HEALTHY FOOD SYSTEMS • HEALTHY ENVIRONMENTS • HEALTHY COMMUNITIES • HEALTHY CALIFORNIANS

University of California
Agriculture and Natural Resources
Making a Difference for California

UCCE

In a Nutshell
Tulare County

July 2019

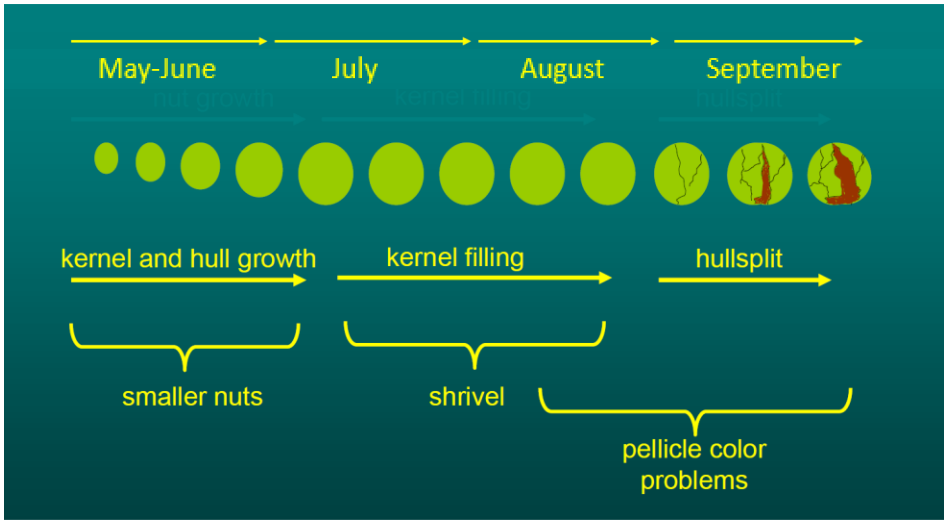
Maximizing walnut quality to improve value in a low-price year

Elizabeth Fichtner[1], Carlos Cristosto[2] and Bruce Lampinen[3]
[1] UCCE Farm Advisor, Tulare County, [2] CE Specialist, Postharvest Physiology, [3] CE Specialist, Plant Sciences

The overall value of a walnut crop is based on yield and nut quality. When commodity prices are depressed, improving nut quality may be the determining factor influencing orchard profitability. Irrigation management is the single most important factor that can be adjusted for increasing kernel size and improving kernel color, two key components of quality. Nuts with a larger kernel size and lighter color pellicle (outer coating on the kernel) garner the highest prices in the market.

The most important irrigation management decision of the season is when to start irrigating in spring. Initiating irrigation too early in the season has been shown to predispose trees to stress at harvest. UC research trials have demonstrated that withholding irrigation until trees reach a midday stem water potential about 2 bars below the fully-watered baseline is best for maintaining overall tree health and higher edible kernel weights after crackout, which favors a higher price per pound. When irrigation was initiated earlier (at the baseline or 1 bar below), the trees exhibited more stress later in the season when irrigation was cut off in advance of harvest. The pressure chamber is the best tool for determining when to initiate irrigating in the spring and should be used throughout the season to schedule irrigation events based on plant stress. The pressure chamber can be used to directly measure midday stem water potential on a subset of trees in an orchard. A number of short articles detailing how to utilize the pressure chamber in walnuts, almonds, and prunes can be found at: sacvalleyorchards.com/manuals/stem-water-potential/.

UC research trials have shown that carbohydrate deprivation can cause darkening of the kernel pellicle. It can result from either excess or lack of water, as well as from shaded conditions in the inner canopy, which itself is exacerbated by either water deficiency or excess. The influence of carbohydrate deprivation on nut quality varies over the season; the diagram below characterizes the symptoms on Chandler at different phases of nut development and highlights the importance of irrigation management at all times during the season to maximize nut size, nut fill, and quality.



