COOPERATIVE EXTENSION UNIVERSITY OF CALIFORNIA

TREE AND VINE NOTES

MAY/JUNE 2002

Almond Field Day

June 11, 2002
8:30-11:00 AM
Location: Sherman Thomas Ranch, 25810 Avenue 11, Madera CA

8:00 AM PCA sign in and refreshments

8:25 AM Introduction: Brent A. Holtz, UCCE Madera County

8:30 AM Effects of Deficit Irrigation on Hull Rot
Dr. Beth Teviotdale, Extension Plant Pathologist, UC Davis/KAC

9:00 AM Ant control in the San Joaquin Valley
Rich Coviello, Entomology Farm Advisor, Fresno County

9:30 AM Navel Orangeworm and Peach Twig Borer Control Strategies in Almonds
Walter Odus Bentley, IPM Advisor-Kearney Ag Center

10:00 AM Carmel budfailure update for 2002
Dr. Bruce Lampinen, Almond and Walnut Extension Specialist, UC Davis

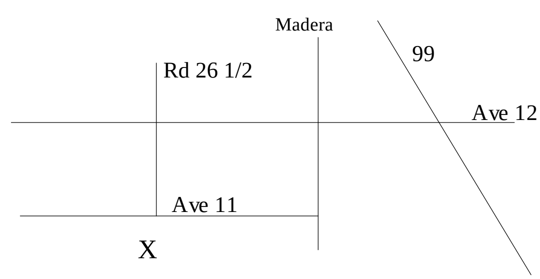
10:30 AM The effects of Surround on budfailure in one Carmel Orchard
Dr. Brent Holtz, UCCE Madera County

10:45 AM Watch out for Almond Leaf Scorch in Madera County
Dr. Brent Holtz, UCCE Madera County

11:00 AM Using a pressure bomb to take midday leaf water potential to monitor irrigations
Dr. Bruce Lampinen, Almond and Walnut Extension Specialist, UC Davis
and a field demonstration of the pressure bomb
B. Lampinen, B. Hotlz, Eric Hoffman, and Mike Braga (grower)

11:30 AM Adjourn

3.0 hours of PCA credit applied for
Sponsored by the University of California



Potassium Deficiency

Roger Duncan, UC Cooperative Extension, Stanislaus County

I have seen several almond orchards this spring exhibiting signs of potassium deficiency, especially in the shallow soils of the Sierra foothills. I am sure this has been exasperated by the very heavy set in most of these orchards. Symptoms of potassium deficiency normally begin in the tops of trees but can be distributed throughout the tree when deficiencies are more severe. Symptoms include leaves that are often pale and smaller than normal. Leaf tips and edges burn and often roll upward like a canoe or "Viking's prow".

Many growers are cutting back these days due to the small profit margin in almond production. However, potassium is an important nutrient and should not be neglected. Producing an almond crop requires approximately the same amount of potassium as nitrogen. A good guide to follow is approximately 10 pounds of potassium for every 100 pounds of nutmeats produced. That means a 2000-pound per acre crop will need approximately 200 pounds of potassium. However, unlike nitrogen, potassium is released slowly from soil particles and is not readily leached. Many soils in Stanislaus County naturally have adequate amounts of potassium and we rarely see potassium deficiencies in even unfertilized blocks, especially in virgin soil.

From our research trial located in Salida, we have learned potassium deficiency does not decrease fruit set and does not result in smaller nuts except under extremely deficient conditions. Yield loss results from the death of fruiting spurs, a lack of spur renewal and overall reduced growth of the tree. Therefore potassium deficiency results in long-term losses that may not show up the first year you see leaf symptoms. Along the same lines, recovery from potassium deficiency is also a long-term process as it takes time to renew fruiting spurs. Keep in mind, once you see leaf symptoms, trees are already deficient and you are already setting yourself up for yield losses.

The bottom line is that growers need to monitor potassium (and other nutrient) levels with leaf analyses to prevent deficiencies from occurring. Current UC recommendations are to keep potassium levels at least 1.4% in July sampled leaves. Some folks in the almond industry suggest potassium levels should be 2% or higher, although there is no scientific evidence to support this, including our trial in Salida.

