ONFARM FORUM 2025

Summary Report

OSCIA

WILTON CONSULTING GROUP

Acknowledgements

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Executive summary

The 2025 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:

- The unique opportunities and challenges of agricultural expansion into Northern Ontario,
- The use of new soil health indicators (SHI) to reliably measure the effectiveness of best management practices (BMP),
- How BMPs and factors like spatial variability effect yields and soil health,
- The effect of cover crops on water quality and runoff, and
- The current supports available for farmers interested in cover cropping.

The key takeaways from the 2025 Forum are:

- ✓ Expanding agriculture in Northern Ontario offers a chance to adopt sustainable BMPs from the start, with the added benefit of lower land prices.
- ✓ Researchers continue to refine the suite of SHIs to make them more reliable and responsive.
- ✓ Adjusting for field variability and other confounding influences helps pinpoint whether a treatment truly affects yield.
- ✓ Year-round ground coverage is crucial to limiting runoff, with standing vegetation providing the best protection (as opposed to harvested cover cropping or crop residue)
- ✓ Cost-share programs and peer-to-peer learning help make BMP adoption less risky and more desirable to farmers.

Through the discussions at the Forum, the following next steps were identified to support advancing ONFARM research:

1. Complete analysis and publication of 2024's data.
2. Continue to collaborate with conservation authorities on water quality analysis. Pressure plate analysis and surface water quality sampling is underway to further investigate water retention and dissolved phosphorus losses. This analysis will be accelerated through implementation of the Lake Erie Enhanced Agricultural Analysis Program (LEEAAP).
3. Determine methods to accessibly relay runoff data to farmers and encourage the analysis of their own sites.
4. Continue to collaborate with the Northern Ontario Farm Innovation Alliance (NOFIA) to enhance Northern Ontario ONFARM research.

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1. Introduction

On February 6th, the Ontario Soil and Crop Improvement Association (OSCIA) hosted the virtual 2025 On-Farm Applied Research and Monitoring (ONFARM) Forum.

The Forum presentations highlighted the latest on-farm developments in support of water quality and soil health. Topics included opportunities for agricultural expansion into Northern Ontario, novel Soil Health Indicators, the variable effects of BMPs in the presence of confounding factors and the effect cover cropping (CC) has on mitigating runoff.

2025 ONFARM Forum outcomes:

- ✓ Supported soil health and water quality knowledge translation and transfer, including for:
  - Farmers with CC 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)
- ✓ Increased understanding of BMPs to support soil health and water quality
- ✓ Grew the profile of the ONFARM program
  - Two new ONFARM sites in the Temiskaming region of Northern Ontario mark the program's expansion into its 2023-2028 phase
- ✓ Fostered collaboration and continued enthusiasm for ONFARM research

What participants said:

- "Excellent work on the Forum. I am excited to hear about the progress of this work."
- "Very interesting! Nice to have a mix of academia, farmers, and conservation authorities."
- "Great Forum! It was my first one, thank you for making it engaging."
- "Looking forward to seeing more statistical analysis in the future."

In total, 231 people registered for the Forum, and 154 people participated. Government representatives (21%), farmers (20%), and representatives from non-profits/non-government organizations (19%) accounted for most registrants. Other registrants included representatives from research/academia (14%), conservation authorities (10%) and other participants (17%).[1]

[1] "Other" representatives included agriculture retail/input suppliers, consultants, and certified crop advisers.

2. Context: ONFARM program

The ONFARM program is a nine-year applied research initiative, developed by the Ontario Ministry of Agriculture, Food and Agribusiness (OMAFA) 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 (Sustainable CAP), 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 (SRG). 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 CC 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 25 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 three new soil health trial sites, as well as two additional EOF sites. ONFARM has recently added two Northeastern Ontario sites in the Temiskaming region and one in Eastern Ontario.

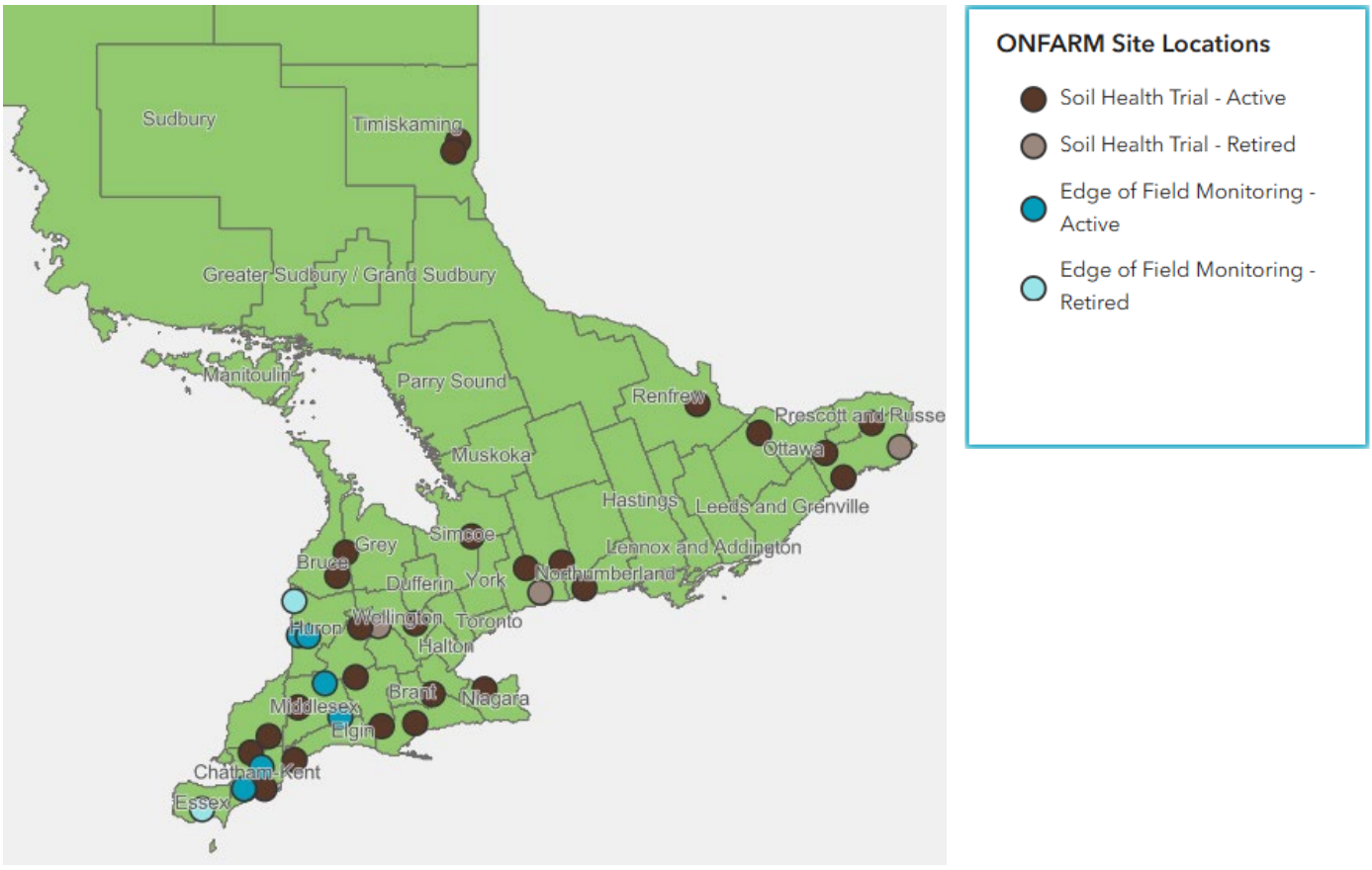

Figure 2. Location of ONFARM's edge-of-field and soil health BMP sites across Ontario featuring two new sites in Temiskaming Region.

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.

Key Points:

- Since 2019, ONFARM has been continuing GLASI's work to monitor PSPs.
- This monitoring has developed into a nine-year (2019-28) applied research initiative developed by OMAFA and currently funded by the Sustainable Canadian Agricultural Partnership.
- Water quality monitoring is focused at the field scale on sites established in former GLASI region.
- OSCIA has received $1 million from the Canada Water Agency to increase data analysis capacities, create critical frameworks for contextualising practice recommendations, and support the adoption of effective BMPs (focused on the reduction of phosphorus loss into the Great Lakes freshwater ecosystem).
    - Funded by the Great Lakes Freshwater Ecosystem Initiatives Lake Erie Innovation Substream.
    - This program – the Lake Erie Enhanced Agricultural Analysis Program (LEEAAP) - allows OSCIA and partnering organizations to analyze historical data (2015-present) from GLASI and ONFARM.
- Soil health trials are underway to evaluate a series of soil health sampling and testing methods to identify a key set of indicators for Ontario's landscape.
- BMP trials are developed with SRG and cooperators through paired strip plots to capture landscape variability. Each trial compares BMPs under conservation tillage systems and utilizes composite sampling in three benchmark locations across slope positions.
- OSCIA is working to develop novel soil health indicators (SHIs) which are not typically included in standard commercial soil health test packages.
- Tools created from ONFARM data are publicly available for farmers to compare their own soil to ONFARM datasets. Access the different Data Dashboards via the ONFARM page of the OSCIA website.
    - Interested farmers can also download their own copy of How to Conduct ONFARM Research Guidebook.
- New to the continued phase of the program (2023-2028) is the expansion into Northern Ontario with the addition of two new ONFARM sites in the Temiskaming region. These sites were identified in consultation with local Soil and Crop Improvement Associations (SCIAs), NOFIA, and SRG.
- Drone imagery helps us understand links between soil health, soil-water dynamics, and crop productivity, with non-invasive aerial measurements. Drone imagery and geographic information system (GIS) tools let us analyze results from the field scale, the strip scale, and at sampling benchmarks.
- OSCIA is continuing to investigate profit mapping which uses precision agriculture tools that combine yield and crop input data costs to create a series of maps to help farmers visualize their profit through a partial budget calculation applied across a field.

