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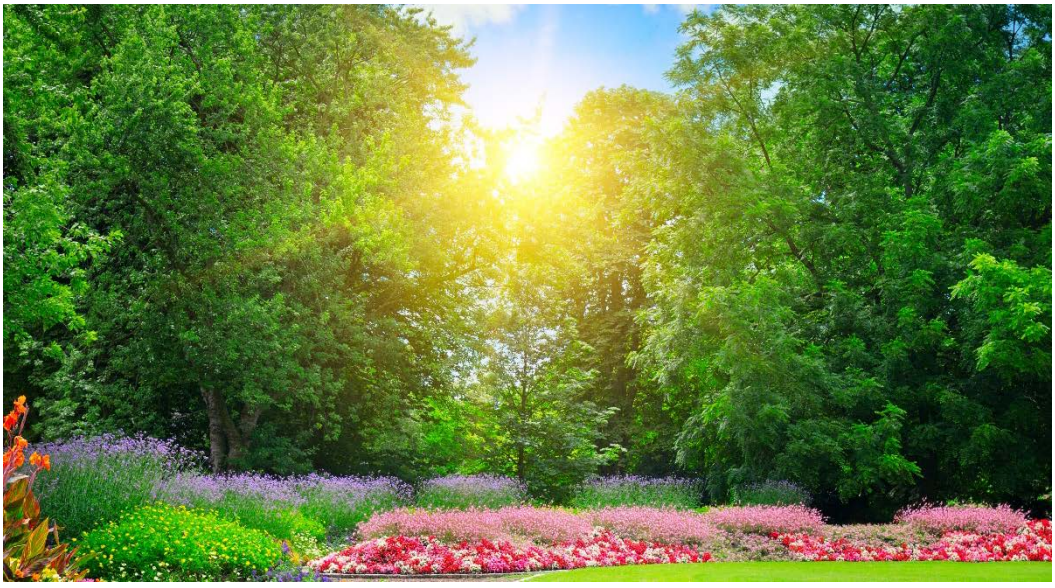
Ontario Horticulture Research Priority Report 2019



ONTARIO FRUIT & VEGETABLE GROWERS' ASSOCIATION

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June 2019

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 renewed commitment under the *Canadian Agricultural Partnership*, 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 this process is simply as a facilitator, the actual delivery of research projects will continue to include the University of Guelph, AAFC, Vineland and any 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.

Edible Horticulture

Sector Consultation

A sector-wide research consultation was co-hosted by Vineland Research and Innovation Centre (Vineland) and the Ontario Fruit and Vegetable Growers Association in January 2017. Grower groups in each category were invited to nominate two industry representatives and any interested researchers were invited to attend.

Defining Research Priority Lists

Prior to the meeting, industry representatives were asked to identify their top pest and disease issues and their top four (non-pest related) research needs from across the value chain. These were discussed with the broader group where researchers and other growers had the opportunity to ask questions and discuss points of commonality.

Grower representatives who attended the workshop were given the opportunity to fine-tune their priority lists following the meeting and a compilation of the top priorities they identified for each crop category is presented here (the “longlist”).

Pest Management (including pests, diseases and weeds) is a high priority need for virtually all horticultural crops therefore this is automatically included as a priority in each category with grower representatives providing further details in many cases to identify the specific pest problems on their crops.

The research priority shortlist was created by taking one priority from each crop category and adding an overarching pest management priority. This shortlist is specifically created for the OMAFRA-University of Guelph partnership funding program and some groups may have opted not to select their top priority but instead made strategic decisions based on other considerations e.g. research already underway; or priorities that align more closely with the available expertise.

For 2019, industry representatives were invited to submit updates or edits to the priority lists from the previous year and these are reflected in the lists on the following pages.

