

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

Activity #8: Prediction, prevention, and mitigation of smoke-taint (and other air-borne aromas) in grapes and wines

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

Smoke-taint originates when ripening wine grapes are exposed to forest fire smoke. Smoke-taint is notoriously difficult to predict ahead of harvest because the chemicals in smoke that are responsible for its pungent aroma (these are called “volatile phenols”; VPs) are transformed by grape enzymes into a plethora of non-volatile—and hence non-detectable by smell—analogues. These masked VP are released by the activity of yeasts during the fermentation process. The overall focus of this research activity is three-fold, encompassing the development of predictive methods, early detection strategies and, most importantly, the development of preventative or mitigation techniques.

To improve our predictive abilities, research will be conducted in improving existing analytical tests, assess the differences in grape varietal sensitivity as well as attempt to correlate simpler atmospheric measurements with the air-borne concentrations of VPs. Detection efforts will also focus on the development of analytical procedures that can be used in nearly real-time by vineyard (or winery staff). Finally, prevention and mitigation strategies will explore the applicability of approved agro-sprays for blocking the absorption of VPs into grape tissues as well as several techniques enabling their targeted elimination either before or after primary fermentation.

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

A large field study was launched to carefully evaluate variety-specific responses to forest fire smoke exposure. This study, paired with improved analytical methods (reported last year) will give the most comprehensive picture produced to date regarding the adhesiveness of smoke-derived aroma compounds for the surface of common BC varieties of wine grapes as well as information regarding post-exposure biochemical transformations of these compounds in-grape. Additionally, a set of experiments was performed evaluating the washability of the grape surface; these experiments investigated the potential application of different treatments, all

aimed at eliminating or reducing the concentration of smoky-aroma molecules from grapes prior to fermentation.

Two proof-of-concept experiments were performed in which the potential to remove smoky aromas from juice before fermentation was investigated. In both instances, our initial data are very promising and these mitigation efforts will be prioritized in the upcoming year.

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?

Understanding varietal-specific responses to smoke exposure is an important component of risk-prediction/crop insurance. Right now, all the industry has is anecdotal evidence largely derived after testing grape after naturally occurring fires. This evidence lacks matching control grapes and, with respect to the different grape varieties, is confounded by the fact that they are either located in different vineyards (so varying in their distance from the smoke source) or at different stages of development during the exposure. This creates uncertainty regarding the actual risks. Systematically evaluating 10 different varieties across multiple ripening time points will be an important benchmark.

Our proposed mitigation strategies are unique. If we are able to advance beyond our initial, successful proof-of-concept, they will enable the targeted removal of smoke-taint causing compounds either from juice/must or wines, representing a significant shift in how smoke-taint is managed in the winery.

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

Not at this time.