3.2. Challenges and opportunities with agricultural research in Northern Ontario

Leia Weaver, the Project Development Advisor with NOFIA and Birgit Martin, OSCIA's director for Northeastern Ontario, discussed the history of Northern Ontario research programs and the benefits of collaboration with initiatives across the province as well as the unique challenges and opportunities in the region.

Key Points:

- NOFIA was established in 2013 to bring together farmers, develop strategies, and strengthen partnerships to further agricultural research and innovation in Northern Ontario.
- The 2021 census of agriculture found that Northern Ontario makes up 88% of Ontario's land mass and has 6% of Ontario's population.
- The Clay Belt region was developed for agriculture from the 1900s onwards as the land conditions were different from other settled areas. The first New Liskeard Agriculture school was opened in 1910 with the New Liskeard College of Agricultural Technology following in the 1970s but it was closed in 1994 due to cutbacks and provincial divestment.
- The New Liskeard Agricultural Research Station has continued its operations and is now called Ontario Crops Research Centre (New Liskeard)
- Other research centres currently operating in Northern Ontario include:
    - The Ontario Beef Research Centre (New Liskeard)
    - The Lakehead University Agricultural Research Station (Thunder Bay)
    - Ontario Crops Research Centre (Emo)
    - The SPUD Unit operated by the Seed Potato Growers Association (New Liskeard)
- Ongoing projects supported by NOFIA include:
    - Strengthening Agri-Food Value-Chain Coordination in Northern Ontario
    - The Northwest SCIA (Soil and Crop Improvement Association) research project on rotational grazing at the Thunder Bay Community Pasture
    - The repurposing of agricultural plastics for new agricultural uses
    - A pilot project aimed at advocating for access to veterinarians in Northern Ontario
- NOFIA also provides education and knowledge mobilization through events like the Northern Ontario Agricultural Conference and other communication channels.
- Some of NOFIA's current programs focus on:
    - Providing tile drainage for the Temiskaming District through the Northern Ontario Heritage Fund
    - Northeast regional representation for Sustainable New Agri-Food Products and Productivity (SNAPP)
    - Northeastern regional communication coordination with OSCIA
- The soils of Northern Ontario are strongly influenced by the Canadian Shield. The soil acidity almost always requires liming and tile drain systems.
- Northern Ontario shows huge potential for future agriculture expansion.
- With favourable land prices, the number of frost-free days increasing, and the total crop heat units growing, Northern Ontario shows great potential for future production growth.
- The Canada Land Inventory identifies 4.4 million acres of Northern Ontario land as suitable for cultivation under classes 2-4 with even more acreage appropriate for grazing.

- Research into the prevention of soil and water degradation in Northern Ontario is important, and the lessons learned from Southern Ontario can provide valuable insights that benefit emerging agriculture in both northern and southern regions.
- Future research should focus on:
    - Identifying BMPs for land clearing,
    - BMPs for conservation tillage for newly cleared land,
    - Grazing and cropping systems that can mimic the carbon sequestration of cleared boreal forest, and
    - Crop types best suited to Northern areas.
- NOFIA maintains the website FarmNorth to share information concerning agricultural research, funding programs, and districts information.

Data:

- **Comparison of frost-free days in 2020:**
    - South: Chatham 185.9 – Guelph 160.9
    - North: New Liskeard 129.6 – Cochrane 116.7
- **Comparison of CHUs in 2020:**
    - South: Chatham 4,241 – Guelph 3,611
    - North: New Liskeard 2,676 – Cochrane 2,306
- **Historical data and changes to frost free days and CHUs in Kapuskasing region:**
    - Kapuskasing frost free days: 101.5 (1976-2005) – 118.7 (2020) – 137.5 (2050-projected)
    - Kapuskasing CHUs: 2,076 (1990) – 2,368 (2021) – 2,924 (2050-projected)

Examples of the substantial agricultural industries in the northern districts and their outputs[2]:

- Rainy River: 161,000 acres with $29.8 million in farm cash receipts, primarily beef cattle, oats (137 bu/ac).
- Cochrane: 42,000 acres with $22.72 million in farm cash receipts, canola (67 bu/ac).
- Temiskaming: 177,000 acres with $65.7 million in farm cash receipts with dairy at $24.1 million farm cash receipts.
- Manitoulin 141,000 acres with $19.91 million in farm cash receipts, over half from beef cattle production.
- Muskoka: 23,500 acres with $3.32 million in farm cash receipts, over half from floriculture, nursery, and sod production.

[2] 2021 stats from farmnorth.com

3.3. Digging into carbon and nitrogen soil health indicators

Adam Hayes, from SRG, helps setup the ONFARM sites and coordinates BMP implementation with the ONFARM cooperators. Adam discussed the opportunity of using novel carbon and nitrogen soil health indicators to identify sooner and more reliable effects of BMPs on soil quality.

Key Points:

- Soil organic matter (SOM) has been researched for decades as an indicator of soil health, but it can take 10-20 years just to see a 1% change.
- Accordingly, it is important to identify and evaluate SHIs that can reflect BMPs sooner than SOM.
- Researchers are currently working to build a database of SHI ranges and ratings specifically for Ontario soils and conditions.
- ONFARM is currently researching both carbon-based and nitrogen-based SHIs.
- Carbon-based indicators include SOM, active carbon, and respiration (carbon dioxide generation).
    - Active carbon makes up about 1% of SOM and indicates the small amount of organic matter available as an energy source for microbial activity.
    - Respiration of the microbial community is measured by the generation of carbon dioxide from active carbon. New ways to measure respiration are being researched.
    - SHIs measuring active carbon and respiration are more responsive to BMPs than SOM but are also more variable. As novel SHIs continue to be examined, researchers are looking for indicators in a mid-range which will be responsive but not too variable.
- Nitrogen-based indicators include Autoclave Citrate Extractable (ACE) protein, Solvita Labile Amino N (SLAN), and Potentially Mineralizable N (PMN).
    - Soil organic nitrogen pools which constitute 5-10% of SOM are not utilized much as a SHI.
    - The ACE protein SHI represents 60-70% of the soil organic nitrogen and indicates the number of protein-like substances and organically bound nitrogen in the SOM which microbial activity can mineralize and make available for plant uptake.
    - SLAN makes up about 3% of the ACE protein and measures the release of ammonia from organic nitrogen available for mineralization.
    - PMN constitutes about 5% of SLAN and indicates the capacity of microbial activity to mineralize nitrogen.
    - Similarly to the carbon, as the indicators rely on smaller pools for measurement, they become more responsive but also more variable.
- It is important to continue to measure SOM and consider visual indicators.
- Active carbon indications are also responsive and show comparatively lower variability.
- ACE Protein shows promise as a SHI, but its reliability is limited as more data is required (it was added to ONFARM monitoring as a new indicator in 2022, two years after measurements began).
- The overall suite of soil health indicators being used is evolving as researchers continue to work on finding responsive SHIs.
- It is important to take samples from the same representative areas in a field at the same crop stage to minimize variability.

