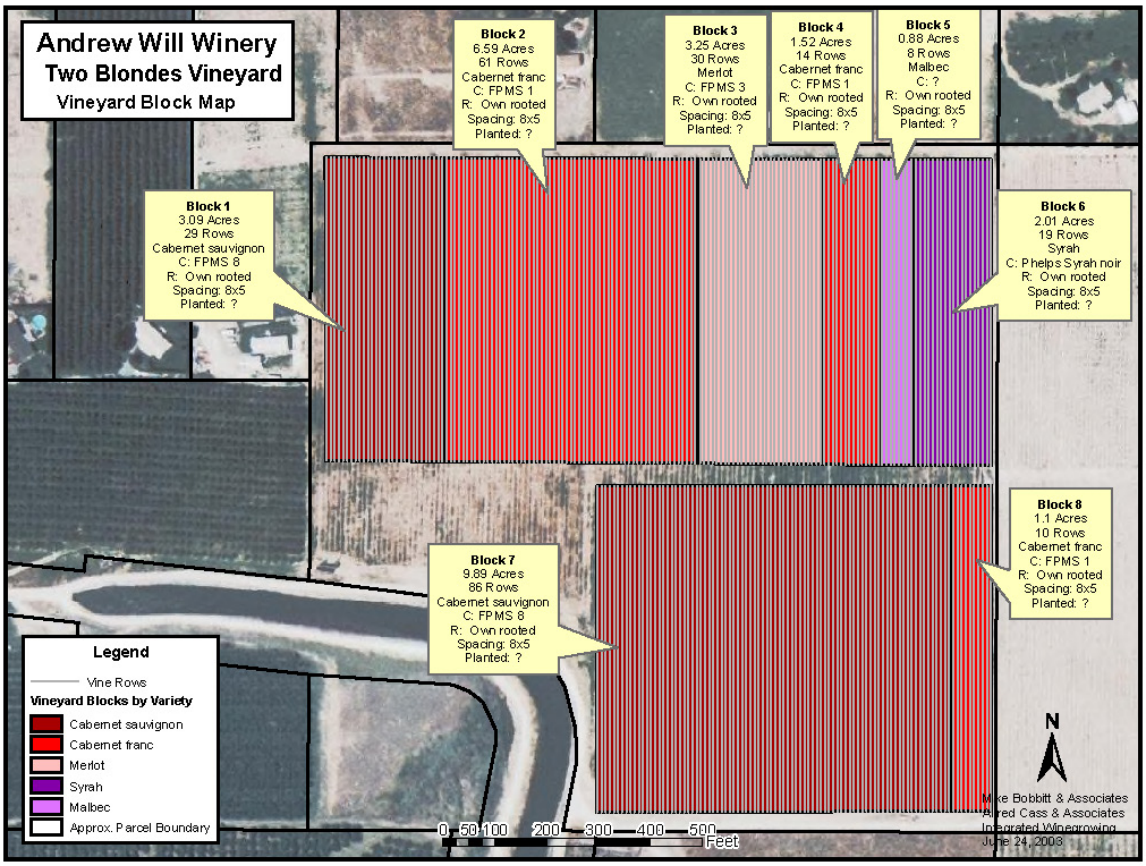
# 2008 Vintage Weather Summary for Two Blondes Vineyard





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# 2008 Weather Summary for Two Blondes Vineyard

## Introduction

This is a weather summary for Two Blondes Vineyard based on measurements made during the 2008 growing season, with comparisons made to the 2005 through 2007 seasons. This report is not a true 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. As more years of data are collected, a better and better picture of the temperature climate of this location will be ascertained. In fact, some consistency in the measurements indicates that some climatic parameters may already be defining themselves.

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. The top station was used as the reference when comparing 2008 to 2005 through 2007.

*Long-term averages from Oakville, CA are included for reference. Oakville was chosen as a representative climate for Bordeaux varieties in California. Oakville's climate is on the cool end of fine Cabernet Sauvignon production and on the warm end of fine Merlot production. Comparison comments to Oakville are presented in italics.*

## I. Temperature and Heat Summation

Two Blondes had 3065 degree days in 2008 compared to 3182 in 2005, 3253 in 2006 and 3235 in 2007 (**Figure 1**). Using heat summation criteria alone, the 2008 season was most similar to that of the 2005 season, but was the coolest growing season in the four year record. July was the warmest month in 2008, as it was in 2006 and 2007, but 2008 was cooler than either of those two years and most similar to that of 2005. On the other hand, August of 2008 (second warmest month) was most similar to 2006 and 2007 and cooler than 2005. Like the previous three years, the months of April and October were quite cool, indicative of the short, intense growing season at this location (and in the region). April of 2008 was the coolest April of the four years recorded.

The lower elevation station had about 190 fewer degree days than the upper station (**Figure 2**). Degree days were higher at the top station for each month, though the differences were greatest during July and August. The differences between the two locations were primarily due to lower nighttime temperatures at the lower location, though daytime temperatures were also a bit cooler at the bottom location.

*There is a distinct difference in heat summations between Two Blondes Vineyard and Oakville. While the heat summations at Two Blondes is about 280 degree days F warmer than Oakville (top station), the season is shorter and more intense at Two Blondes.May, June and September tend to have similar heat summations to those of Oakville, but July and August are much warmer at Two Blondes compared to Oakville. Yet, the heat fades quickly into the fall, and the month of October is much cooler at Two Blondes than in Oakville. This indicates the importance of early fruit maturation at Two Blondes vineyard, as ripening will slow down considerably during the month of October. While the bottom station had more similar heat summations to the Oakville average, the difference in the seasonal pattern is striking.*

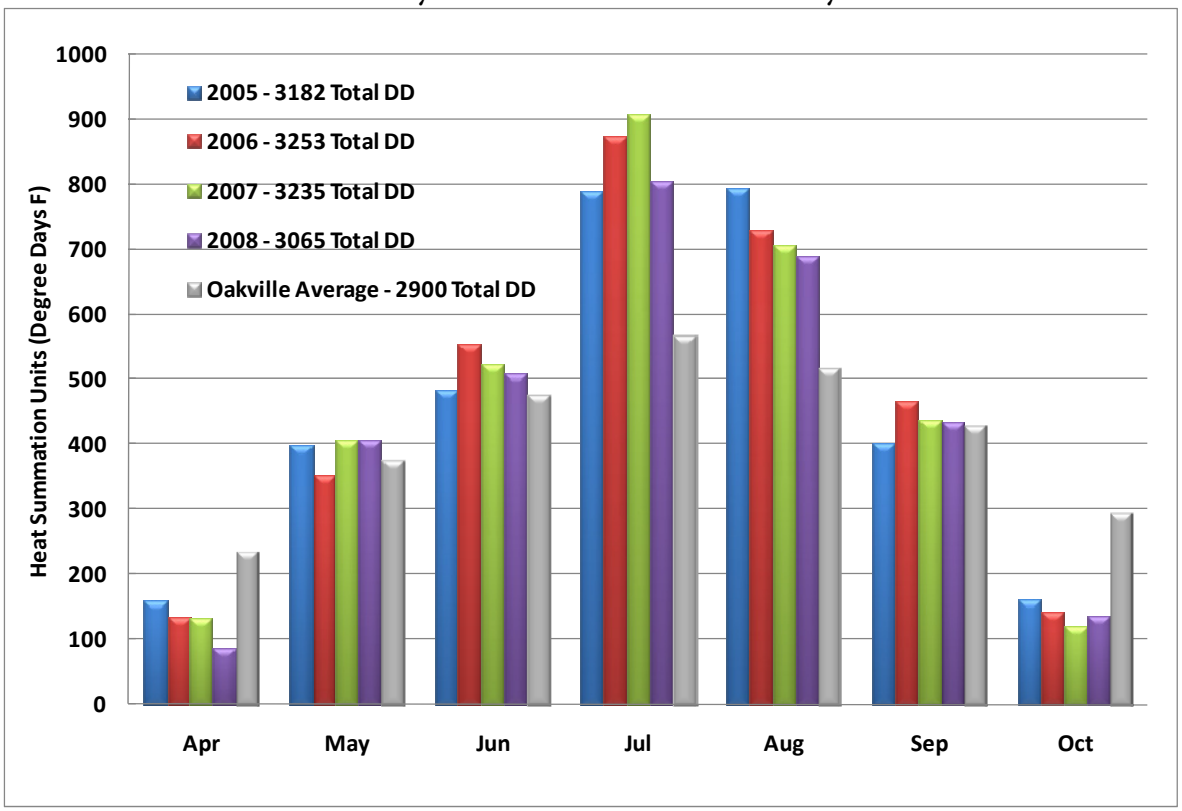


**Figure 1: Monthly heat summations for the top station at Two Blondes Vineyard for the 2005-2008 growing seasons, along with a long-term average for Oakville, CA. 50°F was used as the baseline temperature.**