Edible Horticulture Research Priorities by Crop Group

Pest Management Priority: 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

1. Technology, Mechanization, Automation & Efficiencies

Increased production efficiencies through the use of the latest technologies and precision agriculture. Priorities (not ranked) include, but are not limited to:

- Labour efficiencies
- Pest management and crop protection efficiencies
- Weather risk efficiencies
- Water use efficiencies
- Modelling (for example, modelling for crop load management and integrated pest management)
- Remote sensing, software development and robotics
- Orchard design

2. Sustainable Practices

Sustainable cropping practices (crop load management, training systems, carbon capture, irrigation, fertigation, soil management, nutrition) are optimized according to variety and agro-climatic conditions. Priorities (not ranked) include, but are not limited to:

- Production efficiencies
- Integrated Fruit Production (IFP)
- Lower environmental impact
- Area wide practices
- Organic

3. Variety & Rootstock Development and Evaluation

New varieties and rootstocks are developed and selected according to consumer preferences and their performance in the different regions with the goal of achieving greater market share. Priorities (not ranked) include, but are not limited to:

- New variety breeding and evaluation
- Scion and Rootstock evaluation (i.e. winter hardiness, drought efficiency)
- Genomics
- Consumer preference studies

4. Maximizing Quality & Minimizing Losses

Crop maturity management and post-harvest storage conditions and treatment strategies with the goal of delivering a larger percentage of high-quality fruit for the fresh market. Priorities (not ranked) include, but are not limited to:

- Post-harvest research (for example, storage disorders and diseases)
- Optimal harvest management and timing

Pest Management:

Apples have a complex pest and disease profile and having the adequate strategies to deal with these issues is critical to the viability of the sector.

- Development of sustainable Integrated Pest Management (IPM) practices and resistance management including pesticide efficacy testing, using degree day predictive models, development of economic thresholds, mating disruption strategies and evaluation of biological or cultural control for pests such as apple scab, powdery mildew, fire blight, codling moth, apple maggot, mullein bug, plum curculio, woolly apple aphid, mites.
- Strategies for management of fire blight include nursery tree health, plant growth regulators, cultural methods, biopesticides, predictive models and non-chemical alternatives in high-density systems and for in-season trauma or rootstock blight.
- Development of an integrated approach for difficult diseases and disorders such as black and bitter rot (including cankers), russeting, replant disease.
- Evaluate the efficacy of border sprays using late season reduced risk insecticides for apple maggot and codling moth.
- Due to the loss of broad-spectrum crop protection products, evaluate new management strategies and pesticide efficacy for mullein bug, OBLR, plum curculio, apple maggot, OFM, codling moth, woolly apple aphid.
- Investigate new application or IPM technology techniques such as fixed sprayer systems, storage fogging, drones or automated pest monitoring.
- Strategies for management of invasive/emerging pest issues such as brown marmorated stink bug, viruses, fruit rots, borers, leaf curling midge, European apple sawfly, scale.
- Investigate potential issues associated with sudden apple decline (SAD) including scion/rootstock compatibility, virus, crown/root rot, canker-causing pathogens, borers, herbicide injury, replant disease. *Background* - SAD tree collapse began in 2016 throughout the northeast on young trees, mainly Gala on M9. Detection of fungal pathogens (black rot, phomopsis) at graft union has been found. 2017 collapse continued with significant detections of rootstock fire blight. Latent virus research is on-going in Ontario as well as by USDA. Overall no determined cause though. It is likely a complex of issues involving weather, tree stress and pathogens. Ontario has limited researchers currently working on apple pathology and virology.

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Berries

1. Production Systems/Robotics/Labour

The number one expense to berry growers is labour with the majority of cost being for harvest labour. Robotics, harvest aids and other labour-saving technologies need to be investigated and optimized for Ontario berry growers.

There is an increased interest in new or alternative production systems including the use of artificial media, protected culture and season extension techniques. Interest has stemmed from soil health issues as well as the need to optimize labour and to take advantage of extended production seasons to market locally produced berries. It is critical to seek and test new production systems.

2. Product Quality and Marketing

It is critical to continue to develop and expand the trend of buying local. The "Buy Local" movement is critical for the success of both on farm marketers as well as wholesale producers. Product quality at the wholesale level may be the most limiting factor to the expansion of the Ontario berry industry. Ontario growers need to supply quality fruit that stands the rigors of the wholesale marketing chain. Determining the most cost-effective method of storing and preserving quality of fresh berries utilizing modified atmosphere technology, more environmentally acceptable packaging and any other storage technologies for all the major berry crops is needed.

