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Montana Cropland Soil Health Assessment Guide

Overview

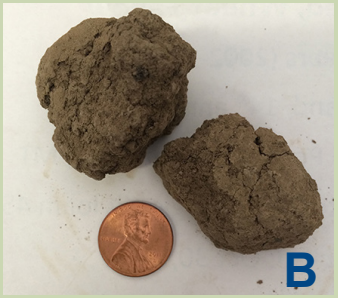
The Montana Cropland Soil Health Assessment Card is a quick and simple method to assess cropland soil health. All it takes is a shovel, water bottle, knife, professional experience, and less than 30 minutes to complete Tier 1.

Site Selection and Information

Note that this assessment is designed for use on cropland, not pasture or range. Fill in the top section with as much information as possible. Include GPS points and photos for reference. Avoid a site on the edge of the field. Manually field texture the topsoil to get a surface texture and clay percentage. Next, dig a hole to a depth of 18-24 inches.

Tier 1

Tier 1 is meant to be completed in the field. Rate each category based on professional experience and local knowledge. Scores range from 1 (least desired) to 5 (most preferred). Written examples are only provided for scores 1, 3, and 5 due to space limitations, but scores 2 and 4 are also available.



Physical Characteristics

Soil Structure: Look at the soil structure and aggregates in the top 6". Healthy cropland soil has granular structure and pore space. Above are two adjacent soils from a 20-yr research experiment at Montana State University. Both soils are mapped as Amsterdam silt loam. Soil A has been managed with no-till in continuous crop rotation and has excellent aggregation and pore space. Soil B has been managed with tillage in a wheat-fallow rotation and has little to no aggregation and pore space.

Compaction: Look for platy structure and/or lateral root growth anywhere in the top 2 feet. Use your eyes, not a penetrometer or wire flag.

Infiltration: Visual assessment only, with input from the producer on seasonal trends. Look for areas of ponded water or evidence of runoff. If more time is available, the single-ring infiltration test can be used to give a quantifiable result.

Soil Erosion: A soil need only have one of the written examples to be given the corresponding score. For example, a field with some rills or gullies over 2" deep, but no deposition at the field border or wind-scoured plants would rate as a 1.

Biological Characteristics

Soil Surface Color: Add a little water and determine the color visually. No need to use a color book.

Crop Residue: Residue is any dead plant material on the soil surface from previous years' crops. Green and growing material from the current year is not considered residue. Look directly down, and not across the field.

Soil Temperature: Measure the difference between the top 1" of crop soil and nearby undisturbed soil with perennial vegetation. Measure only when air temp is 80°F or greater. Digital thermometers are preferred rather than metal. Metal thermometers must be calibrated regularly for accuracy.

Soil Smell: Add a little water and smell the soil.

Crop Condition: If a growing crop is in the field, notice how healthy it looks. If no crop, leave this rating blank.

Worms and Bugs: Rate based on your own knowledge of the area and experience. This is highly subjective.

Scoring

There is no total score for any tier. This is intentional, as it is difficult to subjectively draw the line between "good" and "bad" soil. For example, a field could have great structure and aggregation in the topsoil, but still have a bad compaction layer in the subsoil. The intended outcome of the assessment is to show where there is opportunity to improve and to serve as a communication tool between the planner and producer.

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Tier 2

Tier 2 requires additional testing in the field or lab and gives more in-depth information.

Physical Characteristics

Slake Test: Collect soil peds from the top 3". Let air dry for at least one week, ideally in a sunny, warm windowsill before performing the slake test.

Chemical Characteristics

Soil pH: Montana dryland soils are seeing increased issues with low soil pH from nitrogen fertilizer application. For an accurate pH test, take samples at the 0-3", and 3-6" depths from sites with suspected issues. Field pH meters are available, or lab tests can be conducted.

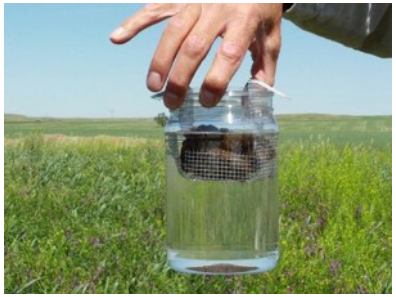
Electrical conductivity (EC): EC is a measure of salinity and can be tested in the field with a meter or in the lab. Be aware that salinity may not always be visibly obvious in the topsoil and can exist at various depths in the soil as a detriment to plant growth.

Sodium Adsorption Ratio (SAR): SAR is a measure of sodicity and can only be determined in a lab.

Biological Characteristics

Organic Mater Percent: Performed in a lab, typically the Loss on Ignition method.

Microbial Respiration: 24-hour CO_2 burst, as measured in a lab with the Haney test. Water extractable organic carbon could also be recorded here. No rating score is given as results are relative, depending on soil type and climate.



Soil health can be improved with management. However, soils with less sand, greater precipitation, and cooler climates have the capacity to have greater soil health than those with more sand, less precipitation, and warmer climates. Because soil health potential is variable, it is better to compare a specific field's current soil health with its own expected future potential, rather than comparing it with multiple fields across various soil types or climate conditions. When possible, choose a field under better management, or an area of undisturbed perennial vegetation, from the same soil series (such as across a fencerow) to evaluate and provide comparison.

Soil Health Management Questions

This section provides insight on how closely the producer is following the 5 soil health principles.

Tillage Intensity: A STIR value can be determined with the assistance of an NRCS planner with WEPS (Wind Erosion Prediction System).

High Residue Crops in Rotation:
(# of high residue crops in rotation/years in rotation) x 100

- High residue crops include: small grains and warm-season grasses harvested for seed and residue not removed, grazed hay with 50% residue remaining, canola, safflower, flax.
- Low residue crops include: hay baled and removed from the field, peas, lentils, chickpeas, sugar beets, fallow, corn silage.
- Assumes all crop residue is left on the field or the field is properly grazed. If residue is removed via any method other than proper grazing (baling, silage, burning, haying, etc.), no credit is given for that crop.

Crop Intensity: Measures how often a living root is in the soil.

Crop Diversity: The four functional plant groups include:

- Cool season grasses (wheat, barley, triticale)
- Cool season broadleaves (alfalfa, peas, lentils, chickpea, fava bean, vetch, camelina, brassicas)
- Warm season grasses (Sorghum-sudan, millet, corn)
- Warm season broadleaves (soybeans, sunn hemp, mung bean, sunflower, safflower)
- To take credit for a functional group as part of a mixed-species cover crop, it must be at least 30% of the biomass.

Livestock Integration: Soil Condition Index (SCI) can be determined with the assistance of an NRCS planner with WEPS.

Montana

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5 Soil Health Principles

Minimize Disturbance | Armor the Soil | Keep a Living Root | Increase Plant Diversity | Integrate Livestock

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