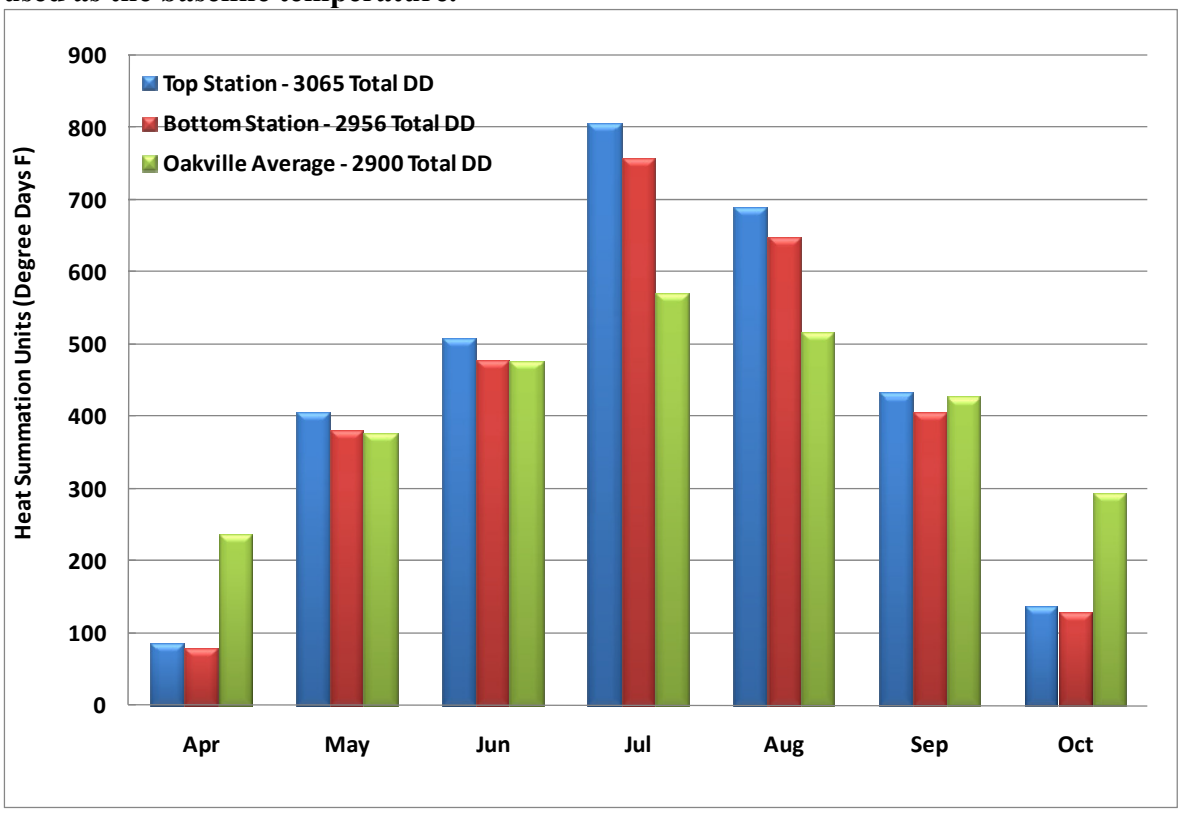


**Figure 2: 2008 monthly heat summations for two locations at Two Blondes Vineyard, along with a long-term average for Oakville, CA. 50°F was used as the baseline temperature.**

## 2008 Weather Summary for Two Blondes Vineyard

During the hottest month (July), average daily maximum temperature was lower in 2008 than in 2007, while August temperatures were similar to 2007 (**Figure 3**). July 2008 high temperatures were most similar to those of 2005. April of 2008 was cooler than in the prior three years, but May and June were similar in all four years, with respect to maximum temperatures. During September, high temperatures were most similar to 2006, while October temperatures were similar in all years.

The top station produced higher maximum temperatures than the lower station (**Figure 4**), but only by about 1°F.

Generally, the heat extremes are not very high at this locations, and the hottest month was relatively mild in 2008.

*Daily high temperatures are higher at Two Blondes than at Oakville during July. In previous years, August high temperatures were higher at Two Blonces than at Oakville, but there has been a cooling trend in the past four years, making August 2008 temperatures similar to the long-term Oakville average. Oakville temperatures are higher during September and much higher during October.*

Temperature minima in April 2008 were much cooler than in the previous 3 years (**Figure 5**), but there was not a trend for the other months of the year. Temperature minima in 2008 were most like 2005 during May, June, July and September. They were most like 2006 during August, September and October and most like 2007 during June, August and September. Minimum temperatures tended to be on the cooler side, in comparison to previous years, during August through October, suggesting that phenolic ripening may have been delayed relative to the prior vintages. This may have necessitated a harvest at a slightly higher sugar content than in recent vintages. As in all years, the cold October temperature minima would have made "flavor ripening" difficult in the later varieties. It is likely that fruit maturation proceeded very slowly during the month of October, if indeed fruit remained on the vines. Any problems with fruit development would be exacerbated at locations represented by the bottom temperature station. The bottom station had consistently colder temperatures than the top station (**Figure 6**), with temperature differences between 2 and 3°F. Colder nighttime temperatures are to be expected at lower elevations within a given location, due to settling of the colder air during the stable night conditions.

The night temperatures are quite cold during early spring and during Fall. Night temperatures during mid-summer are quite mild, and even a bit warm (relatively speaking). The "warmer" nights during a portion of the season will aid in fruit development, since fruit metabolism is generally independent of photosynthesis, and is highly temperature dependent. However, if fruit has not matured by the month of September, further ripening will be impeded by both cool daytime and cold nighttime temperatures. If attaining fruit maturation has been or is found to be a challenge, moving the fruit zone lower to the ground may be a way to increase the temperature regime of the fruit and enhance the ripening process. That should be balanced with the consideration that temperatures are colder nearer to the ground during the winter and early spring.

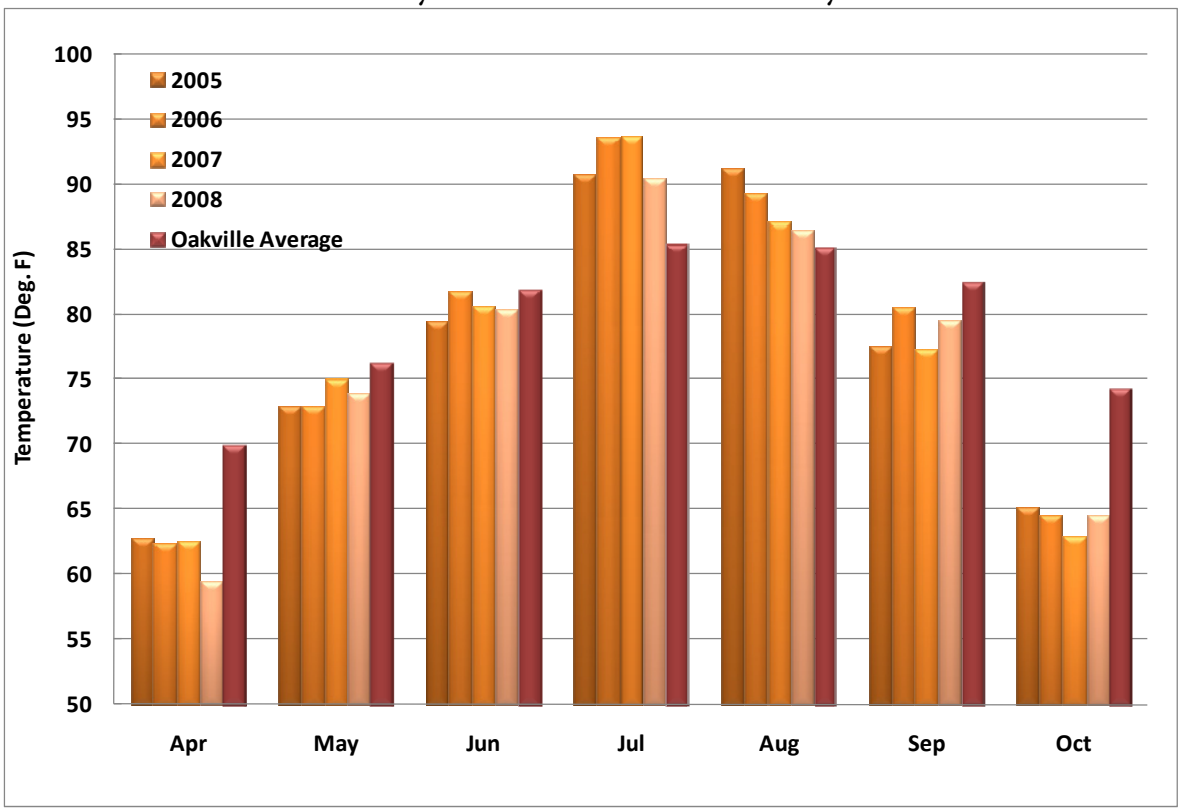


**Figure 3: Monthly averages of daily maximum temperature for the top station at Two Blondes Vineyard, along with a long-term average for Oakville, CA for the 2005-2008 growing seasons.**