Nut quality problems can be associated with current year conditions or previous year conditions

Current season carbohydrate deprivation resulting from water stress (lack or excess) and/or shading related leaf loss

Symptom	Timing
thin shell	early June
severe shrivel	early July
slight shrivel	early August
yellow pellicle	early August
black pellicle	mid-August
bronze pellicle	late Aug/early Sept

Previous season insufficient carbohydrate storage during bud formation resulting in small leaves and small nuts in current season. Likely associated with buds that developed in shaded positions the previous year.

- Very weak bud = pee wee nut
- Relatively weak bud = brown adhering hull

Yellow

Bronze

Black

Historically, dark kernel color has been associated with water-stressed trees resulting from under-irrigation. However, more recent research has shown that it is now most often associated with trees maintained either close to or above the fully-watered baseline (more wet) in mid-to late summer. These studies indicate that optimal kernel color can be achieved by maintaining orchards at a midday stem water potential of approximately 2 bars below the baseline (more dry) during mid- to late summer.

Howard and Tulare are very sensitive to pellicle color problems resulting from carbohydrate deprivation derived from either poor irrigation management or shading. Chandler is relatively immune to these problems. Maximize your profits by paying attention to water management at all times during the season. Early-season stress can result in reduced nut size while stress later can result in kernel shrivel and pellicle color problems.

Regulated Deficit Irrigation in Almonds to Manage Hull Rot

Phoebe Gordon, UCCE Farm Advisor, Madera and Merced Counties

Hull rot is the common name for a disease that can be caused by three pathogens: *Rhizopus stolonifer, Monilinia* spp., and more rarely *Aspergillus niger*. The disease starts when hulls begin to split, which creates a natural wound and allows invasion of the pathogen. As hullsplit progresses, the pathogens colonize hull tissue. *Rhizopus stolonifer* is also known to produce a toxin that spreads down the phloem, resulting in spur and shoot mortality. The damage can be extremely severe, particularly in the lower canopy as those branches will not be replaced.

Image 1: Photo by Phoebe Gordon. Almond shoot strike on a tree severely affected by hull rot. Note the shriveled leaves on the branch, and the carpet of dead leaves on the orchard floor.

While there are effective fungicides that can be sprayed to reduce the severity of hull rot (a correctly timed fungicide spray can reduce disease severity by up to 60-70%), the disease is directly related to high tree nitrogen fertilization and water status (it's nicknamed the good growers' disease), and managing these is the best way to reduce disease severity. Chemical treatments should not be done in the absence of cultural practices. You can go to http://ipm.ucanr.edu to look at products that are effective against hull rot as well as find the almond fungicide efficacy tables.

Trees that are well irrigated and fertilized with nitrogen are more susceptible to hull rot. This is because the plant tissue itself is more vulnerable to infection. Well-fertilized and irrigated trees also progress through hull split more slowly, and while it has been commonly believed that the severity of disease became more pronounced with the length of time nuts were in hullsplit, work done by Saa et al. (2016) showed that this is not the case when it comes to nitrogen fertilization. While early hullsplit progression was delayed in trees fertilized with higher rates of nitrogen, the length of time that fruits were in hullsplit did not increase disease severity.

Image 2: Photo by Phoebe Gordon. Almond hull with Rhizopus hull rot (above).

The ways to culturally reduce hull rot are to fertilize based on your crop load, to cut off pre-harvest nitrogen applications after kernel development has been completed (which ends roughly between the end of May and early June), and to use deficit irrigation at hullsplit to induce moderate water stress. How should you manage deficit irrigation at hullsplit? First, it is best to do so with the use of a pressure chamber. The pressure chamber is the only way to correctly assess plant stress; ET is only an estimation of how much your trees have lost, and soil moisture sensors are only as good as how well they represent your entire orchard; if you have several soil types with very different water holding capacities and only one soil moisture sensor, you do not have an accurate picture of your orchard's soil water status, and you also have no idea how stressed your trees are, unless they are so stressed they are wilting. I've heard performing reduced deficit irrigation (RDI) without a pressure chamber as playing Russian Roulette: you could get lucky and get it right, but things could also go very, very wrong.

