Soil Health Field Assessment Worksheet

Location: _____ Field: _____ Test: ____of____

Name: _____ Assessor: _____ Date: _____

Soil Map Unit: _____ Soil Moisture: _____ Topsoil Texture: _____

Indicator	Avg. Rating	Potential Practices
Compaction (3 = No evidence of compaction; 2 = Some penetration resistance; 1 = Clear evidence of a compacted layer)		329, 340, 345 Location 1____, 2____, 3____
Structure (3 = Strong; 2 = Moderate; 1 = Weak or structure-less)		328, 329, 340, 345 Location 1____, 2____, 3____
Surface crusts (3 = No evidence of surface crust; 2 = Surface crust in places; 1 = Surface crust throughout the field)		329, 340, 345, 484 Location 1____, 2____, 3____
Residue cover (Plant residue cover: 3 = 75% or more; 2 = from 25 to 75%; 1 = less than 25%)		329, 340, 345, 484 Location 1____, 2____, 3____
Roots and Pores (3 = Many roots or pores; 2 = Common roots or pores; 1 = Few to no roots or pores)	ROOTS PORES	328, 329, 340 Location 1____, 2____, 3____
Earthworms (Number of worms or worm sign/cubic foot of soil: 3 = abundant (at least 10); 2 = few (1 to 9); 1 = None)		329, 340, 345, 484 Location 1____, 2____, 3____
Biological activity (The presence of fungal hyphae, macro-invertebrates, etc.: 3 = Clearly evident; 2 = Few evident upon close examination; 1 = No biological activity visible)		328, 329, 340, 345, 484, 528, 590, 595 Location 1____, 2____, 3____
Smell (3 = Earthy, sweet, and rich; 2 = Earthy, fresh, not unpleasant; 1 = Sour, putrid, or chemical-like)		328, 329, 340, 345, 484, 595 Location 1____, 2____, 3____
Aggregate stability (3 = Clods remain intact; 2 = Clods exhibit moderate stability; 1 = Clods disintegrate)		329, 340, 345, 484 Location 1____, 2____, 3____

(328) Conservation Crop Rotation, **(329)** Residue and Tillage Management, No-Till, **(340)** Cover Crop, **(345)** Residue and Tillage Management, Reduced-Till, **(484)** Mulching, **(528)** Prescribed Grazing, **(590)** Nutrient Management, **(595)** Integrated Pest Management

The above indicators are related to the Resource Concerns/Planning Criteria: SOIL QUALITY DEGRADATION – Compaction and/or Organic Matter Depletion.

Useful assessment materials: shovel, wire flag, clear plastic cups or similar, water, small hand lens, texture by feel guide

Field Assessment Instructions

- Dig a shovel-full of soil down to about 8 inches at three representative locations in the field and assign the appropriate score for each indicator.
- Determine an estimate of the average of the three locations for each indicator and record on the sheet.
- Fields with scores of mostly 1s, or 1s and 2s have a good probability of benefiting from the implementation of a management system that utilizes as many soil building practices as practical.

Management History (from a conversation with the producer)

Are cover crops grown during typical fallow periods or between perennial crop rows? (circle) yes / no

If yes, for how many years has the field been continually cover cropped? _____ year(s)

How are the cover crops terminated? _____

Type and frequency of ground disturbing operations? _____

_____

What is the crop rotation? _____

Is water management a concern (i.e. field too wet or too dry at planting)? _____

Does water pond or run off during or immediately after rainfall events? _____

Observations

The indicators should not be thought of as independent and unrelated, since management will typically affect most in a similar way, although some are likely to change faster than others in response to management. For example, fields that have a history of minimum tillage and are cover cropped are more likely to have soils that are well structured, not ponded, without a surface crust, have obvious biological activity, and relatively water-stable aggregates. As a result, in most situations scores for the indicators in a field will be consistent. Because of this, changes in management and implementation of systems that incorporate soil health improving practices have the potential to move most of the indicators toward "3" with time. Also, because of the relationship between indicators, it is not necessary to evaluate all of them, but only those that will enable the planner to adequately assess field soil health and, if necessary, develop an alternate management system. Some indicators may provide a better snapshot of soil health than others depending on the soil and cropping system.

This assessment does not provide quantifiable, absolute values related to soil health, nor is it designed to compare one field to another, but when used with the above management history it can provide an indication of the relative health of the soil in a particular field, and be useful for monitoring changes in the health of that soil over time. Soil chemical properties (nutrients, pH, EC and etc.) are not part of the field assessment, and are best determined by sending samples to a reputable soil testing lab.

