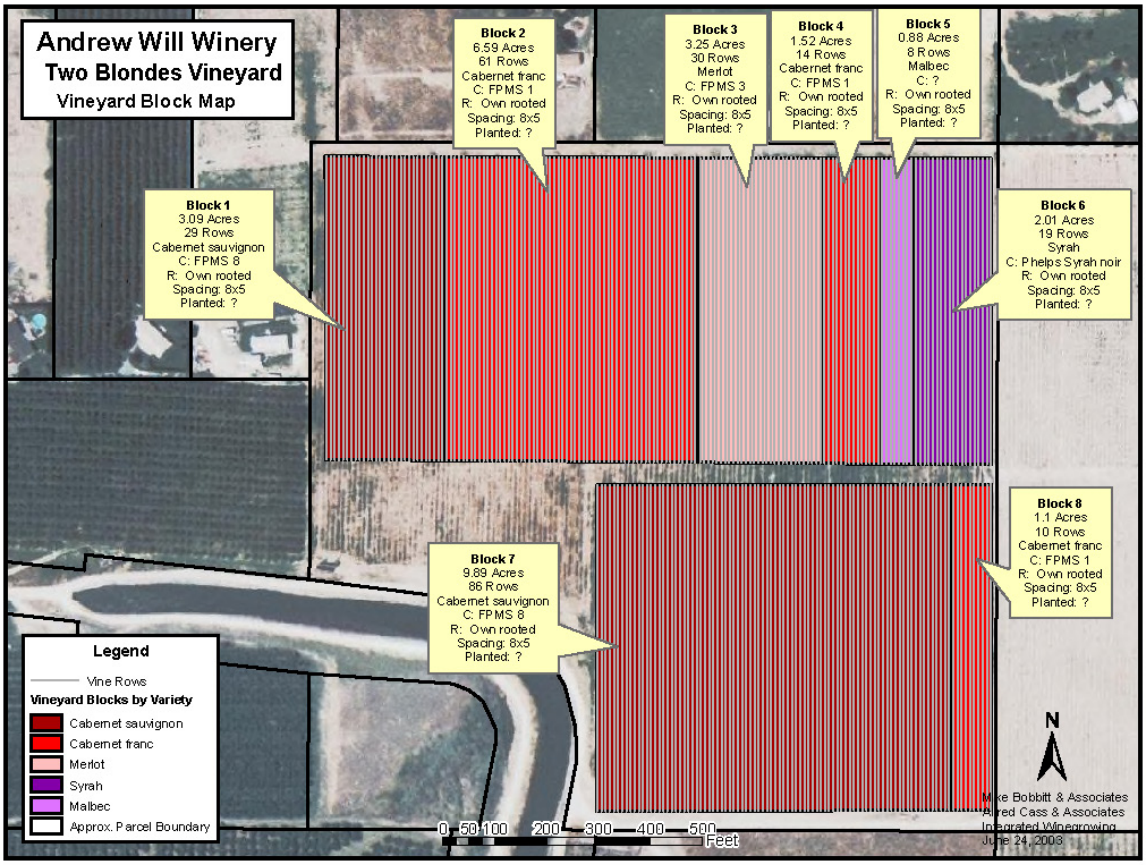
2005 Weather Summary for Two Blondes Vineyard



Prepared by:
Mark Greenspan, Ph.D.
Advanced Viticulture, LLC

2005 Weather Summary for Two Blondes Vineyard

Introduction

This is a weather and climate summary for Two Blondes Vineyard based on measurements made during the 2005 growing season. This report is not a climate survey and does not purport to represent climatic characteristics of the vineyard sites. A climate report requires many years of data while this weather summary uses only the weather data that is available from the automated temperature data loggers that have been installed in the vineyards.

These data represent an archive of historical information that will be built upon as time progresses. To fully exploit the weather data set, it is imperative that a viticultural and wine-quality data set be built simultaneously. The data set should include phenology, yield and yield components, fruit exposure assessments, wine quality assessments, wine review scores, etc. so that correlations can be made as the data set becomes larger.

There are two Hobo weather stations at Two Blondes Vineyard, one located at a higher elevation and the other at a lower elevation. Comparisons between the two locations will be made, when differences are apparent. Additionally, data from an Oakville, CA vineyard will be included for a reference. Oakville was chosen as it is considered to be a region at the upper temperature limit for high quality Bordeaux varieties.

II. Temperature and Heat Summation

Two Blondes had 3119 degree days at the lower station and 3182 degree days at the upper station (Figure 1). The differences between the two locations are small and the lower degree days at the bottom location are primarily due to lower nighttime temperatures (to be discussed).

