THE INNOVATION REPORT

2021-2022

vineland
RESEARCH & INNOVATION CENTRE

Innovation for impact

With the reimagining of Vineland in 2007, we continue the more than century-long task of improving the economic viability, sustainability and competitiveness of horticulture in Canada.

Ian Potter, President & CEO

A recent independent study using a *Research and Technology Organization (RTO) Economic Impact Model* estimates Vineland's efforts since 2010 have contributed more than $518 million in direct economic impact.

With support from the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), Agriculture and Agri-Food Canada (AAFC) and industry collaborators, Vineland has achieved significant impacts for the sector. Highlights include:

- Development of a new Canadian-adapted sweet potato variety, Radiance, commercially launched in 2019 and rapidly scaling up, displacing imported product in grocery stores across Canada while offering consumers a delicious new variety.
- Advancement of horticultural automation through the development and licensing of technologies and the creation of a cross-Canada network.
- Launch of the spin-off bio-tech company Platform Genetics Inc. to commercialize Vineland's proprietary Deep Variant Scanning technology and provide Ontario-based plant genomics services to clients around the world.
- Development of protocols to improve production, planting and survival of trees and green infrastructure implemented by governments and adopted broadly in the nursery and landscape industry.
- Response to high priority greenhouse grower needs to develop science-based recommendations to improve uptake and success of biocontrol products.
- Commercialization of four superior landscape roses under Vineland's 49th Parallel Collection brand and commercialization of other varieties through licensed agreements.
- Development of new greenhouse tomato-on-the-vine (TOV) hybrids designed for Ontario growing conditions with higher yields, disease resistance and superior quality.
- Licensing of Vineland's first three varieties of greenhouse tomato hybrids to a seed company and scaling up toward commercial launch.

Significant opportunities still exist to advance the Canadian horticultural sector, including:

- Automating to address labour costs and availability challenges and grow market opportunities for Canadian manufacturing and automation industries.
- Creating access to plant varieties optimized for Canadian growing conditions to provide food safety, supply and security.
- Ensuring innovation capacity (both people and facilities) are in place to quickly address future unknowns — such as new devastating plant viruses and/or invasive species.

Through our Board of Directors' approved Strategic Plan and our strong relationships with governments and the industry, Vineland offers exceptional science and innovation for competitive R&D projects. This is achieved by investing in state-of-the-art infrastructure, executing business relationships to protect and advance intellectual property, supporting agriculture as part of Canada's natural climate change solution and continuing to meet consumer demand for horticultural products.

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Local breeding with global impact

Spreading happiness with a Canadian pear

The power of partnerships is promising an international future for a Canadian pear variety first bred four decades ago. Happi Pear™ has recently made its North American consumer debut thanks to the combined efforts of Vineland, Agriculture and Agri-Food Canada (AAFC) and grower-marketer Stemilt.

The pear traces its origins to the AAFC tree fruit breeding program, now under the auspices of Vineland, which has been working to bring some of the most promising varieties to market.

Happi Pear™ has attributes in demand with consumers: firm with sweet, juicy flavour and a sun-kissed rosy, yellow-green skin. And it's popular with growers too, consistently producing large fruit from trees that are resistant to fire blight, a destructive bacterial disease affecting apple and pear trees.

"We haven't released any branded pears in the U.S., so we're really excited about this one because it is grower-friendly with unique texture and flavour," says Brianna Shales, Marketing Director at Stemilt. "Vineland has a strong history of coming out with new fruit varieties."

Along with encouraging more Canadian growers and consumers to turn to pears as a local fruit choice, there are also high hopes this new fruit can help rejuvenate the U.S. pear market, where long-time staple varieties like Bartlett, Bosc and Anjou dominate. Although grower-friendly, the traditional varieties are not novel to consumers who are looking for a different product.

The pear could also be commercialized internationally. Vineland is working with AAFC, Stemilt and fruit tree producer Associated International Group of Nurseries (AIGN) to move the pear into non-North American markets.

"Europe is very much into pears and always looking for new selections. In the U.S, the market is growing and as we move into more varieties like Happi Pear™ that deliver for the grower and are a product consumers will enjoy, we can really make a splash," says Kevin Brandt of Brandt Fruit Trees. "We've worked with Vineland and their breeding programs for at least five years to commercialize some of their selections and we have a good relationship."

Brandt Fruit Trees is a member of AIGN, an organization founded by Lynnell Brandt in 1988 to manage intellectual property and work with nurseries to provide high quality fruit trees.

"With pears, if we can have a critical mass and more visibility on shelves, we can add excitement into the category and if we can also do that on a global basis, it will strengthen everything we do," adds Brandt.

Stemilt worked closely with Vineland's Consumer Insights team on marketplace testing in Ontario over the last two growing seasons.

Consumers at select Longo's stores were offered the opportunity to sample Happi Pear™ and provide feedback on its attributes, and in 2020, the Vineland team helped Stemilt in selecting just the right trademarked name for the new pear.

"Whenever we name or brand something, it's like naming a child and we go through a lot of different ideas. With the help of the Vineland team, we landed on Happi Pear™, which is short, fun, memorable — and something we hope will get people excited to try something new," says Shales.

Jennifer DeEll, Fresh Market Quality Specialist at Ontario Ministry of Agriculture, Food and Rural Affairs also worked closely with Vineland and Stemilt to conduct postharvest trials at the Simcoe Research Station.

In Canada, limited quantities of the new pear, grown in the Niagara region, southwestern Ontario and Quebec, were available in select Ontario grocery stores this year, ahead of larger production volumes expected in 2022.

