Plain Language Research Summary - AgriScience Grape & Wine Cluster 2023-2024

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

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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 focuses 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?

We've successfully set up extraction and analytical protocols for UPLC-MS-MS analyses of several types of compounds, including thiol precursors (3MH and 4MMP attached to amino moieties, about 12 compounds), glycosylated precursors (C_6, C_{13}, alcohols, volatile phenols, and terpenes attached to sugar moieties, about 70 compounds), amino acids, organic acids, and sugars. Our

ongoing efforts are now focused on fine-tuning our analytical pipeline to align it with our objectives.

We completed a first study as part of Obj. 3, on the impact of cold storage and partial grape drying at different temperature on berry acidity and aroma precursor content, including thiol precursors and glycosylated precursors. We showed that conditions, mainly temperature, differentially affect the concentration effect due to water loss and the metabolic effect due to the on-going metabolic reactions in senescent berries. Warm temperatures led to more efficient decrease in titratable acidity in all studied varieties. Temperature also affects the profile of aroma precursors (both glycosylated and thiol precursors) in berries.

Finally, we've wrapped up a comprehensive literature review on sustainable winemaking practices, soon to be submitted for peer review. Preliminary trials for sustainable winemaking approaches, exploring the reuse of waste materials like grape shoot and stems, are upcoming. These innovative methods aim to bolster sustainability while preserving or even enhancing wine quality throughout the winemaking process.

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? If so, please provide a brief description here and either link it here or send the file as an attachment along with this summary.**

Four knowledge transfer activities were conducted during Y1, including three conferences (Journée vigne Outaouais, Colloque Alcools d'ici, SERVOS) and one poster (Journée Portes ouvertes UQO) (listed below). These presentations and posters are not available online but slides and posters can be shared with CGCN on demand.

1) **Event organized:** "Journée vigne en Outaouais" held on August 31st, 2023, organized by CREDETAO/ISFORT with the theme "Comprendre et optimiser la qualité du vin."

   At this event, we discussed the biochemistry of cold hardy/disease resistant varieties through diverse conferences, and workshops on cultural practices adapted to CHDR varieties, acidity measurement and berry sensory analyses (event organized by CREDETAO and K. Pedneault, ISFORT/UQO).

2) **Industry conference:** K. Pedneault (speaker), M. Lamine, P. Nicolle, A. Roland. Stress abiotiques et qualité des baies : Approches physiologiques pour gérer l'acidité et bonifier le potentiel aromatique des baies en climat froid. Colloque Alcools d'Ici, Drummondville, QC, 14 mars 2024.

   At this conference, we presented the first results on our postharvest method trials (partial grape drying and cold storage) to grape and wine producers in Quebec (event organized by the CVQ).

3) **Industry and stakeholders conference:** "Stress abiotiques : De la résilience de la vigne à l'utilisation de stress contrôlés en viticulture nordique", Séances d'échanges sur la recherche en viticulture et œnologie, Saint-Hyacinthe ; March 26, 2024.

   At this conference, we presented our partial results on the impact of postharvest treatments trials (partial grape drying and cold storage) to industry stakeholders in Quebec (event organized by Evelyne Barriault, MAPAQ).

4) **Poster, Journée portes ouvertes, UQO :** Lamine, M., Nicolle, P, Roland, A, Hébert-Haché, A, Pedneault, K. Le passerillage peut-il réduire l'acidité des raisins chez les cépages cultivés en climat froid, Journées portes ouvertes UQO, Gatineau, 18 novembre 2023.

   At this event, we presented our results on the impact of temperature on partial grape drying and cold storage on must titratable acidity to a general public audience at the Journée Portes ouvertes of the UQO (event organized by UQO).