Follow-up with Soil Quality Test Kit (SQTK)

A field with a soil-related resource concern that cannot be adequately evaluated by the above indicators may need a specific test from the SQTK to diagnose a problem, measure benchmark conditions, and in the future measure improvement after implementation of the conservation system. The planner can contact their Resource Soil Scientist or Area Office for assistance with using the SQTK.

NOTE: Use of the diagnostics of the SQTK is up to the discretion of the planner and the needs of the client and cropping system, and is not required for most soil health planning situations.

Soil Health Field Assessment Worksheet Appendix

Compaction

Soil compaction in agricultural systems can result from repeated wheel or hoof traffic, or repeated tillage at the same depth. Management-induced compaction occurs at depths of 2 – 8 inches. Try to insert a wire flag into the soil and see how easily it bends. Compare the resistance to a known non-compacted area such as in a fence row. Alternatively, use a knife and cut vertically down the side wall of your observation hole. Feel for areas where there is a significant increased pressure in the knife cutting down into the soil. **Assess moist to wet soil.**

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Soil Structure

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Observe structure in the surface 6 inches. **Strong** structure has units that are distinct in undisturbed soil and separate cleanly. **Moderate** structure has units that are well-formed and evident in place or in a hand sample. **Weak** or **structure-less** soil has barely observable or no discreet units. The photo on the left is an example of a sandy clay loam soil with strong structure. Soil texture will affect structure. Structure in coarser-textured soils will typically not be as well-developed as finer-textured soils. **Assess dry to moist soil.**

Surface Crusts

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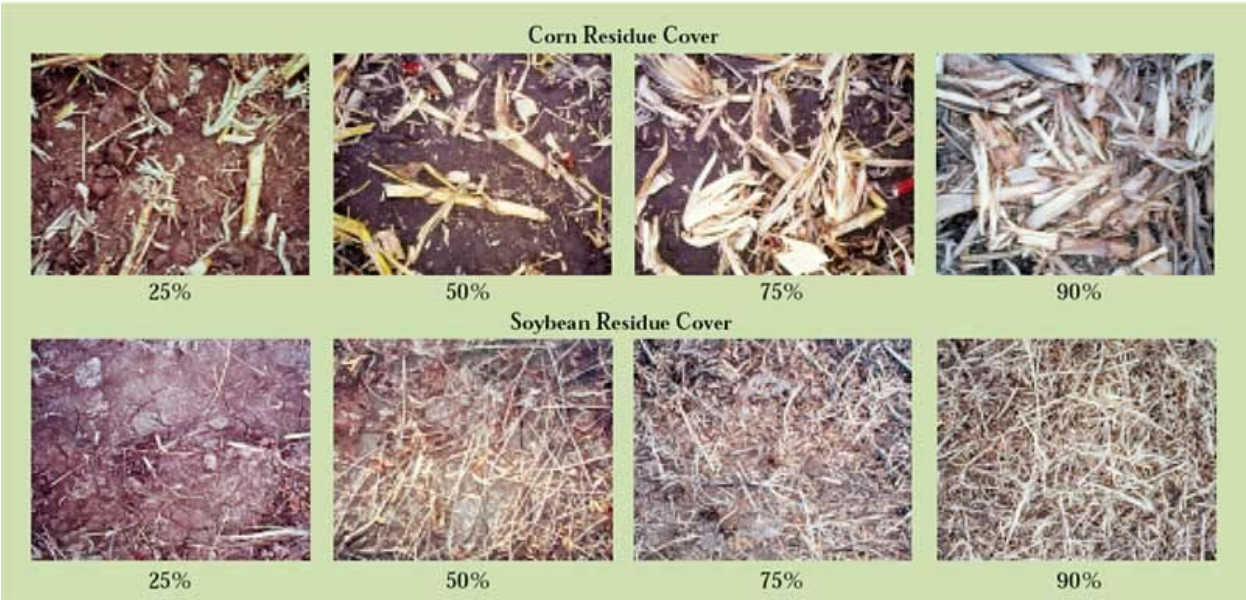
Surface crusts can develop when soil is over-worked and left uncovered resulting in poor aggregate stability. Crusts inhibit seedling emergence and water infiltration. Are crusts throughout the field or only in patches? The picture on the left is an example of what a surface crust might look like. Loam or clay soils will tend to crust more readily than sandy soils. Crusting can also occur in sodic (high sodium) soils. Crusts will remain intact when they are picked up. **Assess after irrigation or rain and before next tillage.**

Residue Cover

A significant factor in promoting soil health is keeping it covered with residue, particularly during fallow periods. For this part of the worksheet, estimate the percent of soil surface covered with dead plant material within the immediate area of your test location. The chart below shows what 25 – 90% residue cover looks like. Your crops will be different, but the percent cover will look the same.



