Vintage 2004: An Overview of Climate, Phenology, and Grape Composition from the 1st Year of the Umpqua Valley Reference Vineyard Project

Summary:

This research has resulted in the establishment of nine reference vineyards in the Umpqua Valley AVA to observe spatial variations in climate, phenology, and composition. From a climate standpoint, temperatures during 2004 in the region were anything but normal with a warm March followed by substantial cool periods during the season. The most notable cool down occurred during the window of bloom and, combined with rainfall at the same, likely affected flowering and fruit set depending on the variety and site. In general, the growing season was mild, with no recorded frost and a low relative number of days above 95°F. Growing degree-day totals ranged from 2372 to 2800 across the reference vineyards. Averaged across all observed varieties and sites, bud break occurred on April 1, bloom on June 5, véraison on August 13, and harvest on October 5. Given the early bud break, the average growing season length, across all varieties and sites, was 185 days in 2004. A snapshot of ripening on September 13th found fruit that was slightly ahead of normal and, after a cool down during mid to late ripening, harvest provided generally balanced fruit, but at low relative yields.

Project Purpose:

The goals of the project were to set up a suite of reference vineyards that monitor temperature, phenology, and composition. The purpose of the research is to provide an in depth look at spatial variations in important weather, plant, and yield parameters in the Umpqua and Applegate Valley AVA.

Data and Methods:

During the project development phase nine vineyards agreed to participate in the study. The nine reference vineyards are distributed in a north-south transect throughout the Umpqua Valley AVA (Figure 1) and at elevations ranging from 335 ft to 1154 ft (642 ft average). The spatial and elevation makeup of the reference vineyards is intended to capture a range of site variability typically found in the Umpqua Valley.

During the late winter of 2004, wood for each variety/clone in the trial was set aside and readied for spring planting. The varieties initially chosen for monitoring included: Tempranillo clone 01, Tempranillo clone 02, Syrah clone 01, Grenache clone 04, Malbec clone 04, and Viognier clone 01. In March 2004, 30 sticks for each variety/clone combination were delivered to each of the nine reference vineyards (180 plants total) and planted to various block designs (Figure 2). However, due to the time needed for growth the project participants decided to monitor phenology and composition of five existing varieties: Pinot Noir, Pinot Gris, Syrah, Tempranillo, and Merlot. While not all of the reference vineyards have every variety, those chosen provide a reasonable suite of variety/site combinations (20 total) that can be monitored until the trial plants are established. In addition, it was decided that Pinot Noir (Pommard clone), Pinot Gris (clone 2), and Riesling (Wente clone) would be added to the trial plantings during the spring of 2005.