Potassium deficiency can be corrected fairly easily in light-textured soils. However, massive doses are often necessary in heavy clay soils. Dry formulations of sulfate of potash or potassium chloride should be applied in concentrated bands to prevent the potassium from being tied up to soil colloids. In clay soils, growers may consider applying double-concentrated bands every other row. Fertilize the skipped rows with double-concentrated bands in future years. Potassium chloride is best applied in the fall when winter rains can leach chloride out of the root zone. Potassium chloride should not be used in areas with water table problems or other soil conditions that prevent chloride leaching.

Foliar potassium sprays can alleviate symptoms more quickly, but these are relatively expensive and effects are short lived. Liquid potassium fertilizers may correct deficiencies more quickly than dry formulations, but these are also more costly. In the long-term, it is cheaper to monitor potassium levels and fertilize when and only when necessary.

Bunch Rot Management

Roger Duncan, UC Cooperative Extension, Stanislaus County

Summer bunch rot, a disease complex involving *Acetobacter* bacteria (sour rot), *Aspergillus niger*, *Botrytis cinerea*, and several other fungal taxa, can significantly reduce yield and wine grape quality in the warm San Joaquin Valley. Many of the organisms associated with bunch rot in our area are secondary pathogens that colonize wounded or leaky berries. Previous trials have shown that "conventional" fungicides generally have limited efficacy against the sour rot component of the disease.

I have conducted several field trials in local 'Zinfandel' vineyards to test strategies for bunch rot management. These trials included "conventional" and "microbial" fungicides as well as strategies to reduce berry crowding and splitting. Plant growth regulator treatments such as gibberellic acid and cytokinin (CPPU) which can elongate berry stems to reduce crowding were applied at 1-2 inch flower length. In 2001, three application timing scenarios were tested with Elevate® fungicide: bloom + pre-bunch closure, pre-bunch closure + preharvest, or bloom + preharvest. Microbial materials (Blight Ban® and Serenade®) were applied four times and foliar calcium sprays five times through the season.

Results:

Typically, the summer bunch rot complex in Stanislaus County vineyards is about 1/3 Botrytis bunch rot and 2/3 sour rot. However, in 2001 *Botrytis cinerea* was uncharacteristically the dominant rot in this trial. Untreated vines had an average of 6.8% sour rot, 10.9% Botrytis, and 18.6% total rot. Many materials reduced Botrytis bunch rot significantly but only gibberellic acid plus leaf removal reduced sour rot. Cytokinin (CPPU) applied at 2 grams per acre significantly increased sour rot in this trial. When compared against untreated vines, all three treatments with Elevate applied at different cluster developmental stages significantly reduced Botrytis rot and total rot but did not reduce sour rot. All three timings were statistically equal in effectiveness. Treatment effects are listed in the table on the next page.

Berry stems in the gibberellic acid treatment were significantly longer than in bunches from untreated vines. The CPPU and Symspray treatments did not increase pedicle length.

Discussion:

As in past trials, the combination treatment of gibberellic acid and leaf removal most significantly reduced rot and was the only treatment proven to reduce sour rot in this trial. In almost every trial I have conducted over the past several years, leaf removal has been the single best rot reduction treatment. Foliar calcium sprays did not reduce sour rot or total rot in this trial, although it sometimes has helped in past trials. This was my first attempt at using CPPU cytokinin for bunch rot control and rates tried were no more than educated guesses. Table grape growers are looking at this product as an alternative to gibberellic acid. Elevated levels of sour rot in the two grams per acre treatment raise concerns about using this product. More research is needed with this material. It is possible if CPPU and/or Symspray® were applied a little earlier in flower development, results may have been more favorable.

Most conventional fungicides have proven to be ineffective in past sour rot trials. Materials like Elevate and Vanguard are very effective against Botrytis but not sour rot. Dithane reduced Botrytis and total rot and the combination of Dithane and Elevate was even better. Blight Ban, a microbiological material (*Pseudomonas inflorescens*) reduced Botrytis and total rot. The addition of Breakthru surfactant did not improve efficacy. QRD 131 & QRD 137 (formulations of Serenade), did not reduce total rot.

