

CROP CURRENTS

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July 2014

- How Much Water Do Trees & Vines Need
- Mid-summer Water Curtailment?
- Water Quality Considerations
- Funding for Irrigation System Improvements
- Cherry Buckskin Survey Results
- Orchard July Leaf Analysis
- Calendar

HOW MUCH WATER DO TREES & VINES REALLY NEED?

The amount of water that plants need is called evapotranspiration (ET) and depends both on climate as well as the size of the plant (leaf area). Because permanent crops like trees and vines leaf out similarly from year to year, it is possible to put together a pretty good estimate of water needs over the course of the season based on historical weather records. There may be some variation from week to week compared to this year's actual weather, but by the end of the season, the cumulative differences are pretty minimal. It is harder to put together a general schedule like this for annual crops or alfalfa as their size will vary with planting date, variety, growth rate, cutting date and other site specific factors.

The chart on the next page shows the amount of water that MATURE trees and vines need from all sources (rainfall, irrigation, stored soil moisture) based on historical climate records for our area. An orchard/ vineyard is considered mature and uses the full amount listed if it shades over 60% of the ground at (solar) noon in the middle of the summer. If it shades less, the water use will be reduced proportionally. For example, if only 30% of the ground is shaded, then the orchard/vineyard will use ½ the amount of water listed in the chart.

Rainfall typically supplies most of the water needs from late fall to early spring. What isn't used immediately by the crop or cover crop (or weeds) is stored in the soil for later use. The amount stored depends on the amount of rainfall, the depth of your root system, and the water holding capacity of your soil. We generally consider the root zone to be 4-5 feet in our deep, uniform soils. A Brentwood clay loam soil holds about 10" of available water in the entire 5 foot deep rootzone. The

water holding capacity per foot of soil for various soil textures are generally as follows:

Clay	1.7 to 2.0 inches
Clay loam	2.0 to 2.4 inches
Sandy loam	~1.5 inches
Gravelly loam	1.0 to 2.0 inches

Once the trees or vines have used ¼ to ½ of the water in the root zone, it is time to begin irrigating. Turn your system on long enough to replace most of the water used (but never more!). If rain falls after you begin irrigating make sure to add that contribution to your water storage calculations and adjust your irrigation accordingly. If you want to control vigor like we typically do in vines, let them dry down a little more using at least ½ of the soil water before irrigating and only add a set proportion of the water they will need till the next irrigation, not the full amount (see more on deficit irrigation below).

In order to know how often and how long to irrigate, you need to know how much water your system puts on per hour and per set. Then every time your orchard/vineyard uses up your set amount, turn your system on to replace the deficit, keeping the plants in their target vigor range. If you have a full coverage irrigation system, you can simply put out a series of catch cans to check the application rate (inches per hour). Sprinkler applications can range from 1.5 to 6 inches in a 24 hours set. If you have drip or partial coverage sprinklers, you'll want to calculate the gallons per hour each emitter/sprinkler puts out by catching the discharge in a bucket. You can convert the information in the chart to gallons per plant (tree or vine) per period using the following equation:

$$\text{Gallons/plant} = \text{inches/period} \times .622 \times \text{plant spacing (ft}^2\text{)}$$

The plant spacing is the distance between rows times the distance between plants in the row in feet. If you want to convert this to gallons per DAY simply divide by the number of

days in the period. I have developed a spreadsheet that can do this conversion automatically so if you provide me with :

- 1) your tree/vine spacing
- 2) your irrigation discharge rate

I can generate a customized chart for your orchard/vineyard.

A look at the chart below will show that July is the highest water use month, followed by June and August, followed by May and September. Use the "cover crop" column when you have a full cover crop (or full crop of weeds) on the orchard/vineyard floor. When the cover crop is disked in or dies, switch to the "bare soil" column. Note that a full cover crop can increase orchard/vineyard water use by 20-30%. If there is spotty cover or weed growth, the water use will fall somewhere in between the cover crop and bare soil column.

