CEUs – New Process

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Sign in sheets and verification sheets are located at the back of each session room.
AGENDA

• **Spencer Cooper**, Almond Board of California, moderator

• **Luke Milliron**, UCCE-Butte County

• **Phoebe Gordon**, UCCE Madera and Merced Counties

• **David Doll**, UC Cooperative Extension
Young Orchard Irrigation

Luke K. Milliron
UC Cooperative Extension
Farm Advisor Butte, Glenn and Tehama Counties
Orchard Systems Advisor Butte, Glenn and Tehama Counties

- Covering all commercial tree crops
  - Primarily: almonds, walnuts, prunes and peaches

- SacValleyOrchards.com
Why is proper irrigation management in 1\textsuperscript{st} and 2\textsuperscript{nd} leaf so important?
Why is proper irrigation management in 1st and 2nd leaf so important?

- Tree growth
- Root health
- Efficiency of: fertilizer, weed control, pruning
- Changing supply with growing canopy and roots

A successful start…
What do you need to know?

1. How much am I applying?
2. How much water is the soil storing?
3. What’s being lost from soil and canopy?
4. How long between my irrigations?
5. How long do I run my irrigation?

1. Have I checked my program by looking at soil or plant water status?
I want to know how long to run my irrigation sets and how frequently…

How much water does my system apply, how quickly is water being lost and what’s my soil bank account between irrigations?

*How do I know it’s working???*
1. System application rate (in/hr)

Multiply: Trees * Emitters/tree * Flow Rate/emitter

120 trees/ac * 1 emitter/tree * 8 gph emitters = 960 gal/ac/hr

\[ \frac{960 \text{ gal/ac}}{27,154 \text{ gal/ac-in}} = 0.035 \text{ in/hr} \]
1. System application rate (in/hr)

What percent of orchard being wetted?

e.g. microsprinkler with cap ≈ 8% of orchard wetted

System application rate divided by % wetted area

\[
0.035 \text{ in/hr} \div 0.08 \text{ in} = 0.44 \text{ in/hr}
\]
1. System application rate (in/hr)

Session on **Wednesday**: 11:10-11:55 a.m.

*Tools for Better Irrigation* (Room 308-309).

Allan Fulton and Spencer Cooper will discuss flow meter use and irrigation system maintenance
2. Soil water storage = Available Soil Moisture

Not all water available...

50% threshold for available soil moisture (ASM)

e.g. sandy loam, 1 ft rootzone

0.7 in/ft * 1 ft = 0.7 in

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>50% ASM (inches water/ft soil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravelly, loamy sand</td>
<td>0.4</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>0.7</td>
</tr>
<tr>
<td>Fine sandy loam</td>
<td>0.9</td>
</tr>
<tr>
<td>Loam</td>
<td>1.0</td>
</tr>
<tr>
<td>Silt loam</td>
<td>1.1</td>
</tr>
<tr>
<td>Clay loam</td>
<td>1.0</td>
</tr>
</tbody>
</table>
3. Current demand = ETc

Evapotranspiration (ETc)
Over the season:

- **temperature**
- **canopy**

<table>
<thead>
<tr>
<th>Month</th>
<th>1st Leaf</th>
<th>2nd Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>March</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>April</td>
<td>0.05</td>
<td>0.09</td>
</tr>
<tr>
<td>May</td>
<td>0.07</td>
<td>0.13</td>
</tr>
<tr>
<td>June</td>
<td>0.08</td>
<td>0.15</td>
</tr>
<tr>
<td>July</td>
<td>0.09</td>
<td>0.16</td>
</tr>
<tr>
<td>August</td>
<td>0.08</td>
<td>0.14</td>
</tr>
<tr>
<td>September</td>
<td>0.06</td>
<td>0.11</td>
</tr>
<tr>
<td>October</td>
<td>0.03</td>
<td>0.06</td>
</tr>
</tbody>
</table>
4. Length between irrigations

50% ASM ÷ ETc = Days between irrigation (max)

e.g. 0.7 in stored / 0.08 in daily June ETc = 8.75 days (max)

• In reality… not an ideal world

• Weekly vs. multiple sets?
5. Estimating run time

How long since last irrigation? 4 days
Daily tree water use? 0.08 in/day (June)
Rainfall event? No

(Days * In/day) – Rain
(4 * 0.08 in/day) – 0 in = 0.32 in
5. Estimating run time

In-ac to replace \( \div \) application rate (in/hr)

\[
0.32 \text{ in} \div 0.44 \text{ in/hr} = 0.73 \text{ hrs} = \approx 45 \text{ min}
\]
What could possibly go wrong with the calculation???