2001 Winegrape Bunch Rot Trial Summary

Roger Duncan, Viticulture Farm Advisor, Stanislaus County

Treatment	% Total Rot	% Botrytis	% Sour Rot
CPPU KT-30 @ 2 grams per acre	27.0 a	9.7 ab	***16.5 a***
Untreated	*18.6 ab*	*10.9 a*	*6.8 b*
Elite @ bloom + preharvest	16.8 bc	8.5 abc	7.2 b
CPPU KT-30 @ 1 g	14.0 bcd	**4.2 cdef**	8.5 b
QRD 131 (AgraQuest)	14.0 bcd	**5.7 bcde**	8.2 b
Vigor Cal® foliar calcium	12.4 bcd	**3.6 cdef**	8.6 b
Organic Serenade®	11.6 bcde	**4.3 cdef**	6.3 bc
Symspray® + foliar nutrients	10.7 bcde	6.4 abcd	3.1 bc
Elevate® bloom + preclose	9.8 bcde	**0.9 ef**	7.8 b
Symspray®	9.7 bcde	**3.8 cdef**	5.6 bc
Elevate® @ bloom + preharvest	8.8 bcde	**3.4 def**	4.8 bc
Blight Ban® + Breakthru®	8.8 bcde	**3.4 def**	5.0 bc
Vanguard @ bloom + preharvest	7.5 bcde	**1.2 ef**	6.1 bc
Dithane®	***7.4 cde***	**3.8 cdef**	2.8 bc
Blight Ban®	***7.3 cde***	**2.8 def**	4.0 bc
Elevate @ preclose + preharvest	***6.7 cde***	**2.0 def**	3.0 bc
Leaf removal	***5.8 cde***	**4.0 cdef**	1.6 bc
Dithane + Elevate®	***4.3 de***	**0.7 ef**	3.2 bc
Gibberellic Acid	***2.8 de***	**1.1 ef**	1.3 bc
GA + leaf removal	***0.4 e***	**0.2 f**	***0.3 c***

Data followed by similar letters are not significantly different at $P \leq 0.05$.

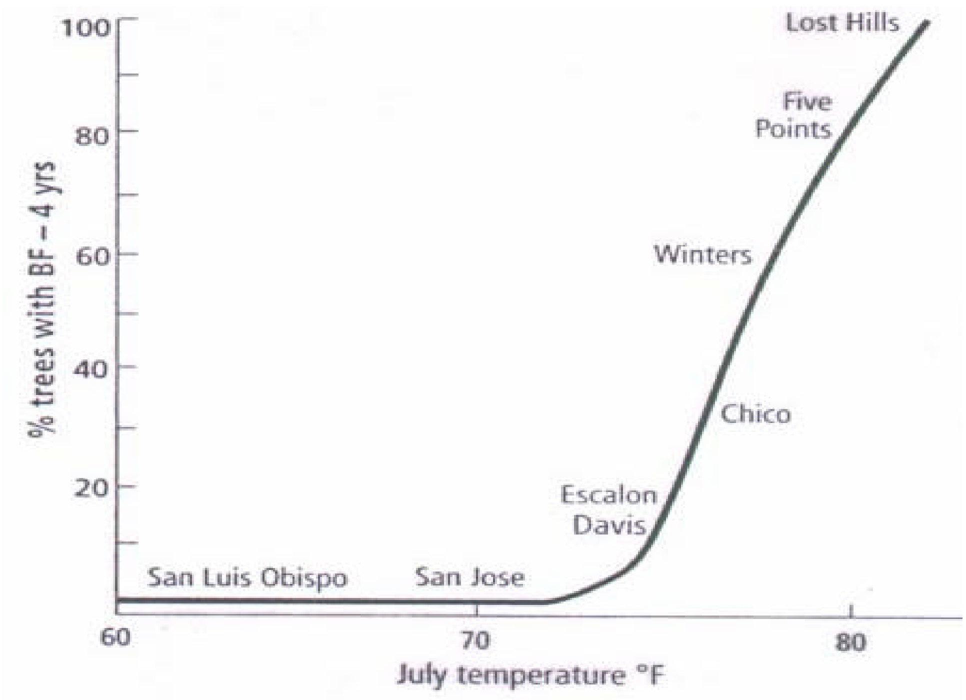
Bud failure or Crazy Top–The Curse of the Carmel