If a look at the chart indicates you may have been under irrigating, be careful in any attempt to catch up. If you need to increase your irrigation, DON'T IRRIGATE FOR LONGER THAN 24 HOURS AT A TIME, but instead shorten the interval between irrigations and irrigate more frequently. Running an irrigation set for longer than 24 hours can predispose the trees/vines to waterlogging and root rot and sometimes crop drop or poor quality – especially on our heavy soils.

Deficit Irrigation. We typically utilize a deficit irrigation strategy on bearing winegrapes and oil olives to improve crop quality and oil volume. The deficit program for oil olives in the chart is based on applying 65% of the reference water use (ETo) for most of the year but reducing this by ½ from June through mid August. This program works well for most olives regardless of variety.

The deficit irrigation program for grapes is more complex and it will vary by variety, rootstock, and training/trellising system. Red grapes are typically subjected to a higher deficit than white grapes. More vigorous varieties and rootstocks may also require a more severe deficit which can range from 35-60% of full water use. The deficit water use for winegrapes in the table below is applicable for a mature, full canopied (California sprawl), moderate vigor, red grape variety with no water table. It is based on applying only 60% of the full water requirement through harvest and 100% after harvest. It may not be accurate for other situations. For most winegrapes, it is preferable to calculate a specific crop coefficient for the vineyard (based on % ground shaded) and to decide on a deficit amount based on the variety, rootstock, soil and winemaker needs. Give me a call if you would like more information on this.

TREE AND VINE WATER USE for BRENTWOOD/TRACY/LIVERMORE											
Date	Ref. ETo (grass)	Deciduous Tree Full Water Use		Table Grapes Full Water Use		Wine Grapes Deficit Irrigation		Table Olives Full Water Use		Oil Olives Deficit Irrigation	
	(inches/period)	(inches/period)		(inches/period)		(inches/period)		(inches/period)		(inches/period)	
		bare soil	cover crop	bare soil	cover crop	bare soil	cover crop	bare soil	cover crop	bare soil	cover crop
Jan	0.99		0.87		0.87		0.87	0.74	1.04	0.64	1.04
Feb	1.8		1.62		1.62		1.62	1.35	1.89	1.17	1.89
Mar 1-15	1.48		1.38		1.38		1.38	1.11	1.55	0.96	1.55
Mar 16-31	2.07	1.12	1.95	0.10	1.95	0.10	1.95	1.55	2.17	1.35	2.17
Apr 1-15	2.46	1.48	2.34	0.54	2.33	0.54	2.33	1.85	2.58	1.60	2.58
Apr 16-30	2.87	1.89	2.90	1.06	2.90	1.06	1.74	2.15	3.01	1.87	3.01
May 1-15	3.19	2.33	3.38	1.56	3.38	0.94	2.03	2.39	3.35	2.07	3.35
May 16-31	3.72	2.94	4.05	2.23	4.05	1.34	2.43	2.79	3.91	2.42	3.91
Jun 1-15	3.8	3.19	4.29	2.66	4.29	1.60	2.58	2.85	3.80	1.24	1.90
Jun 16-30	3.98	3.42	4.54	3.02	4.54	1.81	2.72	2.99	3.98	1.29	1.99
Jul 1-15	4.05	3.77	4.70	3.28	4.70	1.97	2.82	3.04	4.05	1.32	2.03
Jul 16-31	4.14	3.89	4.80	3.52	4.80	2.11	2.88	3.11	4.14	1.35	2.07
Aug 1-15	3.61	3.39	4.26	3.10	4.26	1.86	2.56	2.71	3.61	1.17	1.81
Aug 16-31	3.45	3.24	4.07	2.93	4.07	1.76	2.44	2.59	3.45	2.24	3.45
Sept 1-15	2.83	2.66	3.34	2.32	3.34	1.39	2.00	2.12	2.83	1.84	2.83
Sept 16-30	2.37	2.16	2.70	1.82	2.70	1.82	2.70	1.78	2.37	1.54	2.37
Oct 1-15	1.92	1.63	2.13	1.21	2.13	1.21	2.13	1.44	1.92	1.25	1.92
Oct 16-31	1.53	1.21	1.67	0.69	1.67	0.69	1.67	1.15	1.53	0.99	1.53
Nov 1-15	1.02	0.71	1.07	0.29	1.07	0.29	1.07	0.77	0.97	0.66	0.97
Nov 16-31	0.71	0.00	0.68	0.01	0.68	0.01	0.68	0.53	0.67	0.46	0.67
Dec	0.9		0.79		0.79		0.79	0.68	0.86	0.59	0.86
TOTAL	52.89	39.04	57.53	30.36	57.52	20.51	41.39	39.67	53.69	28.02	43.90

MID-SUMMER WATER CURTAILMENT?

