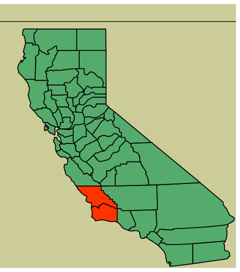
December 2006

University of California Cooperative Extension

Grape Notes

San Luis Obispo & Santa Barbara Counties



Mark Battany
Viticulture/Soils Farm Advisor

2156 Sierra Way, Suite C
San Luis Obispo, CA 93401

805-781-5948 phone
mcbattany@ucdavis.edu

Fine-tuning irrigation management with a post-season evaluation

Locally measured crop coefficients, combined with accurate irrigation records and area climate data, were together used to evaluate how the actual irrigation management at a vineyard compared to the calculated theoretical vine water requirements during the 2006 season.

In the August 2006 Grape Notes, a new and practical method for determining the irrigation crop coefficient was described. Now, an example will be shown of how these locally-specific crop coefficients, along with irrigation records and ET data, can be used to evaluate a given season's irrigation management after-the-fact, expressed in units that permit comparison from year to year.

If our goal is to grow vines with a uniform degree and pattern of water stress every season, then we need to adjust irrigation amounts to take into account the unique growing conditions in any given season. The weather, or more specifically for our purposes, the rate of evapotranspiration (ET), is the variable component that exerts the most influence on irrigation requirements during the season. The size of vine canopy growth, another variable from year to year, is adjusted for by local measurements of the crop coefficient (Kc).

Most growers are familiar with the equation for determining the theoretical full vine water use, from ET data:

$$ETc = Kc * ETo$$

where ETc is the full vine water use, Kc is the crop coefficient, and ETo is the reference ET from a weather station. We will now take this one step further:

$$\% \text{ of } ETc = (\text{Applied irrigation} / ETc) \times 100\%$$

where "% of ETc" is the percentage of the theoretical full vine water use actually fulfilled by the applied irrigation amount. This "% of ETc" value, because it takes into account the differences in weather conditions from year to year (through the ETo measurement) and the differences in canopy size from year to year (through the Kc measurement), allows for an apples-to-apples comparison of irrigation management from one season to the next.

On the following page is an example of how this calculation is applied to a mature Zinfandel vineyard near Paso Robles. At this vineyard the bilateral cordon rows are oriented north-south on level to rolling ground, with the vines spaced 6 ft x 9 ft (1.8 m x 2.7 m) and trained to a VSP trellis system with drip irrigation.

Irrigation applications were accurately recorded with a pressure-activated switch connected to the drip line in the field; whenever the system was turned on or off, the precise time of that event was automatically recorded with a small datalogger. The irrigation amounts per vine over the season are shown in Figure 1.

Also inside this issue:

The local weather data was supplied by the Atascadero CIMIS weather station. The daily reference evapotranspiration (ETo) amounts for the irrigation season are shown in Figure 2.

The crop coefficients for the block were measured using the "Paso Panel" solar panel method, on four dates after budbreak (which occurred about 5/1/06). The evolution of the crop coefficient (and hence canopy size) is shown in Figure 3.

The above three sets of data are then put into a computer spreadsheet for the calculations. For the first evaluation, we will look at the "% of ETc" value for two-

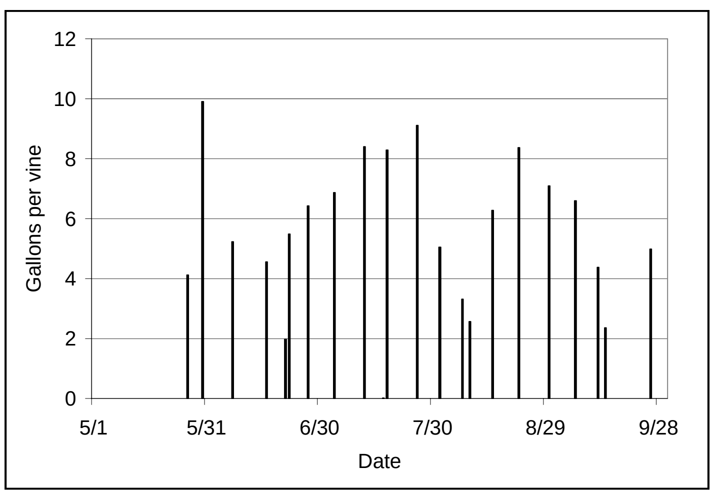


Figure 1. Irrigation amounts recorded in the field.