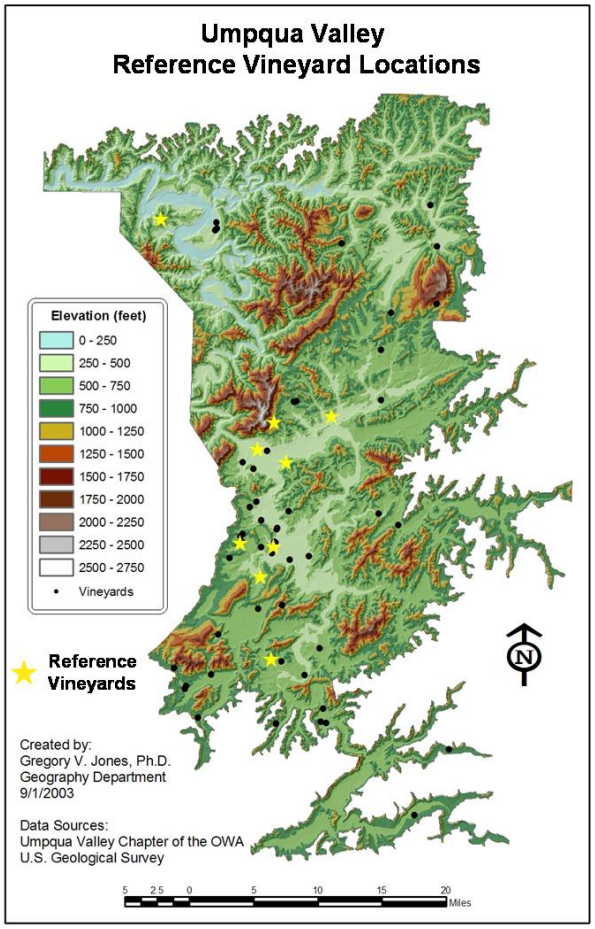

Figure 1 – The spatial location of the nine reference vineyards and all other vineyards in the Umpqua Valley AVA (as of the summer of 2003).

Figure 2 – Example of a trial planting in one of the reference vineyards. The inset shows the temperature sensor housing and typical installation.

On July 29, 2004 HOBO® H8 Pro-Temperature Loggers were installed at each of the nine reference vineyards (see Figure 2 for an example). The sensors were installed in a radiation shield-type housing at six feet off the ground. Typically, the sensors were installed on either an end post or one or two interior posts into the vineyard or trial block. Since the project goals are to measure region-wide spatial differences in temperature, these locations were deemed sufficient. The sensors were initiated with a recording interval of 15 minutes, which will record data for nearly a year with a normal battery charge. In addition, the GPS coordinates of each device were taken with a Trimble GeoExplorer 3.

Temperature sensor data was collected from each site on November 1, 2004. Because the sensors were not installed until late July, missing days were statistically recreated during the period from April 1st through the installation date. To accomplish this, the observations at the Roseburg KQEN weather station were used to generate a regression equation for each site's daily maximum and minimum temperatures and then used to reproduce the missing data. While not perfect, the procedure resulted in a high explained variance ($R^2 > 0.79 - 0.99$) indicating that the method provides a reasonably confident proxy for a given site's temperature (this procedure will not need to be done in future years). One interesting find from this procedure was that the reference vineyards are typically warmer for maximum temperatures, while lower for minimum temperatures as compared to the Roseburg KQEN weather station (site slope effect during the day and urban effect at night). Once each site's growing season temperatures were reconstructed, the data was then aggregated to hourly and daily average, maximum, and minimum values and finally summarized by site and region.

Over the course of the growing season (or at the end of the season) reference vineyards submitted dates of the main phenological events of bud break, flowering, véraison, and harvest for the interim varieties. The phenological data was then examined for average dates and intervals between dates for the entire region and by variety. Of the 20 variety/site combinations, 83% of the data was received.

On September 13, 2004 varietal samples were collected from each reference vineyard. The date was chosen as it represented a "snapshot" of fruit maturity that was not dependent on the subjective determination of ripeness for a given wine style. This date also represented an estimated mid-point of the véraison to harvest period leaving roughly 2-4 weeks before picking. One hundred berry samples were collected from the varieties available at each reference vineyard (19 of 20 possible samples were collected). The samples were then analyzed for °Brix, titratable acidity, pH, and berry weights using standard industry methods: 1) weighed on an Ohaus, Scout II scale to obtain a 100 berry weight, 2) analyzed for Brix° with a standard refractometer, 3) analyzed for titratable acidity using a 0.1N NaOH sodium hydroxide solution on a Corning Stirrer, Scholar 171, and 4) analyzed for pH level using a Vinquiry model 8010. During the last week of September a sampling report was sent out to all members of the Umpqua Chapter of the Oregon Winegrowers' Association.

In addition, the reference vineyards were asked to submit harvest composition at the end of the season (°Brix, titratable acidity, pH, and yields). The composition data were then summarized by region and variety. Of the 20 variety/site combinations, 74% of the possible

harvest composition data was submitted. In most cases the data came from the wineries when the fruit was processed, while in other cases the values came from field observations. Therefore, the harvest composition data is not consistent in terms of measuring techniques or devices.

