

Plain Language Research Summary - AgriScience Grape & Wine Cluster - 2025-2026

Activity #9: Influence of temperature and heat-stress mitigation strategies on grape quality in British Columbia vineyards

Principal Investigator(s): Dr. Simone D. Castellarin (University of British Columbia); Dr. Nathaniel K. Newlands (AAFC Summerland)

1. What is the overall focus of this research activity?

This project aims to assess the effects of heat stress on grape production, and on developing new strategies to mitigate heat stress effects in vineyards. We will elucidate whether varying irrigation levels influences the response to a heatwave in Okanagan Valley vineyards and study the capacity of bio-stimulants and to mitigate heat stress and heatwaves in vineyards. We will also assess how major grape cultivars grown in BC are susceptible to heat stress and which cultivars better recover from heat stress. Finally, we will conduct a regional-scale study of temperature effects on grape quality (sugars, acids, and aroma) in the Okanagan Valley, and model optimal environmental conditions for grape quality.

2. What are the main progress updates/milestones in terms of work that was done on this research activity this year?

In 2025, we performed the first field experiment on irrigation management and bio-stimulant applications to mitigate the effects of heatwaves. We are conducting these studies on two major BC varieties: Cabernet Franc and Shiraz. The experiment was conducted in a commercial field located in the south of the Okanagan Valley (Oliver, BC), where heatwave events normally occur. In 2025, we observed two heatwave events (with temperatures above 35 ° Celsius) and data on grapevine physiology and berry quality were collected before, during, and after these events. In 2025, we have also built portable greenhouses that can be localized in the vineyard for inducing artificial heatwaves. These greenhouses will be used in 2026 to simulate various heatwaves during the season.

We continued conducting greenhouse-, growth chamber-, and laboratory-based experiments to test the tolerance of major grapevine varieties grown in BC to heat stress. We tested what temperature would permanently damage the leaf photosystems. Our results indicate that the threshold where damages become permanent is 47 °Celsius for all those varieties. Additional greenhouse and growth chamber experiments will be repeated in 2026-27.

As part of these activities, a postdoctoral fellow was hired to support with the metabolite analyses.

In 2025, we expanded our contact with industry partners and vineyards across the Okanagan for conducting the experiments related to modeling the impact of climate on grape quality (in Riesling). Two additional vineyards participated in the Okanagan-wide vineyard research, namely: Synchronesh (Okanagan Falls, BC) and Phantom Creek (Similkameen, BC). A statistical analysis of heatwaves in the Okanagan was furthered to identify the frequency, duration, and magnitude of heatwave events regionally in the context of agriculture/grapevine response and heat thresholds from historical weather records. This involved co-supervision and training of a PhD/RAP student in extreme event modeling. This is being written into a collaborative scientific manuscript. Supplementary data on phenology stage, light-attenuation, stomatal conductance, chlorophyll was collected, alongside grape samples at harvest on grape quality and aroma. A rapid tool for automated measurement of conductance and fluorescence was successfully procured which will aid significantly in more intensive sampling in the 2026 growing season. Harvest sample data collected in 2024 is now processed by UBC (Castellarin's lab) and 2025 samples for all plots are being processed by Caley Craven and the AAFC SuRDC analytical chemistry lab. A statistical analysis that is testing several temperature accumulation models for predicting ripening time and level against harvest data collection from the (Riesling) vineyards sites in the Okanagan Valley is being furthered.

As part of the regional vineyard climate analysis, a coop student was hired, supervised, and trained in building a database of vineyard climate data (weather and sensors), linking available high-resolution data from provincial data on soil, elevation, and topography.

Four presentations about the projects were delivered to local (BC) and national (Nova Scotia, Ontario) stakeholder communities. New connections were made with viticulture and climate experts in France regarding a global agro-climate database with the inclusion of Canadian data.

Dr. Castellarin and the BC Wine Grape Council has secured a MITACS grant to support the hiring of a postdoctoral fellow, Dr. Jumi Gogoi, for modeling the impact of climate on diseases and microclimate in vineyards. This postdoctoral fellow is contributing to this project with performing cold hardiness and heatwave analyses for BC and Canada.

3. What is this research activity's intended impact on the Canadian grape and wine industry? What benefits could/will the growers, wineries, consumers, etc. see as a result of this research?

This study will allow us to identify the effects of heatwaves on canopy function (photosynthesis and transpiration) and grape quality and to assess how the impact of irrigation regimes on heatwave effects. The study will also assess the sensitivity of BC grape cultivars to heatwave

events and the impact of climate-change mitigation strategies on grapevine canopy function and grape quality in major grape cultivars cultivated in BC. So far, our analysis has produced usable information for the grape industry related to frequency and magnitude of heatwaves in BC and Canada. Other data produced require validation for multiple seasons.

New grape quality data has been obtained to enable preliminary modeling of temperature (sensor data) effects on grape quality (in Riesling). These models will allow us to make future predictions for the regional suitability and quality of aromatic cultivars. This information may also be useful to aid growers in seasonal management decisions.

4. Do you have any communications materials, publications, or other content related to this research activity that you would like CGCN-RCCV to share?

We presented results related to this project to the BC, Nova Scotia, and Ontario wine industry and community and at national conferences. One proceeding paper has been published and two other manuscripts have been drafted. These presentations and drafts (in-progress) cannot be shared at the moment as results are preliminary and publications have not been finalized. If requested we can provide the copies of the presentations and drafts of the manuscripts but we will ask not to disseminate them publicly.