UNIVERSITY OF CALIFORNIA **COOPERATIVE EXTENSION**

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THE SCOOP

on fruits and nuts in Stanislaus County

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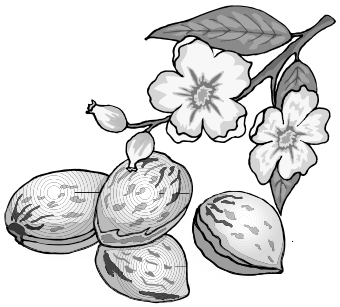
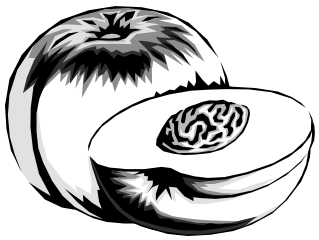
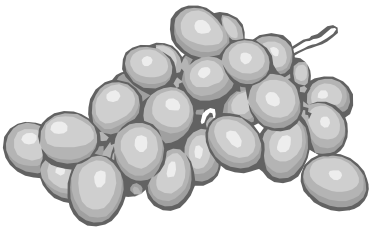
by Roger Duncan

Pomology and Viticuture Advisor







Stanislaus County

Almond Field Day

Sponsored by the University of California Cooperative Extension

Wednesday, May 28, 2008
9:00 – 11:00
6618 Faith Home Road, Ceres
(1/2 mile south of Keyes Road)

- **Observation of Nonpareil and Carmel Almonds Grown on Fifteen Rootstocks**
  Roger Duncan; Farm Advisor, UCCE Stanislaus County
- **Hands on Demonstrations of Soil Moisture Monitoring Devices**
  Dr. Larry Schwankl; Irrigation Specialist, Kearney Ag Center
- **Irrigation Scheduling in Almonds Using Plant-Based Measurements (Pressure Bomb)**
  Dr. Bruce Lampinen; UCCE Pomology Specialist, UC Davis
- **The Story on Crazy Top (Noninfectious Bud Failure) in Carmel Almonds**
  Dr. Tom Gradziel; Professor & Almond Breeder, UC Davis

No Continuing Education Units will be offered for this event.

U.S. Department of Agriculture, University of California, and Stanislaus County Board of Supervisors cooperating

Summary of University of California Research on Irrigation Management for Almond Trees Under Drought Conditions

For maximum growth, yield, crop quality and orchard longevity, almonds trees should be supplied with enough water to meet their full water requirement. There are some disease concerns with hull rot under full water conditions which can be addressed with moderate water stress during hull split. If water availability is limited, growers can react by applying irrigation water when trees are most sensitive to stress and by taking measures to minimize water losses that occur during irrigation events. Supplying less water than the trees can potentially use reduces soil water availability, causes tree water deficits, and reduces transpiration. Cover crops, depending on the coverage and the time of the season in which they are grown can increase the orchard water use by up to 30%. Cover crops should be removed when water is in limited supply.

Water deficits affect almond orchards not only in the year in which stress occurs, but also in the following seasons. Generally, nut size is reduced in the first season of significant water stress. Because water stress also reduces vegetative growth and potentially decreases productivity per unit canopy volume, nut load can be reduced in subsequent years. Recent research indicates some stages of almond fruit growth are more sensitive to water stress than others. Understanding these stages permits growers to withhold water while minimizing damage to trees and to current and subsequent crops.

Early Season Stress

Water stress affects more tree and crop development processes during the early season from leaf out through shoot growth and development of terminal and lateral buds. During this period, rapid vegetative development is necessary for canopy development and fruiting positions for the following season. In addition, orchard water use during this time is low compared to summer demand, reducing potential water savings from an early-season deficit irrigation strategy.