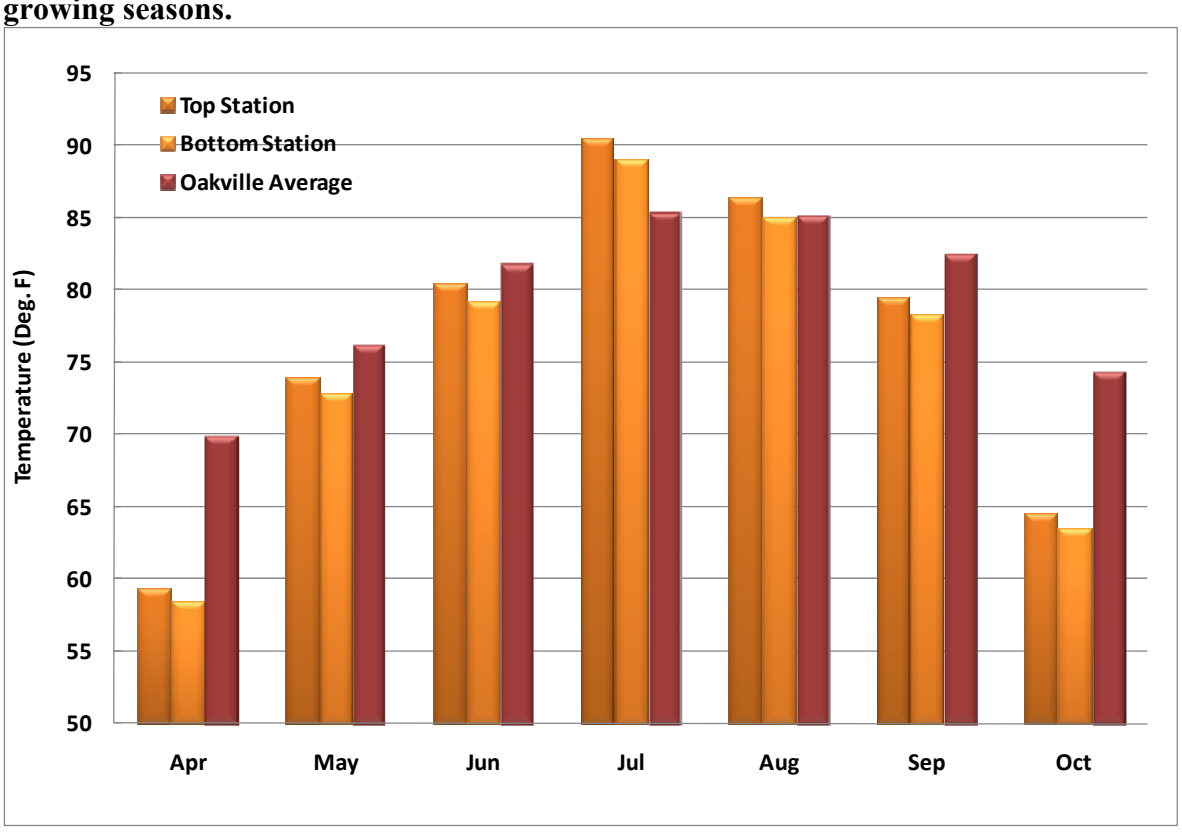


**Figure 4: 2008 monthly averages of daily maximum temperatures for two locations at Two Blondes Vineyard, along with a long-term average for Oakville, CA.**

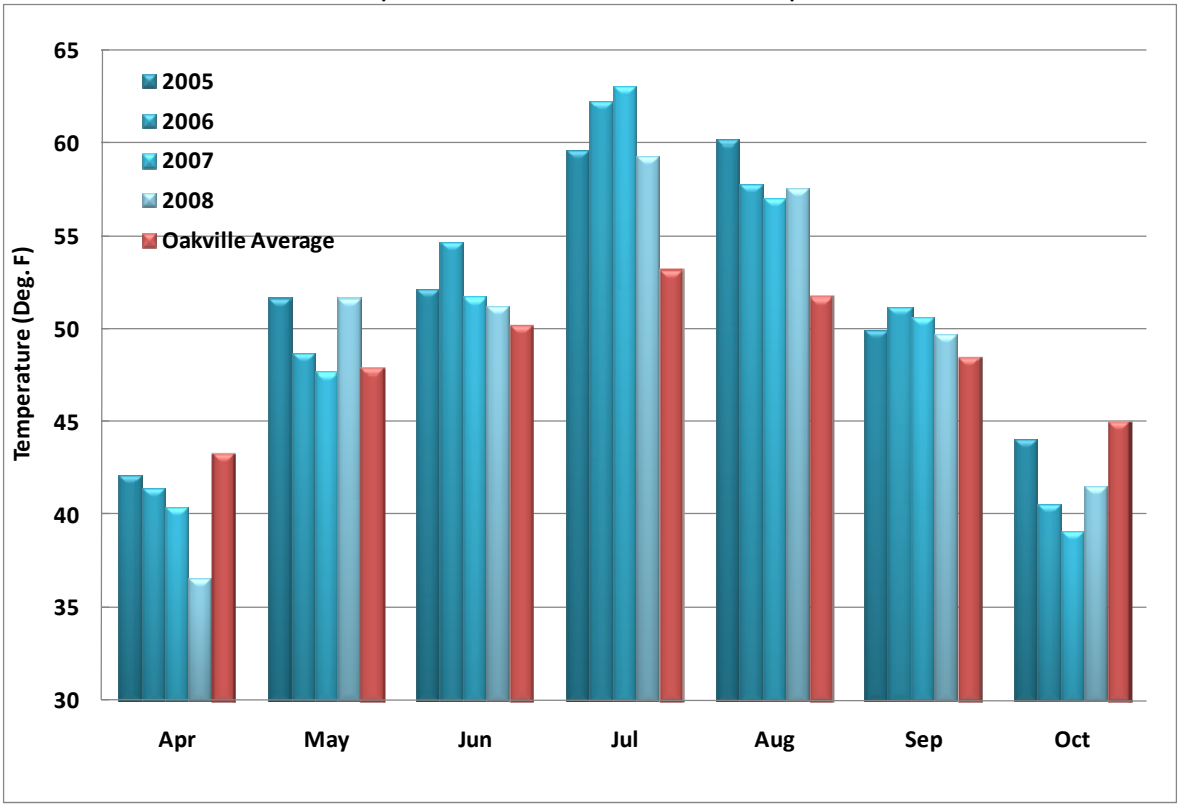


**Figure 5: Monthly averages of daily minimum temperature for the top station at Two Blondes Vineyard, along with a long-term average for Oakville, CA for the 2005-2008 growing seasons.**

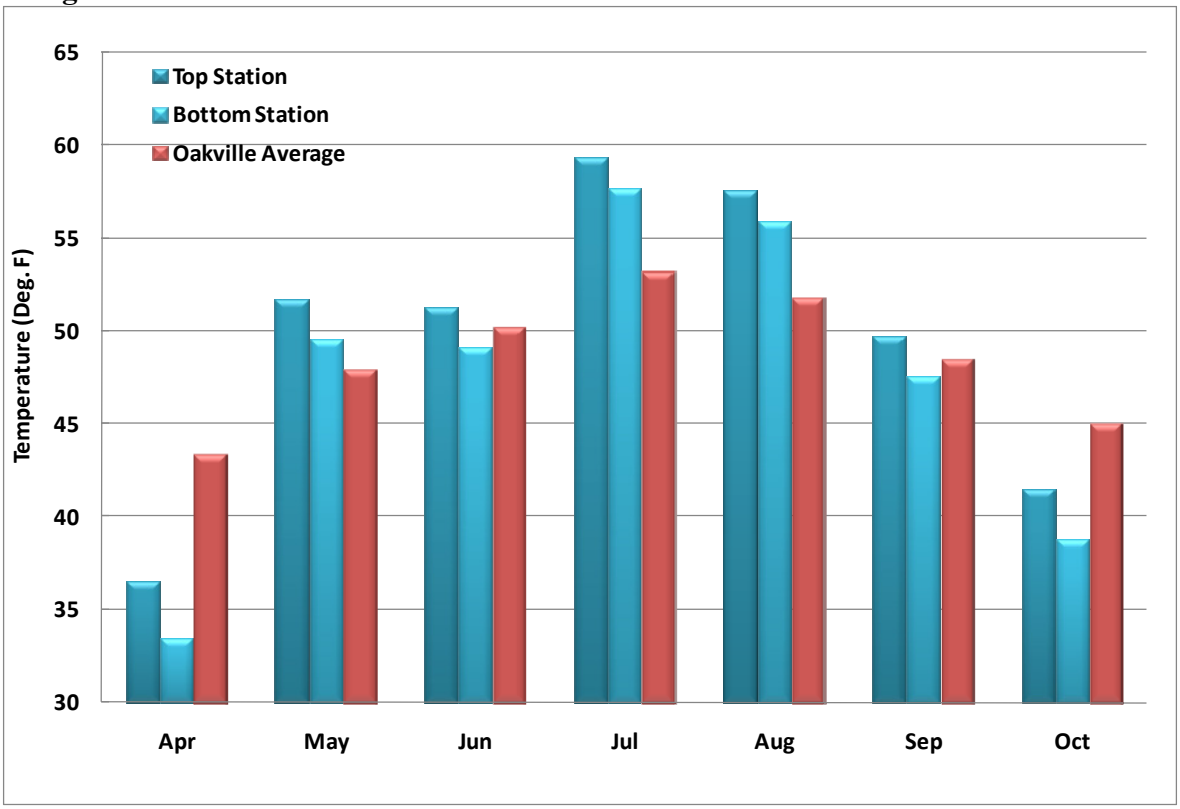


**Figure 6: 2008 monthly averages of daily minimum temperatures for two locations at Two Blondes Vineyard, along with a long-term average for Oakville, CA.**

*Minimum temperatures are remarkably similar between Two Blondes and Oakville during much of the season, though Two Blondes has much warmer night temperatures during July and August. September minimum temperatures are similar, though October temperatures tend to be warmer at Oakville.*

**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 7** for 2005 through 2008. Clearly, temperature minima, maxima and averages were very similar among the four years across this time period, indicating a consistency in year-to-year weather conditions (on average). Consistency of temperatures during the ripening period is a very positive attribute of a vineyard or growing region, as ripening is highly temperature dependent and is highly tied-in to vintage quality. Daily minimum temperatures during this time period showed more consistency from year to year than did maximum temperatures. As was found with all months of the year, temperatures at the top station had slightly higher temperatures during the ripening period (**Figure 8**), but only by about 1°F.

One aspect of the quality of a vintage is the variability of temperatures from day-to-day, not only year-to-year. Temperature variability generally is detrimental to wine quality, especially if variability includes high heat spikes. Dips in night temperature from time-to-time can also retard flavor ripening, causing flavor maturity to occur at higher brix levels or sometimes not occurring to the winemaker's satisfaction at all (especially problematic with short season regions, such as this one). The standard deviations in the daily temperature minima, maxima and averages during ripening are shown in **Figure 9**. There were not great differences among the last four seasons, though 2008 was more similar to 2006 with regard to variation in temperature maxima. On the other hand, variation in temperature minima in 2008 was nost similar to 2007. Temperature variability tends to be higher at Two Blondes than at the Oakville reference location.