At a glance

- **A new Canadian pear variety, Happi Pear,™ has made its consumer debut thanks to the combined efforts of Vineland and grower-marketer Stemilt.**
- **Vineland's Consumer Insights team worked closely with Stemilt on Ontario marketplace testing over the last two growing seasons.**
- **Happi Pear™ has attributes consumers love — firm with sweet, juicy flavour — but is also grower-friendly, producing large fruit from fire blight-resistant trees.**

A national solution against greenhouse pests

Greenhouse vegetable and flower growers are always looking for new tools to fight the pests that go after their crops.

Three promising native Canadian predators are now under evaluation at Vineland as part of a project led by Rose Buitenhuis, PhD, Program Leader, Biological Crop Protection.

She's been heading up the search for new ways to help growers deal with common greenhouse plant pests. Depending on the pest, growers can experience crop losses of five to 20 per cent; if the pest transmits a plant virus, losses can go as high as 100 per cent.

"Our overall goal is to find new native-to-Canada predators that are generalists and will be a good addition to an Integrated Pest Management (IPM) program in horticulture," says Buitenhuis.

She is currently testing three nabid predator species, collected in the Niagara region, Ontario to determine which one has the greatest potential to control pests in Canadian crops. Nabids are common natural enemies of greenhouse crop pests like aphids, spider mites, thrips and whiteflies.

Applied Bio-nomics Ltd. of British Columbia is Vineland's principal collaborator in the project. The goal, according to Buitenhuis, is to have a ready-to-go biocontrol package in place by March 2023. Because the work involves native Canadian predators, there's no need for additional regulatory approvals and if successful, the impact for growers will be immediate.

This work is part of a larger biocontrol project underway at Vineland. Vineland and Applied Bio-nomics have also partnered to bring to market a predatory mite first discovered in the St. Catharines, Ontario area by a Vineland researcher. This predatory mite was also tested in a first-ever trial on cannabis plants last year in partnership with Niagara College's Agriculture & Environmental Technologies Innovation Centre.

As part of research in laboratory and greenhouse settings, the three nabid species are being evaluated for their predation rate, which common greenhouse pests they feed on, how well they survive on supplemental food in the greenhouse and how well they perform in an IPM system with multiple pests.

Vineland's Caitlin MacDonald, Research Technician, Biological Control; Taro Saito, Senior Research Technician, Biological Control and Rose Buitenhuis, PhD, Program Leader, Biological Crop Protection.

"We don't know yet which one will be the best candidate but the goal is to have one that will meet all of those criteria," she says. "For now, they seem pretty similar so it is difficult to pick."

Specialized biocontrol agents are available for most common greenhouse crop pests. A versatile generalist predator would be a good addition to an IPM system as it would target whichever pest population was most prevalent. According to Buitenhuis, this makes pest control more robust and reliable for growers.

"More specialist biocontrol agents disappear when there is no pest to feed on, whereas this one will stay around and feed on other pests — that's why it must play well with others," she adds. "In biocontrol, you always need multiple beneficial insects working together."

Vineland is currently the only team comparing all three nabid species together, however, one is being investigated in Quebec as a possible control against tarnished plant bug in outdoor strawberry production. And Agriculture and Agri-Food Canada's research centre in Harrow is also looking at that same species as a potential candidate against future invasive species that may arrive.

"This is a Canadian solution to address problems faced by Canadian growers," says Buitenhuis. "And we won't face resistance issues like with pesticides where pests adapt to specific modes of action. Pests can change their behaviour but they can't avoid being eaten."

At a glance

- **Crop losses from pests can range from five to 20 per cent and up to total crop loss if the pest transmits a plant virus.**
- **Applied Bio-nomics Ltd. of British Columbia is Vineland's tech transfer partner on this made-in-Canada solution for the industry.**

A flavour boost with global potential

Vineland's Amy Bowen, PhD, Program Leader, Consumer Insights and David Liscombe, PhD, Research Scientist, Biochemistry.

Groundbreaking flavour research led by Vineland could be a game-changer for greenhouse tomatoes and the consumers that love them.

The quest for more flavourful fruit has long been a driving force behind Vineland's greenhouse tomato breeding work, which also harnesses the expertise of its consumer insights and biochemistry teams.

Now, together with scientists from Université Laval and the University of Florida, Vineland has zeroed in on genes responsible for flavour and created a genetic toolbox that breeding programs worldwide can use to develop tastier greenhouse tomato varieties.

It includes a collection of over 100 flavour-related tomato gene variants. More than 20 of those isolated genes impact aroma chemistry and six contribute to specific differentiated flavours.

"This is an exciting discovery in tomato breeding and for the Canadian greenhouse industry," says David Liscombe, PhD, Research Scientist, Biochemistry. "Traditional plant breeding can only go so far and we've approached it by understanding tomato sensory attributes that matter to consumers and by applying this knowledge to the selection process using genomics and metabolite profiling tools."

Vineland harnessed the power of its patented DVS technology, exclusively licensed to spin-off company Platform Genetics Inc., to identify tomato lines with rare versions of genes that could influence tomato aroma. A shortlist of candidates was generated from which the Vineland team grew plants and evaluated the fruit to find those with different aroma chemistry compared to the common or wild type version of the genes.

A different chemistry doesn't necessarily mean differentiated flavour, so that's where Vineland's consumer insights experts stepped in to taste test tomatoes.

"The results of the sensory studies identified at least six different lines with altered chemistry which were actually perceived by the sensory panelists as having different flavours," says Amy Bowen, PhD, Program Leader, Consumer Insights.

