

2024 SOIL HEALTH REPORT



164
FARMERS
PARTICIPATED



220
FIELDS WERE
SAMPLED



285
SOILS WERE
SAMPLED

ABOUT THE PROGRAM

Healthy soil provides long-term economic and environmental benefits that are built by farmers using specific on-farm practices. These benefits can include higher net profits, more consistent yields, improved water and nutrient retention, drought resiliency, reductions in inputs, and decreased erosion.

This report allows you to measure and evaluate the impact of your management practices on soil health. As part of a project to build and refine soil health testing methods in Ontario, your report combines two approaches developed by the Soil Health Institute and the Ontario Ministry of Agriculture, Food and Agribusiness. We tested your soil for the indicators used in both approaches. Your results are reported in Parts One and Two of the report and use different statistical methods and databases. Part One evaluates your soil health and compares it to different management approaches for your soil type and cropping system using a database of 285 soil samples collected from in and around the Golden Horseshoe. Part Two evaluates your soil health relative to a broader range of soils and cropping systems using a database of over 1,500 soil samples collected across Ontario. Your participation helps build soil health testing methods for all Ontario farmers.

We sampled fields on broad categories of coarse loamy and fine loamy soils, and from well, moderately well, and imperfectly drained soils. Fields were growing spring-planted grains and oilseeds. Samples were collected at mid-slope positions within fields in June and July of 2023 and 2024.

YOUR SAMPLE

Name: Farmer

Texture: Sandy loam

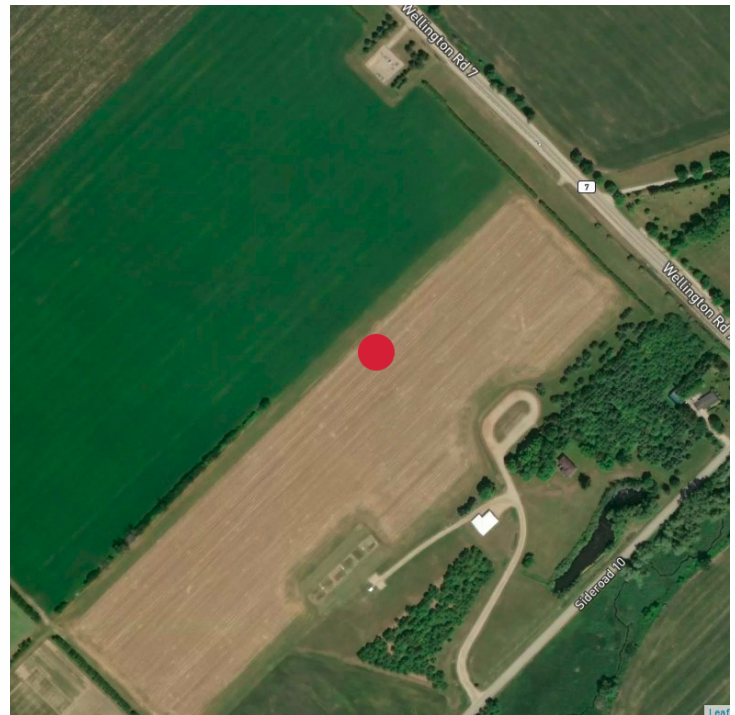
Field: Behind barn

Crop Rotation: Corn-Soy-Wheat

Tillage Practices: No-Till

Cover Crops: Oats, Peas, Sunflower

Organic Amendments: N/A



To learn more about this project visit: www.greenbelt.ca/soil-health or email: soil@greenbelt.ca



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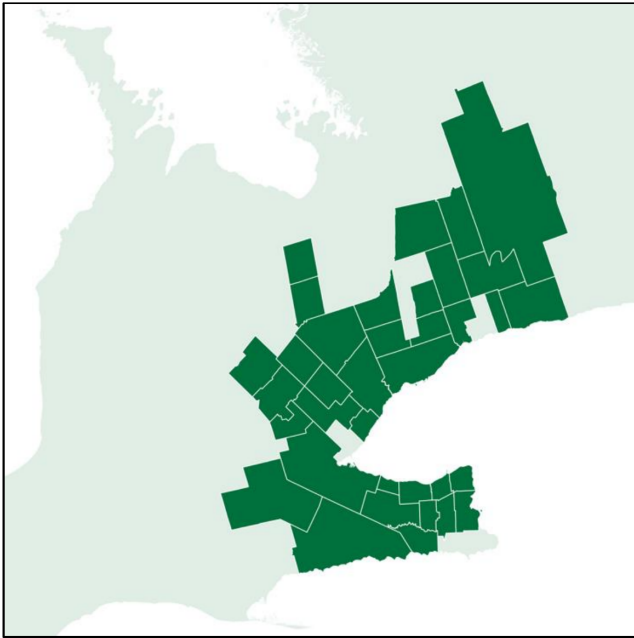