3. Irrigation/Fertigation

There is a need for modernization of benchmarks for irrigation and fertilization of berry crops grown under different growing systems. Growers would like recommendations that provide sustainable and efficient use of both fertilizer and water. New production systems including day neutral strawberries, fall bearing raspberries, protected culture and soilless media production need to be addressed. Fertigation scheduling for highbush blueberries grown under Ontario conditions needs refinement.

4. Breeding and Evaluating New Cultivars

For the future of berry industry there is a need for the development of varieties suited to Ontario conditions. This can be accomplished by plant breeding in Ontario as well as evaluation of new cultivars developed in jurisdictions outside of the province. Research evaluations need to be done in different areas of the province as many climates exist throughout the province. Continue to breed and evaluate new strawberry cultivars that the industry has invested research dollars and time.

Pest Management:

1. Insect and Disease Management

Berry growers are faced with several challenging insect and disease pests that have a serious impact on the economic viability of growing berries.

a. Spotted Wing Drosophila – this pest has become common in all berry growing areas of Ontario. New products have been registered but there continues to be a need for products with short harvest intervals. Research is needed on long term strategies for this pest including cultural management and education as well as the feasibility for biological controls including predators and parasites of SWD. It is critical that AAFC and

other institutions stay abreast of biological control options that are occurring in other parts of North America as well as around the world.

b. Anthracnose – fungicide resistance has been documented in Ontario and there is a need for additional products to manage this disease. Disease resistant cultivars and or management techniques used for propagation could also play a role in managing this disease.
c. Cyclamen Mite – with the loss of endosulfan this pest has caused a increased amount of damage in strawberry. Additional products and alternative management strategies are needed to combat this challenging pest. Cyclamen mite control is critical for the plant growers to supply the industry with clean plants.
d. Virus Complex – virus complexes have caused significant damage to the Ontario strawberry industry. Growers are now managing aphids as a way of managing this complex. Blueberry and raspberry plants are also impacted by virus. Recognizing and management of virus is critical to surviving the impact from virus infections. Clean plants are critical for minimizing the impact of viruses
e. Western Flower Thrips – this pest has become very serious as there are few to no effective control products. The use of biological control needs to be evaluated and management protocols need to be put in place.

2. Soil Health

Optimizing soil health is the key to healthy berry industry. Berry growers have seen decline in berry plantings as a result of soil borne diseases and nematodes. Growers have had to depend on fumigation to manage the complex of soil diseases. Fumigants are expensive and several formulations have or are being phased out of production in Canada. Further research is required to find tools to manage soil borne diseases and increase general soil health. It is critical that berry growers can purchase clean disease-free nursery plants and thus Canadian nurseries require the tools needed to supply these clean plants.

3. Pest Management Products

There continues to be a loss of older broad-spectrum pest control products. For long term viability of the berry industry it is critical that these products have their registrations maintained or be replaced with effective materials. Resistance management is a real concern where in some cases growers are limited to one or two products to control pests which lead to no opportunity of rotation to preserve the efficacy of these products. Resistance management via cultural control methods and grower education should be a priority. To be useful these products must have workable pre-harvest intervals as well as re-entry intervals.

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Bulb and Root Vegetables

Including but not limited to: carrots, onions, leeks, shallots, beets, rutabaga/turnip, radishes, sugarbeets, parsnips, garlic, horseradish, sweet potatoes

1. Develop soil health and/or nutrient management strategies that improve crop quality and/or environmental sustainability in bulb and root vegetables. Areas of research could include (but are not limited to): root health/soilborne disease, soil organic matter, soil biodiversity, resiliency, fumigation alternatives; mitigation of soil compaction; intercropping options; interactions between applied nutrients; crop varieties and harvest date; interactions between applied nutrients; crop quality (including storage characteristics) and variety; interactions between nutrient applications, soil type and water use; best practices for soil amendments and/or cover crops, best practices for nutrient loss, and best practices for nutrient use efficiency. Research should address barriers to adoption and long-term economic impact.

