University of California Cooperative Extension

# Grape Notes

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San Luis Obispo and Santa Barbara Counties

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## Crop load, viruses and potassium effects on canopy health

The 2005 season began with very healthy canopy growth in most areas, due to the abundant winter rainfall. However, as the season progressed, the unexpectedly heavy crop loads began to tax the vines in many plantings. In severe cases, the entire canopy collapsed in early fall, creating considerable problems with ripening crops in affected blocks. Interacting with the effect of the greater crop load were the influences of viruses, while in some cases potassium deficiencies may have also played a role.

Central Coast vineyards were unusually expressive of leafroll-like virus symptoms in 2005. The typical visual symptoms of leafroll have been described for many decades; in red varieties, they include red leaves with green veins, appearing in mid to late summer. Leaf symptoms do not show in spring or early summer. In some cases, leaves may have more of a burned or scorched appearance. Leaf blade symptoms may closely resemble severe potassium deficiency; this is not coincidental, as leafroll virus causes severe potassium deficiencies in blades [1], while leading to increased potassium levels in both the petioles and the fruit [2].

Figure 1. Zinfandel showing both healthy (green) and virus-affected symptoms (red).


The effects of leafroll virus on fruit ripening can be very severe; typically leafroll leads to lower yields, lower final sugar content, and reduced pigmentation of fruit. In Figure 1 at left, about half of the vines in this block of Zinfandel show distinct leafroll symptoms. Juice from symptomatic vines was 4.1 Brix lower than for adjacent non-symptomatic vines in late October. Leafroll also results in higher berry malate, tartrate, TA, and pH [2].

Mild infections of leafroll may be visually symptomless, but they can still have similar effects on fruit ripening; thus field selections based solely on visual criteria can inadvertently spread infected wood to new plantings [3].

Growing conditions affect the expression of leafroll from year to year; more severe vine stress leads to more pronounced visual symptoms. Heavier crop loads are one form of stress that causes more severe symptoms. Earlier attempts to reduce the symptoms of leafroll through increased potassium fertilization have not been successful, even though tissue levels of potassium could be measurably increased [1].

The choice of rootstock also plays a role in leafroll expression; vineyards established using own-rooted vines, AXR-1, and St. George rootstocks all showed minor symptoms with leafroll infections. In contrast, the rootstocks that we now employ are far more susceptible to infections. The practice of using field wood as a scion source was reasonable when we were grafting to rootstocks like AXR-1; today, it is not, and can lead to the types of suspected virus problems seen in many area vineyards [4]. The continued propagation of plant material of unknown viral status increases the risks of significant yield and quality problems throughout the life of the vineyard.

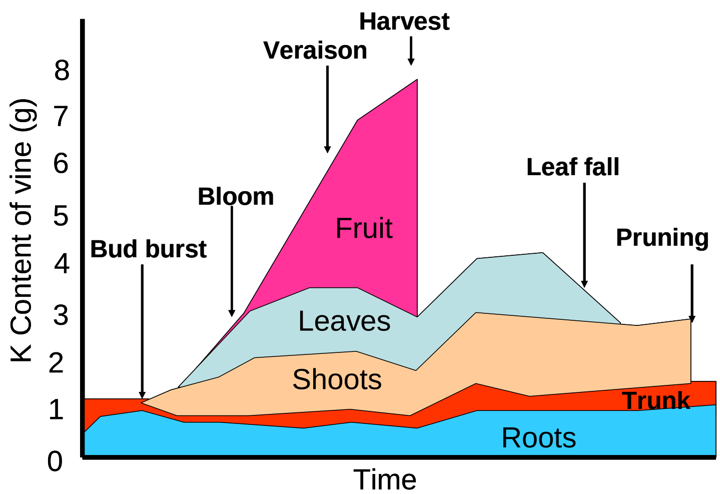
Potassium deficiencies will also be affected by heavy crop loads. In Figure 2 below, adjacent blocks of Cabernet Sauvignon at two different cropping levels show two very different states of canopy health in the early fall. While there may be other unknown influences of pathogens, rootstocks and management in this case, the symptoms are also representative of increased demand for potassium from the larger crop. As fruit matures, it becomes a sink for potassium transferred from vegetative tissue. Research in the Napa Valley on mature vines has shown that 75% of the increase in potassium by the clusters during the month and half before harvest can be

**Figure 2. Adjacent blocks of Cabernet Sauvignon**

attributed to potassium redistributed from the above-ground vegetative tissues during that period [5]. Larger crops will demand more potassium, all else being equal.