There is a very real possibility that irrigation water deliveries from the Byron Bethany Irrigation District may be shut off mid-summer pending a decision by the State Water Resources Control Board. The water supply from the East Contra Costa Irrigation District seems to be more secure. The situation is unfolding rapidly so keep in touch with your irrigation district for the most current update.

Annual crops. The impacts of a water shutoff on annual crops are likely to be immediate and obvious and may be more or less severe depending on the expected harvest date. Yields will decline within a few days to weeks after irrigation stops depending on the plant needs and past irrigation schedule and method.

Alfalfa. An irrigation curtailment in July will induce the stand to go into a summer dormancy. If the stand is in good shape it can usually fully recover from this without being compromised once water returns. The exceptions may be if the field is on heavily cracking clay soils or very sandy soils. This dormancy will of course reduce yields. In this area we have usually harvested about 50% of the yield by mid June and 75% by mid July. So you will lose the later cuttings but this is at a time when the hay quality isn't quite as good anyway.

Trees and Vines. The impact is likely to be felt not only this year but in future years as well. If you have not yet harvested, you can expect reduced yields and quality this year. The severity of those impacts will depend on how close to harvest the cutback occurs. You can expect reduced yields next year as well since the fruit buds for next year are developing this year.

Don't over irrigate. There are a few things that you can do to minimize the effects of a water cut off on trees and vines. The first is to keep your crops fully irrigated *but not over irrigated* for as long as you have water. Refer to the water use chart on the previous page as a guide. Resist the urge to "store" extra water in the root zone which can lead to water logging and root damage or disease and make roots LESS able to take up any water that is available. Don't irrigate for longer than 24 hours in a single set.

Remove the cover crop. Another important step would be to control weeds and eliminate any cover crop that is in your orchards. Cover crops have a number of

excellent benefits but they also increase water use in your orchard by 20-30 %. And their benefits related to improved water penetration and quick orchard access are not relevant unless you are watering. You can replant the cover when the water situation improves much more easily than replanting an orchard.

Mature orchards with deep established root systems are likely to be stressed but survive the curtailment. Young orchards with less established root systems may have a more difficult time. However, young trees don't need as much water so this may tip the balance in their favor – particularly if you are able to occasionally tank in some water. One of the challenges with a tank irrigation is figuring out how to apply it slowly enough that it doesn't just wet the surface but penetrates deeply enough to get to the roots. A shallow cultivation or pulling ditches on either side of the row before tanking can help.

Whitewash? Spraying the trees with a light reflecting material like Surround can reduce sunburn on nuts but does not improve water status of the tree and can in fact accelerate water loss and leaf drop on walnuts when trees are water stressed. So beware.

Pruning off major scaffold limbs to reduce water use in mid-summer is more likely to cause long term problems than benefit. It can lead to sunburn on large limbs and structural problems for years to come. Research in almonds has shown that unpruned trees that survived without any irrigation recovered to full production more readily than those that had been heavily pruned once normal irrigation resumed.

Crop removal may be of limited benefit. It won't reduce water use as transpiration occurs through the leaves not the fruit or nuts. In fact moisture can move from the fruit/nuts back into the tree at night to slightly improve water status. However, if you have a heavy set of fruit that is bending limbs and exposing them to sunburn, fruit thinning that keeps the limbs more upright may help to shade limbs and reduce the sun damage.

The primary goal should be to save the trees. So grit your teeth, manage the water carefully while you have it, remove the cover crop/weeds as soon as it is gone, and let them dry down naturally with little interference. If you have a way to truck water to young trees/vines take advantage of that.