Based on how they align with attributes on the tomato flavour preference map developed by Vineland in 2017, some are predicted to score high in consumer expectations for taste and flavour.

Given this breakthrough, Vineland is using the most promising breeding lines with those consumer-preferred traits to add new, flavour-differentiated

tomato hybrids to its Canadian-adapted tomato-on-the-vine (TOV) program. Canadian growers have been trialing early hybrids which are being commercialized through an agreement with Eminent Seeds.

This will yield benefits to Canadian greenhouse tomato growers and consumers who buy their product but the impact of Vineland's new flavour discoveries will potentially be felt far beyond North America.

"The entire genetic toolbox is available to other tomato breeding programs interested in improving the flavour of their lines, a goal that could be achieved by using our breeding lines and their corresponding set of DNA markers," adds Bowen.

The project has also uncovered a new tomato metabolism pathway influencing the production of specific tomato aroma characteristics. According to Liscombe, a similar approach could uncover the genetics of flavour chemistry in other fruits and vegetables and support the development of new cultivars with differentiated and consumer-preferred flavour.

Additional resources for research work on more complex traits, like climate change resilience, are being investigated and in development.

At a glance

- Groundbreaking flavour research led by Vineland has zeroed in on genes responsible for differentiated flavour in greenhouse tomatoes.
- Vineland is using breeding lines with the most promising traits to add new, flavour-differentiated tomato hybrids to its Canadian-adapted tomato-on-the-vine program.
- A genetic toolbox with over 100 flavour-related tomato gene variants is available to breeding programs worldwide to develop tastier greenhouse tomato varieties.

Case Study

The sweet smell of sweet potato success

How Vineland created a new Canadian industry

Canadians love sweet potatoes — so much so that Canada was the world's third largest importer in 2020 behind only the Netherlands and the United Kingdom. That's now changing with locally grown sweet potatoes, led by Radiance, a new Canadian variety developed by Vineland that is starting to replace imports in grocery stores.

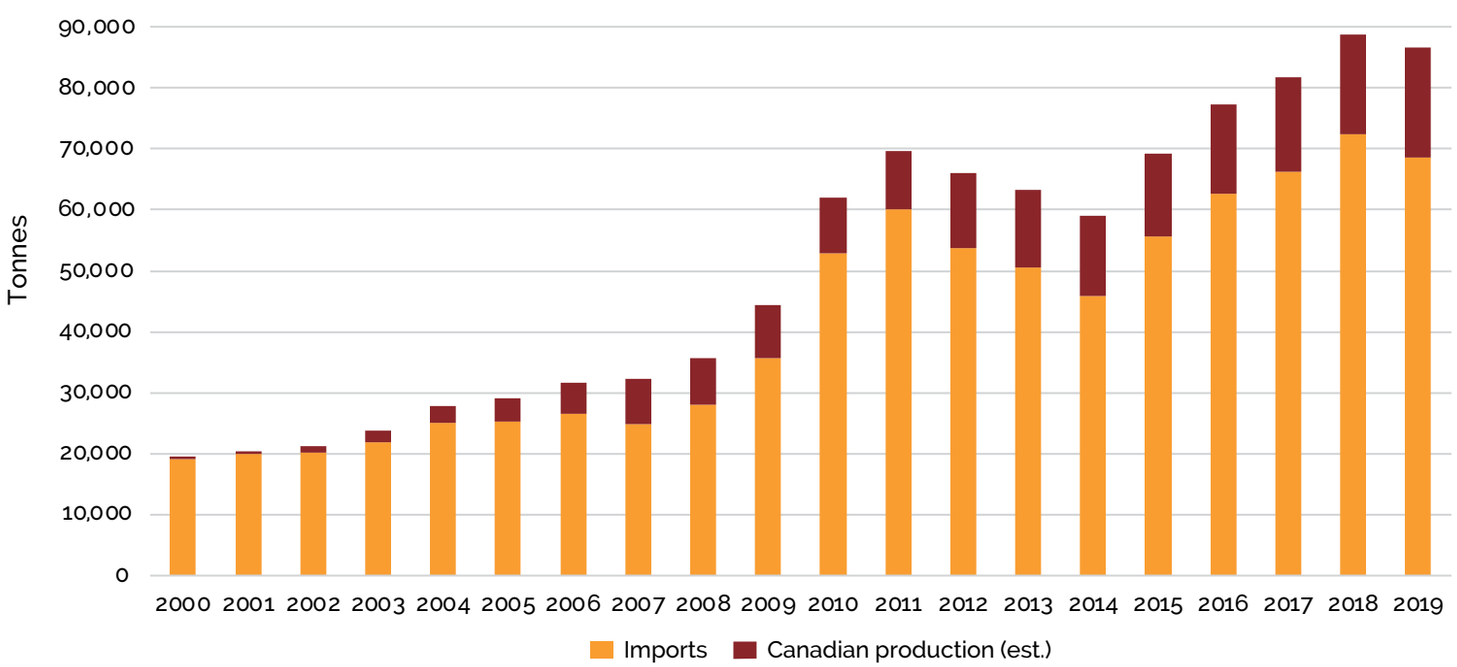
The average Canadian consumption of the antioxidant-rich tuber has been approximately 1.3 kilograms of sweet potatoes per person annually over the last decade. This translates into an opportunity for about 15,000 acres of sweet potato production a year to meet Canadian consumer demand and offset imports.