- Estimating % Wetted Area
- Estimating Root Zone Depth
- Unusually large or small trees
- Resident vegetation or cover crops
- Soil texture variability
- Distribution Uniformity
- Hotter or Cooler than normal
6. How do I know it’s working???
Check the plant or soil

- Pressure chamber
- Backsaver Soil Sampler
- Stem water potential (bars of pressure)
- Available soil moisture by feel and appearance
Almonds, one seasons growth:
Dry treatment: average SWP about -15 bars
Almonds, one seasons growth:
Medium treatment: average SWP about -12 bars
Almonds, one seasons growth:
Wet treatment: average SWP about -8 bars
Which treatment are your trees in?
Additional Resources

• **Google search:** “Young Orchard Handbook” by Farm Advisor Katherine Jarvis-Shean & others

• Consulting your local farm advisor
  • thealmonddoctor.com
  • sacvalleyorchards.com

• almonds.com/irrigation
  • Irrigation Improvement Continuum (1.0, 2.0, 3.0)
Young Orchard Care: Fertilization, Pests, and Diseases

Phoebe Gordon, Ph.D.
UCCE Madera and Merced Counties
Fertilization

- Nitrogen
- Zinc (and sometimes iron)
- Phosphorus and Potassium
  - Sandy soils
  - Potassium fixing soils

Photo: Jack Kelly Clark
Fertilization

• Nitrogen
  – Necessary for all basic cellular functions
  – Deficient in all production systems
• Goal of fertilization: **Provide just enough to get ‘good’ growth**

Photos: D. Doll
First Year Almond Fertilization Rate Trials by D. Doll

![Graph showing change in trunk diameter (mm) vs. pounds of nitrogen per acre at different nitrogen levels.](Image)

- **Conventional**
- **120 Day**
- **Controlled Release**

Ounces of Nitrogen/Tree vs. Change in Trunk Diameter (mm)
Fertilization

• Fertilizer (e.g. urea, CAN-17, potassium nitrate)
• Irrigation water
• Manure, cover crops, other organic amendments
• Residual soil nitrogen

• Lbs residual N/acre = \( \frac{ppm \ NO_3-N \times 2 \times depth \ soil \ sampled \ (in)}{6 \ (in)} \)

• Lbs N in irrigation water =
  – Acre-inch: ppm NO3-N * 0.23 ppm NO3 * 0.052
  – Acre-foot: ppm NO3-N * 2.72 ppm NO3 * 0.62
Fertilization

- 21’ x 21’ = 99 trees/acre at 3 oz N/tree
  - Trees need 20 lbs N/acre
- Irrigation water: 2 ppm NO3-N, 14.5 acre-inches water
  - 6.7 lbs N/acre
- Soil test: 5 ppm NO3-N in top foot of soil
  - 20 lbs N/acre

- 20’ x 18’ = 121 trees/acre at 6 oz N/tree
  - Trees need 45 lbs N/acre
- Irrigation water: 20 ppm NO3-N, 14.5 acre-inches water
  - 66.7 lbs N/acre
- Soil test: 2 ppm NO3-N in top foot of soil
  - 8 lbs N/acre
Fertilization

• Zinc
  – Required for the function of a large number of enzymes
• Deficient in many areas of California
• Goal of fertilization: prevent deficiency and avoid burning leaves off of the plant
Fertilization

• Soil
  – Less effective above pH 7.5 or in sandy soils

• Foliar application
  – Can burn leaves if improperly applied/mixed

• Many forms available
  – Salt (e.g. zinc sulfate)
  – chelate
Pests

• Scales
  – San Jose scale
  – European Fruit Lecanium

• Borers
  – American plum borer, prune limb borer, shothole borer

• Mites
  – Webspinning spider mite
Pests

• Borers
  – Like to attack stressed trees
  – Can damage scaffold

• Best cure is prevention
  – Paint trunks in a 50% white latex paint solution
  – Tree guards
Pests

• Webspinning spider mites
  – Danger is in defoliation
• Two main species:
  – Two spotted spider mite
  – Pacific spider mite
• Monitoring and control:
  – Prevent trees from becoming stressed
  – Treat before webspinning starts
Diseases

- Rust – caused by *Tranzchelia discolor*
- Danger is in early defoliation
- Spores move through the air
- Risk factors:
  - High humidity,
  - Late season rain
  - Trees high in nitrogen

Photo: Jack Kelly Clark
Diseases

• Treatments need to start BEFORE symptoms occur
  – First application five weeks after petal fall
  – Second four to five weeks later
  – Later applications if populations are high

Photo: Jack Kelly Clark
Diseases

• Phytophthora
  – Susceptibility dependent on rootstock
• Other diseases with similar symptoms
  – Other cankers (e.g. bacterial canker)
  – Borer damage
  – Abiotic stress
  – Overirrigation!

Photo: Jack Kelly Clark
Diseases

No flooding

Flooding

Photos: E. Fichtner and M. Morad
Questions?

Email: pegordon@ucanr.edu
Phone: 559-675-7879 ext 7209
Twitter: PhoebeG_orchard
Developing and Managing a New Orchard

David Doll
Farm Advisor
University of California Cooperative Extension
Merced County
Planting, Staking and Trimming
Planting Bare Root Trees

- Dig a big hole
- Plant high
  - Highest root should be covered with a few inches of soil
  - Graft union must be above soil line
  - Allow 3-4 inches for settling
- Tank in the tree with 3-5 gallons of water
  - Re-tank if needed (i.e. hot weather)
- Trim branches, high heading cut (36”+)
Planting Bare Root Trees

Be careful!