Case Studies

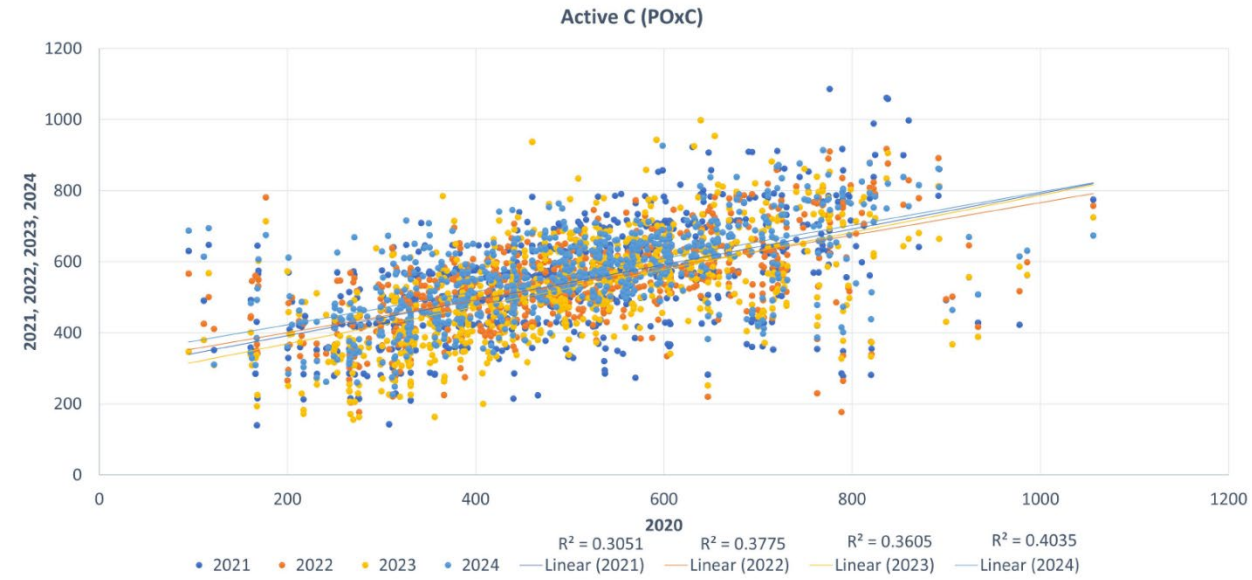

Figure 3. Data points representing active carbon levels taken from all ONFARM sites using 2020 as a baseline. Trendlines show a fairly consistent increase in active carbon with R^2 values indicating slightly improved predictability over time.

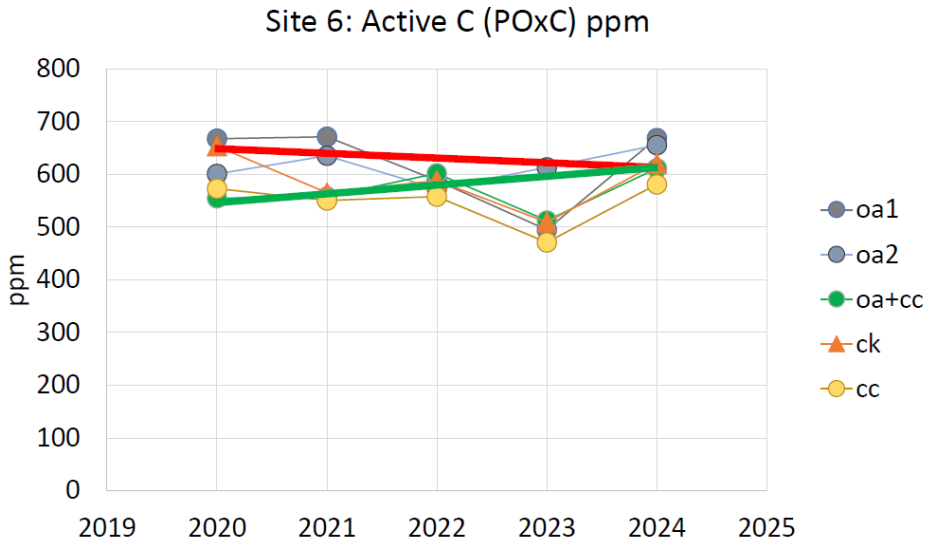

Figure 4. Tracking Active C (POxC) at Site 6 shows that best management practices help maintain or increase levels, while the check trends downward.

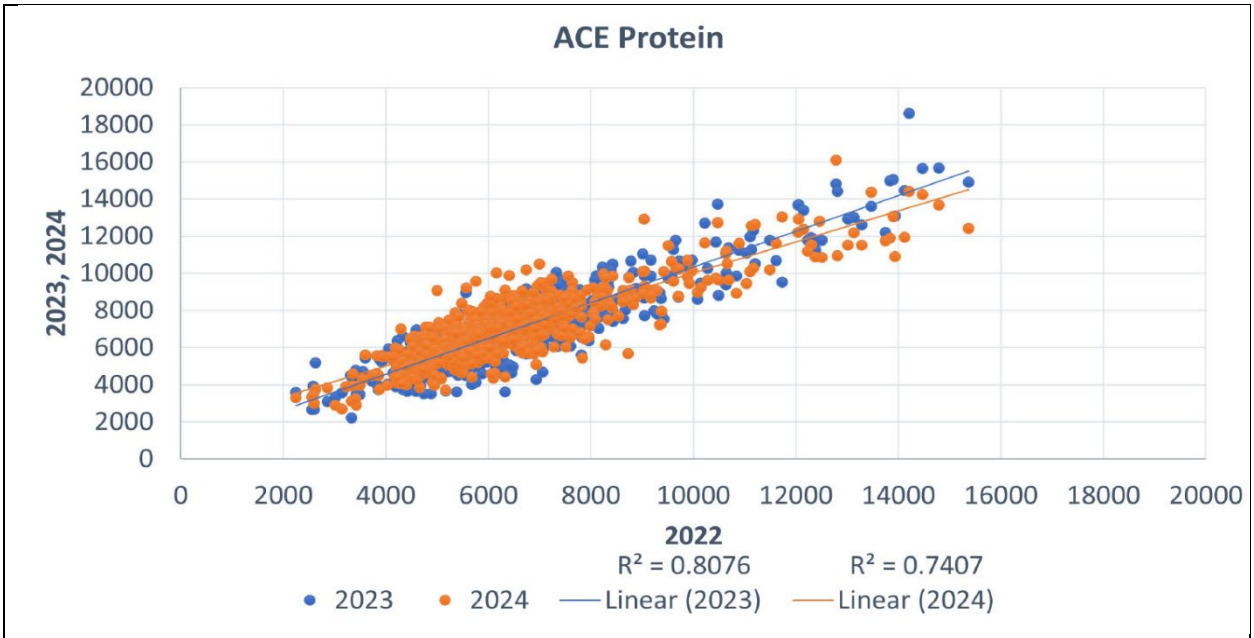

Figure 5. A strong positive correlation between ACE Protein levels in 2022 and subsequent years) is shown with R^2 values above 0.7 indicating high predictability. The trend suggests consistency in ACE Protein measurements over time and its value as a reliable SHI.

Interested in sampling?

The OMAFA Soil Health Assessment and Plan (SHAP) includes AC, PMN, respiration, and physical indicator tests. It also provides management practices to help producers strategize.

3.4. The effects of best management practices on yields and soil health

Caleb Niemeyer, a PhD candidate focusing on precision agriculture at the University of Guelph; Margaret Ribey, Natural Resource Scientist at SRG; and Luke Hannam, a crop science graduate and ONFARM cooperator, discussed the variable effects of BMPs on soil health and yields throughout different field positions.

Key Points:

- Randomized and replicated trials are the gold standard for causal inference, but most farmers do not implement them due to logistical difficulties. These trials help farmers and researchers identify BMP treatment results by limiting the influence of field variance.
- The number of data points collected by yield monitors provides more detailed information than a plot average, but it is influenced by spatial variability, with substrate mismatches possibly occurring between adjacent strips.
- Experimental confounders of BMPs include topography and soil characteristics like texture, or electrical conductivity. Balancing these confounders helps to identify whether treatment or spatial variability affected yield.
- ONFARM strip trial analysis uses propensity score matching to correct for influence of confounding variables by balancing them across treatment sets.
- Correcting for field variability helps to show if a treatment caused yield response, although yield responses may not be immediately present following sustainable agriculture practices.
    - Variability in treatment strips, topography, and soil types can affect yield results.
    - These factors can overshadow BMP improvements if strip yields are the only measurement of a BMP's success.
- Soil variability within a field and the range of soil conditions within soil type can be different. Different types of degradation can inform expectations of treatment results.
- After 5 years of ONFARM research, when comparing BMP to no-BMP fields there are differences found in soil degradation even in small areas of the field which can influence SHIs and yield.
    - Accordingly, it is important to consider zones in the field when evaluating BMPs.
- BMP success to farmers, like Luke, means implementing a practice without interrupting the crop rotation system or breaking the bank. As for variability, the frequency and intensity of BMP application can be adjusted based on the zone's requirements.
- Landscape position can inform the intensity and frequency of BMP application required.
- Increasing the intensity of CC practices means maximizing carbon inputs and biomass accumulation. These factors are affected both by seeding method (aerial, drilled, broadcasted) and termination timing (mid-late fall, overwintering, winter-killed). Allowing the CC to grow for as long as possible will increase biomass accumulation and the carbon inputted.
- Generally, sites with more frequent and intense BMPs possess SHIs which are statistically higher than the controls in a given year.
- Yield impacts from frequent/intense BMPs are best investigated in high stress years where improvement in soil resiliency from BMPs is more evident.