2. Develop strategies that improve product quality in bulb and root vegetables (including storage quality and percent marketable product).

3. Provide options for product diversification within the bulb and root vegetable sector. Projects should include a market analysis and consider consumer trends.

4. Develop strategies and identify barriers to adoption for water management best practices in bulb and root vegetables that considers the any or all of (but not limited to) the following variables: soil type, nutrient management, product quality + yield, irrigation system type, water sourcing, drainage, surface water management (note water management is not a high priority in sugarbeets).

Pest Management:

- Sugarbeets: Cercospora Leafspot, Rhizoctonia Root Rot, Aphanomyces Black Root
- Table Beet: cercospora, rhizoctonia, leafminers, leafhoppers, aphids, weeds

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Leafy Vegetables and Brassicas

Including but not limited to: asparagus, spinach, celery, broccoli, cabbage, cauliflower, lettuce, salad greens, leafy herbs, rhubarb, brussels sprouts

1. Develop strategies to improve long term profitability of leafy and crucifer vegetables that consider options to improve any or all of: labour efficiency, production efficiency and market diversification.
   - Asparagus: Develop high yielding, high quality, disease and replant resistant asparagus cultivars; identify the physiological basis of longevity in asparagus and assess genetic architecture for the trait; and conduct field testing of potential new asparagus varieties.

2. Develop strategies to improve leafy vegetable and crucifer vegetable sector resilience to extreme weather and climate change. Strategies could include: adaptations to changing season length and temperature patterns, new varieties that tolerate extreme conditions and/or longer seasons, models to predict vegetable harvest scheduling (like a degree day model, instead of days to harvest), adaptations to excess rain.

3. Develop strategies to improve soil and nutrient management with a focus on phosphorus management in relation to Lake Erie water quality. Strategies should consider multiple interacting variables including nutrients, plant varieties and soil type.

4. Food safety.

Pest Management:

- Brassicas: aphid control strategies to replace the use of Admire™ systemic insecticide
- Asparagus: improving field management of Stemphyllium and rust; determining the genetic basis of Stemphyllium and rust resistance in Asparagus germplasm; understanding Stemphyllium resistance in the relationship between the fern and spear.

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or

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Fruiting Vegetables

Including but not limited to: peppers, tomatoes, cucumber, pumpkin, squash, green/wax beans, green peas, sweet corn, eggplant, melons, zucchini

1. Crop production systems research, in particular practices aimed at improving harvest quality. Research may include the analysis of the economic benefits of quality improvement practices at any point (or multiple points) along the fruiting vegetable value chain; analysis of existing data; developing new data through crop research, comparing production systems, harvest or post-harvest practices. Research should develop best management practices for quality improvement that can be applied to Ontario.

2. Develop best management practices for improving and maintaining soil health in fruiting vegetables considering any or all of the following: short rotation, root health/soilborne disease, cover crops, soil amendments, soil organic matter, soil biodiversity, and resiliency. Research should include evaluation of barriers to adoption (reduce them) and the long term economic benefits to growers and society.

3. Develop strategies for nutrient management to maximize crop production while minimizing environmental impact in fruiting vegetables. Successful projects will emphasize phosphorus management in relation to a number of variables including runoff, fertilizer application (method, timing, rates) and impacts on Great Lakes quality. Impacts on loss or use-efficiency of other nutrients should be considered.

4. Develop irrigation and water management strategies for optimal crop quality and yield in fruiting vegetables. Variables of interest are water use efficiency, critical irrigation times, cut off times, fertigation, run off, and management in extreme weather. Adaptation to both water shortages and to extreme rainfall events are of interest.

