



Report– VineAlert 2019-2020, MVIP funded project

Prepared by: Debra Inglis and Jim Willwerth

Reporting Period: November 1, 2019 – February 22, 2020

Submission Date: February 22, 2020

Program Coordinator: Dr. Debra Inglis

Executive Summary:

Program Summary:

The purpose of this project is to provide grape growers with comparative levels of bud cold hardiness for key grape cultivars in different viticultural areas during grapevine dormancy. Monitoring bud cold hardiness throughout the dormant period is an invaluable tool to assist grape growers in avoiding freeze injury of their vines. The data collected is provided to grape growers through VineAlert's web-accessible database which allows growers and researchers to see how cold tolerant cultivars are within a specific area at sampling times throughout the dormant period and hardiness responses based on changes in temperature during dormancy. Grapevine cold hardiness is not static but varies throughout the dormant period. Therefore, bud sampling and testing is done throughout the entire dormant season to monitor cold hardiness through the acclimation, maximum hardiness and deacclimation periods. This ever-changing bud hardiness data can be helpful in determining when wind machine use or other freeze avoidance methods are warranted to protect vines from cold temperature injury. Changes in cold tolerance can be very cultivar-specific and through this program we can learn how changing environmental conditions can impact not only maximum hardiness of a cultivar but also how quickly they gain and/or lose cold hardiness. Therefore, this project has important outreach and research aspects that are beneficial to the entire Ontario Grape and Wine sector.

Summary of Activities to date:

Permission was granted for the CCOVI team members (including Brewster Consulting Services (BCS) staff) to access commercial vineyards in each viticultural area for sampling of grapevine tissue (canes with buds) so that bud hardiness can be measured. Updates of freezer and hardiness testing components have been made at both the BCS lab and the CCOVI viticulture lab. The first samples for bud hardiness measurements occurred in mid-October and are ongoing.

Objectives or Goals accomplished:

There are four objectives listed for this project as follows:

1. Understand the impact of environmental conditions on the rate of cold acclimation/deacclimation in Ontario
2. Determine the variability in hardiness level of *V. vinifera* cultivars within Ontario's designated viticultural areas
3. Integrate data in VineAlert's web-platform database and have early warning systems for the grape grower community to mitigate cold weather events.
4. Reduce the effects of freeze injury through effective technology transfer.

Goals 1, 2 and 4 have not yet been accomplished as the deacclimation period is just beginning. The website has been updated to accept the current year's data.

Detailed description of the Project:

Objectives and project Input:

The project objectives are as follows:

1. Understand the impact of environmental conditions on the rate of cold acclimation/deacclimation in Ontario
2. Determine the variability in hardiness level of *V. vinifera* cultivars within Ontario's designated viticultural areas
3. Integrate data in VineAlert's web-platform database and have early warning systems for the grape grower community to mitigate cold weather events.

4. Reduce the effects of freeze injury through effective technology transfer.
5. Build up the database for seasonal variation of bud hardiness to assist in improving grapevine cold hardiness modelling.

Technicians at BCS were hired for bud hardiness sampling. Jim Willwerth and Ryan Brewster were part of the VineAlert program again for the 2017/18 season.

Activities/Methodology:

Site selections of vineyards to be sampled for bud hardiness were confirmed in the Niagara Peninsula, Lake Erie North Shore and Prince Edward County. Sampling began in October for the Niagara Peninsula and mid-November for Lake Erie North Shore and Prince Edward County. All data to date was posted to the VineAlert website and is accessible through the website <http://www.ccovi.ca/vine-alert>

Results to date:

Maximum cold hardiness of grapevines occurred in late January/early February 2020 for most varieties and locations. The growing season had a significant impact on grapevine winter hardiness for the 2019/20 dormant period. The vintage of 2019 consisted of many variables that impacted cold acclimation and maximum hardiness of all varieties growing in Ontario's appellations. The growing season was later and wetter than average even though growing degrees days accumulated were average for all designated viticultural areas. Optimum moisture levels throughout the season coupled with some warmer weather led to excessive vigour/growth as well as large crop loads even with the adequate vine size. Furthermore, cool and wet conditions delayed harvest of large crops and also resulted in late season vine growth. This, in combination with a warmer winter season to date, has led to less maximum hardiness across most varieties and locations (see Figure 1). Maximum winter hardiness was also not optimized even with hardier *V. vinifera* cultivars such as Riesling or hybrid cultivars. In some cases, varieties were up to 2.5°C less cold tolerant compared to some previous years based on LTE50 values (i.e., Chardonnay sampled at Four Mile Creek, Niagara Peninsula) (see Figure 2). There has been quite a bit of weather variability for the fall and winter. Generally, the winter months have been warmer than normal and with less snow cover. Soils have likely been warmer than normal for the winter months compared to average. In some of the sandier locations, with warmer soils, vines are beginning to show some earlier deacclimation.