The average diurnal temperatures during the ripening period are a very illustrative way of looking at the temperature characteristics during this critical period. Comparing diurnal temperatures in 2005-2008 (**Figure 10**), the night temperatures were nearly identical to one another in 2005 and 2006 and very close together in 2007 and 2008. Yet minimum temperatures in 2008 were most similar to those of 2005 and 2006. On the other hand, the daytime temperatures were warmest in 2006, and coolest in 2007, while daytime temperatures in 2008 were most similar to those of 2005.

The 2007 temperature curve of the top station exhibited an unusual "bump" in temperature during the morning, though the temperature pattern became more typical at around noon. This unusual pattern appears to be an anomaly, as it was not present in the bottom station(**Figure 11**)., and was not present in the 2008 measurements. It is likely that the sensor position was picking up some reflected or advected heat from a nearby building or other terrestrial feature.

Comparing the diurnal temperature curves between the top and bottom locations (**Figure 11**), it is clear to see that the top station experienced warmer temperatures during the nighttime as well as the daytime. The temperatures during the nighttime are critical for fruit maturation.

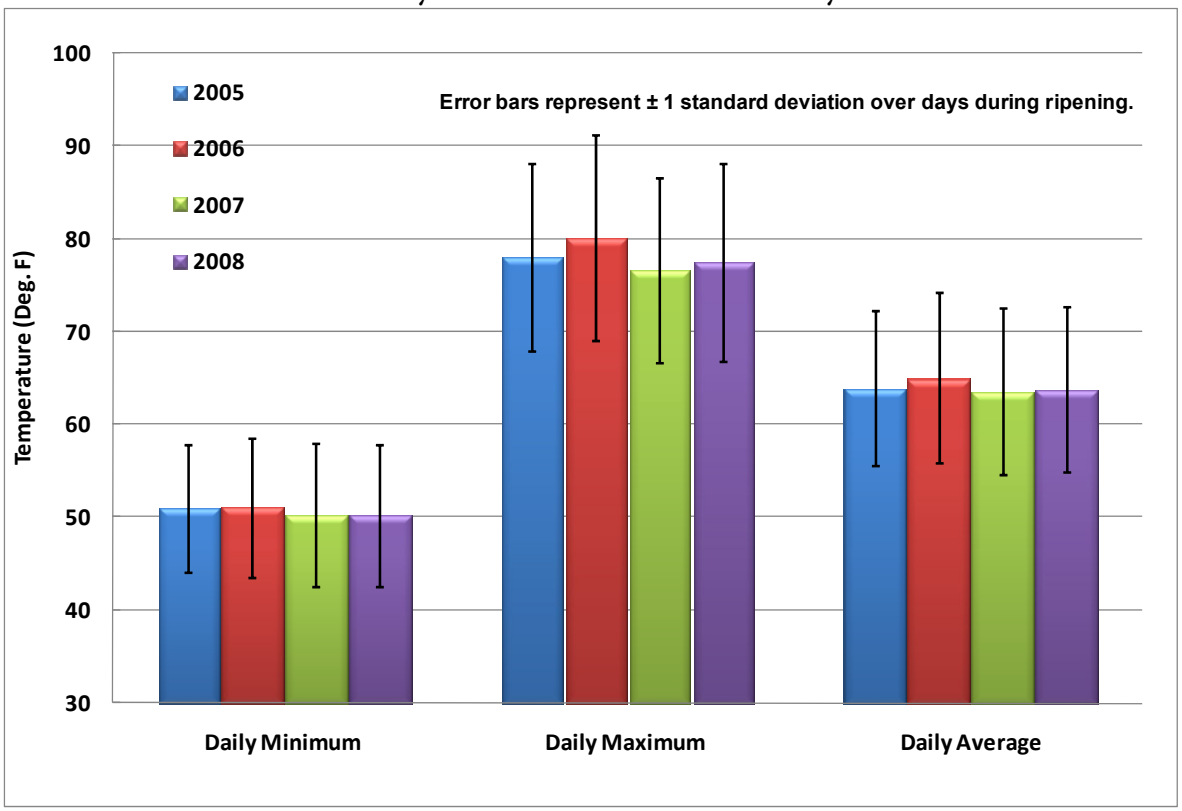


**Figure 7: Average daily minimum, maximum and average temperature during the 2005-2008 ripening periods (August 15th through October 15th).**

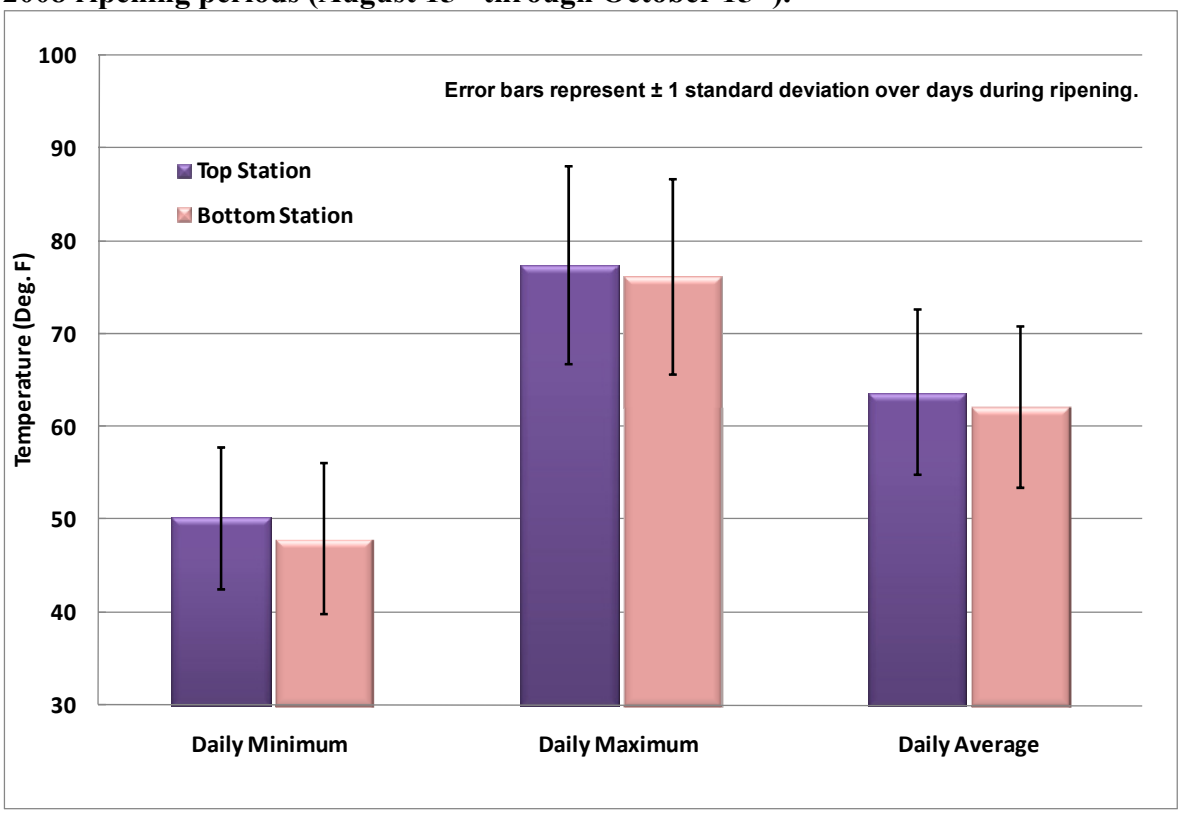


**Figure 8: Average daily minimum, maximum and average temperature during the 2008 ripening period for two stations at Two Blondes Vineyard.**

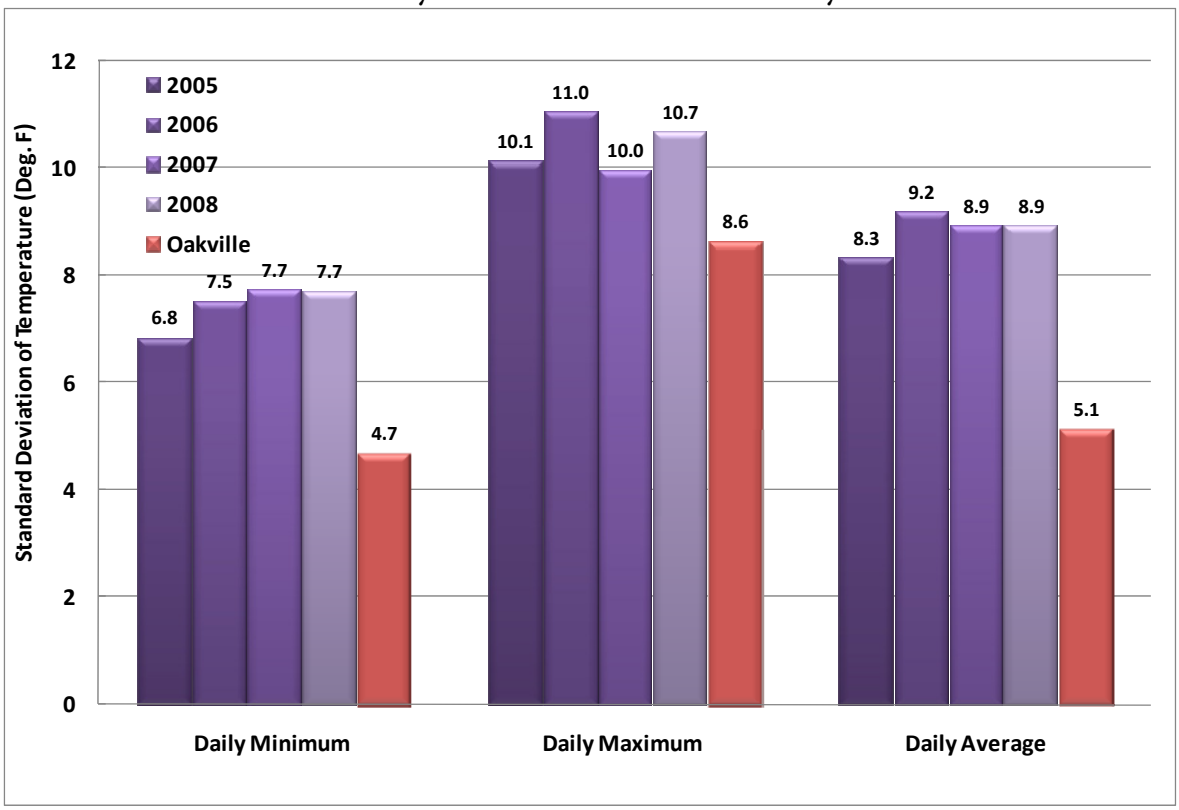


**Figure 9: Standard deviations of daily minimum, maximum and average temperature during the 2005-2008 ripening periods for the top station at Two Blondes Vineyard, along with the same for the long-term average at Oakville.**

