

BCBC Annual General Meeting

Research Report

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As in previous years, this research report includes a table that summarises recently completed and ongoing projects funded through the Council. A large body of research was initiated in 2018/2019 under an AgriScience Project with funding from the BC Ministry of Agriculture and Agri-Food Canada through the Canadian Agricultural Partnership (CAP), which ran from April 1, 2018, to March 31, 2023. This work was in collaboration with the Raspberry Industry Development Council and BC Strawberry Grower's Association under the umbrella of the Lower Mainland Horticultural Improvement Association. Additional research projects were developed from 2019-2021 through competitive Request for Proposals processes.

With CAP ending a few months ago, the bulk of the industry's research and breeding activities are currently tied to a new federal funding cycle that runs from April 1, 2023, to March 31, 2028. Historically, there has been a delay in receiving funding decisions for these research agreements, and this current cycle is no different, meaning that the current months are a transition period between funding programs. Once funding has been secured, we will communicate additional details on what research we will be able to conduct over the next several years. A high-level summary is that the aim is to support the industry's resilience, growth, and environmental sustainability by developing new berry germplasm (i.e., genetic resources) and varieties; identifying genetic markers for pest resistance and fruit productivity and quality, and increasing carbon sequestration during and between cropping cycles.

An industry's access to competitive varieties is the most fundamental factor dictating economic efficiency. The key issue is that most BC blueberry producers rely on varieties bred in other climatic regions. For example, most of our industry's blueberry varieties were developed by breeding programs in regions such as Michigan and New Jersey. The large and important gap that BC blueberry growers face is, therefore, a lack of varieties that are well-adapted to the local climate and that have high yields, superior fruit quality, and resistance to economically damaging pests. Moreover, as the industry replants substantial acreage, there is a gap in the development of cover cropping, organic amendment, and fertilizer management practices to drive carbon sequestration during and between cropping cycles. Therefore, there is the opportunity to build upon current progress in the development of superior berry germplasm (i.e., genetic resources) and new berry varieties, identification of genetic markers to improve breeding efficiency, and establishment of replanting protocols that sequester carbon. Some specific objectives include:

- Sequestering carbon between highbush blueberry planting cycles through the development of cover cropping and organic amendment best management practices.
- Developing disease screening tools that will decrease reliance on pesticides and increase productivity for growers.
- Understanding plant-parasitic nematode species distribution and their impact on highbush blueberry.
- Understanding aphid-parasitoid interactions, the role in virus epidemiology, management implications, and potential sources of genetic resistance in highbush blueberry.
- Developing genetic markers for virus resistance and developing advanced viral diagnostics and treatment tools.
- Developing genetic markers for fruit quality in highbush blueberry.

- Developing genetic markers for increased floral bud set to improve the productivity of highbush blueberry cultivars under local climatic conditions.

As reported in last year's Annual General Meeting report, much of the Council's ongoing work falls into three categories:

1. Blueberry Viruses:

- Assessing viral genetic diversity and improving diagnostic tools so that growers can more effectively determine what viral infections they have on their farms.
- Resolving the taxonomy of the aphids that vector Blueberry Scorch Virus and (potentially) other novel viruses recently detected in blueberry fields in the Pacific Northwest so that we can better control these vectors.
- Evaluating plant genetic resources for resistance to aphid vectors so that we can breed resistance to these vectors into future varieties.
- Developing a model to use drone and/or satellite imagery to map Blueberry Scorch Virus infection across the region.

2. Pollinator Health:

- Addressing bee health concerns by studying the drivers of European foulbrood (EFB) disease in honeybee colonies after pollinating blueberries.
- Creating diagnostic tools for the stressors impacting honeybee colonies during and after blueberry pollination.