Canadian sweet potato production has been steadily increasing from only 600 acres of production to over 2,200 acres in 2019, mostly in Ontario's southwestern Norfolk County. Covington, developed in North Carolina and not ideally suited to Canada's cooler, shorter growing season, is the most commonly grown sweet potato variety in Canada.

This identified the need for high-yielding sweet potato varieties suitable to Canadian conditions and mature enough for harvest in September while holding up well in storage. Alongside, is local production of the slips or sweet potato cuttings growers would need to cultivate those new Canadian varieties.

To meet this challenge, Vineland launched a Canadian sweet potato breeding program in 2012.

Growth of sweet potato production in Canada



Vineland delivers Radiance

Developed by Vineland in collaboration with Louisiana State University, Radiance is the first sweet potato variety bred by Canadians for Canadians.

The sweet potato

Red-skinned with deep orange flesh, Radiance checks all the agronomic boxes for sweet potato success in Canada:

- Matures early and stores well
- Can be harvested between 11 and 20 days earlier than Covington and Orleans, two other leading commercial varieties grown in Canada
- Yields at least 20 per cent higher than Covington and Orleans

Vineland consumer research has shown the majority of consumers prefer a bright orange sweet potato that is firm, uniformly coloured and less moist with a sweet caramel-like flavour.

Here too, Radiance hits all the right notes. Vineland's trained sensory panel gave Radiance high marks as being sweeter, stickier and firmer, making it a clear taste and texture winner compared to other commercially available sweet potato varieties.

The supply chain

Vineland realized early on that ensuring Canadian growers have access to locally grown slips would be critical to Radiance's success. Most sweet potato slips have traditionally been produced in the United States, presenting an attractive opportunity to establish a new sweet potato propagation industry in Canada.

This is part of Vineland's value-chain approach to variety development. As a result, the organization is actively pursuing licensing agreements with slip producers to develop a Canadian supply chain for Radiance and work with growers in establishing a domestic slip production industry.

The opportunity

- 1.3 kg: average annual Canadian sweet potato consumption per person
- 15,000 acres: production needed to satisfy annual Canadian sweet potato demand
- $9,000 per acre gross revenue: sweet potatoes are a high value crop
- 165 million: estimated sweet potato slips needed annually to fully meet Canada's production needs

The challenge

- High-yielding sweet potato varieties suitable to cool climate growing conditions
- Develop a Canadian slip production industry to support growers

The achievement

- Radiance: a high-yielding, high quality sweet potato variety developed in Canada for cool climates with shorter growing seasons; launched in 2019
- Radiance supply chain established to provide slips to growers across Canada

Meet a producer

2021 marked the first time Alberta Sweet Potatoes has grown Radiance slips. Located near Jenner, Alberta, a small town north of Medicine Hat, the business is headed up by livestock and grain farmers Stephanie Lessner and her parents Marjorie and James Larson.

With an increasing interest in sweet potato production on the rise in western Canada, the family decided to fill a niche market by offering growers a local source for sweet potato slips.

"I am excited about the opportunity of supplying growers in British Columbia and the Prairie provinces where sweet potato cultivation is growing and access to slips through traditional suppliers can be a challenge," says Lessner.

The company plans to ramp up production in the coming years to meet expected increasing demand from western Canadian growers.

To date, Vineland has licensed Radiance to five Canadian and one U.S. slip producer, with the goal of building a coast-to-coast network to meet Canadian growers' demand for sweet potato slips estimated at up to 165 million slips annually.

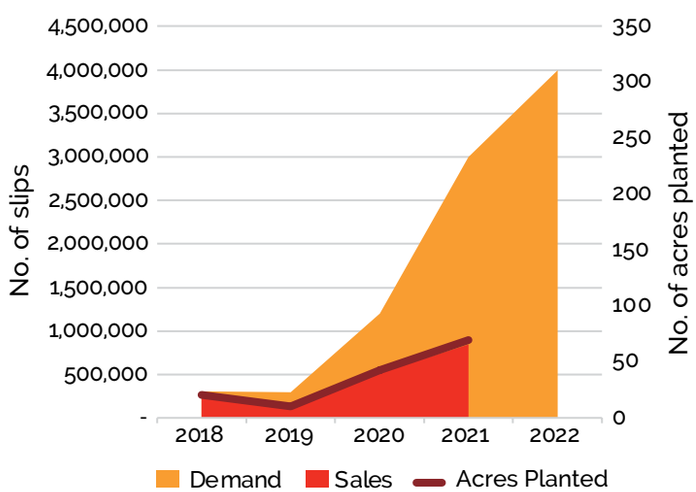
To support slip propagators, Vineland has also developed and published a best production practices guide with agronomic information including cost of production and revenue potential models to grow high quality, high-yielding sweet potato slips in controlled environments.

The impact

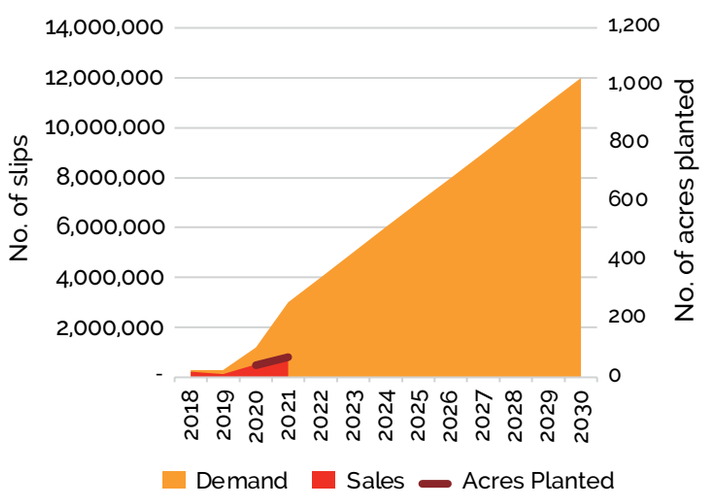
Canada needs approximately 15,000 acres of homegrown sweet potato production to satisfy consumer demand and offset imports. Generating a gross revenue of $9,000 per acre, Radiance and other made-for-Canada sweet potato varieties from Vineland are a game changer for the Canadian vegetable industry.