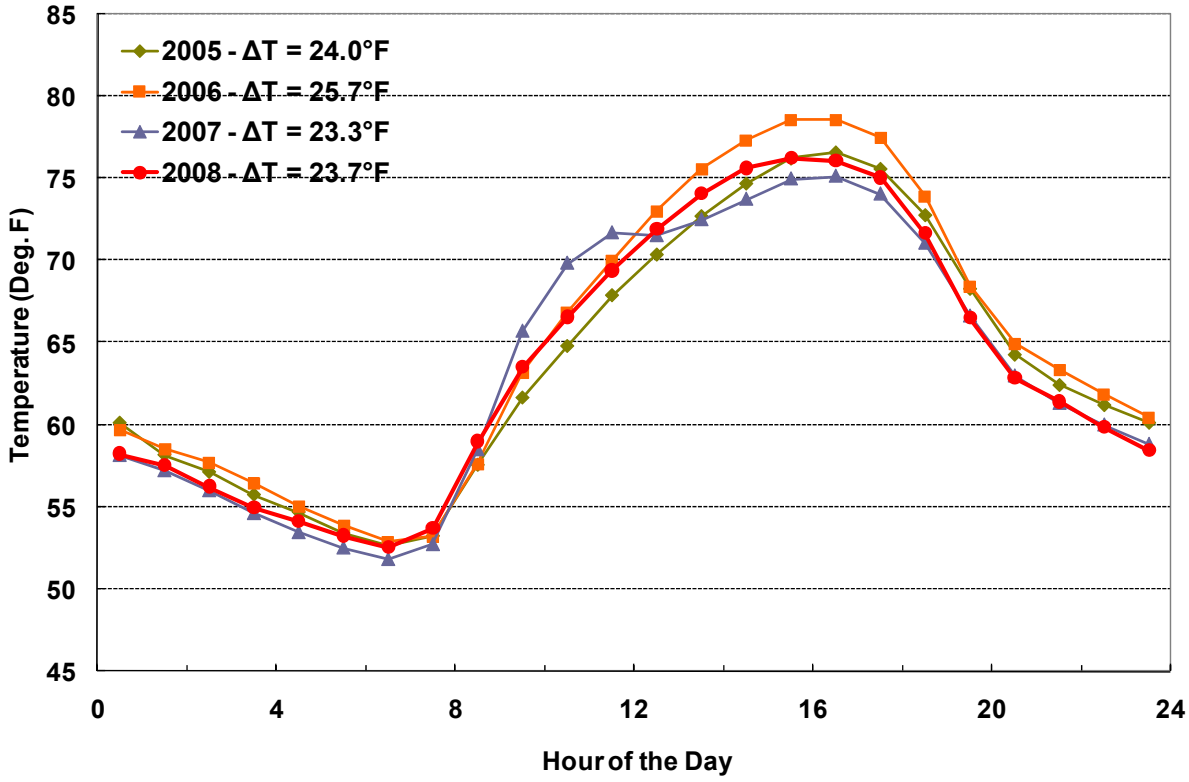


**Figure 10: Average diurnal temperature cycle for two locations during the 2005-2008 ripening periods (mid-August through mid-October) for Two Blondes Vineyard.**

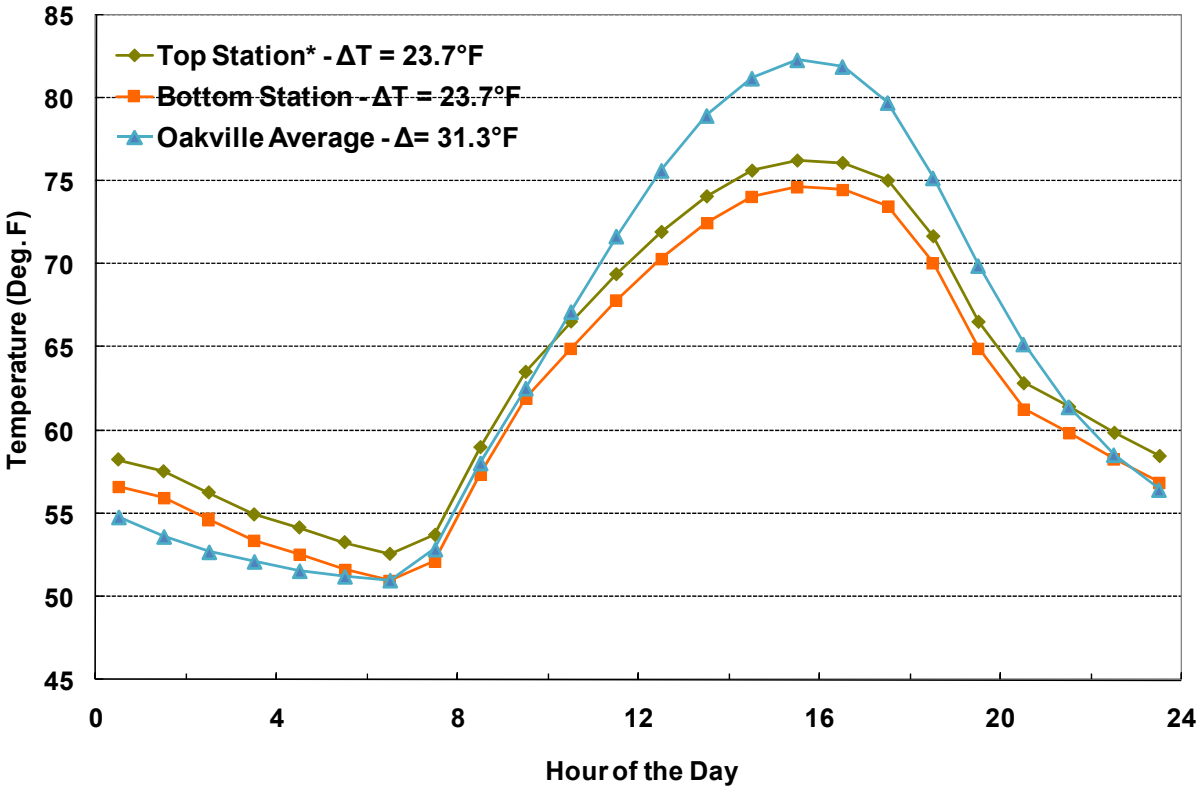


**Figure 11: Average diurnal temperature cycle for two locations at Two Blondes Vineyard, along with a long-term average for Oakville, CA during the 2008 ripening period (mid-August through mid-October).**

Temperatures need to stay above 50°F for berry metabolism to continue. Generally speaking, warmer night temperatures will allow fruit to reach "flavor maturity" at lower sugar content. The upper location better epitomizes the warmer night characteristic.

*The primary difference between the average diurnal temperature pattern during ripening between Two Blondes and Oakville, CA is that the Oakville temperatures are warmer during the day (during the ripening period, at least) and somewhat colder at night. This pattern is not typical for the entire season, as Oakville high temperatures are not as high as Two Blondes during July and August. Night temperatures at Oakville tend to drop more quickly in the evening, but remain mostly level during the nighttime. Two Blondes temperature remains warmer in the early afternoon and declines steadily until dawn, arriving at a similar temperature minima as Oakville.*