Results:

Climate

The 2004 growing season temperatures could be characterized as anything but normal (Figure 4). Warmer than average temperatures from January through mid-April brought about an early bud break (described below). During the growing season daily departures as much as +17°F and -11°F were observed at the Roseburg KQEN weather station. Probably

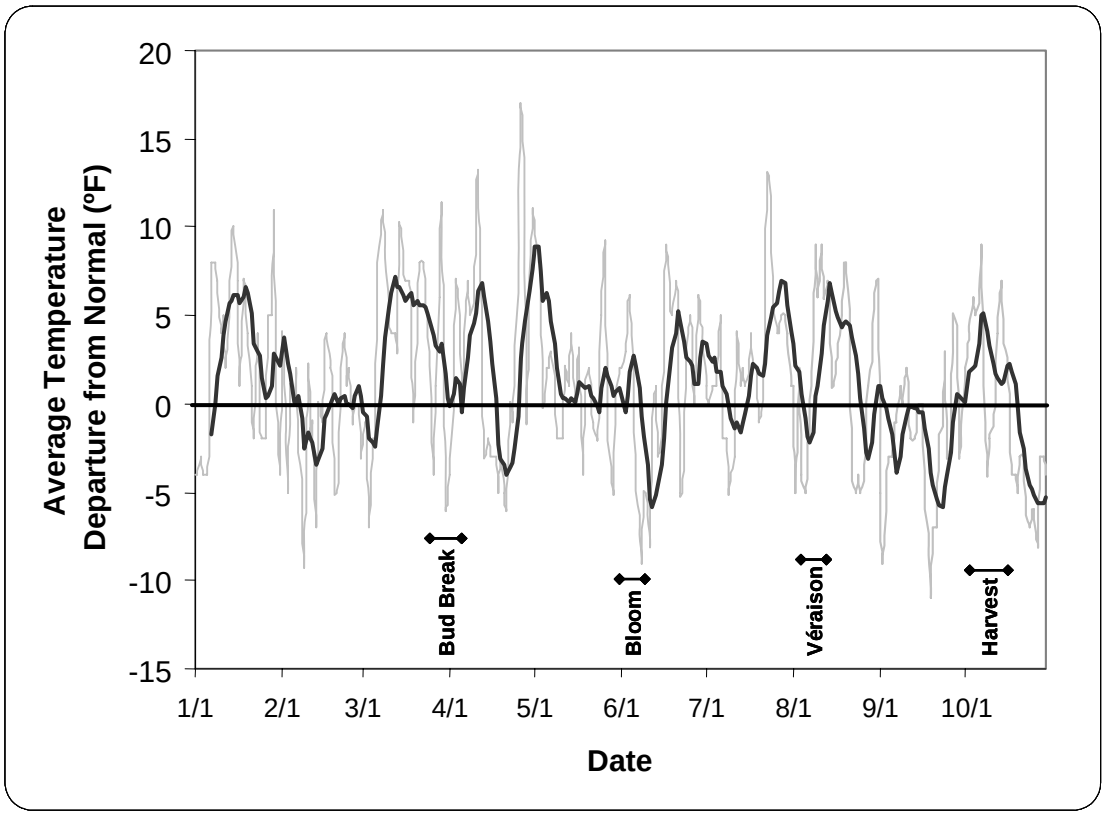

Figure 3 – Temperature departures from normal for January-October from the Roseburg KQEN weather station. The phenological indicators represent the region-wide average with the bar depicting the varietal variability (see text for more details). The long-term average is derived from the 1971-2000 climate normals.

