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Napa County Hang Time Study

Project Summary: January 2007

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Changes in perception about optimal maturity standards have resulted in extended ripening periods and later harvest dates for many Cabernet Sauvignon vineyards in the Napa Valley. Harvest decisions are now often based on qualitative perceptions of flavors and phenolic development in grape berries. Brix levels have become largely irrelevant for many winemakers with regards to deciding when to pick. There is general consensus that clusters lose weight with extended hang time beyond traditional harvest standards (23.5-24.5º Brix), but there is little data to indicate how much weight loss may occur. This trial is designed to study the effects of extended ripening (hang time) on yields of Cabernet Sauvignon in the Napa Valley. Data were collected during 2005 and 2006.

Trial Sites:
Five mature Cabernet Sauvignon vineyards on the valley floor were used, four in the Rutherford/Oakville region and one near Calistoga. There was a range of clones, rootstocks and spacings represented (Table 1). All blocks were cordon trained and used a VSP trellis.

Table 1: Trial sites

Vineyard	General Location	Clone	Rootstock	Spacing	Trellis	Year Planted
1	Oak/Ruth*	337	039-16	7 x 8	VSP	1994
2	Oak/Ruth	4	110R	5 x 6	VSP	1994
3	Oak/Ruth	337	101-14	5 x 6	VSP	1996
4	Oak/Ruth	7	039-16	8 x 8	VSP	1996
5	Calistoga	337	110R	5 x 7	VSP	1997

* Oakville or Rutherford district

Experimental Design:
At each vineyard, a randomized complete block trial with seven treatments (harvest dates) and five replications was established. Each individual replicate included three data vines. The seven treatments allowed for weekly harvests over a seven-week period. Once a week during the harvest period, 15 vines were harvested at each of the five trial sites (65 vines per week).

Harvest Activities:
A 600-berry sample was collected from the vines to be harvested at each vineyard each week. Data vines were then individually harvested. Cluster counts were recorded per vine as was total yield. Average cluster weights were calculated. Brix measurements were made from the 600-berry sample as well as from a must sample of the crushed fruit from each site. Additional analyses were performed at ETS Laboratories in St. Helena.

Winemaking:
A single wine lot was made each week from all the fruit harvested that week. The fruit from each vineyard was crushed separately so that individual must samples could be collected. After sampling, all the musts were combined in a Macrobin and fermented to dryness. In 2005, wines from weeks 1 through 7 were pressed, transferred to barrels and inoculated with ML. Samples of the finished wines were bottled in July 2006. A similar process was followed in 2006 but because of lower yields, there was not enough wine to keep individual lots in barrels. Therefore, after pressing and inoculation with ML, two 5 gallon carboys of each wine (weeks 1 through 7) were collected. Samples of these finished wines will be bottled in 2007. A discussion about the 2005 wines can be found at http://www.winesandvines.com/headline_12_21_06_hang.html

Results:
2005 Harvest
Vines were harvested once a week from September 20 to Nov 1, 2005. Brix levels increased during the first five weeks, then generally leveled off or declined in weeks 6 and 7 (Fig. 1). The weather remained mild in the fall and there were no heat events to raise Brix levels due to dehydration. Commercial harvests surrounding the trial blocks occurred mostly after week 5, as indicated by the arrows in Figure 1. Vineyard 3 had two commercial harvests as the winery was performing their own trial there. Yields were exceptionally high in Cabernet Sauvignon throughout Napa County due to very large clusters. Our results are reflective of this trend.

Figure 1

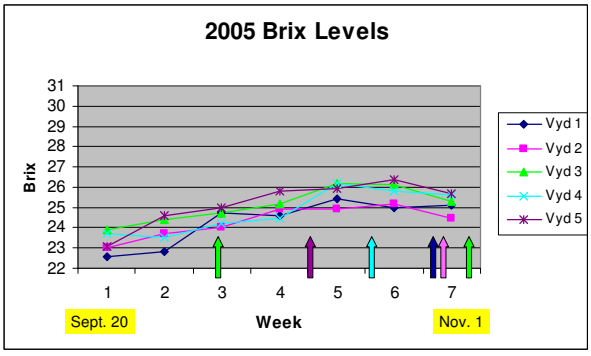
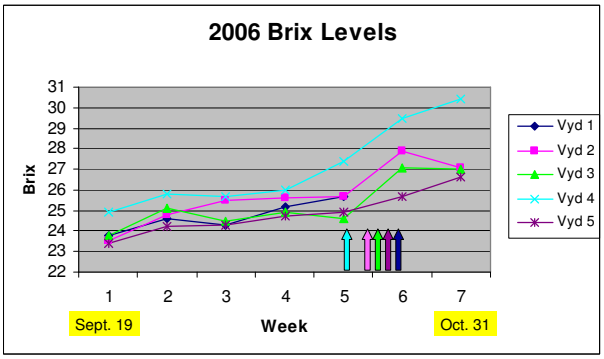