week periods from May through September (Fig. 4). Here we see that the % of ETc gradually increases from 0% (no irrigation applied) to 62% by the end of July. At this point, it decreases abruptly to less than 40%, and remains so through the end of September. This pattern suggests that stored soil moisture largely fulfilled vine needs during early growth phase, but through late spring and early summer irrigation gradually became a larger proportion of total vine water consumption. In early August, irrigation amounts were reduced relative to vine requirements, i.e. the irrigation deficit was greater, and remained consistently so until harvest.

If our goal is to compare "% of ETc" values from year to year, one shortcoming on Fig. 4 is the use of a calendar scale on the horizontal axis. Vine development does not follow the same calendar schedule each year, with 2006 being a very good example of this. A better comparison would be to use a growing degree-day (GDD) scale, beginning at budbreak each year (Fig. 5). This now gives us a true "apples-to-apples" comparison on both axis of the chart, allowing us to compare values from one year to the next.

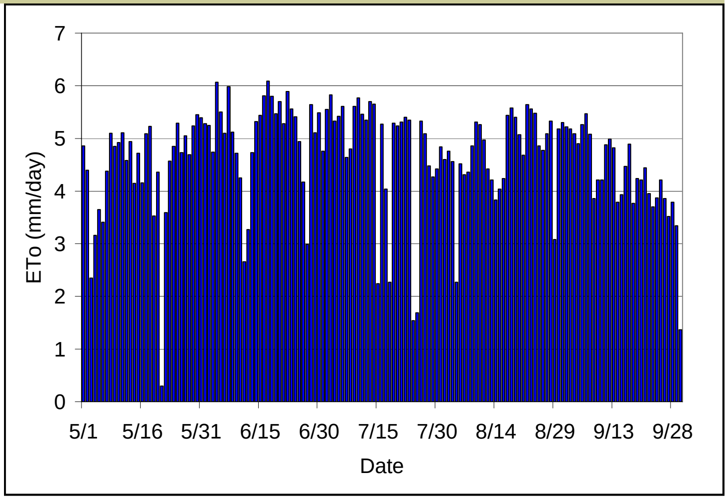


Figure 2. Daily ETo data from the Atascadero CIMIS station.

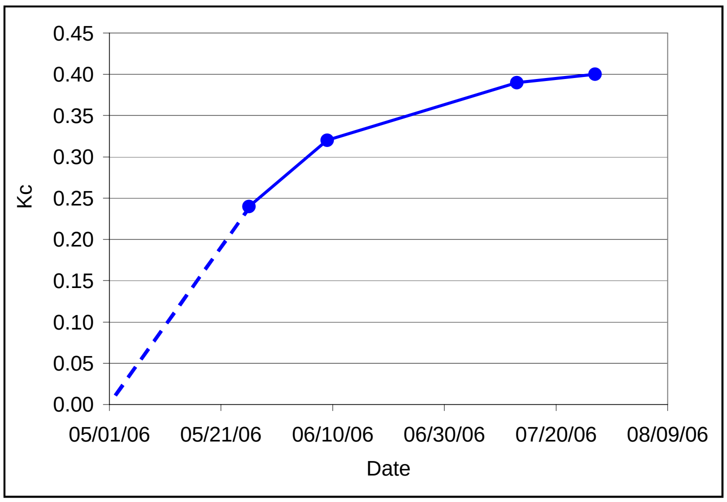


Figure 3. Crop coefficients measured during the growing season, using the "Paso Panel" method of estimating midday canopy shaded areas.

