance in crop rotations, adding cover crops or changing rotations. Test results can also be used as the basis for making management changes. This card is not intended to replace any soil testing that you may already carry out. Soil testing remains critical to making sure your soil fertility and pH levels remain optimum. This is another tool to help you understand your soils and their response to management and environmental conditions. Maintaining good soil health will undoubtedly increase the sustainability of farming into the future.

How to Evaluate Your Soil

1. Read the following ten steps first.

This will help you in preparation to go to the field.

2. When to test.

Best results will be obtained in autumn, two to ten days after a good rain. To allow comparison of results from year to year, sample at the same time of year and under similar conditions. Avoid taking samples from overly wet soils or during drought, at times of extreme high or low temperatures and within a few weeks of fertilizer or lime applications.

3. Prepare your equipment.

You will need to take required test equipment with you to the field.

4. Decide where you will test.

We recommend you start with two sites, one to represent your 'best' soil and the other your 'worst' area. This will give you a good overview of how the tests relate to soil conditions on your land.

5. Decide how many cards you will need.

At each site you select, you may want to use more than one card if:

- there is more than one soil type within the selected area;
- conditions under row crops are quite different in the inter-row (e.g., light, groundcover, traffic); or
- conditions in the field are quite different along the edge of field. Pick a site that represents the best overall measurement of the field.
- For comparison, perform one test in an undisturbed area off the field, such as the fence row and woods. This will be a measurement of natural conditions compared to your management cropfield.

6. Carry out the tests.

Once you are familiar with the tests, it will take you around 20 minutes to carry out one set of tests. We recommend that you do all five sets of tests, as they will provide a broad picture of the soil conditions at the selected site. Selection of the site in a random order, similar to soil testing, is also recommended.

7. Review your test procedure.

As you become more familiar with test procedures and your soils, check whether the sites you have selected are the best sites for the information you need. Also, review the way you do your tests to ensure consistency. Make notes as you go to remind yourself of the details relating to the information gathered.

8. Review your results and follow up on low scores.

Line up your test sheets for areas you wish to compare and look for similarities and differences among your scores. Can you explain the differences? If you have neighbors also undertaking tests, get together with them and compare notes. Where you have low result scores, refer to the sheet that lists possible causes and research additional information on the concerns identified. Explore ways to improve your soil health results.

9. Make sure the test date is on all your soil health cards before you file them.

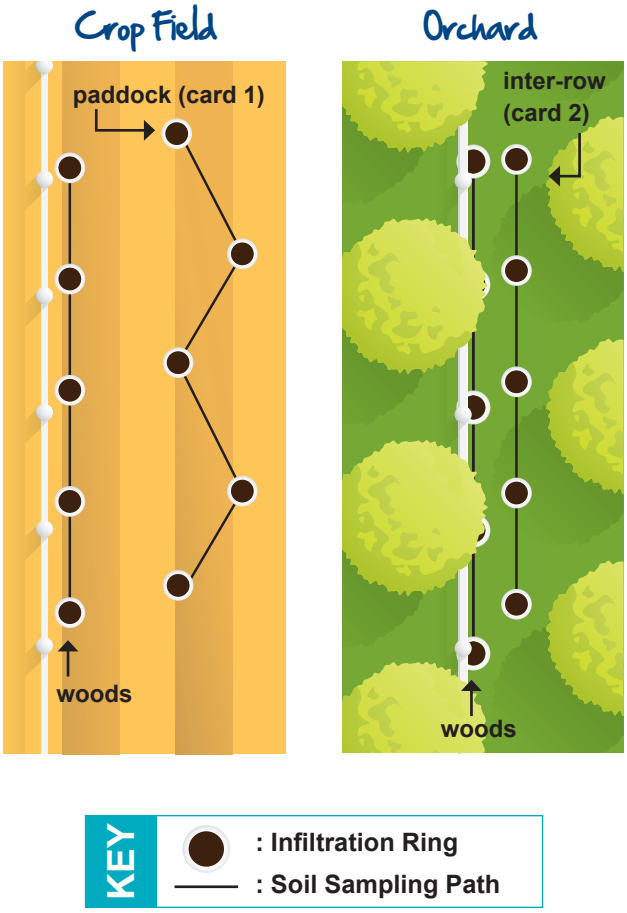
10. Make a note in your diary to repeat the tests in a year.