Figure 2



2006 Harvest
Vines were harvested once a week from September 19 to October 31, 2006. Brix levels were relatively stable during weeks 2 through 5, as mild weather again prevailed. Warm weather pushed Brix levels up during the final two weeks (Fig. 2). All the commercial harvests occurred between weeks 5 and 6 once this rise began. Average cluster weights returned to typical levels in 2006 (0.25 lbs/cluster) which were 34% lower than in 2005 (.38 lbs/cluster). Vineyard 1 was inadvertently harvested following week 5 so no data are shown beyond that date.

Brix Levels and Dehydration

In both years, sugar levels flattened out at approximately 25-26º Brix and remained there for some time. These Brix levels corresponded to moisture contents of 70-72% in both years (Figures 3 and 4, analyses courtesy of ETS Laboratories). The higher Brix levels achieved at the end of the 2006 season corresponded to significant reductions in moisture content. These data suggest that grape berries will accumulate sugar to a maximum level of 25-26º Brix, and that Brix levels higher than this result from dehydration.

Figure 3

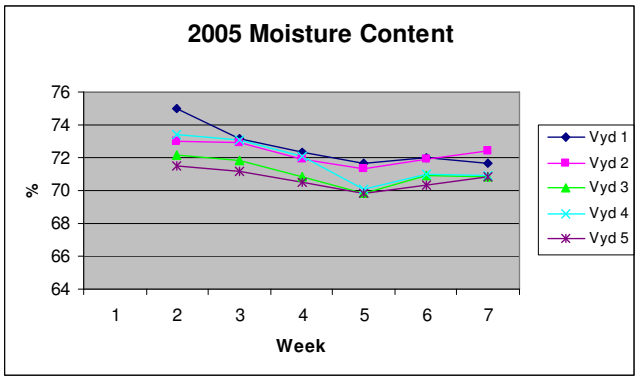
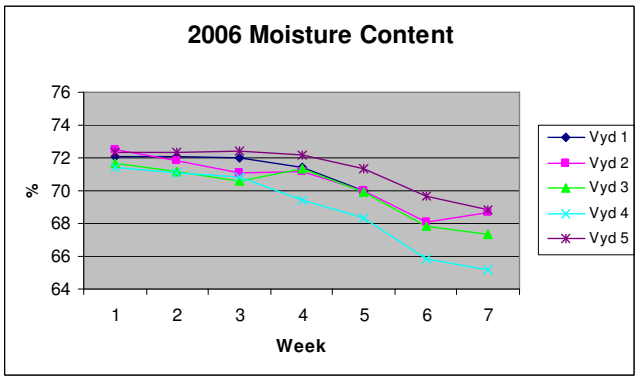


Figure 4



Yield Effects

Data vines in each vineyard were selected in an attempt to minimize vine to vine variation in crop load as much as possible across the seven treatments. This is challenging to do in commercial blocks. We selected our vines in September 2005 after all canopy management practices and crop thinning had been completed. We were fairly successful in this attempt as evidenced by the average cluster numbers per vine shown below.

Figure 5

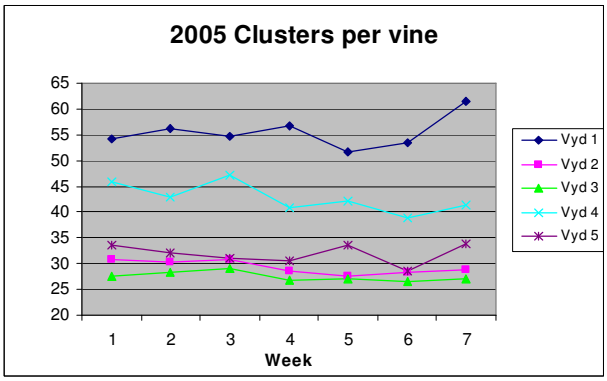
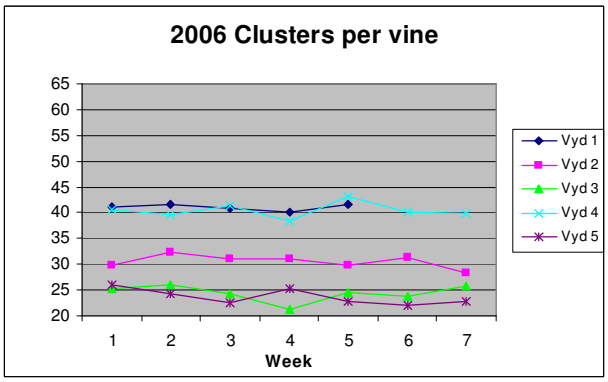