Compare Varieties LTE 50

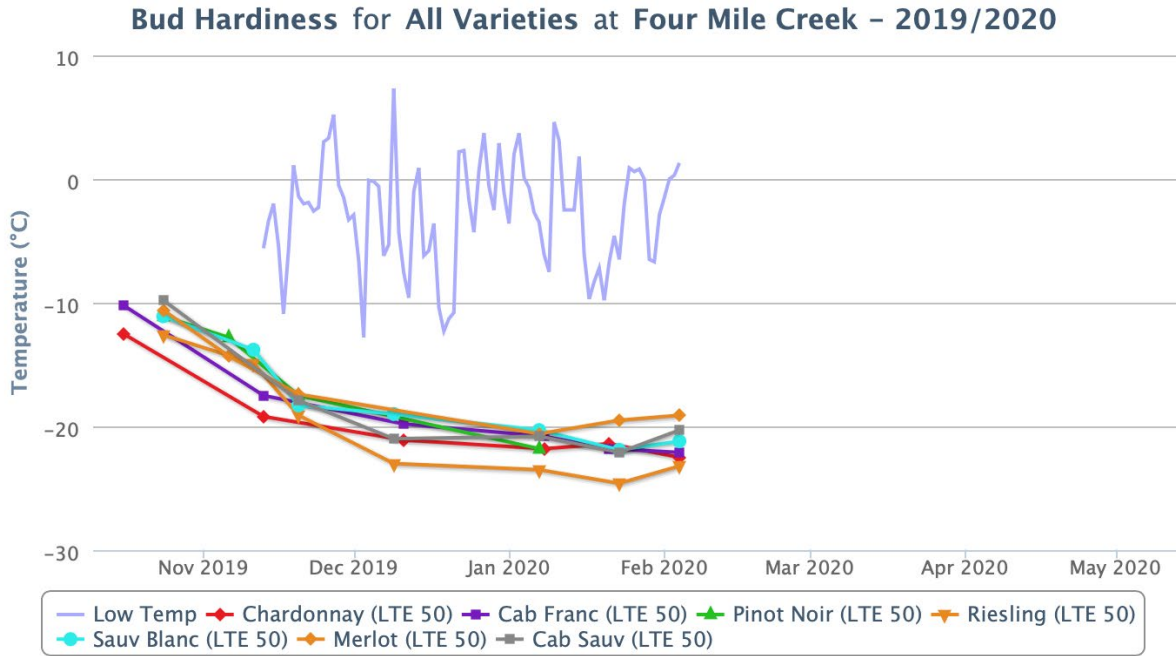


Figure 1. Bud hardiness of different cultivars at Four Mile Creek Sub-appellation with minimum daily temperatures.