Iowa State University

Roots and Pores

Healthy soil should have an abundance of living and dead roots and pores. Usually, the most obvious pores are those that are decayed root channels. Below is a guide for evaluating the quantity of roots and pores. Make the observations on a horizontal plane of the soil, 3 – 6 inches below the surface. The assessment area is dependent on the size of the roots and pores (Table 1). Determine the number of roots and pores per assessment area. Then correlate the number to the quantity class for scoring (Table 2).

Table 1.

Size Class	Code		Diameter	Soil Area Assessed [1]
	Conv.	NASIS		
Very Fine	vf	VF	< 1 mm	1 cm^2
Fine	f	F	1 to < 2 mm	1 cm^2
Medium	m	M	2 to < 5 mm	1 dm^2
Coarse	co	C	5 to <10 mm	1 dm^2
Very Coarse	vc	VC	≥10 mm	1 m^2

Table 2.

Quantity Class [1]	Code		Average Count [2] (per assessed area)
	Conv.	NASIS	
Few	1	#	<1 per area
Very Few [1]	—	#	<0.2 per area
Moderately Few [1]	—	#	0.2 to <1 per area
Common	2	#	1 to <5 per area
Many	3	#	≥5 per area

Earthworms

If soil is too dry, worms may not present. In addition to worms, look for sign of worms such as holes (left photo) or their casts (right photo) in the forms of little piles of soil, mineral particles, or organic matter on or in the soil. The volume of an average shovel full of moist soil will be about ⅙-cubic foot, so multiply the number counted by 6 to score the indicator. Break the shovel of soil apart and carefully look for earthworms or signs of earthworms. **Assess moist to wet soil for worms. Casts can be seen in dry soil.**

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Biological Activity – Fungi, etc.

Fungal hyphae will appear as white to light tan threads (photo on left) or masses (photo on right). Other things to look for are meso- and macro-invertebrates such as mites, springtails, millipedes, roundworms beetles and termites.

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Smell

Healthy soil will have an earthy, sweet, pleasant intense smell while unhealthy soil will have a sour, metallic, rotten egg-like, sulfide, or otherwise unpleasant smell. The sweet, earthy smell of a healthy soil is from geosmin which is produced by actinobacteria in the soil. Regularly cultivated cropland without a cover maintained may smell rich and earthy, but not as intense as soil with high biological activity. If you are unsure what healthy soil should smell like, find an undisturbed/natural area where you can dig a little and take a sniff. **Avoid smelling dry soil because of the increased risk of inhaling dust or other soil constituents or contaminants.**

Aggregate Stability

Take a soil clod, about the size of a golf ball, and submerge it in water. Obtain the sample from the surface just below any residue that may be present. Note whether the clod remains intact or falls apart. The picture on the right demonstrates the test using glass cylinders with suspended samples, but in the field any clear container of adequate depth can be used.

Soil Secrets

Additional Information

Soil Structure –
http://www.soilassociation.org/LinkClick.aspx?fileticket=n5L15U4y8jg%3D&tabid=1703

Surface Crusts –
http://soilquality.org/indicators/soil_crusts.html
http://www.fao.org/docrep/t1696e/t1696e06.htm

Residue Cover –
http://ianrpubs.unl.edu/live/g1931/build/g1931.pdf

Roots and Pores –
Field book for describing and sampling soils, V 3.0. 2012. Pg. 70 – 75.
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052523.pdf

Earthworms –
http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/biology/?cid=nrcs142p2_053863
http://www.ctahr.hawaii.edu/sustainag/news/articles/v5-valenzuela-worm.pdf
http://www.sarep.ucdavis.edu/worms/ewupdate

Biological Activity – Fungi, etc.
http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1015&context=agronomyfacpub

Aggregate Stability –
https://www.youtube.com/watch?v=cx_hmse9Se8

Soil Texture by Feel
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311

Soil Quality Test Kit
http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/assessment/