CANADIAN AGRICULTURAL PARTNERSHIP

Farmland Health Check-Up Guide

Introduction

The Farmland Health Check-Up (FHCU) is a tool that helps farmers identify priority actions that improve soil health, reduce soil and nutrient loss, and improve pollinator health. Healthy soils provide many benefits such as improved productivity, better nutrient cycling, and improved water quality.

The FHCU consists of a workbook with four sections: Client Information, Soil Health, Water Quality and Nutrient Management, and Pollinator Health. The workbook culminates in a series of Farmland Health Challenges that provide a framework for the CCA/P.Ag to create a plan for what improvements the producer could focus on.

Certified Crop Advisers (CCA) and Professional Agrologists (P.Ag) were chosen to deliver the FHCU because of their knowledge, certification, code of ethics, and on farm relationship with farmers. They work directly with farmers and often have an intimate knowledge of their land and production system. Working through the Check-Up, the CCA/P.Ag can provide their professional opinion of farm practices and farmland health priorities. The plan they prepare with the farmer by completing the FHCU will support on-farm changes that will make a significant difference.

Soil health is generally thought of as having three components: physical; chemical; and biological. The physical component considers the extent of soil erosion, aggregate stability, soil compaction, available water holding capacity, and others. The chemical component considers the nutrients and soil pH that plants require for growth. Soil life such as bacteria, fungi, earthworms, insects, and organic matter make up the biological component.

Poor aggregate stability, soil compaction, and poor soil structure are physical problems that have significant negative impacts on crop growth. Poor aggregate stability may lead to crusting which can impede crop emergence and prevent water movement into the soil. Soil compaction and poor soil structure can prevent water movement, root growth, and air movement into the soil. Low fertility levels can reduce crop yields. Excessive nutrient levels can have a negative impact on the environment. Low organic matter levels often impact the chemical and physical components as can low soil life populations.

What is needed to get started on completing the Farmland Health Check-Up?

The FHCU asks for up to five years' worth of information. Ask the farm participant to assemble the following:

- ✓ Environmental Farm Plan (EFP)
- ✓ Two most recent soil tests for each of the three fields being assessed
- ✓ Planting, fertilization, tillage, manure application, weed and pest management records
- ✓ Yield information
- ✓ Crop rotation and cover crop use information
- ✓ Any other information about soil or pollinator health topics they might want to discuss
- ✓ Any field maps, soil maps, etc. that might be useful
- ✓ Crop records – including manure or biosolids application records
- ✓ Farm history notes or other records of crop failures; severe wind or rain storm events

- ✓ Nutrient Management plans

Planner (CCA, P.Ag) needs:

- ✓ Web or Computer-derived maps or aerial photos to verify location
- ✓ Soil survey information – map units, soil series, drainage class, slope class
- ✓ County yield information
- ✓ Farmland Health Check-up Guide
- ✓ BMP publications and other OMAFRA publications to help match BMP to soil health challenges identified in FHCU and to provide supporting information to the farmer
- ✓ Computer and internet access (if internet is not adequate, the CCA or P.Ag may fill out a PDF and complete the digital FHCU once they have returned to more secure internet)

Part 1: Client Information

Section 1: Member Information

Complete all the applicable fields related to the producer's contact information, commodities, and other details.

Provide information on your "least challenging" field and two "challenging" fields. ('Fields Information')

Two challenging fields are requested to identify soil health problems and options to address them. The least challenging field is included so the farmer will have a field to contrast with the other two fields. When deciding on which fields to put in the challenging category - ask the farmer to consider fields with one or more of the following:

- poor or variable yields
- observed soil erosion
- soil crusting
- soil compaction
- low organic matter levels

There may be situations where the farmer does not have a field that fits into one of the two categories. Put three fields in and as you complete the document the category may become apparent.

If you do not have the GPS coordinates for each field, you can use the Agricultural Information Atlas (see Soils Information and Additional Resources (Preparation for Farm Visit) at https://farmlandhealthcheckup.net/ca-en/resources/ for information on how to do this) to find them. Alternatively, they can be obtained using Google Maps by zooming into the field and clicking on the field. The GPS coordinates will appear at the bottom of the screen.

The Conservation Authority of each field can be determined by consulting the map on this page: https://conservationontario.ca/conservation-authorities/find-a-conservation-authority/ (this link is also available on the Resources page)

The quaternary watershed of each field can be determined by consulting the LEADS Eligibility and Watershed Map under 'Soils Information and Additional Resources' on the Resources page of the digital

FHCU. Click on a location on the map, and a pop-up will appear ("QUAT_NAM" is the quaternary watershed).

Create a map showing your three selected fields. ('Map')

The Digital FHCU requires that you upload map document(s) of your 3 fields. The easiest way to do this, if a map does not currently exist that could be used, is with a mapping program such as the Agricultural Information Atlas, Google maps, or a similar program. The instructions on Soils Information and Additional Resources (Preparation for Farm Visit) at https://farmlandhealthcheckup.net/ca-en/resources/ provide guidance on using the Agricultural Information Atlas to create maps and to find soil information; these can also be found on the CCA Farmland Health Check-up Resources webpage.