Figure 6



Extended ripening can not increase the average number of clusters harvested, so the increase shown in Vineyard 1 in week 7, 2005 is a function of our data vine selection for those replicates. However, extended ripening could lead to reduced numbers of clusters being harvested as a result of shrivel disorders and other problems that can occur during the harvest season. Some of the data shown in Figures 5 and 6 suggest such a decline in the number of clusters harvested. There were fewer clusters per vine in 2006 compared to 2005 with the exception of vineyard 2.

Changes in average cluster weights over the 7-week harvest periods are shown below in Figures 7 and 8. A general decline in cluster weights can be observed. Yields per acre are shown in Figures 9 and 10.

Figure 7

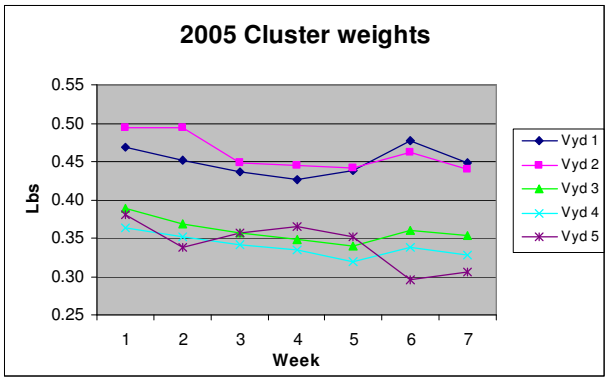


Figure 8

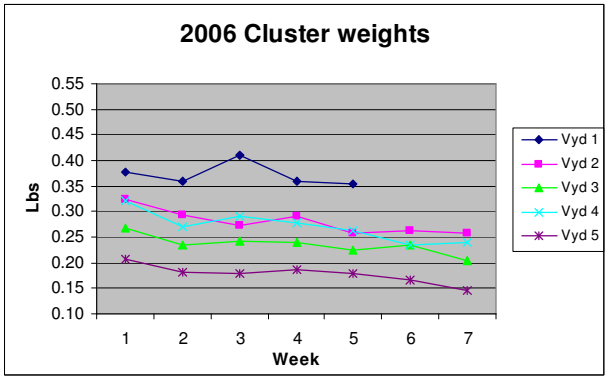


Figure 9

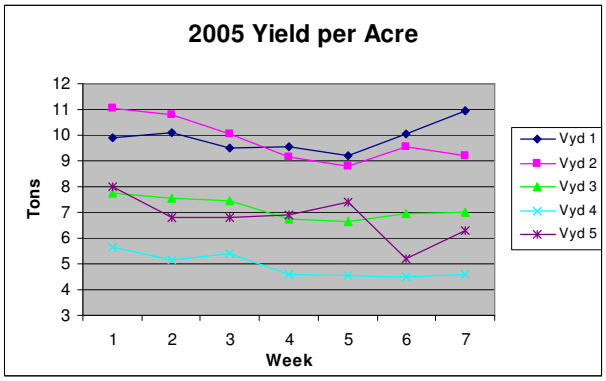
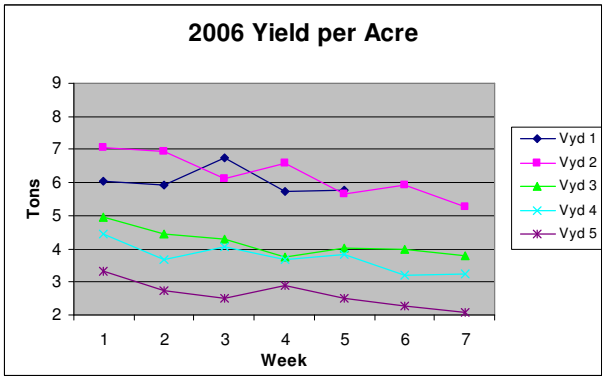


Figure 10



Total yields per acre declined over the 7-week harvest period in all vineyards with the exception of vineyard 1 in 2005. These declines are the result of reduced cluster weights and reduced cluster numbers.