This lucrative opportunity to supply Canadian growers with local sweet potato slips is profitable for the slip producer and helps growers avoid slip deterioration due to shipping and border crossing delays from the southern United States.

Radiance demand and sales 2018-2022



Projected demand for Radiance by 2030



Radiance is the result of a successful collaboration between Vineland, Louisiana State University and Canadian growers who contributed to its development by testing, growing and delivering benefits to a wide range of stakeholders, including consumers.

Through the development of Radiance, Vineland has been instrumental in launching a whole new segment of Canadian horticulture and has laid the foundation for a made-in-Canada sweet potato industry that is also drawing international attention.

Going global

Canada is not the only cool climate country where sweet potatoes are popular. Countries in northern Europe, for example, have similar growing conditions and growers are interested in adding sweet potatoes to their production.

That's why, in response to an interest from Europe and beyond, Vineland is now actively exploring opportunities to license its sweet potato varieties for production outside of North America.

Latest update: In Fall 2021, Vineland signed an agreement with Volmary GmbH, an independent German company that has been in the plant breeding and distribution business since 1925, to distribute five Vineland sweet potato varieties in Europe.

Starting in 2022, Volmary will be adding the following Vineland varieties to their existing line up of sweet potatoes sold under the trademarked Erato® brand: Vineland Early Orange, Vineland Compact Orange, Vineland Intense Orange, Vineland Sunrise and Vineland Salmon Orange.

What Vineland delivered

By the numbers

- Launched Radiance in 2019, a new improved commercial sweet potato variety
- Expanded production of Radiance from 10 acres in 2019 to 70 in 2021 — estimated to reach approximately 300 acres in 2022 and 1,000 acres by 2030, offsetting dependence on imports
- 39 Canadian growers now producing Radiance
- Established a slip production industry in Canada (currently serving six provinces) with demand estimated at 165 million slips annually

Grower checklist

- Grower-friendly Canadian sweet potato variety preferred by consumers
- Agronomic and economic guidance for growing Radiance
- Production guide and commercialization support for slip producers entering the business

An automated future for Ontario's processing vegetable sector

Keith Robbins, OPVG General Manager

Growers who cultivate processing vegetables in Ontario rely heavily on labour to plant, manage and harvest their crops. In fact, reliable access to workers is the number one challenge growers face, one that has become even more acute due to the COVID-19 pandemic.

Automation is one solution to the problem, a solution that could also drive efficiency, profitability and growth in other industrial sectors, such as manufacturing.

The search for where those opportunities lie and how to best harness them for growers and processors led Ontario Processing Vegetable Growers (OPVG) to partner with Vineland and its automation team to develop an innovation roadmap for the sector.

"Working with organizations like OPVG to create technology roadmaps is an important way for Vineland to fill technology and knowledge gaps for the industry and assist with strategy development to ensure long-term impact and results for the horticulture sector", says Hussam Haroun, Vineland's Program Leader, Automation.

"As a sector if we are going to invest in the future, let's do it for the long-term and look for solutions that are going to also help growers be more efficient and control costs," says OPVG General Manager Keith Robbins. "Vineland has such a fantastic reputation for horticulture innovation along with the proper skillset and capacity that they were an obvious choice to partner with us on developing this resource."

The white paper recommends growers adopt cost-effective farm management software to improve labour and supply chain management and to consider using technology to streamline workflow, like an automated weeding system that also reduces the need for expensive chemical products.

Emerging space technologies for food processing and packaging could be adapted to extend produce shelf life. Robots and drones could also help with field scouting, foreign object detection and removal and harvesting.

Tomatoes, carrots and sweet corn are the top three processing vegetable crops grown in Ontario. Labour makes up 20 to 60 per cent of total production costs, with harvesting the most labour-intensive on-farm task. Other time-consuming activities include transplanting, weeding, picking and stemming, grading and removing debris from field crops.

"This automation roadmap helps us in the long-term as we look at where we want to invest, how we can partner for innovation and what kind of support growers will need to get there," says Robbins.

The Ontario Ministry of Agriculture, Food and Rural Affairs' Agri-Food Prevention and Control Innovation Program funded the development of the processing vegetable sector innovation roadmap. Vineland was also involved in the development of sector roadmaps for asparagus and berries. The provincial government has since launched a new agri-tech innovation cost-share program for Ontario's agri-food sector that could support many of the recommendations identified by the roadmaps.

Zeroing in on a new Canadian apple

Apple breeding efforts at Vineland took a significant step forward this year as Canadian growers received the first test trees for on-farm trials.

Five growers in Ontario and one each in Nova Scotia and Quebec are putting Vineland's most promising new apple cultivars to the test in their orchards for the next several years. Each grower received three candidates and will collect data on all aspects of tree and fruit performance to help make a final selection.

It's step one of what Rachael LeBlanc, Research Scientist, Plant Breeding hopes will be an ongoing pipeline for grower trials.