Where relevant, show the following on the map:

- known erosion problems
- erosion control structures
- significant slopes
- windbreaks, woodlots, treelines, etc.
- areas where overland flow reaches surface waters i.e. wells, catch basins, drop inlets, etc.

Section 2: Soil Health

2.1 Using the soil map information and the soil summary sheets, record the predominant soil series, surface and subsurface texture, and natural drainage class for each of your fields (Field 1, Field 2, Field 3). ('Soil Map Information')

- Potential areas of concern to consider when completing the Assessment:
  - all forms of erosion and compaction/crusting
- Water erosion – soils with silt and very fine sand (e.g. silt loam, very fine sandy loam) content are more erodible
- Wind erosion – soils with high fine and very fine sand content or muck/organic soils are more erodible by wind

Finding Soil Information

The soil series, surface texture, soil group, drainage class, erosion factor, slope class, and complexity can be obtained from several sources:

a) The Agricultural Information Atlas (see the instructions on Soils Information and Additional Resources (Preparation for Farm Visit) at https://farmlandhealthcheckup.net/ca-en/resources/) allows users to create maps and find soil information such as the dominant series, texture, and drainage class.

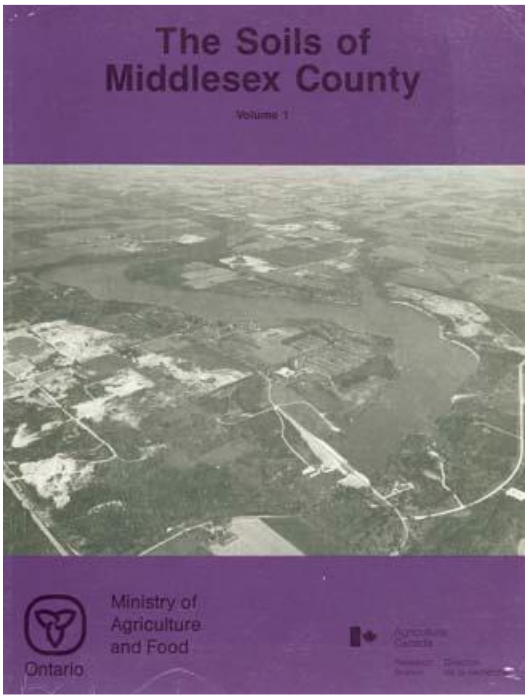
b) Soil Survey Maps and Reports
   - These maps can be found on the Farmland Health Check-up Resources webpage
   - They can also be found at the Canadian Soil Information Service (CANSIS) website: http://sis.agr.gc.ca/cansis/. Soils survey maps and reports can be viewed online and downloaded for free.
   - To purchase a hard copy of the soil survey map and report visit Service Ontario Publications https://www.publications.gov.on.ca/ and search for 'soil survey reports". They are $15.00 each.

Dominant Soil Series

Where there is more than one soil series mapped in a field, the dominant soil series is the one that represents the greatest area.

How to use and interpret soil map information

Soil maps are available for most counties in Ontario. Soils are mapped based on key properties such as surface and subsoil texture, natural drainage (before drainage tile installation), stoniness, slope, and other criteria.



What are the limitations of this information?

