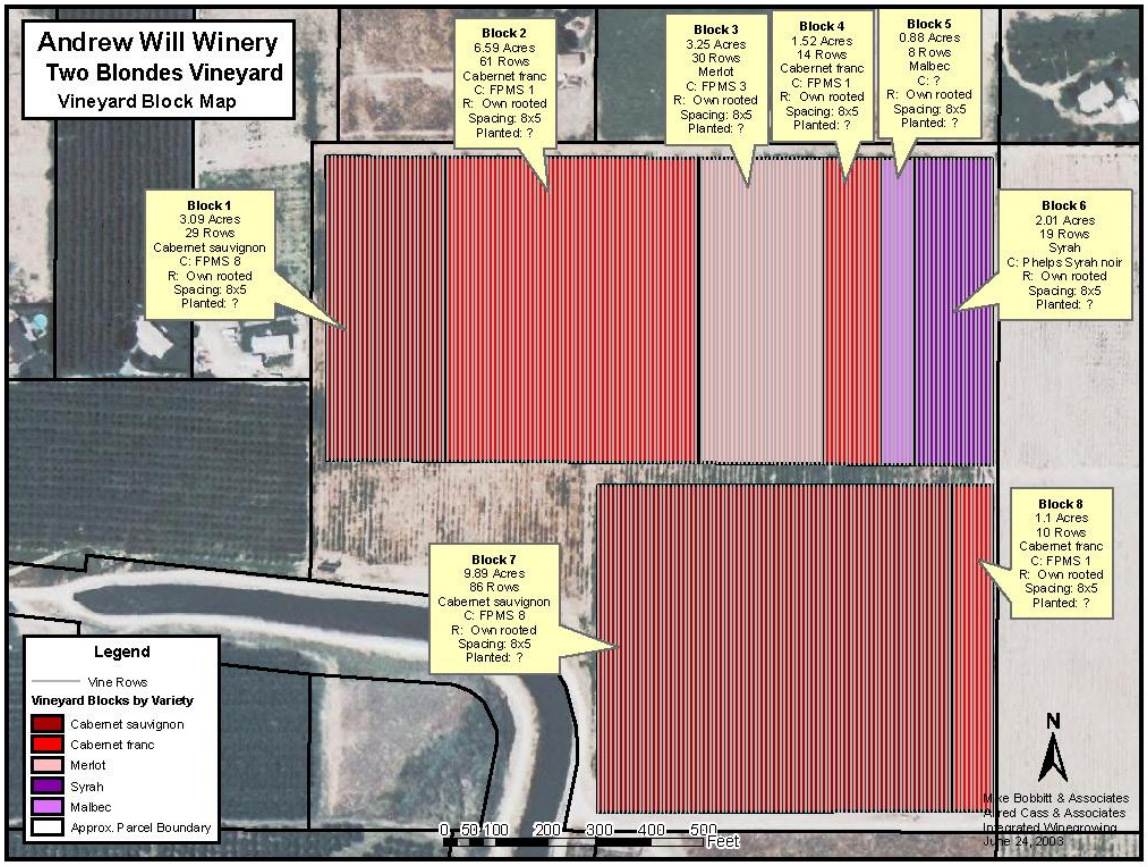
2011 Vintage Weather Summary for Two Blondes Vineyard



Prepared by:
Mark Greenspan, Ph.D.
Advanced Viticulture, Inc.
www.advancedvit.com

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Introduction

This is a weather summary for Two Blondes Vineyard based on measurements made during the 2011 growing season, with comparisons made to the 2005 through 2010 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. Actually, 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 2011 to 2005 through 2010.

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. Data for this season's report were made using the same yearly record period as those measured at Two Blondes Vineyard.

I. Temperature and Heat Summation

Using the upper station as a reference, Two Blondes had 3111 degree days in 2011 compared to 3182 in 2005, 3253 in 2006, 3235 in 2007, 3065 in 2008, 3305 in 2009 and 2833 in 2010 (**Figure 1a**). Following the very cool season the year prior, the heat summation in 2011 was still about 30 degree days lower than the 2005-2011 average. The lower station was about 112 degree days cooler than the upper station, and on average is 155 degree days cooler. The 2011 season followed one of the coolest seasons in recent history (since 2005), and fruit ripening should have been much easier in 2011 than in 2010, which was quite cool. Monthly breakdown (**Figure 2a**) showed that August was the warmest month in 2011. This is a departure from the norm, as July is usually the warmest month. It appears that the season's heat was shifted in time by about a month, as September was also quite warm relative to prior years. August was not abnormally warm, but was the second-warmest August in this limited weather record. May was unusually warm in 2011 while July was unusually cool. Like the previous five years, the months of April and October were quite cool, indicative of the short, intense growing season at this location (and in the region). The heat summation pattern differs from that of Oakville, in that Oakville receives fewer heat units during the summer months, but compensates somewhat by having warmer months of April and October. Hence, the Two Blondes site has a shorter, but more intense climatic growing season than Oakville.

The lower elevation station had fewer degree days than the upper station (**Figure 2b**), a smaller difference than the average of 155 degree days. Degree days were very similar at both sites during most months, though higher at the top station only during August and September. The differences between the two locations were primarily due to lower nighttime temperatures at the lower location. This will impart different fruit maturation characteristics at the two sites.

There is a distinct difference in heat summations between Two Blondes Vineyard and Oakville. The past 7 seasons have shown consistently higher heat summations at Two Blondes than at

Oakville, except for 2008. The average difference between the upper and lower station relative to Oakville is 349 and 194, respectively. While the heat summations at Two Blondes (top station), on average has been about 350 degree days F warmer than Oakville (long-term average), the season is shorter and more intense at Two Blondes. May, June and September tend to have similar heat summations to those of Oakville (though May and September were quite warm in 2011), but July and August are much warmer (in heat summation) 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.

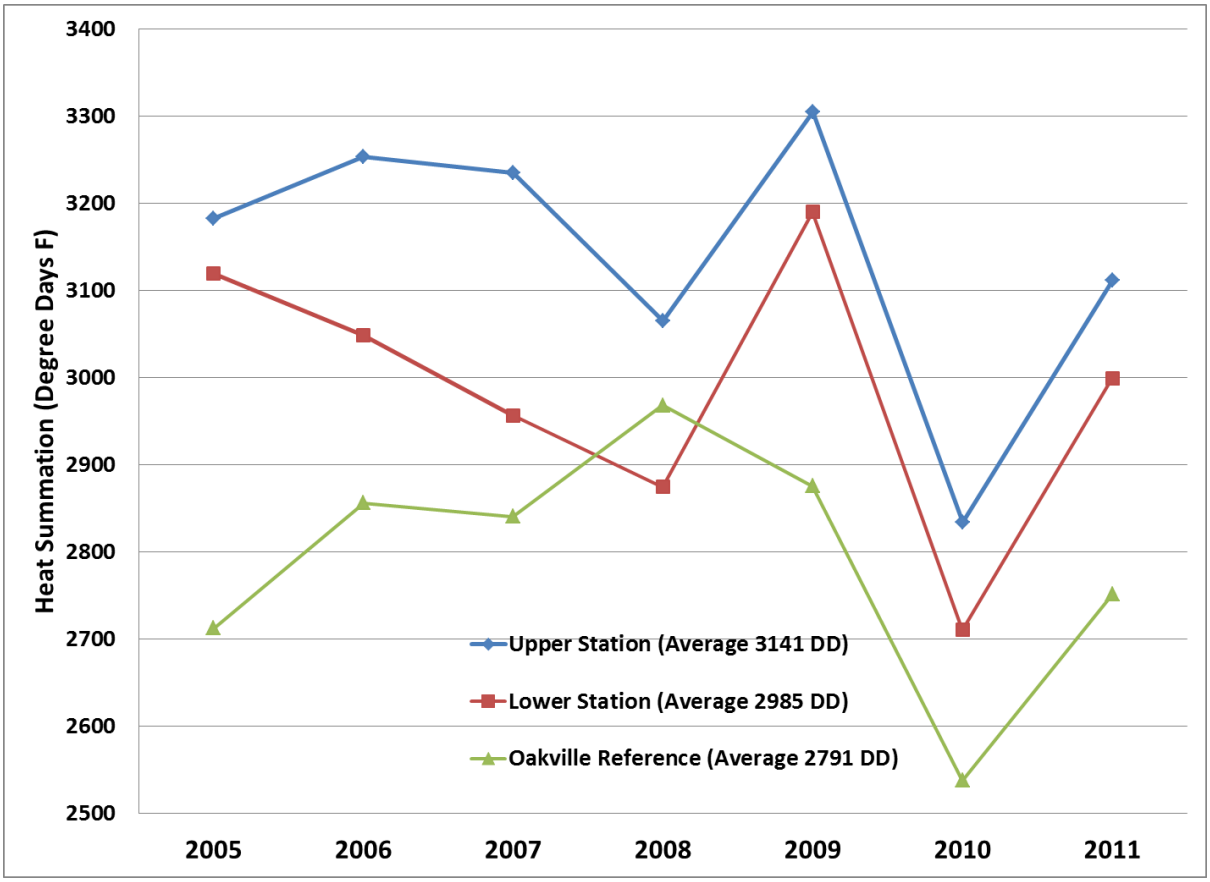

Figure 1a: Growing season heat summations for the two stations at Two Blondes Vineyard for the 2005-2011 growing seasons, along with those for Oakville, CA. 50°F was used as the baseline temperature.