Case Studies:

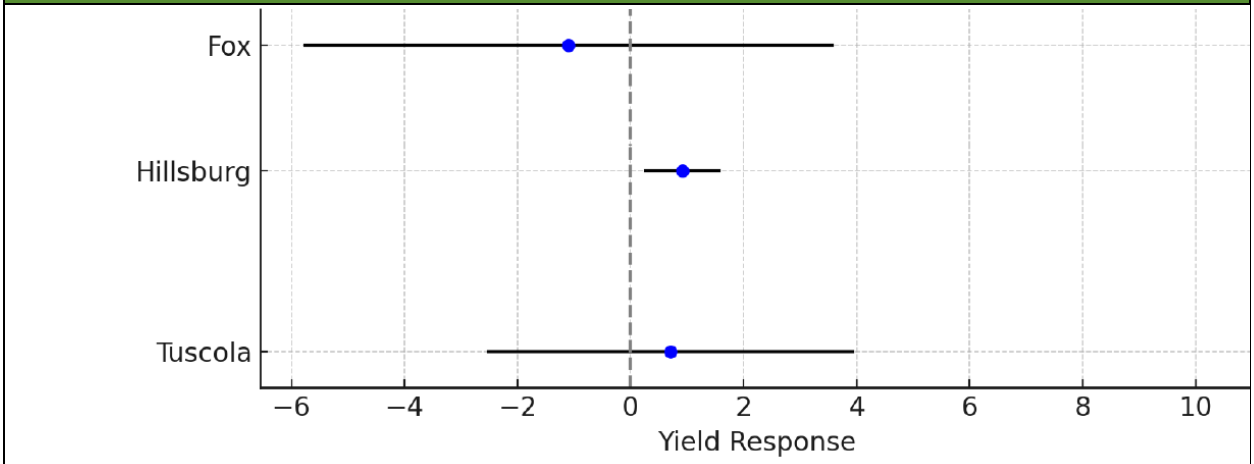

Figure 6. Yield responses to compost application across three soil types, with black lines representing the range of likely treatment effects. Hillsburg sandy loam shows a statistically significant positive yield response due to its narrow confidence range, while Fox and Tuscola soils have wider ranges, indicating greater uncertainty and variability which is partly due to the lower concentration of these soils on the site.

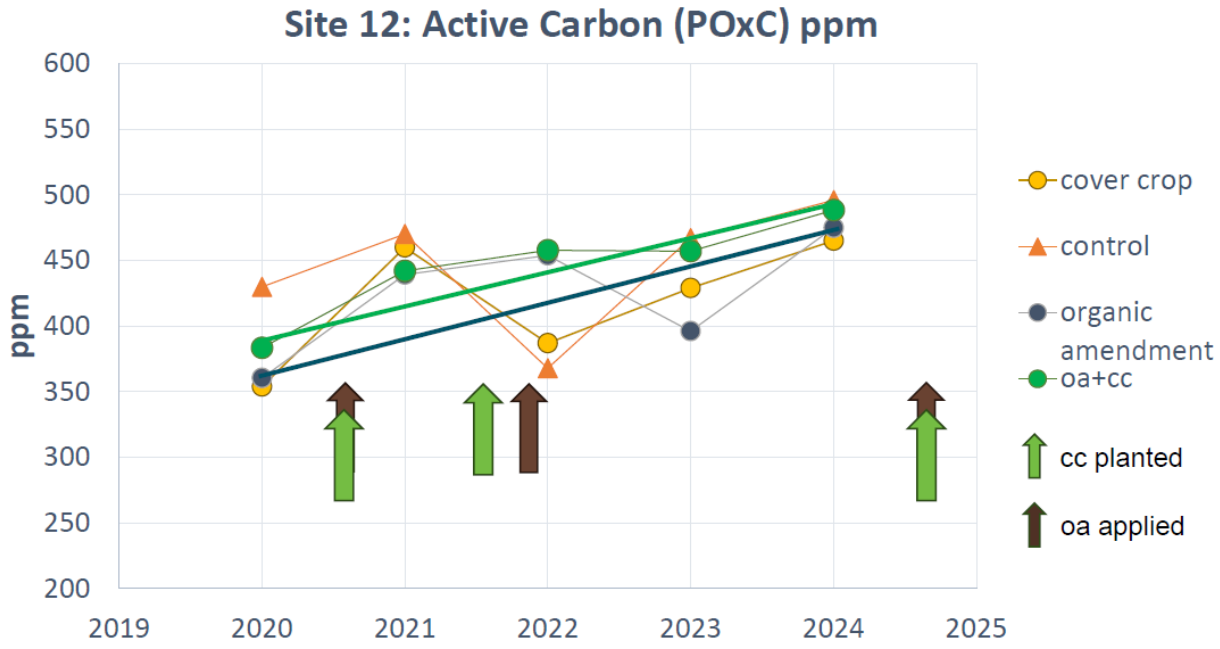

Figure 7. Active carbon (POxC) levels from 2020 to 2024 across different treatments, including CC, organic amendments, and their combination. Despite yearly variability due to crop type, soil temperature, and soil moisture differences, the overall trend shows increasing active carbon levels through BMPs.

3.5. The impacts of cover crops on runoff generation and water quality

Donna Small from the Lower Thames River Conservation Authority; Mari Veliz from the Ausable Bayfield Conservation Authority; and Beth Wrona from the Upper Thames River Conservation Authority discussed the connections between CC, water quality, and runoff generation.

Key Points:

- The Conservation Authorities are focused on monitoring water quality at the edge-of-field scale to understand the effect of BMPs on runoff and nutrient loss. This monitoring focuses on the collection of data relating to water quality/quantity, topography, weather, soil conditions, land management data, and yield data to best quantify the relationship between BMPs and water quality.
- The Conservation Authorities benefit from historical research on some sites and are analyzing data from 2015 onward to evaluate long-term trends and the cumulative impacts of land management on water quality.
- The different sites with edge-of-field data being collected are also being examined for their use of CC, tillage, organic amendments, and different drainage types. Each site has different characterizations and different management practices, so data is also collected from other factors contributing to what is happening on the field.
- At the Upper Thames River Conservation Authority's North Kettle edge-of-field site the effect of CC and no CC treatments on water quality and quantity leaving the field was studied. The two treatments are separated by a double-basin water and sediment control basin (WASCob), and both are randomly tiled with surface inlets.
- Three precipitation events were selected from this site that occurred when varying degrees of vegetative cover were present, to compare the sediment loads that left the fields.
    - Examples of how a poor CC catch versus a good CC catch effects runoff can be found below.
- Parameters being tracked include:
    - Tile discharge, which is the subsurface flowrate measuring the volume of water flowing through the tile in liters per second (L/s).
    - Concentrations of total suspended solids measured in milligrams per liter (mg/L) are taken from multiple water quality samples over the course of the event to better capture the variability of water quality.
    - Discharge volume converted to an equivalent depth in millimetres of rainfall over a catchment to visualize how much rainfall was not absorbed by the ground.
    - Calculation of a flow-weighted mean concentration enables analysis of the concentration for the event. This method provides the variability of samples over time.
    - Total suspended solids (TSS) load leaving the field was scaled to kilogram per hectare to more accurately compare the two fields (CC and no CC).
- When comparing harvested and unharvested oat and pea CC segments of the Gully Creek EOF Site, runoff occurred more frequently in the harvested basin during rain and snowmelt events.

- Loss of total phosphorous and total suspended solids was also twice as high in the harvested basin.
- This shows that standing crops will limit runoff and nutrient loss more than harvested residue.
- Year-round ground coverage is crucial, and the quality of the CC catch or residue coverage will make a difference in nutrient and soil loss.
- Conservation authorities are continuing to work to understand the subtle changes in soil health on water-holding-capacity and the potential for runoff generation.

