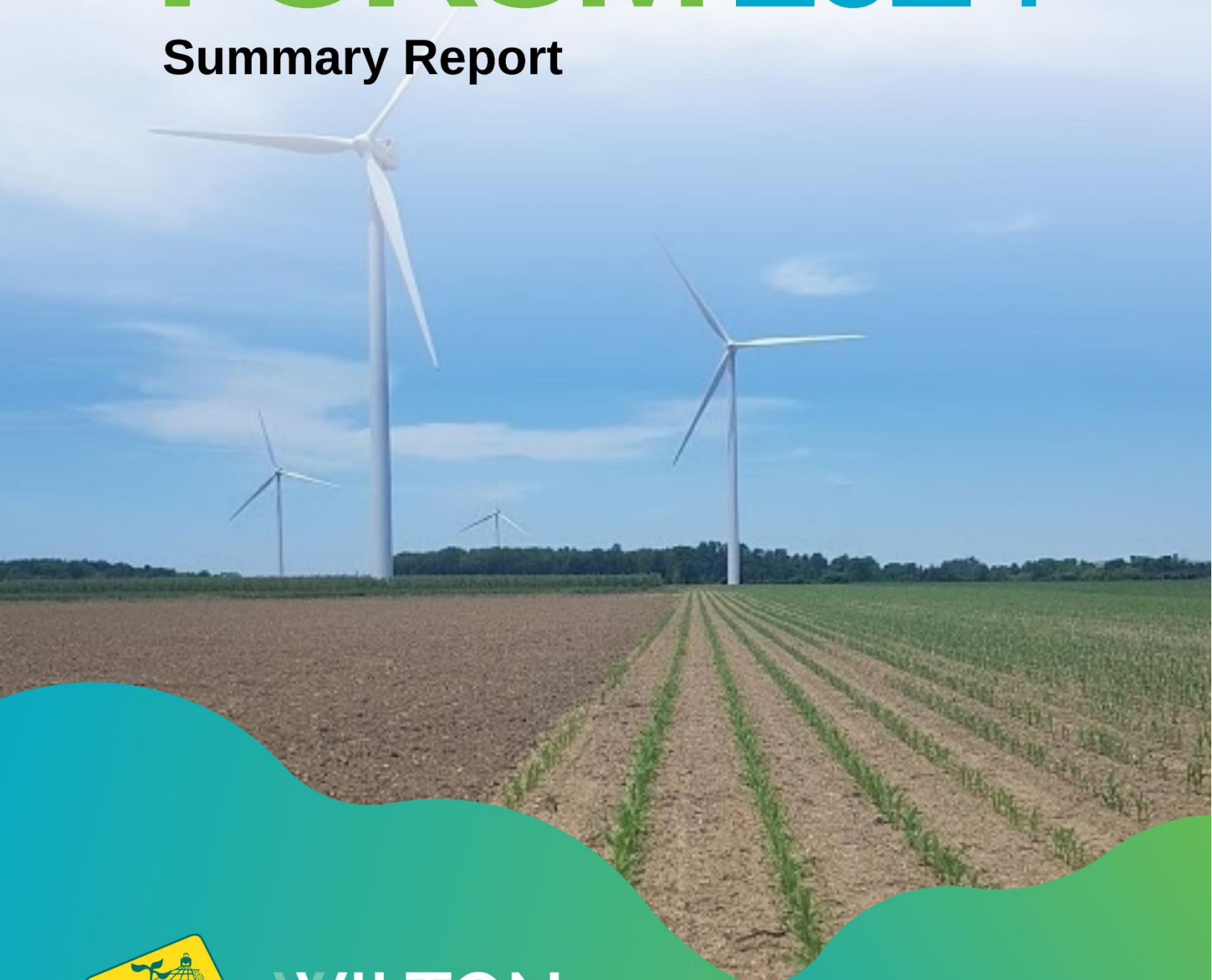
ON FARM FORUM 2024

Summary Report



OSCIA

WILTON CONSULTING GROUP

Acknowledgements

Project oversight

Dr. Angela Straathof
Director of Research and Knowledge Transfer
Ontario Soil and Crop Improvement Association
astraathof@ontariosoilcrop.org

Madeline Rodrigue
Knowledge Mobilization Specialist
Ontario Soil and Crop Improvement Association
mrodrigue@ontariosoilcrop.org

Project team

Lead consultant

Dr. Bronwynne Wilton
Principal and Lead Consultant
Wilton Consulting Group
bronwynne@wiltongroup.ca

Project manager

Dr. Andrea Gal
Consultant
Wilton Consulting Group

Project support

Krista Kapitan and Jessica Deveau, Wilton Consulting Group

Executive summary

The 2024 ONFARM Forum, hosted by the Ontario Soil and Crop Improvement Association (OSCIA), showcased the important work underway through the On-Farm Applied Research and Monitoring (ONFARM) program. This nine-year applied research initiative supports soil health and water quality research on farms across Ontario. The Forum also explored:

- In-field soil-water dynamics and how to manage the limiting factor of water in crop production,
- Innovations in soil health testing, and
- Open access tools to share agricultural research data and results.

The main takeaways from the Forum are as follows:

A. Long-term research is necessary to understand soil health and water quality indicators, as well as to understand the linkages between soil health and water quality.
B. Research must be made accessible to farmers through interactive tools to help encourage practice change.
C. Trade-offs exist between different co-benefits of a best management practice (BMP); more research is needed to better understand how to manage the potential trade-offs.
D. Farmers can improve their soils' water-holding capacity, which can help to create higher-yielding environments for their crops and make them more resilient.

Through the discussions at the Forum, the following next steps were identified:

1. Select two new sites in Northeastern Ontario, and share some basic information about the farms, as well as the BMPs being tested, with the industry.
2. Explore opportunities to optimize the ONFARM Data Dashboard to improve user experience, and to expand the reach of this tool in the industry.
3. Consider whether to continue hosting the Forum online, or whether to move to a hybrid or in-person format.

The report provides an overview of the ONFARM program and summarizes the discussions from the Forum.

"Excellent information and research being presented - much appreciated. This information needs to be heard loud and clear by all producers."

- Forum participant

Table of contents

1. Introduction

The Ontario Soil and Crop Improvement Association (OSCIA) hosted the 2024 On-Farm Applied Research and Monitoring (ONFARM) Forum on Zoom on February 8th.

The Forum provided an update on the latest on-farm developments in support of soil health and water quality. Conservation Authority representatives discussed the connections between soil health and water runoff, sharing findings from their ONFARM edge-of-field site research. An ONFARM cooperator moderated a panel discussion with industry representatives, exploring in-field soil-water dynamics and how to manage the limiting factor of water in crop production. A guest speaker from the Soil Health Institute discussed innovations in soil health testing and a University of Guelph researcher explored open access tools to share agricultural research data and results.

The event facilitated the following outcomes:

- ✓ Supporting soil health and water quality knowledge translation and transfer, including for:
  - Farmers with cover cropping projects funded through the Ontario On-Farm Climate Action Fund (OFCAF), who must participate in a Knowledge Sharing Event (KSE)
  - Certified Crop Advisors who could acquire Continuing Education Units (CEUs)
- ✓ Increasing understanding of the best management practices (BMPs) to support soil health and water quality
- ✓ Building the profile of the ONFARM program
- ✓ Fostering collaboration and enthusiasm for on-farm research

In total, 259 people registered for the event. Farmers (23%) and government representatives (22%) accounted for most registrants. Other registrants included representatives of non-profits/non-government organizations (14%), conservation authorities (11%) and other participants (10%).[1]

In total, 169 people participated in the Forum.

"This was an excellent Forum, and very well organized. Everything from opening remarks, formal presentations, panel discussions, and questions and answers was outstanding. Well done everyone!!"

- Post-Forum survey respondent

[1] "Other" representatives included consultants, agronomists, retired farmers, and members of OSCIA's client services team.

2. Context: ONFARM program

The ONFARM program is a nine-year applied research initiative, developed by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and delivered by OSCIA. The initiative was developed to support soil health and water quality research on farms across Ontario. This program is funded by the Sustainable Canadian Agricultural Partnership, a five-year federal-provincial-territorial initiative. ONFARM is supported by various organizations including Agriculture and Agri-Food Canada (AAFC), several Conservation Authorities and the Soil Resource Group. ONFARM is also supported by a network of farmer cooperators who are essential to the success of this program.

ONFARM builds on work completed under the Great Lakes Agricultural Stewardship Initiative's (GLASI's) Priority Sub-watershed Project (PSP). ONFARM supports Ontario's Soil Health and Conservation Strategy, and helps the industry meet commitments under the Great Lakes Water Quality Agreement. The program involves a variety of activities, such as monitoring the soil and water health on farms across the province. The program also investigates the effectiveness of different agriculture BMPs through paired trials to understand their effects on soil health, water quality, and productivity. These BMPs include cover cropping and the use of organic amendments.

The three pillars of ONFARM that benefit Ontario's agricultural industry are the (Figure 1):

1) Continuation of paired plot trials to evaluate soil health indicators and test BMPs,
2) Implementation of BMPs with edge-of-field monitoring to study impacts on in-field soil-water dynamics and water quality, and
3) Enhanced engagement opportunities with stakeholders and farmers to transfer knowledge on BMP implementation and impact.

Figure 1. Pillars of ONFARM.

ONFARM includes 23 soil health BMP trial sites and seven edge-of-field (EOF) sites where Conservation Authority staff monitor water quality (Figure 2). In the first iteration of the program, ONFARM also had contributions from two additional soil health trial sites, as well as two additional EOF sites. ONFARM will add two Northeastern Ontario sites soon.