WATER QUALITY CONSIDERATIONS

We expect the water to be a little saltier this year as there has been a lot less “pure” rainfall and snowmelt contributing to the river water. If the water is too salty the plants expend a lot of energy excluding the salt when they take up water and this occurs at the expense of growth and yield.

The salt content of our river water normally changes over the season as you can see from the 3 year chart on the next page. We typically have higher salts in the fall (and winter if we don’t have much rain) and lower salts in the spring and summer as snow melt and water releases are added to the river. The chart is for the Clifton Court Forebay but is pretty representative of the water delivered by both Byron Bethany and East Contra Costa Irrigation Districts. Salt levels typically range between 200 and 800 uS/cm. This winter they were slightly over 1000 uS/cm for a few weeks in February & March but have been between 450 and 800 uS/cm since mid March when the irrigation season typically starts.

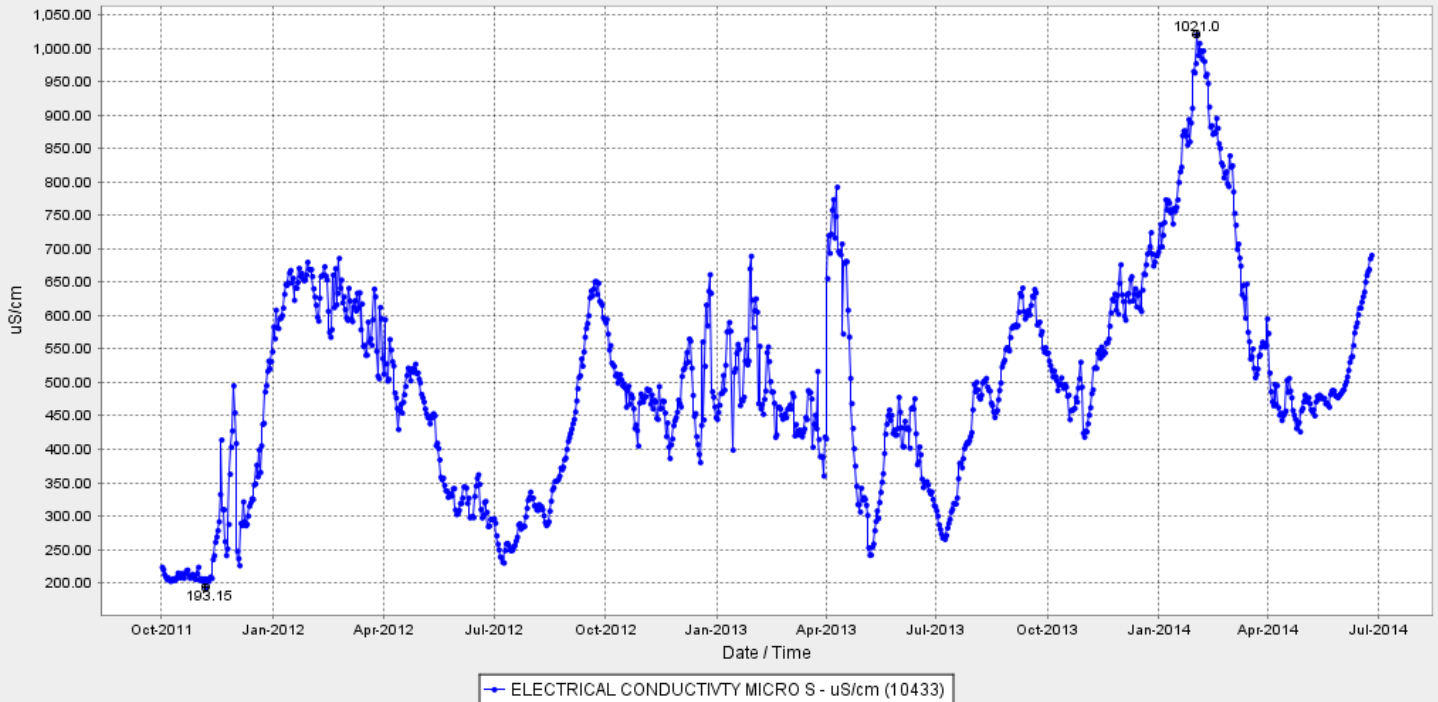
How much salt is too much? Well, it depends on the crop and the AVERAGE salinity of the irrigation water THROUGHOUT the season. Generally, if water is below 700 uS/cm it is suitable for even the most sensitive crops like beans and strawberries and won’t have any negative effect on growth and yield – the plants should be able to achieve 100% of their potential yield (see the Yield Potential Table). Sweet corn, peppers, and most of our tree fruit can tolerate salinity up to 1000 or 1100 all season long without any effect on yield. It is unusual for our salinity to get as high as 1000 during the irrigation season, but it might later this year. If it goes a little above the maximum threshold (the 100% yield column) for your crop as the season progresses, it’s OK if the salinity has been lower than that for much of the season. Many of our sensitive trees can tolerate salinity as high as 1400-1500 all season long with only a 10% reduction in yield.

