

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

Activity #15: From carbon sequestration to terroir: Understanding the impact of abiotic stresses on grapevine, berries, and wine quality to foster sustainable grape and wine production

Principal Investigator(s): Dr. Karine Pedneault (Université du Québec en Outaouais)

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

Grapevines are particularly promising due to their resilience and ability to thrive in diverse environments with minimal inputs. However, challenges such as climate change-induced extreme weather events and energy-intensive practices threaten the industry's sustainability. Our program seeks to address these challenges by developing innovative viticulture and winemaking techniques that prioritize carbon sequestration, low input usage, and reduced greenhouse gas emissions.

To achieve this goal, we will particularly focus on three aspects: 1) Explore the potential of perennial crops like grapevines to capture carbon from the atmosphere in different conditions, offering a sustainable solution to reduce greenhouse gas emissions; 2) Improve our understanding of highly resilient cold-hardy/disease resistant (CHDR) grape varieties ; 3) Develop low-GHG and sustainable viticulture and winemaking approaches to improve the quality of wines made from CHDR grape varieties.

By leveraging new technologies and resilient grape varieties, we aim to enhance vineyard resilience, improve berry quality, and foster sustainable postharvest practices. Through comprehensive assessments of the environmental, economic, and social impacts, our research endeavors to advance the sustainability of Canadian grape growers and wineries, ultimately reducing Canada's carbon footprint and enhancing the industry's long-term viability.

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

In viticulture, we found without surprise that carbon sequestration models developed for *V. vinifera* cannot be applied to resistant varieties. We are currently moving towards new models for this purpose. In lab experiments, we showed that UV-C exposure, even at very low dosage, modifies leaf and berry chemical composition significantly, in both leaf and berries, with a differential response between both organs. Untargeted metabolomics allowed the identification of 502 metabolites in the leaves and 208 in the berries, with 40 and 20 compounds showing

significant differences between treatments in the leaves and berries, respectively. Finally, on the winemaking side, we showed that post-harvest treatments contribute to reduce acidity and significantly modify must and wine composition in resistant grape varieties, providing consistent results at both lab and larger size levels. We also demonstrated the impact of two postharvest treatments on the sensory perception and appreciation scores of wines made from white resistant varieties.

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 research activity focuses on developing different angles of sustainable viticulture and winemaking practices to eventually conduct to improve the sustainability and the resilience of the Canadian wine industry. Our research aims to benefit growers, wineries, and consumers alike. For growers, implementing sustainable practices and resilient varieties can lead to improved vineyard resilience, reduced input costs, and increased profitability. Sustainable methods also contribute to environmental conservation and minimize the industry's carbon footprint, aligning with consumer preferences for eco-friendly products. Wineries stand to gain from enhanced grape quality, resulting in higher-quality wines that appeal to discerning consumers. Additionally, by adopting sustainable postharvest practices, wineries can streamline operations and reduce waste, further improving their bottom line.

Ultimately, consumers can expect to enjoy wines of superior quality, produced in a manner that prioritizes environmental sustainability and social responsibility. This research not only benefits industry stakeholders but also contributes to the broader goal of building a resilient and sustainable Canadian wine industry for future generations to enjoy.

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

The following communication materials and presentations related to this research activity have been produced over the 2025-2026 year:

-  2 scientific conferences (MacroWine 2025 ; Vitinord 2025), 2 webinars CRAAQ and 2 posters (ISFORT, 2025) were presented on the impact of postharvest treatments of different resistant grape varieties on grape and wine composition.
-  1 conference on the theme of viticulture adaptation to climate change was offered to the industry stakeholders (SERVO conference 2025).

 1 poster on the impact of UV treatments on grapevine metabolome was presented at the Colloque de l'ISFORT 2025.

Some of these presentations and posters are available upon request (email karine.pedneault@uqo.ca).