Building resilience in Canadian vineyards through grapevine selections

openaccessgovernment.org/article/building-resilience-in-canadian-vineyards-through-grapevine-selections/186661

19 December 2024

Jim Willwerth, Assistant Professor and Researcher at Brock University, Canada, discusses how to build resilience in Canadian vineyards through grapevine selections

We are always talking about the weather, at least as Canadians, right? Environmental conditions affect important plant responses that can impact agricultural production (yields) and quality. However, it can be argued that yearly weather events and long-term climate can have a more profound effect on grape and wine production and its quality. This is partly due to the “terroir effect” that explains why a wine made from a particular variety sourced from a specific region has its own style and sensory profile.

The entire French Appellation system is based on this and is embraced in “New World” regions such as in Ontario, Canada, with the Vintners’ Quality of Alliance (VQA) wine appellation authority. (1) Weather during the growing season can influence a wine’s taste and flavour profile. This gives wines a “sense of place,” which is why a variety may have subtle differences based on its region. Every vintage is unique; one year may be superior to another or age longer in the bottle.

Wine regions with a long history of weather data have found that their climates have changed. Some wineries with many generations have seen their harvest dates differ and wine styles change from when their parents or grandparents grew wine grapes. However, it may be the extreme weather and potential increased frequency of such events that have more profound impacts. It is nothing new to have crop losses due to extreme weather events. This can result from extreme heat, drought or a singular extreme weather event such as an extremely cold night, hail, or extreme rainfall.

In some cases, it can lead to crop reduction due to reductions in natural production yields or may result from quality-related issues such as disease, poor fruit maturity or composition. No agricultural sector anywhere is immune to weather extremes, and adaptation and mitigation strategies are critical for sustainable production, especially if the frequency of such events is on the rise.

Innovation for grape and wine production

Innovation is required to mitigate weather and climate effects. One of the most important strategies is adaptation through more resilient plant material to weather variability and extremes. Breeding or selecting grapevine material more tolerant and resilient to both abiotic and biotic stress is becoming increasingly important.

This includes greater tolerance to extreme temperatures (heat, cold), water-related issues (drought or too much rain), fluctuations in weather or pests and disease. Grapevine breeding programs use modern technologies to identify genetic markers that may relate to more disease tolerance or other stresses. Genome editing technology (CRISPR- cas9) can then lead to the development of new grapevines that have improved traits making them more resilient and sustainable (however, consumer acceptance is yet to be determined). Aside from breeding new vines, there are thousands of grapevine selections, including cultivars, clones, and rootstocks of different ecotypes and unique characteristics. Many of these selections have not been extensively trialled outside of their region of origin.

Clone and rootstock combinations in Canadian vineyards

One area of research in our lab group at CCOVI, Brock University, has been to evaluate different clone and rootstock combinations in vineyards of different soil types for important cultivars to our industry. We are also expanding this work to study newly developed grapevine cultivars in commercial vineyards and the future Brock Research Farm.

This research is supported by industry stakeholders, Ontario Grape and Wine Research Incorporated (OGWRI) and Canadian Grapevine Certification Network (CGCN) and through matching government funds through Agriculture and Agri-Food Canada's AgriScience program under the Sustainable Canadian Agricultural Partnership.

The main objective of this research is to support the CGCN's domestic clean plant program through an accelerated selection of superior grapevine material for improved performance, cold resilience, and quality using traditional evaluations and genomic and metabolic signatures. Research, innovation, and technology are critical components to ensure the industry's economic growth.

As with other world-class wine-producing regions, Ontario is built largely on V. vinifera cultivars that lack significant cold tolerance. Freeze injury is a continuous threat to the sustainability of the Canadian grape and wine industry even as other threats may exist freeze injury can result in significant fruit shortages and economic losses across the entire value chain from one single cold event.

This is also critical to the CGCN's goal of providing the Canadian grape and wine industry with the highest-performing grapevine material possible. Our previous research has demonstrated that grapevine cultivar, clone, and rootstock can impact cold tolerance [(2)], yield, and fruit quality. Cold hardiness is the most limiting factor for grape production in Canada. Understanding how different grapevine material responds to changes in temperature during the dormant period is critical to developing mitigation strategies.

Cold hardiness is a complex trait and factors such as genotype and environmental conditions can impact cold hardiness and how resilient a grapevine may be to erratic or extreme weather. Our team is examining vine performance and cold tolerance for these selections, and the plan is to expand winemaking and clonal sensory evaluations to

determine best-in-class clones for core V. vinifera cultivars grown in Ontario and evaluate new cultivars for Ontario. Therefore, we are conducting vine evaluations and cold hardiness-related research activities in parallel through a transdisciplinary approach.

This knowledge will further our understanding of grapevine cold hardiness. Most clonal selections are based not on cold tolerance but on fruit composition and wine quality.

If genomic and metabolic markers can be identified and validated through this research it will begin to provide steps in marker-assisted selection of varieties, clones and/or rootstock for improved cold tolerance. This would allow for a more rapid selection of superior grapevine material, which is more resistant to freeze injury for Canadian vineyards. This may include “Canadian” clones that would reduce our reliance on other breeding/selection programs.

All aspects of this project will help support a domestic selection program through the Canadian Grapevine Certification Network and accelerate the selection of plant material in Canada. This is critical because the climate is potentially changing more rapidly than very long-term studies can take place.

Reference

1. https://vqaontario.ca/about-us/
2. Hébert-Haché A., Inglis. D., Kemp, B. and Willwerth, J. (2021). Clone and rootstock interactions influence the cold hardiness of Vitis vinifera cvs. Riesling and Sauvignon blanc. Am. J. Enol. Vitic. 72: 126-136

Contributor Details

Stakeholder Details

- Article Categories
- Agribusiness

- Article Tags
- Agro-Food Sector
- Food Production
- North America Analysis

- Publication Tags
- OAG 045 - January 2025

- Stakeholder Tags
- SH - Brock University - Department of Biological Sciences - Cool Climate Oenology and Viticulture Institute (CCOVI)