3. Berry Breeding and Cultivar Evaluation:

- Investing in the development of new varieties through the long-term effort of the BC Berry Breeding Program – currently there are several “advanced breeding selections” that have entered final stage trials and new varieties may be commercialized in the next couple of years.
- Developing methodologies for assessing phenolic and volatile content in blueberry “breeding selections” – work that will lead to improving the “sensorial” quality of blueberry varieties for better flavour and “liking” by the end consumer.
- Seeking sources of genetic resistance to key pests and diseases so that future varieties are easier and cheaper to manage.
- Evaluating two genetic mapping populations to identify genes relating to high levels of bud set, slowness to become infected with Blueberry Shock Virus, superior fruit quality, and improved “self-fertility”.
- Bridging between berry breeding and the horticultural performance of new varieties in the field, we continue to collaborate with researchers in Nova Scotia, Quebec, and Ontario through the Canadian Berry Trial Network to assess the performance of new varieties from other breeding programs as well as “advanced selections” from the local BC program. Most recently in blueberries, this work is providing BC growers with information about new blueberry genetics coming from three US-based breeding programs (Fall Creek Farm and Nursery, Oregon Blueberry

Farm, and the Michigan State University) as well as several advanced selections from the BC Berry Breeding Program.

Key Issue(s)	Project Title	Lead	Organization	Objective(s)
Diseases (Fungal & Bacterial)	Berry Crop Pathology	Dr. Rishi Burlakoti	Agriculture and Agri-Food Canada	COMPLETED: Developing a decision support system (DDS) for fruit rot will provide growers with better information based on weather station data and predictive models of disease life cycles; isolating and characterizing bacterial blight will be used to develop better screening protocols for the breeding program so that resistant cultivars can be bred for BC and to facilitate the evaluation of alternatives to copper-based products to diversify field-management options.
Diseases (Nematodes)	Development of Molecular Diagnostics for Plant-Parasitic Nematodes in BC	Dr. Tom Forge	Agriculture and Agri-Food Canada	ONGOING: Developing a lab method for detecting nematodes in soil and root samples, filling a gap at BC Agri in diagnostic capacity for the industry.
Diseases (Viruses)	Evaluation of Spray-Induced Gene Silencing of Blueberry Scorch and Shock Viruses	Dr. Jim Mattsson	Simon Fraser University	COMPLETED: Designing a biopesticide that can be used to prevent the spread of economically important blueberry viruses.
Diseases (Viruses)	Development of PCR Based Methods to Reliably Distinguish Shock or Scorch Virus	Dr. Jim Mattsson	Simon Fraser University	COMPLETED: Determining strain variation for blueberry shock and scorch viruses to improve reliability of diagnostic tools available to the industry.
Diseases (Viruses)	Improved Viral Diagnostics and New Pathogen Discovery	Dr. Jim Mattsson	Simon Fraser University	ONGOING: Genomics-based identification and development of diagnostic methods for detection of novel pathogens in BC blueberry farm and nursery industries.
Diseases (Viruses)	Blueberry Scorch Virus Surveillance	Dr. Bing Lu	Simon Fraser University	ONGOING: Use drone flights, satellite imagery, and ground-truthing of virus infection to develop a model for detection of virus-infected plants using satellite imagery.
Genetics & Fruit Quality	Assessing Harvest and Postharvest Fruit Quality in Blueberry	Dr. Simone Castellarin	University of British Columbia	ONGOING: Assessing fruit quality of current cultivars and breeding selections at harvest and at various times postharvest during cooler storage to determine biochemical constituents of fruit quality and direct the development of new cultivars, and evaluating postharvest treatments and advanced packaging materials to improve shelf-life of standard cultivars.
Genetics & Fruit Quality	Canadian Berry Trial Network	Dr. Eric Gerbrandt	Canadian Horticulture Council	ONGOING: Evaluating new cultivars and advanced selections under commercial conditions through on-farm grower trials, linking to similar work in Ontario, Quebec and Nova Scotia as the first Canadian Berry Trial Network.
Genetics & Cultivars	Berry Germplasm Evaluation for the Fraser Valley	Dr. Michael Dossett	BC Blueberry Council	ONGOING: Characterizing germplasm to obtain new genetic sources of resistance to biotic and abiotic stresses, improved fruit quality and novel traits of interest; developing molecular and phenotypic selection tools; and moving the gene pool forward through annual crosses and recurrent selection on each generation of seedlings.
Genetics & Cultivars	Berry Cultivar Development for the Fraser Valley	Dr. Michael Dossett	BC Blueberry Council	ONGOING: Implementing unreplicated observation trials; conducting replicated evaluation trials; and propagating virus-free plant material of breeding selections for advancement toward cultivar release.

