Soil Health Assessment Report

The raw data from the individual indicators and background information about sample location and management history from the sample submission form (page 34) are synthesized in an auto-generated and grower-friendly report (Appendix A). The soil health assessment report presents measured values, interpretive ratings, and constraints identified by soil health indicators in a summary page, followed by a short narrative description of each indicator's importance and status, and selection tables with suggestions for targeted management.

The soil health assessment report summary is laid out in a visually enhanced format to present information to growers and agricultural service providers (Figure 2.53, following page). The sections of the summary page include:

1) **Background information:** includes the farm and agricultural service provider's name and contact information, provided sample name or field identification, sample lab ID, date of sampling, current and prior crop and tillage, provided soil type and both provided and measured soil texture information.
2) **Measured indicators:** provides a list of physical, biological, and chemical indicators that were measured for soil health assessment. Note that values measured for add-on indicators are provided separately.
3) **Indicator values:** presents the values of the indicators that were measured in the laboratory or field, in the units of measure as provided in the indicator descriptions that follow the report's cover page (see Appendix A for a complete sample report).
4) **Ratings:** interprets that measured value using the provided texture-adjusted scoring functions (pages 27-29) on a scale of 0 to 100, where higher scores are better. Ratings are color coded. Those in red (30 or less) are particularly important to take note of as they may indicate a constraint to proper soil functioning. Any in yellow (between 30 and 70), particularly those that are close to a rating of 30, are also important in addressing current or potentially developing soil health problems. Green (70 or higher) indicates high scores, which suggest optimal or near optimal functioning.
5) **Constraints:** If the rating of a particular indicator is poor (red color code), associated soil health constraints will be highlighted in this section. This is useful for identifying priorities for targeting management efforts. Suggested management practices to address the identified constraints can be found in Part III of this manual, and are briefly summarized in tabular form at the end of the assessment report.
6) **Overall quality score:** computed by averaging the individual indicator ratings to provide an indication of the soil's overall health status. However, it is of greater importance to identify which particular soil processes are constrained in functioning or suboptimal, so that these issues can be addressed through appropriate management. Therefore the ratings for each indicator are more important information. The overall quality score is further rated as follows: less than 40 is regarded as very low, 40-55 is low, 55-70 is medium, 70-85 is high and greater than 85 is regarded as very high. The highest possible quality score is 100 and the lowest possible is 0, thus it is a relative overall soil health status indicator.

Poor aggregation can result in poor water infiltration and storage.

Cornell Soil Health Assessment

1

Corey Corn
123 Horizon Rd
New Iowa, NY, 13026

Agricultural Service Provider:
Doe, John
Assessments Inc.
john@doe.com

Sample ID:	S_1
Field/Treatment:	West Upper
Tillage:	7-9 inches
Crops Crown:	COG, COG, COG
Date Sampled:	5/1/2015
Given Soil Type:	Lima
Given Soil Texture:	Silt Loam
Coordinates:	42.44790 °N; 76.47570 °W

Measured Soil Textural Class: Silt Loam **Sand: 37%** **Silt: 53%** **Clay: 10%**

Test Results

	2 Indicator	3 Value	Rating 4	Constraint 5
Physical	Available Water Capacity	0.15	42	
Physical	Surface Hardness	87	84	
Physical	Subsurface Hardness	290	50	
Physical	Aggregate Stability	22.0	22	Aeration, Infiltration, Rooting, Crusting, Sealing, Erosion, Runoff
Biological	Organic Matter	2.9	32	
Biological	ACE Soil Protein Index	4.5	26	Organic Matter Quality, Organic N Storage, N Mineralization
Biological	Respiration	0.39	23	Soil Microbial Abundance and Activity
Biological	Active Carbon	450	27	Energy Source for Soil Biota
Chemical	pH	6.9	100	
Chemical	Phosphorus	4.5	100	
Chemical	Potassium	67.8	93	
Chemical	Minor Elements Mg: 419 Fe: 1.1 Mn: 12.9 Zn: 1.9		100	

6 **Overall Quality Score**	58	Medium

FIGURE 2.53. Sample Soil Health Assessment Report with (1) Background info, (2) Measured indicator, (3) Indicator value, (4) Rating, (5) Constraints, and (6) Overall quality score.

Using the Assessment of Soil Health Information

The Cornell Assessment of Soil Health focuses on identifying priorities and opportunities for improved soil management. The color coded results and constraints listed on the summary page help the user get an overview of the field's soil health status.

Identified constraints in soil process functioning are highlighted in red, and the associated soil processes represented by these constrained indicators are listed. While an overall soil quality score is provided at the bottom of the report summary page to integrate the suite of indicators, it is important to note that the most important information is which indicators are suboptimal, because it is this information that informs management decisions. As an entry point in our understanding of soil health, any measured soil constraint can be taken as a management target.