This method of looking at "% of ETc" only evaluates applied irrigation water, and can't measure the vine consumption of stored soil moisture. If the amount of stored soil moisture in the root zone at budbreak was consistent from year to year this would not be a big issue, but in many areas the stored moisture can vary considerably. Thus, measurements of soil moisture would be useful in this assessment of irrigation management. Likewise, other variable factors may also need to be considered, such as the changing effects of soil salinity or water consumed by a cover crop.

Performing this type of after-the-fact irrigation assessment is a good way to become comfortable with how the ET-based method functions. With several seasons of after-the-fact data, one will have more confidence, and less risk, in employing the method for real-time irrigation management.

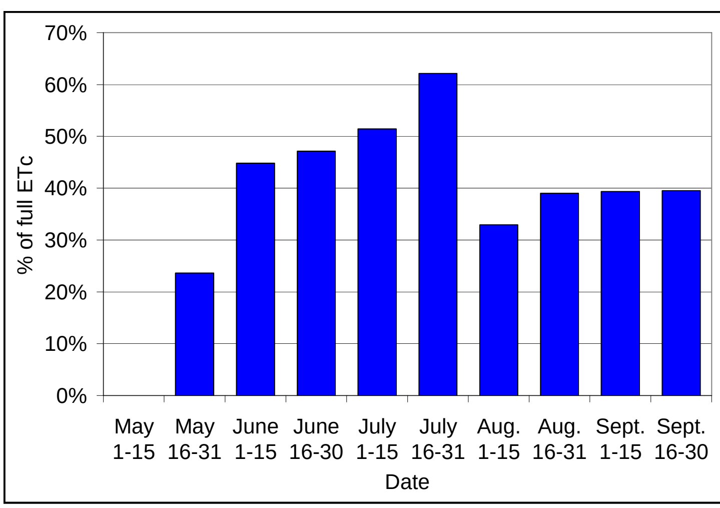


Figure 4. Applied irrigation, expressed as a % of full ETc, for two-week periods beginning at budbreak.

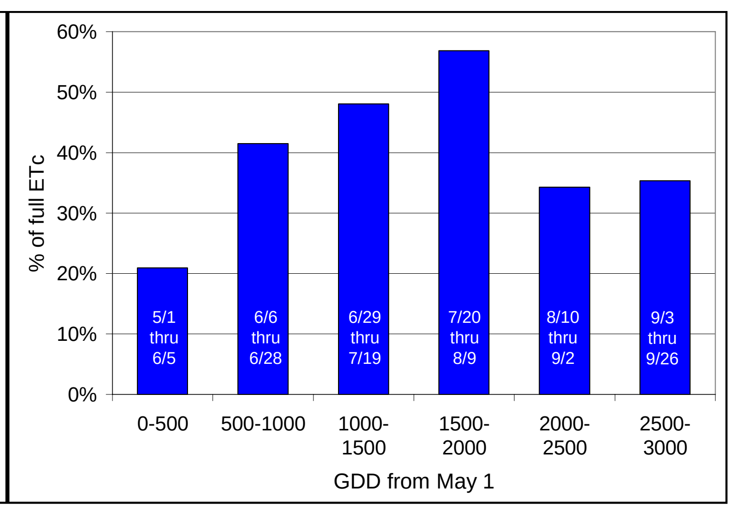


Figure 5. Applied irrigation, as % of full ETc, for 500 GDD periods. GDD calculated in F with a base of 50 °F, from May 1, 2006.

Accessing online soil survey information

A large amount of useful soils information is now readily available via the NRCS Web Soil Survey website; it allows a user to produce detailed maps and reports for a wide range of soil properties for a chosen area.

The NRCS Web Soil Survey has now made available on the Internet all the information which was previously found only in the printed soil survey books. These older printed surveys were often difficult to find outside of libraries or government offices, so having this information online will make it much more convenient to access this useful information.

