

FOCUS: SOIL HEALTH & CROP NUTRITION

Breaking new ground on soils, carbon and sustainable orchards

As climatic conditions continue to evolve, farmers must adapt the crops they grow and how they grow them, as well as look for sustainability approaches that encourage and lead to meaningful carbon sequestration.

The challenge: there is very little data or practical information on how to improve carbon storage in the soil, particularly for horticultural crops such as orchards.

The response: exciting and breakthrough research involving Vineland's Plant Responses and the Environment team to create data-driven links between soil carbon storage and sustainable orchard management.

"There is a lack of understanding of how different production practices can impact carbon storage in soils. A lot of the carbon historically stored in the environment is in the soil and some of it is locked away or is mineralized organic matter," says Rhoda deJonge, PhD, director, Plant Responses and the Environment, Vineland Research and Innovation Centre (Vineland). "Depending on tilling practices and the incorporation of new organic materials, soil texture and compaction, that carbon can either be released from the soil or it can be built."

"Nobody has looked at this closely for Ontario orchard growers and we want to see how their existing on-farm practices impact carbon storage," she adds. "With this work, we are not just filling a critical knowledge gap, but more importantly, we are filling a gap for on-farm implementation of practices by farmers."

In a three-year project with the Ontario Tender Fruit Producers Marketing Board and Ontario Apple Growers, announced in May

2024 by Vance Badawey, parliamentary secretary to the Minister of Transport and Member of Parliament for Niagara Centre, on behalf of the Honourable Lawrence MacAulay, Minister of Agriculture and Agri-Food Canada, the Vineland team is working with Ontario Ministry of Agriculture, Food & Agribusiness tree fruit specialists to collect and analyze soil samples, as well as surveying growers about their production practices.

Ontario apple orchards are a mix of older, traditional and new high-density plantings. However, there is a shift beginning to happen in tender fruit growing as well. A key question is how this shift in production practices is impacting soil health and carbon sequestration. Another goal is to understand how typical spraying, mulching and pruning practices also impact soil carbon sequestration.

"At Vineland, we understand soils in a way that so many others don't or can't and pair that with our expertise in horticultural production practices. This makes us an ideal agent to find the answers to these important questions," she says.

A particularly valuable asset is Vineland's soil laboratory and its capacity to look at more than just the chemical and nutritional components of soil, such as physical, hydrological and biological aspects. Looking at all characteristics of soil health can pinpoint what is challenging the soil and help build specific recommendations for growers based on what's needed.



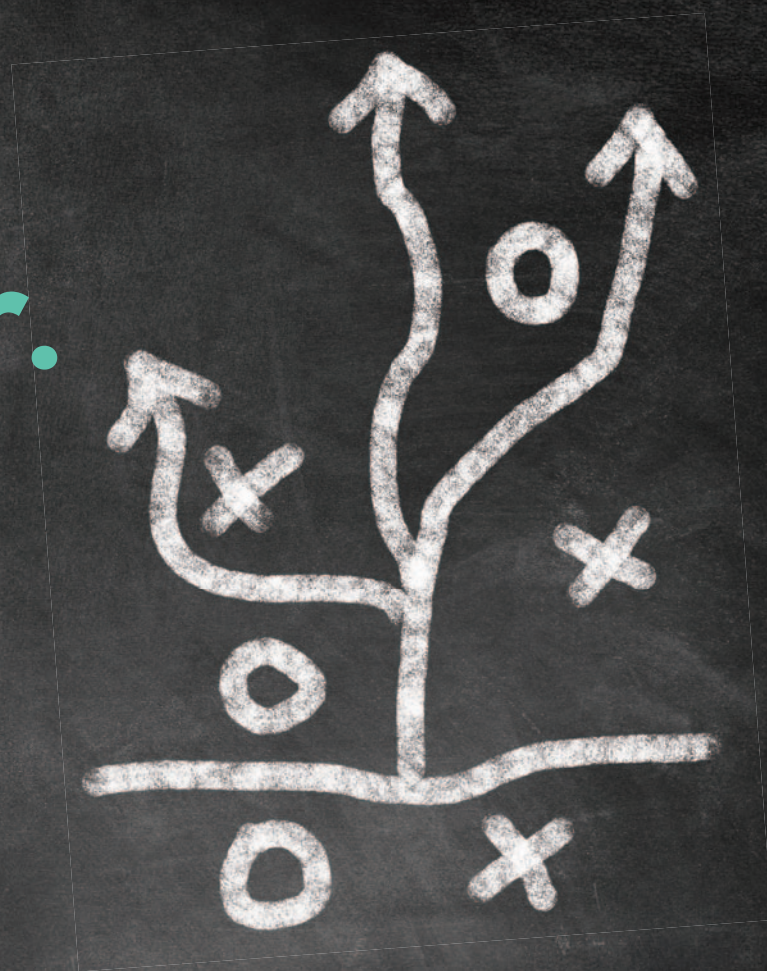
Opened in 2023, Vineland's newly restored Jordan Building is a dynamic hub for the Plant Responses and the Environment team, featuring office and cutting-edge laboratory spaces. This upgraded facility has significantly enhanced Vineland's research capabilities, including two state-of-the-art laboratories focused entirely on soil and substrate analysis. Over the past year this space has advanced optimal substrate blends for indoor strawberry production, assessed the impact of orchard practices on soil health and carbon storage, and investigated the effective use of various organic waste products in soils and substrates. Further work on the use of biostimulants to reduce synthetic fertilizer is underway in addition to determining the best use for vegetable and soil wastes from vegetable cleaning processes. These initiatives highlight Vineland's pivotal work in supporting the horticultural industry, small- to medium-sized businesses and government to develop solutions, foster innovation and advance commercialization.