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YOUR RESULTS

PART ONE

The **soil health** of your farm was compared to other grain and oilseed farms and undisturbed sites representing the maximum soil health in the shaded regions below.



SOIL HEALTH MEASUREMENTS

The following indicators recommended by the Soil Health Institute were assessed:

Soil Organic Carbon measures the carbon contained in soil organic matter. Increasing this promotes soil structure, microbial activity, available water, and available nutrients.

Wet Aggregate Stability measures soil structure and resistance to disturbance. Soils with greater aggregate stability are more resistant to erosion and have improved infiltration, water storage, and aeration.

Respiration is the amount of CO₂ respired from soil through biological activity once rewetted. Greater respiration indicates more biological capacity to cycle residue and nutrients.

Available Water Holding Capacity (AWHC), predicted from texture and soil organic carbon, is the amount of water the soil can store in the top 15 cm and provide to plants. Greater AWHC improves resilience to drought and flooding.

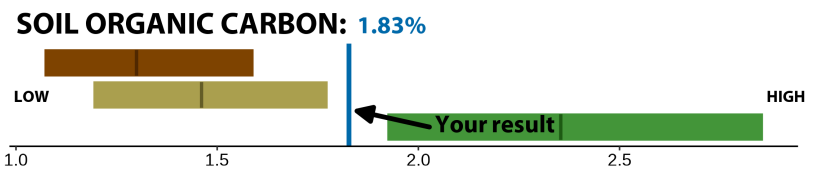
SAMPLED MANAGEMENT SYSTEMS



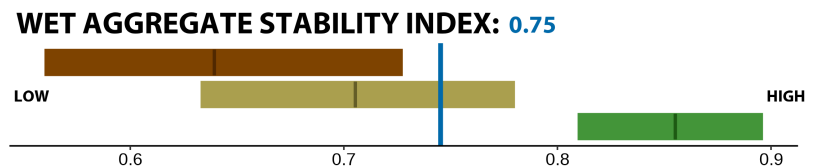
SOIL HEALTH RESULTS

The **blue vertical line and number** is the measured result for your soil. Each bar represents the likely range of results for your soil under each management. The vertical line within each bar is the average.

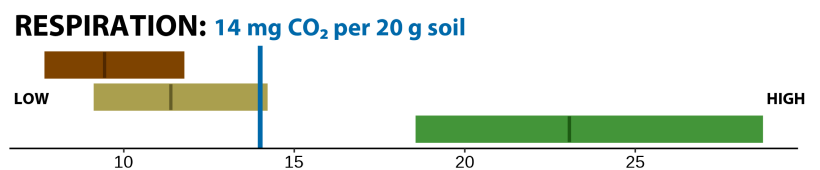
High Tillage Low Tillage +/- Cover Crops Fencerows & Pastures



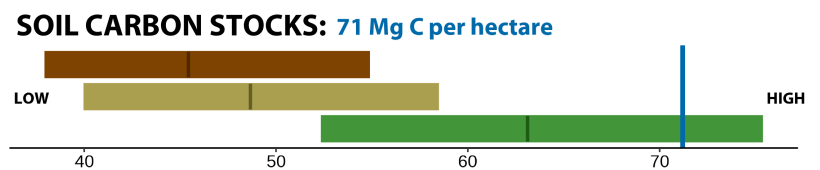
Your organic carbon is **above average**. There is **moderate** potential to increase organic carbon in your soil.



Your aggregate stability is **average**. There is **significant** potential to increase aggregate stability in your soil.



Your respiration is **above average**. There is **moderate** potential to increase respiration in your soil.