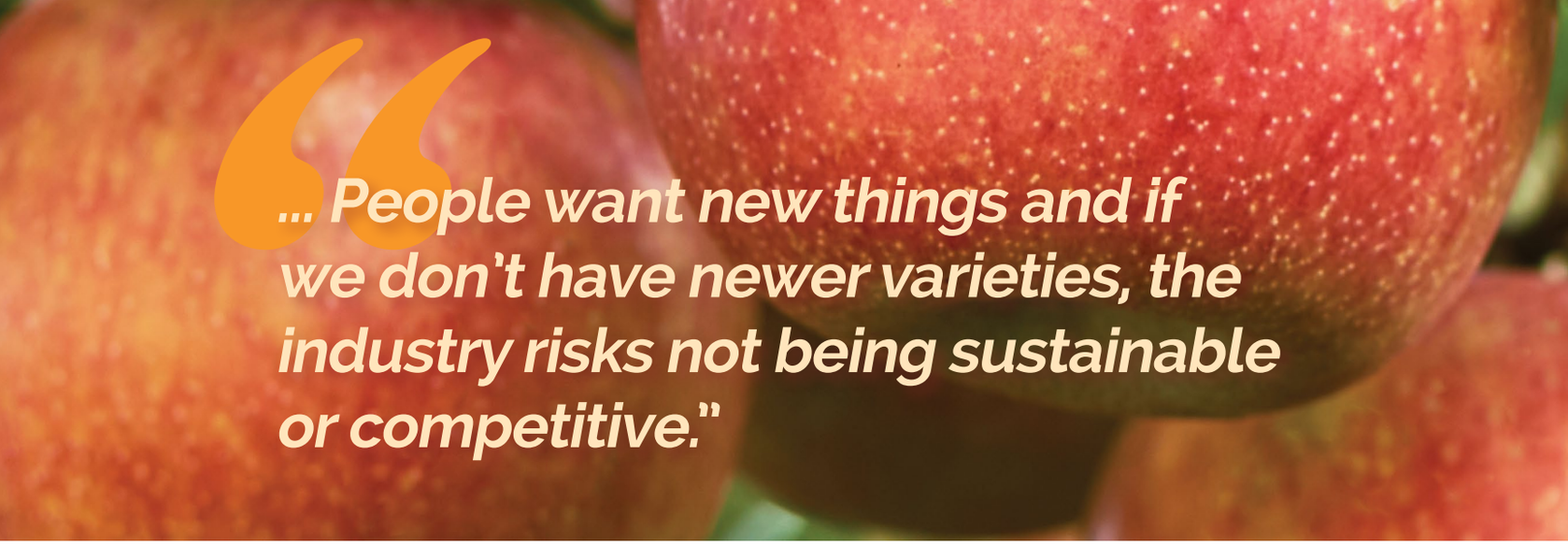
"We want to make sure our varieties grow well across all of Ontario's apple-growing regions, as well as other provinces," explains LeBlanc. "At this stage of the breeding process, we want to see how well trees perform in a real-world setting and make sure the fruit looks and tastes the same across all regions."

To get this far, cultivars already underwent considerable testing and evaluation to ensure only the most promising candidates continue to move through the lengthy breeding process. Vineland launched its apple breeding program in 2011 when first crosses were made and since 2017, researchers have annually selected 10 to 20 trees to move forward into further testing on the Vineland campus.

Candidate trees must first and foremost produce crisp, juicy fruit but researchers also look at characteristics like fruit storability, flavour, tree performance and disease resistance to select the most promising candidates.

Vineland's trained sensory panel has already evaluated apples from this current crop of cultivars to ensure taste, flavour and textures align with preference and consumer evaluations in late 2021 will further validate those findings.

Vineland's Rachael LeBlanc, Research Scientist, Plant Breeding



"... People want new things and if we don't have newer varieties, the industry risks not being sustainable or competitive."

Vineland's biochemistry and consumer insights experts have been working concurrently with the apple breeding program to understand defining apple characteristics most liked by consumers. They are also developing tools to make it easier and faster to screen for desirable characteristics — like flavour and texture — and choose which cultivars to advance for further evaluation.

Ultimately, their work will ensure only the apples that most appeal to consumers will come to market.

"We look at what's known about apple genetics and biochemistry and we know that there is one gene that controls many of those flavour volatiles. We focus on developing our own DNA markers for that gene and select seedlings based on those markers," explains David Liscombe, PhD, Research Scientist, Biochemistry.

Markers, which Vineland has already developed for disease resistance and flavour, will lower the cost and shorten the time it takes to bring these new varieties to market.

According to LeBlanc, the Canadian apple industry is looking for new varieties to replace older ones that are no longer as popular with consumers or fill a harvest window so growers can pick fruit consistently throughout the fall.

That's precisely what attracted Cleaver Orchards to participate in Vineland's variety trial program. The Simcoe-area family business currently grows Honeycrisp, Gala, Ambrosia, McIntosh, Empire, Red Delicious and Golden Delicious, selling to both Norfolk Fruit Growers and at an autumn roadside stand.

"The hope is that we find something that really stands out amongst the current selection of varieties being grown in the province. We are always looking for high quality early or late varieties that fall outside of the picking window of Gala, Honeycrisp and Ambrosia and have good storage life," says grower Casey Cleaver.

Once a variety is ready for commercialization, Vineland will be looking for a partner to bring it to market in Canada and internationally. The first Vineland apple variety is expected to be available for growers to plant by 2028, with the first fruit on the market for consumers by 2030.

"We have to predict what people will want 10 years from now, so what kind of apples will our kids be shopping for when they are 20? If we had a crystal ball, it would be so much easier," says LeBlanc. "People want new things more often, and if we don't have our own newer varieties, the industry risks not being sustainable or competitive."