In comparison to Oakville, which had a total of 2991 degree days in 2005, the degree days during April through June are similar. However, there are far greater heat summation units during July and August (about 50 and 100 degree days, respectively) at Two Blonds relative to Oakville. The greater number of degree days during July and August relative to Oakville will accelerate the fruit development and ripening process. This is necessary in this area because fruit maturity must be attained by early October, as it becomes too cool and frost-prone later in the month to continue the ripening process. In contrast, Oakville, has a longer ripening period, but receives more heat summation units in October allowing harvest to occur into late October. The growing season at Two Blondes Vineyard is truncated by the lack of heat during October.

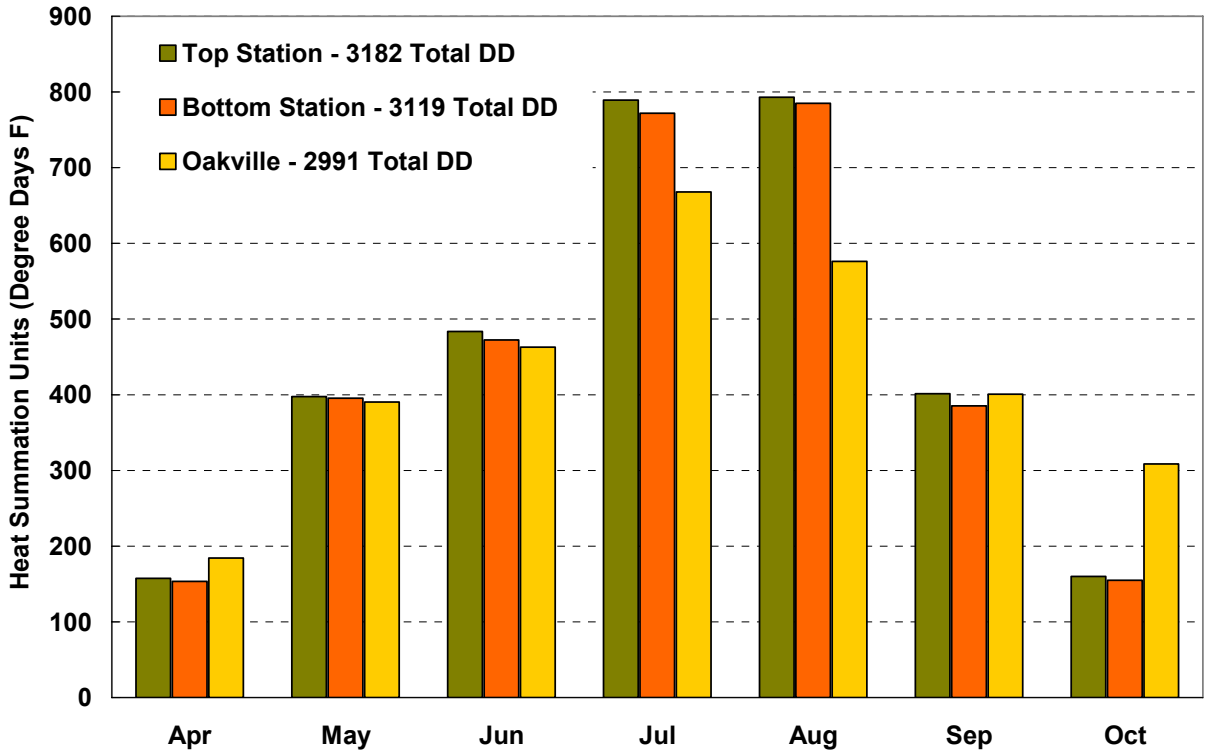


Figure 1: 2005 monthly heat summations for two locations at Two Blondes Vineyard plus a reference location. 50°F was used as the baseline temperature.

Comparing daily maximum temperatures at the same two locations (Figure 2) for 2005, there is very little difference between the two locations in this respect. At most, there is a 1 degree difference between the two locations, with the upper station being higher. However, it is the daily minimum temperatures that account for the primary temperature and heat summation differences between the two stations. Minimum temperatures are consistently from 1 to 3 degrees cooler at the lower station than at the higher station (Figure 3). Minimum temperatures are typically influenced by elevation, as the cooler air settles into the lower elevations during the stable conditions of the nighttime.

Comparing monthly averages of daily maximum, minimum and mean temperatures (Figures 2, 3, and 4, respectively) there are clear differences between the two Bordeaux variety growing locations. Two Blondes Vineyard displays dramatically cooler maximum temperatures as well as dramatically higher minimum temperatures. In other words, the day/night temperature fluctuation is smaller at Two Blondes. The daily mean temperature comparisons illustrates how much colder the temperatures are in the early and late portions of the growing season, indicative of this location's short and intense growing season.