Compare Years LTE 50

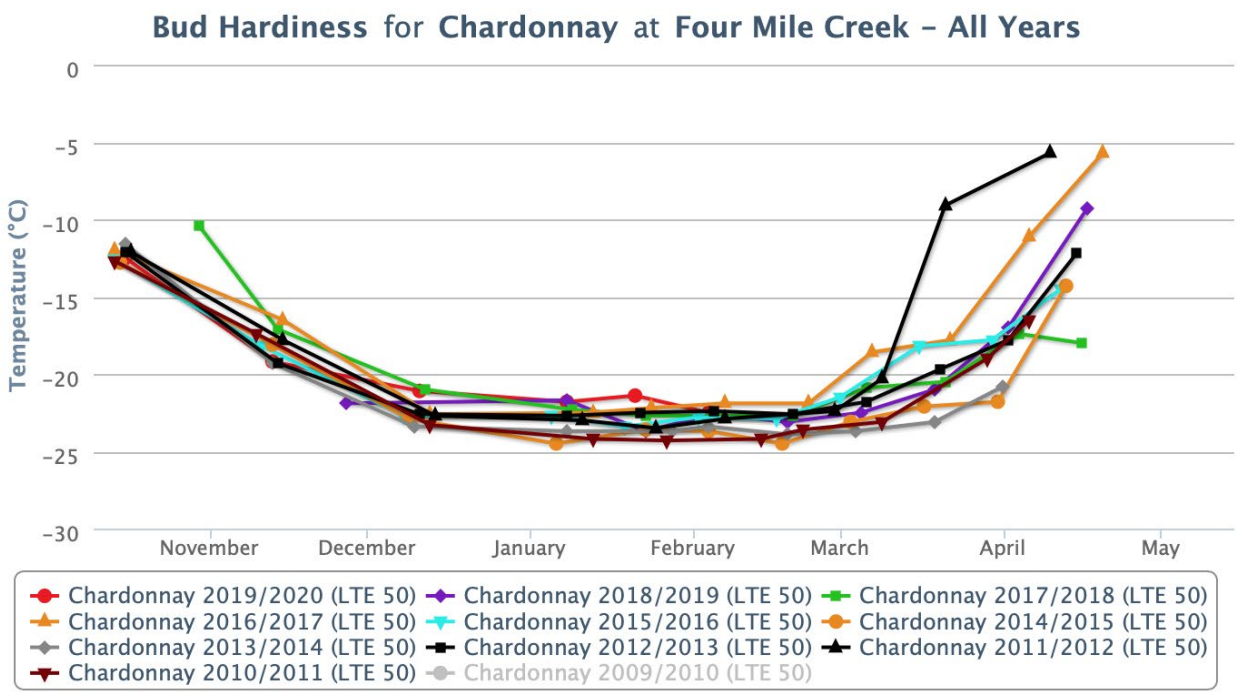


Figure 2. Comparative hardiness of Chardonnay from 2010-2020 dormant seasons at Four Mile Creek Sub-appellation.

Ontario grape growing regions experienced a cold weather event during mid cold acclimation, which is uncommon. The most significant event was the 3rd week of November in 2019 where some vines still had crop hanging. Generally speaking, most cultivars were hardy enough to avoid damage and little freeze injury was reported through VineAlert sampling. However, some damage has been recorded on younger vines, vines that were over-cropped or out of balance, and tender varieties. The most significant impact of the freeze event was in Lake Erie North Shore where minimum temperatures were -17.5°C on November 21, 2019. Merlot was found to have 41% bud survival in Colchester whereas other cultivars were in the range of 79-92% primary bud survival. Outreach through this project has identified some growers reporting damage in late varieties such as Cabernet franc as well as nurseries who had damage to their nursery stock that was not dug from the field. Very little primary bud loss has been reported in the Niagara Peninsula with most cultivars having >90% bud survival. Prince Edward County had temperatures <-25°C so bud survival from aerial canes not buried under ground or covered with geotextile will have higher bud mortality. Further sampling is going to occur the week of February 24 to confirm the level of bud damage. At the time of this report, significant vine cold deacclimation has not begun but some loss of hardiness was observed following the abnormal warm weather later in February of 2018. Late winter and spring freeze injury risk may be increased due to poorer hardiness and warmer conditions. However, the true risk assessments are difficult due to the uncertainty of the long-term weather forecasts.

Reach and Communication:

The primary target of this project are grape growers in Ontario. Cold hardiness and bud survival alerts were sent at least once/week to VineAlert users. Currently VineAlert is used by 440 users to assist in making vineyard management decisions to mitigate the impact of a cold weather event. Global interest in this program continues to grow with individuals from over 60 countries accessing the database with over 10,000 individual page views that occur from October to April each year. VineAlert was recognized in 2016 by the Council of Ontario Universities' Research Matters program as one of 50 'game-changing' research partnerships across the province <https://brocku.ca/brock-news/2016/08/brock-recognized-for-successful-partnerships-with-industry/> .

Project Outcomes:

Short term: Monitoring comparative cold hardiness levels of grapevines across Ontario's grape growing regions provides tremendous benefit to the entire grape and wine industry. This work provides data to the VineAlert web-based cold risk management system to help reduce freeze injury in Ontario's major grape varieties that produce the highest valued grapes and wine. Through this project, freeze injury can be avoided through freeze mitigation technology (i.e., wind machines) coupled with the knowledge of current cold tolerance of given grape varieties within different regions. Freeze injury can also be mitigated through understanding of if and when a freeze event may have occurred and to what level of damage. If freeze injury did occur, then cultural practices such as pruning can be used to help mitigate the associated crop loss and reduce the impact on vine health to ensure more consistent grape production.

Long term: Through this project, more sustainable grape production can be achieved. Millions of dollars can be saved annually by mitigating crop loss and tens of millions of dollars saved by grape growers by reducing vine loss, vine damage and associated vine replacement or renewal costs. This project also continues to build VineAlert's cold database to help understand how growing season and climate impact grape cold hardiness in both short-term and long term. These information can provide key data to build cold hardiness models for improved cold mitigation strategies and also help with predictive analysis of how climate change may impact cold hardiness. All of these long-term outcomes will greatly improve the sustainability of the entire grape and wine production and allow for consistent grape production and growth of the industry.