At a glance

- **Growers in Ontario, Quebec and Nova Scotia are now testing the first apple varieties from the Vineland breeding program.**
- **Vineland researchers have identified the key characteristics consumers want in apples and developed tools to shorten the time it takes to bring new varieties to market.**
- **The industry needs new Canadian varieties to remain sustainable and competitive.**

Growing a cross-country innovation network for horticulture

In Canadian horticulture, Vineland is well known for being an innovation leader. There are limits, though, to what the organization can achieve on its own. There are also untapped innovation opportunities across the wider national agri-food and agri-tech sector that can contribute to industry growth, sustainability and success.

That's why Vineland has put a focused effort into expanding its reach across the country and supporting the growth of the national agriculture innovation sector.

"As a not-for-profit research organization, we can expand our national impact by working closely with like-minded groups with whom we can collaborate to share ideas, opportunities and projects," says Tania Humphrey, PhD, Vice President, Research and Development. "Through partnerships, we can leverage this expertise into greater outcomes."

During the last several months, Vineland has solidified a partnership with Bioenterprise which is the driving force behind Canada's Food & Agri-Tech engine, a growing national innovation network with an explicit focus on agriculture, agri-food and agri-technology. The two organizations have worked together in the past and a newly signed Memorandum of Understanding paves the way for new and bigger opportunities in horticulture-focused innovation.

"The partnership is a natural fit that will help both Vineland and Bioenterprise expand their national footprints and further support a cross-Canada approach to research and innovation," says Humphrey. "We look forward to accessing their network of experts, mentors and funders while contributing our skills and expertise."

At a glance

- **Vineland extends its in-house expertise through partnerships with innovation-focused organizations as well as project-specific collaborators.**
- **Vineland secured partnerships with a leader in the Canadian innovation space this year, Bioenterprise, and is a partner with CAAIN, NGen and the new Greenhouse Technology Network.**
- **Partners beyond the agri-food sector are needed to drive innovation and commercialization with both levels of government supporting that call to action through significant investments.**

Vineland is taking part in a three-way partnership with Niagara College and the University of Guelph in developing the Greenhouse Technology Network. While still in its infancy, this collaboration highlights combined capabilities to help attract new businesses and opportunities to the agriculture sector.

Vineland is also part of a cross-Canada network through partnerships with the Canadian Agri-Food Automation and Intelligence Network (CAAIN), a nation-wide automation initiative for agriculture that can trace some of its origins back to Canada's Automation Cluster housed on Vineland's campus, and Canada's Advanced Manufacturing Supercluster NGen.

According to Humphrey, Vineland also brings in project-specific partners when it needs to complement its in-house expertise with additional strategic knowledge to help drive impact.

This approach has spelled success for Vineland, including:

- New made-in-Canada tomato on the vine varieties (see page 8 for the latest development)
- Development of a new sweet potato industry in Canada (find a case study on page 10)
- North American launch of a new branded pear variety (see page 4 to learn more about Happi Pear™).

"We know our strength lies in research and innovation," Humphrey adds. "That's why we are always looking across the country and internationally for new ways to further leverage our expertise, build our network and connect to more people, companies and organizations. Working together, we can create more impact."

New urban greening initiative focuses on innovation for Canada's urban landscapes

Vineland's Darby McGrath, PhD, Program Leader, Plant Responses and the Environment; Ryan Munroe, Senior Research Technician, Environmental Horticulture and Charlene Williams, Research Technician, Environmental Horticulture.

An exciting new chapter in urban greening and healthy Canadian landscapes has begun and is centred at Vineland.

The new public-private Greening the Landscape Research Consortium to address common urban landscape challenges has launched with an initial cohort of 13 members. Together, consortium participants will set research priorities reflecting industry needs and access training and skills development, innovative data, network connections and emerging knowledge. They will also take part in an urban forestry pilot project.

"One of the key features attractive to members is the opportunity to build a customized case study. One of the challenges in urban forestry is gaps in accessing proper solutions — everyone wants nature-based solutions but how do we do it and what type of information can we rely on?" says Darby McGrath, PhD, Program Leader, Plant Responses and the Environment. "We want to fill those gaps with evidence-based research."

Projects are now underway and consortium members will have access to case study findings and resources as part of Vineland's goal to build an information network and a collective capacity for solving common industry challenges.

Current consortium partners make up a range of stakeholders from across the industry, such as municipalities, government, conservation authorities, non-governmental organizations, professional associations, suppliers, nurseries, landscape professionals, developers and consultants. A new membership intake will open in spring 2022.

"The reason for joining the consortium is different for each member and is related to where they fit in the industry. For some, what is important is being able to test and solve a real problem and create a value proposition in their area," adds McGrath. "For others, it's to access information and learn more about what others are doing."

Having a forum to engage directly with participants across the entire industry was the main driver behind the City of Burlington's decision to join the consortium. The city has been encouraging urban forestry and the concept of canopy growth, with healthy, long-living trees critical to success.

"You have to look at the entire value chain to achieve the desired result, which for us is a good, healthy tree that will last at least 40 to 50 years. That starts with quality nursery stock, having a qualified vendor plant the trees and us, the end-users, caring for the trees over a few years," says arborist Steve Robinson, Burlington's Manager of Urban Forestry. "It's something we've identified for many years as a need for the industry and having Vineland take that quarterback position to bring everybody together is invaluable."