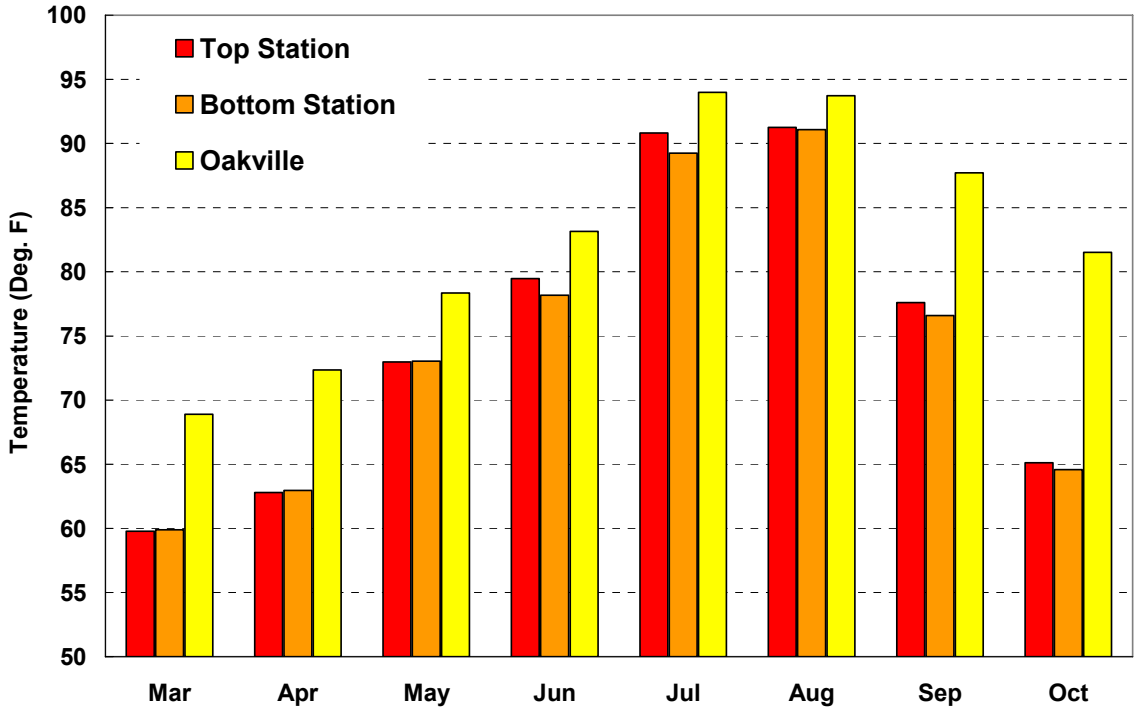


Figure 2: 2005 monthly averages of daily maximum temperatures for two locations at Two Blondes Vineyard plus a reference location.