Irrigation practices in this area will also play a role in potassium nutrition. About 80% of the root uptake of potassium from the soil is by diffusion of potassium ions through the soil water to the roots, while 20% arrives by mass flow, e.g. the potassium is carried with moving water to the roots. As a soil dries, the films of water surrounding the soil particles become thinner and more tortuous, thereby increasing the distance that ions must diffuse in order to arrive at the roots. As diffusion slows, potassium uptake is reduced. Excessive soil moisture stress during the period when fruit is making the largest demands for potassium will likely contribute to any deficiencies in the vine. Figure 3 below indicates how potassium is partitioned between the different tissues of young vines throughout a growth cycle; older vines will have a much larger overall proportion of potassium in the permanent tissues.

**Figure 3. Potassium partitioning in a young vine thoughout the season[6].**




In summary, leafroll virus and potassium deficiency can have similar leaf visual symptoms. Leafroll infections are permanent, while potassium deficiencies are more transient. To diagnose a consistently symptomatic planting, virus testing may be very useful as a first step; if the results are negative, then further analyses of potassium fertilization, cropping levels, and irrigation practices may prove worthwhile.

**Citations:**


1. Goheen, A.C. and J.A. Cook. 1959. Leafroll (Red-Leaf or Rougeau) and its Effects on Vine Growth, Fruit Quality, and Yields. Am. J. Enol. Vitic. 10:173-181.
2. Hale, C.R. and R.C. Woodham. 1979. Effect of Grapevine Leafroll Disease on the Acid and Potassium Composition of Sultana Grapes. Am. J. Enol. Vitic. 30(2):91-92.
3. Wolpert, J.A. and E.P. Vilas. 1992. Effect of Mild Leafroll Disease on Growth, Yield, and Fruit Maturity Indices of Riesling and Zinfandel. Am. J. Enol. Vitic. 43(4):367-369.
4. Golino, D.A. 2005. Personal communication.
5. Williams, L.E. and P.J. Biscay. 1991. Partitioning of Dry Weight, Nitrogen, and Potassium in Cabernet Sauvignon Grapevines From Anthesis Until Harvest. Am. J. Enol. Vitic. 42(2):113-117.
6. Conradie, W. J. 1981. Seasonal uptake of nutrients by Chenin blanc in sand culture. II. Phosphorus, potassium, calcium and magnesium. S. Afr. J. Enol. Vitic. 2:7-13.

# Extended Ripening Project

## Summary

Research was conducted on the effects of extended ripening on cluster weight, berry weight, and juice soluble solids, for the varieties Merlot, Cabernet Sauvignon, and Syrah in the Paso Robles area during the 2005 season. Over a period of eight weekly samplings, berry weights declined by 15.7%, 25.3%, and 31.8% respectively for Merlot, Cabernet, and Syrah, while juice soluble solids increased by 13.7%, 20.1%, and 42.2% respectively. Weekly-measured declines in berry weight and cluster weight, and increases in soluble solids were all highly significant with the exception of Merlot cluster weights. Unusually cool fall weather led to lower-than-normal maturity levels for all varieties, with final juice soluble solids values of 24.0, 25.1, and 29.2 Brix for Merlot, Cabernet and Syrah respectively.

## Introduction

Questions have risen in recent years regarding the effects of extended ripening or “hang time” on the harvested weight from a given vineyard; growers have been concerned that with prolonged delays in harvest, that the harvested tonnage tended to decline due to evaporative loss of water from the fruit. This study intended to document any weight loss experienced by three varieties at a Paso Robles area vineyard in 2005.

## Method

The 2005 research was conducted in a commercial vineyard located 6 km east of the city of Paso Robles, CA. Measurements were made on the varieties Merlot (clone 3/101-14), Cabernet Sauvignon (clone 8/1103P), and Syrah (Estrella/5c). All varieties were VSP-trained at a spacing of 5 ft x 10 ft, with an east-west row orientation, and planted in 1997.

Treatments consisted of eight weekly ‘harvest time’ sampling events. For each variety and harvest date, individual sample units consisted of four vines; the sample units were arranged in a randomized complete block design across eight adjacent replicate rows (Figure 1).