Pest Management:

- nematodes (common to many crops)
- Field Tomatoes: Bacterial disease (primarily spot, but including speck and canker), Fruit rots, Root health (disease, nematode, tired soils/replant issues), mitigation if chlorothalonil use restricted
- Field Peppers: Bacterial disease, Fruit rots, including *Phytophthora capsici* (also bacterial soft rot, anthracnose, plus improved identification of causes); Tarnished plant bug; Pepper weevil
- Eggplant: phytophthora (*P. capcisi*), verticillium, mites, Colorado potato beetle, broadleaf weeds, grassy weeds

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Ginseng

1. Identify skin disorders that affect marketability of the root (pre- and post-harvest rots not included)
2. Identification and Remediation of the Factors that Lead to Pesticide Residues in Ginseng and Other Non-Target Effect of Pesticide Use
3. Improve Ginseng Seed Viability
4. Identify Methods to Mitigate the Effects of a Changing Climate

Pest Management:

Identify the cause and develop solutions for replant disease of ginseng

For further information contact:
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Grape and Wine

1. Viticulture Research
    - Quality Improvement (Canopy Management, pest management etc)
    - Vitis Certification (Local Vine Proliferation/Supply)
    - Winter Injury
    - Spray Programs Strategies (Rotation, Feedback Mechanism)
    - Short and Long Term Effects of Viruses on Plant Performance
    - Clonal and Sub-Clonal Stability (Assessing Trueness to Type)

2. Oenology Research
    - Clonal Sensory Evaluation
    - Post-frost picking strategy and must handling in the winery
    - Crop Level vs. Quality (i.e. Color, Tannin Development)
    - Sparkling Wine, Icewine, Late Harvest
    - Operations of Winery (i.e. Filtration, Yeast, Nutrients)
    - Site Selection (Terroir)

3. Market Research
    - Export/Market Development
    - Forecast of “Winning” Varieties and Style of Wine
    - Sparkling Wine Profiles
    - Sensory and Consumer Science

Pest Management:

- Identification and mitigation of Leaf Roll and Red Blotch
- Multicoloured Asian Lady Beetle (Replacements for Synthetic Pyrethroids)
- Powdery Mildew, Black Rot, Fruit Fly, Brown Marmorated Stink Bug
- Sour Rot

For further information contact:
Eleanor Hawthorn
Ontario Grape and Wine Research Inc.
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Greenhouse Vegetables

1. Environmental Sustainability
    - Energy efficiency research aimed at reducing carbon emissions per unit produced, including: renewable energy projects, breeding for low light and temperature varieties, more insulated greenhouse coverings, etc.
    - Reduced or improved management of greenhouse waste

2. Production Efficiency
    - Strategies to support the transition to year-round production
    - Water and nutrient use efficiency that support emerging production technologies
    - Labour efficiency, including robotics and automation

3. Product and Market Development
    - Identify products suited for new and emerging markets both domestically and abroad for both consumer and food service segments
    - Maintain or improve the quality of Ontario greenhouse produce through consumer and/or market research, directed breeding programs, postharvest management and/or supply chain improvements

For further information contact:
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Honey Bees and Pollination

1. Investigate methods to improve hive health including management, nutrition treatments and queen health

2. Conduct a long-term survey of hive products (honey, pollen, propolis etc) from honey bee colonies to investigate the extent of environmental chemicals, bee forage plants, the adverse effects of agrochemicals and agrochemical residues, including synergistic effects on bee health, reproduction and habitats and on ecosystems.

3. Determine the value of pollination to the ecosystems and to horticultural/field crops from managed and native pollinators

4. Determine best management practices for bee colonies moved for pollination, for alternative pollinators and new pollinator systems.

