

IMPROVING WINEGRAPE QUALITY WITH IRRIGATION MANAGEMENT

By Janet Caprile

University of California Farm Advisor, Contra Costa & Alameda Counties

The amount of water that a vine uses is based on climate as well as on the size of the canopy and can be easily calculated. In the chart below, I have listed the historical, bi-weekly, Reference Water Use (ET_o) from our Brentwood CIMIS weather station (Column A). This is the amount of water that grass uses based on our local climate.

We can convert this to the amount of water that grapes use by multiplying it by a conversion number that we call the Crop Coefficient (K_c). This number depends on canopy size and will naturally vary over the course of the season and between vineyards with different spacings and trellis systems. To determine the K_c for your own vineyard, calculate the average % shaded area under the vines at mid-day and multiply by 0.017. The example in Column B below is for a VSP trellis on a 6' x 9' spacing.

If you multiply the Reference Water Use (Column A) by the Crop Coefficient (Column B), you'll get the amount of water that grapes (of this size) would use in Brentwood if they were given all they wanted (Column C). However, for the best winegrape quality, we often want to **deficit irrigate** – meaning we don't give them their full water requirement. If done correctly, deficit irrigation will reduce vegetative growth and allow enough extra light into the fruiting zone to increase color and other quality parameters without reducing yields. If done *incorrectly*, you can lose leaves and overexpose the fruit which can have a negative impact on both quality and yields. Deficit irrigation should never be practiced on young vines that have not yet begun to fruit.

Typically the best effect on fruit quality occurs when the vines are allowed to dry down naturally, using the winter rainwater stored in the rootzone, until they experience a mild to moderate stress. That's when irrigation should begin and then, only a certain % of the Full Water Use should be applied at each irrigation until harvest. After harvest, the vines should be irrigated fully.

So the first trick is figuring out **when to begin irrigating**. This really depends on your soil, your rootstock/variety combination, and your rooting zone. Generally the vine begins to experience a sufficient water deficit when they have used up about half of the available moisture in the rootzone. You can use soil moisture monitoring tools like a neutron probes or a

dielectric probe to let you know when you have reached this point. The less expensive tools like tensiometers and gypsum blocks do not usually measure these lower soil moisture levels very well. Any type of soil measurements can be difficult to interpret if you have a high or intermittent water table.

You can also use a plant moisture monitoring tool like the Pressure Chamber (or Pressure Bomb) which directly measures vine water stress. A threshold level of 10-14 bars is typically used as the point when irrigation should begin. The lower threshold (10-12 bars) may be better for white varieties (they don't need color enhancement) or less vigorous varieties. The higher values (12-14 bars) may be better for red and/or more vigorous varieties. This plant based method is probably the most accurate but measurements must be taken exactly according to recommendations. Find recommendations on Terry Prichard's website at:

<http://cesanjoaquin.ucdavis.edu/files/2949.pdf>

Once you have reached the threshold where irrigation should begin, the next trick is determining **how much water to put on**. That's where the water use chart below comes in very handy. Applying 35-60% of the Full Water Use amount each week should keep vines sufficiently stressed. The 60% deficit is a conservative amount which should not overstress your vines. This is a good value for white varieties which don't need as much stress to obtain good quality. It will also work for low to moderate vigor red varieties. The 35% deficit can be pretty risky so only use this on very strong vines and watch them carefully to make sure they don't get overstressed. If your vineyard has a water table then you may also be able to use the lower portion of the deficit range as they will have access to this water as well.

The chart below provides an example of how weather station information can be used to help schedule irrigations. You can customize this information for your own vineyard by calculating your own Crop Coefficient (K_c) and deciding on an appropriate deficit amount for your situation. To improve accuracy, use the current season's E_{to} data (instead of the historical information I have used below) from the Brentwood weather station (#47). This can be obtained from the Ca. Dept. of Water Resources website at:

<http://www.cimis.water.ca.gov/cimis>.

Updated Feb 2007

GRAPE WATER USE

Cabernet Sauvignon on VSP trellis Brentwood (Historical Averages)

Date	Days from budbreak	A	B	C	D	E		F	
		Reference Water Use (ETo)	Crop Coefficient (Kc)	Full Water Use (ETc)	Deficit Water Use (60%ETc)	Net DEFICIT Irrigation Requirement (begin at 12 bars)		Net FULL Irrigation Requirement (begin after harvest)	
		(inches/ period)		(inches)	(inches/ period)	gallons/ vine/day*	gallons/ vine/wk*	gallons/ vine/day*	gallons/ vine/wk*
Jan		0.99							
Feb		1.80							
Mar1-15		1.48							
Mar 16-31	0	2.07	0.05	0.10	0.06	0.1	1		
Apr 1-15	15	2.45	0.10	0.25	0.15	0.4	2		
Apr 16-30	30	2.87	0.20	0.57	0.34	0.8	6		
May 1-15	45	3.19	0.25	0.80	0.48	1.1	8		
May 16-31	61	3.72	0.30	1.12	0.67	1.5	10		
Jun 1-15	76	3.80	0.35	1.33	0.80	1.9	13		
Jun 16-30	91	3.98	0.40	1.59	0.96	2.3	16		
Jul 1-15	106	4.05	0.50	2.03	1.22	2.9	20		
Jul 16-31	122	4.14	0.50	2.07	1.24	2.8	19		
Aug 1-15	137	3.61	0.50	1.81	1.08	2.6	18		
Aug 16-31	153	3.45	0.50	1.73	1.04	2.3	16		
Sept 1-15	168	2.83	0.50	1.42	0.85	2.0	14		
Sept 16-30	183	2.37	0.50	1.19	0.71	1.7	12		
Oct 1-15	198	1.92	0.30	0.58	0.35	0.8	6	1.3	9
Oct 16-31	214	1.53	0.20	0.31	0.18	0.4	3	0.7	5
Nov 1-15	229	1.02	0.15	0.15	0.09	0.2	2	0.3	2
Nov 16-31	245	0.71	0.01	0.01	0.00	0.0	0	0.0	0
Dec		0.90							
TOTAL		59.2		17.0	10.2	8.1 inches/season			

Notes:

A = Historical Reference Water Use (ETo) for Brentwood. Get current ETo values from <http://www.cimis.water.ca.gov/cimis>

B = Crop Coefficient (Kc) based on the size of the canopy.

To calculate your own vineyard Kc: [Average width of the midday shade under vines (ft)/ Row spacing (ft)] x 100 x 0.017

C = Full Water Use (ETc) = ETo x Kc

D = Deficit Water Use amount selected for this vineyard was 60% of ETc.

The deficit amount can range from 35%-60% ETc depending on vine vigor and soil water table.

E = Selected deficit threshold was -12 bars which was reached on June 15th. Deficit irrigation of 60% ETc began 6/16

To convert inches (column D) to gallons/vine (columns E&F):

$\text{Gallons/vine/day} = \text{inches/period} \times .622 \times \text{vine spacing}$
(sq.ft.)

days/period