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Ontario Horticulture Research Priority Report 2016



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Ontario Horticulture Research Priority Report

2016



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May 2016



Introduction

Innovation and research can be a driving force that enhances growth, profitability and sustainability in any sector, including horticulture. To achieve the greatest impact from investments in research and innovation, there is a need for a co-ordinated, strategic approach that achieves a balance of both short and long term goals.

Horticulture is a unique and challenging sector due to its sheer diversity, with around 150 different fruit and vegetable crops, thousands of ornamental species plus mushrooms, maple syrup and honeybees. Defining research priorities for this large, diverse sector is a challenging task that requires co-ordinating input from many different groups.

As part of our commitment under *Growing Forward 2*, Vineland Research and Innovation Centre (Vineland) facilitates the collection of the Ontario horticulture sector's research priorities. These are then used as input for OMAFRA's priority setting system, they are used to shape Vineland's own research strategy and they are provided to Agriculture and Agri-Food Canada and other research providers to assist them in meeting the needs of the Ontario industry.

Vineland's role in the process is simply as a facilitator, the actual delivery of research projects will continue to include the University of Guelph, AAFC, Vineland and other research providers.

Approach

Priority-setting is an evolving process for which Vineland works alongside the major sector organizations to invite participants and design workshops that ensure the broader needs and opportunities of the sector are identified.

Due to the diversity of crops, production systems and consumer markets, separate processes are conducted for the edible and ornamental horticulture sectors.

Wherever possible, a full value chain perspective is taken although it can be challenging to bring together what can be disconnected or even competing groups within the sector. Meetings are chaired by independent facilitators.

Even though this is an industry consultation process, it is important to include some balanced researcher input as the best outcomes are achieved through open dialogue and interaction. Industry perspective brings the "need" and science provides "what's possible".

Participants in the process are encouraged to take a big picture view of the long term growth and sustainability of their sector in order that the priorities achieve a balance of long and short term goals. In this context, "short-term" refers to a goal that could be achieved

in one to three years in a single research project and “long-term” goals may take many years to achieve with multiple projects, grants and researchers involved.

Specific topics for evaluation and registration of pesticide products are not considered in this process as they are covered by the Minor Use Pesticide Program.

As research priorities generally remain fairly consistent from one year to the next, formal priority setting meetings are not held every year but rather on a rotating schedule every two to three years. In interim years, sector groups are given the opportunity to edit their priority list to reflect any new issues that may have arisen. This report is prepared and distributed each year to include the latest updates.

The development of a research strategy or priority list is the first step that helps to provide focus and direction. Then, actually implementing these priorities requires leadership from both industry groups and researchers. Both need to work together to come up with specific project ideas and matching funds and develop proposals for applying to research funding programs.

Note: in this report, numbering has been used where sector groups have indicated clear prioritization, otherwise, bullet points represent non-ranked priorities.

Sector Consultation

The Ontario Fruit and Vegetable Growers Association partnered with Vineland to host a research strategy workshop in November 2014 with the goal of defining the top five research priorities for each crop group. Grower organizations were invited to nominate two representatives to participate on their behalf and a number of researchers from relevant fields were invited to contribute their expertise.

The first part of the workshop agenda included a number of short presentations from research and technology organizations to highlight general scientific developments in the major areas of 1) labour and automation; 2) crop protection products; 3) biopesticides and systems approaches; and 4) plant breeding and genomics. Following the speakers and a general discussion of strengths and challenges within the sector, the participants broke out into crop groupings to discuss commodity-specific research needs.

Much of the workshop discussion was taken up with pest management issues and concerns were expressed about the difficulty of narrowing down priorities for a multitude of different pests on so many different crops. In response to this feedback and after additional consultation with grower groups, it was later decided to define a single overarching pest management priority, to include all crops, all pests, diseases and weeds. This more inclusive approach now puts the onus back onto researchers to engage with grower organizations and ensure that research proposals clearly articulate the importance of a particular pest issue and the potential value of the solution being proposed.

