CEUs – New Process

Certified Crop Advisor (CCA)
• Sign in and out of each session you attend.
• Pickup verification sheet at conclusion of each session.
• Repeat this process for each session, and each day you wish to receive credits

Pest Control Advisor (PCA), Qualified Applicator (QA), Private Applicator (PA)
• Pickup scantron at the start of the day at first session you attend; complete form.
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• Turn in your scantron at the end of the day at the last session you attend.

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

• **Gabriele Ludwig**, Almond Board of California, moderator

• **Allan Fulton**, California State University Sacramento

• **Spencer Cooper**, Almond Board of California
**WATER MANAGEMENT + EFFICIENCY**

<table>
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<th>Measurement</th>
<th>1.0 Minimum</th>
<th>2.0 Intermediate</th>
<th>3.0 Advanced</th>
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<tr>
<td><strong>Orchard Water Requirements</strong></td>
<td>Estimate orchard water requirements using “normal year” regional ETC to estimate irrigation demand on a monthly basis.</td>
<td>Estimate orchard water requirements using “normal year” regional ETC—adjusting for current weather and cover crop use on a bi-weekly basis.</td>
<td>Estimate orchard water requirements using “normal year” regional ETC to plan irrigations, then use real-time ETC data to correct the schedule on a weekly basis.</td>
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<td>Evaluate irrigation system for pressure variation and average application rate at least once every 3 years. Correct any diagnosed system performance problems.</td>
<td>Assess distribution uniformity and average application rate by measuring water volume at least every 3 years. Correct any diagnosed system performance problems.</td>
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<td>Evaluate soil moisture based upon feet and appearance by augering to at least 3-5 feet. Monitor on a monthly time step.</td>
<td>Use manually operated soil moisture sensors at least 3-5 feet and monitor on a bi-weekly time step. Use information to ensure calculated water is not over/under irrigating trees.</td>
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<td>Evaluate orchard water status using visual plant cues just prior to irrigation or on a bi-weekly basis.</td>
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<td>Use irrigation system performance data with regional estimates of “normal year” ETC to schedule irrigations and adjust based on feedback from monitoring soil moisture or crop water status.</td>
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TODAY WE’LL HEAR MORE ABOUT HOW TO:

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TOOLS FOR BETTER IRRIGATION
- FLOW METERS

Allan Fulton
UC Irrigation and Water Resources Advisor
Tehama County
aefulton@ucanr.edu
(530)-527-3101
TOPICS

• Flow measurement basics
• Measuring water – a step towards a common irrigation language
  - Applications and benefits of flow measurement information
FLOW METER BASICS

• Q = flow, expressed as volume of water per unit time
• Q is determined by measuring two separate components
  - Water velocity (V) in feet per second (ft/sec)
  - Cross sectional area (A) of pipe in square feet (ft²)

\[ Q = V \text{ (ft/sec)} \times A \text{ (ft}^2) = \text{ft}^3 \text{ per second (cfs)} \]

1.0 cfs = 449 gallons per minute (gpm)

\[ Q = \text{flow, gpm} \]
SINCE \( Q = V \times A \), WHICH FLOW METER INSTALLATION IS LIKELY TO WORK BETTER AND WHY?
FLOW MEASUREMENT ACCURACY DEPENDS ON:

- Installation conditions
  - Influences water velocity
  - Cross-sectional area
    Need laminar flow but what is that?

Seeking laminar flow and a full pipe
SO, WHICH FLOW METER INSTALLATION IS LIKELY TO WORK BETTER AND WHY?
TWO GENERAL TYPES OF METERS

• Point velocity meters
• Velocity average meters
POINT VELOCITY METER EXAMPLE (AKA INSERTION OR PADDLE WHEEL METERS)
VELOCITY AVERAGING METERS

Impeller meters

Magnetic meters

Doppler and ultrasonic meters
SOME CONSIDERATIONS WHEN CHOOSING A FLOW METER

• Initial cost, warranty, and service
• Installation requirements and adaptations
• Durability and maintenance
• Automation and data management capabilities
• Water quality
• Power requirements
• Security
MEASURING WATER

- Irrigation management requires gathering, evaluating, and communicating information to implement decisions or troubleshoot problems

- Using flow meters is a step towards a common irrigation management language and conversation

“I’m sorry. I don’t know where yonder is.”
FREQUENT IRRIGATION QUESTIONS AND CAUSE TO SEEK ANOTHER OPINION:

• Is my irrigation management holding back orchard development or production potential?
• Areas of my orchard have sick trees and they are expanding, is irrigation the cause?
• Is my irrigation frequency and duration about right?
• Why doesn’t irrigation water penetrate deeper into the root zone?
• Can I reduce my power bill?
• Other questions like … how much are declining groundwater levels affecting the flow rate and distribution uniformity?
TO TROUBLESHOOT, HOW WOULD YOU RESPOND TO THE FOLLOWING – HOW MUCH WATER HAS BEEN APPLIED TO THE ORCHARD SINCE BEGINNING THE IRRIGATION SEASON?

- “I don’t know”.
- “The microsprinkler flow rate is 12 gallon per hour”.
- “Most recently, about 18 hours”.
- “I usually turn on the pump after 6 pm on Friday and turn it off before noon on Monday, I try to give it a good deep irrigation every other weekend”.
- “This irrigation system is 13 years old. It was designed to deliver 1.6 inches in 24 hours. A few days ago, I ran the system 20 hours.”
- “The flow meter at the pump indicates 10 acre-feet was applied across this 60 acre orchard one week ago … that works out to about 2.0 inches of water per acre for the past week”. “So far this season, 110 acre-feet has been applied to this orchard or about 1.8 acre-feet per acre (22 inches/acre)”.

WHICH RESPONSE IS MORE LIKELY TO HELP TROUBLESHOOT THESE QUESTIONS?

✓ “The flow meter at the pump indicates 10 acre-feet was applied across this 60 acre orchard one week ago … that works out to about 2.0 inches of water per acre for the past week”. “So far this season, 110 acre-feet has been applied to this orchard or about 1.8 acre-feet per acre (22 inches/acre)”.
Important conversions to achieve common irrigation language:

- **Gallons to inches** *(per acre)*

\[
\frac{\text{Total Gallons Applied}}{\text{Acres Irrigated}} \div 27,152 = \text{Inches of Water Applied}
\]

- **Example**

\[
\frac{62,665,728}{60} \div \frac{27,152}{2} = 38.5
\]

Inches of Water Applied

http://www.almonds.com/sites/default/files/misc/alm_flow_meter_application_rate_v2.pdf
FLOW METER UNITS

Important conversions to achieve common irrigation language:

- **Acre-feet to inches (per acre)**

  \[
  \text{Inches of Water Applied} = \frac{\text{Total Acre-feet Applied}}{\text{Acres Irrigated}} \times 12
  \]

- **Example**

  \[
  876.8 \div 215 \times 12 = 48.9 \text{ Inches of Water Applied}
  \]

http://www.almonds.com/sites/default/files/misc/alm_flow_meter_application_rate_v2.pdf
FLOW METER UNITS

Important conversions to achieve common irrigation language:

• gpm to inch per hour (rate of application)

\[
gpm \div \frac{\text{Acres Irrigated}}{\text{Acres Irrigated}} \times 0.0022 = \text{Inch per hour application rate}
\]

• Example

\[
1150 \div 40 \times 0.002 = 0.063 \text{ Inch per hour application rate}
\]

http://www.almonds.com/sites/default/files/misc/alm_flow_meter_application_rate_v2.pdf
FLOW METER UNITS

Important conversions to achieve common irrigation language:

• gallons to inch per hour (rate of application)

\[
gallons \div \text{time measured (min)} \div \text{Acres Irrigated} \times 0.0022 = \text{Inch per hour application rate}
\]

• Example

\[
1,610,185 \text{ gallons} \div 1,440 \text{ (minutes)} \div 60 \text{ Acres} \times 0.0022 = 0.041 \text{ Inch per hour application rate}
\]

[http://www.almonds.com/sites/default/files/misc/alm_flow_meter_application_rate_v2.pdf]
FLOW METERS – A STEP TOWARDS A COMMON IRRIGATION LANGUAGE

Measured applied water and water application rates can be compared to:

• Estimated crop ET in inches
• Rainfall measured in inches
• Soil water holding capacity expressed in inches per foot of soil
• Soil intake rates expressed in inches per hour

➔ We can begin to resolve questions

“Yes. I know where the French Riviera is.”
FLOW METERS – BETTER INFORMATION, MORE CONFIDENCE IN OPINIONS AND SOLUTIONS

- Crop ET for almonds is estimated to be about 17.5 inches through mid June of this season. An average of 22 inches of applied water up to this point indicates over irrigation may have occurred along the way.