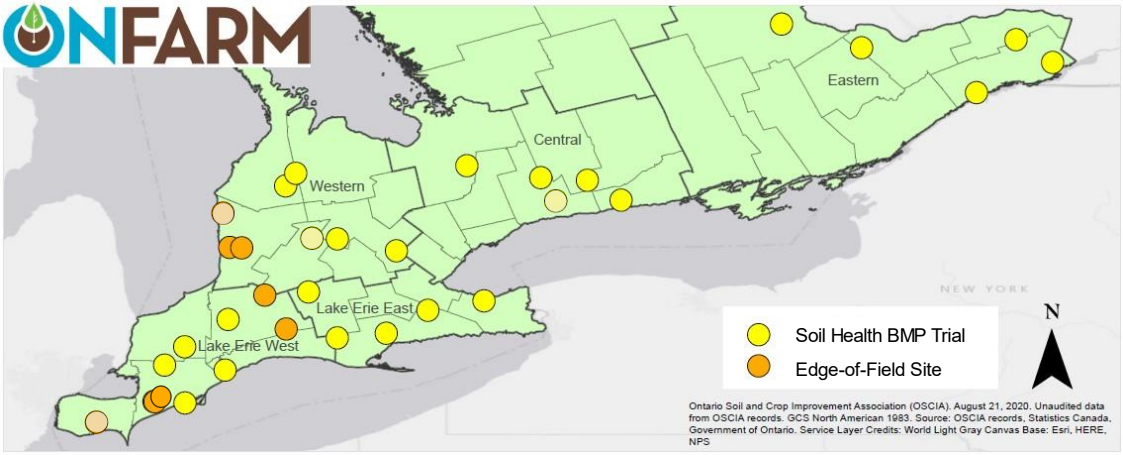


Figure 2. Location of ONFARM's edge-of-field and soil health BMP sites across Ontario. Two sites will be added in Northeastern Ontario soon.

ONFARM Data Dashboards

ONFARM has three data comparison tools that allow users to dig into the ONFARM data and results:

1. Soil Health Indicator Comparison Tool
2. Cover Crop Data Comparison Tool
3. BMP Site and Trial Data Comparison Tool

Check out the tools to explore how relationships between soil health indicators may change over time or by BMP treatment, or to see how your soil health might compare to that of other Ontario farms.

3. Summary of Forum discussions

3.1. Welcome & setting the stage

The Forum began with a welcome from Dr. Angela Straathof, OSCIA's Director of Research and Knowledge Transfer, as well as Cale Selby, the Director of the Environmental Management Branch in OMAFRA's Food Safety and Environment Division. The video from this session can be viewed here.

Key Points:

- ONFARM has three pillars: soil health, water quality, and engagement. The two-way flow of information and communication is crucial for ONFARM's continued success.
- One of the key takeaways to date is the critical role slope position and texture play in determining the success of BMPs.
- The long-term monitoring of soil health and water quality indicators continues to be a priority for OSCIA and OMAFRA.
- In this next iteration of ONFARM, the program will delve deeper into the key factors for the longevity of BMP success and the linkages between soil health and water, as well as building a better understanding of the economics (e.g., costs and benefits) behind BMP success.
- The ONFARM program is pleased to continue successful partnerships, such as with Syngenta on Operation Pollinator, and to add new partnerships, such as with TerraNova UAV.
- Read the ONFARM Technical Report and explore the soil health data here.
- Two new sites in Northeastern Ontario will contribute to a growing body of knowledge on the regional variations and conditions across the province.
- Farmer cooperators continue to be key in the success of ONFARM.

"We see ONFARM as an important program identified in a number of Ontario policy documents and priorities, including Grow Ontario: A Provincial Agri-food Strategy, New Horizons: Ontario's Agricultural Soil Health and Conservation Strategy, the Canada-Ontario Lake Erie Action Plan, and Ontario's broader commitments to Great Lakes water quality and ecosystem health."

- Cale Selby, Director of the Environmental Management Branch, OMAFRA

3.2. How BMPs improve aggregate stability & Slakes App overview

Dr. Elizabeth (Liz) Rieke, a Soil Microbiome Scientist at the Soil Health Institute, shared recent research findings related to aggregate stability as a measure of soil health and provided an overview of the Slakes App. Dr. Rieke is developing DNA sequence-based indicators to describe changes in soil functionality not captured by current soil health indicators. The video from this session can be viewed here.

Key Points:

- Dr. Rieke's research is underpinned by two key questions:
  - (1) Is the management practice contributing to healthier soil?
  - (2) Is the soil performing each job to the best of its ability (e.g., what are the functional outcomes the practices will achieve for the soil)?
- The North American Project to Evaluate Soil Health Measurements (NAPESHM) is identifying the most effective indicators of soil health from 124 long-term experimental sites across North America (Figure 3).

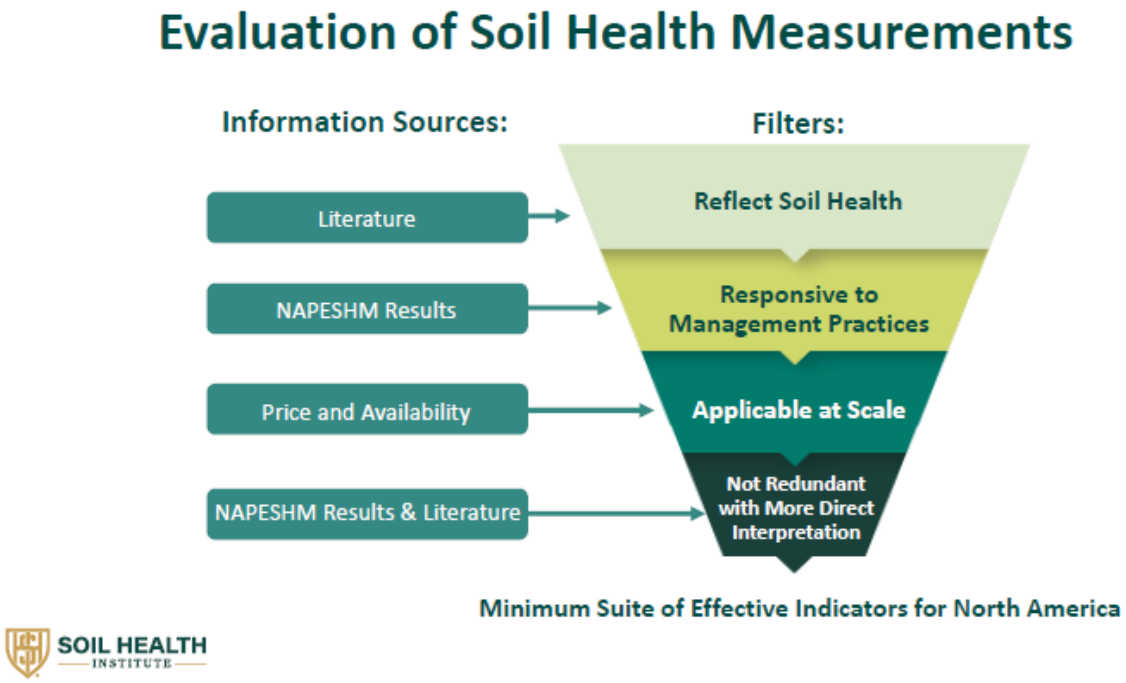


Figure 3. Schematic of the evaluation process for the minimum suite of effective soil health indicators for North America. Source: Soil Health Institute (2024).

- The long-term experimental sites are assessing paired treatments of tillage practices, cover crops and crop rotations.
- The NAPESHM is exploring 30 measures of soil health.
- Aggregate stability is one such measure that shows promise as an effective indicator for North America for four key reasons:
  - It indicates soil structure.
  - It is biologically driven.
  - It is linked to improved water infiltration and reduced erosion.
  - It can be easy and affordable to measure through the Slakes App.

- The Soil Health Institute is partnering with the Greenbelt Foundation over the next four years to conduct soil health testing on grain and oilseed farms in the Golden Horseshoe.
- So far, the benchmarking data shows that at least five years of reduced or no tillage and cover cropping use results in an aggregate stability index 1.2 times higher than the baseline (Figure 4).

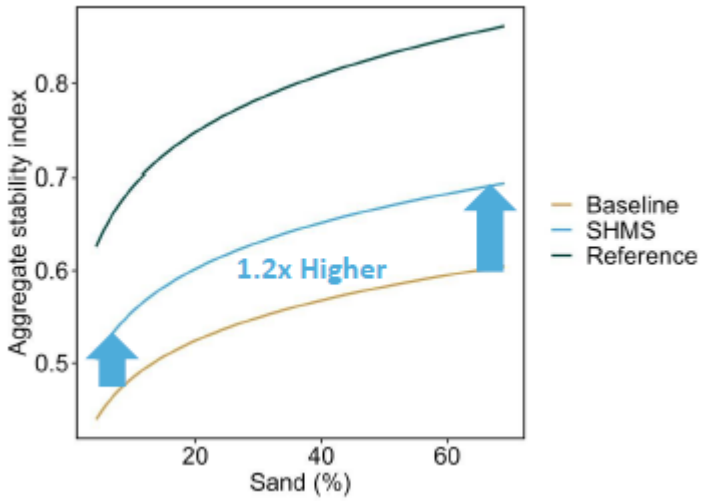


Figure 4. Greenbelt soil health testing benchmarking data. Source: Soil Health Institute (2024).

- When assessing aggregate stability, one should only compare soils with similar textures from similar climates.
- Local climate, soil texture, and management practices all impact aggregate stability.

The Slakes App

- All a farmer needs to use the app is one handful of intact soil from the top two inches of soil, a smartphone, an empty clear plastic dish, and water.
- Farmers and researchers can use the Slakes App to measure aggregate soil stability by calculating the aggregate stability index value.
- Users can export the test results from the app to their computer, add management and location data, and track changes in stability index values on the farm over time.
- Learn more about the Slakes App and download it here.

3.3. Linking soil health and water runoff: Insights from monitoring agricultural BMPs

Donna Small from the Lower Thames River Conservation Authority, Mari Veliz from the Ausable Bayfield Conservation Authority and Tatianna Lozier from the Upper Thames River Conservation Authority discussed the connections between water runoff and soil health. The video from this session can be viewed here.

Key Points:

- The Conservation Authorities are monitoring at the subwatershed and edge-of-field scale. Monitoring at the subwatershed level is crucial to understand long-term trends and cumulative impacts of what is happening across the landscape on water quality.
- Winter is an important period for water quality; the largest sediment and nutrient losses occur during the winter on an annual basis. For example, the Conservation Authorities have seen events where a third of the annual phosphorus load can be lost in a two- or three-day event in the winter. From a water quality perspective, we need BMPs that are effective during this time.
- However, it is difficult to understand the effectiveness of BMPs through monitoring at the subwatershed level, given all the complexities of land use at that scale. To understand how effective any BMP can be, we need to focus on a smaller scale – i.e., the field scale, which is the focus of the Conservation Authorities' efforts in this iteration of ONFARM. The edge-of-field scale allows the researchers to understand water quality and tie it to the use of different BMPs or land management strategies. Research at this scale also allows the team to begin to look at other factors (e.g., water quantity, soil health, yield, etc.) to start to tie together the environmental, agronomic, and economic components of a practice.
- The Conservation Authorities are monitoring tile and/or surface runoff.
- The research involves both field management (e.g., cover crops, nutrient management, and tillage) and drainage (e.g., controlled drainage, contour drainage vs. free drainage) BMPs.
- The key research questions are:
    - What field conditions generate water and how do they differ across different locations with the same BMPs or different BMPs?
    - Can these conditions be modified with management or stacking of BMPs?
    - Can we relate soil health indicators to the ability of fields to retain water or improve water quality?
    - Where do trade-offs exist between different co-benefits, and how can we manage these trade-offs?
- Inherent soil conditions can contribute to higher nutrient loads relative to other fields with different soil types.
- Long-term monitoring and research are crucial; it takes time to connect soil health and water quality.
- Field-edge monitoring gives the opportunity to isolate the practice and understand the trade-offs.
- It is important to manage expectations and to be patient; positive changes to soil take time.