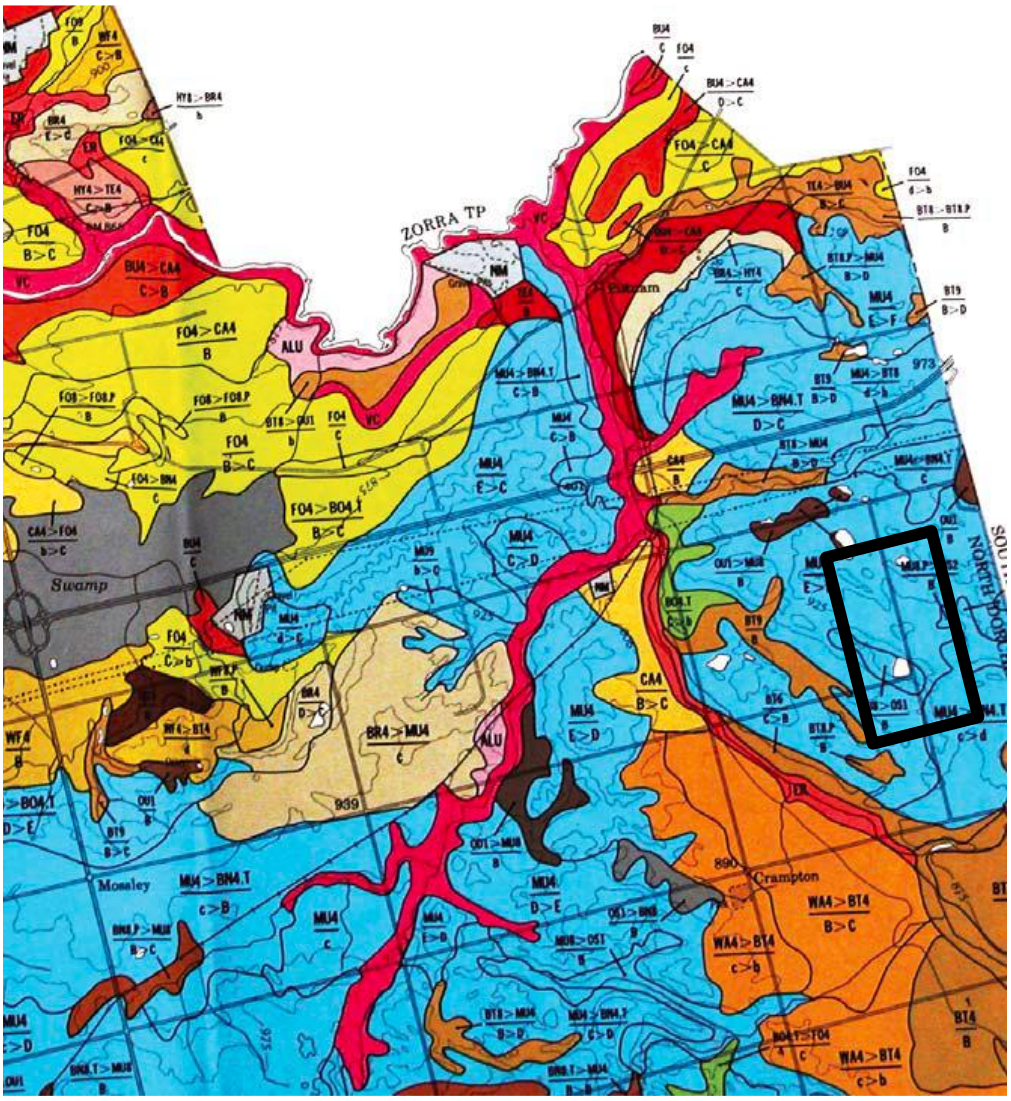
The level of detail may vary depending upon the county/regional municipality and survey date.

How can this information be useful for Farmland Health planning?

- Soil maps show soil types (series), their properties (materials, slopes, natural drainage class, stoniness), and extent of these soils on farm fields
- This information can then be used to determine risk of soil erosion, soil compaction, etc.

Below you will find:

- ✓ a portion of the Middlesex County Soil Map – with soil, topographic and municipal features
- ✓ a portion of the soil legend – a table which explains the terms and codes used for each map unit description on the map
- ✓ a graphic explaining the codes described in the legend (Soil type, slope class, etc.)
- ✓ slope class

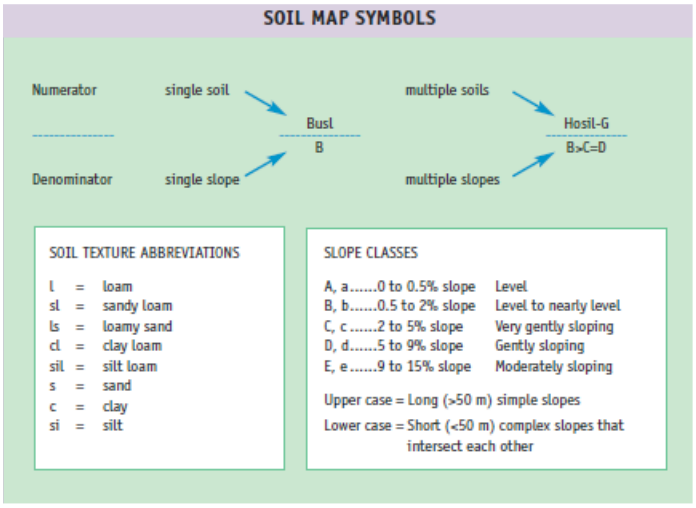


Portion of Middlesex County Soil Map, with a theoretical field outlined.

SOIL SERIES	SOIL SERIES MEMBERS & DRAINAGE	USUAL SURFACE TEXTURE	SOIL MATERIAL DESCRIPTION	LANDSCAPE UNITS*	DOMINANT SOIL DRAINAGE COMPONENT	SIGNIFICANT SOIL DRAINAGE COMPONENT
Bennington (BN)	Bennington – Well Tavistock – Imperfect Maplewood – Poor	Silt loam, loam	40–100 cm of glaciolacustrine loam, silt loam and occasionally very fine sandy loam overlying clayey glaciolacustrine deposits	BN4	Well to imperfect	—
				BN6	Well to imperfect	Poor
				BN8	Poor	—
				BN9	Poor	Well to imperfect
Muriel (MU)	Muriel – Moderately well Gobles – Imperfect Kelvin – Poor	Silt loam, loam, silty clay loam	Silty clay loam, silty clay, and occasionally clay loam glacial till deposited by glaciation from the Lake Erie Basin	MU4	Moderately well to imperfect	—
						—
				MU6	Moderately well to imperfect	Poor
				MU8	Poor	—
				MU9	Poor	Moderately well to imperfect

Newer soil maps like the one for Middlesex County provide more soil information than the older maps. Where a ">" sign is used two soil types and/or slopes can be found in that map unit. When recording the soil series use the soil type or the slope that is on the left of the sign (i.e. WA4>BT4 use WA4).