the most telling departures of the season came during early June during bloom, which clearly affected flowering and fruit set depending on location and variety. Early spring warmth resulted in heat accumulation (degree-days from April 1st through October 31st using a base of 50°F with no upper cut-off) that was above 2003, which it remained until late August (Figure 4). By the end of the growing season, vintage 2004 ended up as the second warmest in the last four years and was substantially warmer than the long term averages from the Roseburg KQEN weather station. Rainfall during the growing season was slightly less than the long-term mean with a moderately wet spring that ended with rainfall during the cool

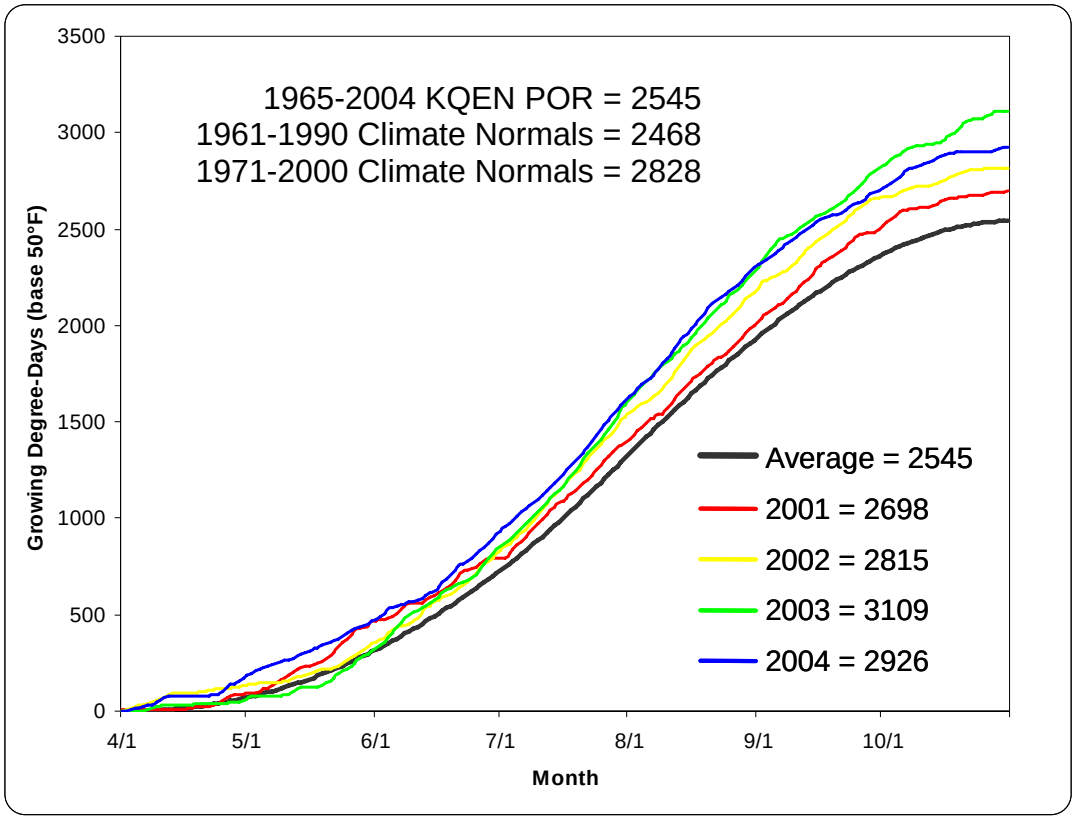

Figure 4 – Growing degree-day accumulation during April-October from the Roseburg KQEN weather station (base 50°F). The long-term averages are derived from the period of record values (POR).