Case Studies: Overwinter cover

- The North Kettle edge-of-field site includes two fields; one uses cover crops and the other has no cover crop. The researchers are analyzing tile and surface runoff for both the growing and non-growing seasons.
    - So far, the results do not show much of a difference between seasons and between treatments (i.e., cover crop vs. no cover crop). The Conservation Authorities hypothesize the situation is a result of the tillage used in both fields, as well as the poor stand of the cover crops.
    - Since the farmer uses a sweet corn and soybeans rotation, they can plant a cover crop ever year. However, they often must plant the cover crop late in the year, so establishment is a challenge.
    - The team seeks opportunities to get the cover crop established earlier or at a higher seeding rate.
- The Gully Creek site has been monitored since 2013. Here, the researchers are looking into flow versus no flow. Between June 2013 and September 2021, the Conservation Authorities monitored 277 rain events, but not all events precipitated to a flow being generated in the field.
    - To understand what was precipitating flow, the researchers started by looking at the cropping system present during the events. Instances of no flow occurred more frequently with the cover crops. In periods with less cover (e.g., soybean stubble), more flow events occurred.
    - In the fall of 2020, the cooperator harvested part of his peas and oats cover crop and left the other part of the crop unharvested. Between October 2020 and April 2021, the field experienced 12 rain and three snowmelt events.
    - In the harvested plot, 31% of the rain events and all the snowmelt events created flow in the field. In contrast, in the unharvested plot, only 8% of the rain events created flow and none of the snowmelt events created flow.
    - When the runoff was measured, half as much of the total phosphorus (TP) and total suspended solid (TSS) was lost from the unharvested plot compared to the harvested plot. However, little difference was seen between the dissolved phosphorus in both plots.
- At the Huronview site, researchers are looking at the impacts of different types of tile drainage on water quality and quantity, as well as other BMPs, such as cover crops.
    - Before planting the 2022 soybeans, the field had a lush, eight-way cover crop blend that had a good stand. The next year after the beans were harvested, the cooperator planted 30 pounds/acre of rye, but that did not yield as much of a cover crop.
    - Water quality samples were collected from tiles in each winter. The fields with the cover had lower water quality. The fields with the minimal cover had higher nitrate concentrations. The data variability may suggest that the differences are related to other in-field processes.
    - Two of the fields had low soybean yields (24 bushels/acre [bu/ac] and 32 bu/ac), and these soybeans were planted into the six-foot-high cover crop that had been crimped and rolled. In contrast, the field with the higher yield (50 bu/ac) had been sprayed with RoundUp and Enlist, and then strip tilled.
        - It is important to consider the trade-offs, in terms of managing the cover crops.

- The Fairview site is a new site for this iteration of ONFARM. The producer applies liquid swine manure, so the researchers have an opportunity to evaluate how the organic amendments could be affecting soil health and water quality.
    - The team can apply the lessons learned from the previous iteration of ONFARM, such as the importance of the timing of the manure applications. Organic amendments contribute to the soil organic matter, but the potential trade-off is the water quality. The team is looking for opportunities to manage these trade-offs, such as moving the fall manure application a bit earlier in the season. The team will work with the producer and their land management practices to hopefully gain an understanding of how to reduce those nutrient losses.
- The Jeannette's Creek site has two fields on flat, Brookston clay soils that are systematically tile drained.
    - The first field is a no-till continuous cover crop (NTCC) system with a corn-soybean-soybean-wheat rotation. The producer plants a cereal rye cover crop and a multi-species cover after winter wheat.
    - The second field is a conservation tillage (CT) system with a corn-soybean-soybean-wheat rotation. The producer plants red clover after winter wheat with a fall termination.
    - The sites have been studied since 2017.
    - Through the first four years of ONFARM, it was found the CT site had consistently higher TSS, TP, particulate phosphorus, and nitrate loads. These findings might be expected with more tillage and less cover cropping.
    - At the NTCC site, in contrast, during the 2018-19 year, the dissolved reactive phosphorus (DRP) loads were significantly higher.
    - Higher dissolved phosphorus losses occurred from fall flow events when fertilizer was broadcast and not incorporated into the soil at the NTCC site.
    - At the CT site, the fertilizer was surface broadcast and incorporated through tillage within 48 hours of application. This management strategy considerably mitigated DRP losses in subsequent flow events. Overall, however, the CT site still experiences much higher TSS and nitrate losses over time.

Perspective, patience and people

"We are aware of the water quality concerns, but we are also looking at things from the people (i.e., producers') perspective. Farmers … are usually concerned about yields and soil health. The fact they are allowing us to analyze the water quality is really important to paint that whole picture of what is going on. We can continue to work with farmers to identify and validate feasible BMP solutions. And, finally, the patience piece – we understand we need to manage our expectations. We are all aware that building the dataset requires a lot of time."

- Donna Small & Mari Veliz

3.4. Managing the limiting factor of water in crop production

Next, a panel discussed managing the limiting factor of water in crop production. Norm Lamothe, an ONFARM cooperator, moderated the session. The following panelists shared their insights:

- Dan Saurette from OMAFRA,
- Kevin McKague from OMAFRA,
- Marty Vermey from Grain Farmers of Ontario, and
- Ted Taylor from the Soil Resource Group.

The video from this session can be viewed here.

Key Points:

- Soil is a three-phase system. About 50% of it is void space; about 25% can have water and about 25% can have gas. The remaining 50% is solid, and soil organic matter makes up a portion of this solid phase.
- Around permanent wilting point, plant start to wilt because their roots can no longer access soil water. These conditions result from the water being held too tightly to the soil particles.
- Once the soil is saturated, if it drains for about 24 to 48 hours, these conditions would be considered field capacity.
    - Field capacity can be increased by increasing the porosity of soil. Increasing organic matter increases the porosity of soil, which means there is more room to hold water in the soil.
    - The less tillage, the more opportunity there is for the soil to form water-stable aggregates, which also allows the soil to hold more water.
- The distance between field capacity and permanent wiling point is the available water holding capacity of the soil. That range is important, in terms of dictating how much water a soil can hold and make available for plants, as well as how long that reserve will last.
- Generally, soil's productivity follows the available soil moisture. Typically, through ONFARM, researchers have found that the mid- to lower-slope positions in a field have the balance between water table fluctuation and available water, and generally have the higher yields.
- Generally, ONFARM researchers have found more tillage erosion degradation issues occur on upper-slope positions. Some evidence of water erosion issues is evident on the mid-slope positions. The lower-slope positions have a slightly greater risk for compaction because of the higher moisture levels.
- The loss of organic matter also affects infiltration rates; less water gets into the system, and there is less water in the topsoil in these sites.
- Compaction contributes to a loss of porosity in the soil, which can reduce available water.
- Through erosion, the top part of the soil is lost, and this is the part of the soil that has the higher water-holding capacity.
- Tillage erosion sites have white caps, a higher concentration of stones, and, in many cases, very little topsoil. As the growing season progresses, these sites typically have stunted and discoloured corn. Yields can be substantially lower in these sites too – mostly because of the extreme moisture deficit.

- Over the longer term, the industry has moved to larger equipment, larger fields, and less permanent cover. These conditions all contribute to the changing of the effects of water runoff. When water starts moving in larger fields, it has more momentum. Runoff occurs if the water cannot infiltrate the soil.
    - Cover crops and residue can help to slow the water down, which can create an opportunity for infiltration during intense rain events.
- Edge-of-field buffers are more of a "last ditch effort" to reduce runoff from the field, as they do not assist with water infiltration across the full field. However, these buffers can help to clean sediment (i.e., particulate phosphorus) from runoff.
    - Water that flows through tile drains also bypass these buffers. In systematically tiled fields, this can be 65% to 80% of the water leaving the field.
- Medium-textured soils are kind of that "sweet spot" in terms of available water-holding capacity; they have a natural advantage over some of the other textures (i.e., clays and sands).

Insights from the Great Lakes Yield Enhancement Network

- The Great Lakes Yield Enhancement Network is a multidisciplinary network, including researchers, extension staff, the Michigan Wheat Program, and Grain Farmers of Ontario, focused on wheat production in the Great Lakes region.
- Through crop modelling, the research team measures what a farmer's potential wheat yield could be.
- In 2023, yields ranged from 55.9 bu/ac to 173.4 bu/ac. The yield potential ranged from 98 bu/ac to 230 bu/ac.
- Higher-yielding environments had more loam content and better water-holding capacity. In contrast, the lower-yielding environments were more sand and clay and had lower water-holding capacity.
- In total, 25% of the yield component is made up of farm management (i.e., how the soils are managed).
- High-yielding farmers have cover crops in their rotation.
- Farmers are finding ways to improve the water-holding capacity in tougher soils through different management strategies.

What is one piece of advice you would give farmers to increase water retention and holding capacity?

- Continue to build the soil organic matter over time. For example, add organic amendments, use cover crops, and diversify the crop rotation.
- No one silver bullet exists; a systems approach is the best way to address the challenge since so many things impact water-holding capacity. As part of the whole-farm approach, be sure to address compaction.
- When trying a new practice, start on a field you know has good growing conditions so you can get a sense of costs/benefits of a new practice.

3.5. Practical tools to share agricultural research data and results

Dr. Adrian Correndo, an Assistant Professor in the Department of Plant Agriculture at the University of Guelph (U of G), explored some interactive and open-access tools to improve the accessibility of data and results in agriculture. He also discussed potential tools to be developed at U of G to enhance knowledge mobilization and open data sharing, which aligns with the core objectives of ONFARM. The video for this session can be viewed here.