Equipment

- penetrometer (see Wisconsin Soil Health Test Sheet)
- infiltration ring
- clipboard and pencil
- one soil health card for each set of tests planned
- spade
- soil test information for the sites being tested
- slake test (fruit jar and wire or mesh platform)
- container of water (allow .33 gallons or 1.25 liters of water per\sample point if soil is dry or .75 liters if soil is moist)

Sampling Procedure

Suggested layout of sample points:



Notes

- Start from an identifiable point (eg. paint on fence post).
- Stay within a single soil type for each card.
- Sketch a plan of the sample points on the back of the assessment sheet and mark any soil type boundaries.

Infiltration Ring

An infiltration ring measures the rate at which a fixed volume of water soaks into the soil. You will need a 6 inch diameter PVC pipe cut to 6 inch length. Bevel the bottom end to make it easier to push into the soil.

- Use plastic wrap to avoid plugging soil pores. Pull plastic away after water is added.
- Clear the area of residue and trim the vegetation as close to the soil as possible without disturbing the soil.
- Push the infiltrometer ring 3 inches into the soil, avoiding cracks and other holes in the ground. The ring should be nearly level for accurate testing. Use your finger to gently firm the soil around the inside edge of the ring to prevent leakage of water here.
- Carefully pour 500 ml of water into the ring and record the amount of minutes it takes for this 1 inch to infiltrate. This represents a 1 inch rain.
- Stop timing when at least half the surface is just glistening.
- On extra dry soil, test may need to be repeated until the surface glistens (usually twice).

Slake Test

Select a soil aggregate. Drop the aggregates carefully on the mesh/wire platform suspended in water inside the small wide mouthed jar. Allow to stand for one minute. Observe if the aggregates break apart or stay intact. If they are intact after one minute, gently swirl the bottle several times and observe again. The aggregates of a healthy soil are normally more stable than those of a less healthy one. Poor aggregate stability is associated with greater susceptibility to erosion.

Earthworms

Break up your entire soil block into crumbs. Higher numbers of earthworms indicate conditions that are favorable.This often reflects high organic matter, adequate pH levels and good fertility. These are also conditions favorable for plant growth.

Leaf Color

Examining your crop to reveal plant health problems. Examine fully formed leaves about four leaves back from the growth tip (Young leaves at the tip are often naturally pale or red leaves while old leaves nearer the stem may show mottling that is normal).

From Soil Survey (soilmap.psu.edu or websoilsurvey.nrcs.usda.gov)	Soil 1	Soil 2
Soil series		
Stoniness		
Drainage issues		
Slope		
Bedrock depth		
Seasonal water table		
Profile permeability		
Inherent soil constraints (e.g., depth to fragipan, seasonally high water table, high rock fragment content, shallow depth to bedrock, seasonal flooding)		

Crop Rotation	2 Years Ago	Last Year	This Year	Comments
Crops in rotation (underline current)				
Cover crop				
Crop residue left on soil				
Tillage				
Lime applied				
Fertilizer applied				
Manure applied				
Pesticides applied that may have a negative effect on soil quality				
Yield				