Fruit Growth and Development Period

Nuts undergo a rapid growth phase early in the fruit growth and development period and are sensitive to water deficits during this time. However, trees can tolerate drought stress fairly well during the two months prior to harvest, allowing for the successful use of deficit irrigation strategies during this period. Providing less than the full water requirement to cause moderate water stress during this period will have little influence on kernel weight. However, severe water stress in the months leading up to hull split will reduce kernel weight and significantly reduce hull splitting. A one-inch irrigation prior to hull split will mitigate the water stress impacts and will improve hull split and reduce the number of hull-tights. If drip irrigation is used, possibly less irrigation can provide the same benefit, but this has not been proven in the field.

Post Harvest Stress

The effect of water deficits during the postharvest period are substantially affected by 1) pre harvest water deficits and 2) the quantity of water use over the remainder of the season. Bud differentiation can continue through mid-September. Moderate stress during this period will have little effect on subsequent year's nut numbers, but severe stress during bud differentiation has been found to dramatically reduce fruit set the following spring. In early harvest (early August) districts, particularly with early varieties, more of the high water use season remains after harvest. This increases the necessity for postharvest irrigation. Later harvest (north State) districts and later varieties have a slightly shorter postharvest period which occurs at a time of lower crop water demand. These factors reduce the chance of moderate water deficits causing bud differentiation problems.

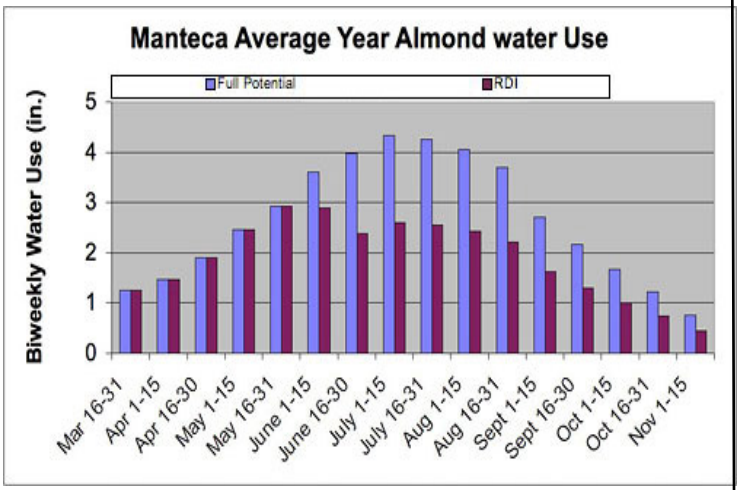
Tree response to postharvest stress can be influenced by the type of irrigation system used, and the previous irrigation management. Low volume systems with limited soil water reserves can result in severe water deficits very quickly after irrigation cut off. In the southern San Joaquin Valley where harvest is earlier than in the north, or with drought-sensitive varieties, postharvest irrigation is a necessity. Deep rooted, surface irrigated trees may have enough pre-harvest deep

moisture remaining to carry them through the critical period of bud differentiation. This all depends on the irrigation management occurring pre-harvest.

Developing a Deficit Irrigation Strategy

Crop water use. Almond water use begins when the leaves develop and shoot growth begins. Concurrent with canopy development, the climatic demand increases, driven by longer days and higher temperatures and low humidities as the season progresses. Both of these factors result in a seasonal water use starting at a low level, peaking in mid-season and falling as the season ends. Sources of water available to trees include: soil-stored moisture (including frost protection water applications if the root zone is less than field capacity when applications are made), any in-season rainfall absorbed by the soil, and applied irrigation water. These all combine to determine the total seasonal water available to the orchard.

Mature conventionally spaced almond trees in the Southern Sacramento Valley can use about 41 - 44 inches of water in an average year of unrestricted water use. High-density orchards, long pruned orchards, or those with a cover crop can have even higher use. Soil moisture monitoring demonstrations in more than 40 almond orchards in Kern County indicate that seasonal water use in the southern San Joaquin Valley may be as high as 50 - 54 inches. The graph below shows a typical water use pattern for fully irrigated almonds and a deficit irrigation regime in the Manteca area.