Key Points:

- Three challenges are associated with agricultural research data and results:
  - Education – limited curriculum is available for "applied data science"
  - Reproducibility – limited capacity exists to reproduce analyses and results (especially since data and codes are rarely shared)
  - Accessibility – researchers are not translating enough science into flexible decision-making tools
- More interactive and accessible tools are needed to help bridge the gap in the knowledge translation and transfer (KTT) of agricultural research (Figure 5).

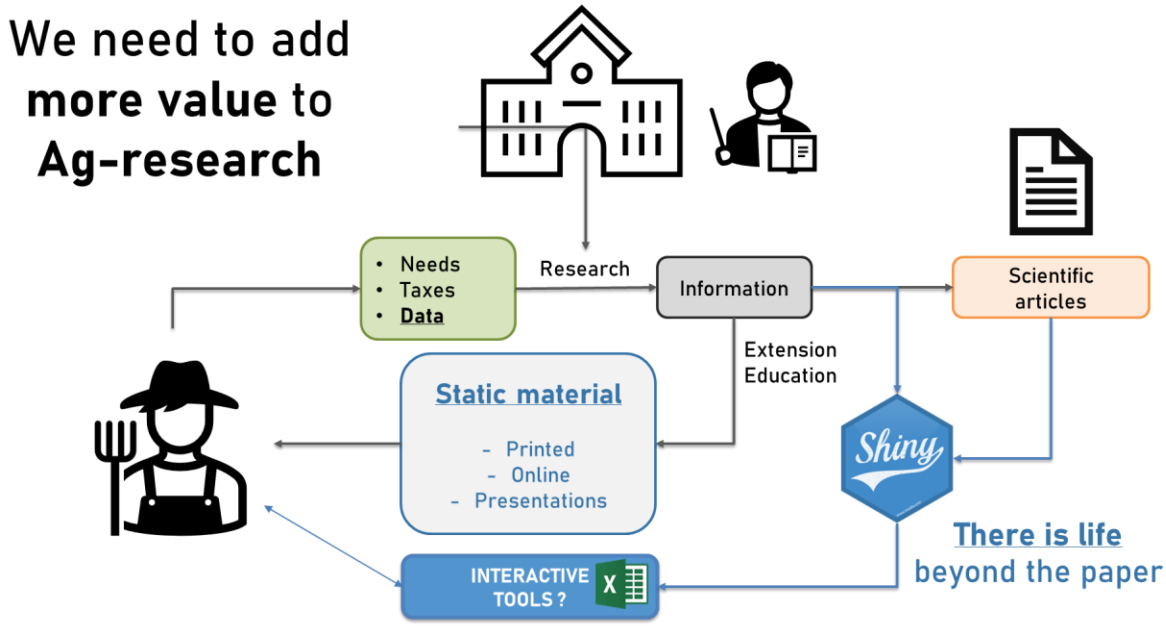


Figure 5. Diagram showing the current ways of sharing agricultural research, as well as how interactive dashboards and tools could fit in.

- Excel tools can be useful, but they have limitations (e.g., compatibility, ability to reproduce, and processing of maps/images).
- Interactive dashboards and web applications (e.g., Shiny) can help enhance knowledge mobilization.

    - Shiny's user interface allows the user to provide inputs in choices and data and creates outputs such as reports, tables, plots, maps, and files. Shiny's back-end server uses code that is open-source software.
    - When using technology such as Shiny, an opportunity exists to gather some basic information on how many users are accessing the data, as well as how they are using it.
- To develop a useful tool to help share agricultural research, consider the following steps:
    - Identify the need for, and the purpose of, the application (e.g., use industry partners and outreach methods like focus groups)
    - Ensure the application is simple to use
    - Test the application through pilots and ask for feedback
    - Check the accessibility of the application
- User benefits of such tools include:
    - Flexibility to explore results at their own pace
    - Understanding the sources of variation
    - Helping with visualization gaps
    - Facilitating data processing
- The benefits for researchers include:
    - Understanding the audience to create optimal KTT plans
    - Learning the limitations in datasets and models
    - Ensuring the research is reproducible and follows the same management practices
    - Increasing data literacy
- Using these applications for sharing agricultural data needs to go hand-in-hand with a well thought out KTT and social media plan.

Example: Soybean Variable Rate Seeding Simulator

- Researchers worked together with the Iowa Soybean Association to develop an interactive soybean variable-rate seeding simulator. Farmers could input their data (i.e., yield maps) and the app would identify different yield zones. The farmer would also specify their current seeding rates and prices. The farmer could select whether to look at their aggregated yield levels or aggregated yield stability.
- Then, the app would run different models to look at such considerations as projected survival rate and try to minimize the estimated lost profit. Ultimately, the app will give recommendations to minimize that lost profit (Figure 6).

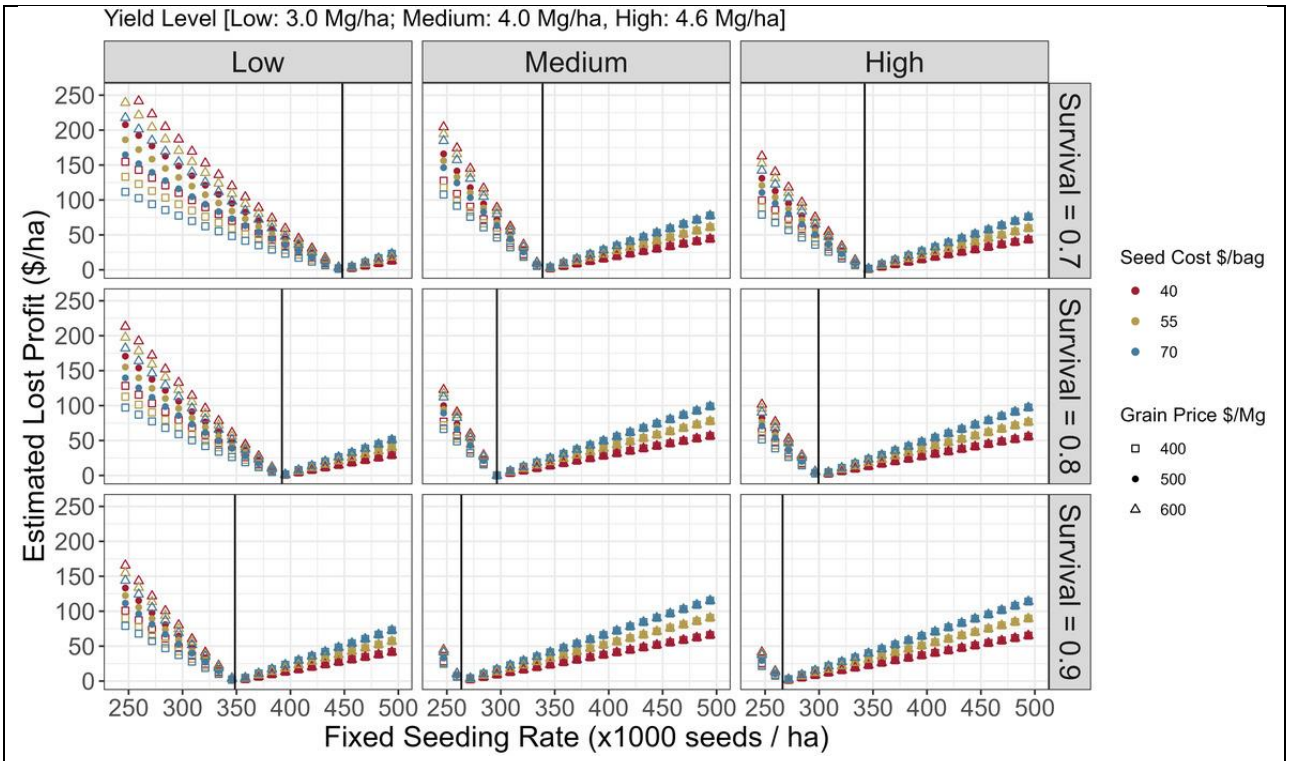


Figure 6. Example of a model looking at different fixed seeding rates compared to estimated lost profit.

Example: Corn-Yield-0N

- To create this database, data such as management methods, soil types, and weather from over 1,000 corn trials across the United States and Canada were inputted. A machine learning model was used to produce the forecast for yield without nitrogen inputs.
- The user can select a variety of management methods, soil types and weather to find the predicted corn yield without nitrogen inputs (Figure 7).
- This application has also been expanded to other crops.

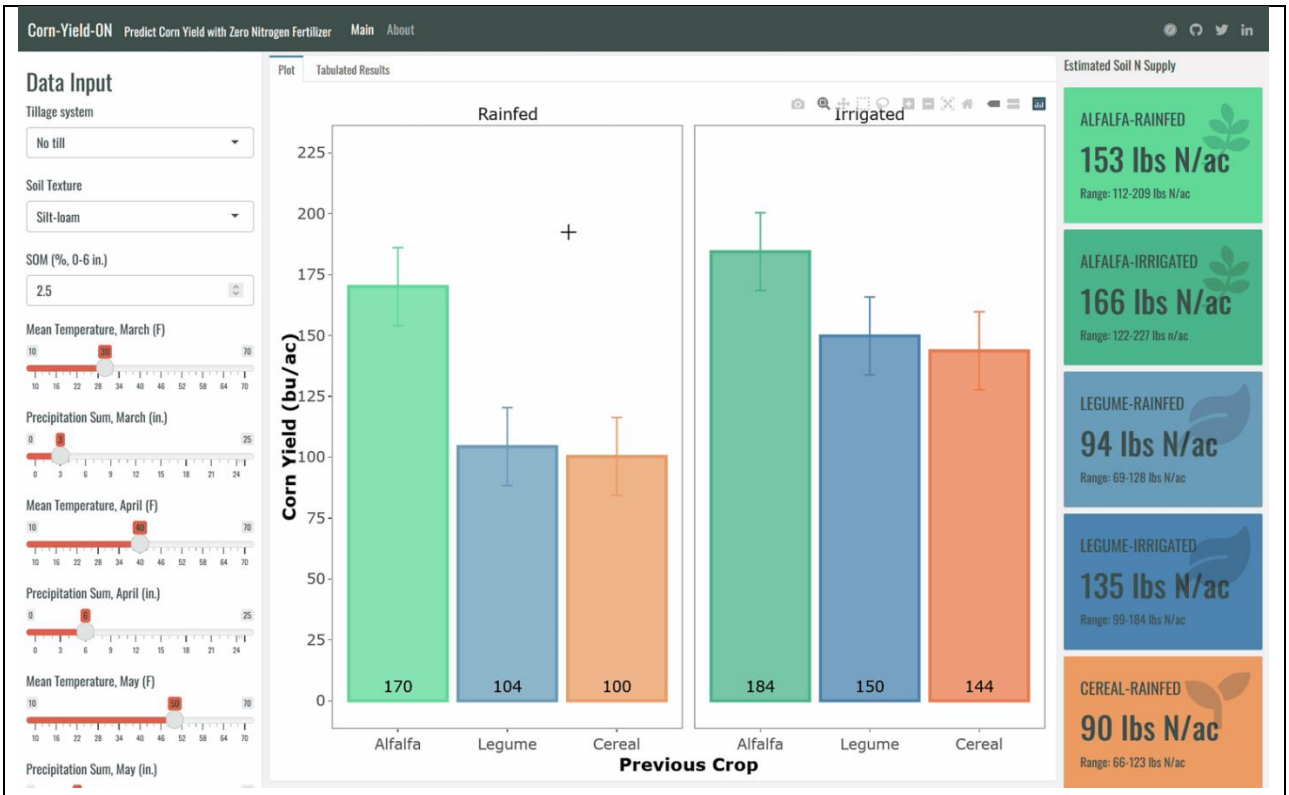


Figure 7. Interactive database page for the Corn-Yield-ON which predicts corn yield with zero nitrogen fertilizer.

