

Ranking Wine Grape Varieties for Winter Bud Hardiness Grown in the Okanagan Valley of British Columbia

Carl Bogdanoff, Pat Bowen, Brad Estergaard, Steve Marsh, and Emmanuelle Jean

Summerland Research and Development Centre, AAFC

The bud hardiness of major wine grape varieties in the Okanagan Valley has been regularly measured from late October to early April since 2012, and as a result these varieties can be ranked for their tolerance to extreme cold winter temperatures. Initial hardiness testing began with Cabernet Franc, Cabernet Sauvignon, Chardonnay, Gewurztraminer, Merlot, Pinot blanc, Pinot gris, Pinot noir, Riesling, Sauvignon blanc and Shiraz from 36 vineyard sites in the Okanagan Valley. Since then bud sampling has been expanded to 72 vineyard sites and now includes two additional varieties; Malbec and Viognier. At each site 15 buds from six vines were tested every two weeks to determine the mean temperature for primary bud mortality (LTE_{50} (°C) - low temperature exotherm). All varieties were sampled from multiple sites, and analysis showed that despite the year to year differences in winter temperatures the bud hardiness of these varieties relative to each other remained fairly consistent. For each variety a fourth order polynomial equation was used to create average daily hardiness values from October 20 to April 15 using the mean bud hardiness for each sample date over seven winter seasons. For the eleven most widely planted varieties in the Okanagan Valley the average daily hardiness values are plotted in Figure 1.

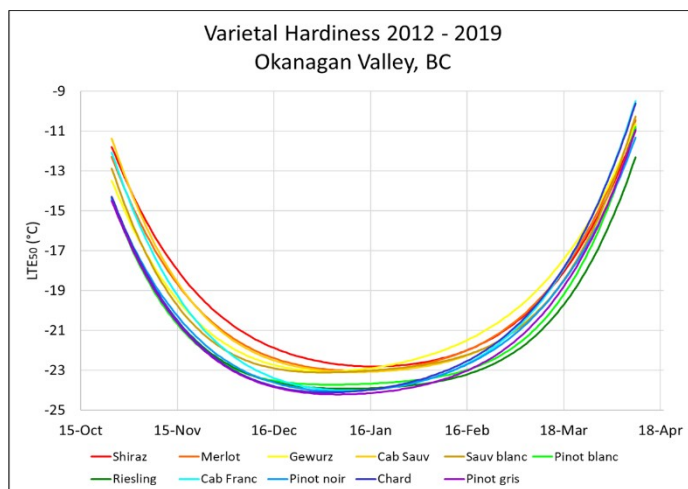


Figure 1. Bud hardiness of the eleven most widely grown wine grape varieties in the Okanagan Valley in British Columbia.

For all varieties there are three periods of hardiness where bud hardiness increases (October and November - period of acclimation), remains fairly constant at its maximum (December through February - period of maximum hardiness), and then decreases (March and April - period of deacclimation). Ranking these varieties by their average maximum hardiness show Shiraz and Pinot gris to be the least and most hardy varieties, respectively (Table 1). The relative ranking among varieties however does vary through out the winter season and seems to be highly

November 1 Mean Varietal Bud Hardiness (°C)		Variety	Maximum Bud Hardiness (°C)	Date of Maximum Bud Hardiness	March 1 Mean Varietal Bud Hardiness (°C)	
Shiraz	-14.3	Shiraz	-22.8	17-Jan	Gewurz	-20.1
Cab Sauv	-14.4	Merlot	-23.0	12-Jan	Merlot	-20.7
Merlot	-14.9	Gewurz	-23.1	2-Jan	Shiraz	-20.8
Cab Franc	-15.0	Cab Sauv	-23.1	12-Jan	Chardonnay	-21.0
Sauv blanc	-15.8	Sauv blanc	-23.1	1-Jan	Cab Sauv	-21.2
Gewurz	-16.0	Pinot blanc	-23.7	3-Jan	Cab Franc	-21.2
Pinot noir	-16.8	Riesling	-23.9	8-Jan	Sauv blanc	-21.2
Chardonnay	-16.9	Cab Franc	-24.0	9-Jan	Pinot noir	-21.3
Riesling	-16.9	Pinot noir	-24.1	6-Jan	Pinot gris	-21.7
Pinot gris	-17.0	Chardonnay	-24.1	3-Jan	Pinot blanc	-21.9
Pinot blanc	-17.1	Pinot gris	-24.2	6-Jan	Riesling	-22.2