Portion of Legend found on each Soil Survey Map (e.g. Middlesex County)



The graphic above explains the codes used in Soil Map Unit labels and is further explained in the legend above.

For the field identified on the map above, the soil information would be:

Field ID	Soil Series	Surface Texture	Subsurface Texture	Natural Drainage*
1	Muriel	Silt loam	Silt loam	Well

* natural drainage can also be found on the soil summary sheet for the county. For information on summary sheets, visit County Soil Summary Sheets at https://farmlandhealthcheckup.net/ca-en/resources/.

Field ID	Slope Class	Complexity
1	Hilly (E)	Simple

How can you obtain more soil information?

- contact your local office of the Ontario Ministry of Agriculture, Food and Rural Affairs
- call the toll-free Agricultural Information Contact Centre, 1-877-424-1300
- visit the OMAFRA website at http://www.omafra.gov.on.ca
- contact your local conservation authority or municipal office

2.2 Describe the slope of Fields 1, 2, and 3 using information from the county soil map and report. ('Slope Information')

- Potential areas of concern to consider when completing the Assessment:
  - water erosion
  - tillage erosion
- The risk of water erosion increases with slope steepness (grade) and length
- The risk of tillage erosion increases with slope grade and complexity (short, irregular slopes with more knolls site positions than with long even-sloping field)

See 'Finding Soil Information' above for more information to obtain slope data.

2.3 Describe your crop rotation, tillage practices and yield over the last five years. ('Crop rotation, tillage practices, and yield information')

- Potential areas of concern to consider when completing the Assessment:
  - erosion
  - ponding
  - crusting
  - correlates with severity of erosion and compaction
- Tillage system relates to degree of disturbance and quality of seedbed/structural stability as well as level of soil organic matter
- Cropping system relates to cover, organic amendments, soil biology, and structural stability

a) Crop Rotation

Record the crop harvested for each year for the last five years for each field. See the table below for a breakdown of crop families.

Crop Families			Perennial
Broadleaf	Legumes	Soybeans Edible beans, snap beans Peas Alfalfa, clover	Yes
	Non Legumes	Winter, spring canola Most vegetables – cabbage, cauliflower, broccoli, tomatoes, asparagus, rhubarb, berries, and fruit Sugarbeets	
Grasses	Warm Season	Corn, seed corn Sweet Corn Corn Silage	

	Cool Season	Winter cereals (wheat, rye, triticale, barley) Spring Cereal (oats, barley, spring wheat)	
Mixture of Both		Hay Pasture	Yes Yes

b) Yield

Record the yield for the crop listed for each year from the producer. In the next field, record the County or township yield as found in the NMAN program or from the yield tables found on the Farmland Health Check-up Resources webpage. Ensure that the units used are the same for both the producer's fields and the county average (i.e. if the average yield for Oxford county is recorded in bushels/acre, please also record the producer's average in bushels/acre).

c) Cover Crop

Include cover crops where grown. A cover crop is a crop that is grown between periods of regular crop growth and is not harvested. Exceptions would include annual grasses like oats planted after main crop harvest and grazed or harvested for feed.
If applicable, producer may also note the percentage soil cover both after planting and going into winter (of the previous year).

d) Tillage

The tillage field records tillage information for each of the three fields for five years of crops. The intent is to capture the tillage system that was used prior to planting the crop. Select the tillage system that fits the tillage that was done from harvest of the previous crop to planting of the current crop. For example, if winter wheat was harvested in the summer of 2019 and chisel plowed that fall, then was cultivated in the spring of 2020 - the tillage for the 2020 crop of corn would be reduced tillage.

Tillage definitions:

- No disturbance
- No-till – soil is minimally disturbed for seed placement only (e.g. slot-till or 1 coulter and/or trash whippers)
- Zone till/strip till – not full field, targeted to specific area and its needs (e.g. strip coulters on planter)
- Light disturbance - disturbs less than 30% of the soil surface (includes up to 2 passes of vertical tillage with a disk or cultivator)
- Moderate disturbance
    - (includes ridge till, 3 or more vertical tillage passes and any other tillage equipment that does not invert the majority of the residue)
    - 1 to 2 passes after wheat or corn
    - Achieves more than 30% residue cover after planting

- Full disturbance (includes mouldboard tillage and any other full inversion tillage; roto-tilling, power-bedders)

The producer must also disclose the number of spring and fall passes, as well as the depth of the deepest pass.

e) Soil Cover

Risks of concern: water and wind erosion; crusting.

- Inadequate cover offers no protection from wind, flowing water or from heavy rains/rapid drying
- Cover crops, crop residue and perennial crops protect soil from all degradation forces

Soil cover refers to the amount of the field protected by residue from the previous crop, cover crops, and perennial crops.