Example: Don-Maiz **(Corn nitrogen response curve)**

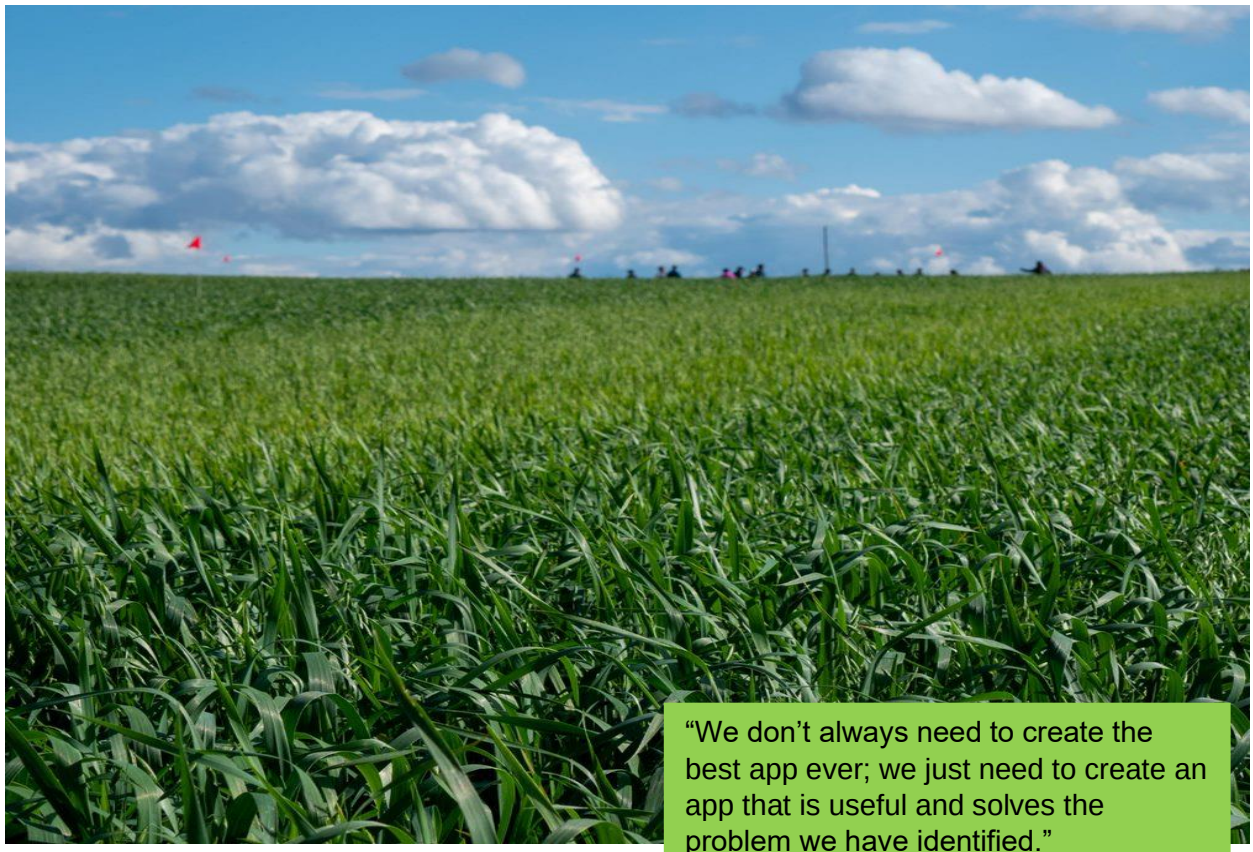
- A paper was published capturing corn nitrogen response based on almost 800 trials in Argentina.
- This data was used to create an interactive database for Argentinian producers to use to help determine how the optimum nitrogen rate for their corn, based on their yield potential, soil texture, nitrogen price, and corn price.
- After three months, the application was used for over 2,000 hours showing that this type of tool provided valuable information for Argentinian producers.

Example: ISOFAST **(Share on-farm research data in Iowa)**

- An interactive web-based data visualization and analysis tool was created to help synthesize on-farm research network data in Iowa.
- The tool includes information on yields, weather, and soil texture. The server processes this data to produce descriptive analysis, statistical modelling, and economic results. This information is on the dashboard that users can explore. Users include students, agronomists, and researchers.
- The user can explore trial results based on crop, research topic, and location.

Example: Elora Long-Term Cropping Trial Visualization

- This database compiles over 40 years of cropping data that has been collected from the Elora Research Centre.
- The mission is to facilitate internal access to the data.



"We don't always need to create the best app ever; we just need to create an app that is useful and solves the problem we have identified."

- Dr. Adrian Correndo

Did you know?

A Shiny app is available for calculating soil health scores for the different soil health indicators in OMAFRA's Soil Health Assessment and Plan (SHAP) tool.

3.6. Closing remarks

Gord Speksnijder, an OSCIA Board member and Chair of the Research Committee, provided closing remarks.

Key Points:
▪ ONFARM research is crucial to help us better understand the linkages between management practices and soil health and water quality outcomes. ▪ Enhancing our knowledge of key soil functions, like aggregate stability, is key in our understanding of ways we can keep nutrients in the soil. ▪ Recent work with partnering Conservation Authorities revealed ways farmers can identify 'red flags' in our fields and manage water-holding capacity. ▪ Applying research knowledge at the farm level can be a challenge; tools like the ONFARM data portal, the Slakes App, and those shared by Dr. Correndo can all help to bridge the gap. ▪ The information generated from ONFARM data is really helpful for farmers. It empowers farmers to have more power in their fields, as it allows them to identify problems and manage them in a timely and cost-effective manner. Continued long-term research will strengthen our knowledge and ability to adapt.

4. Main takeaways

A. Long-term research is necessary to understand soil health and water quality indicators, as well as to understand the linkages between soil health and water quality.

- This research must occur at several scales, including the field scale, the edge-of-field scale, and the subwatershed scale.
  - **Field scale:** enables researchers to understand how effective a BMP can be
  - **Edge-of-field scale:** enables researchers to understand water quality and tie it to the use of different BMPs or land management strategies
    - Also enables researchers to look at other factors (e.g., water quantity, soil health, yield, etc.) to start to tie together the environmental, agronomic, and economic components of a practice
  - **Subwatershed scale:** enables researchers to understand long-term trends and cumulative impacts of what is happening across the landscape on water quality
- Patience is needed to build the dataset.

B. Research must be made accessible to farmers through interactive tools to help encourage practice change.

- Strong examples of such tools include:
  - **The ONFARM Data Dashboards** – enables users to explore how relationships between soil health indicators may change over time or by BMP treatment, as well as how their soil health might compare to that of other Ontario farms
  - **The Slakes App** – allows farmers to measure their aggregate soil stability using a handful of intact soil from the top two inches of soil, a smartphone, an empty clear plastic dish, and water
  - **The Corn-Yield-0N tool** – allows farmers to predict their corn yield without nitrogen inputs

C. Trade-offs exist between different co-benefits of a BMP; more research is needed to better understand how to manage the potential trade-offs.

- For example, organic amendment applications help to build soil organic matter, but the timing and method of application must be carefully managed to reduce the chances of impacting water quality.

E. **Farmers can improve their soils' water-holding capacity, which can help to create higher-yielding environments for their crops and make them more resilient.**

- A systems approach to this work is crucial; farmers should consider how to incorporate organic amendments, cover crops, and diverse crop rotations into their management strategies. Farmers should also address compaction in their fields and implement BMPs to help reduce the risk of future compaction issues.

5. Next steps

5.1. New ONFARM sites

The ONFARM team is in the process of selecting two new sites in Northeastern Ontario. These sites will contribute to a growing body of knowledge on the regional variations and conditions across the province. Once these sites are selected, it will be beneficial to share some basic information about the farms (e.g., crop rotation and soil type), as well as the BMPs being tested, with the industry. This way, industry representatives in this region will know to watch for findings from more local research.

5.2. ONFARM Data Dashboard

ONFARM has a strong foundation of data available through the data dashboard. Dr. Correndo's presentation underscored the benefits of Shiny from a user perspective, as well as the importance of well-thought-out KTT and social media plans. As ONFARM's datasets grow, an opportunity exists to explore ways to optimize the dashboard to improve user experience, and to expand the reach of this tool in the industry. For example, OSCIA could host webinars or lunch and learns to help increase the profile of the dashboard in the industry. In the longer-term, hopefully users will be able to explore trends, such as change in soil health indicators over time.

5.3. 2025 ONFARM Forum

As OSCIA plans for the next ONFARM Forum, it must consider whether to continue hosting the Forum online, or whether it should move to a hybrid or in-person format. While strong engagement is already evident through the chat in the online events, an in-person Forum would increase opportunities for networking and relationship building.

> "Make (the Forum) in-person!! We would love to see this turned into a full-day in-person session to increase networking between attendees."
>
> - Survey respondent

This program is funded by the Sustainable Canadian Agricultural Partnership, a five-year (2023-2028), $3.5-billion investment by federal-provincial and territorial governments to strengthen competitiveness, innovation, and resiliency of the agriculture, agri-food and agri-based products sector. This includes $1 billion in federal programs and activities and a $2.5 billion commitment that is cost-shared 60 per cent federally and 40 per cent provincially/territorially for programs that are designed and delivered by the provinces and territories.