The soil surveys contain information about the fundamental physical and chemical properties of soils in a given area, with interpretations on the suitability of the soil for various uses. The soil survey information is delineated in 'mapping units'; these are collections of soils that are largely similar; however there is likely some minor variation within any single mapping unit. For more accurate information, one must dig pits and sample the actual soils at the site itself.

To find information for a desired area, the property must first be located on the aerial photograph used in the online soil survey. The online survey uses the same aerial photographs from the original printed surveys; in some cases, these aerial photographs are several decades or more old. While the age of the photographs does not affect the underlying soil characteristics, it can sometimes make it difficult to locate a property because landmarks and land uses may have changed substantially in recent decades.

Much more recent aerial photos are available on Google. On this website, one can enter a street address, and the website will produce a recent aerial photo overlain with road information. Depending on the age of the vineyard, the Google image may show some or all of the existing vineyard blocks and itself be useful as a block map. By comparing with the known location on the newer Google aerial photographs with the older soil survey photographs, it may be much easier to pinpoint the desired location for analysis.

On the following two pages are example images from Google and Web Soil Survey from an area west of Paso Robles. The address at this location is 8910 Adelaida Road (Halter Ranch Vineyard). These images will demonstrate some of the types of information available on these sites; note that the images have been slightly modified to better fit this newsletter format.

Step 1. Locate the vineyard using Google Maps. Simply type in the street address and Google will show the road map of the area. Select the 'Hybrid' map option to show both road and aerial photograph together (Figure 1). Use the zoom/drag features to show the desired area in the image.

Step 2. Using Web Soil Survey, type in the street address and use the zoom/drag features to adjust the aerial photo to show the desired area (Figure 2). Set this as the 'Area of Interest' (AOI), which is the mapping area in which you desire information. Once the AOI is set, one can then use the 'Soil Map' and 'Soil Data Explorer' options to view specific soil characteristics.

Step 3. Begin viewing soil characteristics. The soil mapping units within the AOI for the example site are shown in Figure 3. A wide variety of soil physical and chemical properties are available for viewing, at user-specified depths. An example is the Available Water Holding Capacity (AWC) for the 0-1 meter depth, which would be very useful for estimating the potential vigor or irrigation requirements for an existing or future vineyard (Figure 4).

A very useful and powerful feature of the Web Soil Survey is the ability to automatically produce detailed reports of individual characteristic for the chosen AOI, including colored maps. By default these reports are saved as PDF format files, allowing them to be easily stored or shared with others.

The NRCS Web Soil Survey has many features and does require some practice to be able to fully access all the available information, but it can be a very useful information resource for planning future vineyard developments or managing existing plantings.

For more information:

Web Soil Survey website:

http://websoilsurvey.nrcs.usda.gov/app/

Google Maps:

http://www.google.com/maps

NRCS Service Centers:

Templeton Service Center
65 S Main St., Ste. 106
Templeton, CA 93465-8703
(805) 434-0396

Santa Maria Service Center
920 E Stowell Rd.
Santa Maria, CA 93454-7008
(805) 928-9269

Figure 1. Google aerial photo with road map overlain. This more recent image shows the current vineyard developments.

Figure 2. Web Soil Survey aerial photo of the same area. This older photo predates vineyard development in the region, but the roads and many of the large oaks still serve as useful landmarks. All of the soil characteristic maps produced by the Web Soil Survey will be superimposed onto this photo, so having a more recent Google or similar aerial photo available as a current reference will make it easier to orient the survey characteristics to the actual locations of plantings.