Case Studies:

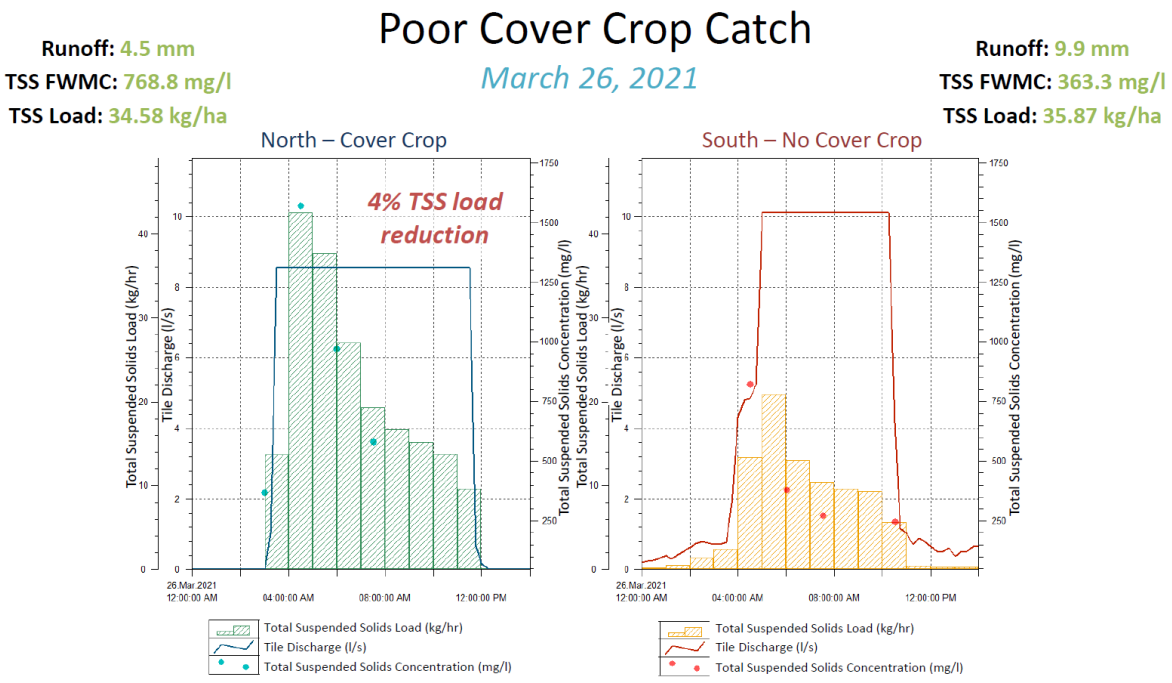

Figure 8. Comparison of tile discharge and TSS between a CC field with poor establishment and no-CC field after a 25mm rainfall in March 2021. While the CC field had higher TSS concentrations (768.8 mg/L) but lower runoff (4.5 mm), the TSS load reduction (4%) suggests that a poor CC catch limits its effectiveness in reducing runoff.

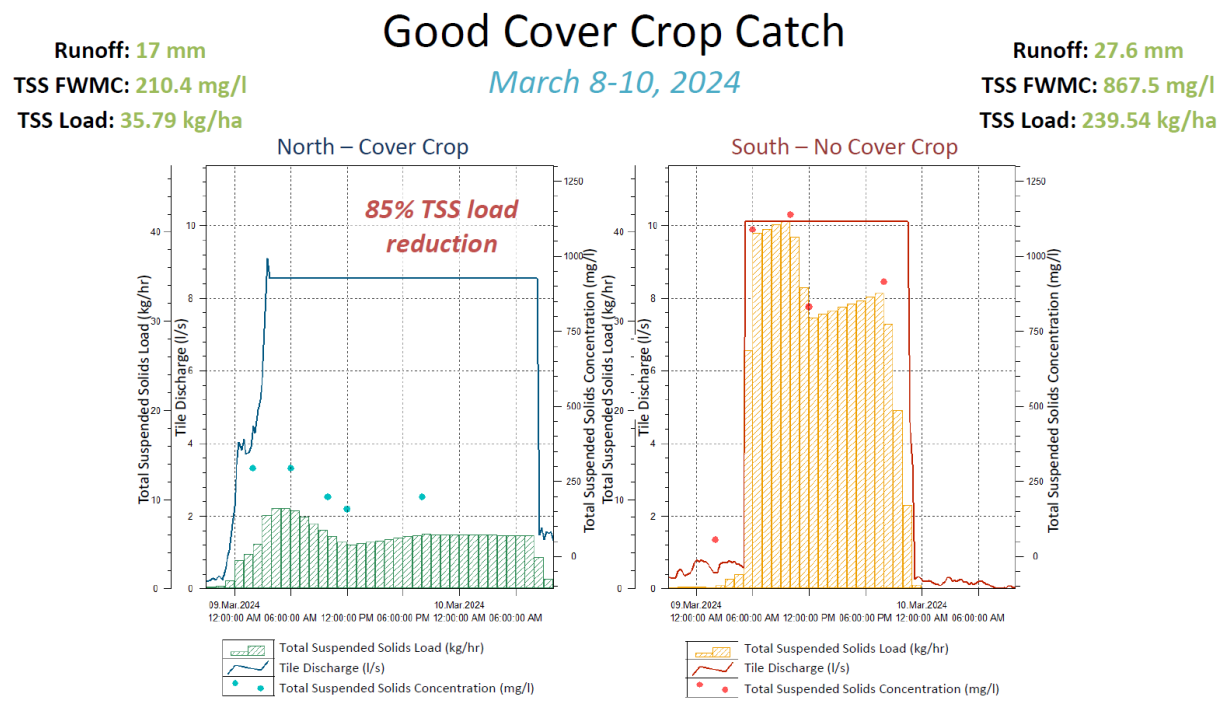

Figure 9 Comparison of tile discharge and TSS between a CC field with good establishment and a no-CC field during a March 2024 event. The CC field had significantly lower TSS concentrations (210.4 mg/L vs. 867.5 mg/L), less runoff (17mm vs. 27.6mm), and an 85% reduction in TSS load. The CC field also showed a 59% reduction in total phosphorus load. Overall, this figure illustrates how a good CC catch is effective in limiting runoff and retaining nutrients.

Figure 10. A visual representation of the variability of TSS concentrations collected over the course of a precipitation event.

"When there's water moving, it will be transporting nutrients. And, the more no-runoff conditions that we provide with vegetative cover, the less nutrients will runoff and the less prone the field will be to erosion" - Mari Veliz

3.6. Supports and trends with cover cropping

Sarah Midlane-Jones, the Community Outreach Specialist for the Bay of Quinte Remedial Action Plan (BQRAP), and Jennifer Nash, an OSCIA Field representative facilitating Environmental Farm Plan workshops in the East Central Region, discussed the supports available for CC projects in Ontario.

Key Points:

- OSCIA is delivering programs to help farmers implement BMPs like CC by de-risking the initial investment made by the farmer through cost-shared support.
- Under the Sustainable Canadian Agricultural Partnership, 300+ projects were supported province-wide with 150 projects implemented under the Lake Erie Agriculture Demonstrating Sustainability (LEADS) program in the Lake Erie region.
- The OFCAF also promotes and financially assists with CC implementation. From 2022-24 the fund received over 1,200 applications specifically for CC projects. Over 80% of approved applications resulted in completion and claim submissions, helping over 500 farmers successfully implement CC on new acres.
- Overall, OFCAF supported over 35,000 hectares (or 86,500 acres) of CC in Ontario, the most common CC were oats, rye, red clover, peas, and radish.
- Majority (96%) of the farmers participating in OFCAF said they would continue implementing the practices they initiated with OFCAF funding, which highlights long-term benefits of these programs in promoting sustainability.
- On January 28th, 2025, AAFC announced an additional $300 million in national funding would be available through OFCAF from 2025 to 2028. OSCIA will continue to deliver cost share to support CC under the OFCAF expansion phase.
- If farmers are interested in cost-sharing their CC, keep an eye out for an OFCAF intake opening in the Spring of 2025 by subscribing to OSCIA's program mailing list.
- The BQRAP offers a Rural Stewardship Program which encompasses a suite of BMPs.
- The BQRAP is primarily concerned with keeping phosphorous out of the Bay of Quinte and local tributaries by offering cost-sharing for farmers in the area.
- The BQRAP's goal for CC is to encourage cover on fields through the non-growing season.
- Controlling runoff and erosion is essential so it is fitting that the most applied for BMP is CC. BQRAP's Rural Stewardship Program grant covers the purchase of CC seed at $30 per acre up to a grant maximum of $2,500.
- The Rural Stewardship Program can be accessed through BQRAP and applications are reviewed by a grant committee before approval.
- Applicants receive a site visit to ensure the CC is growing and can submit receipts to collect the grant money.
- The Rural Stewardship Program started in 2016, and application numbers have been growing as farmers talk to farmers and cooperations continue between OSCIA and ONFARM to promote knowledge mobilization.
- Cost share programs make BMP adoption less risky for farmers. OFCAF knowledge sharing events and peer-to-peer learning help to increase adoption and shift mindsets.
- CC research includes multispecies mixes to promote soil resilience, better moisture retention, and weed suppression, the possibility for livestock integration and grazing of CC, and improvements to the logistics of CC in cash-cropping and harvest schedules.

3.7. Closing remarks

Norm Lamothe, an ONFARM cooperator since 2020, provided closing remarks.

Key Points:
▪ ONFARM balances BMP implementation with profitability and ecological benefits in a way that aligns with a farmer's own concerns. ▪ ONFARM's extension to 2028 means more valuable data can be collected and added to the research dataset from last five growing years while exploring new regions and research priorities. ▪ Expanding into Northern Ontario will allow new farmers to bring new perspectives to the ONFARM program through their history of adaptive and innovative farming. ▪ The collaboration with conservation authorities to focus on water quality and runoff paired with continued funding is a positive step to ensure water quality long-term.