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Horticultural Management	Berry Crop Enhancement	Dr. Eric Gerbrandt	Sky Blue Horticulture Ltd.	COMPLETED: Enhancing crop establishment, yield, and fruit quality through evaluating alternative crop inputs and mitigating cultivar-specific challenges related to adaptation to local climatic conditions for novel blueberry cultivars.
Horticultural Management	Controlling Blueberry Fruit Development using Plant Growth Regulators	Dr. Charitha Jayasinghe	Agriculture and Agri-Food Canada	ONGOING: Using plant growth regulators to de-blossom new plantings as well as delay the ripening for various blueberry cultivars to shift the harvest window.
Pests (SWD)	Ecological Pest Management for Spotted Wing Drosophila	Dr. Juli Carrillo	University of British Columbia	COMPLETED: Developing alternative methods of SWD control to reduce regional pressure and reliance on chemical tools, including evaluation of intercropping options to repel SWD, developing better attractants for lures and traps, and establishing effective biological control species in the region.
Pests (SWD)	Evaluating Mass Trapping as a Tool for Non-chemical Spotted Wing Drosophila Management	Allyson Kang	ES Cropconsult Ltd.	COMPLETED: Evaluating mass trapping as an option for reducing SWD pressure in conventional and organic settings.
Pests (Weevils)	Minor Use Screening Trial for Weevils – 2020 and 2021	Arlan Benn	ES Cropconsult Ltd.	COMPLETED: Assess efficacy of new chemistries against standard products for their ability to control root weevils.
Pests (Aphids)	Minor Use Screening Trial for Aphids – 2022	Jen McFarlane	ES Cropconsult Ltd.	ONGOING: Assess duration of efficacy for novel pre-bloom aphicides compared to current standards.
Pests (Aphids)	Understanding the Population Genetic Structure of the Blueberry-Infesting Aphid, <i>Ericaphis fimbriata</i> species complex, in the Pacific Northwest	Drs. Bryan Brunet and Michelle Franklin	Agriculture and Agri-Food Canada	ONGOING: Resolve the taxonomic issues relating to the aphid species responsible for vectoring Blueberry Scorch virus.
Pests (Various)	Implementing Integrated Pest Management Practices on Small-Scale Farms	Marjo Dessureault	ES Cropconsult Ltd.	COMPLETED: Developing IPM training materials for small-scale fruit and vegetable growers to handle shifts in pest pressure due to climate change and to improve region control.
Pests (Various) & Genetics	Berry Crop Entomology	Dr. Michelle Franklin	Agriculture and Agri-Food Canada	COMPLETED: Providing the breeding program with information on the relative susceptibility or resistance of advanced selections to key arthropod pests to inform decisions about release and management of new cultivars.
Pests (Voles)	Non-Chemical Vole Control in Berry Fields	Sofi Hindmarch	Fraser Valley Conservancy	COMPLETED: Assessing effectiveness of a non-chemical option for killing voles (i.e., a commercial trap that has a self-resetting, bolt-action kill mechanism) as compared to rodenticides.

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Pollination & Bees	Effects of Host, Pathogen, and Environmental Factors on Increased Incidence of European Foulbrood in Honey Bee	Dr. Sarah Wood	University of Saskatchewan	COMPLETED: Determining effects of common pesticides on bee susceptibility to European foulbrood (EFB) disease and assessing ways to improve bee nutrition and health.
Pollination & Bees	Effect of Brood-to-Nurse Bee Ratio and Pathogenicity of <i>M. plutonius</i> on EFB Disease Association with Blueberry Pollination	Drs. Sarah Wood, Ivanna Kozii, Elemir Simko	University of Saskatchewan	ONGOING: Refine a colony infection model to determine impact of bee ratios on susceptibility to European foulbrood (EFB) disease and compare strain virulence from blueberry pollinating hives.
Pollination & Bees	The Blueberries and the Bees: Assessing Honey Bee Health Stressors Using Proteomics	Dr. Leonard Foster	University of British Columbia	ONGOING: Develop diagnostic tools to assess the cause(s) of weak hives as an objective means of diagnosing and mitigating challenges to bee health.