Don’t skip an irrigation if the water is saltier than the threshold – instead, irrigate a little more frequently! This may sound counterintuitive. You are adding a little more salt but you are also adding a lot more water. This helps to keep the salts that ARE in the rootzone more dilute and it takes less energy for the plants to extract the water. So the best approach is to keep the rootzone a little moister with shorter, more frequent irrigations if the water is a little salty.

CROPS		YIELD POTENTIAL due to irrigation water salinity (uS/cm)				
		100%	90%	75%	50%	0%
Field Crops						
MS	Alfalfa	1300	2200	3600	5900	10000
MS	Corn	1100	1700	2500	3900	6700
Vegetable Crops						
T	Asparagus	2700				
MT	Zucchini	3100	3800	4900	6700	10000
MT	Artichoke					
MS	Scallop Sqsh.	2100	2600	3200	4200	6300
MS	Garlic	2000				
MS	Tomato	1700	2300	3400	5000	8400
MS	Cucumber	1700	2200	2900	4200	6800
MS	Corn	1100	1700	2500	3900	6700
MS	Pepper	1000	1500	2200	3400	5800
MS	Kale					
MS	Melon					
MS	Pumpkin					
S	Onion	800	1200	1800	2900	5000
S	Bean	700	1000	1500	2400	4200
Fruit and Nut Crops						
MT	Fig					
MT	Olive	2800				
MT	Pomegranate					
MS	Grape	1000	1700	2700	4500	7900
S	Citrus	1100	1600	2200	3200	5300
S	Peach	1100	1500	1900	2700	4300
S	Apricot	1100	1300	1800	2500	3800
S	Almond	1000	1400	1900	2800	4500
S	Plum	1000	1400	1900	2900	4700
S	Apple					
S	Cherry					
S	Loquat					
S	Pear					
S	Persimmon					
S	Walnut					
S	Blackberry	1000	1300	1800	2500	4000
S	Strawberry	700	900	1200	1700	2700
Codes: <i>T = Tolerant</i> <i>MT = Moderately Tolerant</i> <i>MS = Moderately Sensitive</i> <i>S = Sensitive</i>						

CLIFTON COURT (CLC)

Date from 09/30/2011 16:42 through 06/26/2014 16:42 Duration : 1000 days
Max of period : (02/01/2014 00:00, 1021.0) Min of period : (11/06/2011 00:00, 193.15)



RCD SEEKS FUNDING FOR LOCAL IRRIGATION SYSTEM IMPROVEMENTS

In 2008, the Contra Costa Resource Conservation District (CCRCD) provided financial assistance to several local farmers to help them convert flood and furrow irrigation to drip irrigation on over 300 acres. Those projects reduced water use and tailwater discharge, improved water quality by lowering suspended sediments, improved productivity for some crops, and reduced weeds, yielding cost savings for the participating growers. Since that time, the USDA Natural Resources Conservation Service has assisted numerous other growers with similar voluntary practices.

The CCRCD is working with the San Joaquin RCD to seek new grant funding to build on that work and assist growers in their compliance with requirements for the Irrigated Lands Regulatory Program. *In order to be successful in obtaining the funds, we need to demonstrate a high level of interest from local farmers.* Please let them know if you would be interested in technical and financial assistance with irrigation efficiency and water quality improvements, such as:

- Converting flood and furrow irrigation to micro-sprinkler or drip irrigation.