With the pest management issues all captured within a single research priority, there were 51 other research topics remaining which needed to be narrowed down further. Grower groups were asked to select one additional non-pest management topic from the others already on the list. All groups actively engaged in this process and the resulting shortlist is presented below. The full commodity specific long-list follows, along with some additional detail regarding specific pest management issues (where provided).

In 2016, all groups were invited to update or modify their selections and the current report reflects these latest changes.

Evolution of the Process

The research priority setting process is continually evolving and as we seek to improve and perfect the approach, we appreciate the feedback from all involved. During the last round of consultation, the practical need for narrowing down the priorities was more broadly accepted and grower groups became more engaged in the decision-making process. Going forward, we will focus on re-introducing the value chain perspective.

We have also consulted recently with representatives of the field vegetable crops with the goal of re-organizing this category into more equitable groupings before the next round of consultations. The approach that has been agreed upon will see the creation of three new categories of Bulb & Root Vegetables; Leafy Vegetables & Crucifers; and Fruiting Vegetables in place of the previous categories of Field Vegetables and Asparagus.

Edible Horticulture Research Priority Shortlist

Note: these priorities have been selected by commodity representatives specifically as input for the OMAFRA research priority-setting process.

- **All crops:** Developing integrated pest management strategies for horticultural production systems that incorporate pesticides, alternative control measures, host resistance and/or take a systems approach to controlling pests, disease and weeds.
- **Apples:** Develop cultural management strategies including in-field maturity assessment; variety breeding and evaluation; rootstock evaluation; and/or cultural practices for optimum yield and marketability
- **Asparagus:** Improve shelf life and understand the factors that influence it, e.g. importance of cooling, packing etc.
- **Berries:** Product quality and marketing – how to supply quality fruit that stands the rigors of the wholesale marketing chain; how to capitalize on the “Buy Local” movement
- **Field Vegetables:** Evaluate the entire water management process, including regulatory hurdles and identify ways to conserve and reduce water use in all areas of production e.g. irrigation and fertigation efficiencies; evaluate new processes to minimize or replace the use of water in wash tank operations while maintaining a food safety focus.
- **Ginseng:** Identification and remediation of the factors that lead to pesticide residues in ginseng and other non-target effects of pesticide use.
- **Grape and Wine:** Develop a clean plant program and national standards to ensure virus negative material is propagated and planted within Ontario.
- **Greenhouse Vegetables:** Develop strategies for 12 month production.
- **Honeybees and Pollination:** Research the potential improvement of pollinator health through the implementation of an IPM program in crop production. Adopting IPM strategies can benefit both crop production and bee health. This should include a focus on pest and disease monitoring and establishing economic thresholds for treatment application.
- **Maple Syrup:** Assess the impacts, including tree growth and syrup quality, of the use of TreeAzin (a natural systemic insecticide) for Asian Longhorn Beetle.
- **Mushrooms:** Address labour issues by evaluating automation systems, e.g. pick and pack, as well as alternatives or enhancements to the Foreign Labour Program.
- **New and Specialty Crops:** Developing agronomic practices and efficiencies: e.g. propagation and establishment, fertility and water requirements, season extension, harvesting methods and post-harvest handling and storage issues. Research on efficient production methods that impact labour, energy, and water requirements.

- **Potatoes:** Identify and evaluate potato new potato lines that can help to provide a 12 month supply of high quality potatoes to the Ontario fresh and chip processing industries through value added traits such as early maturity, long term storage-ability and nutritional potential, any of which would serve to enhance the competitiveness and profitability of the Ontario potato industry.
- **Tender Fruit:** New variety acquisition, development, best management and commercialization processes that result in; higher value varieties suited to Ontario; an increase in organic production; fast tracking of commercial production of promising varieties; disease resistance especially to fireblight, black knot and bacterial spot
- **Vegetable Processing:** Enhancing Raw Product Quality e.g. varieties, crop protection, suitable production systems.