The best way to manage RDI is to induce moderate stress in almonds at the initiation of hullsplit. Reduce irrigations by 30 to 50% in the first two weeks of hullsplit. Monitor stress with a pressure chamber – you should aim to keep the trees between -14 and -16 bars. I've talked to a grower who let their trees get a little too stressed during this period and suffered a lot of sticktights, so again, induce RDI without using the pressure chamber at your own risk! Severe water stress has also been found to delay hullsplit (Goldhamer et al., 2006) so it is very possible to take things too far. It should be noted that Goldhamer did not find an increase in sticktights with deficit irrigation in that study.

Pre-harvest deficit irrigation can have a slightly negative effect on yield. Tievodale et al. (2001) performed research on deficit irrigation in advance of harvest and found that short and severe pre-harvest deficit irrigation reduced leaf and shoot death (which again is the real problem with hull rot). In this study, kernel weight was reduced with the imposition of 50% ET during hull split, though the reductions in kernel size were less severe than the protection of fruiting wood. Goldhamer et al. (2006) also found that preharvest deficit irrigation reduced yield via smaller nuts, but found that it did not reduce next year's fruit load (i.e. the number of nuts on a tree). It has been shown that postharvest water stress DOES decrease next year's fruit load, so make sure you can resume full irrigation after you've done your two weeks of deficit irrigation at the beginning of hullsplit. If you have an orchard that is severely affected by hull rot, the small yield reduction via smaller kernels may be far outweighed by the avoidance of the loss of fruiting wood.
Cited studies:

Goldhamer, David A., Mario Viveros, and Mario Salinas. "Regulated deficit irrigation in almonds: effects of variations in applied water and stress timing on yield and yield components." *Irrigation Science* 24.2 (2006): 101-114.

Saa, Sebastian, et al. "Nitrogen increases hull rot and interferes with the hull split phenology in almond (Prunus dulcis)." *Scientia horticulturae* 199 (2016): 41-48.

Teviotdale, B. L., D. A. Goldhamer, and M. Viveros. "Effects of deficit irrigation on hull rot disease of almond trees caused by Monilinia fructicola and Rhizopus stolonifer." *Plant disease* 85.4 (2001): 399-403.

On-Farm Recharge on Pecans for Groundwater Sustainability

Project Cooperators: UC Cooperative Extension, Bachand & Associates, Pacific Gold, UC Davis, Sustainable Conservation, CA Pecan Growers Association

The Sustainable Groundwater Management Act (SGMA) has been enacted to stabilize groundwater levels and thus improve groundwater sustainability. Declining groundwater levels negatively impact growers in various ways. Irrigation wells can go dry or pump less water, potentially leading to declining yields and plant health, fallowed fields, and higher pumping costs from increased energy demand to pump from greater depths and the drilling of new replacement wells. Most of the San Joaquin Valley is designated under SGMA as critically overdrafted. By 2020, Groundwater Sustainability Agencies (GSAs) are required to submit Groundwater Sustainability Plans identifying strategies for sustainable groundwater and must achieve groundwater sustainability by 2040. Unless groundwater supply is augmented, agricultural acreage in the San Joaquin Valley will contract.

On-Farm recharge (OFR) offers a flexible approach in which captured floodwater is applied to farmland to recharge aquifers. OFR has been done on various crop types, usually using flood irrigation systems, and has not been associated with adverse effects on plant health and productivity. Pecans have not been studied; however, they may be especially suited for OFR because they are a facultative upland species able to tolerate saturated soils and post-dormancy flooding. Standardized OFR practices for pecans will help to prevent negative agronomic impacts while offering a SGMA compliance approach that increases water supplies and promotes expansion of pecan acreage.