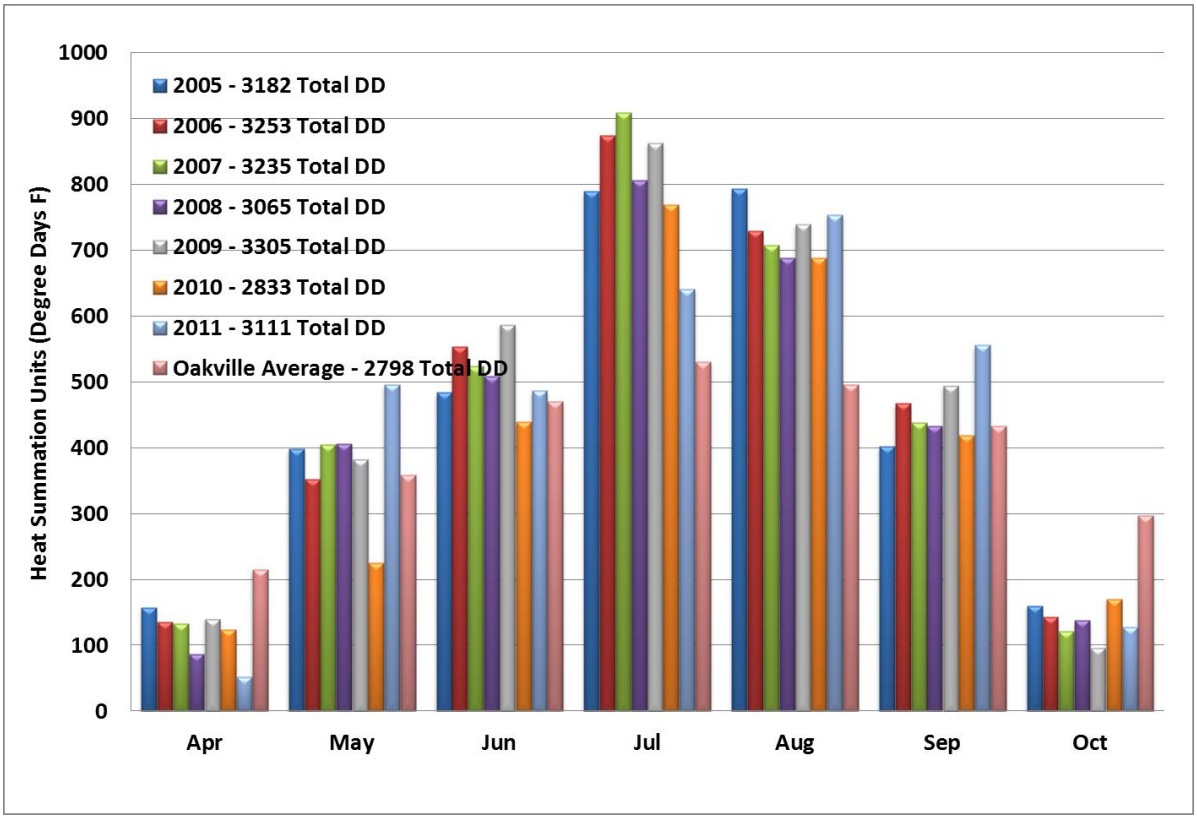

Figure 2a: Monthly heat summations for the top station at Two Blondes Vineyard for the 2005-2011 growing seasons, along with a long-term averages for Oakville, CA. 50°F was used as the baseline temperature.

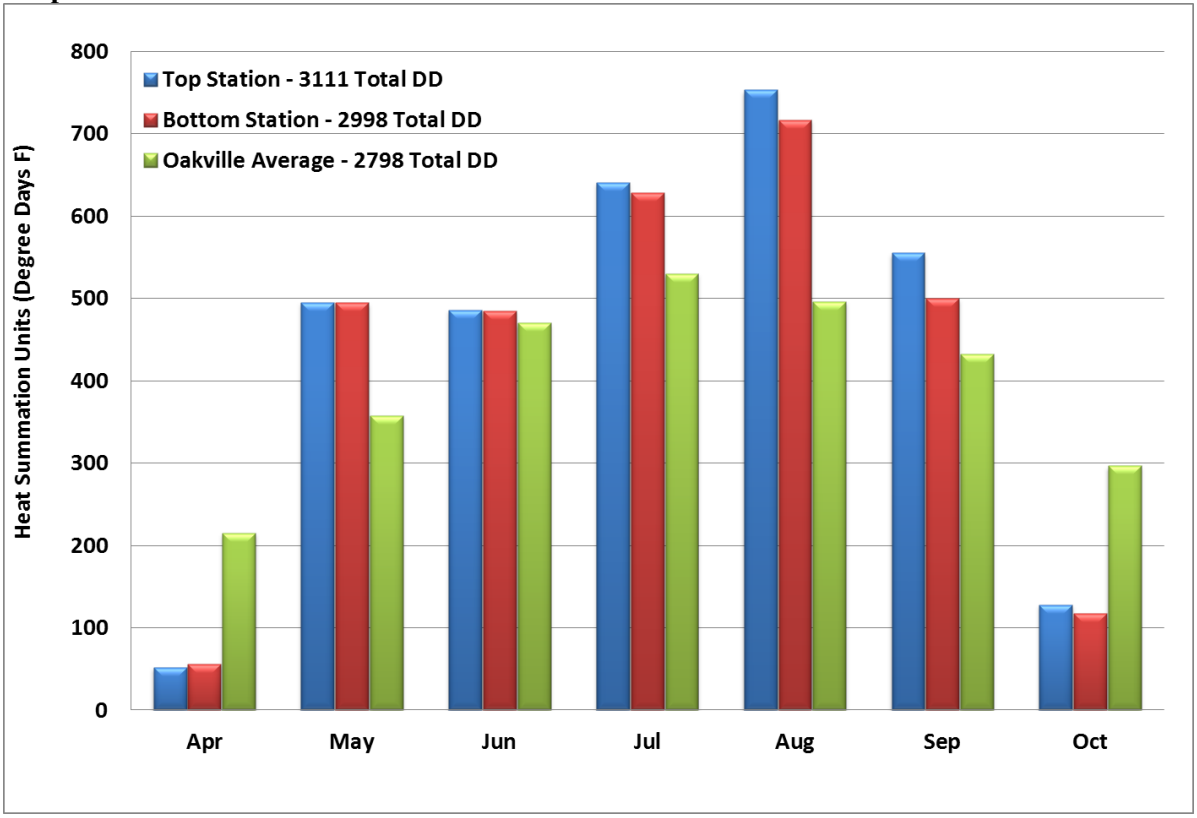

Figure 2b: 2011 monthly heat summations for two locations at Two Blondes Vineyard, along with a long-term average for Oakville, CA. 50°F was used as the baseline temperature.

Despite more heat summations in August than in the past, temperature maxima were not out of the ordinary. During August, average daily maximum temperature was about mid-range among the prior years' temperatures (**Figure 3**). July, on the other hand, was much cooler than in previous years, with average maximum temperature of 80°F, about 10 degrees cooler than in previous years. Similarly, June had very cool temperatures, being over 10 degrees cooler than in previous years. September had higher temperatures than in past years, but only by about 5°F.

Comparing the upper and lower weather stations on the property (**Figure 4**), spring and summer daily maximum temperatures were quite similar, and fall temperatures were only about 1-2 degrees warmer at the upper station relative to the lower station.

Generally, the heat extremes are not very high at this location, and the hottest summer months were very mild in 2011, as they seem to always be.

Daily high temperatures were higher at Two Blondes than the Oakville average only during August in 2011. High temperatures were similar to the Oakville average in May and September and lower than Oakville for the other months of the growing season. The milder daily maximum temperatures are conducive to high quality wine production, but present a challenge to grape ripening in the short-season at this location. The recent trend of cooler temperatures in early summer and warmer temperatures later into the summer is only short-term and should not be interpreted as climate change, necessarily. It is likely to be evidence of a shorter-term climatic oscillation than a longer-term change.

The temperature minima (nighttime) draw a distinct difference between this location and the Oakville site. Warmer night temperatures allow for better fruit maturation despite the cooler daytime temperatures. The warmer nights are primarily responsible for the peak in heat summation during the summer months. Temperature minima were exceptionally high during May and June of 2011 (**Figure 5**). They were quite cool in April, similar to those of 2008. Otherwise, they were quite similar to previous years. The cool April night temperatures would have delayed early vegetative development as well as bloom and fruit set. Relatively warm minimum temperatures in August and September would assist the ripening process as tannins and other flavor components would be allowed to mature even during the nighttime. October temperatures showed cold nights, and coupled with cool days, the ripening processes would have slowed down and stopped at about mid-October. As has been true in the past, the bottom station had consistently colder temperatures than the top station (**Figure 6**), though differences were even greater than in previous years. Temperatures were about 13 degrees cooler in May and June, and 4-5 degrees cooler in September and October. 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. Warmer uphill temperatures at night are generally beneficial to fruit ripening, and this may be important in cool years such as this one. The lower elevations of the property may struggle to ripen fruit and crop load may need to be adjusted to compensate for the slower maturation process. Additionally, some leaf removal in the fruit zone may be necessary (or to a greater extend) in the lower elevations to allow fruit to warm up and ripen more thoroughly. There does not appear to be a risk of heat damage at this location (see below).

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 end 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 (as well as the leaf removal discussed above). That should be balanced with the consideration that temperatures are colder nearer to the ground during the winter and early spring.

