Canadian Grapevine Certification Network
CGCN · RCCV
Réseau Canadien de Certification de la Vigne

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

Activity 14: Increasing climate change resilience by a better understanding of cold hardiness and with novel frost protection methods

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

Cold damage is the biggest economic threat to grape growing in cold climate. Extreme weather events like polar vortex and spring frosts are now recurring in regions where they were seldom observed before. Current cold protection methods can only go so far. Passive methods like site and cultivar selection are not helpful when vineyards are facing unpredictable winters or fall and spring frosts. Active methods, such as wind machines and burning logs throughout the vineyard have a high carbon footprint and cannot protect against certain types of weather events. Important decrease in yield caused by cold and frost damage are well known, but cultural practices and spray program still need to be implemented, with their related greenhouse gas emissions and economic cost. This means that the yield reduction associated to cold damage is significantly increasing the ratio of energy input and greenhouse emission per bottle of wine. Mitigating yield reduction associated to cold damage would positively impact this ratio, the industry, and the environment.

This project was designed to address the current challenges in the industry and the gap in literature regarding the scientific knowledge and application of specific technologies with regards to cold events in the winter and in the spring. To achieve this, the project proposes three specific objectives: 1) to improve bud survival and overall yields by strengthening our knowledge of site differences and physiological influences on cold hardiness for hybrids and *Vitis vinifera* cultivars, 2) reduce cold damage under geotextiles by a better understanding of their impact on acclimation, maximum hardiness, deacclimation, and bud break, and 3) mitigate yield reductions associated to primary bud damage and tissue mortality caused by deep-freeze event and spring frosts by using novel protection methods in vineyards. Three methods will be tested as part of this final objective: an application of phytohormone called abscicid acid, the use of heated electric wires, and the use of a cellulose nanocrystal spray. These three objectives will help the Canadian grape growing regions deal with the extreme weather events they are regularly facing. By stabilizing or improving yields annually, this proposal will also support the economic growth of the sector by helping growers make more wine per acre.

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

The work this year focused on initiating the data collection and to organize the research plots for real-life trials in the 2024-2025 winter. As part of the first sub-activity on cold hardiness and dormancy, the research vineyards were selected and the research plots within them were designated. Data collection on cold hardiness, dormancy status and deacclimation rates in forcing conditions were collected for all research sites throughout the winter. Harvest data and pruning weights were also collected. The second sub-activity on geotextile is in its initiation states. The vineyard was selected, and research plots were identified, but the full experimental design will be set up for the 2024-2025 winter. Similarly to the second sub-activity, sub-activity 3 is in the organization stages and data collection will start during the 2024-2025 winter. The research plots have all been identified, and the equipment and materials required for laboratory testing of some of the technologies have been trialled and are ready to be used. As soon as the products are received, testing will begin.

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?**

The proposed projects address two main priorities namely 1) climate change and environment, and 2) economic growth. Cold damage is the biggest abiotic threat to grape growing in cool climate. Better understanding the dynamics of cold hardiness and dormancy and investigating novel ways of fighting the cold and frost events are pivotal steps in improving winter survival. Overall, this project has the potential to provide benefits to all grape-growing regions in Canada. It will improve the sustainability of the industry through the reduction of cold and frost damage and support the economic growth of the sector. The economic impact of cold damage is well documented. In Ontario, losses of $13.8M were projected for a cold event leading to a 16% crop loss in the year of the cold event, and $11.7M in subsequent years related to vine death. Moreover, work in vineyards require the same number of tractor passages even following cold events where significant proportion of the crop is lost. Providing growers with freeze and frost mitigation strategies that improve yield annually will therefore decrease greenhouse gas production per ton of grape produced.

Better understanding of physiology can lead to the development of new technology or adaptation to better protect grapevines against extreme winter temperatures. The data collected as part of this activity will be used for the development and validation of models of phenology and cold hardiness for hybrids and *V. vinifera* which will improve our ability to predict dangerous freezing events and our usage of mitigation strategies related to changing climates to improve the sustainability of the industry. Important information will also be

generated that could be used for more efficient management of frost protection systems, such as wind machines against spring frost. Optimization of use of the wind machine was also demonstrated to reduce monetary and environmental cost related to their usage. Again, improving our resilience when facing freezing and frost events will improve the sector's sustainability. Finally, the three objectives of this project will allow a better understanding of grapevine physiology related to cold hardiness of several varieties produced under Canadian eastern climatic conditions. Damage caused by frost (winter, spring or autumn) generates significant losses each year. At the end of this project, growers, agronomists, researchers and stakeholders alike will have a varied arsenal to combat frost and have a positive impact on the yields and fruit quality.

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.**

No material is available for this year.