Select the amount of soil cover going into the winter and after planting for the most recent crop year. For example, the 2020 crop year - what was the soil cover in the fall of 2019 going into the winter and the soil cover after planting of the 2020 crop. If the information is being collected in the fall or winter it may be the residue from the spring and fall of the same year.

Examples of different levels of crop residue are shown on the following pages to help the producer choose the correct category. It is important to look at the residue from above rather than from the side of the field as the level will appear higher from the side.

Corn Residue

0 to 9% (corn silage would fit in this category)

10 to 29%

30 to 59%

> 60%

Soybean Residue

0 to 9%

10 to 29%

30 to 59%

>60%

Wheat Residue

0 to 9%

30 to 59%

>60%

If the residue level after planting is not known, then it may be estimated from one of the tables below. The first table shows residue cover after planting with various tillage systems and residue covers. The second table shows residue cover after various field operations. It can be used to calculate residue cover after one or more tillage passes.

Residue Cover and Soil Loss Reduction for Various Tillage Systems

Residue Type	Tillage System	% Residue Cover	% Erosion Reduction from Moldboard Plow
CORN	Moldboard plow, 2 cultivations, plant	7	-
	Chisel plow, cultivate, plant	35	74
	Disc, plant	21	72
	Ridge till plant	34	86
	No-till plant	39	92
SOYBEAN	Moldboard plow, 2 cultivations, plant	2	-
	Chisel plow, cultivate, plant	7	32
	Disc, plant	8	26
	Field cultivate, plant	18	46
	No-till plant	27	64
WHEAT	Moldboard plow, cultivate, plant	9	-
	Chisel plow, cultivate, plant	29	72
	No-till plant	86	96

Table from Best Management Practices-Field Crop Production, Page 20

For vegetable rotations – if residue level after planting is not known – assume 0 to 9%.

Calculating Percent Residue Cover

See the note at the bottom of Table 1 for what is included in the non-fragile and fragile categories. The upper end of the range represents above average yields. See example below the table.

Table 1. Influence of Various Field Operations on Surface Residue Cover Remaining.

Tillage and Planting Implements	Percent of residue remaining after each operation[1] Non-Fragile	Fragile
Moldboard Plow	0-10	0-5
Machines Which Fracture Soil		
Paratill/Paraplow	80-90	75-80
V-ripper/12-14" deep w/20" spacing	70-90	60-80
Chisel Plows		
Sweeps	70-85	50-60
Straight or spike points	60-80	40-60
Twisted points (3 or 4")	50-70	30-40
Combination Chisel Plows		
Coulter Chisel Plow with:		
Sweeps	60-80	40-50
Straight or spike points	50-70	30-40
Twisted points (3 or 4")	40-60	20-30
Disk Chisel Plow with:		
Sweeps	60-70	30 50
Straight or spike points	50-60	30-40
Twisted points (3 or 4")	30-50	20-30
Disk or Disk Harrows		
Tandem or Offset		
10" or greater blade spacing	25-50	10-25
9" or greater blade spacing	30-60	20 40
7-9' blade spacing	40-70	25-40
After harvest as primary tillage	70-80	40-50
Field Cultivators (Including leveling devices)		
As primary tillage:		
Sweeps 12-20"	60-80	55-75
Sweeps or shovels 6-12"	35-75	50-70
Duckfoot points	80-90	50-70
Sweeps or shovels 6-12"	70-80	50-60
Duckfoot points	60-70	35-50
Finishing Tools		
Combination finishing tools with:		
Disks, shanks, and leveling attachment	50-70	30-50
Spring teeth and rolling baskets	70-90	50-70
Harrows:		
Springtooth (coil tine)	60-80	50-70
Spike tooth	70-90	60-80
Flex-tine tooth	75-90	70-85

Roller harrow (cultipacker)	60-80	50-70
Packer roller	90-95	90-95

Table 1. (cont'd) **Tillage and Planting Implements**	**Non-Fragile**	**Fragile**
Row Cultivators (30" and wider)		
Single sweep per row	75-90	55-70
Multiple sweeps per row	75-85	55-65
Finger wheel cultivator	65-75	50-60
Rolling disk cultivator	45-55	40-50
Ridge-till cultivator	20-40	5-25
Unclassified Machines		
Anhydrous applicator	75-85	45-70
Anhydrous applicator with closing discs	60-75	30-50
Subsurface (Injected) manure applicator	60-80	40-60
Rotary hoe	85-90	80-90
Drills		
Conventional w/ double-disc openers	85-95	75-85
No-till with following coulters		
Ripple or no coulter	85-95	70-85
Bubble or fluted/wavy (<1" wide)	80-85	65-85
Fluted/wavy (1" wide or greater)	75-80	60-80
Planters		
Conventional:		
Staggered double-disc openers	90-95	85-95
Non-staggered double-disc openers	85-95	75-85
No-till:		
Smooth ripple or no coulter	85-90	75-90
Bubble or fluted/wavy (<1"wide)	75-90	70-85
Fluted/wavy (1" wide or greater)	65-85	55-80
Strip-till:		
2 or 3 fluted/wavy coulters	60-80	50-75
Row cleaning devices (5-10" bare strip)	60-80	50-60
Ridge-till (sweeps/double-discs/horizontal)	60-80	40-60
Climatic Effects		
Over-winter weathering:		
Following summer harvest (wheat/oats)	70-90	65-85
Following fall harvest	80-95	70-80

