

Sector	Priority Areas	Strategic Outcomes	Investment Priority for Research
Field Vegetables	Optimize Production Practices	<ul style="list-style-type: none"> · A reduced need on farm inputs (i.e. fertilizers) · Labour issues/shortages · Support access to labour and encourages the development of labour application efficiencies 	<ul style="list-style-type: none"> · Conduct research in the automation of production as a means to reduce labour costs; · Conduct research in order to reduce farm inputs (for instance fertilizer) without impacting yields; · Develop best practices to mitigate climate change effects and extreme weather events. · Irrigation technology and water management
	Improve Pest and Disease Management Practices	<ul style="list-style-type: none"> · The sector employs effective integrated pest management methods widely; · Growers have access to knowledge regarding the emergence and prevalence of pests; · Growers have effective and cost-effective methods for detecting and monitoring pests; · Growers have thresholds for action for the control and management of pests as they relate to various crop development stages. 	<ul style="list-style-type: none"> · Exploring alternatives to address <i>loss of product registrations and usage patterns</i> (e.g. chlorpyrifos) · Develop, understand and disseminate effective and safe integrated pest management methods that conciliate crop protection, economic profitability, environmental protection, public health, quality and safety of vegetables. · Improve and disseminate knowledge about new and existing pests · continued support for responsive minor use registration system · Develop and transfer tools and methods for detecting and monitoring crop pests · Determining genetic basis of disease resistance in breeding program germplasm, and understand the relationship of resistance/susceptibility between growth stages (i.e. spear and fern in asparagus); · Develop or modify action thresholds for pests as relating to crop development stage (i.e. number of scouted cabbage maggots per broccoli plant); · Develop and/or adapt predictive models for insects/disease · Priority pests including:, Pepper weevil, Aster Leafhopper, Carrot rust fly (fall), Carrot weevil (spring), Leafhoppers, Wireworms, Aphids, Cabbage maggot, Flea beetles, Onion maggot, Onion thrips, Leek moth, Tarnished plant bug, Seed corn maggot, Colorado potato beetle, Cucumber beetles, Asparagus beetle, Serpentine leafminers, Red headed flea beetle, Swede midge, Squash vine borer, Squash bug, Bean seed Maggot, nematode, and the 3 Lepidopterous larvae (Diamond Back, Imported, and Looper), sclerotinia white mold, carrot forking, neck rot in onion.
	Optimize Post-Harvest and Storage Practices	<ul style="list-style-type: none"> · Growers use optimized storage methods and technologies that minimize losses and maximize produce quality; · Growers employ strategies and approaches that minimizes water usage. · Improve and maximize shelf life/time in storage of Canadian produce 	<ul style="list-style-type: none"> · Conduct research in storage techniques to minimize losses and improve efficiency; · Research conditions required to improve storability of produce; · Research on wash water use on vegetable farms.
	Plant Breeding, Variety Development and Evaluation	<ul style="list-style-type: none"> · Ongoing variety research is carried out that improves post-harvest shelf life and quality, adapt to new climatic conditions and increase resistance to bacteria and diseases, and quality & yield · Growers benefit from national coordination of variety evaluation. 	<ul style="list-style-type: none"> · Conduct work on genetic breeding and selection to improve post-harvest shelf life and quality, to adapt to new climatic conditions & extreme weather events, to increase resistance to diseases (including physiological disorders) and to develop early and late varieties; · Conduct variety evaluation on vegetable crops; · Develop high yielding, high quality, disease and replant resistant vegetable cultivars; identify the physiological basis of longevity in vegetables and assess genetic architecture for the trait; and conduct field testing of potential new vegetable varieties.
	Marketing and Consumer Education	<ul style="list-style-type: none"> · Research on the Health Benefits of Vegetables · Encourage higher consumption of Canadian grown vegetables 	<ul style="list-style-type: none"> · Consumer research and education working with ethnic populations to encourage consumption and change consumer perceptions of Canadian grown vegetables
	Food Safety	<ul style="list-style-type: none"> · quantify products (new or emerging) that will need to be included in the Food Safety scheme (CanadaGAP) in the future 	<ul style="list-style-type: none"> · CHC is currently pursuing funding through AAFC's AgriAssurance program; Complimentary research may be required
	Apples	Maximizing Quality & Minimizing Losses	Outcome/Attained Goal: Crop maturity management and postharvest storage conditions and treatments lead to larger percentage of high quality fruit reaching market, and therefore higher returns for growers.
Technology, Mechanization, Automation and Efficiencies		Outcome/Attained Goal: Increased production and postharvest efficiencies through the use of the latest technologies and precision agriculture.	<ul style="list-style-type: none"> · Development of new techniques, alternative control methods, products and practices for pest management/crop protection · weather risk mitigation · water use