Pest Management:

- Further development of effective IPM, best management practices and food safety programs for controlling varroa mites, small hive beetles, tropilaelaps, Nosema, honey bee viruses, waxmoth and other infectious diseases or potential invasive pests of honey bees, including treatment-resistant pests and diseases.
- Further investigation into identification/biology/epidemiology of new pathogens/pests, evolution of existing/enhanced pest and disease diagnosis

For further information contact:
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Maple Syrup

1. Develop an easy to use test to identify buddy sap prior to processing into maple syrup (e.g. – possibly similar to using litmus paper for detecting pH). [Note – this would be of great help to all maple syrup producers across Ontario and beyond. It would increase the production and quality of maple syrup by avoiding off-flavours from buddy sap]

2. Determine how to best clean and sanitize storage barrels to prevent/minimize mould-damaged syrup.

3. Determine at what temperature and for how long it is required to preheat small glass bottles prior to hot-packing with maple syrup to prevent/minimize mould-damaged syrup. [Note – it is virtually impossible to remove all mould spores from maple syrup, but syrup should be hot-packed into clean containers in conditions that are as hostile to mould growth as possible. Small glass containers seem to be the most problematic due to the high mass of glass and relatively small amount of syrup that cools quickly upon contact]

4. How to best prevent maple decline on acidic soils (Canadian Shield).

Pest Management:

Asian Long-horned Beetle (ALHB) is currently the single most serious potential threat to maple trees in Ontario. TreeAzin (approved to control Emerald Ash Borer in ash trees) has been used as a treatment but lab results indicated high residues in both sap and syrup of treated trees. TreeAzin is not yet registered for use in Canada in food products so it is not yet possible to do the research to determine if sap and/or syrup flavor is affected.

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Mushrooms

- Automation or other strategies to address the high costs and availability of labour
- Strategies for improving food safety and preventing listeria contamination
- Improving energy efficiency and carbon footprint in mushroom production
- Analysis and validation of mushroom nutritional information e.g. Vitamin D, niacin

Pest Management:

In mushrooms pest management research is less of a priority than other research areas. White mold can be a problem.

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New and Specialty Crops

The Specialty Crops sector consists of over 100 different commodities that are typically grown on small acreages in Ontario. These include, but are not limited to, sweet potatoes, edamame, and other non-traditional vegetables, specialty fruit, medicinal herbs including cannabis, culinary herbs, lavender, hops, hazelnuts and other tree nuts.

- Developing agronomic practices and efficiencies: e.g. propagation and development of high quality, pest-free, true to type nursery stock; pruning and pollination; fertility and water requirements; season extension; improving winter survival of certain perennial crops (e.g. lavender and hazelnuts); and harvesting methods / 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
- Germplasm development: Breeding programs and research on efficient propagation of new germplasm resources adapted to Ontario growing conditions and resistant to key pests.

Pest Management:

Field research on pest management including weeds under Ontario conditions (e.g. conventional and organic pest control products, pest identification, IPM, pesticide resistance management, product timing and rotations, identification of pest-resistant germplasm). Examples of specific pest management needs include:

- Basil downy mildew
- Spotted wing drosophila in specialty berries
- Powdery mildew in haskap
- Downy mildew, powdery mildew, cone diseases, viruses, and leaf hoppers in hops
- Black rot, grubs, and wireworms in sweet potatoes
- Grubs and wireworms in tigernut
- Weevils in tree nuts
- Chestnut blight
- Powdery mildew, white mould, and mites in cannabis
- Eastern filbert blight, bacterial blight, and bud mite in hazelnuts
- Four lined plant bug, Phytophthora root rot and Septoria leaf spot on lavender
- Weed control in all crops

For further information contact:
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Potatoes

- Identify and evaluate 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.

Pest Management: Evaluate cultural, biological and chemical methods to reduce the incidence of soil borne diseases and blight.

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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 virus free 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.

Pest Management: Develop strategies for management of invasive species, e.g. Brown Marmorated Stink Bug and Spotted Wing Drosophila.

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Edible Horticulture Research Priority Shortlist

Note: these priorities have been selected by industry representatives specifically as input for the priority setting process of the OMAFRA-University of Guelph partnership program.

- **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:** Technology, Mechanization, Automation & Efficiencies. Increased production efficiencies through the use of the latest technologies and precision agriculture. Priorities include, but are not limited to: Labour efficiencies; Pest management and crop protection efficiencies; Weather risk efficiencies; Water use efficiencies; Modelling; Remote sensing, software development and robotics; Orchard design.