[1] Crop residues are generally classified as either non-fragile or fragile. Following is an abbreviated listing of crops common to Indiana that are classified into these categories:

Non-Fragile: Corn, Wheat, Rye, Oats, Alfalfa or legume hay, Cotton, Tobacco

Fragile: Soybeans, Canola, Rapeseed, Fall-seeded cover crops, Vegetables

Source: Managing Crop Residue with Farm Machinery, AY-280, Purdue University Cooperative Extension Service.

Example 1:
Wheat residue (100 bu/ac yield) disked in the fall. Calculate residue cover going into the winter.

Field Operation	Percent Residue Cover Remaining (non-fragile, from table)
Following summer harvest, cereal	85%
Disk – after harvest as primary tillage	75%
Calculation: 85% x 75% = 64%	

Example 2:
Corn residue (180 bu/ac) chisel plowed with 4" twisted shovels in the fall, disked 2x and cultivated once in the spring.

Field Operation	Percent Residue Cover Remaining (non-fragile, from table)
After corn harvest (high yield)	90%
Chisel plow with 4" twisted shovels	60%
Disk once	55%
Disk once	55%
Field Cultivate once	75%
Plant	95%
Calculation: 90% x 60% x 80% x 55% x 55% x 75% x 95% = 9%	

2.4 Number of times crusting was observed ('Crusting and Emergence')

- Potential areas of concern to consider when completing the Assessment:
  - surface crusting
  - erosion by water and tillage
  - deposition by all 3 erosive forces
- Frequency reflects seedbed aggregate stability
- May indicate organic matter (SOM) levels
- Indicates impact of tillage and cropping practices

Soil crusting – a thin, dense layer of surface soil caused by the impact of rainfall and subsequent drying on weak soil aggregates. Crusting can reduce crop emergence and water infiltration.

2.5 Over the last five years, has there been evidence of erosion on Fields 1, 2, or 3? ('Evidence of Erosion')

- Potential areas of concern to consider when completing the Assessment:
  - erosion by water, wind, and tillage
- Observations relate to type of erosion – water, wind, tillage
- Nature and frequency and sequence of observations relate to severity of the problem
- A clearer picture of the severity of erosion is created when the evidence is related to risk features (e.g. soil texture) and past management

Refer to the Best Management Practices Booklet: Controlling Erosion on the Farm for descriptions and photos of soil erosion.

2.6 Which of these conservation practices already exist on your fields? ('Conservation Practice Information')

- Potential areas of concern to consider when completing the Assessment:
  - erosion by water, wind, and tillage
- Identifies which BMPs have been adopted
- Specifies past action or suite of BMPs or conservation system operating on field
- Effectiveness of BMPs is clearer when compared with evidence

Refer to the Best Management Practices Booklet: Controlling Erosion on the Farm for descriptions and photos of conservation practices.

2.7 Indication of earthworm activity ('Earthworm Activity Information)

2.8 How long does it take for water on the soil surface to infiltrate (soak) into the soil immediately after a heavy rainfall during the growing season? ('Water Infiltration Information')

- Potential areas of concern to consider when completing the Assessment:
  - subsurface compaction
  - surface crusting
  - water erosion
  - inadequate subsurface drainage
- Nature, extent, and frequency of ponding is noted
- Frequent, long lasting, and seasonal occurrence of ponding verify infiltration and percolation problems
- This information is linked back to soil drainage classification, slope features and drainage system to verify soil drainage problems
- Also linked to soil texture, cropping and tillage practice, evidence of crusting and emergence/performance issues to verify crusting or compaction problems

Consider a heavy rainfall i.e. 1" in an hour.

2.9 After the crop is established, how evenly does it grow across the field? ('Growth Information)

- Potential areas of concern to consider when completing the Assessment:
  - Cropping and tillage systems
  - Efficacy of fertility and pest management
  - Crop growth problems may be evidence of poor soil health. For example:
    - Shallow root systems lead to short crop height
    - Cold and wet soils lead to poor performance
    - Crops on eroded soils generally perform poorly due to moisture and nutrient deficits
- One of the best times to assess uniformity of growth is in the early to mid-vegetative stages (i.e. May for winter wheat, late June for corn, July for soybeans, etc)

2.10 Is there a soil compaction issue and if yes, is it having an impact? ('Compaction Issues')

- Potential areas of concern to consider when completing the Assessment:

    - subsurface compaction
    - surface crusting
    - water erosion
- Drainage system is noted and related to natural soil drainage class, texture, slope class, risk of compaction and crusting/ponding, crop performance + yield to verify drainage problem vs. soil structure problem.