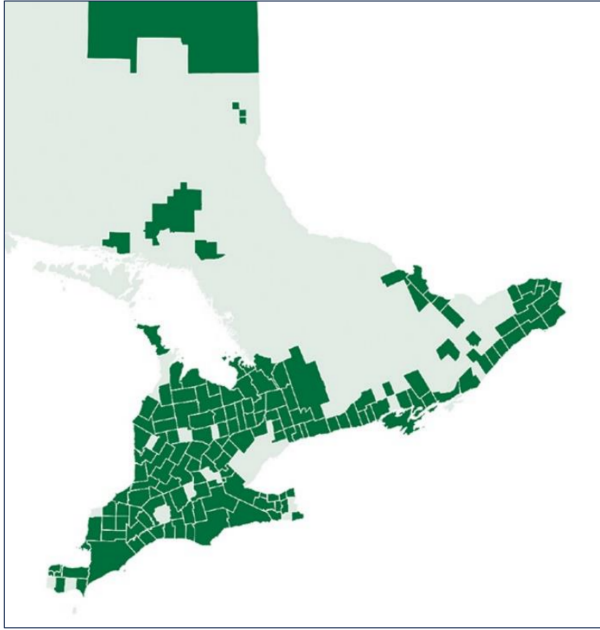


Your soil carbon stocks are **above average**. There is **low** potential to increase soil carbon stocks in your soil.

YOUR RESULTS

PART TWO

The **soil health** of your farm was compared to other farms in the shaded regions below.



SOIL HEALTH MEASUREMENTS

The following indicators recommended by the Ontario Ministry of Agriculture, Food, and Agribusiness in the Soil Health Assessment Plan were measured:

Organic Matter was calculated from soil organic carbon. Increasing this promotes soil structure, microbial activity, available water, and available nutrients.

Potentially Mineralizable Nitrogen measures how much of the nitrogen in organic matter can be converted (mineralized) to plant-available ammonium. Higher values result in more nitrogen available for crops and relate to soil microbial activity.

Active Carbon represents a fraction of soil organic carbon that is not the most microbially available, but rather moderately stable and slightly processed. Greater active carbon is related to the benefits that come with healthy soil biology.

See previous page for **Respiration** and **Aggregate Stability** definitions.

SOIL HEALTH RESULTS

The number in the coloured box is the score of your soil. This score is a percentile based on a database of 1500+ Ontario samples. The indicator's measured result is in **blue**.



67

ORGANIC MATTER: 3.47%

Your organic matter is in the **high** range.

46

RESPIRATION: 14 mg CO₂ per 20 g soil

Your respiration is in the **medium** range.

73

POTENTIALLY MINERALIZABLE N: 12 µg N per g soil

Your potentially mineralizable nitrogen is in the **high** range.

42

ACTIVE CARBON: 450 mg per kg

Your active carbon is in the **medium** range.

58

AGGREGATE STABILITY: 86.6%

Your aggregate stability is in the **medium** range.

PRINCIPLES OF SOIL HEALTH

The following principles are recommended to improve soil health:

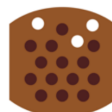
Minimizing disturbance improves soil aggregation, infiltration, and water holding capacity.

Maintaining living roots throughout the year promotes nutrient cycling and increases organic carbon stocks.

Keeping the soil covered reduces erosion, regulates soil temperature and soil moisture, and increases organic carbon stocks.

Diversifying crops enhances nutrient cycling, improves weed suppression, and increases yield.

Building soil organic matter improves soil structure, maintains aggregate stability, and feeds soil ecosystems.



MINIMIZE
DISTURBANCE



YEAR ROUND
ROOTS



COVERED



DIVERSIFY



BUILD

SOIL HEALTH MANAGEMENT PLAN

CONTINUE

- The strong crop rotation, using corn, soybeans, and winter wheat.
- Using a cover crop mix after winter wheat harvest.
- The no-till practices in all cropping years.

CONSIDER

- Planting an overwintering species in cover crop mix after wheat, for example, cereal rye or vetch.
- Adding cover crops to additional years of the rotation, for example, cereal rye after corn.
- Applying organic amendments like manure, compost or biosolids once in 5 years.

Based on the soil assessment, the following practices could be considered for your operation:

Management Actions	Concerns Addressed	Considerations
Early wins: High-priority issues and/or low-hanging fruit (to implement next season)		
Add to cover crop mix.	Soil Structure, Soil Life	Include an overwintering species after wheat, for example, cereal rye or vetch.
Short-term recommendations: Incremental improvements towards more permanent solutions (2–5 years)		
Plant additional cover crops.	Soil Life, Soil Structure	After corn harvest, if time allows, plant cereal rye as a cover crop.
Apply organic amendments.	Soil Organic Carbon, Soil Life	Once in 5 years, apply manure, compost, or biosolids to maintain the soil's SOC level.
Long-term vision (5+ years goals)		
Maintain or improve the soil organic carbon level.	Soil Organic Carbon, Soil Structure, Soil Life	Maintain or improve (suggestions above) current soil management practices.