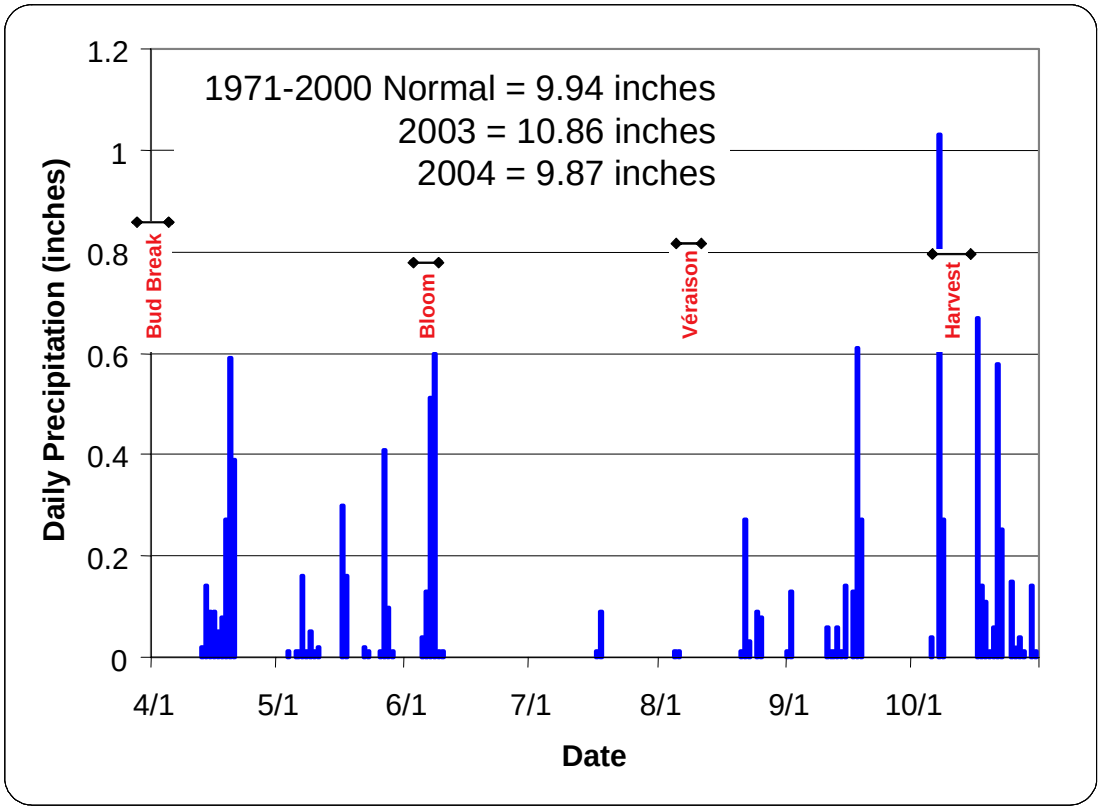

Figure 5 – Growing season precipitation during April-October from the Roseburg KQEN weather station. The phenology represents the region wide average dates for 2004.

down near bloom, followed by a dry summer, then a wet mid-September and October (Figure 5, Roseburg KQEN).

Site temperature data from the reference vineyards (the combined observations and reconstructed data) revealed that the 2004 growing season average degree-day accumulation was 2636 with a standard deviation of 144 units (Table 1). Maximum accumulation was 2800 degree-days while the minimum was 2372 degree-days. Growing season temperature extremes summarized from the reference vineyards indicate site differences in high and low temperatures (Table 1). The summer of 2004 saw maximum temperatures average 107.7°F and reach as high as 113.3°F with a range of 10.7°F over the reference vineyards. In addition, the number of days over 95°F averaged 17, ranging from 5 to 27 (note that in a normal year, the Roseburg KQEN weather station observes 27).

In terms of minimum temperatures and frost, the 2004 growing season was very mild (Table 1). Absolute minimum temperatures never dipped below 32°F at any of the reference vineyards. The average absolute minimum was 33.9°F with a range of 5.9°F between sites. Given the mild conditions, it's not surprising that the last spring and first fall frost did not occur within the typical growing season of April 1 through October 31. Using the Roseburg KQEN weather station as a proxy, found that it experienced its last spring frost on February 13th and its first fall frost on November 5th.

Table 1 – Reference vineyard growing season temperature characteristics (April-October 2004).