4. Main takeaways

A. Expanding agriculture in Northern Ontario offers a chance to adopt sustainable BMPs from the start.

- In addition to more affordable land prices, the number of frost-free days and total crop heat units are increasing in Northern Ontario. Together, this shows great potential for agricultural productivity growth in Northern Ontario.
- BMPs that can mimic the carbon sequestration potential of boreal forests cleared for agriculture are crucial.
- The Canada Land Inventory identifies 4.4 million acres of Northern Ontario land as suitable for cultivation under classes 2-4 with more acreage appropriate for grazing.

B. Researchers continue to refine the suite of SHIs to make them more reliable and responsive.

- SOM can take 10-20 years to see a 1% change.
- Researchers continue to identify and evaluate SHIs that can reflect measurable outcomes of BMPs sooner than SOM.
- A database of SHI ranges and ratings specifically for Ontarian soils is in development.

C. Adjusting for field variability and other confounding influences helps pinpoint whether a treatment truly affects yield.

- Balancing confounding influences like topography, historical yield data, and soil electrical conductivity helps to identify whether treatment or spatial variability affected yield.
- Soil variability within a field and the range of soil conditions within soil type can be different; different types of degradation inform expectations of treatment results.
- Yield impacts from frequent/intense BMPs are best examined in high stress years where improvement in soil resiliency from BMPs is more evident

D. Year-round ground coverage is crucial to limit runoff, with standing vegetation providing the best protection (as opposed to harvested CC or residue removal)

- When comparing unharvested and harvested CC, the loss of total phosphorous and suspended solids was twice as high in the harvested field.
- Similarly, a good CC catch is essential to limiting runoff and nutrient loss.

E. Cost-share programs and peer-to-peer learning make BMP adoption less risky and more desirable to farmers

- From 2022-24 OFCAF supported over 35,000 new hectares (or 86,500 acres) of CC in Ontario
- BQRAP's Rural Stewardship Program began slowly in 2016 but applications increase as farmers talk to farmers and cooperations continue between OSCIA and ONFARM to promote knowledge mobilization.

5. Next steps

Activity	Description
Publish soil data	Completing the analysis of 2024 ONFARM data includes the comparison of 2024's findings with past years. The statistical significance of regression coefficients could then be examined to help researchers identify which soil health indicators are the most reliable and predictable.
Continue to collaborate for water quality outcomes	Conducting pressure plate analysis will help link BMPs and water retention to solve issues related to runoff. At the same time, the Upper Thames River Conservation Authority is performing surface water quality sampling in Spring 2025 at the Thorndale Demonstration Farm to investigate dissolved phosphorus losses and other variables.
Re-examine runoff data	Finding a method to more accessibly communicate runoff data to farmers and developing tools to help them perform their own runoff research may enhance cooperators focus on water quality and retention.
Continue collaborating to enhance ONFARM research in Northern Ontario.	The NOFIA also acts as the Regional Communication Coordinator for the Northeastern Ontario (NEOSCIA) region of OSCIA. Maintaining this relationship while considering forum participants' interest in Northern market access and infrastructure is essential to agricultural expansion.

This program is funded by the Sustainable Canadian Agricultural Partnership (Sustainable CAP), a 5-year (2023-2028), $3.5-billion investment by federal-provincial and territorial governments to strengthen competitiveness, innovation, and resiliency of Canada's 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% federally and 40% provincially/territorially for programs that are designed and delivered by the provinces and territories.

6. Appendices

6.1. Information package for attendees

Agenda

February 6, 2025 via Zoom videoconference

The Ontario Soil & Crop Improvement Association looks forward to welcoming you to the 2025 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 effects on soil health and water quality. Originally a four-year program, ONFARM was 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: • Wilton Consulting Group (WCG) • Dr. Angela Straathof, Ontario Soil & Crop Improvement Association (OSCIA)
9:25 am	**Challenges and opportunities with agricultural research in Northern Ontario** Speakers: • Leia Weaver, Northern Ontario Farm Innovation Alliance • Birgit Martin, OSCIA
9:40 am	**Digging into carbon and nitrogen soil health indicators** Speaker: • Adam Hayes, Soil Resource Group
10:00 am	**The effects of best management practices on yields and soil health** Speakers: • Caleb Niemeyer, Woodrill Farms and the University of Guelph • Margaret Ribey, Soil Resource Group • Luke Hannam, Woodrill Farms & ONFARM

Time	Activity
10:45 am	**Break**
11:00 am	**The impacts of cover crops on runoff generation and water quality** Speakers: • Donna Small, Lower Thames Valley Conservation Authority • Beth Wrona, Upper Thames River Conservation Authority • Mari Veliz, Ausable Bayfield Conservation Authority
11:30 am	**Supports and trends with cover cropping** Speakers: • Sarah Midlane-Jones, Bay of Quinte Remedial Action Plan • Jennifer Nash, OSCIA
11:50 am	**Closing remarks** Speaker: • Norm Lamothe, Woodleigh Farms & ONFARM

ONFARM Background

The On-Farm Applied Research and Monitoring (ONFARM) program is a nine-year initiative that is completing extensive soil health trials with 25 cooperators across Ontario and in-depth water quality analysis through seven edge-of-field projects. Through the field trials, the ONFARM team is studying the impacts of BMPs, such as cover crops and organic amendments, on soil health by measuring novel soil health indicators. Through the edge-of-field projects, the ONFARM team is evaluating the impact of BMPs on water quality, the potential impact of widespread BMP adoption, and BMP cost effectiveness. These BMPs are conservation tillage, cover crops, and fertilizer incorporation.

The Soil Resource Group (SRG) is collecting the soil quality data, 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. ONFARM was developed by the Ontario Ministry of Agriculture, Food and Agribusiness (OMAFA) and is delivered by the Ontario Soil and Crop Improvement Association (OSCIA).

Meet the speakers

Welcome & setting the stage

Dr. Angela Straathof is the Director of Research and Knowledge Transfer at OSCIA. She oversees delivery of OSCIA's on-farm research initiatives, connecting farmers with researchers and resources to test 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.

Challenges and opportunities with ag research in Northern Ontario

Leia Weaver is the Project Development Advisor with the Northern Ontario Farm Innovation Alliance (NOFIA). Since 2022, she has assisted with new and ongoing projects, funding and outreach. She obtained her BA in international development at the University of Guelph and a diploma in agriculture from Ridgetown Campus. She was born and raised in Chatham Kent, working on farms and in agricultural business with a focus on organic production before moving north to New Liskeard in 2018. She also enjoys making music and parenting her three amazing kids.

Birgit Martin farms with her husband, Jim, and two sons, Nick and Alex, on western Manitoulin Island. They have a large cow-calf through to finish operation where they produce both grain- and grass-finished beef for their brand, Pure Island Beef, as well as raise Shorthorn and Angus breeding stock. The family also custom graze 300 to 400 steers each summer and crop about 1,300 acres of hay, wheat, corn, canola, soybeans, oats and barley. Birgit has been OSCIA's director for Northeastern Ontario since 2018. She represents OSCIA on the Ontario Forage Council, where she is Chair.

Digging into carbon and nitrogen soil health indicators

Adam Hayes retired from OMAFA as a soil management specialist in 2019. Soon after, he was hired by SRG to help set up the sites and coordinate BMP implementation with the cooperators for the ONFARM project. Adam also assisted with developing soil health training for the University of Guelph Ridgetown Campus. In his spare time, he enjoys spending time with family.

The effects of best management practices on yields and soil health

Caleb Niemeyer leads the Groundwork digital soil mapping program at Woodrill Farms in Guelph. He is also working on a PhD in precision agriculture at the University of Guelph where his research focuses on the analysis of unreplicated on-farm strip trials. In both activities, he enjoys working with farmers to make the most use of farm data to improve decision making across their farming operations.

Margaret Ribey is the Natural Resource Scientist at SRG. Her areas of expertise include soil chemistry and physics, nutrient sourcing and transport, BMPs, soil health, environmental considerations in production agriculture, and nutrient management planning. Margaret coordinates agronomic field sampling, data management and analysis, GIS support, and reporting requirements for SRG projects.

Luke Hannam is a recent graduate from the University of Guelph with a crop science degree. He is also a grain farmer located in the Guelph area. His family farm grows corn, wheat, and soybeans, as well as operates a commercial grain elevator and crop input supply business. They also have a new branch of the business that focuses on precision soil mapping to help manage the farm's soils independently and accurately by soil type.

The impacts of Cover Crops on runoff generation and water quality

Donna Small is the Agricultural Program Coordinator for the Lower Thames Valley Conservation Authority (LTVCA). Donna has experience working with producers to implement agricultural BMPs with the goal of improving soil health and reducing agriculturally sourced nutrient loads. She contributes to water quality research/monitoring, BMP incentive program delivery, and education/outreach projects for the LTVCA.