RELEVANT COST-SHARE PROGRAMS

Ganaraska Region Conservation Authority (GRCA) has funding for various projects

Contact GRCA for further information at 905-885-8173 or by email at info@grca.on.ca.

<https://grca.on.ca/watershed-stewardship/clean-water-healthy-land-funding-program/>

Ontario Soil and Crop Improvement Association has funding for various projects

Contact Robin Brown at 705-718-4859 or rbrown@ontariosoilcrop.org

<https://programguides.ontariosoilcrop.org/program/?cat=agricultural-stewardship-initiative>

Educational resources are available at www.greenbelt.ca/soil-health-resources



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APPENDIX

YOUR DETAILED SOIL HEALTH MANAGEMENT PLAN

Management Information Provided:

Year	Crop	Cover Crop	Tillage	Organic Amendment
2020	Corn		No-Till	
2021	Soybeans		No-Till	
2022	W Wheat	Oats, Peas and Sunflower	No-Till	
2023	Corn		No-Till	
2024	Soybeans		No-Till	

1. Soil Organic Carbon

Background: Soils with high soil organic matter levels have resilient soil structure (stable aggregates), high water-holding capacity and infiltration rates, more exchange sites for nutrients, robust soil life, and higher levels of organic nutrient sources. To increase soil organic carbon (SOC) levels, the gains must exceed the losses. Reduce carbon loss by reducing soil disturbance and soil erosion. Add carbon with high biomass crops, cover crops, and organic amendments.

Overall Rating*

3
MEDIUM

Comments: The SOC level is Very Good.

Suggested Soil Management Practices: Maintain current low soil-disturbance practices. Maintain the current rotation. Include cover crops in most years of the rotation. Consider applying solid manure, compost, biosolids, or other organic amendments once in 5 years.

2. Surface Structure

Background: Refers to the top 15 cm (6") of soil and reflects how sand, silt, and clay particles are arranged into clumps or aggregates that are bound by clay and organic matter. Soils with good soil structure are very porous, form functional ecosystems for soil life, are sound mediums for crop root growth, and show resilience to the forces of degradation – such as structural degradation, compaction, and soil loss. To improve soil structure, see the Suggested Soil Management Practices below.

Overall Rating

3
MEDIUM

Comments: The soil structure rating is Good. It is mostly open with a moderate crumb structure (small block shapes) and breaks apart with some pressure. No crust was observed. Wet aggregate stability rating is Very Good. Available water-holding capacity rating is Very Good. The bulk density rating for the top 30 cm (12") is Good. **Note:** The bulk density was only checked at 1 point in the field. Check the rest of the field for soil compaction to see if it may be a problem in other areas of the field. A tile probe, drainage flag, or penetrometer can be used to check for compaction.

Suggested Soil Management Practices: Maintain current low soil-disturbance practices. Maintain the current crop rotation. Include fibrous and/or deep-rooted cover crops (e.g., cereals, clovers, radish) in the rotation 2 to 3 times in 5 years, or interseed red clover in wheat once in 3 years. Consider applying manure, compost, biosolids, or other organic amendments once in 5 years. Continue using current soil-compaction prevention measures.

Note: The potential for tillage erosion is Moderate due to the undulating topography and moderate slopes. Tillage erosion is the movement of soil material downslope by tillage and gravity. It is most likely to occur on complex, sloped fields with a history of downslope tillage and cropping practices. Reducing tillage and tilling across the slope will reduce tillage erosion.

3. Soil Life

Background: Refers to all living things in the soil ecosystem – all flora and fauna, from micro-organisms (e.g., bacteria) to macro-organisms (e.g., earthworms). Healthy soils have rich and diverse soil life forms and high levels of activity that improve the resilience of soils to the forces of degradation, improve soil habitat and seedbed quality, and increase the availability of plant-available soil water and organic nutrients. Reducing soil disturbance and implementing the suggested soil management practices will provide food and habitat to support soil life.