Variable	*Mean*	*Standard Deviation*	*Maximum*	*Minimum*
Growing Degree Days (base 50°F with no upper cut-off)	2636	144	2800	2372
Average Growing Season Temperature (°F)	62.0	0.7	62.7	60.8
Maximum Temperature (°F)	107.7	3.4	113.3	102.6
# of Days > 95°F	17	8	27	5
Minimum Temperature (°F)	33.9	1.8	38.2	32.3
# of Days < 32°F	0	0	0	0
Last Spring Frost	< 4/1	NA	NA	NA
First Fall Frost	>10/31	NA	NA	NA
Frost-Free Period	NA	NA	NA	NA

Note that no frost dates occurred for the reference vineyards during the growing season.

Phenology

Summarizing phenological observations across all varieties and the entire region shows an average bud break of April 1 with a 7-day standard deviation (Table 2). Ranges of 19-33 days were observed across the region and varieties. Varietal differences in phenological timing reveal minor differences in bud break, flowering, and véraison, while harvest showed the greatest variation. Bud break across the varieties occurred earliest for Pinot Noir (March 30) and latest for Syrah (April 5). Flowering was earliest for Pinot Gris and Pinot Noir (June 4) and latest for Syrah (June 10). Véraison occurred during mid-August with Pinot Gris the earliest (August 8) and Merlot, Syrah, and Tempranillo all occurring on August 15. Harvest

dates by variety are more widely spread due the time needed to achieve either grower or winemaker style characteristics (Table 2). Optimum ripeness appears to have been achieved earliest with Pinot Noir and Pinot Gris (September 28 and 29, respectively), while Merlot was the latest (October 14). Larger variations in phenological event dates with some varieties are the result of a lower number or observations for that variety or event (e.g., Tempranillo bud break) or greater site elevation differences for that variety (e.g., Pinot Noir).

Table 2 – Umpqua Valley reference vineyard average phenological dates and average dates by the interim observed varieties. Note that most of the varieties were only observed at a few sites during the first year.

Region	*Bud Break*	*Flowering*	*Véraison*	*Harvest*
All Reference Vineyards				
Median	4/1	6/5	8/13	10/5
Standard Deviation	7 days	5 days	7 days	9 days
Maximum	4/12	6/20	8/27	10/20
Minimum	3/15	6/1	8/1	9/22
Merlot				
Median	4/2	6/7	8/15	10/14
Standard Deviation	2 days	4 days	8 days	10 days
Pinot Gris				
Median	4/1	6/4	8/8	9/29
Standard Deviation	7 days	1 day	6 days	3 days
Pinot Noir				
Median	3/30	6/4	8/11	9/28
Standard Deviation	7 days	8 days	11 days	12 days
Syrah				
Median	4/5	6/10	8/15	10/11
Standard Deviation	7 days	4 days	6 days	6 days
Tempranillo				
Median	3/31	6/5	8/15	10/1
Standard Deviation	11 days	2 days	3 days	5 days

Average intervals between phenological events (an important measure of vine and berry development timing) revealed that bud break to flowering was 65 days on average; that flowering to véraison was 68 days on average; and that véraison to harvest was 55 days on average (Table 3). The intervals had a 6-13 day variation across both regions and varieties. To ripen fruit to the desired level required an median bud break to harvest period of 185 days with some varieties requiring as few as 163 days, while others needed 208 days. The length of the intervals this year was largely the result of an early bud break, which extended all subsequent intervals.

Table 3 – Umpqua Valley reference vineyard average intervals between phenological dates.