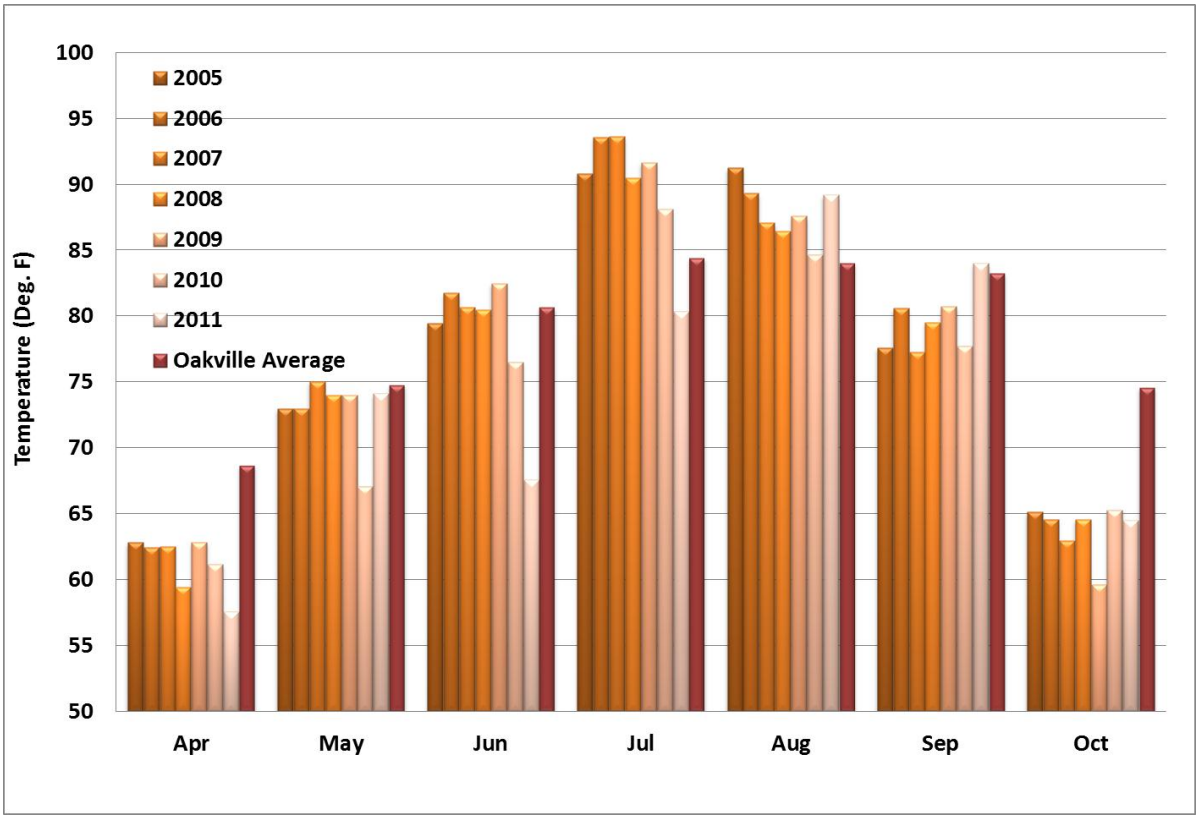

Figure 2: Monthly averages of daily maximum temperature for the top station at Two Blondes Vineyard, along with a long-term average for Oakville, CA for the 2005-2011 growing seasons.

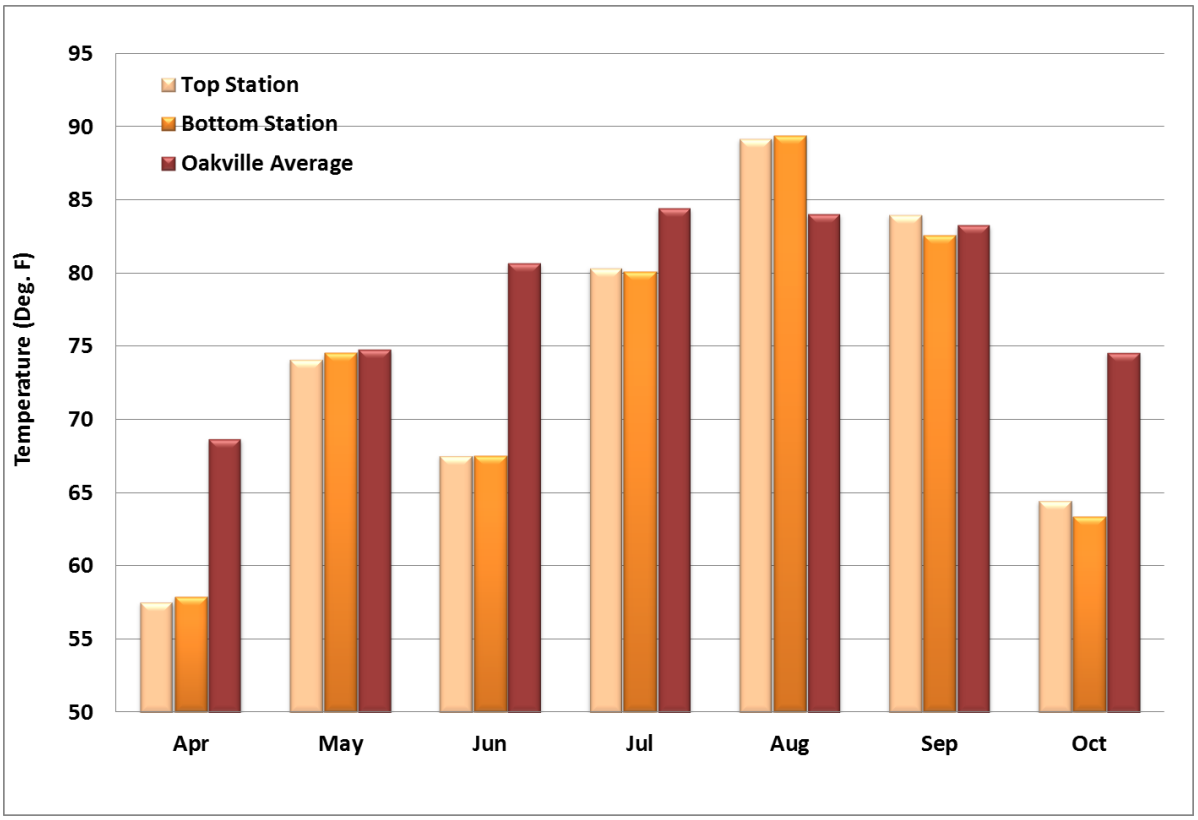

Figure 3: 2011 monthly averages of daily maximum temperatures for two locations at Two Blondes Vineyard, along with a long-term average for Oakville, CA.

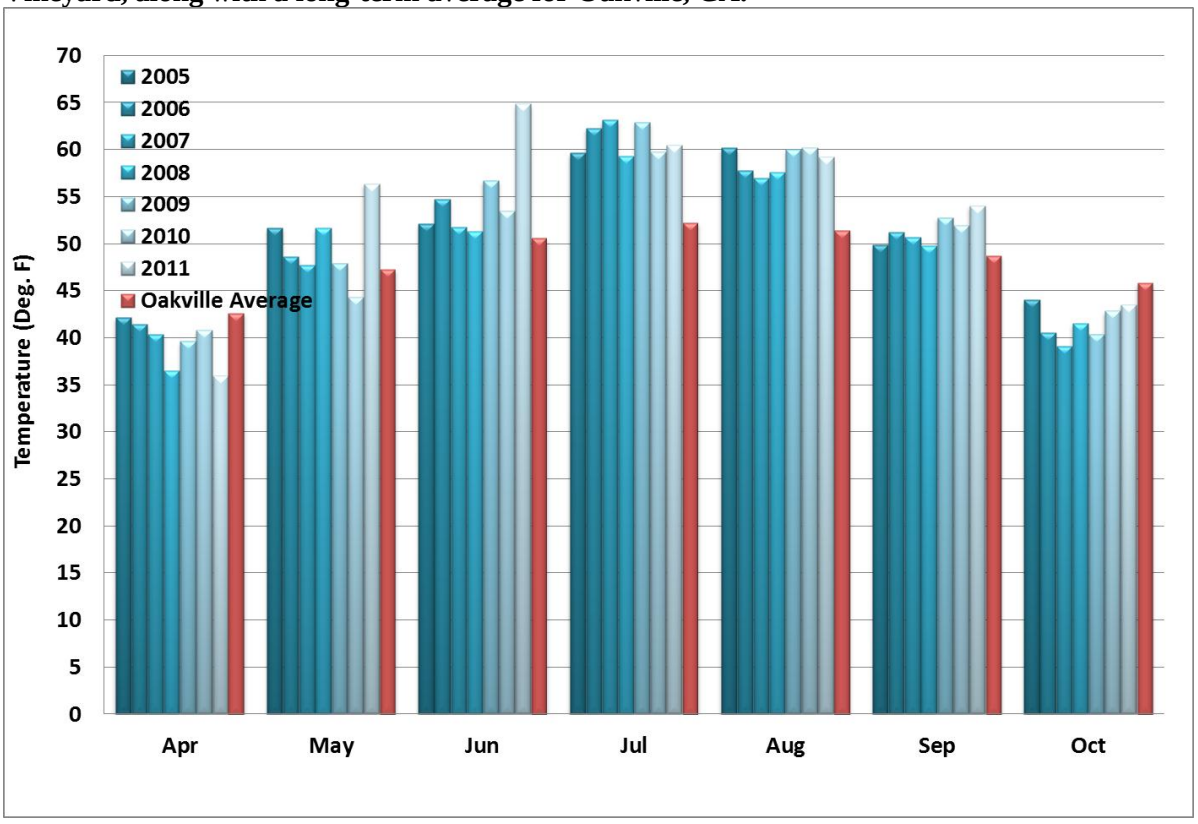

Figure 4: Monthly averages of daily minimum temperature for the top station at Two Blondes Vineyard, along with a long-term average for Oakville, CA for the 2005-2011 growing seasons.