6. Appendices

6.1. Information package for attendees

Agenda

February 8, 2024 via Zoom Videoconference

The Ontario Soil & Crop Improvement Association looks forward to welcoming you to the 2024 On-Farm Applied Research and Monitoring (ONFARM) Forum! Since 2019, the ONFARM program has completed extensive soil health and water quality analysis on farms across Ontario to build a stronger understanding of best management practices (BMPs) and their effect on soil health and water quality. Originally a four-year program, ONFARM was recently renewed until 2028. During the Forum, we will reflect on what we have learned so far and look forward to the exciting research priorities that the next phase of the program has in store.

Time	Activity
9:00 am	**Welcome & setting the stage** Speakers: • Dr. Bronwynne Wilton, Wilton Consulting Group (WCG) • Dr. Angela Straathof, Ontario Soil & Crop Improvement Association (OSCIA) • Cale Selby, Ontario Ministry of Agriculture, Food, & Rural Affairs (OMAFRA)
9:25 am	**How BMPs improve aggregate stability & Slakes App overview** Speaker: • Dr. Elizabeth (Liz) Rieke, Soil Health Institute **Linking soil health and water runoff: Insights from monitoring agricultural BMPs** Speakers: • Donna Small, Lower Thames River Conservation Authority • Mari Veliz, Ausable Bayfield Conservation Authority • Tatianna Lozier, Upper Thames River Conservation Authority
10:25 am	**Break**

Time	Activity
10:40 am	**Panel: Managing the limiting factor of water in crop production** Moderator: • Norm Lamothe, Woodleigh Farms & ONFARM Speakers: • Dan Saurette, OMAFRA • Kevin McKague, OMAFRA • Marty Vermey, Grain Farmers of Ontario • Ted Taylor, Soil Resource Group
11:10 am	**Practical tools to share agricultural research data and results** Dr. Correndo will explore some interactive and open-access tools to improve the accessibility of data and results in agriculture, including tools he developed while at Kansas State University. Dr. Correndo will also present some potential tools to be developed at the University of Guelph to enhance knowledge mobilization and open data sharing, which aligns with the core objectives of ONFARM. Dr. Adrian Correndo, University of Guelph
11:50 am	**Closing Remarks** Speaker: ▪ Gord Speksnijder, OSCIA

Connect with and learn more about ONFARM

www.ontariosoilcrop.org/onfarm/

onfarm@ontariosoilcrop.org

@OntarioSoilCrop

ONFARM Background

The On-Farm Applied Research and Monitoring (ONFARM) program is a nine-year initiative developed by OMAFRA, delivered by OSCIA, that is completing extensive soil health and water quality analysis on 30 farm sites across Southern Ontario. This network of sites and established partnerships will help build a stronger understanding of BMPs and their effects on soil health and water quality on Ontario farmland. The ONFARM program is collecting water and soil quality data to assess various BMPs such as cover cropping and the use of organic amendments. Soil quality data is being collected by the Soil Resource Group, while teams at three conservation authorities are conducting water quality research. ONFARM is also supported by a network of farmer cooperators, who are essential to the success of the program.

Meet the speakers

Welcome & setting the stage

Dr. Angela Straathof is the Director of Research and Knowledge Transfer at the Ontario Soil and Crop Improvement Association (OSCIA). She oversees delivery of OSCIA's on-farm research initiatives, connecting farmers with researchers and resources to test best management practices (BMPs) and support knowledge mobilization of those findings. Angie has a PhD in Soil Biology and Chemistry from Wageningen University in the Netherlands, and conducted research at the University of Manchester's Soil and Ecosystem Ecology laboratory in England before joining OSCIA in 2018. She has supported delivery of the ONFARM program since its inception in 2019.

Cale Selby is the Director of the Environmental Management Branch in OMAFRA's Food Safety and Environment Division. Cale's career has spanned 20 years in government and has included working with the Ontario Ministry of Natural Resources, OMAFRA, and internationally with the government in New Zealand. The common thread in his career has been the intersection of natural and agricultural systems and working on collaborative solutions for highly complex challenges. Cale is the Co-chair of the Soils Action Group and Chair of the Agriculture Sector Working Group.

How BMPs improve aggregate stability & Slakes App overview

Dr. Elizabeth (Liz) Rieke is a Soil Microbiome Scientist at the Soil Health Institute. Dr. Rieke has a background in microbiology and engineering. She is developing DNA sequence-based indicators to describe changes in soil functionality not captured by current soil health indicators. Dr. Rieke's work also focuses on unearthing the microbial drivers of currently adopted soil health indicators. Dr. Rieke received her PhD in Agricultural & Biosystems Engineering from Iowa State University. She is a member of the Soil Science Society of America.

Linking soil health and water runoff: Insights from monitoring agricultural BMPs

Donna Small is the Agricultural Program Coordinator for the Lower Thames Valley Conservation Authority. Donna has experience working with producers to implement agricultural BMPs with the goal of improving soil health and reducing agriculturally sourced nutrient loading in the Lower Thames River watershed. Donna's areas of expertise include water quality research/monitoring, BMP incentive program delivery, and agricultural education/outreach. Donna graduated from the University of Guelph.

Mari Veliz is the Healthy Watersheds Manager at Ausable Bayfield Conservation Authority (ABCA). She has worked at ABCA since 2000. Mari has managed water quality, bio-monitoring, agricultural and urban best practice evaluation, and community outreach programs.

Tatianna Lozier is the Stewardship Services Coordinator at the Upper Thames River Conservation Authority, where she works closely with farmers to adopt agricultural BMPs. She has worked in rural water quality research to evaluate BMPs since 2012 and continues to be involved in innovative projects to address water and nutrient management concerns.

Panel: Managing the limiting factor of water in crop production

For six generations, Woodleigh Farms has worked the rolling hills in Peterborough County. **Norm Lamothe** and his family manage a diverse 500-acre cash crop farm which includes a four-crop rotation of corn, soybeans, wheat and oats. The family has recently transitioned its 1,500-tap maple syrup operation to organic and everyone enjoys spending time in their year-round passive solar greenhouse which supports their three-acre market garden. Norm has a lifelong interest in supporting soil health and biodiversity through the use of soil amendments such as biosolids, green manures as well as compost processed on-farm using municipal leaf and yard waste. Combining extensive soil sampling data, imagery and variable rate technologies, Norm is keen on demonstrating the economic benefits of being ecologically sustainable in a modern cropping system.

Daniel Saurette is a Land Resource Specialist (soil scientist!) with OMAFRA, based in Guelph, ON, since 2016. Daniel specializes in soil classification, soil mapping, and landscape interpretation. His current focus is on soil sampling and developing baseline soil data for Ontario soils. Daniel is also developing predictive digital soil mapping techniques to expedite delivery of updated soil maps for agricultural areas of Ontario through the use of big data and machine learning.

Edward (Ted) Taylor, MSc., is a Pedologist with the Soil Resource Group. Ted has over 40 years of professional experience interpreting soil resources for agriculture and forestry, and developing BMP educational materials, predominantly with OMAFRA until his retirement in 2019. His technical knowledge of southern Ontario agriculture spans pedology, the nature and properties of most soil types, soil-plant relations, crop performance on a wide range of soil conditions, soil degradation and soil health.

Marty Vermey is the Senior Agronomist at Grain Farmers of Ontario (GFO). He manages GFO's agronomy team, which helps to support Ontario grain production. Key projects include the Great Lakes Yield Enhancement Network and the Ontario Cover Crop Working Group. Marty has a Bachelor of Science in Agriculture, Crop Science from the University of Guelph and completed technical training at Ridgetown College. Marty lives on a farm in southwestern Ontario with his wife Marcia. They spent the last 25 years raising their sons, some cattle and chickens, and producing grain crops.

Kevin McKague is an Agricultural Engineer with a master's degree in water resources engineering. He has worked in the field of soil and water conservation for most of his career in both the private and public sectors. Currently, Kevin is the Water Quality Engineer with OMAFRA, where he participates in a variety of studies evaluating the influence of soil health practices on water quality leaving the field edge.

Practical tools to share agricultural research data and results

Dr. Adrian Correndo is an Assistant Professor and the Research Chair for the Pick Family Chair in Sustainable Cropping Systems in the Department of Plant Agriculture at the University of Guelph. His mission is to develop and evaluate cropping systems that effectively deal with the challenge of producing more food, fuel, and fiber without degrading our natural resources. Dr. Correndo maintains and leverages the value and legacy of multiple long-term trials at the Elora Research Station, where studies explore such management practices as tillage, crop rotation, cover crops, and fertilization management.

Closing remarks

Gord Speksnijder serves on the OSCIA Board, representing the Quinte region. He is Chair of the Research Committee and sits on the Ontario Soil Management Committee. Gord earned his MSc from the University of Guelph. He lives with his wife and two kids in Port Hope in Northumberland County, and farms with his brother.

This event has been approved for 2.5 Continuing Education Units (CEUs) for Certified Crop Advisors (1.5 Soil & Water Management CEUs and 1 Crop Management CEU).

This event is an OSCIA-recognized Knowledge Sharing Event (KSE) for Ontario farmers with On-Farm Climate Action Fund (OFCAF) projects in the Cover Cropping category.

6.2. Information about Forum registrants

Most of the Forum registrants were farmers (59) or government staff (58). The professions for people that selected “other” included consultants, and other agriculture/agri-food service supports.