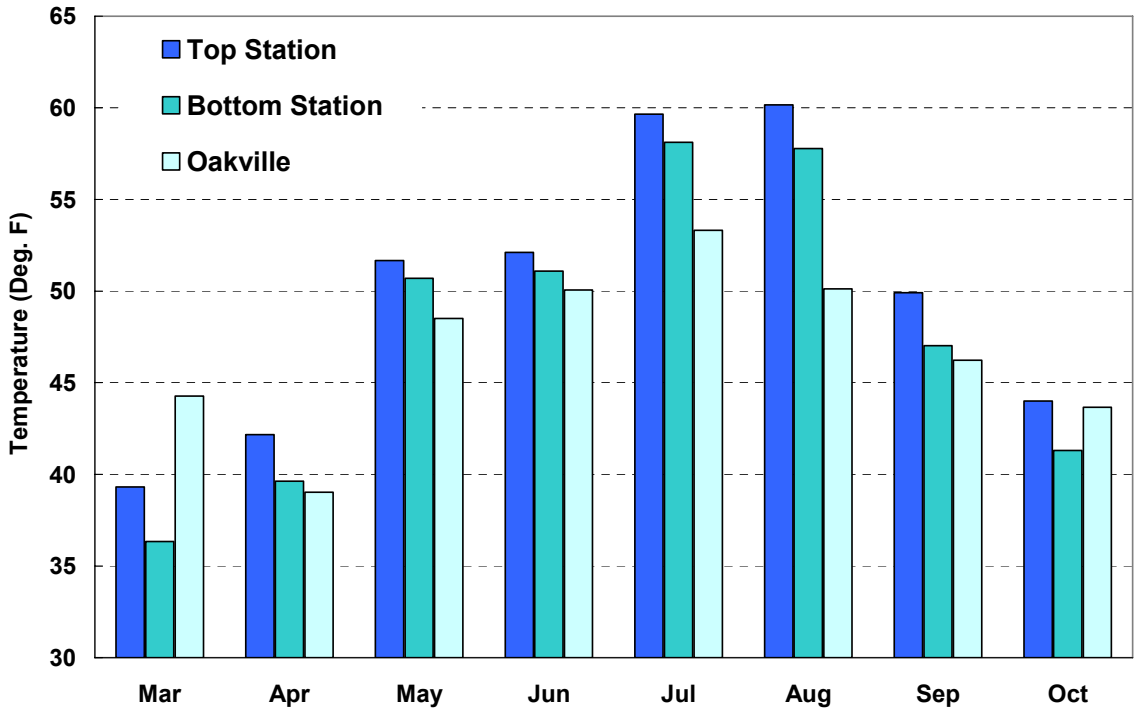


Figure 3: 2005 monthly averages of daily minimum temperatures for two locations at Two Blondes Vineyard plus a reference location.

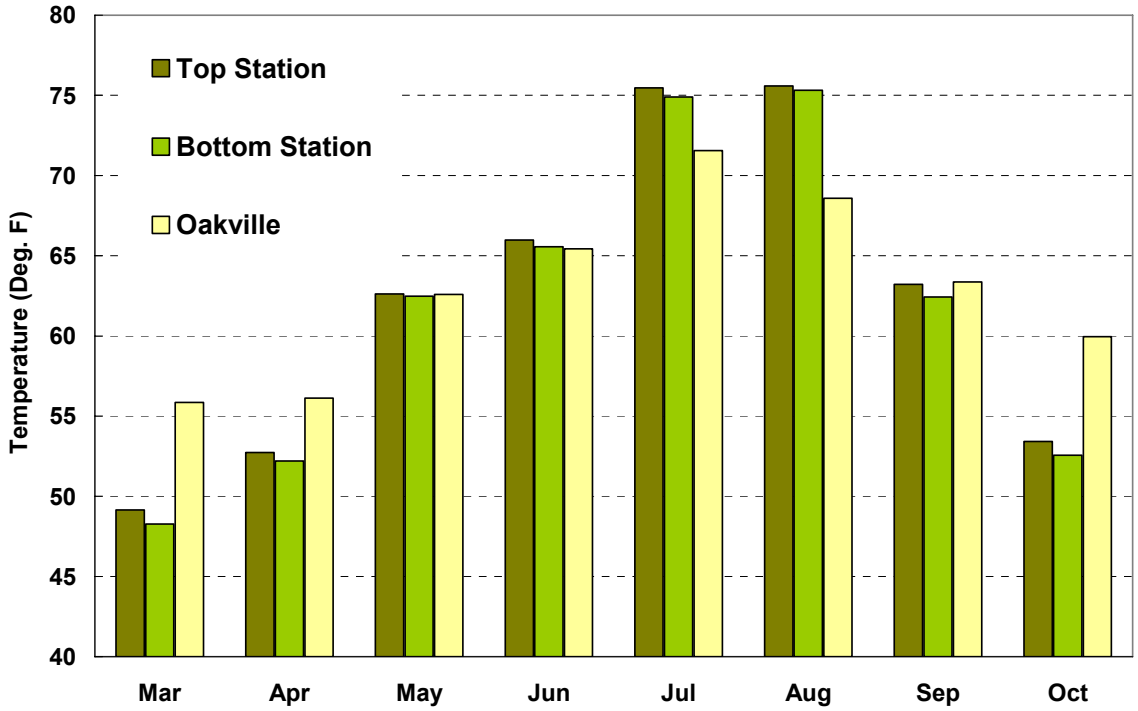


Figure 4: 2005 monthly averages of daily mean temperatures for two locations at Two Blondes Vineyard plus a reference location.

II. Ripening Period Analysis

A general period of ripening was chosen for analysis, which comprises mid-August through mid-October. This period was chosen as a standard to capture the ripening periods of multiple regions and grape varieties. The average daily minimum, maximum and mean during the ripening period are shown in Figure 5 for 2005. That figure, along with the average diurnal temperature pattern during ripening (Fig. 6) reveals that the primary differences in the temperature regimes between these two locations were in the nighttime temperatures, where temperatures were about 1 °F cooler at the lower location from midnight to about 7 am. Daytime temperatures were essentially identical from one location to the other.