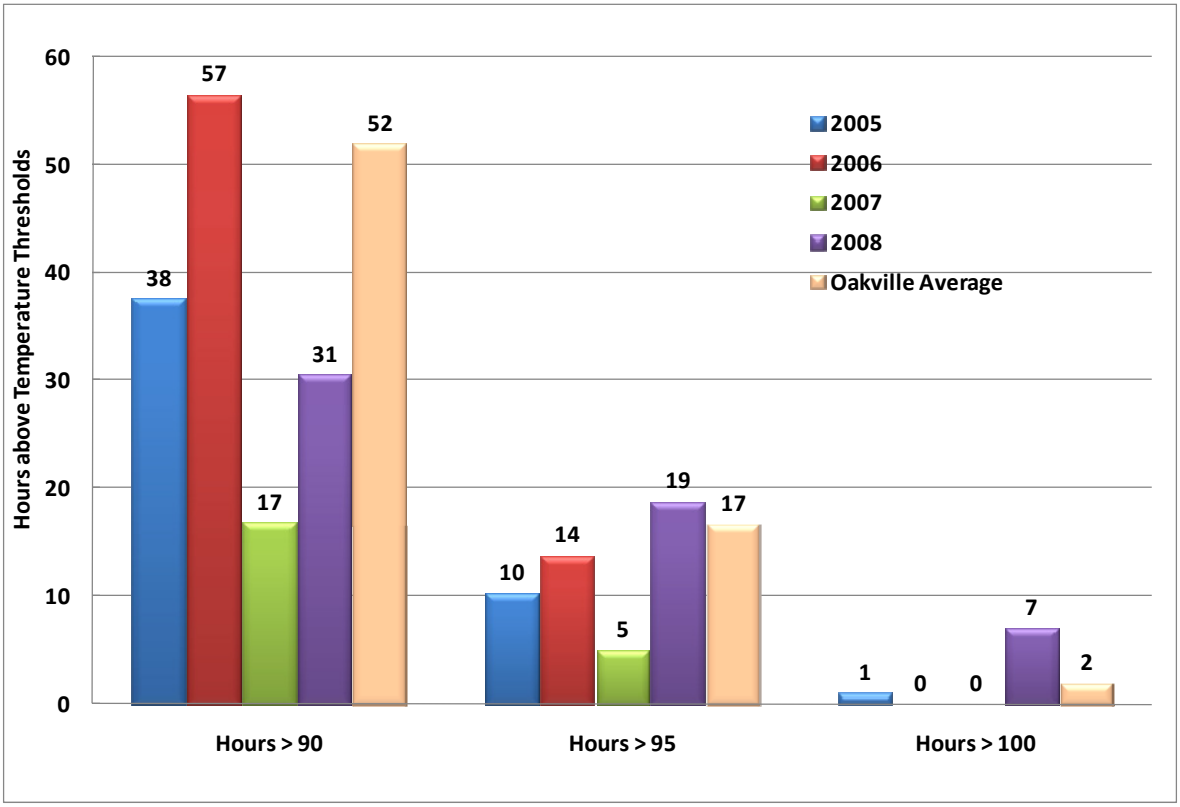


**Figure 12: Hours above given critical temperatures during the ripening stage in 2005-2008 for Two Blondes Vineyard along with long term averages for Oakville, CA.**

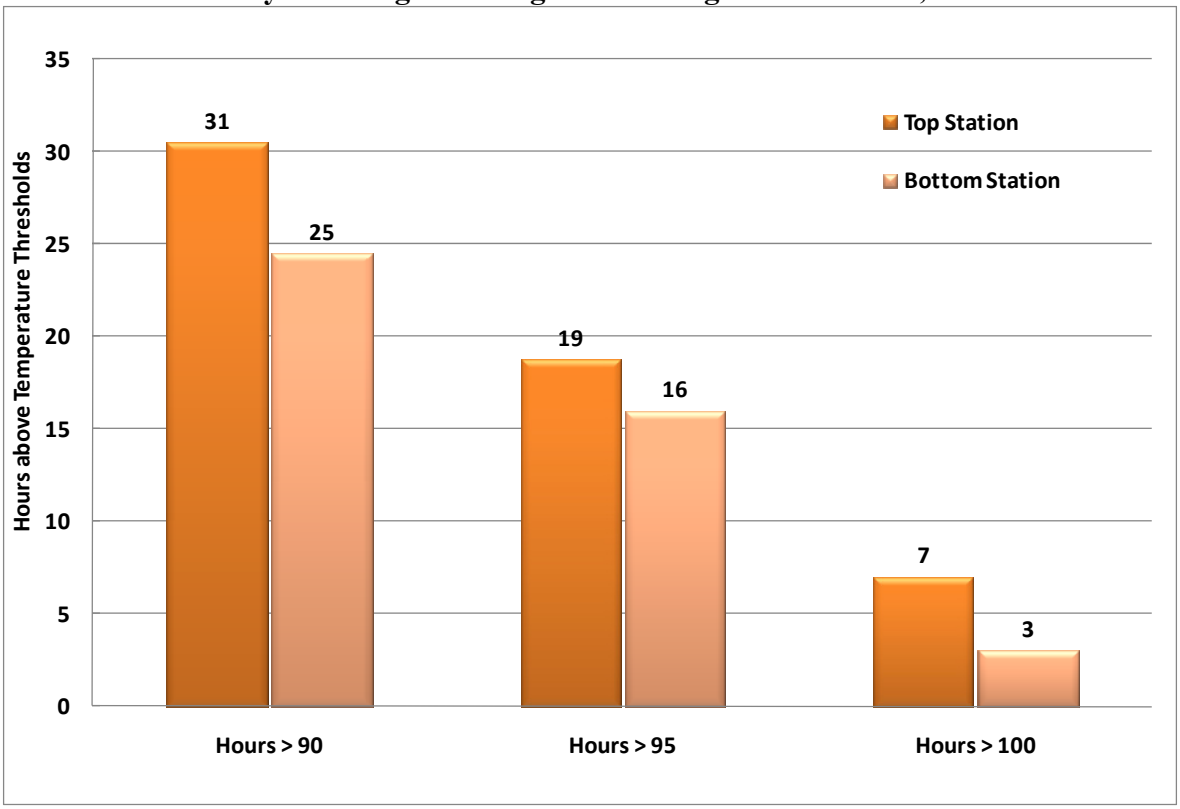


**Figure 13: Hours above given critical temperatures during the ripening stage in 2008 for two locations at Two Blondes Vineyard.**

Finally, it is instructive to evaluate the time during which the temperatures exceeded given threshold levels during the ripening period (**Figs. 12 and 13**). 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, but fruit quality is not thought to be significantly impacted. There were fewer hours above 90°F in 2008 than in 2005 or 2006, but more hours above 90°F than 2007. The bottom station experienced even fewer hours above that threshold than did the top station.

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. It is generally felt that air temperatures in excess of 100°F will degrade wine quality, while temperatures between 95 and 100°F will be less detrimental to quality.

At Two Blondes Vineyard, 2008 exhibited 19 hours above 95°F and 7 hours above 100°F. The heat above 100°F was relatively unusual for this vineyard, though 7 hours in this temperature range is not sufficient to raise concern for wine quality loss. From the last four seasons' data sets, it does not appear as though this location receives long periods of high heat during the ripening period, which bodes well for wine quality. The scarcity of high temperature events indicates that high heat stress conditions are not a common occurrence at this vineyard during ripening, which is a strong positive characteristic. That will allow the fruit to attain high quality with a rapid degradation of undesirable vegetative character during the ripening process.

However, temperatures can be quite high during the months of July and early August (data not included in these charts). While fruit is less susceptible to damage before veraison, it may be damaged when temperatures rise above 105°, or even slightly lower. Hence some fruit protection should be provided by leaves on the west side of the canopy.

*High temperature events during ripening are quite similar to those of Oakville, or even less common. The scarcity of high temperatures during ripening is a characteristic of high-quality growing regions.*

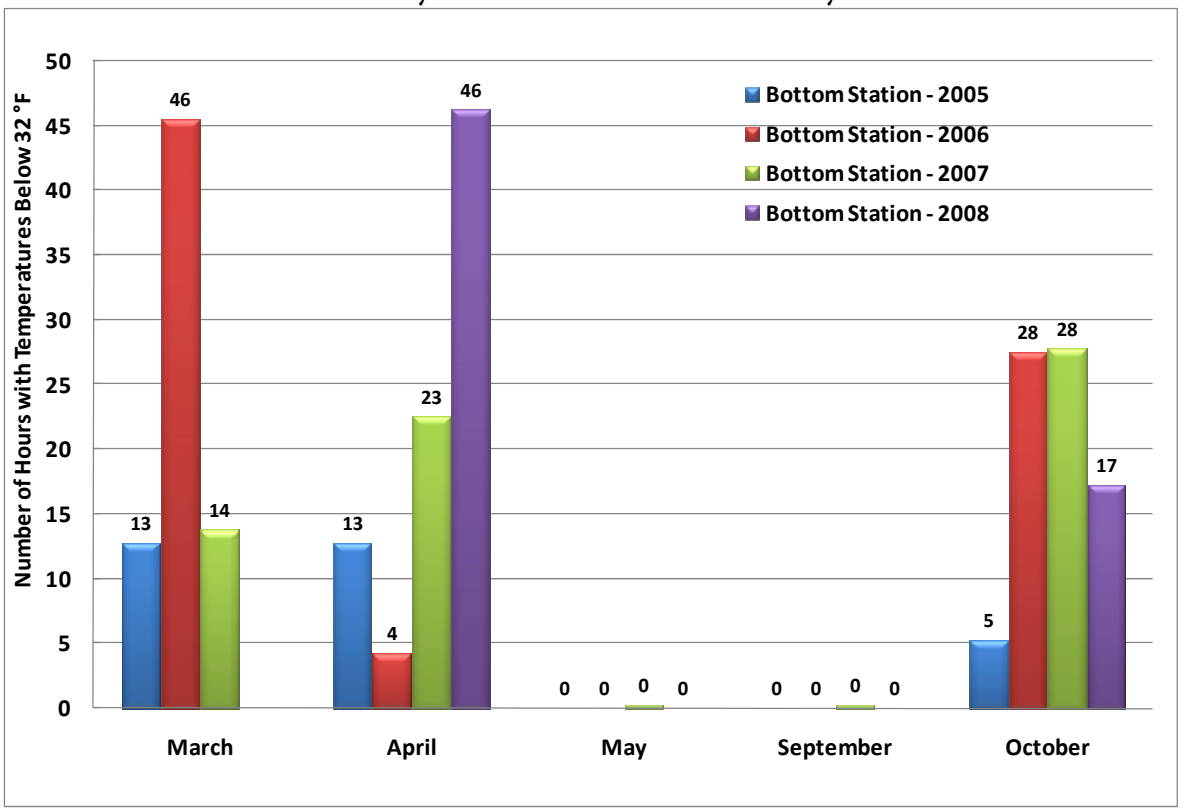


**Figure 14: Total number of hours per month below 32°F for the bottom location at Two Blondes Vineyard for 2005-2008 (frost-prone months only). March 2008 data was not available.**

### III. Frost Risk Analysis

The bottom station is most likely to be affected by frost, due to its consistently lower minimum temperatures than the top station **(Figure 15)**. Data from March were not available for this growing season, but there were many more frost-prone hours in April of 2008 than in the previous three years (**Figure 14**). This would have created a significant need for spring frost protection of the vineyard. It appears consistent that the spring frost season ends with the month of April on a consistent basis. On the other hand, the fall frost season begins with the month of October, for which 2008 was similar to prior years, but had fewer frost hours in October than the prior two years.