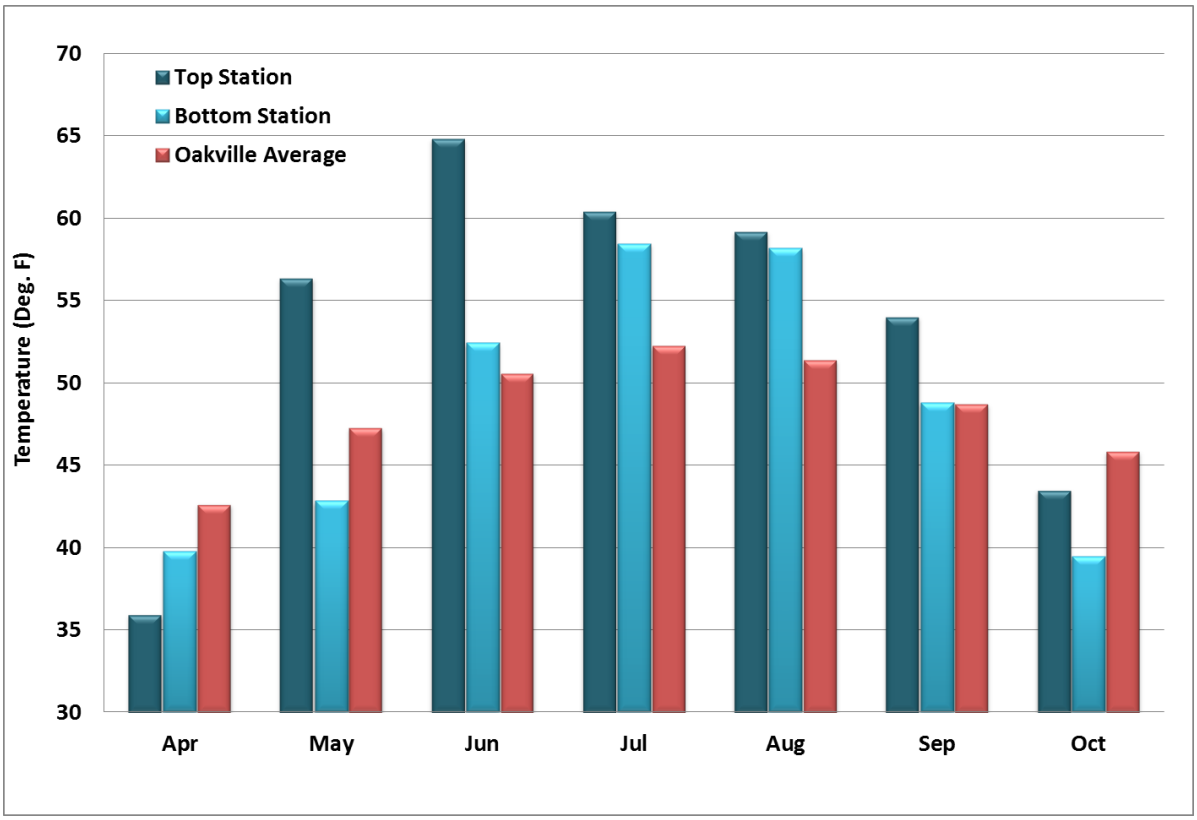

Figure 5: 2011 monthly averages of daily minimum temperatures for two locations at Two Blondes Vineyard, along with a long-term average for Oakville, CA.

Minimum temperatures were similar between Two Blondes and Oakville Average during early spring and fall. On the other hand, Two Blondes had much warmer night temperatures during June through August (especially at the upper station location). 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 2011. Clearly, temperature minima, maxima and averages were very similar among the six years across this time period, indicating a consistency in year-to-year weather conditions (on average) during the latter portion of the growing season. 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 to vintage quality. Daily minimum temperatures during this time period showed slightly more consistency from year-to-year than did maximum temperatures. As was found for the latter months of the growing season, temperatures at the top station had higher temperature minima during the ripening period (**Figure 8**), by about 3°F. Maximum temperatures, on the other hand, were quite similar to one another during this period of time, as has been found in previous years.

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 with flavor maturation 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 8**. Day-to-day temperature variability during the ripening period was typical in 2011 and greater than it had been in 2010. This was true for maximum, minimum and average daily temperatures, but mostly for maximum temperatures. The variability in maximum temperature may detract from the vintage slightly, but the minimum temperatures are very important for ripening and the variability was typical of this location. Temperature variability during the ripening period tends to be higher at Two Blondes than at the Oakville reference location, and the variability tends to be mostly in the nighttime or daily minimum temperatures.

The average diurnal temperatures during the ripening period are a very illustrative way of looking at the temperature characteristics during that critical period. Comparing diurnal temperatures in 2005-2011 (**Figure 9**), the night temperatures were warmer in 2011 than they had been in past years by about 2-4°F. Likewise, daytime temperatures tended to be slightly warmer than in previous years, at least in the morning hours. Warmer temperatures would have the effect of accelerating ripening of fruit relative to the other recent vintages. Warmer night temperatures would have especially had a positive impact on phenolic development.

The ripening temperature differences between the upper and lower vineyard locations is evident in the average diurnal temperature curves (**Figure 10**). It is clear to see that the top station experienced warmer temperatures during the nighttime as well as the daytime, typical of that seen in previous years. The effect is stronger for the nighttime temperatures.

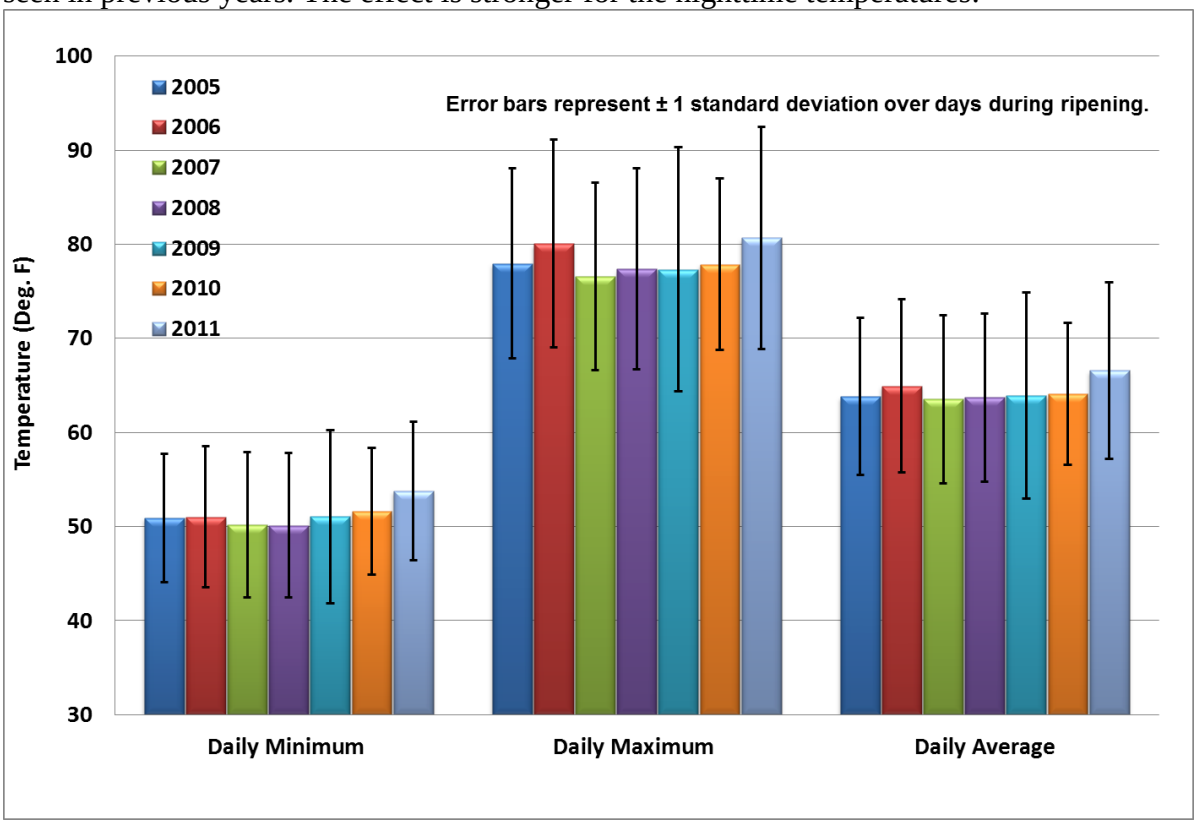

Figure 6: Average daily minimum, maximum and average temperature during the 2005-2011 ripening periods (August 15th through October 15th).

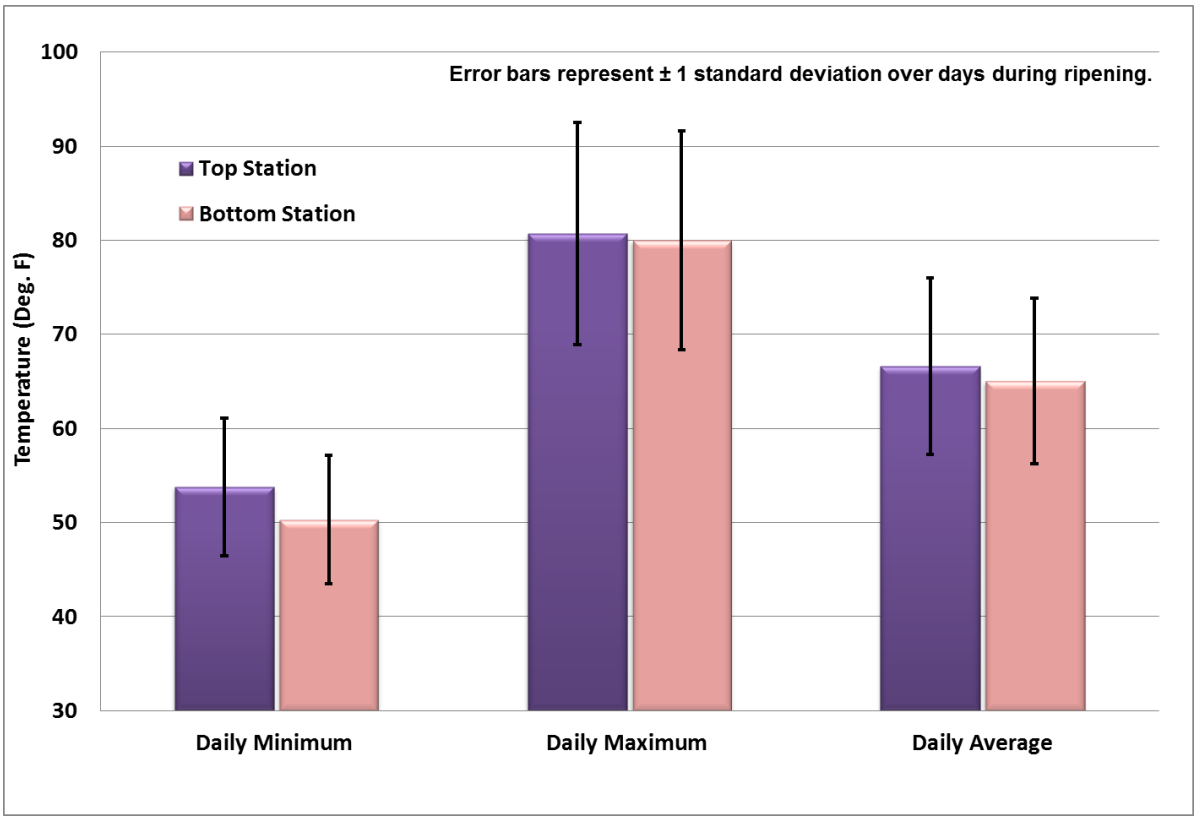

Figure 7: Average daily minimum, maximum and average temperature during the 2011 ripening period for two stations at Two Blondes Vineyard.