The contrast between the Two Blondes Vineyard and the Oakville location is best illustrated in the diurnal temperature cycles. While Oakville exhibited almost a 40 °F diurnal temperature amplitude, The Two Blondes Vineyard exhibited only about a 25 °F diurnal amplitude. The smaller diurnal amplitude coupled with ample heat summation units creates a very favorable climate for high quality Bordeaux variety wine production. Cooler daytime temperatures avoid fruit degradation from excessive heat while warmer night temperatures allow for tannin ripening processes to continue during the night while sugar accumulation is stopped. This allows fruit to become “flavor ripe” at a lower relative sugar concentration. Despite the contrasting diurnal cycles between the two regions, note that the daily average temperatures were essentially identical during this period of time.

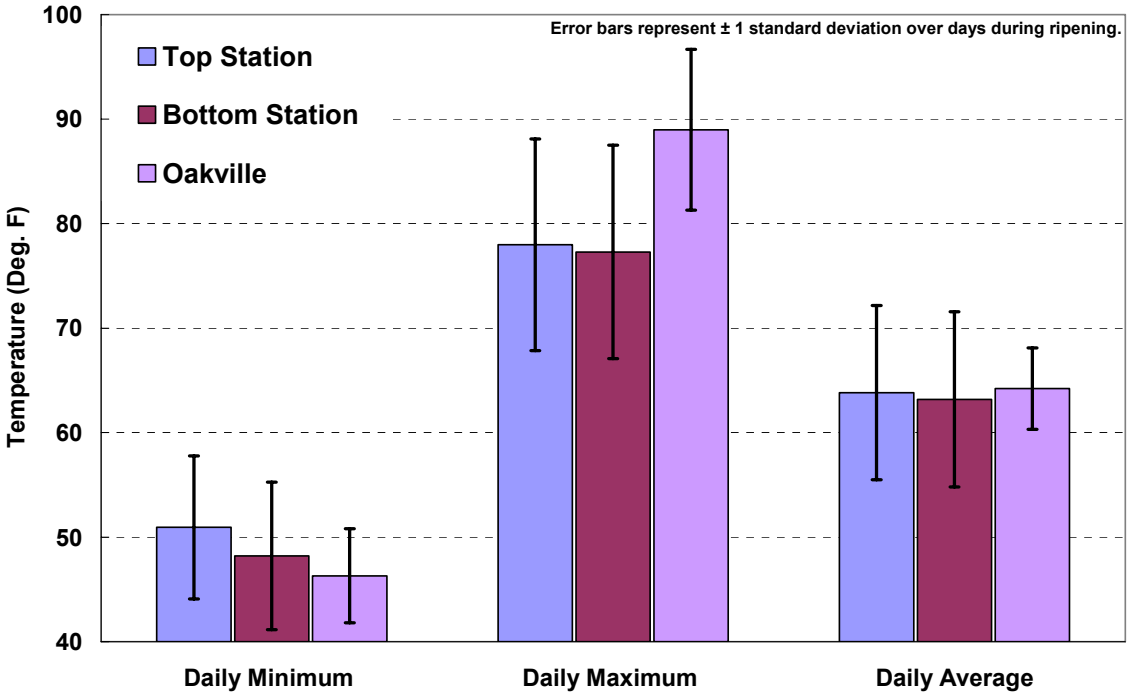


Figure 5: Average daily minimum, maximum and average temperature during the 2005 ripening period for two locations at Two Blondes Vineyard plus a reference location.