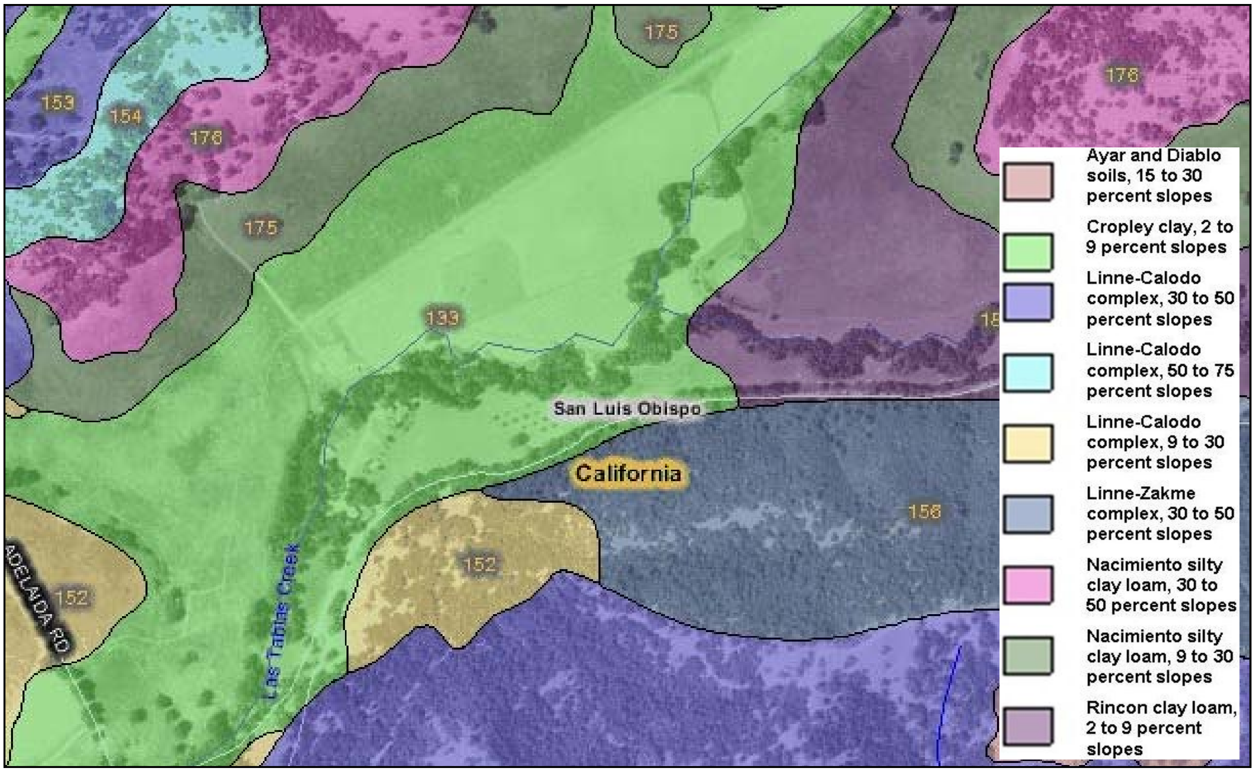


Figure 3. Soil mapping units; from a winegrape perspective they might also be thought of as 'terroir' units, as each one encompasses soils of similar characteristics and behavior.