2.11 What practices do you use to reduce soil compaction? ('Soil Compaction Information')

- Potential areas of concern to consider when completing the Assessment:
    - subsurface compaction
    - surface crusting
    - reduced GHG emissions
- Measures to reduce the risk or mitigate compaction are noted
- Adopted BMPs are compared with evidence of erosion to verify effectiveness and potential need for further measures

Section 3: Water Quality and Nutrient Management

3.1 Describe your soil sampling protocol. ('Soil Sampling Protocol Information')

- Risk addressed: nutrient loss
- This question is intended to establish the sampling protocol farmers are using for soil fertility analysis.
- Key features include frequency, season-timing, # of samples/ field (density), how landscape is subdivided.
- Effective sampling protocol fosters confidence in soil test analysis results.

3.2 Use the soil test results to provide soil organic matter, soil phosphorus and pH levels. ('Soil Test Results Information')

- Potential areas of concern to consider when completing the Assessment:
    - nitrate leaching
    - P runoff
- Soil test results are clear indicators for soil fertility and fertility is a component of soil health.
- These analyses also report on organic matter (indicator of soil health, structural stability, moisture availability) and pH (overall availability of nutrients; extent of soil loss).

If there is one value for the field for organic matter, soil phosphorus and pH levels enter it in the Avg (average) box. If there are multiple values i.e. from a grid sample, enter an average or representative value in the Avg box and enter the range in the Min (minimum) and Max (maximum) boxes.

3.3 How do you decide what amount of fertilizer (nitrogen and phosphorus) to apply? ('Fertilizer Application Information')

- Potential areas of concern to consider when completing the Assessment:

- nitrate leaching
- P runoff
- GHG emissions
- Crop performance and yield is closely tied to soil fertility and nutrient management.
- Applying the right rate – or what the crop needs – is related to the list of preferred considerations in the question (e.g. soil test results, recommendations, adjustments, etc.).
- Whereas, selecting a rate based on habit or without considering the contributions of other sources, often leads to over-application and an increased risk of loss to water resources.

3.4 In the last cropping year, when/how did you apply inorganic nitrogen fertilizer? ('Nitrogen Fertilizer Application Information')

- Potential areas of concern to consider when completing the Assessment:
  - Nitrate leaching
  - GHG emissions
- Based on the 4R's, the best timing centres around when the crop needs it.
- Side-dressed application is ideal
- Pre-plant application risks loss due to leaching, runoff, volatilization, or denitrification

3.5 In the last cropping year, how and when did you apply inorganic fertilizer phosphorus? ('Phosphorus Fertilizer Application Information')

- Risk addressed: P in runoff
- Best timing is closest to time of season when crop needs it or risk of runoff is lowest
- Best methods are closest to root system or at least incorporated

3.6 How do you prevent nutrients, such as nitrogen and phosphorus, from entering surface or groundwater? ('Groundwater Infiltration Prevention Information')

- Potential areas of concern to consider when completing the Assessment:
  - nitrate leaching
  - P runoff
  - GHG emissions
- BMPs in list reflect the 4R's of Crop Nutrient Management: right source, right rate, right place, and right time

3.7 Which of the following Best Management Practices do you use for manure and other organic amendments? ('Organic Amendments Information')

- Potential areas of concern to consider when completing the Assessment:
  - nitrate leaching
  - P runoff
  - GHG emissions
- BMPs in list reflect the 4R's of Crop Nutrient Management: right source, right rate, right place, and right time

If the farmer has not used organic amendments, skip to Section 4.

3.8 Describe how you determine the nutrient content of manure or other organic materials. ('Nutrient Content Information')

- Potential areas of concern to consider when completing the Assessment:

    - nitrate leaching
    - P runoff
    - GHG emissions
- Assurance of right rate when organic source nutrient analysis accounted for

3.9 Describe the typical use of organic amendments, like manure, biosolids or compost, on Fields 1, 2, and 3 over the last five years. ('Organic Amendment Use Information')

- Potential areas of concern to consider when completing the Assessment:
    - nitrate leaching
    - P runoff
    - GHG emissions
- Assurance of right place and right timing for manure application practices
- For example – surface applied solid manure in the fall poses a high potential risk for runoff

Section 4: Pollinator Health

- Potential areas of concern to consider when completing the Assessment:
    - Loss of habitat

Section 4 is the only section that considers the whole farm.
Use the questions to start a discussion on pollinator health on farm, by habitat and forage sources.

Part 2: Information about Farmland Health Challenges

Farmland Health Challenges:

Water Erosion
Water erosion can be dramatic, in the form of a gully, or almost unnoticeable like sheet erosion, but the damage to overall soil health and productivity is significant. This ranking section utilizes the soil texture and topography to determine the inherent risk of erosion. These consider aspects of the field that are not under the control of the farmer. The other factors take into account observed erosion and soil management practices to protect the field from water erosion. When working to reduce water erosion consider the watershed and sub watersheds within fields, start with cultural methods like reduced tillage before installing erosion control structures.