by Brent Holtz, UCCE Pomology Advisor

Non-infectious bud failure or crazy top is dramatically worse this year in many Carmel and Nonpareil orchards in the San Joaquin Valley. Bud failure is more common in the Carmel variety, but Nonpareil, Merced, Price, Thompson, and Mission also have well documented cases. Crazy top is a genetic disorder which appears when portions of the affected tree bloom but do not leaf out. The first obvious manifestations of bud failure appears in the spring when vegetative buds on vigorous shoots of the previous year's growth fail to emerge. Often the buds on the basal part of a shoot are unaffected whereas buds on shoots produced as later flushes of growth are severely affected. This pattern of bud failure develops because the growing points in lateral vegetative buds died the previous summer or fall. Flower buds are usually unaffected and develop normally even when on the same node with a severely necrotic bud. In some years flowers on bud failure-affected branches may set profusely and produce nuts even though few leafy shoots are present. In other years the number of flower buds can be severely reduced, indicating that bud failure reduces flower initiation and fruiting wood. In bud failure affected trees the time of bloom is often delayed. In research preformed by Mario Viveros in Kern County, he determined that bud failure can reduce yields in Nonpareil from 265-860 meat pounds per acre, and can reduce yields in Carmel from 150 to 1,200 meat pounds per acre.

Researchers at UC Davis (Dale Kester & Warren Micke) who have studied bud failure have shown that symptom development is different in California depending on the location of the orchards. Bud failure was found to develop more frequently and severely in locations with higher average summer temperatures, with the rate of bud failure directly proportional to average temperatures above 80 degrees. If the average critical temperatures were above 90 degrees trees had a much greater chance of developing bud failure (Figure 1). Their research has shown that early season high heat accumulation may predispose susceptible almond varieties to show more severe bud failure the following spring. Last year the San Joaquin Valley had some of the hottest average May temperatures on record, which most likely was responsible for the severe bud failure observed in 2002.

Figure 1 Correlation of the average summer temperatures at various locations and the average percentage of BF-affected trees produced.



What do growers do once bud failure symptoms appear? Pruning can do little to permanently eradicate bud failure. Symptoms and yields will fluctuate yearly depending on temperature patterns during the previous summer as well as on the amount of new growth. Because yield depends on vigor, growth reduction is not a viable control option. By avoiding moisture stress, particularly in midsummer, the grower may keep symptoms from worsening. In general, no program of management to date has consistently controlled bud failure symptoms once they have developed.

After symptoms appear a grower may consider several options. If young trees between the ages of 2-4 years old are already showing bud failure, I would recommend removing them. The decision to replace a tree involves an evaluation of potential yield loss, the time required to bring replacement trees into production, and the projected life of the orchard. Replacement is expensive and effective only if the new trees planted do not also get bud failure. The earlier that symptoms appear in an orchard or tree the more severe bud failure will ultimately be, with a greater potential for yield loss. Usually nurseries will replace trees without cost if symptoms show in the first 4 years (depending on nursery). Tree replacement is most effective when the orchard is 1-3 years of age.

If symptoms first appear in a tree when it is 5-6 years old, and if they appear mostly in the upper parts of the canopy and not in the main framework of the tree, yield may not be seriously reduced. As the age of a tree in which symptoms appear increases the need to replace it decreases and the cost of replacing an older tree may not be recoverable within the remaining life of the orchard. Thus with many older trees, I would not bother to replace them for the cost of tree replacement and loss of yield during replacement will not be offset by improved yield. I have seen severe bud failure trees produce a pretty good crop, but they usually are much more prone to alternate bearing.

Now, after recommending that you don't pull out trees 6 or more years old, I have observed some 20 plus year old orchards where growers are still replacing bud failure trees. In such instances I have seen growers keep good records of trees showing bud failure, and if they fail to produce for 2 years in a row, they will remove them. And most of these growers are happy that they have removed such eye sores from their orchard.

If a grower wants to replace bud failure affected trees with other varieties, Sonora and Monterey are choices recommended by Mario Viveros (Kern County Farm Advisor) because they are good producers which bloom with Nonpareil, and Sonora will harvest with Nonpareil and Monterey will harvest with Carmel. After talking about Carmel replacements, I would also like to state that I know several growers who are unwilling to go to other varieties. These growers have observed that their Carmel production is still quite good despite bud failure, and that Carmel has been an excellent pollinator for Nonpareil.

