

2017 THE ALMOND CONFERENCE

TOOLS FOR BETTER IRRIGATION



Room 308-309 | December 6 2017

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 with 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.
- Sign in and out of each session you attend.
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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

Measurement	1.0 Minimum	2.0 Intermediate	3.0 Advanced
Orchard Water	Estimate orchard water	Estimate orchard water	Estimate orchard water
Requirements	requirements using "normal year"	requirements using "normal year"	requirements using "normal year"
	regional ETc to estimate irrigation	regional ETc—adjusting for current	regional ETc to plan irrigations, then
	demand on a monthly basis.	weather and cover crop use on a	use real-time ETc data to correct
		bi-weekly basis.	the schedule on a weekly basis.
Irrigation System	Evaluate irrigation system for	Assess distribution uniformity	Assess distribution uniformity
Performance	pressure variation and average	and average application rate	and average application rate
	application rate at least once every	by measuring water volume at	by measuring water volume at
	3 years. Correct any diagnosed	least every 3 years. Correct any	least every 2 years. Correct any
	system performance problems.	diagnosed system performance	diagnosed system performance
		problems.	problems.
Applied Water	Use application rate and duration	Use water meters to determine	Use water meters to determine
	of irrigation to determine water	flow rate and water applied.	applied water and compare to crop
	applied.		water use (ETc, evapotranspiration)
			to determine irrigation efficiency.
Soil Moisture	Evaluate soil moisture based upon	Use manually operated soil	Use automated moisture sensors
	feel and appearance by augering	moisture sensors to at least 3-5	that store data over time. Review
	to at least 3-5 feet. Monitor on a	feet and monitor on a bi-weekly	weekly to ensure calculated water
	monthly time step.	time step. Use information to	is not over/under irrigating trees.
		ensure calculated water is not	
		over/under irrigating trees.	
Plant Water Status	Evaluate orchard water status	Use pressure chamber to measure	Use pressure chamber to measure
	using visual plant cues just prior to	midday stem water potential just	midday stem water potential
	irrigation or on a bi-weekly basis.	prior to irrigation on a monthly	prior to irrigation on a weekly
		basis. Ensure calculated water	basis. Ensure calculated water
		applications are not over/under	applications are not over/under
		irrigating trees.	irrigating trees. Use it to assess
			when to start irrigating.
Integrating Irrigation	Combine irrigation system	Use irrigation system performance	Develop an irrigation schedule
Water Management	performance data with "normal	data with regional estimates of	based on predicted "normal year"
Practices	year" regional ETc to determine	"normal year" ETc to schedule	demand, monitor status using soil
	orchard-specific water	irrigations and adjust based on	and plant based methods. Adjust
	requirements and schedule	feedback from monitoring soil	irrigation schedule with real-time
	irrigations. Check soil moisture	moisture or crop water status.	ETc as the season progresses.
	with an auger and/or monitor plant		
	water status to verify scheduling.		

ALMOND IRRIGATION IMPROVEMENT CONTINUUM

ETs interpret water used in instance of wet

order to assess the orchard's water reg

ETe (reference ET) information is availal California Department of Water Resource

provide daily reference evapotranspirat

Thirty-year average evapotranspiratio

almonds

nes within almond producing area Zone 12" Kat 810 810

IRRIGATION SCHEDULING USING EVAPOTRANSPIRATION (ET)

Understanding the characterization and and them to meet our with use by exceptionspratelys, or E.T., is a first step toward optimum inguistionics oblisation exponention and transmission throughout the year according to waited or corp stageling to board back in in

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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)

 $\begin{aligned} \mathsf{Q} &= \mathsf{V} \; (\mathsf{ft/sec}) \; \mathsf{X} \; \mathsf{A} \; (\mathsf{ft}^2) = \mathsf{ft}^3 \; \mathsf{per} \, \mathsf{second} \; (\mathsf{cfs}) \\ 1.0 \; \mathsf{cfs} &= 449 \; \mathsf{gallons} \; \mathsf{per} \; \mathsf{minute} \; (\mathsf{gpm}) \\ \mathsf{Q} &= \mathsf{flow}, \; \mathsf{gpm} \end{aligned}$

SINCE Q = V X 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

No

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

Magnetic

meters

Impeller 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)

Total Gallons ÷ Applied	Acres Irrigated	<u>•</u>	27,152	=	Inches of Water Applied
• Example 52,665,72 8 Gallons	↔ 60 ÷ Acres	•	27,15 2	=	38.5 Inches of Water Applied



Important conversions to achieve common irrigation language:

• Acre-feet to inches (per acre)

Total Acre- feet Applied	•	Acres Irrigated	х	12	=	Inches of Water Applied
Example						
876.8 Acre- feet Applied	•	215 Acres	х	12	=	48.9 Inches of Water Applied



Important conversions to achieve common irrigation language:

• gpm to inch per hour (rate of application)





Important conversions to achieve common irrigation language:

• gallons to inch per hour (rate of application)



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



JUST SET IT



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





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:

- <u>http://www.netafimusa.com/wp-content/uploads/2016/09/A012-Drip-System-Ops-Maint.pdf</u>
- <u>https://www.jainsusa.com/resources/technical-brochure</u>
- http://www.r2000wf.com/assets/rotator_r2000wf-pocket.pdf
- http://www.rainbird.com/ag/support/dripline.htm
- http://rivulis.com/knowledge_center/product-info-library/

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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