			<ul style="list-style-type: none"> Labour efficiencies Modelling (crop production and quality, pest degree day models, data analytics, pathology, etc.) Remote sensing, software development and robotics Orchard design Development of optimized spraying strategies and equipment
Sustainable Practices	Outcome/Attained Goal: Sustainable cropping practices (crop load management, pest management, training systems, carbon capture, irrigation, fertigation, soil management, nutrition) are optimized according to variety and agro-climatic conditions.		<ul style="list-style-type: none"> lower environmental impact herbicide alternatives Integrated Fruit Production (IFP) Organics area wide practices (monitoring and control) Soil health Irrigation Climate change adaptation i.e. greenhouse gas emissions & carbon sequestration Development of new techniques, alternative control methods, products and practices for pest management/crop protection Clean plant program
Variety & Rootstock Development & Evaluation	Outcome/Attained Goal: New varieties and rootstocks are selected according to their performance in the different Canadian apple producing regions. We will have achieved greater market share, domestically and internationally, through new variety breeding and evaluation, scion and rootstock evaluation in all Canadian apple producing regions.		<ul style="list-style-type: none"> rootstock evaluation scion regional adaptation and evaluation genomics variety breeding and evaluation, including disease resistant cultivars consumer preference studies
Enabling Strategy: Knowledge Translation & Transfer	Outcome/Attained Goal: An adequate portion of research project budgets is dedicated to KTT, to ensure faster technology uptake, greater awareness of the results of our research and innovation investments and reduced duplication of efforts.		<ul style="list-style-type: none"> Webinars Grower meetings and conventions Newsletters & magazines Develop an online presence and repository to share current projects (Cluster and other programs) in each province with a short summary with links to the results (in both languages)
Broad Marketing Strategy	Outcome/Attained Goal: Consumer preferences are identified and marketers & retailers are informed of the preferences.		<ul style="list-style-type: none"> economic impact study of Canadian apples economic study on launch and distribution of new varieties, club varieties evaluation of market structure and supply chain challenges
Greenhouse Vegetables	Energy and Efficiency, Production Outcomes	<p>Transition to alternative energy sources (heat and electricity), greater efficiencies from traditional and alternate fuel sources, lighting under abatement strategies, informed by producer knowledge have resulted in greater energy efficiency and higher quality production.</p> <p>Circular economies, finding ways to reuse our products, and waste (plant and plastic).</p> <p>Initiatives to explore enhanced growing methods have resulted in expanding crops, enhanced yields, lower production costs, higher quality and more consistent products and sustainable production methods that have a positive impact on the environment.</p>	<ul style="list-style-type: none"> Research to guide the validation and feasibility of various energy sources and technology components for Canadian greenhouse vegetable production systems Carbon emission reduction Carbon dioxide direct capture Net zero production Alternative fuels, renewable energy options Latent heat recovery Water efficiencies Waste management Precision agriculture Lighting regimes, under abatement strategies Less energy intensive crops Growing methods (i.e.: year-round production, sap analysis, fertilization, etc.) Post-harvest management Breeding (for low light conditions, reduced temperatures, automation, etc.)
	Labour	<ul style="list-style-type: none"> More full-time, year-round employment; reduced need for hand labour and increased demand for highly skilled workers. Increased automation and mechanization of certain production tasks (e.g., harvesting) Data systems that register input needs, inform inventory and order products have increased need for technology and data systems savvy workers 	<ul style="list-style-type: none"> Enabling the transition to an automated workplace Protecting economic viability of farms through transition to automation Education/training programs related to elements of automation (AI) Micro-credentialing (i.e., short course certifications, e.g., cybersecurity) Validation of mechanization for certain production tasks (i.e. solutions in other sectors or countries that could be validated for greenhouse use) Integrated data systems to increase farm management efficiencies within the value chain