More detailed looks at the daily minimum temperatures and how they may impact frost are shown in Figures **16 and 17** for spring and fall, respectively. There was a severe and relatively late spring frost in 2008, occurring on April 19-21, where temperatures fell to 22-23 °F. The frost occurred 6 days after the less-severe, but significant frost event on April 13, 2005. The severity of this frost would have been difficult to protect even with overhead sprinklers.

From the last 3 years of data, fall frost does not appear to be a significant hazard. Frosts seem to occur consistently at the very end of October. Because the temperatures cool so quickly in the fall, fruit will probably not continue to mature that late into the month anyway. Fruit will withstand frost temperatures just below 30°F, but foliage will be damaged below this temperature level, and will drop as a result. No long-term damage will result from the fall frosts, but it would be beneficial to have harvested fruit by mid-October to allow the vines some

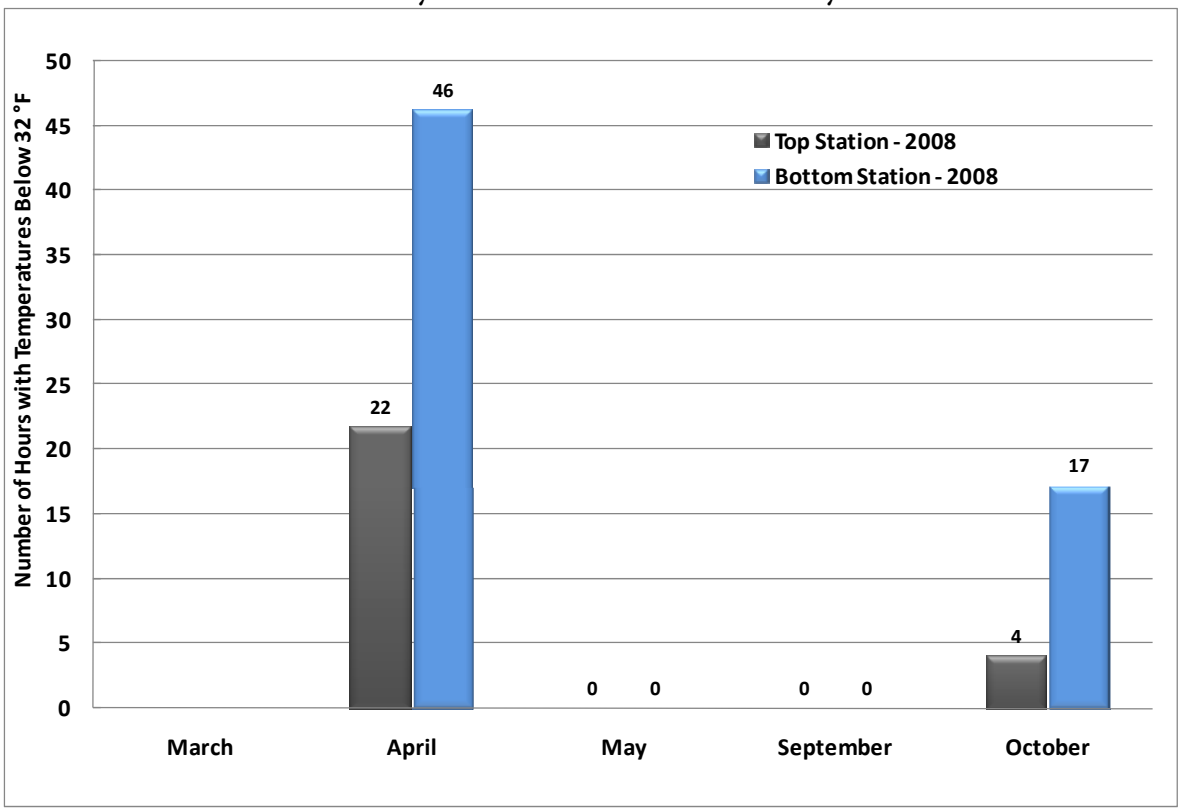


**Figure 15: Total number of hours per month below 32°F during the frost-prone periods for two locations at Two Blondes Vineyard in 2008. March 2008 data was not available.**

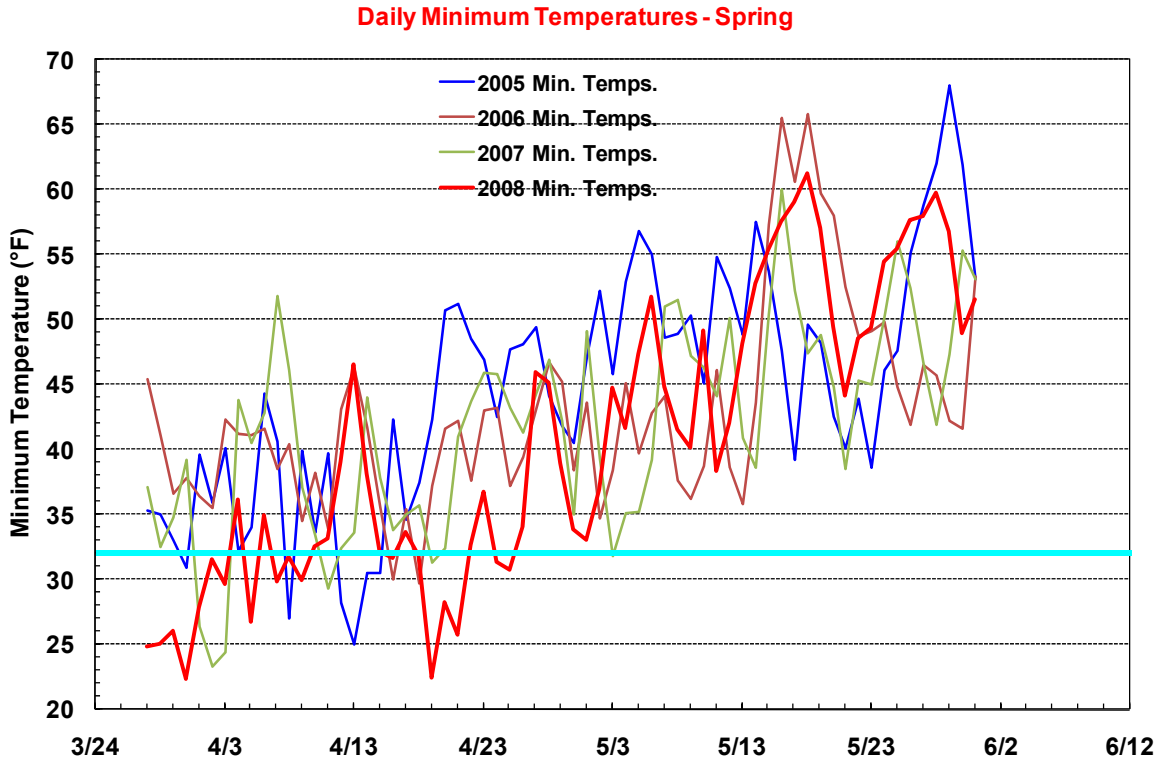


**Figure 16: Daily minimum temperatures during the spring frost periods of 2005-2008 for the bottom station at Two Blondes Vineyard.**

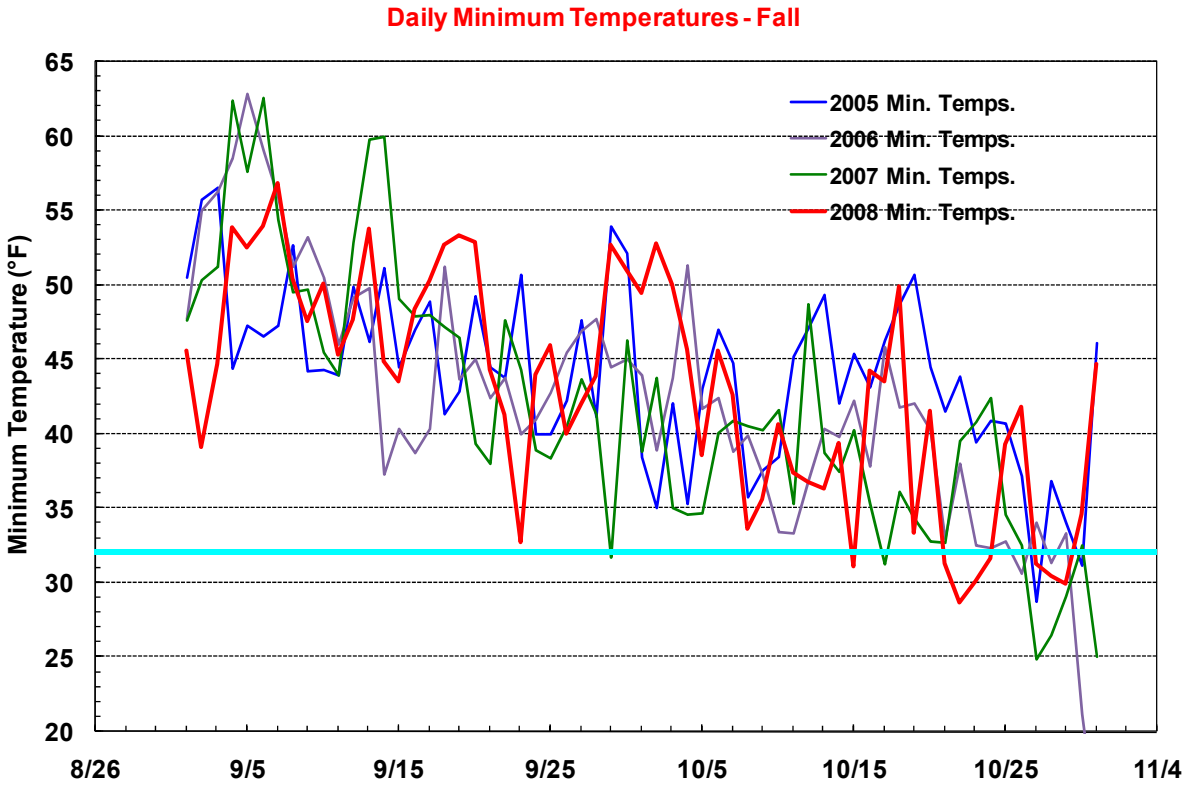


**Figure 17: Daily minimum temperatures during the fall frost periods of 2005-2008 for the bottom station at Two Blondes Vineyard.**