We are conducting a Pecan Orchard On-Farm Recharge Study to investigate the feasibility and benefits of OFR on pecan. The project goals include assessing OFR's feasibility, costs and benefits on pecan orchards; standardizing OFR cultural practices to reduce economic or agronomic risk; determine potential benefits to promoting healthy soils; and integrate a pecan OFR strategy into SGMA compliance planning.

If you are a nut grower, please consider taking a few minutes to complete the survey to provide information on your knowledge and interest in SGMA and OFR. Please mail the completed survey to 231 G St., Suite 28, Davis, CA 95616. Alternatively, you can take a picture of the completed survey and email it to reilly@bachandassociates.com. All responses, including names and contact information, will remain confidential and will only be used for the purposes of this research project.

UC DAVIS UNIVERSITY OF CALIFORNIA

UC CE University of California Cooperative Extension

Sustainable Conservation

BACHAND & ASSOCIATES

CALIFORNIA PECAN GROWERS ASSOCIATION

PACIFIC GOLD AGRICULTURE

Survey on Grower Interest in the Sustainable Groundwater Management Act (SGMA) and On Farm Recharge (OFR)

All responses are confidential

Name: _____ Email: _____
Phone: _____ County: _____

1. What do you think is true about SGMA? (check all that apply)
   - ☐ A SGMA goal is to stabilize groundwater levels
   - ☐ Compliance is voluntary
   - ☐ Groundwater pumping will not be affected
   - ☐ Degradation of groundwater quality is an undesirable result under SGMA
   - ☐ SGMA has no regulatory implications for surface water or its management
2. How could drops in groundwater levels affect your farming operation? (check all that apply)
   - ☐ Fallow fields
   - ☐ Change crops
   - ☐ Change farm management
   - ☐ Drill deeper wells
   - ☐ Increase energy costs
   - ☐ Other _____
3. How do you think SGMA could affect fruit and nut tree growers? (check all that apply)
   - ☐ Reduce acreage
   - ☐ Increase cost of production
   - ☐ Other_____
   - ☐ Increase acreage
   - ☐ Increase profit
4. What are benefits of On-Farm Recharge (OFR)? (check all that apply)
   - ☐ Increases Groundwater Storage
   - ☐ Flexible and relatively low-cost
   - ☐ Flushes Salts from the Root Zone
   - ☐ Increases Soil Moisture and delays 1st Irrigation
   - ☐ Helps GSAs meet sustainable groundwater goals
   - ☐ Does not require change in crop management
5. Do you think specific OFR management practices (such as flooding timing) can reduce the potential for negative effects of flooding on crops? ☐ Yes ☐ No
6. What crops do you grow? ☐ Pecans (how many acres?) _____ ☐ Walnuts
   ☐ Almonds ☐ Other_____
7. If you flooded a field/orchard before, for what purpose did you use this practice? (check all that apply)
   - ☐ For Recharge
   - ☐ To Flush Salts
   - ☐ For Irrigation
   - ☐ Did not flood before
8. What are important factors in deciding whether to conduct OFR? (check all that apply)
   - ☐ Cost of OFR
   - ☐ Impact on yield
   - ☐ Crop Health
   - ☐ Ease of Implementation
   - ☐ Aid in SGMA Compliance
   - ☐ Other_____
9. Are you interested in conducting pecan orchard OFR?
   - ☐ Yes
   - ☐ No
10. If you are not a pecan grower, would you be interested in planting pecans in order to conduct OFR?
    - ☐ Yes
    - ☐ No
11. If you are a pecan grower, are you interested in providing agronomic and/or economic information on your operation to support our efforts (whether or not you conduct OFR)?
    - ☐ Yes
    - ☐ No

If you are interested in more information about OFR practices or this survey, please contact us at sandra@bachandassociates.com.

Kings/Tulare Counties
NUT HARVEST SAFETY TRAINING DAY

Wednesday, July 17, 2019

8:00 a.m. to 12:00 p.m.