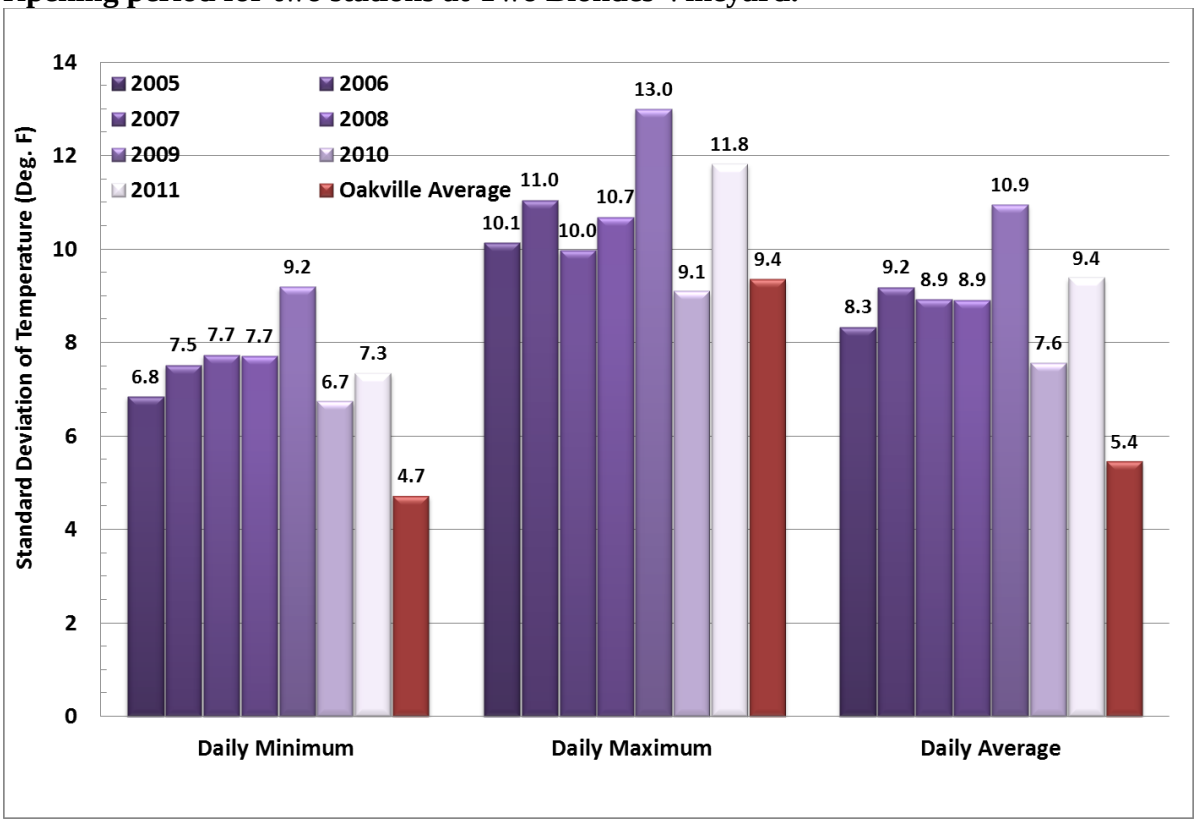

Figure 8: Standard deviations of daily minimum, maximum and average temperature during the 2005-2011 ripening periods for the top station at Two Blondes Vineyard, along with the same for the long-term average at Oakville.

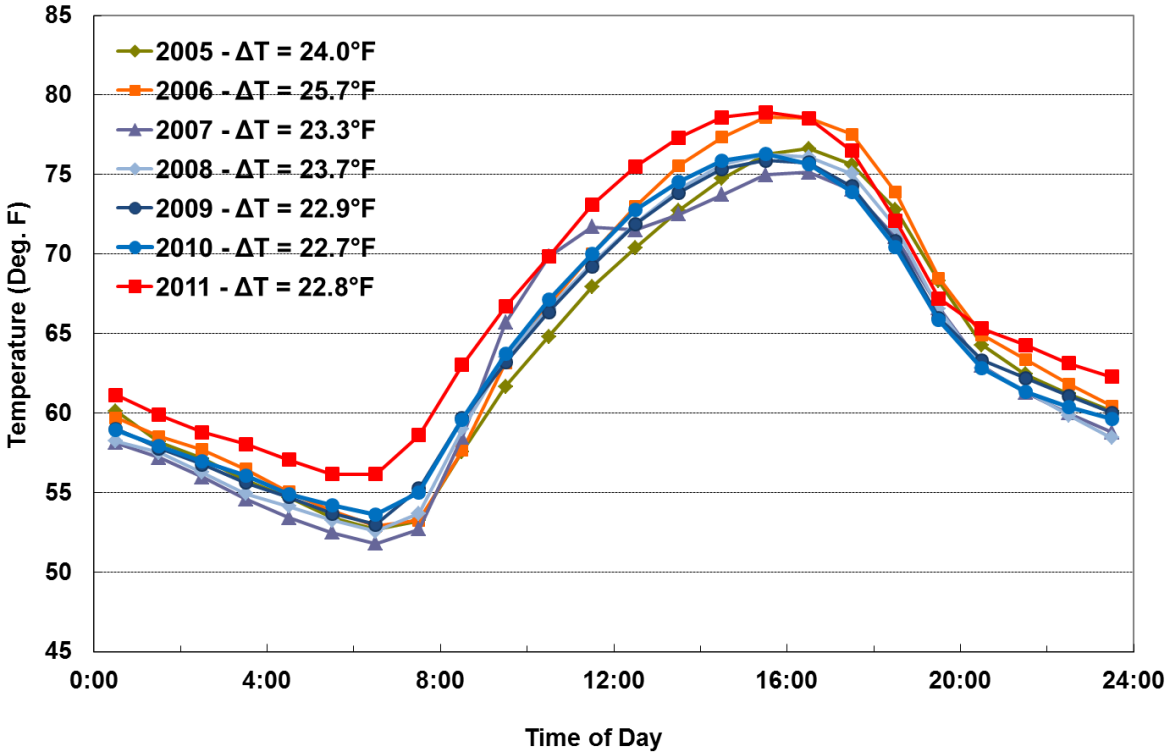

Figure 9: Average diurnal temperature cycle for two locations during the 2005-2011 ripening periods (mid-August through mid-October) for Two Blondes Vineyard.

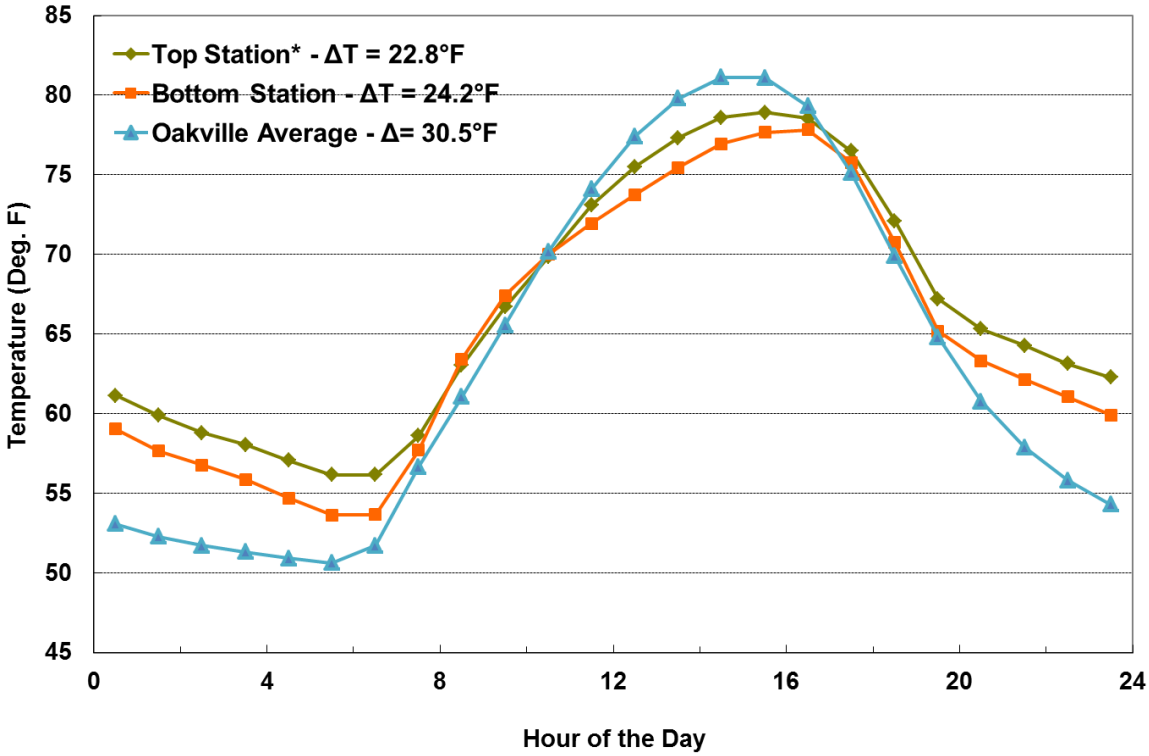

Figure 10: Average diurnal temperature cycle for two locations at Two Blondes Vineyard, along with a long-term average for Oakville, CA during the 2011 ripening period (mid-August through mid-October).

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 about 2-4°F warmer during the day (during the ripening period) and 4-7°F 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 and much of this is due to the warmer October temperatures at Oakville. 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 for the bottom station. The upper Two Blondes location remains about 5°F warmer than Oakville during its coldest (predawn) time.