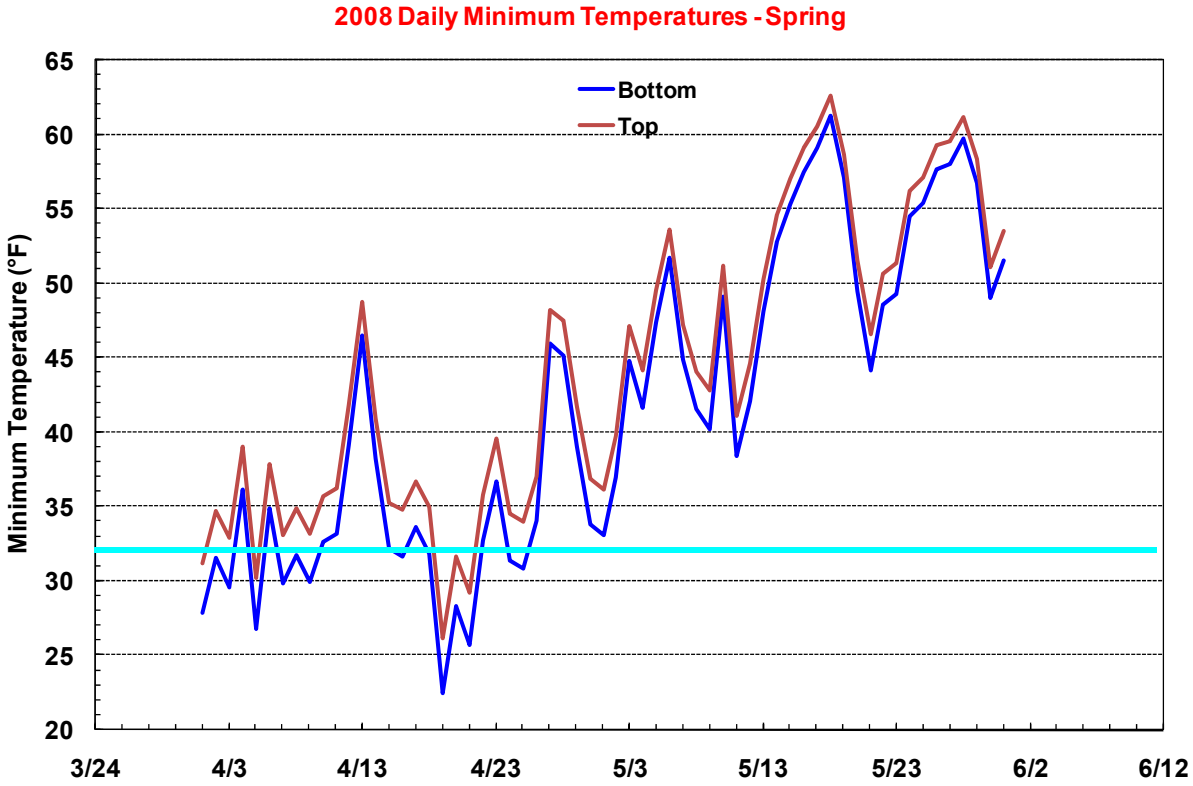


**Figure 18: Daily minimum temperatures during the spring frost period of 2008 for the two stations at Two Blondes Vineyard.**

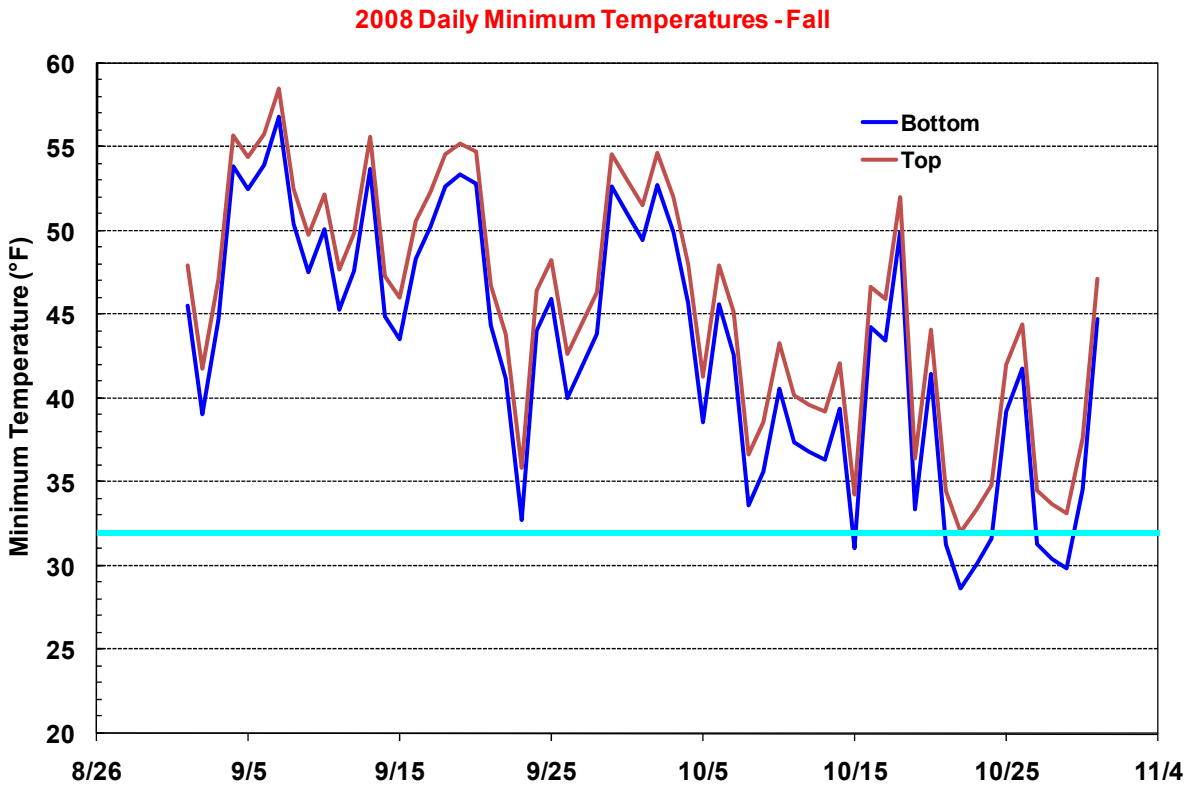


**Figure 19: Daily minimum temperatures during the fall frost period of 2008 for the two stations at Two Blondes Vineyard.**

time for recovery after harvest and before leaf drop.

For interest, plots of daily minimum temperatures for the two locations are plotted alongside one another for 2008 in **Figures 18 and 19**. Clearly, there is less potential for frost in the upper elevations of the property. The upper side also appears as though it would escape the fall frosts in late October.

## IV. Conclusions

This limited data set suggests that there are sufficient heat summation units available to ripen all Bordeaux varieties. The site receives about 3100-3200 degree days F, putting it in a cool Region II on the Winkler scale. The lower portions of the vineyard receive about 200 fewer degree days than the upper portions, which may make ripening of the later-season varieties more difficult, but still possible, as slightly warm night temperatures allow for "night ripening". The season length is short, but temperatures warm quickly in spring, allowing vine development to catch up with other growing regions, such as those at lower latitudes. However, temperatures also fall rapidly during the fall, so fruit must mature by early October, or it will have difficulty achieving flavor maturity. Cabernet Sauvignon is the most difficult variety to ripen here, so it should be treated with some exposure of the fruit to increase fruit temperature, so as to expedite the ripening process.

The 2008 vintage was characterized by a lower than average heat summation (3065 degree days F), due mainly to a cold April and a relatively cool July (the site's warmest month). While there were a greater number of hours at high heat than normal during the ripening period, the site

should not be thought of as having high heat. High heat hours were relatively small. In 2008, July maximum temperatures were relatively low and similar to those of 2005.

The lack of extreme temperatures during ripening is a benefit to this vineyard, as this will allow fruit to ripen without potential for sunburn or other degradation due to excessive heat. However, there may be high temperatures before fruit has reached veraison, since July temperatures tend to be warm to hot in some years. Heat during July may also be damaging to the green berries, so some heat protection should be maintained, in the form of retained leaves on the afternoon sun side of the canopy. This is particularly important for the Merlot.

The mild temperatures during ripening are accompanied by mild, but not cold, temperatures at night (at least early in the ripening period). This will allow for some "night ripening" of fruit, which allows flavors and tannins (etc.) to develop without accompanying sugar accumulation, which occurs during daylight hours. The net result is that flavor maturity may be reached before sugar (and potential alcohol) levels become excessive.

Harvest must be concluded at or before mid-October, as temperatures cool rapidly, with the potential of first fall frosts late in the month. The relatively short season is created by cool months of April and October. This, coupled with warm months of July and August, but without high heat during the ripening period characterizes the winegrowing climate of this site. This differentiates it from other Bordeaux-variety-growing regions, such as Napa Valley, which has a longer growing season, can tolerate long hang-times, yet is punctuated by occasional heat events throughout the fruit development period. The latter characteristics are not found at Two Blondes Vineyard.