Physical project sites will be set up with each consortium partner so they are geographically relevant and some of the work is expected to also take place at the newly anticipated TreeCulture Research Park on the Vineland campus.

The park is the first of its kind in Canada and will include a laboratory, field testing and flexible spaces for collaboration, education and demonstration. The open-air laboratory will feature Canada's only individually instrumented tree compartments for replicated testing to mimic a range of urban conditions.

Integrated sensor technology in compartments will log trees' responses to stress in real-time and monitor weather, soil function and canopy health.

"Tree treatments will be different in each compartment and we are combining different sensing technologies to gain an understanding of what trees are experiencing," McGrath says.

The goal is to have a portion of the outdoor laboratory compartments ready for a phased-in approach by spring 2022.

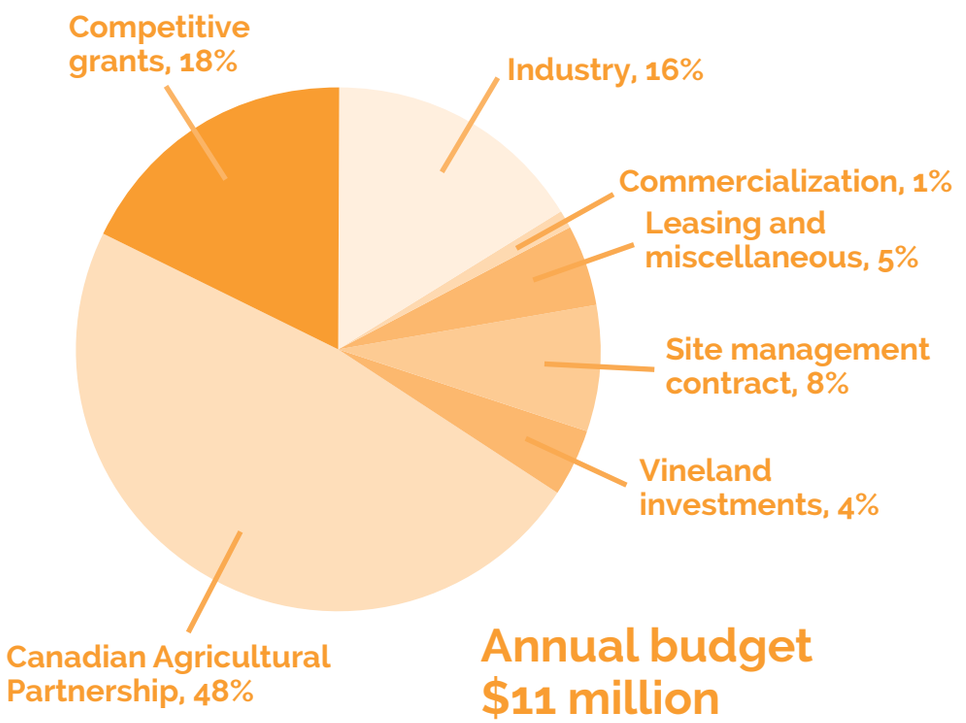
The Consortium and TreeCulture Research Park have evolved from more than a decade of urban forestry research at Vineland through its Greening the Landscape program, which focused on improving tree survival and increasing the sustainability of urban trees and shrubs.

At a glance

- **Vineland has launched a Greening the Landscape Research Consortium to set research priorities for the industry and build an innovation network across the value chain. Membership information is available at https://tinyurl.com/ntudvwjn.**
- **Each consortium member is participating in a research case study to find a solution to urban landscape problems they are facing, with results shared among all partners.**
- **Vineland is developing a unique TreeCulture Research Park that will be home to Canada's only individually instrumented tree compartments to mimic a range of urban conditions.**

Vineland by the numbers

Revenue April 1, 2020 – March 31, 2021



Annual budget $11 million

Partnerships

164 partners*

113 industry **15** academic

36 government

From

10 **Canadian provinces and territories** (Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, Québec, Saskatchewan and Yukon)

15 **countries** (Australia, Belgium, Canada, China, France, Germany, Greece, Luxembourg, Netherlands, New Zealand, Spain, Switzerland, Taiwan, United Kingdom and United States)

*For fiscal year 2020-2021

Commercialization

10 Vineland developed technologies with patents issued/filed

26 plant varieties protected by PBR and/or U.S. plant patents

8 trademark applications filed

45 technologies commercialized

87 per cent of Vineland's protected IP is out-licensed and/or under further collaborative R&D with business partners

Research capacity and performance*

19
research scientists

$198,141
research intensity (research revenue generated per researcher)

$7,315
innovation strength (royalties generated per researcher)

83%
grant application success rate

65
peer-reviewed publications (cumulative total)

1,799
citations (cumulative total)

*For fiscal year 2020-2021

Job creation, education and training*

82 full-time staff

57 highly qualified positions

2 Postdoctoral scholars

4 PhD students underway

2 MSc students graduated, **1** more underway

17 sensory panelists

*For fiscal year 2020-2021

Karen Belaire
Board Chair

Vineland's Board of Directors (2021-22)

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- Ray Price

Vineland Research and Innovation Centre is a uniquely Canadian results-oriented organization dedicated to horticulture science and innovation. We deliver innovative products, solutions and services through an integrated and collaborative cross-country network to advance Canada's research and commercialization agenda.

We are an independent, not-for-profit organization, funded in part by the Canadian Agricultural Partnership, a five-year federal-provincial-territorial initiative.

We are located in Canada's Niagara Region, on the traditional territory of Anishinaabeg, Ojibway/Chippewa and Haudenosaunee peoples, this territory is covered by the Upper Canada Treaties.

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