Table 1. Date and mean of maximum varietal bud hardiness and mean bud hardiness for November 1 and March 1, 2012 – 2019.

influenced by the timing of grapevine phenological events such as fruit ripening and bud break. Chardonnay is very tolerant of cold temperatures during the periods of acclimation and maximum hardiness but becomes less tolerant during deacclimation and tends to break bud early. Cabernet Franc, a relatively hardy variety during the period of maximum hardiness, is less tolerant of cold fall and spring temperatures when compared to the other varieties. And Gewurztraminer is the least hardy of all varieties in February and March indicating that it begins to deacclimate early. Buds of Malbec and Viognier were first sampled from multiple sites in the winter of 2018 – 2019 (Figure 2), and for these varieties Malbec is less hardy than Merlot while Viognier is less hardy than Chardonnay until the deacclimation period. Figure 2 also shows that deacclimation was delayed in 2019 until mid-March due to the record cold temperatures for most of February and the first two weeks of March.

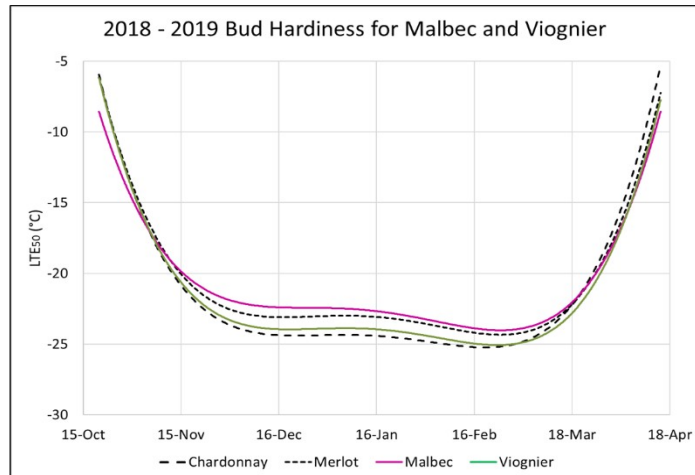


Figure 2. Comparison of bud hardiness for Malbec and Viognier to that of Merlot and Chardonnay during the winter of 2018 – 2019.

For British Columbia, where cold weather events tend to occur earlier in the winter season than in eastern Canada (Bowen, et al. 2016), the ranking of varietal hardiness during the periods of acclimation and maximum hardiness are particularly important. Varieties such as Malbec, Shiraz, Merlot and Cabernet Sauvignon have a greater risk of winter injury than Pinot gris, Pinot blanc, Pinot noir, Chardonnay, Viognier and Riesling when grown in the Okanagan Valley. Knowing the relative hardiness and the seasonal hardiness profiles of grape varieties is information growers can use to minimize the risk of winter injury and crop loss. In planning and planting new vineyards cold tolerant varieties can be assigned to areas prone to colder ambient temperatures while in established vineyards the timing of when an extreme arctic event occurs (during acclimation, maximum hardiness or deacclimation periods) will cause varying levels of winter injury to different varietal blocks. In this case vineyard managers will know which blocks to assess for winter injury and to respond accordingly by adjusting pruning levels.

Reference: Bowen P, Shellie KC, Mills L, Willwerth J, Bogdanoff C, and Keller M. 2016. Absciscic acid form, concentration, and application timing influence phenology and bud cold hardiness in Merlot grapevines Can. J. Plant Sci. 96: 347–359 (2016) [dx.doi.org/10.1139/cjps-2015-0257](https://doi.org/10.1139/cjps-2015-0257)