Long term control of bud failure will mean selecting propagation bud wood from sources with a low potential for bud failure. Researchers feel confident that they will some day develop trees lines which will be free of this genetic disorder. At the moment the best tree line that we have for Carmel is "FPMS #1." In our regional variety trial, the FPMS # 1 Carmels are showing bud failure in only 14 percent of the trees and they are now 9 years old.

The Effect of Surround on Carmel Return bloom

by Brent Holtz, PhD, UCCE Madera

Last year we performed and experiment at the Sherman Thomas Ranch (Mike Braga) where we applied Surround to 6 almond rows in a Nonpareil, Sonora, Carmel orchard. Two of the Carmel rows in this orchard received Surround. Surround is a white clay or a processed-Kaolin particle film which can be easily dissolved into suspension and sprayed onto trees. Several research reports have been published in the Journal American Society Horticulural Science and HortTechnology describing how this reflective film can reduce heat stress on a number of crops in several countries. These studies have shown that the processed-kaolin particle film "Surround" is highly reflective to ultraviolet wavelengths and has reduced solar injury to both leaves and apple fruit in Chile, Washington, and West Virginia (1). This research described how Surround treatments increased leaf carbon assimilation and that canopy temperatures were reduced (2). In studies in New York and Idaho Surround again reduced the incidence of sunburn to apples, but it also reduced the fruit weight and color and left an undesirable residue (3).

We sprayed 3 applications of Surround on Nonpareil, Sonora, and Carmel almonds in April, May, and June 2001. The Surround treatment was on 2 Carmel rows at opposite ends of a 40 acre orchard at the time we experienced record hot temperatures in May 2001. Remember from our bud failure discussion that it was this hot period in May that we are attributing to the severe bud failure symptoms observed in 2002.

Mike Braga (manager of Sherman Thomas Ranch) observed this spring (2002) that the Carmel trees which were sprayed with Surround in 2001 had substantially more bloom when compared to the Carmel trees which were not sprayed with Surround. I also observed the same phenomenon and then proceeded to evaluate the number of bloom observed between Surround sprayed and non-sprayed Carmel trees. We found that the Surround sprayed trees had more than twice the number of bloom per 3 feet of almond shoot. The Surround sprayed trees had an average of 14.38 blooms per 3 feet of almond shoot while the non-Surround sprayed trees only had an average of 6.79 blooms per 3 feet of almond shoot (figure 2). The difference was statistically significant in a *Student's T-test*. This particular Carmel orchard had been stressed with a large crop in 2001 and was showing severe symptoms of bud failure in 2002.

It appears that the Surround treatment may have reduced heat stress in May 2001, and consequently more bloom was observed on Surround-treated trees. The Surround treated trees probably had less heat stress and consequently more carbon assimilation, as described for apples (2). More research is needed, but come see this trial at our field meeting on June 11 at the Sherman Thomas Ranch. Surround is sold by Engelhard Corporation and if you would like to examine it in your own orchard you can call Mitchell King 209 613-8543.

1) Glenn, D.M., Prado, E., Erez, A., Mc Ferson, J., and Puterka, G.J. 2002. A reflective, processed-Kaolin particle film affects fruit temperature, radiation reflection, and solar injury in apple. J. Amer. Soc. Hort. Sci. 127(2):188-193.

2) Glenn, D.M., Puterka, G.J., Drake, S.R., Unruh, T.R., Knight, A.L., Baherle, P., Prado, E., and Baugher, T.A. 2001. Particle film application influences apple leaf physiology, fruit yield, and fruit quality. J. Amer. Soc. Hort. Sci. 126(2):175-181.

3) Schupp, J.R., Fallahi, E., and Chun, I.J. 2002. Effect of particle film on fruit sunburn, maturity, and quality of "Fuji" and "Honeycrisp" Apples. HortTechnology 12(1):87-90.