Beth Wrona is the Agricultural Stewardship Technician at the Upper Thames River Conservation Authority. Beth manages projects demonstrating innovative agricultural BMP applications and promotes their adoption in the Upper Thames River watershed. She coordinates monitoring programs and trials with farmers and rural landowners to assess the efficacy of a range of BMPs to improve water quality and soil health while maintaining productivity.

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, biomonitoring, agricultural and urban best practice evaluation, and community outreach programs.

Supports and trends with cover cropping

Sarah Midlane-Jones has worked with the Bay of Quinte Remedial Action Plan (BQRAP) for the past 16 years. In her role as Community Outreach Specialist, she interacts with all aspects of the BQRAP, including the Rural Stewardship Program. She has been involved in the program since its inception and works closely with stakeholders to ensure the program meets the needs and expectations of the agricultural community.

Jennifer Nash is one of thirteen OSCIA Field Representatives in Ontario. Jenn facilitates Environmental Farm Plan workshops in the East Central Region and Biosecurity webinars province wide. She also assists farmers preparing OSCIA-delivered cost-share applications and project claims. As a seasoned greenhouse grower and sheep farmer, Jenn can identify with the farmers she is supporting.

Closing remarks

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, and 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.

Connect with and learn more about ONFARM

www.ontariosoilcrop.org/onfarm/

onfarm@ontariosoilcrop.org

@OntarioSoilCrop

The 2025 ONFARM Virtual Research Forum is an OSCIA-recognized Knowledge Sharing Event (KSE) for farmers with On-Farm Climate Action Fund (OFCAF) projects in the Cover Cropping and Nitrogen Management categories.

This event has also been approved for 2.0 Continuing Education Units (CEUs) for Certified Crop Advisors (0.5 Nutrient Management, 1.0 Soil & Water Management, and 0.5 Crop Management CEUs).

This program is funded by the Sustainable Canadian Agricultural Partnership (Sustainable CAP), a 5-year (2023-2028), $3.5-billion investment by federal-provincial and territorial governments to strengthen competitiveness, innovation, and resiliency of Canada's 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% federally and 40% provincially/territorially for programs that are designed and delivered by the provinces and territories

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6.2. Information about Forum registrants

Most of the Forum registrants were government staff (21%), farmers (20%), or non-profit/NGO staff (19%). The professions for people that selected “other” included consultants, and students.

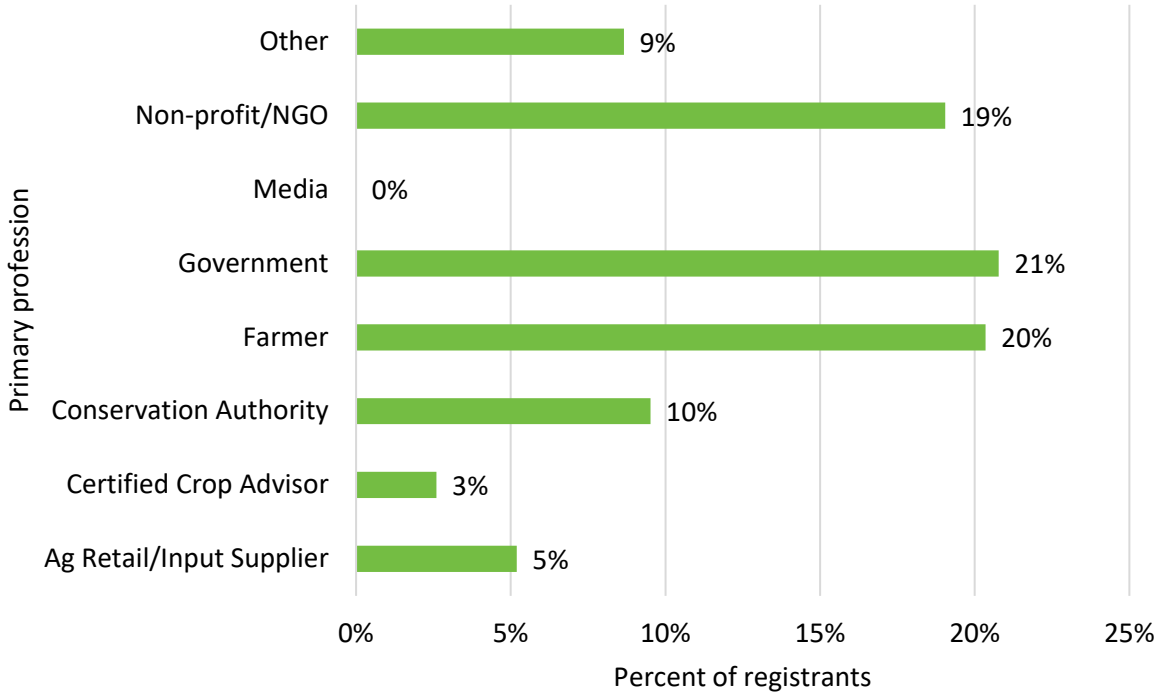

Figure 11. Primary profession of 2025 ONFARM Forum registrants (n=230).

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.

Challenges and opportunities with agricultural research in Northern Ontario

How do farmers manage to grow crops that require more growing degree days despite having fewer frost-free days?

- By using lower yielding varieties that are bred for less growing degree days.

Digging into carbon and nitrogen soil health indicators

You showed two different time-trend lines for annual changes in oxidizable organic matter. Are either of those regression coefficients statistically significant, including the difference between the two?

- SRG is in the process of running stats on the 2024 data in relation to previous years. Stay tuned!

The effects of best management practices on yields and soil health

What would be the accuracy increase if we combined propensity score matching with replicated trials?

- You can combine the results of the propensity score matching method across sites and/or years to help improve the power of the test. I think in one experiment the 95% Confidence interval width was reduced by 5 bu/ac or so.

Caleb, given the variability that exists in soil characteristics within a single field, is it possible to choose one site that is "representative" of the whole field/farm?

- It would be hard to find one location that is truly representative given all the underlying layers that vary continuously across a farm. For sure you can pick areas where the differences between the treated and control are minimized though. For example, having your strips perpendicular to a hill rather than parallel.
- It is hard to choose one sampling location and call it "representative". In the Topsoil Project, we sampled 3 different locations, Upper, Mid, and Lower slopes on purpose. We certainly saw that soil health indicators generally score lower in upper slopes and higher in lower slopes. I think the message there is if you want to track soil health over time, sample from the same place!

Are there interactions between soil types and weather conditions each year on the response to soil health treatments?

- Not sure how much data there is on this, but I would think that CC and organic amendments would have a greater response in dry years due to the greater water holding capacity.
- We'll learn more about the link in those practices and in-field water retention as we get data back from the site where we're conducting pressure plate analysis to determine water retention.

- We are always considering that soil moisture impacts these biological measurements. And we can say that the analysis of indicator values and differences in 2024 (so far) is certainly different than the other years where we had moisture deficits in June. Particularly the PMN indicator.

With targeting organic amendments to the "poorer" areas of the field, to try to improve the yields, is there a significant probability of the P and K levels getting into excessive ranges, because we are applying more than crop removal over time?

- That's something to be watched. Each farm is different but potentially could look at VR P and K to help manage that issue depending on the situation.

When organic amendments are applied, are the mineral fertilizer programs adjusted so the total inputs stay the same?

- Yes, they are. When we resample points in the field to regenerate our soil property maps, any changes due to organic amendments would be measured the application rates would be adjusted for.

The impacts of cover crops on runoff generation and water quality

Have you looked at the proportion of DRP in TP in the tile flow compared to the surface runoff?

- We have looked at the proportion of DRP to TP at some of our sites. It can give a good indication of the amount of erosion. We will be looking at the tile numbers, as you suggest at one of our sites a little more closely now. We installed a magmeter to quantify tile flow and will spend more time running up the flow weighted mean concentrations. I look forward to sharing those numbers in the future.

6.4. Post-Forum survey

A short survey was emailed to participants after the Forum. In total, 25 people completed the survey, which equates to a response rate of about 16%. This was the first ONFARM Forum for 44% of respondents. Almost all (96%) of survey respondents felt satisfied or very satisfied with the 2025 ONFARM Forum.

Most commonly, survey respondents identified as farmers (44%), conservation authority (20%), and government staff (20%) (Figure 12).