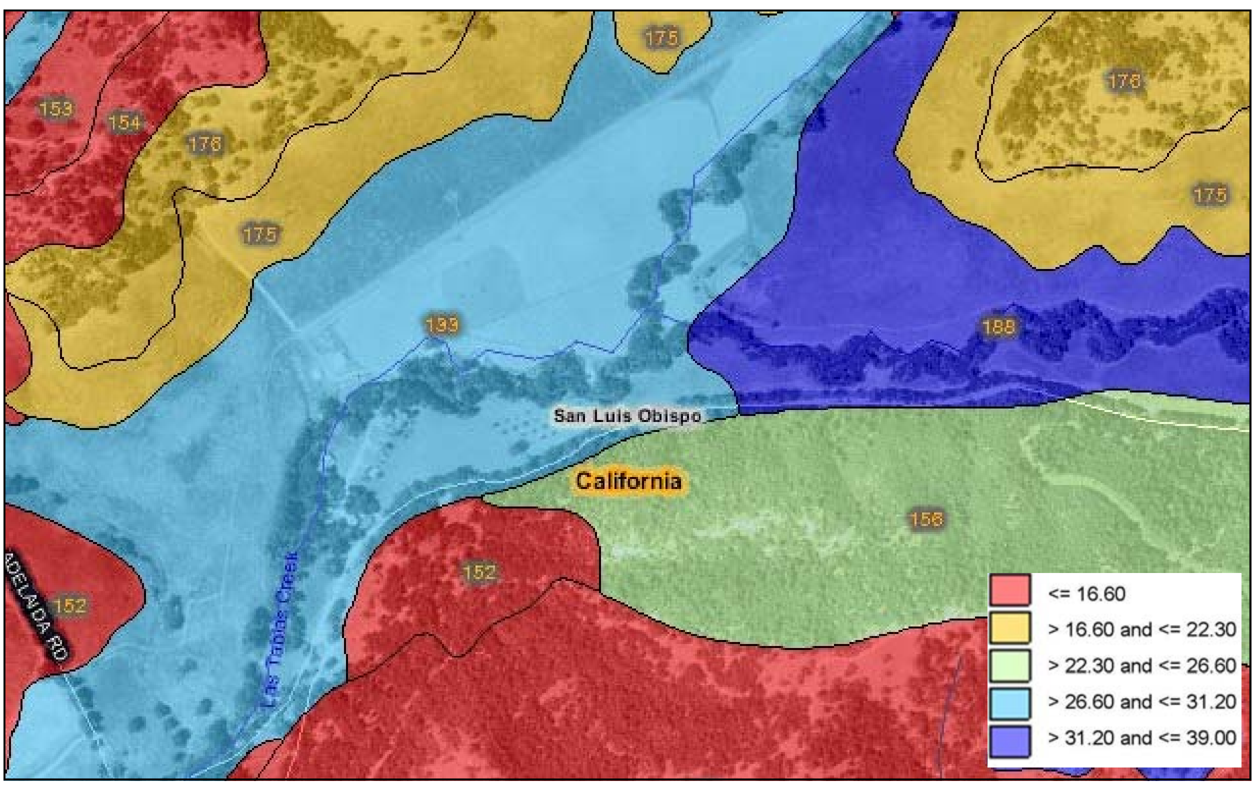


Figure 4. Map of Available Water Supply (AWS) for the 0-100 cm depth of soil. The units of AWS are centimeters of total plant-available water for the top 100 cm depth of soil, with the soil water content at field capacity.

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805-781-5948 phone
805-781-4316 fax
mcbattany@ucdavis.edu

About the UC Cooperative Extension

The University of California's 64 Cooperative Extension offices are local problem-solving centers. More than 400 campus-based specialists and county-based farm, home, and youth advisors work as teams to bring the University's research-based information to Californians. UCCE is a full partnership of federal, state, county, and private resources linked in applied research and educational outreach. UCCE tailors its programs to meet local needs. UCCE's many teaching tools include meetings, conferences, workshops, demonstrations, field days, video programs, newsletters and manuals.

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http://cesanluisobispo.ucdavis.edu/newsletterfiles/newsletter363.htm

Announcements:

Upcoming UCCE Seminar

Date: Friday, Feb. 16, 2007

Location: Paso Robles Library Conference Center, 1000 Spring Street, Paso Robles

Time: 8:30 am—12:30 am

Invited speakers include:

- Dr. Dave Smart, Assoc. Professor, UC Davis Dept. of Viticulture & Enology
- Dr. James Wolpert, UCCE Extension Viticulture Specialist, UC Davis Dept. of Viticulture & Enology
- Dr. Matthew Fidelibus, UCCE Extension Viticulture Specialist, Kearney Agricultural Center

More details and sign-up information will be emailed to subscribers of this newsletter in early January.