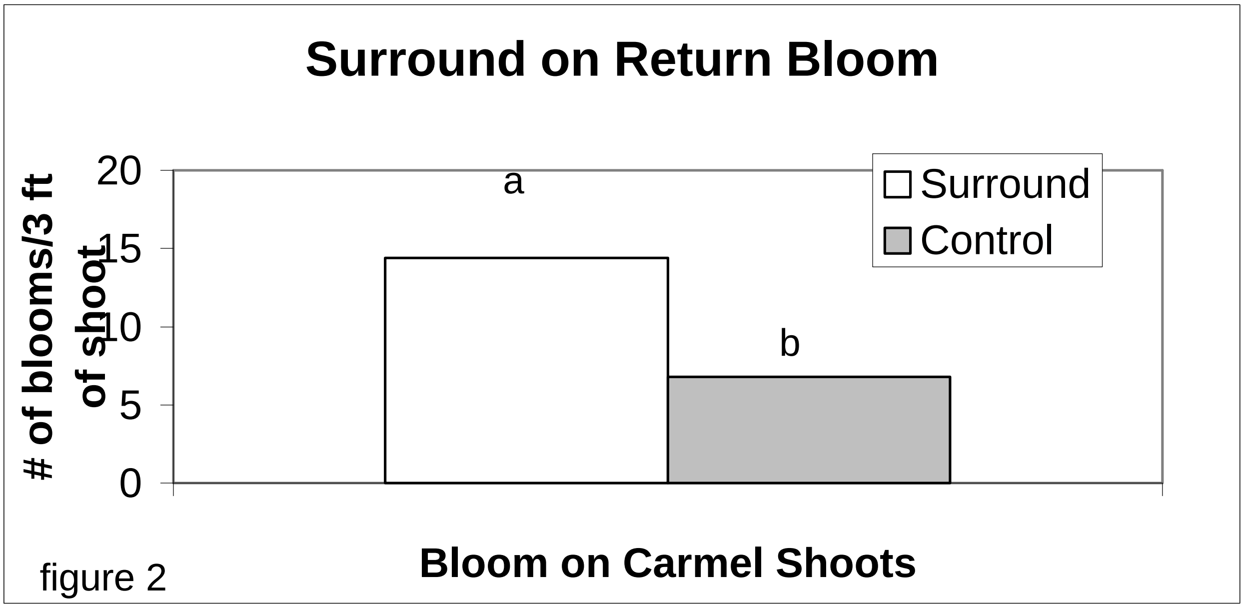


figure 2

Hull Rot on Almonds

by Brent Holtz, UCCE Pomology Advisor

Many growers noticed this spring that their Nonpareil, Sonora, or Monterey almond varieties lacked bloom in the lower half of their trees while other varieties, displayed normal bloom. Most of the orchards I observed with these symptoms I attributed to hull rot infections which took place the previous growing season after hull split. Many growers confuse hull rot with shading out since both can produce dead wood in the lower canopy. I believe that hull rot actually enhances shading out as the tree abandons infected wood in the lower canopy for healthy wood receiving sunlight at the top of the canopy. Irrigation management is the only control for Hull Rot and if you have hull rot I suggest you come to our Almond Field Day on June 11th, 2002 at the Sherman Thomas Ranch in Madera. At this field meeting we will discuss irrigation management practices aimed at reducing this serious disease, and we will demonstrate the pressure bomb as a method of timing irrigations to avoid hull rot.

As almond trees approach harvest, at about mid hull split, clusters of dry leaves begin to appear scattered through the tree canopy. Individual spurs, small shoots or entire small branches may collapse due to hull rot infections. The loss of fruiting wood, especially in the lower parts of the tree, can negatively affect yield for years to come. Nonpareil is usually the most severely affected cultivar though Sonora and Kapareil can also sustain extensive damage.

Hull rot is caused by either of two fungi, *Monilinia fructicola* or *Rhizopus stolonifer*. *Monilinia fructicola* is best known as one of the brown rot fungi and *R. stolonifer* is often called the bread mold fungus, and will turn bread left out black and moldy. These two organisms are very different but can cause similar disease symptoms on almonds. As the name implies, a lesion or dryish rotted area develops on the hull, and dense masses of *Rhizopus* spores produce a powdery dark gray to black growth between the hull and the shell. *Monilinia* spores are buff-colored and can be seen on inner and outer hull surfaces. The nutmeat is not damaged, but a toxin produced in the infected hull moves from the hull into the neighboring leaves and shoots causing death of these tissues.