Spade and buckets used to collect soil health samples.

The soil health report is part of an overall Soil Health Management Planning Projcess and can be used to:

- Understand soil processes and past management impacts
- Identify constraints, assess soil health status
- Select and implement managment strategies that address needs and are feasible for the operation
- Monitor change
- Measure progress and adjust management

It is important to recognize that the information presented in the report is not intended as a measure of a grower's management skills, but as a tool to understand soil processes and past management impacts to inform management decisions towards addressing specific soil constraints that have not been previously measured as part of standard soil testing.

When multiple constraints are considered together, management strategies can be developed that select particular practices to address needs that are feasible for the operation and can restore functionality to the soil. These strategies become part of the Soil Health Management Plan discussed in Part III.

Using Soil Health Assessments in Soil Health Management Planning

Considerations in interpreting soil health assessments

First some general guidance to consider when embarking on evaluating the information gained from soil health assessments, and using it to decide on management solutions:

The report is a management guide, not a prescription: Nutrient management has largely been prescription-based (for example, a soil test report is returned with a recommendations to 'add 80 pounds of potassium per acre to increase plant available potassium'). The soil health report shows the aspects of the soil needing attention in order to alleviate constraints and thus enhance productivity, resilience, and sustainability. However, there is not a single and specific prescribed treatment for a given identified constraint, because options for addressing soil health constraints are more complex and varied (and also still less well understood) than options for alleviating nutrient deficiencies. Rather multiple diverse management options are provided for any given constraint, to guide the producer in understanding the types of practices that would alleviate the constraint identified. The choice and details of management efforts to be used in overcoming identified soil health constraints are dependent on various factors related to the operation, as will be discussed in the Soil Health Management Planning Process section in Part III.

Different management approaches can be used to mitigate the same problem: A number of different management practices that achieve similar outcomes can be used to address a constraint, as shown in the management suggestions tables provided as part of the soil health assessment report (see Part III). For example, growers seeking to increase aggregate stability in their fields need to find ways to protect and build soil aggregates through improving biological activity that accomplishes this, as discussed previously (page 42). They might approach this by using manure, growing shallow, dense-rooted cover crops, mulching, reducing tillage, or a combination of these methods, depending on their operational opportunities and challenges.

Management practices can affect multiple indicators: A single management practice can affect multiple indicators and the functioning of soil processes associated with them. For example, adding manure to the soil will improve soil aggregation, increase organic matter, increase active carbon and soil protein contents, increase microbial activity, and improve soil nutrient status. The magnitude of such synergistic effects are dependent on the specific management practices, soil types, and management history.

Certain indicators are related, but over-interpretation of these relationships may be misleading: While several soil health indicators used in this assessment provide information about interrelated processes, the degree of interrelationship varies with soil type and previous management history. For example, a general relationship exists between total soil organic matter and active carbon contents. However, active carbon is an indicator of actively decomposing organic fractions that are readily available to the soil microbial community. A soil may be high in stabilized soil organic matter from past high carbon inputs and microbial activity, but it may be lacking the fresh decomposable component currently, and thus may show relatively low active carbon content. An example of such a situation is provided in the case study in Part III, pages 97-103.

Direct comparison of two fields that have been managed differently may lead to confounded interpretations: Comparing two soil health assessment reports of fields with different management practices, histories, and soil types should be done with care. The absence of baseline data and similar inherent soil types for such comparisons makes it difficult to conclude on beneficial effects of a management practice. However, if a field was managed the same way and then divided up into comparable sections with different management practices (preferably replicated), a soil health assessment can be used to compare management alternatives.

Soil health changes slowly over time: Soil health problems have generally developed as a result of long-term management choices, so it can be expected that a "heavy footprint" on soil health parameters cannot be instantaneously alleviated as is the case for most nutrient deficiency problems. Generally, management practices to address soil health constraints take variable amounts of time for desired effects to be observed and measured. Some changes in the indicators can be seen in the short term, while others may take a much longer period to be realized. For example, fertilizer application for nutrient deficiencies, and even targeted deep subsoiling to alleviate a subsoil plow pan, or surface disturbance to alleviate compacted surface soils, may produce immediate effects within a season. But with conversion to no-tillage it may take 3-5 years before beneficial changes in soil health and productivity become noticeable. The speed of change also depends on climate and soil type. For example in very cold or very warm climates, measurable changes may take longer. Some producers are experiencing more rapid changes when they strategically combine multiple locally-adapted practices into soil health management systems, such as combining reduced tillage with cover cropping, grazing of those covers, and improved rotations.

REMEMBER: SOIL HEALTH MANAGEMENT IS A LONG-TERM INVESTMENT!

The Comprehensive Assessment of Soil Health Report fits into the Soil Health Management and Planning Framework to be discussed in further detail in Part III.

Growing Aroostook cereal rye cover crop. Photo credit: Troy Bishopp