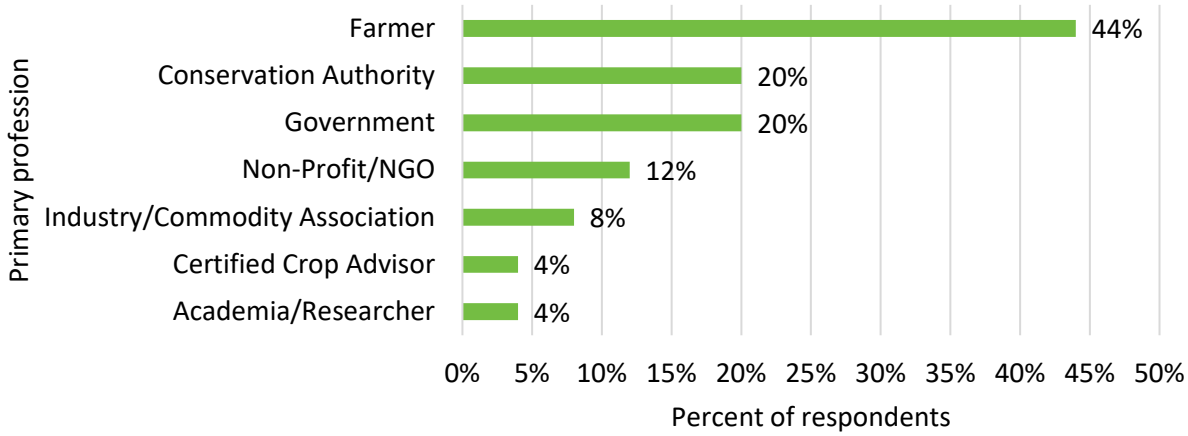

Figure 12. Primary profession of survey respondents (n=25).[3]

Most of the survey respondents farm and/or work in Southern Ontario (44%) (Figure 13). This was followed by Western Ontario (16%), Central Ontario (12%), and Eastern Ontario (12%).

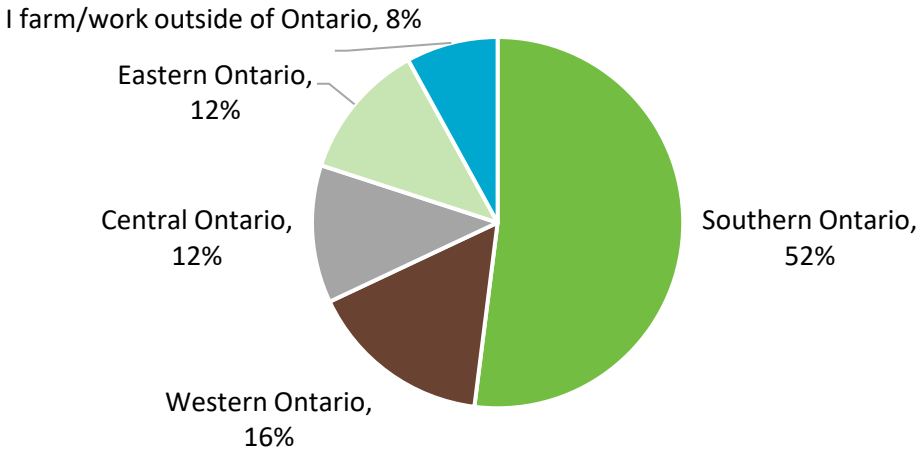

Figure 13. Regions in which survey respondent farm and/or work in (n=25).[4]

[3] No ag retail/input supplier participants filled out the survey.
[4] No forum participants from Northern Ontario filled out the survey. Respondents that farm/work outside of Ontario were from Quebec and Hungary.

Most respondents agreed or strongly agreed with the following statements (Figure 14):

- The format was an effective way to share ONFARM project information (88%)
- The presenters were knowledgeable about the subject matter and content (96%)
- The presenters delivered content in an effective and engaging manner (92%)
- The information was presented in a clear and logical way (92%)

What we heard:

Respondents liked the presentation and content but said they would appreciate more visuals to help illustrate key information. Some also wanted more time to explore each topic in depth.

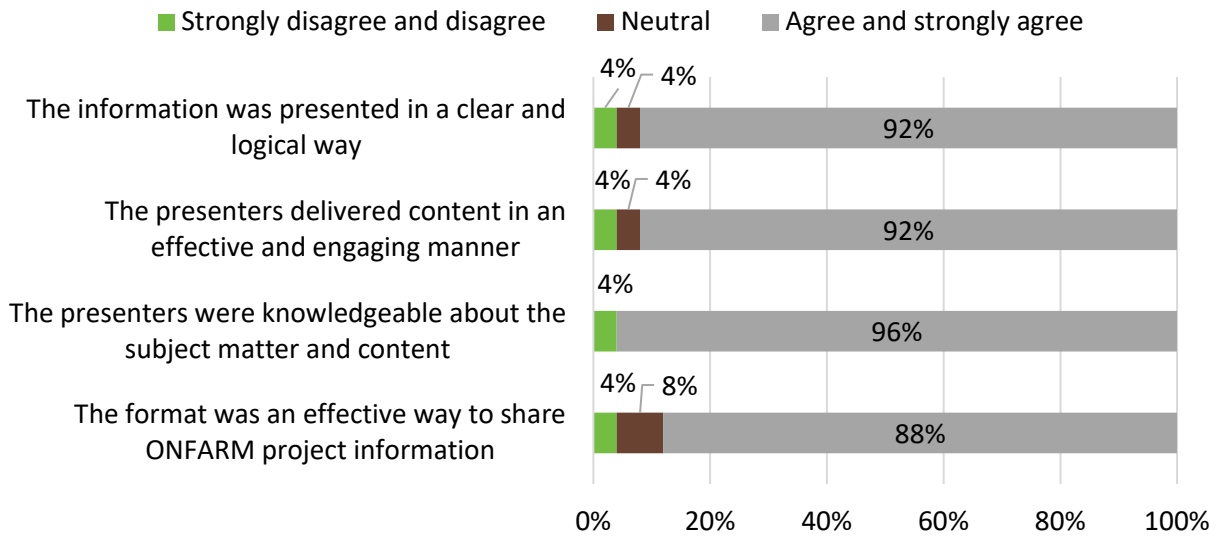

Figure 14. Respondents' level of agreement with four statements about the Forum (n=25).

Almost a quarter (24%) 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 15). Most respondents (72%) said maybe or were unsure if it applied to them.

The ways respondents intend to implement this information include:

- Cover crops
- Organic amendments
- Adopting new ways to present runoff data

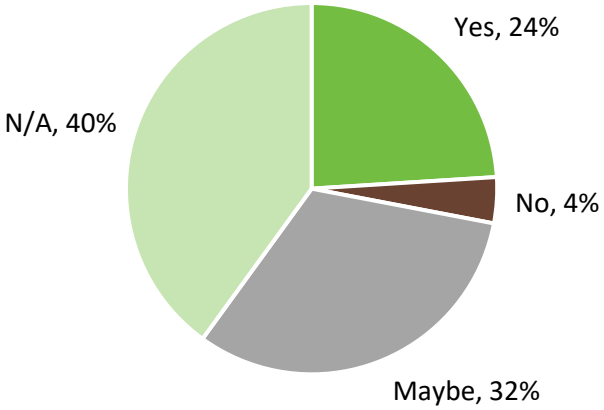

Figure 15. Respondents' intent to implement a new or revised practice on their farms, in their research programs, or in their advisory services based on content learned from the Forum (n=25).

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 7.04/10, while the average after the Forum was 7.8/10 (Figure 16). Thus, respondents increased their knowledge through their participation in the Forum.

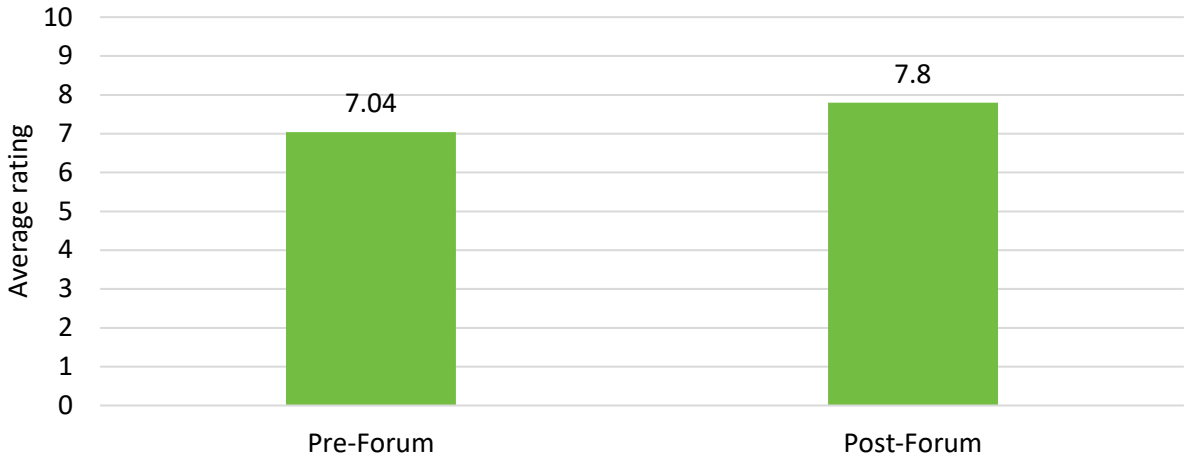

Figure 16. Respondents' average weighting of pre- and post-Forum knowledge of the indicators and/or BMPs for soil health/water quality (n=25).