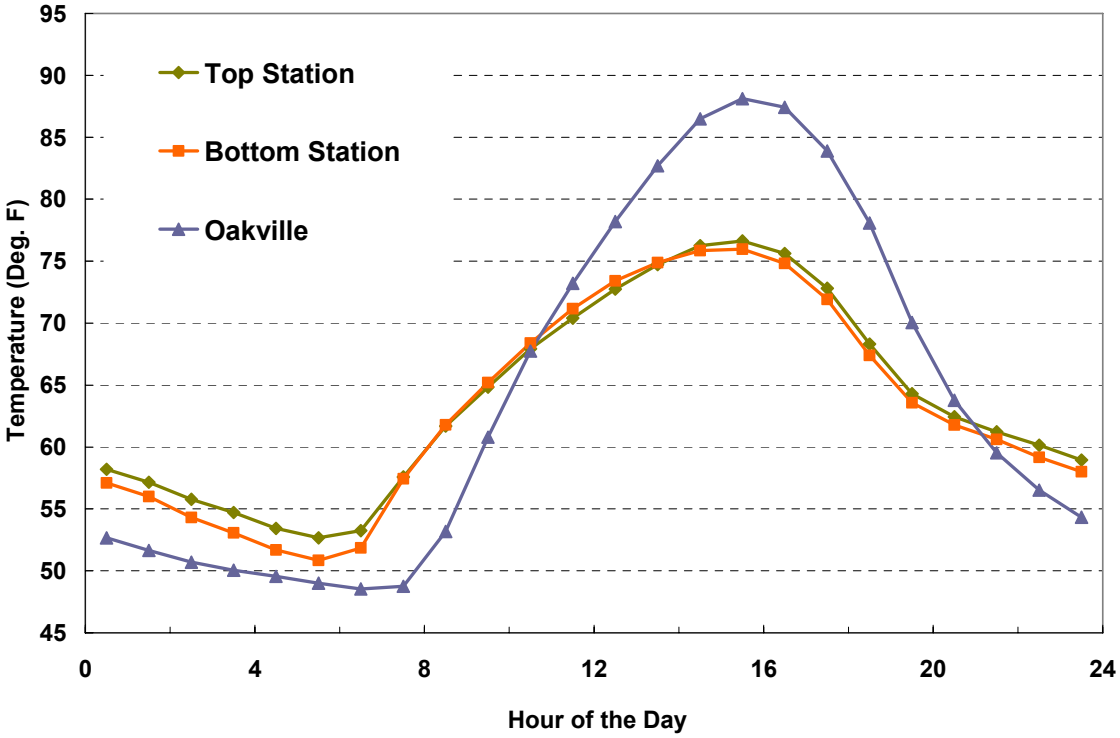


Figure 6: Average diurnal temperature cycle for two locations at Two Blondes Vineyard plus a reference location during the 2005 ripening period (mid-August through mid-October).

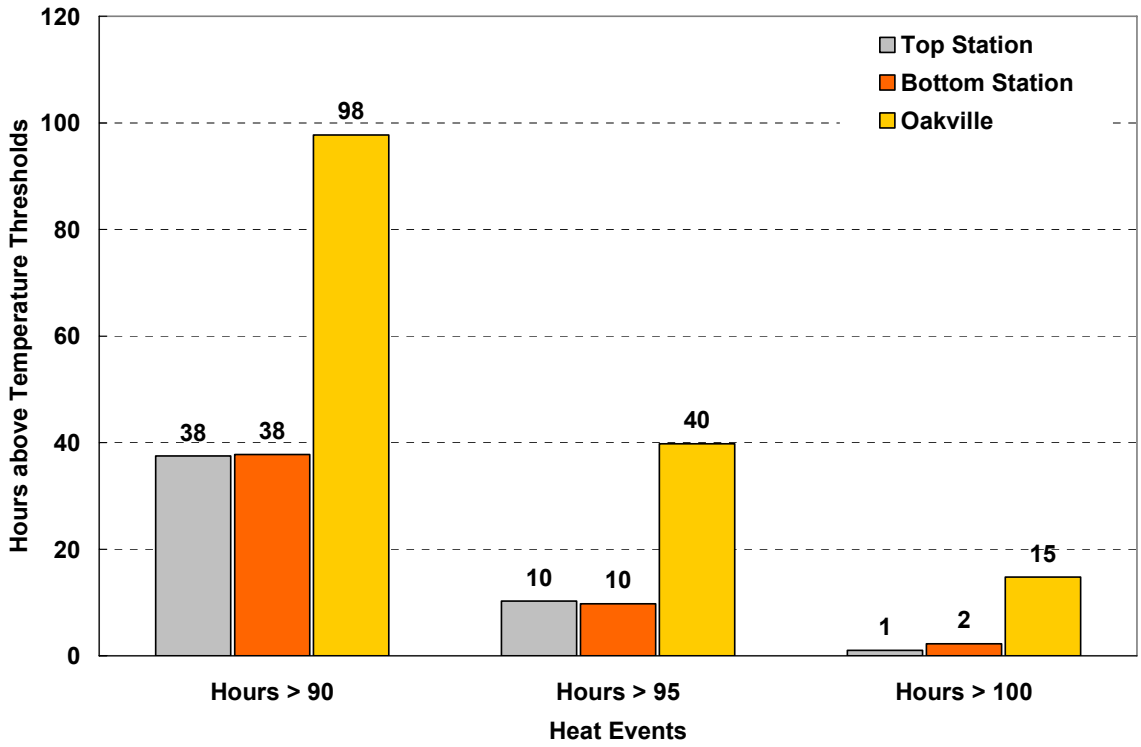


Figure 7: Hours above given critical temperatures during the ripening stage in 2005 for two locations at Two Blondes Vineyard plus a reference location.