The moderately deficit irrigated orchard used (in a combination of soil supplied and irrigation water) 28 inches of water or about 34% less than the full potential orchard.

Water deficits. Water deficits occur when the climatic water demand exceeds the water absorbed by the roots. As the soil becomes depleted of readily available moisture, water uptake by the roots lags behind water use causing plant stress in the mid to late afternoon. This minor crop water deficit has little effect on the crop yield. However, as soil water becomes increasingly difficult to extract, water stress increases. One way to measure tree stress is to use a portable pressure chamber to measure midday stem water potential. To use this technique a few leaves from representative trees are first covered with an opaque plastic bag while still on the tree. The covers need to remain on the leaves at least 10 minutes after which they are detached and the water potential measured using the pressure chamber. The pressure chamber measures the amount of pressure needed to force water out of the leaf petiole, indicating the tree's water status. For more information on using the pressure bomb, go to the UC Davis Pomology web page at: "http://fruitsandnuts.ucdavis.edu/crops/Almond_MiddayStemWaterPotential.pdf".

A moderate water stress strategy. From the previous discussion it can be concluded that tree water use from leaf out through mid-June should not be compromised. From mid-June through harvest, reductions up to 50% of full water use have been successfully used to reduce orchard water use. The best results were achieved when water applications occurred at a uniform deficit rate across the season relative to full potential crop ET. The uniform deficit rate does not mean a uniform irrigation amount across the season (e.g. 1.5 inches each week), but rather a uniform (e.g. 85%) reduction of full ET for each period. Deficit irrigation rates of 55%, 70%, and 85% were tested with the 70% and 85% irrigation reduction treatments showing little yield loss compared to the full ET treatment. The 70% and 85% uniform across the season deficit treatments experienced little early season stress, likely because stored soil moisture supplemented the applied irrigations. Another approach that is likely an improvement over the approach outlined above is to schedule irrigations using periodic pressure chamber readings and irrigate when midday stem water potential reaches a pre-determined threshold stress level.

This method effectively extends the irrigation interval, but the interval is determined by tree water status rather than the calendar. Irrigations should be in the volume of a normal set as performed with a full irrigation regime. In a deficit irrigation study conducted on mature almonds in Manteca, delaying irrigation until a midday stem water potential threshold value of -20 to -22 bars was achieved, resulted in 34% less tree water consumption. This had no significant influence on yield for the 4-year measurement period. It should be noted that a reduction in vegetative growth was measured in this treatment, indicating that use of this threshold for a longer-term strategy (more than 4 years) may reduce yields by reducing nut numbers. The impact of stress on a developing tree canopy is much more detrimental as opposed to the impacts on a canopy that has already reached its full volume.

A more severe water stress strategy. A more severe strategy that reduces seasonal tree water use by 50% requires that stress be imposed early as well as mid to late season. Using this strategy, irrigations in April and May are withheld until trees reach a midday stem water potential of -12 to -14 bars. Using conventional sprinklers, a normal set time is used. If lighter applications are made, more water is lost by evaporation. From June 1st through hull split, midday stem water potential values should be allowed to reach -20 to -22 bars prior to irrigation. This strategy will require a pre-harvest irrigation of about 2 inches with sprinklers but less with micros and drip to ensure good hull split. Note: this strategy reduces water use significantly but also reduces nut weight the year it is used and the nut number in succeeding years. In the Manteca trial discussed above, it took 2 years of full irrigation for trees to recover.

A "staying alive" drought strategy. Less is known about this strategy since it is a rarely used option. However, based on past drought conditions, trees may be kept alive with about a foot of applied water. This strategy does not consider growth and yield, just tree survival. This strategy is best conducted using a micro-irrigation system which maximizes water distribution and minimizes evaporative losses from irrigation. Using this strategy no irrigation is applied until water potential reaches -16 bars from leaf out through the end of May. Monitor stem water potential until the threshold is reached again then repeat the cycle. After June 1st, and for the rest of the season allow the stress to climb to -25 bars prior to irrigation. As a guide, try to just retain the leaves on the tree. Good luck, as this is only a guide. Remember that following this severe deficit strategy, it will take at least 2 years of full irrigation for the trees to recover to normal yields.