Wind Erosion
Like water erosion, texture plays an important part in the potential for wind erosion. The other aspects ranked are things that a farmer can control as part of his/her soil management practices. There are three basic principles of wind erosion prevention: keep the soil covered, break up the fetch or field length and keep the soil surface undisturbed.

Tillage Erosion
Tillage erosion is the net down-slope movement of soil that occurs due to tillage practices. Tillage erosion happens in the field because typically more soil is thrown down-slope when tilling down the hill than is thrown up-slope when tilling up the hill. Much of the soil is redistributed within the field and depending upon the field be deposited in areas prone to water erosion. Steeper slopes, hilly or hummocky landscapes and production systems with many tillage passes are more prone to tillage

erosion. The amount of soil disturbed is determined by the implement as well as the speed and depth of tillage operations. Tillage erosion tends to increase variability within a field which will be noticeable in crop growth over time.

Surface Structure
Good surface structure and aggregate stability resist crusting and erosion and allow more effective water infiltration. The potential for stable soil aggregation is heavily influenced by soil texture and organic matter content. The management questions i.e. rotation and tillage look at the potential determined by grower practices while the observational questions confirm the success of on-farm practices.

Subsurface Compaction
Subsurface compaction interferes with crop growth and yield due to restricted root systems and less access to water and nutrients. Some soils are of course more prone to compaction than others. This section assesses potential and observed compaction and management efforts to minimize the compacting actions of agricultural operations.

Organic Matter
Organic matter is one factor that overlaps the three pillars of soil health – chemical, physical, and biological. Soil texture is an inherent soil characteristic that does influence soil organic matter levels. This assessment also looks at the ongoing management of organic matter through rotation, tillage, and organic amendments additions.

Soil Life
Healthy and diverse soil biology is critical to a high functioning soil. Soil biology influences most other aspects of soil from structure and soil development to nutrient cycling. There is no one test for soil biological health currently. Soil organic matter, pH and texture influence the potential for a thriving soil biology. Management in terms of rotation, tillage, and the use of best management practices like cover crops, organic amendments and residue management affect number and diversity.

Soil Chemistry
Soil chemistry is one of the three pillars of soil health. It is important to have nutrient and pH levels in the correct range. Fertility and pH directly affect crop growth, yield, and the soil biology of the field. In turn, this influences soil structure. Soil sampling and nutrient testing allow you to know what you have available for crop production. Application of the correct rate of fertilizers is important for both the bottom line and the environment. Nitrogen and phosphorous movement are of concern.

Nitrogen
Before phosphorous became a nutrient of concern, most of the concern was around nitrogen. While vital for crop production, nitrogen can be lost through leaching and contribute to some human health issues. Nitrogen losses can also lead to more release of nitrous oxide, a greenhouse gas. Matching nitrogen application rate and timing to crop need and yield potential will reduce the chance of loss.

Phosphorous
Phosphorous is a nutrient of concern currently. The overall goal is to keep phosphorous on the land, available for crop production and out of surface waters. There are several farm practices that can help to achieve this. Minimize soil losses from erosion to reduce the amount of soil borne phosphorous that enters surface waters. Target phosphorous placement below the soil surface to make phosphorous less vulnerable to loss.

Part 3: BMP Planning (Assessment)

This section brings together the totals from each component to help set priorities and address farmland health concerns. Components in the fair or poor range indicate the need for a change. The Digital FHCU will not allow for a user to proceed until the required fields are completed.

The totals and ratings will calculate automatically. As part of the FHCU planning, note the Factors to Improve and suggest some BMPs that might be beneficial and suited to the farm operation. Ensure that explanation is given and where possible be specific about the suggested BMPs.

BMP Planning Examples	
Good	Better
Make use of cover crops to control soil erosion	Make use of an overwintering cover crop such as rye to prevent soil erosion

Be sure to identify the priority level of each action (assigning 1 to 10, with 1 being the top priority), note an ideal date of completion and suggest some other activities that will support the actions.

Example (Farmland Health Challenge: Subsurface Structure)

Field	BMP(s) to Implement and Rationale	Priority	Target Date	Future Supporting Activities
3	Tougher clay soils are showing evidence of compaction from uneven growth. Lower yields have been observed on this farm compared to other farms around it. Consider reducing tire pressures or using VF tires on manure tankers, grain buggies and other equipment to reduce compaction. Look at planting a cover crops with a taproot after corn silage if harvested by the first few days of September to open up the compacted areas of the farm.	2	2020-12-01	Manure application equipment modifications that reduces compaction. Drag hose components or tanker tire changes (lower tire pressure tires). Grain buggy and grain harvesting equipment tires with reduced tire pressures. VF tires.

All areas that score poor or fair must be addressed by recommended BMPs. If a component rates good or best but there are one or more factors that rank low (1, 2 or 3) it is appropriate to suggest actions that may be helpful.

Using the numbers and the priorities from the Digital FHCU and the BMP Selection Guide document under Program Materials at https://farmlandhealthcheckup.net/ca-en/resources/, develop best management practices and system changes that are most suited to address identified problem areas. Consider the components as well as factors when determining the priority and the timing of when the change would be implemented.