		<ul style="list-style-type: none"> • Training programs have attracted upper/middle production management graduates to work in production greenhouses. 	<ul style="list-style-type: none"> • Addressing and Assessing Mental Health across all workplace
	Pest Management	<ul style="list-style-type: none"> • Research and innovations in pest management initiatives enable us to detect invasive pests and diseases before they become established, resulting in less pesticide use, a reduced footprint and increasing consumer confidence. • We have an improved and more responsive regulatory framework for pesticides, and bio-controls for emerging/invasive pests and diseases, relative to trading partners. 	<ul style="list-style-type: none"> • System approaches to greenhouse pest issues, integrating technology • Furthering the body of knowledge on Tomato Rugose (ToBRFV) • Identification of domestic beneficial species • RNAi pesticides or other tools (mechanical and cultural) • Furthering the IPM tool kit for greenhouse • Cultural practices to reduce pest and disease pressure • Genomic scouting techniques • Whole greenhouse pest monitoring, genomic specifically
	Enabling Strategy: Knowledge Translation and Transfer	<p>National collaboration with growers, universities and government researchers has resulted in</p> <ul style="list-style-type: none"> • Coordination of research; • Translation of results; • Transfer of knowledge & technologies for grower use; • High adoption rates by industry. 	<ul style="list-style-type: none"> • Training programs • KT Coordinator • Communications and dissemination strategies (i.e. webinars, magazine, newsletters, etc.) • Tours/Open houses for government policy decision makers
Berries	Integrated Pest Management	Effective tools, resources, and practices to manage new and existing pests	<ul style="list-style-type: none"> • Alternative products or techniques for crop protection, and their efficacy (e.g., technology, labour savings, worker safety, bio-controls, reduced residues, etc.) • Resistance management (e.g., new active ingredients, chemical groups, affordable tools for growers to evaluate the efficacy of IPM products and monitor pest pressure) • Management of Spotted Wing Drosophila (SWD) • Develop biological or alternative control methods against blueberry maggot and blueberry flea beetle (wild blueberries) • Predictive models (e.g. growing degree days, biovigilance, disease and insect lifecycle modeling based on weather, etc.) • Continued support for responsive minor use registration system (e.g. harmonization of products available and MRLs with Canada and the US) • Automated and precision IPM diagnostic and management solutions
	Agri-tech and labour saving solutions	Agricultural technology and labour-saving solutions that will improve production efficiency and fruit quality both pre- and post-harvest. We are interested in project concepts for field demonstration, validation or adaptation of developed technologies.	<ul style="list-style-type: none"> • Harvesting solutions, technology • Automation (pre and post-harvest) • Irrigation technology, water management • Labour management solutions, data and HR management • Tools for monitoring (e.g., drones, automatic pheromone traps reporting through cloud based systems, weather stations, irrigation and soil nutrient equipment reporting to smartphones or tablets through cloud based systems, equipment to read plant health through scans) • Precision farming equipment (e.g., harvesters that produce quality product to facilitate processing and lower the loss, fertilizer applicators) • Amendments and cultural practices allowing better water retention, better protection against erosion and better soil fertility
	Cultivar Development & Evaluation	New, profitable cultivars that meet consumer and market demand	<ul style="list-style-type: none"> • Development and evaluation of new cultivars with the following features: <ul style="list-style-type: none"> o resistance to insects & diseases o high quality / increased shelf life o uniform ripening / machine harvesting o consumer preferences (size, flavor, etc.) o timing according to global demand o adapting to changing weather patterns o adapting to soilless production • Regional development and testing of cultivars for adaptation to regional conditions
	Pollination		<ul style="list-style-type: none"> • commercial honey bee research • supporting native pollinators • improved access to pollinators • Promote research allowing the expansion of supply in both native and commercial pollinators (including honey bees and bumblebees)

Production	Farmers have the necessary tools to optimize their quality and cost of production	<ul style="list-style-type: none"> · Cost of production modelling (e.g., software programs, predictive modelling) · Fertilization – both organic and conventional · Cold chain improvement · Cultural practices · Alternative production systems (production in substrate) · Climate change adaptation and mitigation · Adapting to changing climate and weather patterns and more extreme weather events (e.g. frost damage) · Plant growth regulators and bio-stimulants
Product-Market Development	Develop the capacity within Canada to maximize use (from farm to processing) of the product within Canada, capturing the full economic opportunity. New, value-added berry-based products that meet global demand.	<ul style="list-style-type: none"> · Pre-commercialization support programs for new product development (e.g., nutritional labels, storage, benchtop recipes to go, market testing, business plan, risk management, etc.) · Infrastructure from pilot project to reality (e.g., kitchens) · Consumer trends and consumer preferences for domestic and export market opportunities · Collaboration with the value chain · Market & trade data collection and analysis
Health Research	Sustained investment in new clinical trials on the health benefits of berry consumption	<ul style="list-style-type: none"> · Recruitment of new researchers, supporting students and universities · Supported and valid peer review for health research proposals (to evaluate and determine whether this research has already been done) · Investment in WBANA to leverage industry funds (wild blueberry)
Enabling Strategy Knowledge Translation and Transfer		<ul style="list-style-type: none"> · Centres of excellence / resource for farmers and researchers dealing with a particular issue or question · Effective Communication of research results to farmers/end users · Value chain collaboration · Virtual platforms (webinars, social media, etc.)

In addition to the above noted strategic priorities:

- *There is interest in exploring the creation of a National Promotion & Research Agency (NPRA). It is felt that the benefits to the sector of the creation of such an agency would include better coordination, collaboration and funding on research initiatives.*
- *There is an ongoing need in the berry industry, as well as all edible horticultural crops, to establish new plantings with disease free planting stock. There is support for CHC to engage the Canadian Food Inspection Agency and Agriculture and Agri-Food Canada for the creation of an eastern Canada Clean Plant Hub (Centre) which includes berries under a National Clean Plant Program.*