Contributors to this article: Allan Fulton, UCCE Irrigation and Water Resources Advisor; Dave Goldhamer, UCCE Water Management Specialist; Bruce Lampinen, UCCE Integrated Orchard Management Walnut and Almond Specialist; Terry Prichard, UCCE Water Management Specialist; Blake Sanden, UCCE Irrigation & Agronomy Farm Advisor; Larry Schwankl, UCCE Irrigation Specialist; Ken Shackel, Professor, Plant Sciences, UC Davis

UC Water Management Tool Features Almonds

Irrigation and water management specialists from the UC Division of Ag and Natural Resources have developed a Web site that compiles University research results from years of studies on irrigation strategies and water management practices to be implemented during periods of reduced water availability. The research has been conducted by farm advisors, Extension specialists and UC researchers. Project leaders are Larry Schwankl, UC irrigation specialist, and Terry Prichard, UC water management specialist.

Lodi Regional Viticulture Research Road Show

Wine and Roses Hotel, Garden Ball Room
3700 Turner Road, Lodi, CA
(at Turner Road and Lower Sacramento Roads)
Wednesday, May 28, 2008
8:45 am to 4 pm, followed by a wine social

Brought to you by University of California Cooperative Extension & the Lodi Winegrape Commission

Speakers from the University of California will present their most current research findings to the local wine and grape industry. This meeting is sponsored in part by a grant from the American Vineyard Foundation.

Speakers and Topics:

- **Extended Ripening: From Grape to Wine Sensory**
  Dr. Hildegarde Heymann, Professor Sensory Scientist, UC Davis
- **The New University of California Rootstocks--Coming Soon to Your Vineyard**
  Dr. Andy Walker, Professor Geneticist-AES Vice Chair, UC Davis
- **Evaluation of Winegrape Cultivars & Clones for the San Joaquin Valley**
  Dr. Matthew Fidelibus, Assistant CE Viticulture Specialist, Kearney Ag Center
- **Evaluation of Cabernet Sauvignon Clones: Heritage, French & California Sources &**
- **Evaluation of Zinfandel Heritage Selections**
  Dr. Jim Wolpert, CE Viticulture Specialist, UC Davis
- **Syrah Disorder & Decline**
  Mark Bettany, Farm Advisor, UCCE San Luis Obispo County
- **Grape Importation News: Varieties & Clones**
  Deborah Golino, CE Specialist Director Foundation Plant Services, UC Davis
- **Identification of Factors that Influence the Level of Tannins & Polymeric Pigments in Grapes & Wines**
  Dr. Doug Adams, Associate Professor of Viticulture, UC Davis

Please register by Friday, May 23, 2008 at no charge
or $10 per person at the door (cash or check only)
RSVP at LWWC by phone 209-367-4727 or email to cliff@lodiwine.com

5 hours of CCA Continuing Education credit and 1.5 PCA credit.

THE SCOOP on fruits and nuts

Take a look at what's inside:

Summary of University of California Research on Irrigation Management for Almond Trees under Drought Conditions

Upcoming Meetings:

2008 Stanislaus County Almond Field Day

Wednesday, May 28, 2008 9:00 - 11:00 a.m.
6618 Faith Home Road, Ceres (1/2 mile south of Keyes Road)

Tree & Vine IPM Update Breakfast Meetings

June 4th & June 18th, 7:00 - 8:00 a.m.
Peach Tree Restaurant, 2535 E. Whitmore Ave, Ceres
These are the last two meetings, don't miss out!

Lodi Regional Viticulture Research Show

Wednesday, May 28, 2008, 8:45 a.m.- 4:00 p.m., Followed by a Wine Social
Wine & Roses Hotel, 3700 Turner Road, Lodi

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