Edible Horticulture Research Priorities by Crop Group

All Crops

Developing integrated pest management strategies for horticultural production systems that incorporate pesticides, alternative control measures, host resistance and/or take a systems approach to controlling pests, disease and weeds.

Apples

- Identify post-harvest strategies for optimal apple quality
- Engage in research to support market strategies and new product development. Market strategies might include apples for health, etc. New product strategies might include slices, chips, etc.
- Increase production efficiencies, e.g. labour, pest management and water use, etc.
- Develop cultural management strategies including:
 - in-field maturity assessment
 - variety breeding and evaluation
 - rootstock evaluation
 - cultural practices for optimum yield and marketability
- **Additional Pest Management Details:** Develop innovative Integrated Pest Management (IPM) knowledge and practices that incorporate new pesticides; alternative control measures; understanding pests and beneficial dynamics; and/or understanding impacts on food quality and storability.

Asparagus

- Reduce production costs, particularly relating to crown populations and fertilizer rates
- Improve shelf life and understand the factors that influence it, e.g. importance of cooling, packing etc.
- **Additional Pest Management Details:**
 - Develop integrated disease control to address: rust; fusarium; stemphelium purple; fertility (as it relates to disease)
 - Enhance pest control, particularly with beetles
 - Develop integrated disease control to address: herbicide resistance; fleabane; Ontario specific conditions

Berries

1. Product quality and marketing – how to supply quality fruit that stands the rigors of the wholesale marketing chain; how to capitalize on the “Buy Local” movement
 2. Breeding and evaluating new cultivars for suitability to Ontario conditions with evaluation in different areas of the province.
 3. Irrigation/Fertigation – Optimize fertilizer and irrigation recommendations (quantities and scheduling) based on plant need for more sustainable and efficient production. New production systems including day neutral strawberries and fall bearing raspberries do not have any local based research to make fertility and irrigation decisions.
- **Additional Pest Management Details:** Spotted Wing Drosophila; Anthracnose; Virus Complex on strawberries; Cyclamen Mite; Western Flower Thrips; soil borne diseases; product registrations

Field Vegetables:

(Bulb & Root Vegetables, Leafy Vegetables and Crucifers, Fruiting Vegetables)

1. Optimize Soil Health for Fresh Vegetables to Maximize Crop Yields and Product Quality. Soil and Crop management systems, with an integrated approach, to:
 - reverse yield declines over time
 - Minimize crop losses due to plant pathogens and soil health issues
 - Improve Best Management Practices especially in regards to Honeybees and other pollinators.Areas of focus should include strategies for foliar bacterial disease management from pre-seeding to harvest, diagnosing and managing soil borne plant pathogens including nematodes, and how soil health impacts crop productivity and stress tolerance.
 2. Evaluate the entire water management process, including regulatory hurdles and identify ways to conserve and reduce water use in all areas of production.
 - irrigation and fertigation efficiencies
 - evaluate new processes to minimize or replace the use of water in wash tank operations while maintaining a food safety focus.
 3. Develop savings and efficiencies in crop inputs.
 - address energy issues including efficiency, carbon footprint, natural gas and electrical infrastructure necessary at the farm gate to increase competitiveness in the global marketplace.
 - improve labour efficiencies in all areas of production with emphasis on the field practices, handling and packing of fresh vegetables.
- **Additional Pest Management Details:**
 - Solanaceous crops: bacterial diseases; total Integrated Pest Management (IPM) strategies; soil borne pests, i.e. nematodes and disease insects; resistant weeds
 - Cucurbits: bacterial leaf spot, fusarium, cucumber beetles (neonic replacements), downy mildew (organic and conventional); crop rotation

- Sweetcorn: weed control; resistance management; thresholds and timing and scale for new lepidoptera control products
- Sugarbeets: Cercospora leafspot and rhizoctonia crown and root rot management; weed management/herbicide resistance