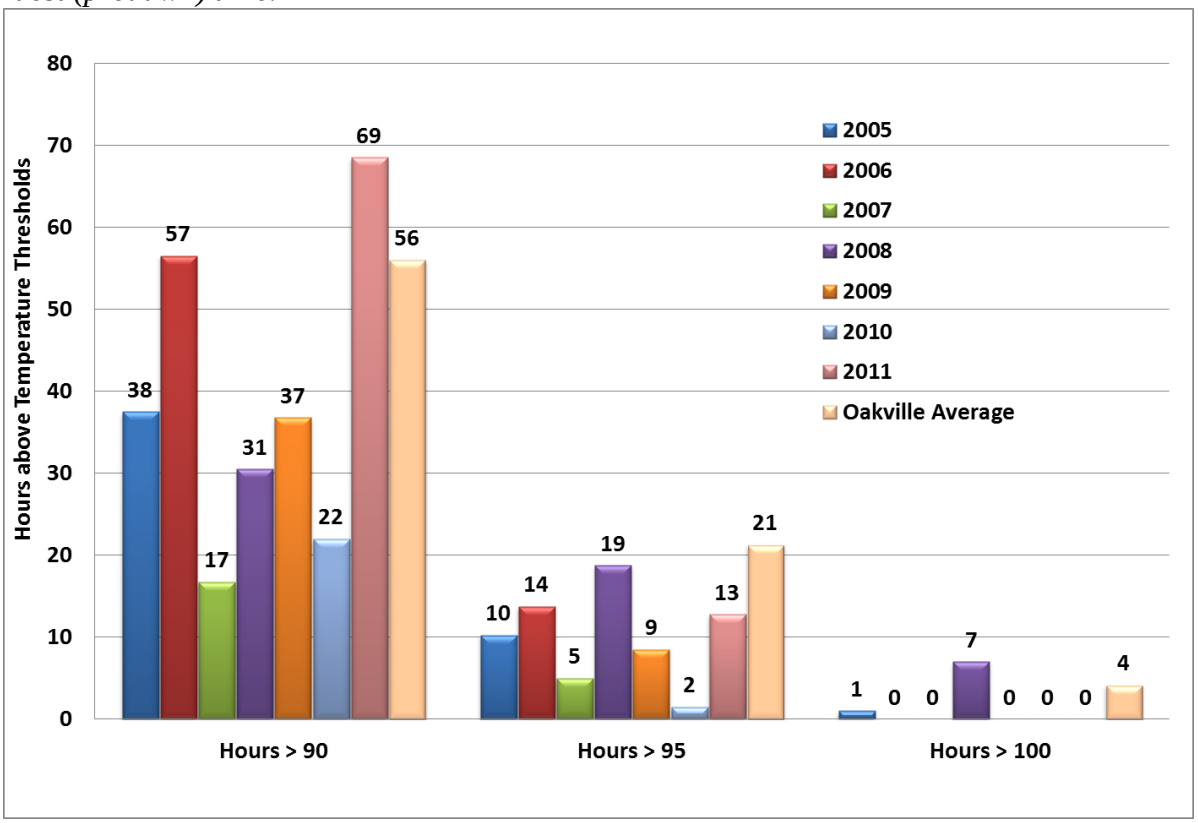

Figure 11: Hours above given critical temperatures during the ripening stage in 2005-2011 for Two Blondes Vineyard along with long term averages for Oakville, CA.

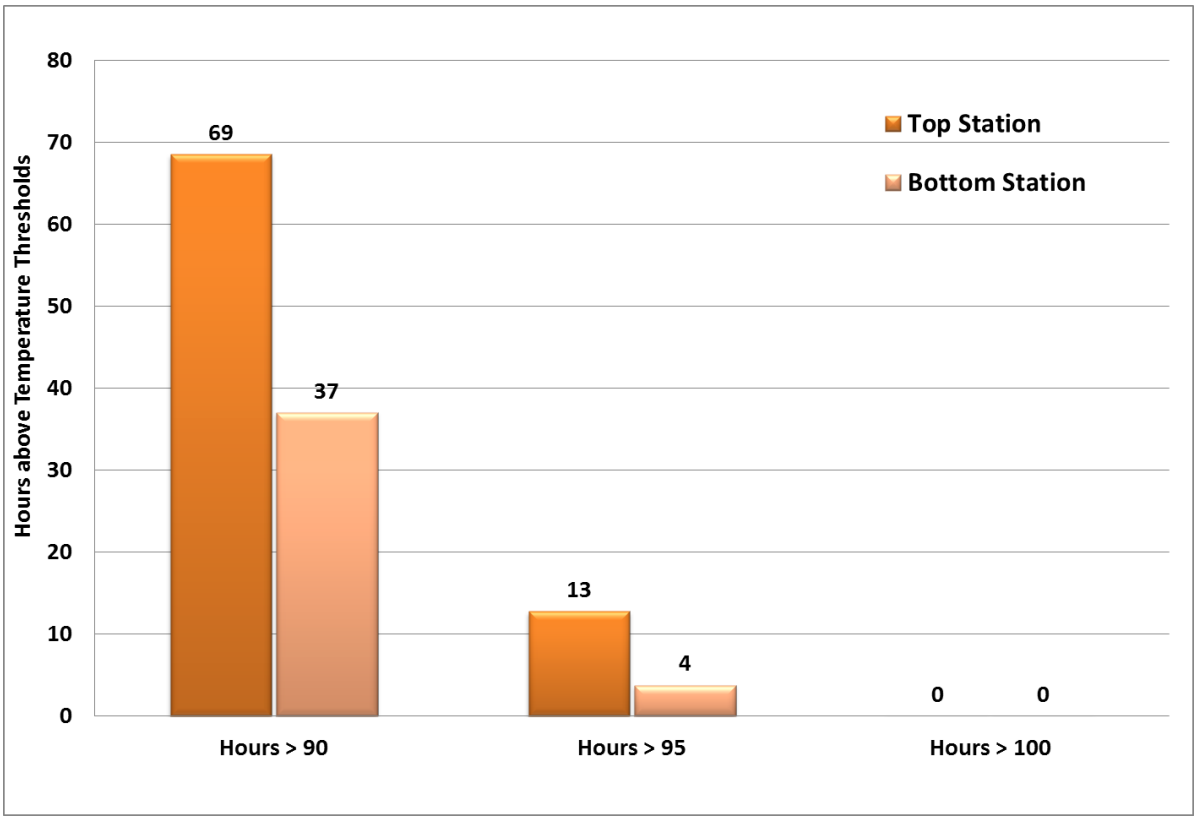

Figure 12: Hours above given critical temperatures during the ripening stage in 2011 for two locations at Two Blondes Vineyard.

Finally, it is instructive to evaluate the time during which the temperatures exceeded given threshold levels during the ripening period (**Figs. 11 and 12**). 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. Fruit in persistent shade will equilibrate to ambient temperature, while fruit exposed to sunlight may reach at least 15°F above ambient temperature. 90°F represents a temperature above which photosynthesis in the leaves begins to decline, but fruit quality is not thought to be impacted. Actually, such temperatures are desirable, as they slow down the progress of powdery mildew fungus. During the ripening period, there were 69 hours above 90 degrees in 2011, more ever than in the records since 2005. The bottom station experienced about 32 fewer hours above this threshold than the top station, which was unusual, since the opposite has usually been the case.

At 95°F, leaf photosynthesis declines even more, while 100°F is the temperature above 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. There were no instances of extreme heat events above 105°F at Two Blondes, a temperature which is relatively common in California vineyards.

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At Two Blondes Vineyard, 2011 exhibited 13 hours above 95°F and zero hours above 100°F during the ripening period. These are typical values for this location. This is indicative of the relatively mild climatic conditions of Two Blondes with few high temperature events, and essentially no extreme temperatures. From the last six 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.

High temperature events during ripening are similar to those of Oakville, but even less common. The scarcity of high temperatures during ripening is a characteristic of high-quality growing regions. There were generally fewer hours of high temperatures (above both 95° and 100°F thresholds) at Two Blondes relative to Oakville in most years of record. That is true for both the upper and lower locations of Two Blondes Vineyard.

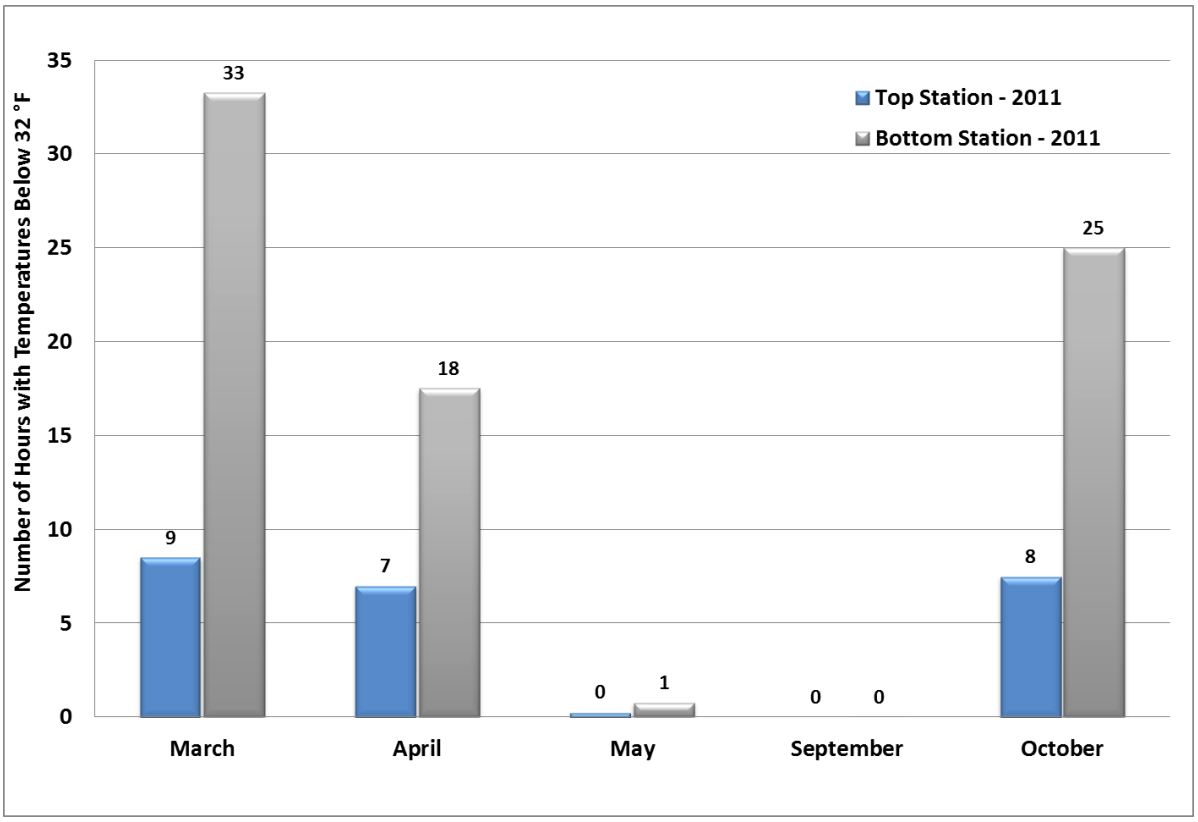

Figure 13: Total number of hours per month below 32°F during the frost-prone periods for two locations at Two Blondes Vineyard in 2011.