Planters often are in a hurry and

Keep an eye on the field
Planting Potted Trees

Allows for adjustment in schedules due to fumigation, land preparation

Trees should be evaluated for structure and pot-bound roots

Different processes for spring and fall plantings:

**Winter/Spring:** Remove limbs back to two buds, if too young, delay until the next winter

**Fall:** Allow to take root, prune back in winter to two buds
Concerns with Potted Trees

Be on the lookout for pot-bound plants!

Pot-bound plants can root girdle.
Managing Potted Trees

Poor tree structure is common with potted plants.

In fall of first year, prune back to two buds to re-develop the scaffolds.

After pruning: essentially a bare-root
Tree Staking

Stake should be placed away from the tree, tie is looped through upper 1/4th of trunk.

Trees are grown at an angle, creating problems with shaking, eventual barking of tree.
Issues with Tree Staking

- Tree tie too low, too tight
- Tree is growing around tie
Tree Staking

Stake is oriented into the prevailing wind, shortly after planting. Tie is loose.

Trellis systems have been used in areas with multi-directional winds.
Training Almond Trees
Training after the First Growing Season

Two goals of growing almonds:
1. Capture Light;
2. Capture light as fast as possible.
Stanislaus County Training Trial

Planted fall, 1999
Very vigorous orchard in development years
Four pruning strategies
Four tree spacings

Roger Duncan, UC Farm Advisor

See his poster!
Stanislaus County’s Training Experiment Treatments

1) Standard trained, annually pruned

2) Standard trained, left unpruned
Stanislaus County's Training Experiment Treatments

3) Minimal training

4) Untrained
First “dormant” pruning
February 2001

Trained to 3 scaffolds
Minimally trained
Untrained
2 Year Old – Spring 2001

Standard trained & pruned

Untrained

10’ x 22’
After Second “dormant” pruning
Spring 2002

- Standard trained, pruned annually
- Minimally trained, minimally pruned
- Untrained, unpruned
## Stanislaus County Training Trial 2000-2012

The Effects of Pruning on Current (13th Leaf) & Cumulative Yield

<table>
<thead>
<tr>
<th></th>
<th>Nonpareil</th>
<th>Carmel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012 Yield (lb / acre)</td>
<td>Cumulative</td>
</tr>
<tr>
<td>Trained to 3 scaffolds; Annual, moderate pruning</td>
<td>4209 ab</td>
<td>29,338</td>
</tr>
<tr>
<td>Trained to 3 scaffolds; unpruned after 2nd year</td>
<td>4387 a</td>
<td>30,670</td>
</tr>
<tr>
<td>Trained to multiple scaffolds; Three annual pruning cuts</td>
<td>3979 b</td>
<td>28,769</td>
</tr>
<tr>
<td>No scaffold selection; no annual pruning</td>
<td>4220 ab</td>
<td>30,683</td>
</tr>
</tbody>
</table>

Courtesy of Roger Duncan, UCCE

See his poster for updates.
Training First Leaf Almonds

Trained to 3-4 Leaders

Thinning cuts are made to remove scaffolds
Limited heading cuts are made
Tying is typically necessary, depending on tree vigor

Once a decision is made, stick to it!

Trained to 6+ Leaders

Thinning cuts are made to remove scaffolds
Typically, only 2-3 are removed
Tying is necessary for years 2-4
Removing double breaks at nodes is a good idea
Training Second Leaf Almonds

Typically 1-2 cuts are removed from the internal part of the tree

- Thinning cuts
- Typically vertical wood or limbs crossing over the tree
Training Second Leaf Almonds and Later

Typically 1-2 cuts are removed from the internal part of the tree

- Thinning cuts
- Typically vertical wood or limbs crossing over the tree
- Cutting too much causes regrowth
Developing and Managing Young Orchards: Conclusions

Plant trees properly as many mistakes occur at this stage;

Tree staking should occur to keep trees straight to prevent barking, tie loosely with stake into the prevailing wind;

The more cuts made on young trees, the less yield in the first few harvests;

Training should vary by tree and age, with larger # of cuts being made after year one, fewer cuts in years two and three.
Thank you!
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Research Poster Sessions

Wednesday, December 6
3:00 p.m. – 5:00 p.m.
Featured topics:
• Irrigation, nutrient management
• Breeding
• Soils, if related to organic matter input
• Sustainability, irrigation improvement continuum, life cycle assessment, dust
• Food quality and safety

Thursday, December 7
1:30 p.m. – 2:30 p.m.
Featured topics:
• Insect and disease management
• Fumigation and alternatives
• Biomass (including biochar-related efforts)
• Pollination
• Almond Leadership Program
2017 Research Update Book

• Pickup your copy at the ABC Booth in Hall A+B

• Includes a one-page summary of every current ABC-funded research project
What’s Next

Tuesday, December 5 at 4:15 p.m.

• State of the Industry – Hall C

Be sure to join us at 5:30 p.m. in Hall A+B for Dedicate Trade Show Time and Opening Reception, sponsored by The Bank of Stockton