For each weekly sampling, the following measurements were conducted for each variety:

1. Sixteen random clusters were harvested from each of the four vines in each sample unit;
2. The total cluster weight for each sample unit was measured (64 clusters per sample unit);
3. From each cluster, three berries were sampled, taken from the top, middle and bottom of the cluster;
4. The total berry weight for each sample unit was measured (192 berries per unit);
5. The berries were crushed and strained, and the juice soluble solids measured with a refractometer

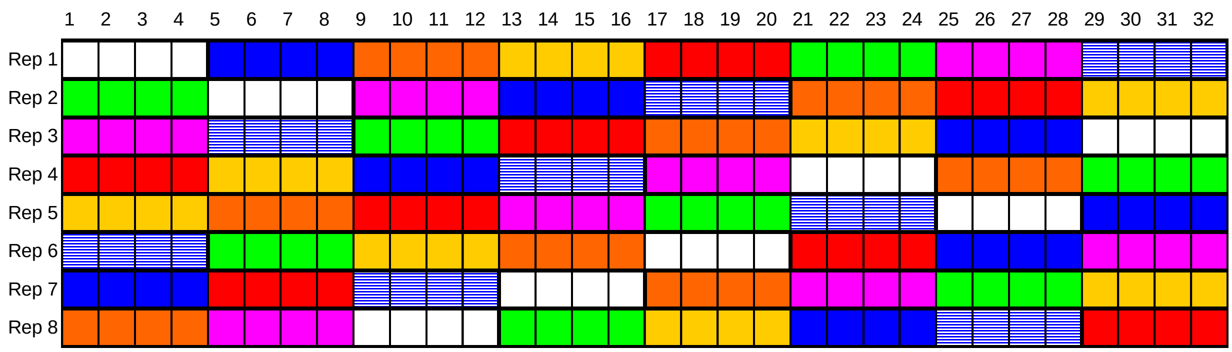
The first set of samples was taken on Sept. 22, 2005, and the eighth and final set of samples was taken on Nov. 10, 2005.

A single automated soil moisture sensor (Watermark™) was placed in each variety, directly beneath a drip emitter at a depth of 35 cm. Sensors were logged at 15 minute intervals, and the average soil moisture tension for the week prior to the day of sampling was later calculated.

Irrigation applications were measured with a single flow gauge placed beneath a drip emitter for each variety. Local ETo data was accessed from a PRWCA weather station located approximately 2 km from the study site. The applied irrigation was calculated as a percentage of ETc, assuming a crop coefficient of 0.5 for all varieties.

The weekly measurements were analyzed with repeated-measures ANOVA, using the Statmost™ software program.

**Figure 1. Example plot layout. Each square represents a single vine; the eight color combinations designate the eight weekly sampling treatments.**




## Results and Discussion

The 2005 season was an unusually late year for ripening in the area; as such the measurement period is not fully representative of the type of extended ripening behavior that would be expected in a more typical season, The Syrah, which matured earlier than either the Merlot or Cabernet, did experience an extended ripening period. Summary graphs for each variety are presented on pages 7, 8 and 9 of this newsletter for Merlot, Cabernet and Syrah respectively.

For all varieties, the trend over time of decreasing cluster weight, decreasing berry weight, and increasing juice soluble solids was highly significant, with the exception of the Merlot cluster weights (Table 1). The disparity between the behavior of the Merlot cluster weight and berry weights can be explained by the smaller sample size of the cluster measurements.

The berry weight differences between the first and last samplings showed a reduction of 15.7%, 25.3%, and 31.8% respectively for the Merlot, Cabernet, and Syrah. Likewise, the increases in juice soluble solids over the same period were 13.7%, 20.1%, and 42.2% respectively for Merlot, Cabernet and Syrah.

Irrigation patterns for both Merlot and Cabernet were similar, with moderate amounts provided during the first five weeks, followed by three weeks of no irrigation.

The Syrah received similar irrigation amounts as the other varieties during the first four weeks, followed by much larger irrigations during the last four weeks after the commercial harvest of the block.

| **Table 1. Repeated Measures ANOVA** | | | | |
|---|---|---|---|---|
| | | **F** | **P** | |
| Cluster Weights (kg) | Merlot | 1.2419 | 0.2987 | **ns** |
| | Cabernet | 3.3045 | 0.0059 | ** |
| | Syrah | 10.1204 | 9.30E-08 | ** |
| | | | | |
| Berry Weights (g) | Merlot | 8.7013 | 6.67E-07 | ** |
| | Cabernet | 15.7707 | 1.25E-10 | ** |
| | Syrah | 33.7701 | 1.21E-16 | ** |
| | | | | |
| Soluble Solids (Brix) | Merlot | 61.0229 | 5.22E-22 | ** |
| | Cabernet | 113.2675 | 5.07E-28 | ** |
| | Syrah | 72.2274 | 1.29E-23 | ** |
| | | | | |
| | Confidence Level = 95.00% Critical F(0.0500,7,49) = 2.2032 | | | |
| | Confidence Level = 99.00% Critical F(0.0100,7,49) = 3.0285 | | | |

Soil moisture levels corresponded well in the Merlot and Cabernet to the irrigation patterns; increasing dryness was clearly indicated during the irrigation cutoff period. The Syrah soil moisture was similar to the other varieties earlier in the season, but was wetter later, reflecting the large post-harvest irrigations.