KINGS COUNTY FAIRGROUNDS

801 10th Ave

Hanford, CA

Same Day Registration from 7:30 – 8:00 a.m.

Hosted by: Kings County Farm Bureau and Tulare County Farm Bureau

This safety training program is directed towards nut commodity harvest equipment operators, crews and farm employees in conjunction with farm managers/supervisors, and growers. Harvest equipment for walnuts, almonds and pistachios will be included. The training will be held in English and Spanish. Be sure that you indicate on your registration form which training the employee will be attending.

Staff from the Family Healthcare Network will be on hand from 7:00 to 8:00 a.m. to provide free health screenings for participants.

Mail or fax by July 12, to the following:

Tulare County Farm Bureau
P.O. Box 748
Visalia, CA 93279-0748
Fax: 559-732-7029

Or call to register by phone: 559-732-8301

It is IMPORTANT to make your reservations prior to July 12th, to give us time to complete certificates of participation with the attendees name and company name. Lunch will NOT be served this year.

Company Name: _____ **Address:** _____ **Phone:** _____ **Contact:**	**Language**	
Please clearly print name of person(s) attending	**English**	**Spanish**

Sponsored by:

AMERICAN PISTACHIO GROWERS

KCFB KINGS COUNTY FARM BUREAU

Tulare County Farm Bureau

WAPA WESTERN AGRICULTURAL PROCESSORS ASSOCIATION

University of California
Cooperative Extension
Tulare County
4437B S Laspina St
Tulare, CA 93274-9537

Nonprofit Org
US Postage Paid
Visalia, CA 93277
Permit No. 240

In a Nutshell: July 2019

Elizabeth Fichtner
Farm Advisor

SAVE THE DATE!

2019 ALMOND SHORT COURSE

NOVEMBER 5-7, 2019

VISALIA CONVENTION CENTER

REGISTRATION COMING SOON AT:
https://ucanr.edu/sites/almondshortcourse/

It is the policy of the University of California (UC) and the UC Division of Agriculture & Natural Resources not to engage in discrimination against or harassment of any person in any of its programs or activities on the basis of race, color, national origin, religion, sex, gender, gender expression, gender identity, pregnancy (which includes pregnancy, childbirth, and medical conditions related to pregnancy or childbirth), physical or mental disability, medical condition (cancer-related or genetic characteristics), genetic information (including family medical history), ancestry, marital status, age, sexual orientation, citizenship, or service in the uniformed services (as defined by the Uniformed Services Employment and Reemployment Rights Act of 1994 [USERRA]), as well as state military and naval service. This policy is intended to be consistent with the provisions of applicable state and federal laws and University policies. University policy also prohibits retaliation against any employee or person in any of its programs or activities for bringing a complaint of discrimination or harassment pursuant to this policy. This policy also prohibits retaliation against a person who assists someone with a complaint of discrimination or harassment, or participates in any manner in an investigation or resolution of a complaint of discrimination or harassment. Retaliation includes threats, intimidation, reprisals, and/or adverse actions related to employment or to any of its programs or activities. In addition, it is the policy of the University and ANR to undertake affirmative action, consistent with its obligations as a Federal contractor, for minorities and women, for persons with disabilities, and for covered veterans. The University commits itself to apply every good faith effort to achieve prompt and full utilization of minorities and women in all segments of its workforce where deficiencies exist. These efforts conform to all current legal and regulatory requirements, and are consistent with University standards of quality and excellence. In conformance with Federal regulations, written affirmative action plans shall be prepared and maintained by each campus of the University, including the Division of Agriculture and Natural Resources. Such plans shall be reviewed and approved by the Office of the President and the Office of the General Counsel before they are officially promulgated. Inquiries regarding the University's nondiscrimination policies may be directed to Linda Marie Manton, Affirmative Action Contact, University of California, Agriculture and Natural Resources, 2801 Second Street, Davis, CA 95618, (530) 750-1318.