- Replacing an old, poorly operating sprinkler or drip system with a properly functioning and more efficient system.
- Evaluating the efficiency and output of your current irrigation system with recommendations for increased efficiencies.
- Assistance with scheduling and management to optimize your irrigation.
- Stabilizing banks of an on-farm waterway to reduce erosion and sediments, and improve water quality.

As always, any RCD program is completely voluntary and your farm and ranch information remains confidential.

If you think you might be interested in these or other projects that improve water quality and irrigation efficiency, **contact Ben Wallace, by July 9, 2014.** There is no obligation to participate but your interest and input will help them obtain the funds and assure that projects meet our specific local needs. You can reach him at:

Ben Wallace
Executive Director, CCRCD
5552 Clayton Road
Concord, CA 94521
(925) 672-6522 ext. 106
ben.wallace@ca.nacdnet.net

CDFA WATER EFFICIENCY GRANTS

Due to the current drought, the California Department of Food and Agriculture (CDFA) has recently announced a competitive grant program called the State Water Efficiency and Enhancement Program (SWEET). The purpose is to provide financial assistance for agricultural operations to invest in irrigation systems that reduce water and energy use, augment supply and increase water and energy efficiency. An estimated \$10 million will be available through this program.

For detailed information and program requirements access the Application Guidelines at www.cdfa.ca.gov/go/WEEP. **Applications must be received by Tuesday, July 15, 2014** and be submitted electronically using the Financial Assistance Application Submittal Tool (FAAST). Set up a FAAST account at: <https://faast.waterboards.ca.gov>.

CDFA will hold an application webinar to provide information on program requirements and the FAAST application process on **July 8 from 9:30 to 11:30 a.m.** There is no cost for the webinar but you must register at grants@cdfa.ca.gov to get the webinar login and details.

Contact CDFA's Grants Office at grants@cdfa.ca.gov for more information.

CHERRY BUCKSKIN SURVEY RESULTS

Every year I coordinate a survey of the cherry orchards in Contra Costa County with the help of the Ag Dept and about 20 Master Gardener volunteers in an effort to keep Cherry Buckskin Disease from getting established in our area. Pat McKenzie with Mid Valley Agricultural Services has helped with the effort by covering the lab fees. Last year we found NO trees with the disease but I'm sorry to report that we found two diseased trees this year. Both trees were in an orchard that has had a history with the disease and is near the site of the original infection at Walnut Blvd and Eureka Ave. The orchard has a small, localized "hot spot" that continues to show a few infected trees most years. We have not found the disease in any other orchard since 2009. So while we haven't yet eradicated this disease, we have definitely managed to contain it with careful monitoring and management.

In order to preserve the headway we have made, it is important for cherry growers in the core area - within 1 mile of Walnut Blvd. & Eureka Ave. – to continue to be diligent in their preventative management efforts.

A key component of this is **controlling leafhoppers** from late June/early July through mid-October. This requires 3-4 sprays depending on the materials and rates that you use. The following materials are good leaf hopper products and will last as indicated:

- Asana @ 10 oz/A 4 weeks
- Asana @ 14 oz/A 6 weeks
- Actara @ 5.5 oz/A 4 weeks
- Danitol @ 10.7 oz/A 4 weeks
- Danitol @ 21.3 oz/A 5 weeks
- Warrior @ 2.56 oz/A 5-6 weeks

Asana can lead to mite flare ups. The lower rates of Asana will cause fewer problems than the higher rates. Consider including a preventative miticide with the spray, especially in the early season applications, to prevent later mite problems. Warrior and Danitol are less likely to promote mites. Actara can only be used once/season.

Organic options: We don't have good research based data on the effectiveness of organic materials for leafhopper control. Potential organic options include Surround (kaolin clay), Oil, Pyganic (pyrethrum), and Ecotrol (volatile plant oils). If you are organic and near an infected orchard it might be prudent to use Surround (either alone or mixed with 1-2% oil) after harvest to discourage leafhoppers from entering your orchard.