Neither *Monilinia* or *Rhizopus* are able to invade the healthy outer hull surface. Only after hull split begins can spores gain access to the inside of the hull and initiate infections. Once hull split starts, trees are at risk of becoming infected. One or both pathogens may be present in an orchard, but *Monilinia* hull rot is less common in southern San Joaquin Valley orchards than in other almond growing regions of the state. Leaves may become infected near infected nuts and sometime the hole spur or shoot can die as well. Clusters of dead leaves can become visible in the summer scattered among healthy green foliage. Spur and leaf die-back are attributed to fumaric acid which is produced by the pathogens and transported to the leaves and shoots. The black vascular tissues in the dead spurs and wood can be traced back to a pedicel or infected fruit. The nut kernel is not harmed but the death of the fruiting wood reduces bloom and yield in subsequent years. Sometimes infected fruit does not fall during mechanical harvest and must be removed by hand poling and can also provide overwintering sites for navel orangeworm (NOW).

Cultural practices play a crucial role in determining the severity of hull rot in an orchard. Vigorous, heavily-cropped, well-watered and fertilized orchards suffer the most damage. I have often referred to hull rot as the “good growers disease” since the disease is often worse in well maintained orchards. The reasons for this are not clear. The association with heavy crops might be simply a matter of numbers: more infected fruit means more toxin produced which results in more leaf and shoot death.

Research by Drs. Beth Teviotdale , David Goldhammer and Mario Viveros have shown that hull rot can be reduced by inflicting mild water stress on trees during early hull split. In experiments in Kern County, hull rot incidence was lessened by half or more when half the normal amount of water was delivered to trees for two weeks during early hull split. Eliminating irrigation during the two weeks preceding harvest reduced hull rot by 400-500%, but completely denying trees water for two weeks may be dangerous and less drastic irrigation reductions may also reduce disease and stress trees less. In their research they irrigated almond trees at 70, 85, and 100% of potential evapotranspiration (Etc). There were two types of deficit irrigation: sustained and regulated. The sustained irrigation was just reduced irrigation the whole season while the regulated started the year at normal irrigation but then drastically reduced irrigations (50% Etc) during the period preceding and during hull split. For Kern county those dates included 50% Etc from 1-15 July (85% season Etc reduction) or 1 June- 31 July (70% season Etc reduction). The regulated deficit irrigations were much more effective at reducing hull rot than the sustained deficit irrigations.

Soils can vary greatly throughout the state, and irrigation management may be difficult in some orchards. The University of California is currently testing several approaches to reduce water use under different irrigation strategies and soil types. Experiments in Stanislaus County demonstrated that hull rot severity increases with increasing amounts of nitrogen. Nitrogen should not be applied in excess of that needed for tree health and productivity. The nitrogen content of the irrigation water should be included in calculations of required added fertilizer. In another UC trial we are experimenting with midday stem water potential readings to monitor deficit irrigations in almonds to reduce hull rot without severely stressing our trees. We will demonstrate this technique at our field meeting on June 11 in Madera. See you there!!!! In this experiment we are using the pressure bomb to monitor midday stem water potential (SWP). During most of the growing season we will try to keep the trees within stem water potentials of -7 to -9 bars and during hull split we will try to irrigate less in order to achieve SWP's between -14 to -18 bars. This higher the negative number the more the stress. By using the pressure bomb to monitor trees we hope to impose enough stress that the trees do not get hull rot, and not over stress the trees so that they are more susceptible to mites or defoliating.

Below is an experiment that we did without the use of a pressure bomb where we just reduced irrigations and were able to achieve a 50% reduction in hull rot. Hull Rot Trial/Madera County--the following irrigation schedule resulted in a 50% reduction in Hull Rot in a Madera County Trial in 1997.

Dates	Deficit Irrigation (Cut-Off)	Normal Irrigation	% Hull Split
June 9-12	100% (24 hr)	100%	
June 16-19	50% (12 hr)	100%	1%-June20/21
June 23-26	50%	100%	
June 30-July 3	0 (no irrigation)	100%	5-40%
July 7-10	50%	100%	>40%
July 21-24	0 (dry down)	0	
July 28-31	Harvest		
Post Harvest	100%	100%	