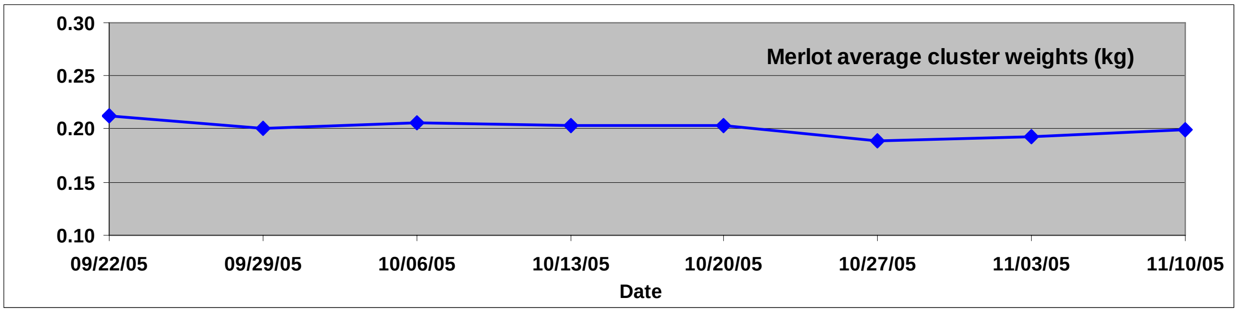
In contrast to the either the Merlot or Cabernet, the Syrah appeared to either stop losing fruit weight (by the berry weight data), or even re-gain fruit weight (by the cluster weight data) during the last two sample periods. This behavior is probably due to the expected decrease in vine water stress with the large irrigations during the last four weeks of sampling.

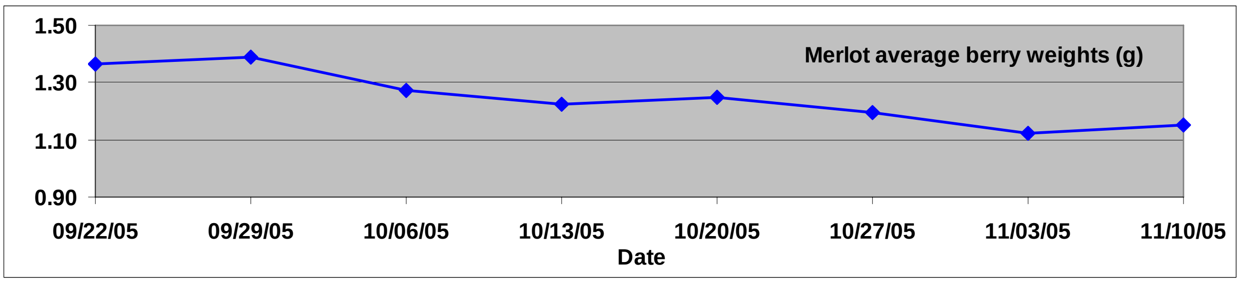
## Conclusion

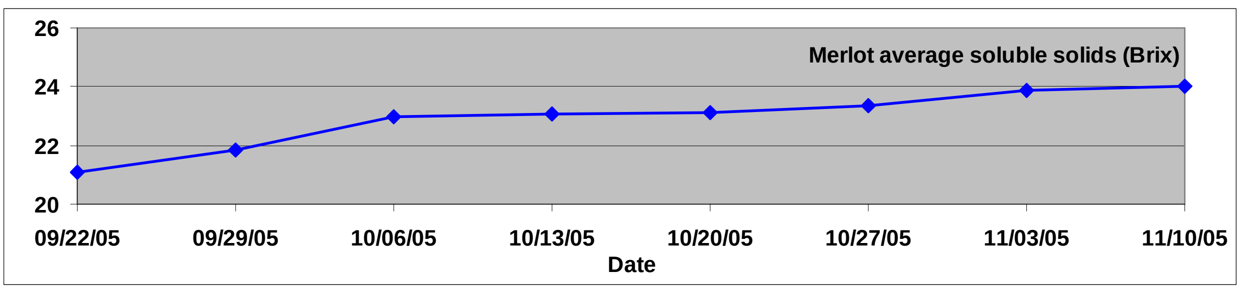
Over a period of eight weekly samplings, berry weights declined by 15.7%, 25.3%, and 31.8% respectively for Merlot, Cabernet, and Syrah, while the juice soluble solids increased by 13.7%, 20.1%, and 42.2% respectively. Weekly-measured declines in berry weight and cluster weight, and increases in soluble solids, were all highly significant for all varieties, with the exception of Merlot cluster weights.