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 13)**. There were about an average number of frost-prone (below 32°F) hours in April of 2011 (**Figure 14**) though the historical record indicates that frost occurrences can vary widely among years. It appears consistent that the spring frost season ends with the month of April on a consistent basis, even though one hour below the temperature threshold was recorded in May of 2011. On the other hand, the fall frost season begins with the month of October, for which 2011 was among the years with the most frost hours recorded.

More detailed looks at the daily minimum temperatures and how they may impact frost are shown in **Figures 15 and 16** for spring and fall, respectively. Frost temperatures occurred primarily during March and April, with almost no occurrences below 32°F after the third week in April. There was a single, short, period of temperature just below 32 degrees on May1, but temperatures climbed after that. The upper portion of the vineyard was much less prone to frost, and there were no frost potential days after April 12. The first fall frost day did not occur until October 26, which would have allowed foliage to remain viable and on the vines for an extended period of time relative to typical conditions. This may have allowed for extra "hang time" on the vines for extended fruit maturation.

Using the data from 2005 through 2011, frost probabilities were computed for each day and summarized by week in **Figures 17 and 18**.It appears that the chance of frost diminishes rapidly in late April to about 5% during the last week and finally to zero probability by May 14. For fall frost, the probability is about 5% the first week in October and climbs dramatically, reaching about 45% by the end of October. However, plant tissues are more likely to withstand mild frosts around 30°F in the fall, so the true frost risk is more likely to be around the middle of October.

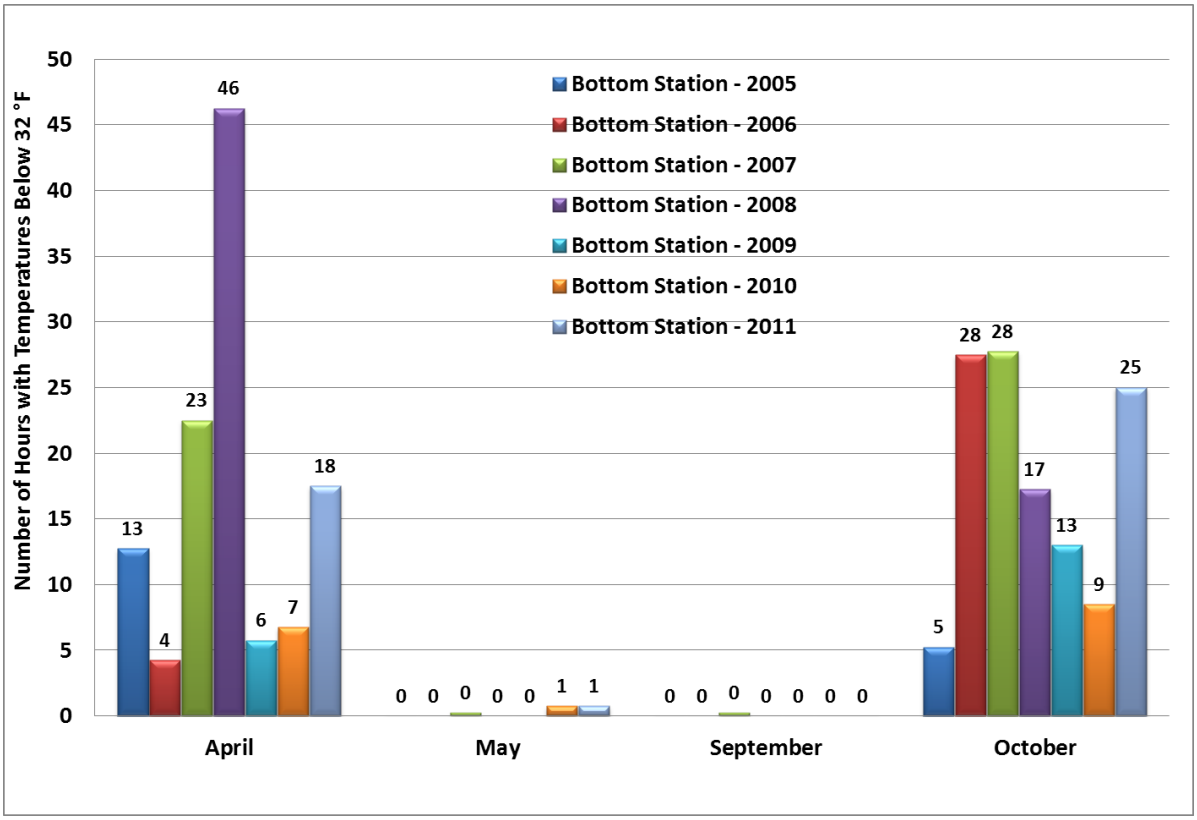

Figure 14: Total number of hours per month below 32°F for the bottom location at Two Blondes Vineyard for 2005-2011 (frost-prone months only).

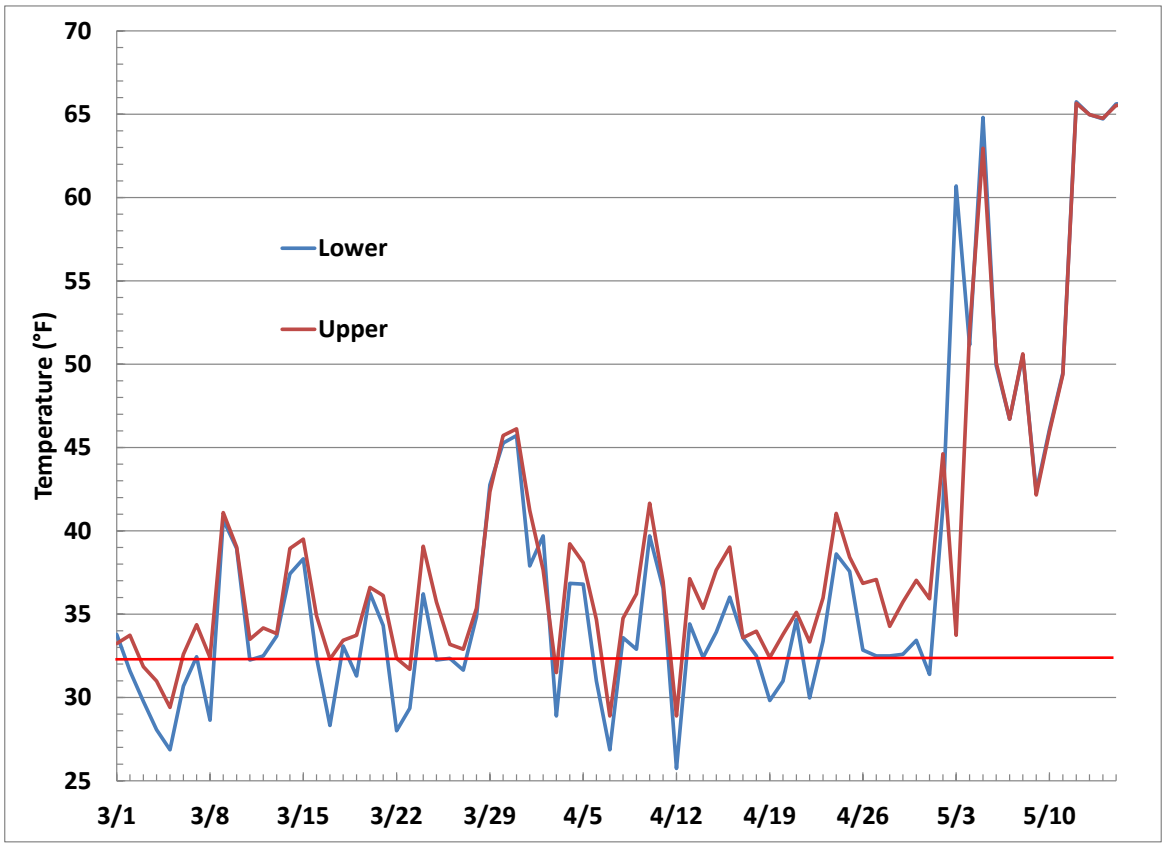

Figure 15: Daily minimum temperatures during the spring frost period of 2011 for the two stations at Two Blondes Vineyard.