Finally, it is instructive to evaluate the time during which the temperatures exceeded given threshold levels during the ripening period (Fig. 7). While foliage and fruit temperatures are of primary importance (not ambient temperatures), we can estimate that foliage temperature roughly tracks air temperature ± a few degrees, depending on stomatal opening or closure. Fruit temperature, on the other hand, is difficult to broadly determine. However, fruit in persistent shade will equilibrate to ambient temperature, while fruit exposed to sunlight will reach at least 15 °F above ambient temperature. 90 °F represents a temperature where photosynthesis in the leaves diminishes. As expected, the two contrasting sites had approximately the same number of hours when the temperature thresholds were exceeded. This is not unexpected, due to the very similar daytime temperature patterns.

At 95 °F, leaf photosynthesis is essentially zero while 100 °F is the temperature at which heat shock proteins are produced by the plant (a protection against heat stress). In the fruit, secondary metabolism (responsible for anthocyanin, tannin and flavor precursor formation and degradation) is highly sensitive to temperature, although the optima and maxima have not been elucidated by researchers yet. However, it is clear that, at hot temperatures (especially those of exposed fruit), anthocyanins are degraded resulting in lower extractable wine color. Fruit aromatic compounds are similarly degraded.

At Two Blondes Vineyard, 2005 exhibited very few hours of fruit-degrading temperatures above 95 °F and almost no hours above 100 °F. The scarcity of high temperature events indicates that high heat stress conditions are not a common occurrence at this vineyard, which is a strong positive characteristic. There does not appear to be a reason to protect fruit from direct sunlight, thus the canopy may allow for nearly full fruit exposure. That will allow the fruit to attain high

quality with a rapid degradation of undesirable vegetative character during the ripening process. This is in contrast with Oakville, which struggled with some hours of high temperatures, even during 2005, which was a notably cool weather season during ripening. Fruit in Oakville must be protected from direct afternoon sunlight to avoid heat damage.

III. Frost/Freeze Risk Analysis

Hobo temperature loggers were installed late in January, so data are available only from February 2005 through December 2005 (Figure 8). Cold temperatures are a hazard in this region, and these data do not represent how cold it can be. Nevertheless, there were numerous hours below 20 °F, though grapevine tissue can generally survive temperatures above 15 °F. Temperatures below 15 °F are more hazardous as they may injure dormant buds. However, there were few hours below 10 °F, indicating an insignificant hazard for total vine kill (above-ground) during the measurement period. All of the cold temperatures measured in 2005 (February and onward) occurred during the month of December.

Spring Frost appears to be a hazard at this location, though in 2005 there were only two frost days during March and April at the upper station. The lower station, on the other hand, had 12 days during March and April that were below 32 °F, thus protection will be particularly necessary in the low-lying portions of the vineyard. There were no frost days during the month of May, according to these temperature sensors.