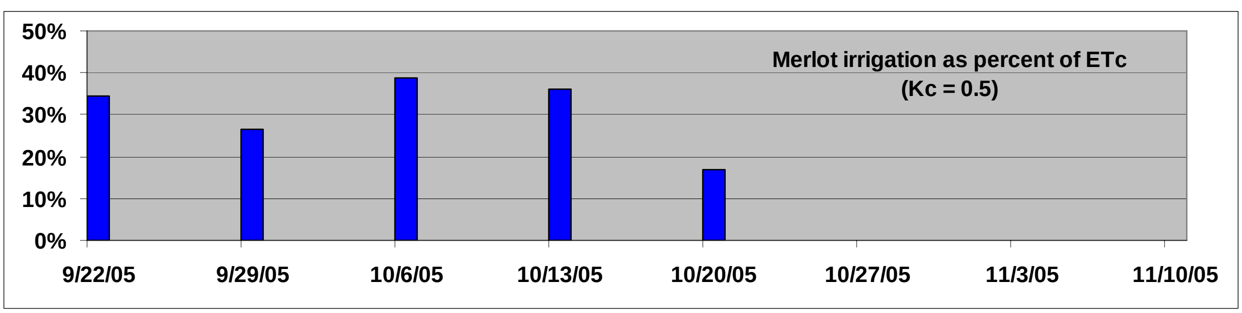
Unusually cool fall weather led to lower maturity levels for all varieties, with final juice soluble solids values of 24.0, 25.1, and 29.2 Brix for Merlot, Cabernet and Syrah respectively. As such the measurements do not reflect the type of extended ripening conditions that might be expected in a more typical season, when juice soluble solid values would be higher. Syrah, due to its earlier ripening characteristics, did experience the type of extended ripening period that this research intended to document.