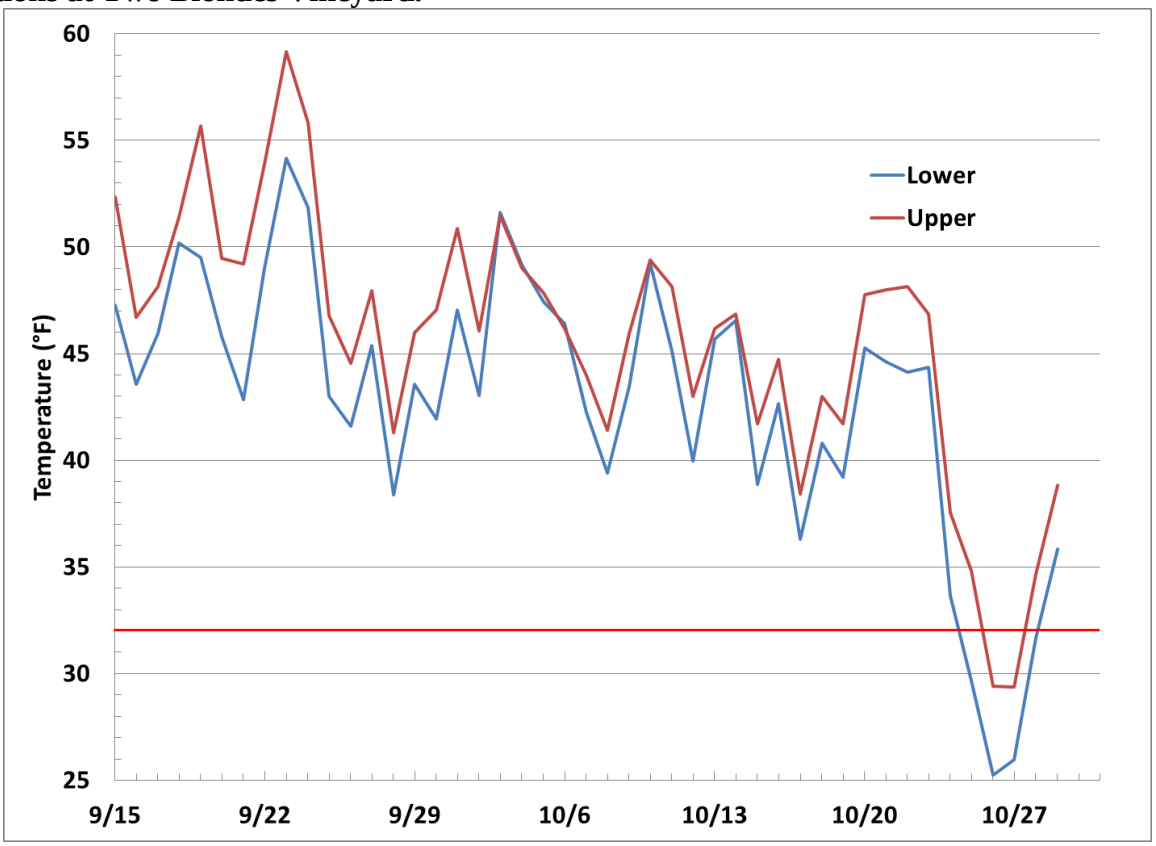

Figure 16: Daily minimum temperatures during the fall frost period of 2011 for the two stations at Two Blondes Vineyard.

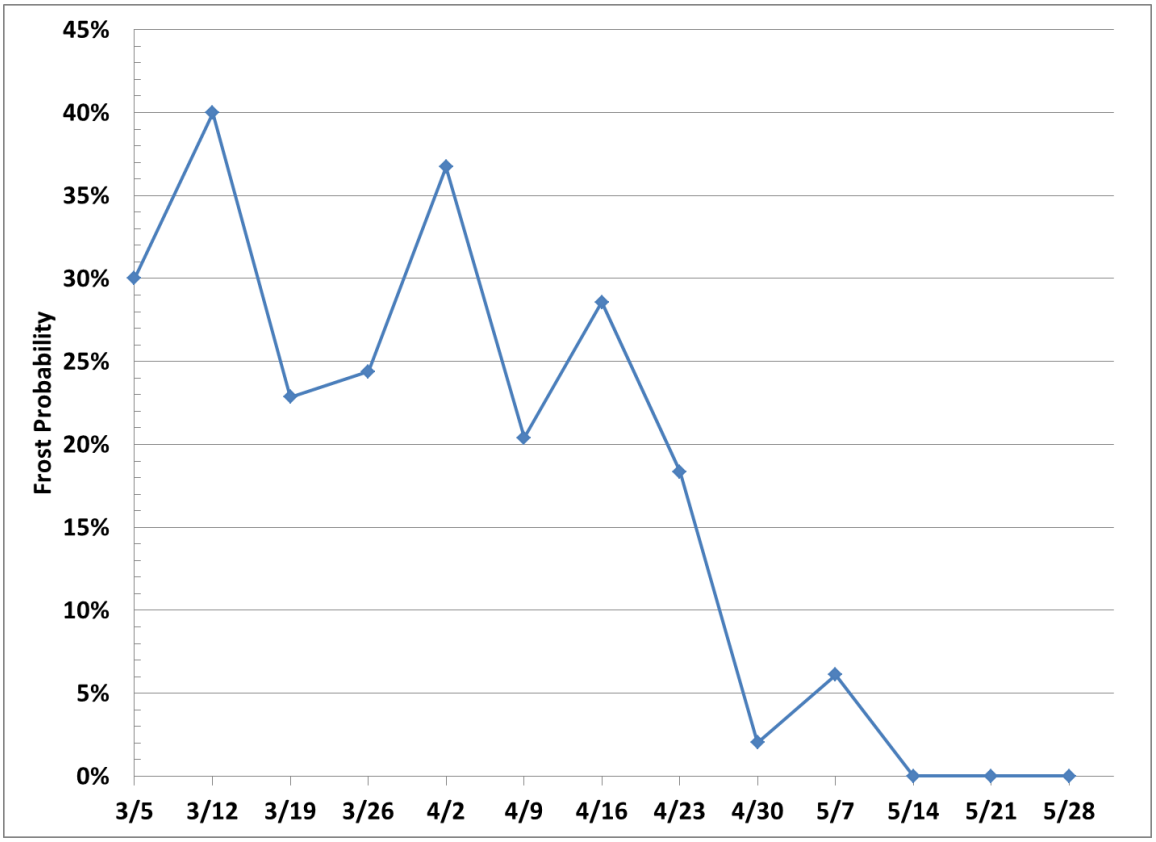

Figure 17: Frost probability (using a 32°F threshold) for spring, using data from 2005 through 2011 (as available).

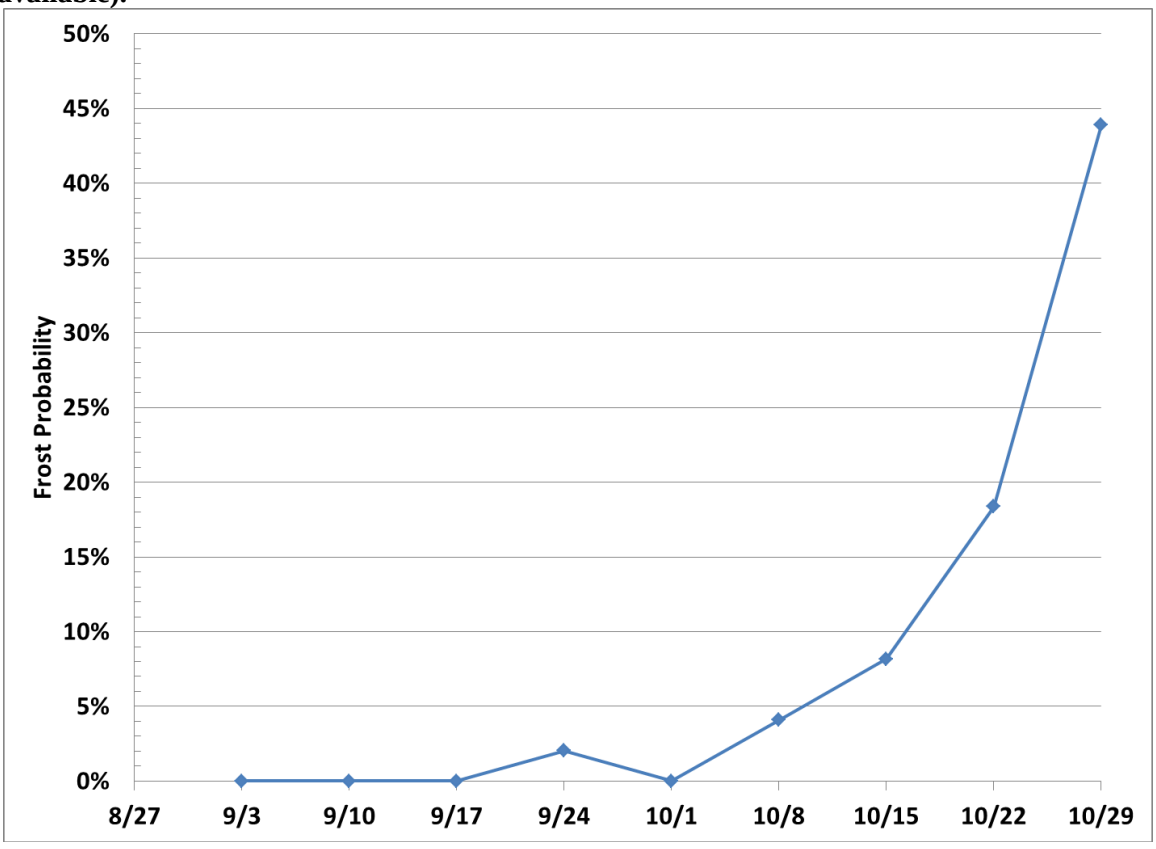

Figure 18: Frost probability (using a 32°F threshold) for fall, using data from 2005 through 2011.

IV. Conclusions

This limited, but continually-growing data set suggests that there are sufficient heat summation units available to ripen all Bordeaux varieties. On average, the site receives about 3140 degree days F, putting it in a cool Region III on the Winkler scale. The lower portions of the vineyard receive about 155 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" of fruit. Nevertheless, Cabernet Sauvignon may be challenging to ripen at the lower elevations of the property. 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 and risk termination of the growing season by frost. 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 lack of extreme heat here indicates that some moderate leaf removal may be performed without high risk of fruit sun-damage.

The 2011 vintage was characterized by a time shift in temperatures from July into August. That was largely due to an unusually cool July. 2011 was a rather typical season, with respect to heat summation, and the season was allowed to extend a bit later, as frosts did not occur as early in October as usual. Temperatures were much cooler than normal during the spring and early summer, though warmer nighttime temperatures at that time helped to compensate for the cooler days. It is possible that cool June temperatures may have impacted bud fruitfulness in 2012. As usual, fruit maturation was more likely to be rapid and complete in the upper elevations of the property relative to the lower ones.

General climatic assessment:

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. This lies in contrast with the statement regarding Cabernet Sauvignon. Leaf removal in that variety should be performed when the berries are at pea-size or slightly smaller, which will allow them to acclimate to the changed light regime.

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, creating wines that are complex, yet elegant in style.

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 (usually) 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. Napa Valley has a longer growing season, can tolerate long hang-times, and yet is punctuated by occasional heat events throughout the fruit development period. The latter characteristics are not attributes of Two Blondes Vineyard. For example, the cool 2010 season was preceded by a relatively warm season, which is illustrative of the unpredictable nature of the weather in this region. That means that the bloom and/or fruit set dates should be recorded every year and that delays in the season (due to cool spring weather) should be accommodated by fruit thinning, modest leaf removal, and reduced irrigation to stimulate the ripening processes (i.e. mild water stress before and during veraison).