Wisconsin Soil Health Test

Date:_____ **Name:**_____ **Location:**_____

Soil Type:_____ **Management:**_____ **Soil Moisture: dry / mesic / wet**

RESULT► TEST▼	POOR 1---------2	FAIR 3	GOOD 4----------5	Test Scores (1-9)					
				1	2	3	4	5	Av.
1. GROUND COVER	< 50% ground cover (canopy or mulch).	50% to 75% ground cover (canopy or mulch).	More than 75% ground cover (canopy or mulch) year round.						
2. PENETROMETER (Compaction)	Over 300 psi. Evidence of plow pan.	Between 200 & 300 psi. Subsoil Resistance.	Under 200 psi. No restriction layers.						
3. INFILTRATION RING (Visual Signs)	More than 7 minutes. Surface ponding of rain.	3 to 7 minutes. Some runoff.	Less than 3 minutes. No runoff or ponding.						
4. DIVERSITY OF MACROLIFE	Fewer than two types of soil organisms.	Two to five types of soil organisms.	More than five types of soil organisms.						
5. ROOT DEVELOPMENT	Few fine roots, damaged roots, disease.	Shallow roots, evidence of restriction layer.	Many fine roots throughout, strong roots, straight roots.						
6. SOIL STRUCTURE	Mostly in clods or with a surface crust, tracking.	Some clods, some crusting, wheel tracking.	Friable, granular structure, no crusting, no compaction.						
7. SLAKE TEST	Aggregate broke apart in less than one minute.	Aggregate remained intact after one minute.	Aggregate remained intact after swirling.						
8. EARTHWORMS	0 - 4	5 - 9	Miniumum of 10 worms.						
9. SOIL pH	pH 5 or lower	pH 5.5 - 6.0	pH 6 - pH 7						
10. LEAF COLOR	Stunted plants, leaf discoloration.	Some variation in growth and color.	Appropriate leaf color and uniform plant growth.						
11. ORGANIC MATTER	Organic matter on surface-no break down, light soil, dull color.	Organic matter in upper surface, residue on top with slow break down, somewhat dark appearance.	Dark in color, visible organic matter throughout profile, residue breaks down.						
12. SOIL EROSION	Rills and Sheet deposition.	Some evidence of small rills and minor soil movement.	No visible erosion, no signs of soil or residue movement from erosion.						

TEST COMMENTS	
1.	
2.	
3.	
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8.	
9.	
10.	
11.	
12.	

Low Test Scores: Possible Causes

Test Result	Situation Indicated	Possible Causes
1. Low ground cover	Ground plants absent or growth is poor.	Unsuitable plant type(s), soil compaction, erosion, shading, trampling (especially when wet), overstocking.
2. Low probe penetrability	Soil is generally hard at the surface only hard layer at greater depth.	Compacted by traffic, livestock or by overworking. Organic matter content low. Compacted by traffic or livestock, especially if soil is wet at the time. Compacted by heavy vehicles or 'hard pan' formed by soil inverting cultivators.
3. Slow water infiltration	High proportion of clay particles, lack of spaces, channels or burrows in soil.	Naturally high clay content of soil type, possible loss of topsoil. Soil compaction, poor soil structure, lack of earthworms, surface crusting.
4. Low variety of soil fauna	Lack of habitat or food for fauna, poor soil structure, presence of harmful chemicals.	Sparse litter, low soil organic matter, lack of soil spaces and channels frequency or intensity of tillage has been excessive. Mortality from recent use of insecticides or regular use of cumulative chemical(s) such as copper.
5. Poor root development	Hard soil lacking spaces, poor plant nutrition, root disease or attack.	Loss of topsoil, poor soil structure, soil compaction. Soil pH not suitable for crop, lack of major or minor nutrients. Presence of soilborn pathogen, rootfeeding nematodes or rootfeeding insects.
6. Poor soil structure	Powdery soil, few crumbs, excessive clods.	Lack of soilbinding substances and processes, low soil organic matter (sparse ground cover), few worms. Topsoil loss, soil compaction, low organic matter, 'puddling' of wet soil by stock, excessive cultivation.
7. High slaking	Soil particles disperse when wet.	10 cm: topsoil loss, compaction, low organic matter, excess tillage. 20 cm: poor mixing of soil by soil animals, acid conditions.
8. Low earthworm count	The pH is unfavorable, poor food supply, lack of soil spaces, predators or parasites present, presence of harmful chemical.	Soil pH naturally low, pH reduced by use of acidifying fertilizers. Sparse litter and/or ground cover (and roots), low organic content, low populations of fungi and bacteria loss of topsoil, soil compaction, poor structure. Predators (such as flatworms) and parasites (eg parasitic fly may occur in 'plague' numbers. Mortality from recent use of insecticides or regular use of cumulative chemical(s) such as copper.
9. Low pH	High level of acidity.	5 cm: excess of nitrogen from inorganic fertilizers and legumes, poor drainage, low organic matter. 20 cm: shallow top soil, unused N leached from above, if pH is less than 4 consider acid sulfate soil (grey clay, sometimes with yellow veins).
10. Poor leaf color	Unthrifty plant.	Soil problem as indicated in tests 19, one or more essential nutrients deficient or unavailable (confirm via soil or leaf analysis), low organic matter, disease, waterlogging.
11. Low organic matter	Soil Color Chart. Soil Condition Index (above zero).	Tillage, crop rotation, residue management.
12. Soil erosion	Excessive soil erosion	Lack of positive soil health conditions. Excessive wind and water on vulnerable soil.