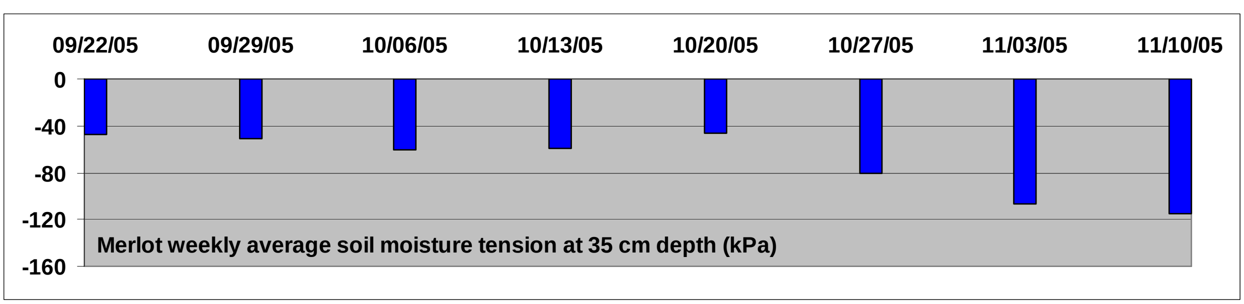
## Merlot Summary Data



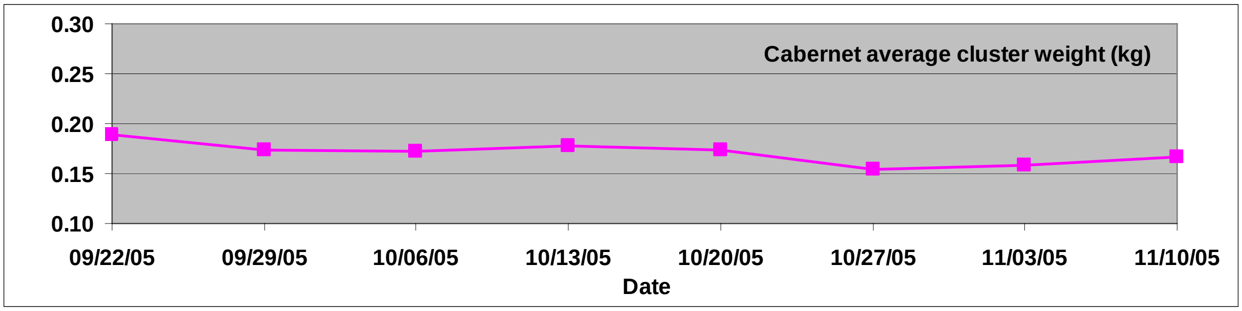



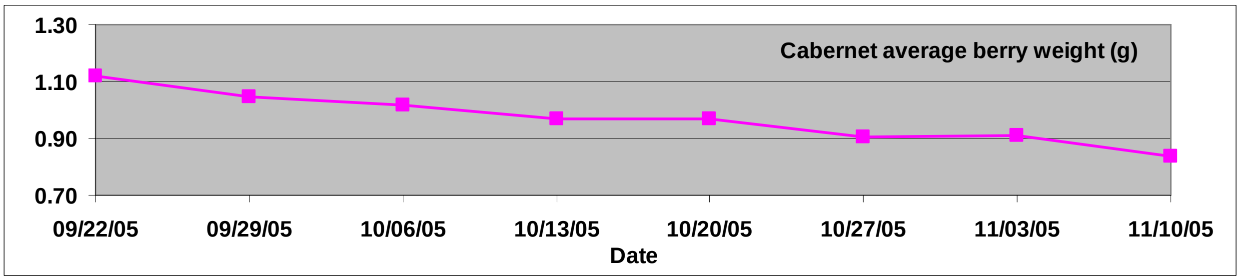



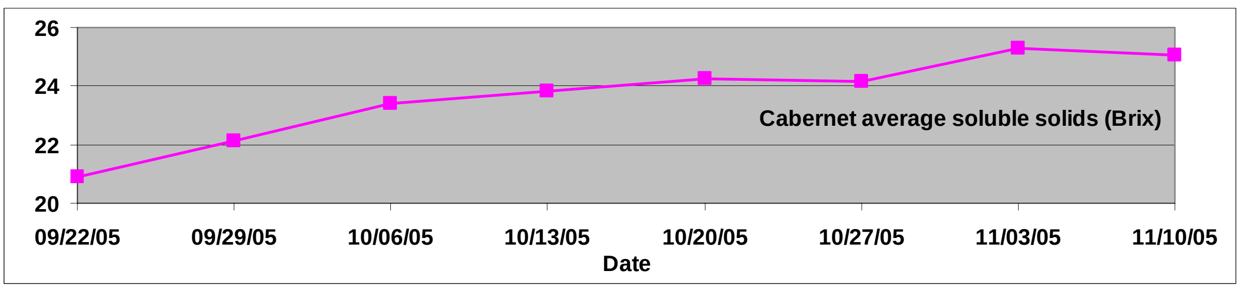



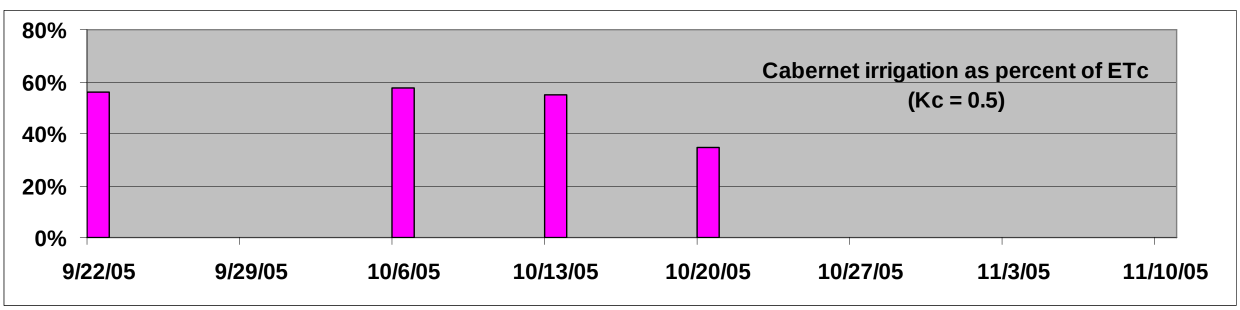



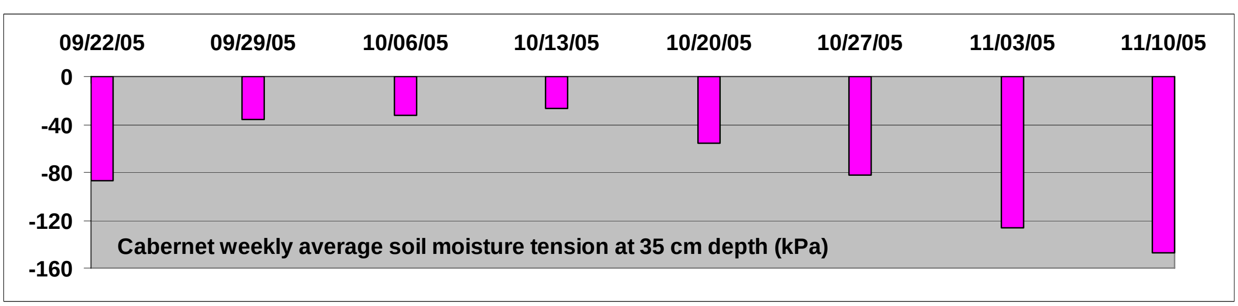
## Cabernet Sauvignon Summary Data



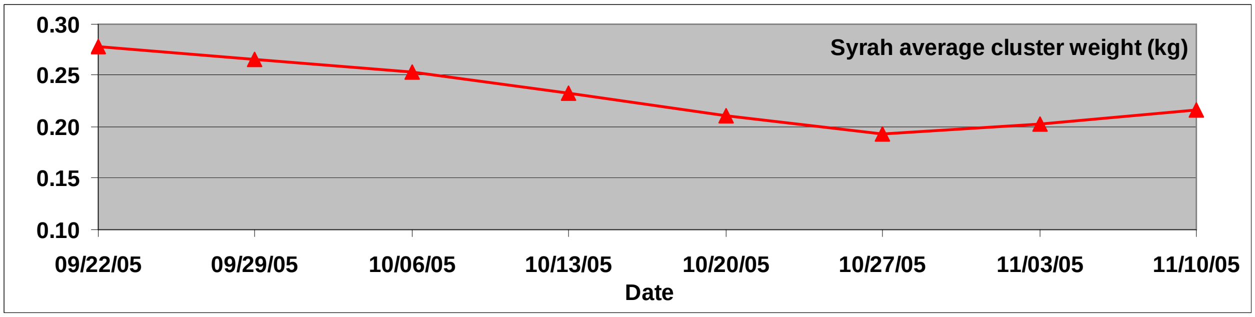



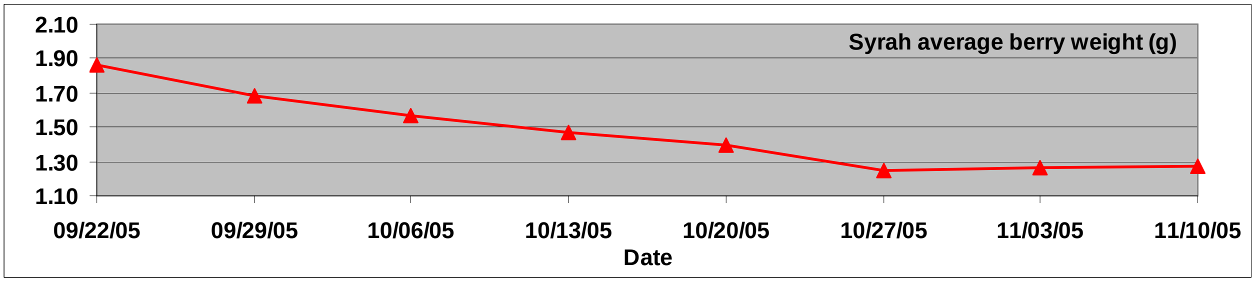



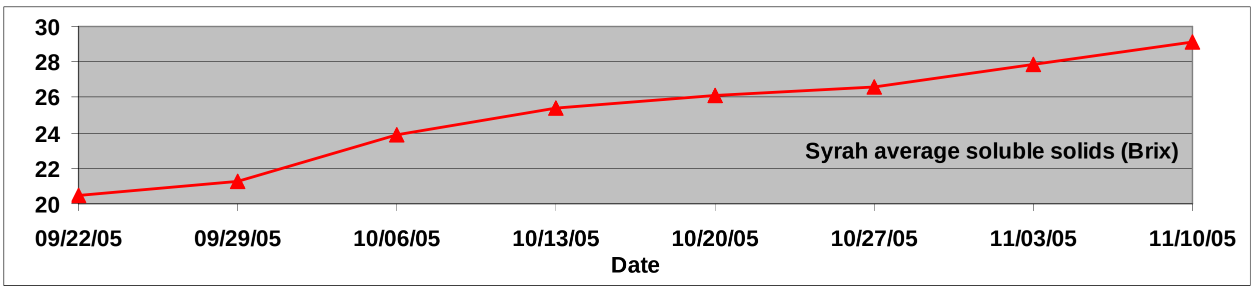



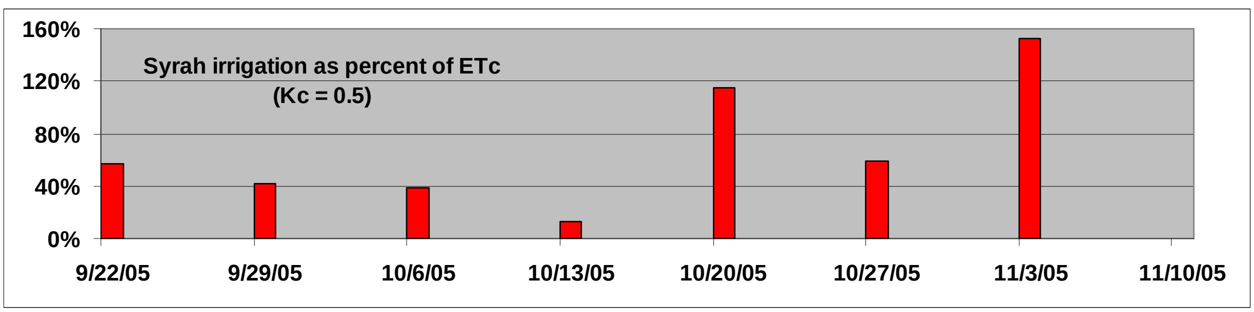



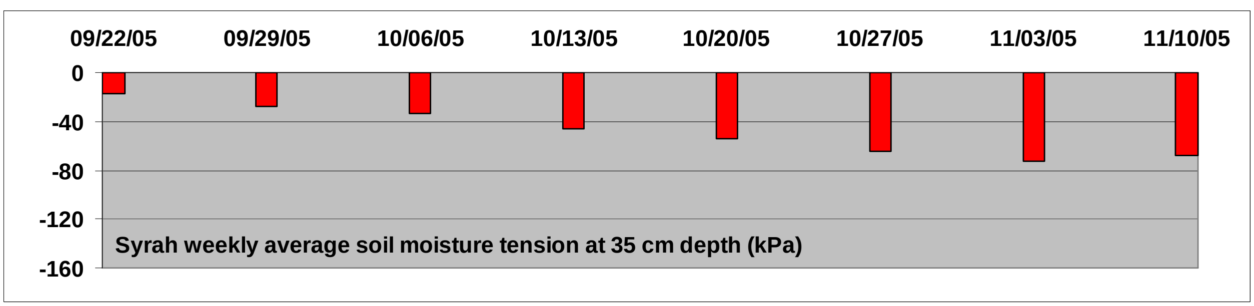
## Syrah Summary Data



## Winter 2006 Courses in Winemaking and Vineyards

The courses below are offered by UC Davis