Overall Rating

3
MEDIUM

Comments: Potentially mineralizable nitrogen (PMN) rating is Moderate. The potentially mineralizable carbon (PMC) rating is Very Good. The permanganate-oxidizable carbon (POC) rating is Low. The living roots index rating is Moderate. The earthworm midden count is Moderate.

Suggested Soil Management Practices: Maintain current low soil-disturbance practices. Maintain the current rotation. Continue using a diverse cover crop mix after wheat and consider planting a cover crop in most years of the rotation. Consider applying manure, compost, biosolids, or other organic amendments once in 5 years. To improve PMN rating, regularly include a legume cover crop, a nitrogen-rich organic amendment (e.g., manure). To maintain the PMC rating, consider including organic amendments and continue current practices of winter cereals and cover crops that support the soil biology. To improve the POC rating, consider applying an organic amendment once in 5 years. Increase the living roots index by including a winter cereal once in 3 years, a cover crop 3 out of 5 years, and, if possible, include a perennial forage.

4. Water Erosion

Background: Refers to the detachment, transport, and deposition of soil particles by water. The risk of water erosion increases with intensity of rainstorms, slope steepness, slope length, loams and silt soils, and the lack of erosion control practices and structures. Erosion control measures include keeping the soil covered with residue and cover crops and slowing overland flow of water with erosion control structures.

Overall Rating

4
HIGH

Comments: The soil type and topography present little risk for water erosion. Watch for and mitigate any erosion along ditches and watercourses.

Suggested Soil Management Practices: Maintain current low soil-disturbance practices. Continue leaving high levels of crop residue over winter. Continue leaving high levels of crop residue after planting. Include an overwintering crop or cover crop at least twice in 5 years. Maintain or improve the current suite of soil-health BMPs.

Notes: When applying nutrients, fertilizer, or organic amendments, it is important to consider the 4Rs to achieve nutrient use efficiency and keep nutrients out of surface and groundwater. The 4Rs are right rate, right place, right time, and right product.

* The ratings of soil health are assigned on a 4-point scale.

The soil management practices included in this report are suggestions for improving soil health. The implementation of these practices should be undertaken with your agronomist or another experienced person who can provide specific advice for your management system.

YOUR DETAILED SOIL HEALTH DATA

Behind Barn

Measurement	Depth: 0-15 cm	Depth: 15-30 cm
Sand (%)	72	70
Silt (%)	19	19
Clay (%)	9	11
Soil Organic Carbon (%) ¹	1.83	1.97
Inorganic Carbon (%)	0.02	0
Total Nitrogen (%)	0.2	0.2
Estimated Organic Matter (%) ²	3.47	
Active Carbon (mg/kg) ²	450	
Respiration (mg CO ₂ /20 g soil) ^{1,2}	14	
Potentially Mineralizable N (µg N/g soil) ²	12	
Aggregate Stability ¹	0.75	
Stable Macroaggregates (%) ²	87	
Mean Weight Diameter (mm)	1.7	
Bulk Density (mg soil/cm ³)	1.27	1.23
Available Water Holding Capacity (mm) ¹	16	
Carbon Stock (Mg C/hectare) ¹	35	36
pH	6.1	
Buffer pH	N/A	
Calcium (mg/kg)	1700	
Potassium (mg/kg)	85	
Magnesium (mg/kg)	100	
Sodium (mg/kg)	13	
Phosphorus (mg/kg)	46	

¹Part One: Soil Health Benchmarks (Soil Health Institute)

²Part Two: Soil Health Assessment and Plan (Ontario Ministry of Agriculture, Food, and Agribusiness)

NOTES:

- Inorganic carbon represents the amount of carbonates (e.g., limestone, dolostone) in the soil
- Organic matter was calculated from organic carbon using a conversion factor of 1.9
- Respiration is per a 4-day incubation
- Potentially mineralizable N is per a 7-day incubation
- Aggregate stability is unitless and was measured by slaking for Part One
- Stable macroaggregates and mean weight diameter were measured by sieving for Part Two
- Available water holding capacity was calculated from texture and organic carbon
- pH was measured by saturated paste
- Extractable cations were measured by ammonium acetate
- Phosphorus was measured by Olsen extraction

Extractable nutrients cannot be relied upon to make fertility decisions for your farm because of the differences in sampling procedure. However, if a deficiency is shown, it may highlight a need for additional fertility sampling. See the Ontario Soil Fertility Handbook for more info.