Ginseng

1. Identification and remediation of the factors that lead to pesticide residues in ginseng and other non-target effects of pesticide use
2. Identify methods to mitigate the effects of a changing climate
3. Improve ginseng seed viability. This could include: understanding field conditions that lead to poor viability and pathogen infection; improved handling and storage practices; or protective seed treatment technologies.
4. Minimize phosphorus and other nutrient losses to the environment
 - **Additional Pest Management Details:**
 - Identify the cause and develop solutions for replant disease of ginseng

Grape and Wine

- Develop a clean plant program and national standards to ensure virus negative material is propagated and planted within Ontario.
- Research winter injury recovery strategies to ensure the sustainability of our industry.
- Develop mitigation strategies for the elimination of leaf roll and red blotch viruses in Ontario vineyards.
- Improve water management strategies to protect the existence of our natural resources.

Greenhouse Vegetables

- Identify 12 month production strategies
- Improve energy efficiency by 20 to 30%
- Improve water and nutrient use efficiencies by 20%

Honey Bees and Pollination

1. Research and develop registered products that can be used to treat for varroa mites mid-season and/or during honey flow. Discouraging varroa mite population growth throughout the season can help improve colony survival and honey bee health overall. Having treatment options is beneficial to the industry. Relying on one product for use during a honey flow is not conducive to an effective IPM approach.
2. Research the potential improvement of pollinator health through the implementation of an IPM program in crop production. Adopting IPM strategies can benefit both crop production and pollinator health. This should include a focus on pest and disease monitoring and establishing economic thresholds for treatment application.
3. Continued research and implementation of honey bee breeding innovations to select for pest and disease resistance in honeybees. Breeding bees for resistance to pests and diseases can improve colony health, decrease the use of miticides, and reduce susceptibility to pests and diseases.
4. Research and develop best management practices for colony health in relation to honey bee pollination services. Transportation, nutrition, pest and disease management, and equipment sanitation are all factors of pollination where research is required.

Maple Syrup

- Address mold contamination both pre-and post-processing:
 - Identify the source and eliminate contamination in new containers and storage barrels
 - Develop strategies for consumers to minimise mold damage
- Determine the most effective protocol for hot packing syrup i.e. temperatures and times for different containers
- Determine the optimal degrees Brix (between 66-67) for packing maple syrup
- Assess the impacts, including growth and syrup quality, of the use of TreeAzin (a natural systemic insecticide) for Asian Longhorn Beetle

Mushrooms

- Address labour issues by evaluating automation systems, e.g. pick and pack, as well as alternatives or enhancements to the Foreign Labour Program
- Evaluate improved energy systems, e.g. gas turbine, bio char, etc.
- Identify positive impacts of research and education outreach programs and training
- Identify the nutraceutical products with strong potential to add value

New and Specialty Crops

- Developing agronomic practices and efficiencies: e.g. propagation and establishment, fertility and water requirements, season extension, harvesting methods and post-harvest handling and storage issues. Research on efficient production methods that impact labour, energy, and water requirements.
- Develop the market for new and specialty crops:
 - Market requirements
 - consumer education
 - cost of production information
 - access to processing facilities
 - value added opportunities
- Optimise post-harvesting handling and storage
- Germplasm development: Breeding programs and research on efficient propagation of new germplasm resources adapted to Ontario growing conditions and resistant to key pests.

Potatoes

- Identify and evaluate potato new potato lines that can help to provide a 12 month supply of high quality potatoes to the Ontario fresh and chip processing industries through value added traits such as early maturity, long term storage-ability and nutritional potential, any of which would serve to enhance the competitiveness and profitability of the Ontario potato industry.
- Develop a breeding program that considers disease resistance, focusing heavily on common scab. Low N, P, K requirements and drought tolerance as priority traits
- Identify selections and cultivars that are adapted to environments with lower fertility and water availability. Improve water use efficiency by altering timing and use of new irrigation technologies
- Identify and evaluate tablestock lines for value added traits that may have a positive effect on human health.
- **Additional Pest Management Details:** Evaluate cultural, biological and chemical methods to reduce the incidence of soil borne diseases and blight.

