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## **Is There an Ideal Climate for Cabernet?**

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Climate is arguably one of the most important factors in viticulture whereby the general suitability, overall productivity, and potential wine quality are largely determined by a region's baseline climate and its variability. Every cultivar grown worldwide for premium wine quality has found a home in its "ideal" climate (e.g., Cabernet Sauvignon in Bordeaux and the Napa Valley). However, is there truly an ideal climate that can produce the general typicity of a given cultivar or is there a range of climates that can produce an array of styles from the same cultivar? In assessing climate the simplest measures typically used are based on numerous variations in indices of temperature, such as growing degree-days or average temperatures of a given month or period. These measures generally show that most winegrape cultivars have a 2 to 4°C niche in their average vintage climate. However, many other weather/climate factors and their relationships with the soil and landscapes can play important roles in producing the "ideal" climate for any variety.

The noble Cabernet cultivars, Cabernet Sauvignon and Cabernet Franc, are clearly two of the most widely recognized winegrapes in the world. While no one knows for sure which winegrape cultivar is the most widely planted in the world, Cabernet Sauvignon is possibly the most planted high quality cultivar and seemingly a must try for virtually every wine region in the world. The spread of these two cultivars worldwide has produced an assortment of wine styles from quite diverse regions. From Bordeaux to Napa, from Coonawarra to Stellenbosch, from the Maipo Valley to the Loire Valley, from Paso Robles to Mendoza, from Hawkes Bay to the Margaret River, and from the Priorat to Tuscany this presentation provides a general climatic comparison between these and other benchmark regions growing Cabernet Sauvignon and Cabernet Franc. The work examines both station data and global gridded climate data to detail similarities and differences for known regions (summarized below), along with finding theoretical matches for these ideal climates worldwide that may not have been explored (not shown).

Using long term station data from 21 wine regions growing Cabernet reveals a growing season average temperature (GSTavg) of 18.2°C, ranging from 16.2 and 16.4°C in Hawke's Bay, New Zealand and the Loire Valley of France, respectively to 20.4°C and 20.8°C in Mendoza, Argentina and Robertson, South Africa, respectively. The benchmark region of Bordeaux is below this group's average at 16.8°C while Oakville in the Napa Valley and Coonawarra are near the average at 17.9°C each. In terms of growing degree-days a similar structure is seen with an average of 1753 GDD and a range of 1307 to 2300 GDD (Loire Valley to Robinson, respectively). While these average conditions are quite useful comparative measures, diurnal temperatures during the early fall can play a prominent role in Cabernet ripening. Locations with warmer nighttime temperatures allow vegetal characters (green pepper/green bean aromas due to a class of pyrazines) to metabolize more fully. Whereas cooler nighttime conditions, which are ideal for ripening for many other cultivars, tend to produce Cabernet wines that are more vegetal. This analysis shows that diurnal temperature ranges

(DTR) during ripening (Sep-Oct in the NH and Mar-Apr in the SH) average 14.1 C<sup>2</sup> ranging from a low of 8.8 C<sup>2</sup> in Tuscany to 20.7 C<sup>2</sup> in Paso Robles. Compared to the European locations, which have lower DTR during ripening (8.8 to 13.0 C<sup>2</sup>), regions in the United States, Chile, and Argentina have much higher DTR (15.0 to 20.7 C<sup>2</sup>). A general observation from growing season versus ripening conditions is that regions that are cooler overall in GSTavg or GDD, typically have lower DTR which may equalize the difference between the two climate factors. Finally, in terms of rainfall, these 21 stations experience on average 615 mm annually with the lowest amount seen in Mendoza (193 mm) and the highest seen in Bordeaux (953 mm). During the growing season these locations receive on average 229 mm with the driest being Paso Robles (50 mm) and the wettest Bordeaux (497 mm). In terms of percentages of growing season to annual rainfall totals, the average for these locations is 40% with the lowest percentage in the Maipo Valley of Chile (14%) to the highest in Mendoza (77%). Higher percentages of growing season rainfall to annual are commonly found in those regions with a higher frequency of summer thunderstorms compared to those dominated by high pressure and stable conditions.

Comparing climates of the world's top quality Cabernet producing regions reveals broad similarities in the general thermal environments for these two cultivars. However significant differences in the seasonal and daily climate structure of these regions are seen from the more moderate, moist climate with substantial vintage rainfall of Bordeaux to the hot, dry continental climate of Walla Walla, Washington. The likelihood of an "ideal" climate for Cabernet cultivars is shown to be very low, as evidenced by growers/producers being able to craft varietal typicity and wine styles in a wide array of climate types worldwide.