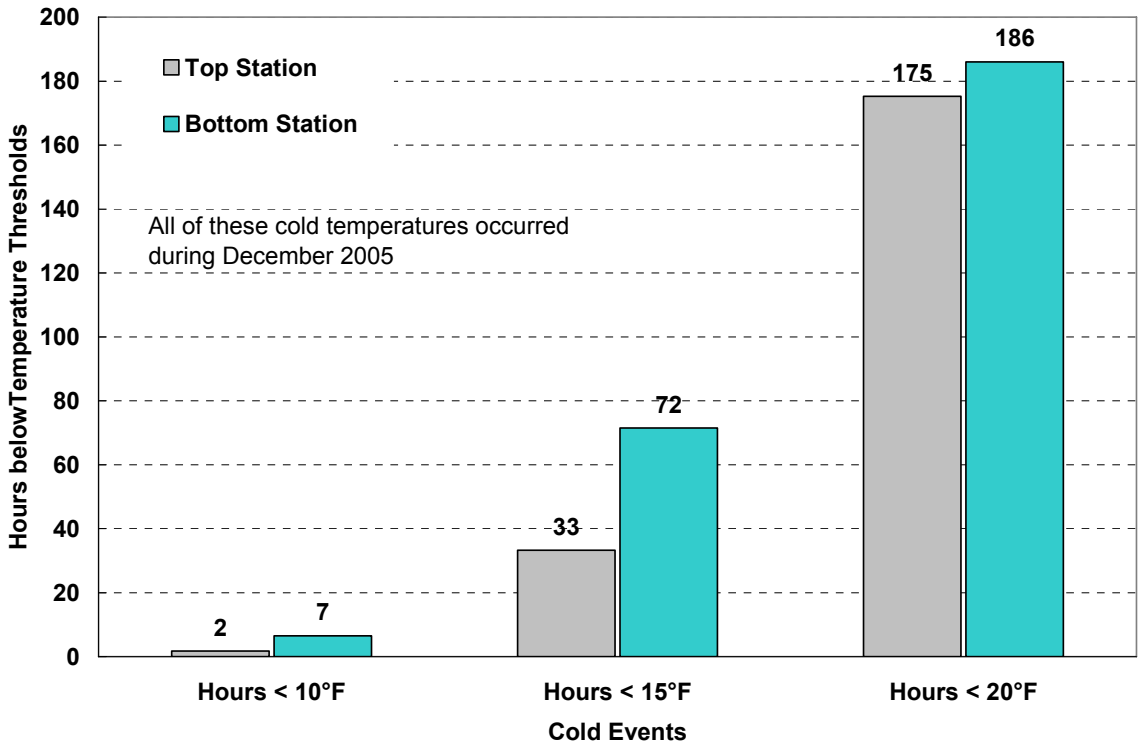


Figure 8: Average number of hours below selected temperature thresholds for two locations at Two Blondes Vineyard during February 2005 through December 2005.

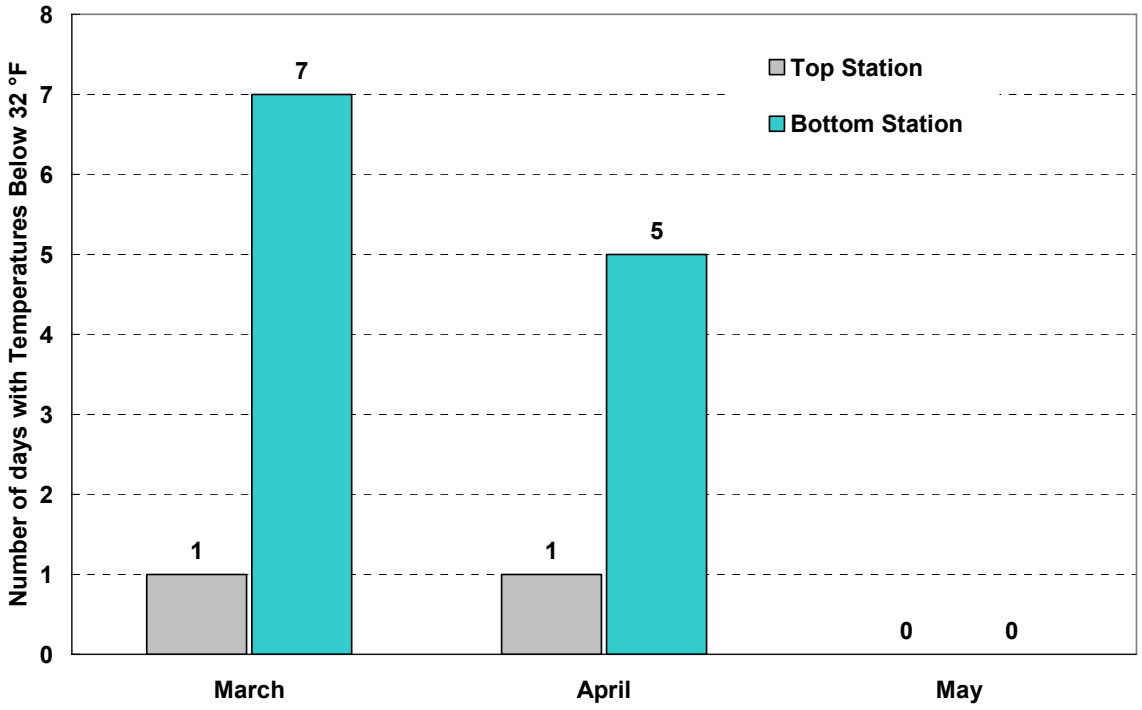


Figure 9: Average number of days below 32 °F during March-May for two locations at Two Blondes Vineyard.

IV. Conclusions

This limited data set suggests that there are sufficient heat summation units available to ripen all Bordeaux varieties. The heat summation units are slightly higher than that of Oakville, CA. However, the season at Two Blondes is relatively short, and harvest must be completed by early October to avoid cessation of ripening and/or Fall frost.

The temperature climate during fruit ripening at Two Blondes Vineyard is ideal for high quality wine production, having a very similar average temperature to Oakville in the Napa Valley, but benefiting from a cooler daytime temperature and a warmer nighttime temperature. This characteristic is favorable to fruit ripening and maintenance of fruit integrity.

The Two Blondes Vineyard is in a region of extreme cold winter temperatures as well as recurring frost hazards during the spring. The data collected during this time period do not necessarily represent the extreme conditions that can occur at this location.