Final Comments and Conclusions

Monitoring comparative cold hardiness levels of grapevines across Ontario's grape growing regions provides tremendous benefit to the entire grape and wine industry. This work provides data to the VineAlert web-based cold risk management system to help reduce freeze injury in Ontario's major grape production regions. The 2019/20 cold hardiness monitoring program demonstrates the value of this project through understanding how climate and growing season impacts are influencing cold hardiness across many different key cultivars and regions. These data provide crucial information to help mitigate freeze injury in the short term and will also help develop strategies to improve sustainability with inherent climate change risks that the entire grape and wine industry is facing.

.

Appendix

VineAlert Grape Bud Survival Results 2019/20

NIAGARA RIVER

The Niagara River sub-appellation is a small strip of land running along the Niagara river from John Street (old town Niagara-on-the-Lake) south to Dee Road (Queenston) and inland (west) approximately one kilometer.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	94
Cabernet Franc	92
Syrah	86
Sauvignon Blanc	85
Riesling	92

FOUR MILE CREEK

The Four Mile Creek sub-appellation makes up central Niagara-on-the-Lake. It lies slightly inland from the lake and below the bench of the Niagara Escarpment.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	94
Cabernet Franc	99
Merlot	91
Pinot Noir	92
Sauvignon Blanc	92
Riesling	92
Cabernet Sauvignon	94

NIAGARA LAKESHORE

Niagara Lakeshore sub-appellation follows the shoreline of Lake Ontario from the Welland Canal east to the Niagara River and inland for approximately 3 kilometers.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	95
Cabernet Franc	97
Merlot	100
Pinot Noir	97

ST. DAVID'S BENCH

St. David's Bench lies 10 km south of the shore of Lake Ontario and follows the contour lines that define the Niagara escarpment east of the Welland Canal to the Niagara River, with a complex topography.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	94
Cabernet Franc	89
Merlot	89
Pinot Noir	93
Syrah	82
Sauvignon Blanc	93

CREEK SHORES

The Creek Shores sub-appellation is situated immediately west of St. Catharines with Lake Ontario to the north, Twelve Mile Creek to the east, Twenty Mile Creek and Jordan Harbour to the west.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	93
Cabernet Franc	88
Merlot	97
Syrah	88
Riesling	93
Cabernet Sauvignon	95

LINCOLN LAKESHORE

The Lincoln Lakeshore sub-appellation runs along the Lake Ontario shore from Winona Road to Jordan Harbour and Twenty Mile Creek. The south boundary is the foot of the escarpment bench.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	94
Cabernet Franc	89
Merlot	93
Riesling	90
Sauvignon blanc	97
Cabernet Sauvignon	90

SHORT HILLS BENCH

Short Hills Bench sub-appellation encompasses the land rising up from the plain of the peninsula (south of the Regional Road 81) to the Escarpment Brow and situated between Twelve Mile Creek and Fifteen Mile Creek.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	93
Cabernet Franc	92
Merlot	85
Sauvignon Blanc	89
Riesling	89

TWENTY MILE BENCH

The Twenty Mile Bench area stretches east to west from Fifteen Mile Creek to west of Cherry Avenue (Vineland). Bisected by Twenty Mile Creek, it has a distinctive double bench formation west of Twenty Mile Creek, and short, varied slopes that roll to the brow of the escarpment.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	94
Cabernet Franc	93
Sauvignon Blanc	89

BEAMSVILLE BENCH

The Beamsville Bench runs along the Niagara escarpment from just west of Cherry Avenue to Park Road west of Beamsville. This is the narrow plateau sloping gradually from the cliff of the Niagara Escarpment northwards to Regional Road 81.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	93
Cabernet Franc	94
Riesling	95
Pinot noir	94

VINEMOUNT RIDGE

Vinemount Ridge lies just above and south of the brow of the Niagara Escarpment. This appellation covers two prominent geological features - the Fonthill Kame to the east and the Vinemount Moraine on its western edge.

Cultivar	% Primary Buds Alive Dec 3-9, 2019
Chardonnay	95
Cabernet Franc	90
Riesling	87

LAKE ERIE NORTH SHORE COLCHESTER

Cultivar	% Primary Buds Alive Dec 12, 2019
Chardonnay	88
Cabernet Franc	83
Riesling	79
Merlot	41
Cabernet Sauvignon	86
Pinot noir	92

PRINCE EDWARD COUNTY
HILLIER

Note: Bud survival data in Prince Edward County are sampled from exposed canes and do not represent bud survival below ground on any buried canes.

Cultivar	% Primary Buds Alive Dec 16, 2019
Chardonnay	91
Cabernet Franc	80
Riesling	74
Pinot noir	97