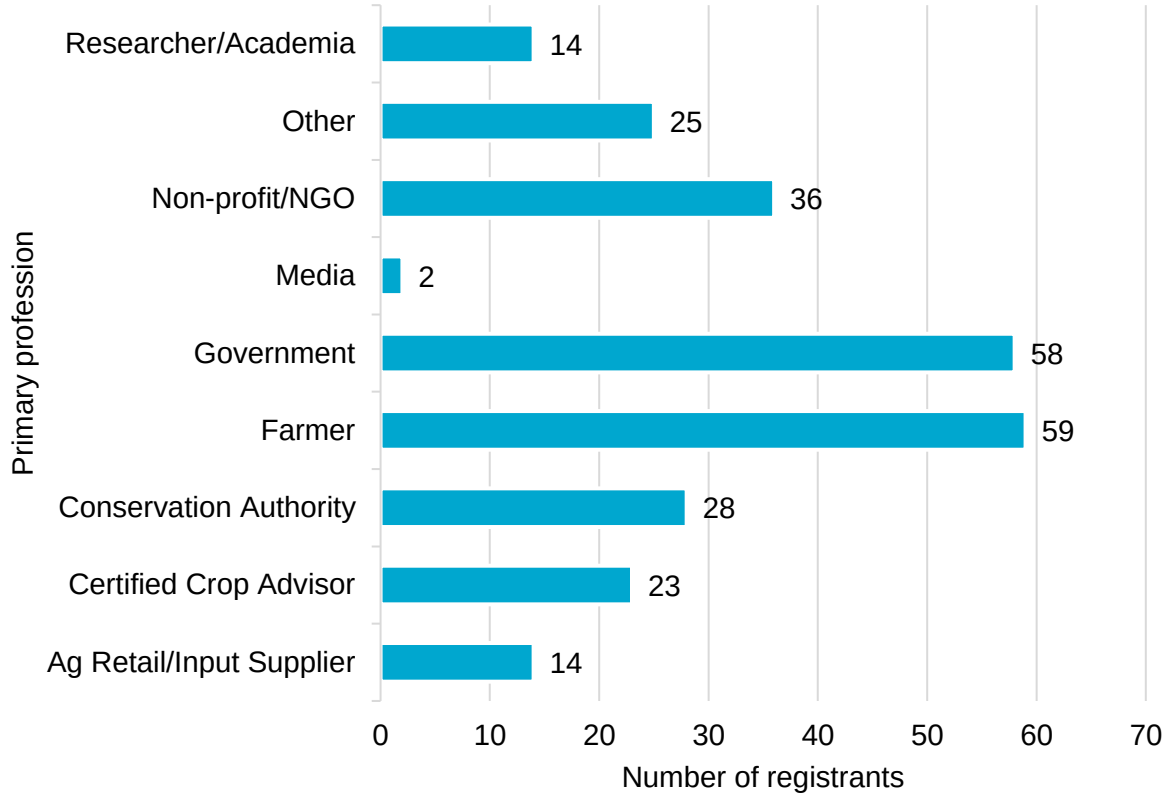


Figure 8. Primary profession of 2024 ONFARM Forum registrants (n=259).

6.3. Forum questions and answers

Forum participants were actively involved in discussions through the chat. The questions and answers from these discussions are presented below.

Welcome & setting the stage

How was CEC measured? Was it a lab measure, or calculated by summing the cations?
▪ For most reports, the CEC is the sum of equivalents of calcium, potassium, magnesium, and acid equivalents + 1.2. If the pH is <6.5, a bpH correction is included as well. ▪ The CEC calculation is the standard accredited method in Ontario.

How BMPs improve aggregate stability & Slakes App overview

Did you apply a latitude lens to the aggregate stability data, particularly through the winter and spring? In many of our soils, as the soil is thawing, the surface structure breaks down into a thick slurry, but then stable structure reforms as the soil dries.
▪ While it is okay for the soil to be moist, you do not want to take a sample if your soil is saturated. You want to ensure you can break apart those aggregates when you go to pull a sample. We primarily recommend thinking about what makes sense for you, in terms of sample timing, and then being consistent. Try not to sample after a primary management event (e.g., fertilization, tillage) to get the best picture of the measurement. ▪ Sampling won't occur at the same time for everyone. For example, in 2019, we started sampling at lower latitudes and worked our way north throughout the growing season.
Higher sand content yields higher aggregate stability?
▪ Correct, sand particles tend to stay more complacent than clay particles that disperse, leading to a smaller change in area over the 10 minutes.

Linking soil health and water runoff: Insights from monitoring agricultural BMPs

Has there been any comparison of the dry matter input from the organic amendments compared to the dry matter accumulation from the cover crops?
▪ The Soil Resource Group is measuring the cover crop dry matter accumulation, so they can investigate that.
Are you looking at both fall desiccated cover crops and no cover crops? How is it affecting the runoff analysis?
▪ A trial with the Upper Thames River Conservation Authority had oats in 2023, and it was left to winterkill. Previously, it has been cereal rye or winter wheat if a cereal rye could not be sourced. The cooperator has had an overwintering cover crop for most of the years.
What is the soil test phosphorus (P) at each site?
▪ Soil test P at both sites is similar and in the low to mid 20s.
Which phosphorus (P) form is the concerning one?
▪ Dissolved reactive phosphorus is typically more bioavailable for the formation of algal blooms. ▪ Both. Dissolved P has an immediate effect on water quality, while particulate P is a long-term source. We usually consider particulate P to be about 30% as bioavailable as dissolved reactive P.

Which BMP have you tested that has the biggest positive impact on water quality?

- It is a systems approach. It is important to understand the system and the trade-offs. We have seen changes over time with the use of cover crops. If you think about that, across a landscape, the use of cover crops will surely have some impacts at bigger scales, too.
- The ONFARM modelling work that was done at Upper Medway and Garvey-Glenn subwatersheds suggested that the application of the 4Rs was showing the biggest positive impact. But it would always depend on the site. If there was a significant erosion issue at the site, addressing that would likely be the key practice.

Managing the limiting factor of water in crop production

In some regions of Canada and the United States, the practice of landscape restoration – the moving of some soil from lower slops to upper slopes – is used to reverse soil degradation. The practice is almost a reset of sorts, and then the farmer can move forward with better BMPs to keep soil in place. Is this approach possible/feasible in Ontario or worth exploring?

- It may be feasible in extreme cases of degradation. Dr. David Lobb in Manitoba has spearheaded this research and is planning to do work in Ontario.
- The eroded area must be carefully mapped out, as must the resources at the bottom of the slope. Conditions must be dry. Then, once the work is done, the farmer must use a suite of BMPs (e.g., organic amendments, cover crops, etc.) to protect the soil.
- Not necessarily does this work pay; rather, the farmer might elect to change their expectations and their practices (e.g., changing seeding rates and inputs) in these parts of the field.
- There are producers in Ontario who move topsoil back to the upper slopes when they buy a new farm.
- A farmer near Granton did that a couple of decades ago and saw a significant yield response. The limitations will be the cost of earth moving equipment, and the risk of severe compaction during the land forming process.
- Work done on several sites in Ontario has shown a benefit to moving soil back up to severely tillage eroded shoulder slopes.
- Farm & Food Care Ontario has a video on soil remediation.

What about a few words on controlled drainage?

- The perception is that controlled drainage is more effective on soils like sands over clays (Berrien/Wauseon series) and on generally level landscapes where depth to water table is mostly consistent.
- It is an effective tool, but it is applicable on a limited part of the land area.
- Two of the ONFARM sites are monitoring field drainage and further information will become available over time.

In the Great Lakes Yield Enhancement Network (YEN) program, do they collect data about the other crops in the rotation? If so, do the fields with a higher water-holding capacity have a higher frequency of wheat/small grains in rotation?

- There are over 200 data points collected and calculated. Farmers supply soil samples, leaf tissue samples, grain samples, whole plant samples (100 shoots) as well as all the agronomic practices and timing rates, etc. Three-year crop rotation, organic amendments, and pesticide and fertility applications are also provided.
- The YEN collects information about the crop that was planted prior to the wheat crop, though the project team does not have data for how often wheat was grown on a given field. The team has not correlated water-holding capacity with frequency of wheat, but that is an interesting question the team can investigate in the future.

What are some of the novel methods ONFARM will be using as it continues to understand the in-field soil-water dynamics at the edge-of-field sites?
▪ With the support of the Soil Resource Group and OSCIA, Dr. Asim Biswas's research team has collected intact soil cores at select ONFARM sites across the different BMP treatments to determine soil water retention curves and key soil water characteristics to better understand the effect of soil health BMPs on these critical parameters.

General questions

Too many are producers are continuing to do the same old, same old. The message being discussed today needs to be loud, to a broader audience; how do we share this message?
▪ It's definitely an objective of ONFARM as it continues to spread the message even further and wider. Fortunately, ONFARM has generous cooperators and host-farmers to help with that. OSCIA would love to hear more "outside-the-box" suggestions for how we can reach new audiences.

Practical tools to share agricultural research data and results

How do we get these tools, frameworks, and opportunities into the hands of new users when oftentimes we see its the same users and farmer-demographic groups that we reach cyclically?
▪ Part of the issue is that research papers available online are not really available given that, although many are free access, just as many are not. We need some sort of portal that allows all research to be available at no charge to further information transfer to all that desire to get it. Also, a more focused and dedicated commitment to knowledge mobilization and science communications is necessary so those who do not read journals can get the key points. ▪ The big thing is "information transfer" at no charge so that the benefit of the research can be passed on to those who can use it. ▪ I do not know the practicality, feasibility, or applicability. But it is my opinion/pie-in-the-sky vision that we need to integrate tools within the tools stakeholders are already using (e.g., John Deere Operations Center, Climate FieldView). It is beyond my expertise, but there are API connections possible with most of this software; we should find ways to integrate our understandings/models in the tools using stakeholders' data for assisting decision making. ▪ We need scientific papers that can be cited and advance knowledge among researchers with the level of detail they need to test or replicate methods. We also need more readily consumable products with clear take-home methods like factsheets, case studies and project profiles (which the ONFARM team loves to produce!). ▪ Accessibility is great, as long as there is adequate vetting to make sure the data sourced is relevant to the end users. As Murray Miller drilled into us many years ago, "The conclusions giveth; the materials and methods taketh away." ▪ Interactive tools can help to reach a wider audience, as can social media.

What methods (e.g., surveys, focus groups, grower organization consultations) would you use to identify the need?
▪ It is crucial to have partners involved in the project. They may know the right method to use to ask for feedback. The boards of partner organizations can be particularly helpful. ▪ Focus groups are helpful to identify which features of the app are really needed, and which features might just be nice to have.
Apps like Shiny depend on availability of large databases. Who is taking on responsibility for maintaining the databases – data architecture, data input, data quality control, and continual updating to ensure databases remain in an accessible format?
▪ Exactly, this is a key point. I think working on developing these tools may put some pressure on researchers on gathering the data, making it accessible, and working on minimum standards. ▪ Not only researchers, but all parties because data is “legacy.”

6.4. Post-Forum survey

A short survey was emailed to participants after the Forum. In total, 22 people completed the survey, which equates to a response rate of about 13%.

Most commonly, survey respondents identified as farmers (32%), Certified Crop Advisors (23%), or government staff (18%) (Figure 9).