Extension; most take place on the UC Davis campus or nearby. Contact the UC Davis Extension at (530) 757-8899 for more information or to enroll in a course. You may also access their website at:

www.extension.ucdavis.edu/winemaking

**Varietal Winegrape Production Short Course**

This intensive three-day course is designed as an in-depth and comprehensive study of all aspects of varietal winegrape production. Topics covered include:

- Physiology Review
- Vineyard Establishment
- Vineyard Management
- Pest Management

When: February 28 – March 2, 2006
Where: Freeborn Hall, UC Davis
Cost of course: $625

**Additional UC Davis Extension courses in 2006:**

- Introduction to Wine Analysis for Professional Winemakers and Winery Lab Workers
  - Jan 21, 2006
- Health and Safety for Winery Operations: An Overview
  - Feb. 3, 2006
- Tasting Room Design and Management
  - Feb. 7, 2006
- Managing the Small Vineyard
  - Feb. 25, 2006
- Introduction to Sensory Evaluation of Wine
  - Feb. 25 and 26, 2006
- Introduction to Wine Analysis for Home Winemakers
  - March 11, 2006
- Recent Advances in Viticulture and Enology
  - March 16, 2006
- Descriptive Analysis of White and Red Table Wines
  - Mar. 18 and 19, 2006
- Geographic Information Systems for Vineyard Management
  - March 24, 2006
- Variety Focus: The Rhone
  - May 25, 2006