Controlling the weeds that host the disease or leafhoppers from the orchard floor is also important in reducing the likelihood of infection and spread. This includes controlling all clovers, dandelion, and curly dock. Clovers are common components of cover crops but these mixes should NEVER be used in cherries.

Photos of the disease, plant hosts, and vectors and more information can be found on the Cherry page of my website at:

http://cecontracosta.ucanr.edu/Commercial_Agriculture/Crops/CROP_INFORMATION/Fruits_and_Nuts/Cherries

ORCHARD JULY LEAF ANALYSIS

Leaf nutrient levels change throughout the season but there is a period of time in July when they are fairly stable. This is a good time to do a leaf analysis which can reveal not only specific nutrient deficiencies but can alert you to developing trends when compared to July critical values and your results from previous years.

Taking the Sample: For *deciduous trees*, collect 1 or 2 leaves from 50 to 100 trees throughout the block until you have gathered about 100 leaves. Select fully expanded, mature leaves from non-fruiting spurs. For *olives*, collect 100 leaves from the middle of non-bearing current season shoots.

Trees of different varieties, rootstocks and ages should be sampled separately. Likewise trees grown on different soil types or with different irrigation systems should be sampled separately. If you have applied any foliar nutrients, tell the lab to wash the samples. Otherwise, you will get a false high reading because of the excess material on the outside of the leaf.

Once the sample is collected, place the leaves from each sample in a clean bag with an identifying label and send them to the lab as soon as possible. Include your contact information and the type of analysis you want. A List of Labs that do agricultural testing and a Table of Critical Nutrient Values can be found in the Soil-Water-Nutrient section of my website at: http://cecontracosta.ucanr.edu/Commercial_Agriculture/Crops/MANAGEMENT_INFORMATION/.

What to test for: If you've never had a leaf analysis done on your orchard before, it would be a good idea to analyze at least for N, P, K, and Zn to get some good baseline data. If there are symptoms of marginal burn, you should make sure the test includes Sodium (Na), Chloride (Cl) and Boron (B). Many labs have a complete analysis package that is cheaper than ordering individual analysis.

The levels can vary slightly from year to year due to weather, cultural practices or other orchard conditions. For example, an excessive crop load can reduce the percentage of K and increase Ca and Mg levels. High (not excessive) soil moisture conditions tend to increase P, K, Mg and Ca levels, probably due

to increased root activity. The improved water and nutrient status can lead to increased top growth which, in turn, may result in lower leaf N levels due to "dilution".

CALENDAR

July 10

WEED DAY 2014

UC Davis

Registration: \$120 after 6/26/14.

<http://wric.ucdavis.edu>; click on **WEED DAY**

Be a Weed Day sponsor and receive a complimentary registration with a \$500 amount

July 16

VINEYARD HERBICIDE TRIAL FIELD MEETING

9 am - 10:30 am

FREE

Location: Napa: off Hwy 221, about 1 mile N of the Hwy 12 cutoff on Anderson Road, behind the P G & E substation (follow the signs)

More Info: <http://cenapa.ucanr.edu/?newsitem=52052>

July 21

OLIVE OIL SHORT COURSE:

The Intricacies of Olive Oil

8:30 am-2:30 pm

University of California Cooperative Extension Office
133 Aviation Blvd. #109, Santa Rosa, CA

Registration: \$95, by July 11th

<http://cesonoma.ucanr.edu/SpecialtyCrops/OLIVES/>

Six-hour course fee includes instruction and the focused tasting of 18 olive oils, plus a coffee welcome at morning registration, snack break, and catered lunch. Class size is limited.

September 16-18

SENSORY EVALUATION OF OLIVE OIL

Certificate Course

UC Davis, Robert Mondavi Institute

Registration: \$745 until August 16, 2014

\$895 after August 16, 2014

<https://registration.ucdavis.edu/Item/Details/121>

September 23-25

FRESH CUT PRODUCTS WORKSHOP:

Maintaining Quality & Safety

Alumni Center, UC Davis

Registration: \$1150

<http://postharvest.ucdavis.edu/Education/FreshCut/>

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TIME SENSITIVE MATERIAL

UCCE – CONTRA COSTA COUNTY
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PLEASANT HILL, CA 94523-4215