- **Berries:** Product quality, packaging and marketing e.g. How to capitalize on the "Buy Local" movement; How to grow and supply quality fruit that withstands the rigours of the wholesale marketing chain; Determining the most cost effective method of storing and preserving quality of fresh berries; Development of more environmentally acceptable packaging.

- **Bulb and Root Vegetables:** Develop soil health and/or nutrient management strategies that improve crop quality and/or environmental sustainability.

- **Leafy Vegetables and Brassicas:** Develop strategies to improve long term profitability of leafy and crucifer vegetables that consider options to improve any or all of: labour efficiency, production efficiency and market diversification. In asparagus the specific need is for development and evaluation of improved cultivars with high yield, high tip quality, disease resistance, winter hardiness and longevity traits.

- **Fruiting Vegetables:** Crop production systems research, in particular practices aimed at improving harvest quality along the entire fruiting vegetable value chain.

- **Ginseng:** Identify skin disorders that affect marketability of the root (pre- and post-harvest rots not included)

- **Grape and Wine:** viticulture and oenology research to improve grapevine health, quality, and winter survival and to establish a clean plant network.

- **Greenhouse Vegetables:** Environmental Sustainability through reducing carbon emissions per unit produced (e.g. renewable energy, breeding for low light and temperature varieties, more insulated greenhouse coverings, etc); and/or improved management of greenhouse waste.

- **Honeybees and Pollination:** Investigate methods to improve hive health including management, nutrition treatments and queen health

- **Maple Syrup:** Develop an easy-to-use test to identify buddy sap prior to processing into maple syrup.

- **Mushrooms:** Automation or other strategies to address the high costs and availability of labour.

- **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 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.

- **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 virus free commercial production of promising varieties; disease resistance especially to fireblight, black knot and bacterial spot

Ornamental Horticulture

Sector Consultation

A research priority list was originally generated from input provided at a broad industry consultation with the floriculture and nursery-landscape sectors held in January 2015. The list was updated and ranked in 2017 at a small group meeting of Landscape Ontario and Flowers Canada (Ontario) representatives. In 2018, the LO and FCO research chairs reviewed the priority list and agreed to move the labour issue up to a higher ranking.

Prioritization Criteria

- Size of Opportunity or Problem: What is the size or the reach of the research problem or opportunity for discovery? e.g. How much of the sector does it relate to? How many growers / businesses are affected and stand to benefit from the solution? How much potential uptake will it have?
- Economic Impact: To what degree does research in this area improve the sector's market share, growth and enterprise profitability? E.g. Does it create a superior product, increase yields or reduce production costs in a significant way? To what extent will it improve the competitiveness of Ontario's sector?
- Socio-Environmental Impact: How will this research benefit the environment and/or broader society? e.g. Will it enable sector businesses to reduce their environmental footprint? Will it create jobs, reduce pollution or meet other societal needs?
- Probability of Success: How likely is this area of research to succeed relative to the investments required? How do the risks weigh up against the possible returns?

Ontario Ornamental Horticulture Research Priority List

(ranked)

1. **Reduce water use by 20 percent.** Utilize water more efficiently in ornamental plant production with strategies that are economically viable and commercially practical.
2. **Optimize nutrient use.** Develop strategies to optimize the use of nutrients in plant production in order to reduce input costs, promote plant health and eliminate nutrient runoff.
3. **Improve irrigation water quality.** Develop strategies to improve irrigation water quality e.g. by optimizing source water, irrigation systems and/or storage and recirculation systems.
4. **Reduce labour costs.** Identify issues and opportunities for driving down labour costs in the sector.
5. **Improve energy efficiency.** Strategies to reduce electrical, energy and fuel use that are economically viable and commercially practical.
6. **Pest control.** Research for more effective and sustainable control of insects, weeds and disease in ornamental plant production and landscape maintenance. In greenhouse floriculture the primary focus should be on biocontrol strategies.
7. **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.
8. **Supplemental lighting.** Strategies to improve plant production with supplemental lighting.
9. **Consumer research.** Understand market trends, quantify environmental benefits, identify what plants to grow, when to supply them, and how to present and market them.

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