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“When you have a long-life crop such as a tree, you must look at more than just nutrients. A tree needs to have a stable foundation to grow for a decade or more and our soil laboratory allows us to test all aspects of soil health and how they interact with each other,” deJonge says. “With a holistic view of the soil, you could improve the soil biota to get more long-term benefits from the soil and reduce fertilizer use, for example.”

The potential impact of this work could be significant. There are approximately 9,000 acres of tender fruit orchards in Ontario with a farmgate value in 2023 of more than \$85 million and more than 15,000 acres of apple orchards with an average annual farmgate value estimated at \$118 million over the last five years. The information gathered through this research will help the industry understand the impacts of its current practices as well as develop tools for future sustainability.

“Tree fruit growers have long been adopting sustainable farming practices to improve soil health and use water, fertilizer and crop science tools more efficiently to produce healthy food for our consumers,” says tree fruit grower Brian Rideout, chair of Ontario Apple Growers. “We know there are research and information gaps for growers in the area of carbon sequestration and sustainability, and filling those gaps will help determine next steps.”

While Vineland’s soil baseline work has just begun, it is part of a larger Life Cycle Analysis project for Ontario peach and apple orchards launched in 2024. This project also involves evaluating new peach varieties for climate resilience — work that is also taking place at Vineland. All of this work is funded in part by the governments of Canada and Ontario through the AgriScience Program under the Sustainable Canadian Agricultural Partnership, a five-year, \$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.

Did you know...

Vineland is now part of Ontario’s Soil Action Group, a collaboration comprised of government, industry stakeholders, conservation organizations and academic institutions to provide guidance and recommendations for implementing Ontario’s Agricultural Soil Health and Conservation Strategy.

“To understand carbon storage in the soil and how the dynamics of that relate to different planting practices, we need more information beyond orchards and being part of the Soil Action Group helps us get these broader perspectives,” says Rhoda deJonge.

Source: *Vineland Research and Innovation Centre*



Rhoda deJonge, PhD, director, Plant Responses and the Environment



Matthew Coker, technical assistant, Research & Development.

Supporting healthy soils

Best practices and tools lead to increased productivity

Farmers are responsible stewards of the land. They know that taking good care of the soil has multiple benefits. It sequesters carbon, supports crop growth, and reduces impacts from extreme climatic conditions, pest outbreaks, and nutrient imbalances.

“In a nutshell, enhancing soil health is a key element to crop productivity. Farmers know that conserving and caring for their soil is essential for long-term profitability and productivity,” says Mike Buttenham, Sustainability Manager with Syngenta Canada.

Soil health best practices

There are several principles farmers could consider adopting to achieve these benefits. The first is minimizing soil disturbance through no-till or reduced-till. This practice improves the diversity and functionality of soil organisms that decompose plant material, aids in nutrient cycling, enhances soil structure, and helps retain and build organic matter.

Keeping plants in the ground for as long as possible also promotes soil health. The use of cover crops between cash crops help to protect soil from wind and rain by building residue, which reduces soil erosion and increases carbon inputs. It also suppresses weed growth through competition and improves biodiversity by providing resources that stimulate microbial activity by pumping carbon into soils.

Crop rotation and precision application are other best practices that help build soil health and quality.

“Farmers who adopt these soil health practices could realize increased productivity through a more resilient crop,” says Buttenham.

In addition, soil health enables them to access their fields for planting and harvest at the right time because of improved drainage and soil strength.

Soil health tools

Achieving soil health takes a collaborative approach by all stakeholders, including Syngenta.

“We are committed to expanding the toolset that enables farmers to nurture the health of their soils for sustainable food production,” says Matt Wallenstein, Chief Soil Scientist for Syngenta Group. “I’m excited to collaborate closely with farmers from around the world to co-develop solutions that regenerate soil and nature.”

He highlights three global strategies on Syngenta’s soil health journey – building scientific excellence in soil health research and product development; measuring and capturing the value of improved soil health; and solving farmer challenges through novel products, services, and digital insights.

For instance, biological innovations offer new tools to improve soil health. Syngenta has added biological products such as Amatis™ to the toolbox, giving farmers additional choices to enhance soil health.

Amatis 3-0-8 contains selected humic acids, amino acids, polysaccharides, and vitamins

which help to revitalize and improve the rhizosphere and soil structure around plant roots, promoting root growth. Young plants with healthy roots are more capable of reaching essential nutrients and water in the soil, allowing for improved yield and fruit uniformity.

“Early stand establishment and root growth are essential to a high-performing crop. With Amatis, growers can enhance the soil environment, giving crops the best start to the season, and in turn, the greatest chance to achieve overall yield goals,” says Gustavo Roelants, Biologicals Marketing Lead at Syngenta Canada.

Amatis can be used on a wide variety of crops, including fruit and vegetables, potatoes, and row crops such as corn, wheat and soybeans. Amatis is soil applied with liquid fertilizers or transplant water.

“We are committed to expanding the toolset that enables farmers to nurture the health of their soils for sustainable food production.”

Matt Wallenstein
Chief Soil Scientist
Syngenta Group

For more on soil health at Syngenta: syngenta.com/en/sustainability/soil-health



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