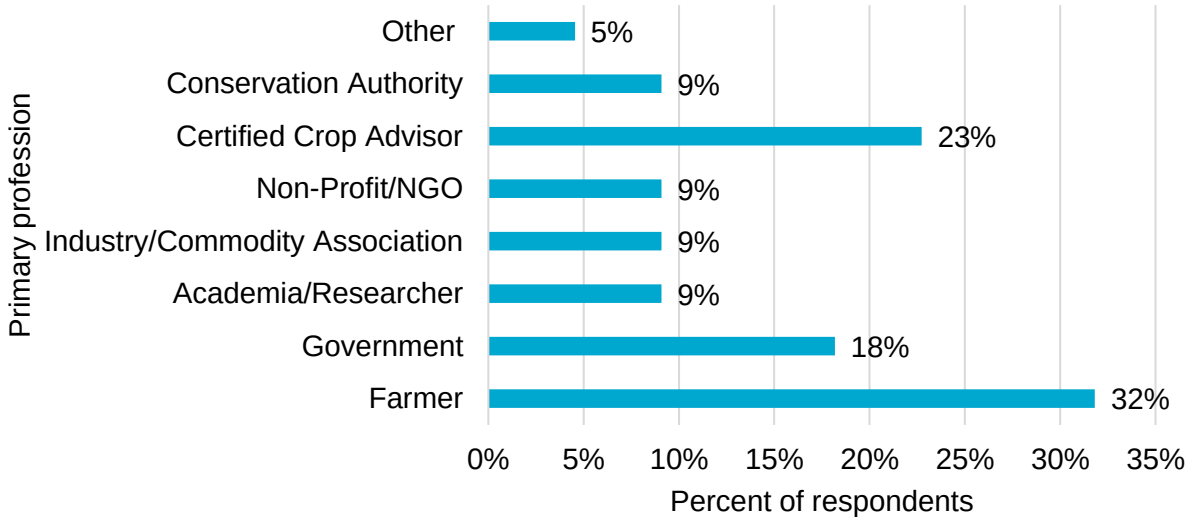


Figure 9. Primary profession of survey respondents (n=22).[2]

Most of the survey respondents farm and/or work in Southern Ontario (59%) (Figure 10). Equal numbers (14%) of survey respondents were from Eastern, Central, and Western Ontario.

[2] No ag retail/input supplier participants filled out the survey. The individual who identified their primary profession as “other” was an environmental technologist.

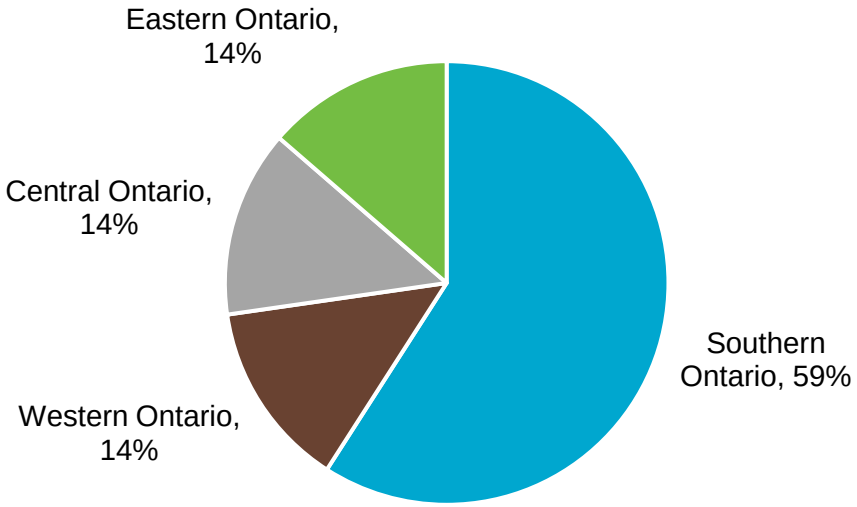


Figure 10. Regions in which survey respondents farm and/or work in (n=22[3]).

Most respondents agreed or strongly agreed with the following statements (Figure 11):

- The format was an effective way to share ONFARM project information (91%)
- The presenters were knowledgeable about the subject matter and content (86%)
- The presenters delivered content in an effective and engaging manner (95%)
- The information was presented in a clear and logical way (91%)

Respondents enjoyed the informative event and appreciate that the annual Forum is recorded. This way, people can "go back" and watch the recordings from previous years.

[3] No participants from Northern Ontario completed the survey.

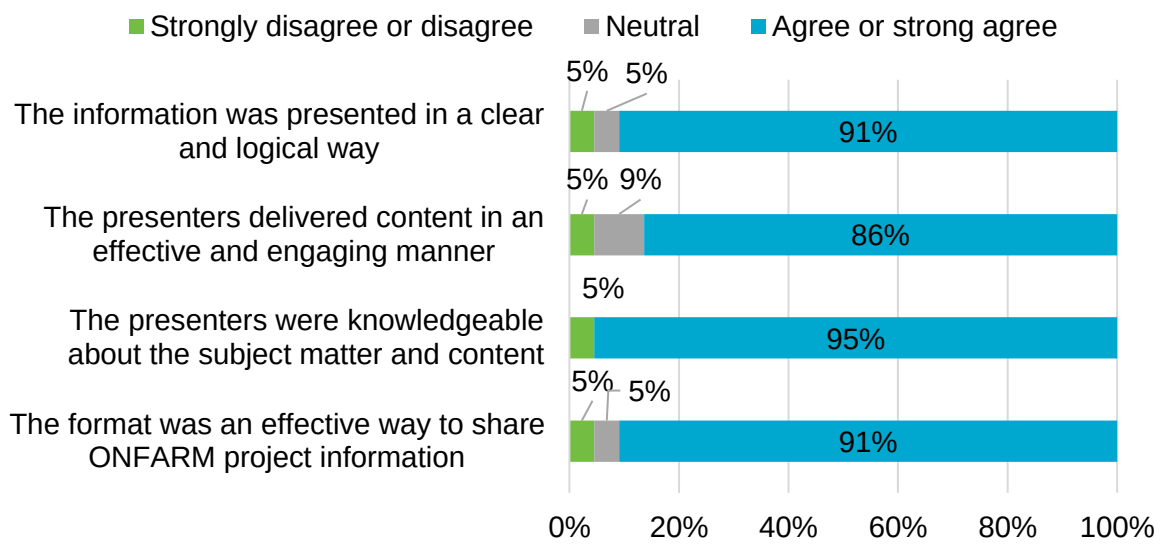


Figure 11. Respondents' level of agreement with four statements about the Forum (n=22).

Over a quarter (27%) of the respondents indicated that they intend to implement a new or revised practice or process in their farm/research program/advisory service because of resources/knowledge gained at the Forum (Figure 12). Most respondents (68%) felt that this statement was not applicable for them.

The ways respondents intend to implement this information include:

- Using the Slakes App
- Applying phosphorus in the spring as opposed to in the fall
- Comparing their findings to case studies from the Forum

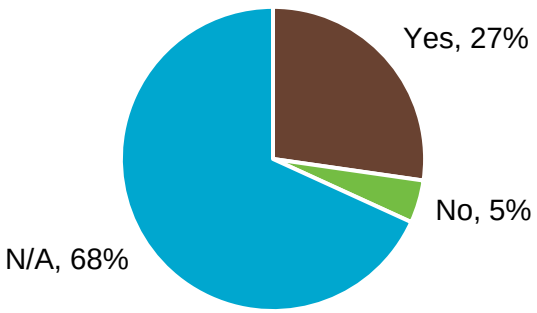


Figure 12. Respondents' intent to implement a new or revised practice on their farms, in their research programs, or in their advisory services based on content learned from the Forum (n=22).

Respondents rated their knowledge of the indicators and/or BMPs for soil health/water quality before and after the Forum. The average rating before the Forum was 7.8/10, while the average

after the Forum was 8.5/10 (Figure 13). Thus, respondents increased their knowledge through their participation in the Forum.

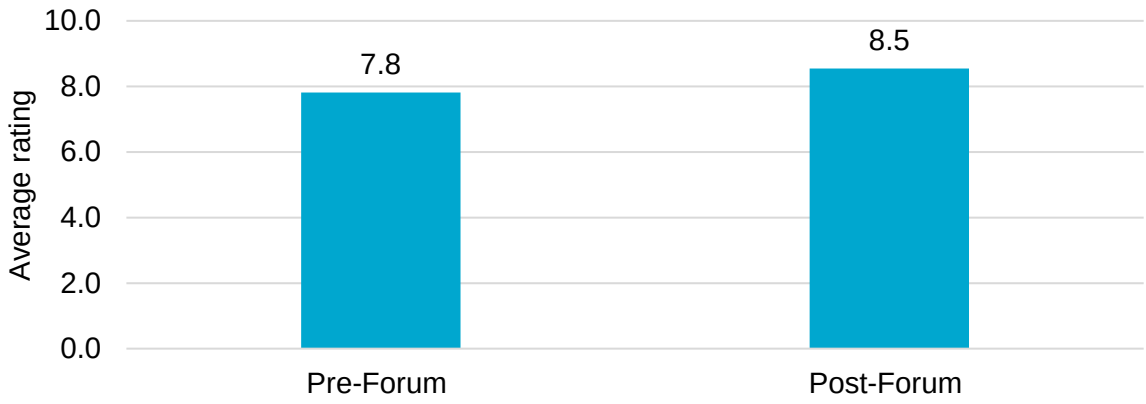


Figure 13. Respondents' average weighting of pre- and post-Forum knowledge of the indicators and/or BMPs for soil health/water quality (n=22).

Most respondents (68%) have attended an ONFARM Forum in the past (Figure 14).

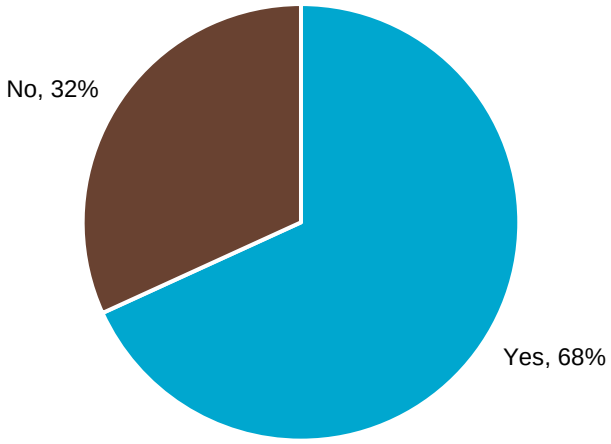


Figure 14. Respondents' answer to if they have attended an ONFARM Forum before (n=22).

All survey respondents indicated that they were satisfied or very satisfied with the 2024 ONFARM Forum.