A standard harvest parameter for Cabernet Sauvignon at many wineries used to be 23.5-24.5º Brix. These levels were achieved around weeks 2-3 in 2005 and weeks 1-2 in 2006 (Figures 1 and 2). Commercial harvests occurred primarily during weeks 6-7 in 2005 and weeks 5-6 in 2006. In both years, there were approximately four weeks of extended hang time after Brix levels reached historical harvest standards. During these four weeks, average yields in vineyards 2, 3 and 4 declined by 10.3% in 2005 and 14.9% in 2006. Yield losses were greater in the Calistoga site (vineyard 5) which is in a warmer region and has much rockier soil than the other sites. There were incomplete data for vineyard 1, although in 2005 there appeared to be little, if any, crop loss over the 7-week harvest period.

Yield and Brix Relationships

Figures 11 and 12 show regression lines correlating average cluster weights to Brix levels for each vineyard. Some data sets fit the regression lines better than others as indicated by the r^2 values in Table 2. In general, the 2006 data were better fit to these lines than the 2005 data.

Figure 11

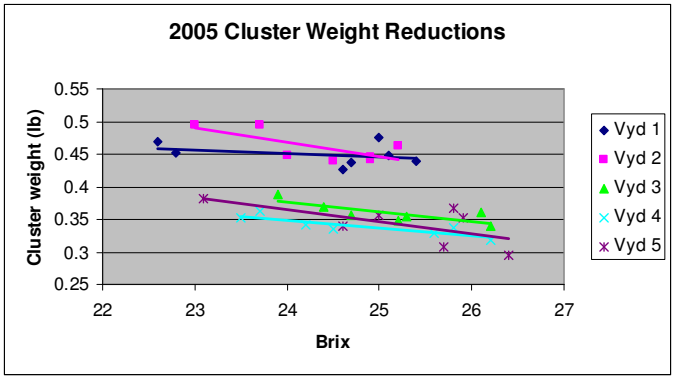


Figure 12

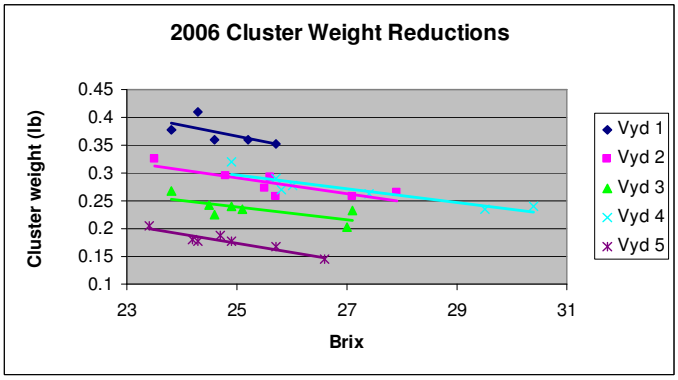


Table 2: Coefficients of determination (r^2)

Vyd	2005	2006
1	0.124	0.854
2	0.545	0.690
3	0.613	0.525
4	0.745	0.807
5	0.426	0.888

Table 3: Predicted cluster weight losses per degree Brix.

Vyd	2005	2006
1	1%	6%
2	5%	5%
3	4%	5%
4	4%	4%
5	6%	10%

Table 3 indicates reductions in average cluster weight for each increase of 1º Brix as predicted by the regression lines. The Calistoga site (vineyard 5) showed the greatest cluster weight reductions. This vineyard is on an extremely rocky site and had the smallest clusters of all the vineyards. The other vineyards all showed cluster weight reductions of close to 5% per degree Brix with the exception of vineyard 1 in 2005.

Summary:

Extended ripening periods beyond the traditional Brix harvest standards are now the norm for many producers of Cabernet Sauvignon in Napa Valley. While sugar accumulation appears to stop once the berries reach 25-26º Brix, other physiological changes continue to occur that may affect wine quality. Cluster weights decline during these extended ripening periods and fewer clusters may ultimately be harvested. There was considerable variation in the response to extended hang time among the vineyards studied in this trial. Nevertheless, data from this trial indicate that a 5% reduction in cluster weight per degree Brix is a reasonable estimate of what might occur in Napa Valley Cabernet Sauvignon vineyards with extended hang time.