Tender Fruit

- Increase labour and operational efficiencies. Improved processes and systems that reduce impacts of and/or costs for;
 - Pruning, thinning, harvesting and packing
 - Pest and disease management
 - Adverse weather management
- New variety acquisition, development, best management and commercialization processes that result in;
 - higher value varieties suited to Ontario growing conditions and marketplace needs
 - an increase in organic production
 - fast tracking of commercial production of promising varieties
 - disease resistance especially to fireblight, black knot and bacterial spot
- Increase post- harvest quality. Optimal harvest timing, packing and cold chain management systems and practices to increase shelf life.
- Irrigation, Water and Nutrient Use. Developing processes and systems to maximize efficiencies.
- **Additional Pest Management Details:** Develop strategies for management of invasive species, e.g. Brown Marmorated Stink Bug and Spotted Wing Drosophila.

Vegetable Processing

- Processing and packaging innovations e.g. new packaging, new processing technologies, process improvements
- Enhancing raw product quality, consistency and productivity e.g. plant varieties, production techniques
- Consumer research for Ontario / Product of Canada labelling standards
- Food safety, esp. imports vs domestic
- **Additional Pest Management Details:**
 - Optimize control of bacterial diseases
 - Address soil health to reduce soil borne diseases and improve productivity

Ornamental Horticulture

Sector Consultation

In 2015, for the first time, the Ontario floriculture and nursery-landscape sectors were considered together in a unified ornamental horticulture sector consultation. Landscape Ontario, Flowers Canada Growers and Vineland hosted a research strategy workshop that included growers and other members of the value chain such as input suppliers, consultants, researchers, wholesale and retail. The goal was to define a shortlist of research priorities for the whole ornamental horticulture sector which includes greenhouse floriculture, nursery and sod production and some downstream landscape management.

The facilitated workshop began with a general discussion of market trends and a discussion that explored potential research areas. The group then developed a set of criteria for prioritizing research topics as follows:

- Does it answer a need – is it relevant to the industry?
- Timelines – how fast can it be done?
- Feasibility
- Impact – what is the size, economic value and/or breadth of the potential impact?
- It needs to be specific, clear and well communicated

With these criteria in mind, industry participants were then invited to define individual research topics which were then arranged into common themes. The input within each theme was consolidated to capture the main points and define a draft priority list which was then sent back to meeting participants for revisions and comment. The final (non-ranked) priority list was first presented in the 2015 priority report. In 2016, industry representatives were invited to update the priority list and the resulting minor edits have been incorporated here.

Ornamental Horticulture Research Priority List

- **Optimize water use.** Utilize water more efficiently in ornamental plant production and improve water quality in storage and recirculation systems e.g. by optimizing growth media, irrigation systems and/or recirculation systems.
- **Optimize nutrient use.** Develop strategies to optimize the use of nutrients in plant production in order to reduce input costs, promote plant health and manage contamination of water runoff.
- **Reduce labour costs.** There is a need for early-stage research to characterize labour use and to identify issues and opportunities for driving down labour costs in the sector.
- **Pest control.** Research to improve control of **insects, weeds and disease** in ornamental plant production and landscape maintenance. In greenhouse floriculture the primary focus should be on biocontrol strategies.
- **Consumer research.** Understand market trends, quantify environmental benefits, identify what plants to grow, when to supply them, and how to present and market them.
- **New varieties.** Identify low maintenance, high performing, environmentally beneficial and/or consumer preferred plant cultivars through trials and/or breeding.
- **Improve plant establishment and survival.** Understand and improve plant establishment and survival in challenging environments, especially with regards to root growth in container nursery production and compacted soils.
- **Improve energy efficiency in greenhouse production.** Strategies to reduce heat, electrical, energy and fuel use that are economically viable and commercially practical.
- **Supplemental lighting.** Strategies to improve the production potential of supplemental lighting in greenhouse floriculture.

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