- The most recent irrigation of 2.0 inches is just slightly more than the past week of ET, your irrigation frequency and duration appears reasonable now.

- It is reasonable to expect 2.0 inches of applied water might penetrate 1 to 2 feet deep in this loam soil depending on how dry it was when irrigated.

- Let’s check soil moisture or orchard water status to affirm these notions?

- This season’s records suggest there may be some opportunity to reduce pumping and energy costs in the spring in upcoming seasons.

“Go three blocks straight, turn left and you will have arrived.”
ALTERNATIVES TO FLOW METERS (POINT IN TIME MEASUREMENTS, NOT CUMULATIVE)

- Designed application rate
- Average flow rate measured at representative sprinklers before aerial distribution
- Average flow rate from catch can data after aerial distribution
EXAMPLE – IMPORTANCE OF FLOW METERS

A. Designed application rate = 10.6 gph (per tree) = 0.049 in/hr \* 24 hrs = 1.18 inches

B. Average flow rate at representative sprinkler nozzles (before aerial distribution) = 0.045 in/hr \* 24 hrs = 1.08 inches

C. Average flow rate from catch can data (after aerial distribution) = 12 gph (per tree) = 0.056 in/hr \* 24 hrs = 1.34 inches

Key point – total hours needed to apply 36 inches of water over season?

A. 735 hours
B. 800 hours
C. 643 hours

The range in hours of pumping varies 20% using these three methods of estimating flow. Can a flow meter improve on these alternatives?
THANK YOU!
TAKE TIME TO VISIT WITH THE FLOW METER MANUFACTURERS AT THE TRADE SHOW.
IRRIGATION SYSTEM MAINTENANCE

Spencer Cooper
Senior Manager, Irrigation and Water Efficiency
WHERE SHOULD ANNUAL MAINTENANCE TAKE PLACE

➔ In the Field
➔ The Pump Station
FLUSHING YOUR SYSTEM

• 1st Flush: Mainlines
• 2nd Flush: Submains
• 3rd Flush: Irrigation Hoses
EMISSION DEVICE MAINTENANCE

• Micro Sprinkler/ Drip
  - Check for Mineral Deposits
  - Exam for Excessive Wear

• Sprinkler (Rotatory or Impact)
  - Check for Excessive Wear
FILTER STATION

- Filters
  - Sand Media
  - Disc
  - Spin
- Pressure Relief Valves
  - Quick Acting
  - Fresno Style
- Flow Meters
  - Mag Meters
  - Insertion
  - Impeller

*Source: Jain USA
*Source: Netafim USA
FILTER MAINTENANCE

- Sand Media
  - Is there any sand in the tank?
  - Has the sand been polished?
  - Is there bacteria build up prevent adequate filtration?

- Screen Filter (Spin Filter)
  - Check For Screen Wear
  - Rinse Particulate Build Up Off With a Pressure Washer

- Disc Filter
  - Check For Algae Build Up
  - Check For Damaged Disc
PRESSURE RELIEF VALVES AND AIR VENT

- Pressure Regulating Valves
- Pressure Relief Valves
  - Quick Acting
  - Fresno Style Spring
- Air Vent
  - Dual Acting
  - Continuous Air Release
  - Combination Dual Acting Release
IRRIGATION STATION

• Fertilizer Tanks
• Gypsum/ SOP Silos
  - Clean Out Auger
  - Silo Boot
• Soil Solution Machines
  - Change Screen Filter
  - Flow Regulator
  - Replace Pump Diaphragm
  - Belts
  - Gear Box Seals
• Diamond K
  - Clean out
ADDITIONAL RESOURCES

For details on the Almond Irrigation Continuum visit:
• http://www.almonds.com/irrigation

For brand specific maintenance details visit:
• https://www.jainsusa.com/resources/technical-brochure
• http://www.rainbird.com/ag/support/dripline.htm
• http://rivulis.com/knowledge_center/product-info-library/
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What’s Next

Wednesday, December 6 at 12:00 p.m.

• Luncheon Presentation – Hall C

The Future of Agriculture: Innovation, Ingenuity, Perseverance
Speaker: Steve Forbes

Luncheon is ticketed and is sponsored by Yosemite Farm Credit