Interval	*Median*	*Standard Deviation*	*Maximum*	*Minimum*
Bud Break to Flowering	65 days	7 days	86 days	53 days
Flowering to Véraison	68 days	6 days	79 days	59 days
Véraison to Harvest	55 days	11 days	69 days	34 days
Bud Break to Harvest	185 days	13 days	208 days	163 days

Composition

Reference vineyard varietal sampling on September 13, 2004 resulted in a "snapshot" of ripening parameters commonly observed by growers and winemakers. General observations include fairly uniform sugar levels across most varieties with the highest values seen in Tempranillo and the lowest for Syrah and Merlot (Table 4). Titratable acidity values averaged 7.1 g/L with the lowest values observed for Tempranillo and the highest values for Syrah. Average sample pH values were 3.05 with values ranging as high as 3.36 for Tempranillo to a low of 2.89 for Syrah. Varietal berry weights (per 100 berries) averaged 142.2 grams with Merlot having the lowest weights and Tempranillo the highest weights.

Table 4 – Umpqua Valley reference vineyard °Brix, titratable acidity (TA, g/L), pH, and 100 berry weights (g) statistics from the sampling conducted on September 13, 2004 and from harvest numbers submitted. Note that in some cases the values come from small samples and should be considered carefully.

Variety	*September 13th Sample*				*Harvest Numbers*			
	°Brix	*TA*	*pH*	*Weight*[1]	*°Brix*	*TA*	*pH*	*Yield*[2]
Average	20.2	7.1	3.05	142.2	24.1	6.6	3.50	1.7
Merlot	19.0	7.4	2.91	122.8	24.3	6.2	3.52	1.1
Pinot Gris	21.1	7.0	3.03	134.5	24.3	7.5	3.34	3.1
Pinot Noir	20.3	7.6	3.05	136.2	24.2	6.6	3.40	1.2
Syrah	18.9	8.6	2.89	146.9	24.1	7.2	3.60	1.1
Tempranillo	21.8	5.2	3.36	170.7	23.7	5.4	3.65	1.9

[1] Weight of 100 berries, [2] Tons per acre

Data from the harvest composition submitted by growers or wineries indicates an average °Brix of 24.1 with a narrow range from 23.7 for Tempranillo to 24.3 for Merlot and Pinot Noir. Titratable acidity averaged 6.6 g/L with a low of 5.4 g/L for Tempranillo and a high of 7.5 g/L for Pinot Gris. Harvest pH numbers averaged 3.50 with a spread of 0.31 from Pinot Gris to Tempranillo. Harvest yields averaged 1.7 tons per acre across all reference vineyards and varieties. Lowest average yields were reported for Syrah and Merlot, while highest average yields were seen with Pinot Gris.

Conclusions and Future Issues

The first year of this project has provided a spatial overview of climate for the Umpqua Valley AVA. In addition, the initial observations of phenology and composition have helped establish and document the regional and site similarities and differences for the area.

While this research represents a big step in understanding the region's grape growing characteristics, the project is intended to be a long-term collaborative effort that better documents some of the most important factors that influence high quality grape and wine production. As time unfolds the information will provide more insights into the potential and character that are Southern Oregon wines.

Future funding is being pursued with the hope that the project and the potential understanding it can provide will continue. In the meantime, the following items are being addressed and/or planned:

- The first year's trial planting survival will be assessed and replacement wood will be readied. In addition, wood for Pinot Noir (Pommard clone), Pinot Gris (clone 2), and Riesling (Wente clone) will be added to the trial plantings.
- The results will also be used to provide a Southern Oregon component to the Oregon Wine Industry Symposium's "Vintage Overview" on March 8, 2005 at Oregon State University.
- Temperature data will be collected from the sensors on or near March 31, 2005 for the dormant period and analyzed.

Acknowledgements

This research was made possible by a grant from the Oregon Wine Board (OWB105R), the collaborative support of the Umpqua Chapter of the Oregon Winegrowers' Association, and all of the participating vineyards. Thanks also goes to Jack Day who provided the lab space at Roxy Ann Winery, Rachael Martin and Will Brown for their time analyzing the samples, and especially Sara Powell who pushed me for years to do this sort of research in southern Oregon.

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