UNIVERSITY of CALIFORNIA COOPERATIVE EXTENSION

Proactively Addressing Water Quality

Blake Sanden -- Irrigation & Agronomy Farm Advisor Kern County

CA State Board of Agriculture Meeting Mendota 9/11/12

What is UC Cooperative Extension?

It is the land grant university ‘extending’ research-based information to the people of CA through county-based advisors and statewide specialists connected to UC campuses. Counties ‘cooperate’ by supplying offices and staff for the university paid advisors.

Traditionally 3 Main Areas

(1) Agriculture and natural resources production & management
(2) Family and consumer sciences
(3) 4-H youth development.

UC Cooperative Extension is part of Ag & Natural Resources

- 200 locally based Cooperative Extension advisors and specialists
- 57 local offices throughout California
- 130 campus-based Cooperative Extension specialists
- 9 Research and Extension Centers
- 6 statewide programs
- 700 academic researchers in 40 departments at 3 colleges and 1 veterinary school

Identify and manage pests in crops and agriculture - UC Statewide IPM Program - Windows Internet Explorer

http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html

File Edit View Favorites Tools Help Convert Select

Favorites Suggested Sites Free Hotmail Web Slice Gallery Juno E-mail on the Web My Juno

Identify and manage pests in crops and agriculture - ... Page Safety Tools

UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES

UC IPM Online

Statewide Integrated Pest Management Program

PRIN

HOME

MORE ABOUT AGRICULTURAL PESTS

- About agriculture pages
- Recent updates
- PDFs to print
- Weather, models, & degree-days
- Weed gallery
- Natural enemies gallery
- Monitoring forms

ON THIS SITE

- What is IPM?

Agricultural pests

Information about managing pests, including University of California's official guidelines for monitoring pests and using pesticides and nonpesticide alternatives for managing insect, mite, nematode, weed, and disease pests.

Index by crop

A – C · D – O · P – Z

Includes Year-Round IPM Program, with annual checklist.

- Alfalfa
- Almond
- Apple
- Apricot
- Artichoke

Campuses

UC Berkeley College of Natural Resources

UC Davis College of Agricultural and Environmental Sciences

UC Davis School of Veterinary Medicine

UC Riverside College of Natural and Agricultural Sciences

ANR Research and Extension Centers

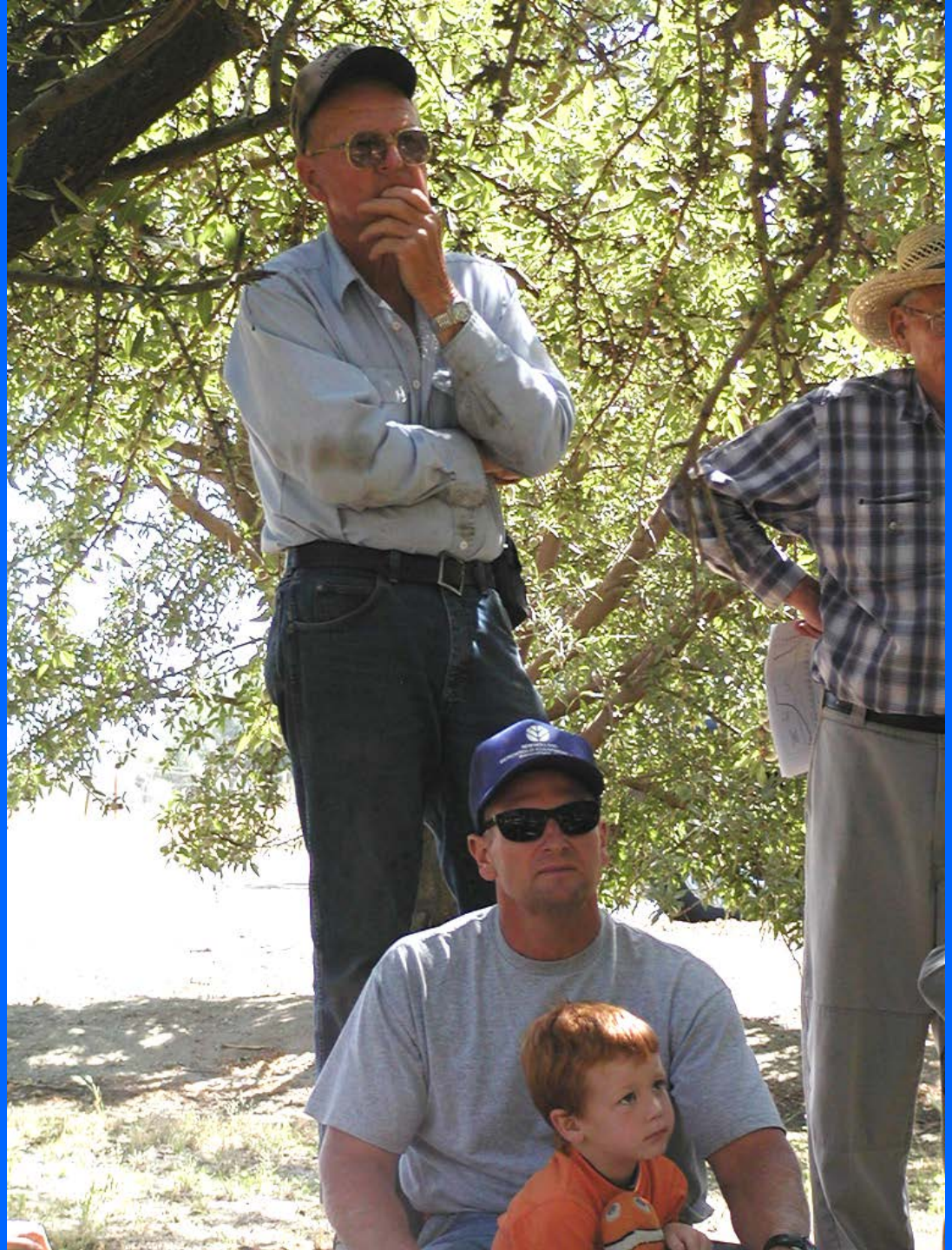
Desert Research & Extension Center	El Centro
Hansen Research & Extension Center	Santa Paula
Hopland Research & Extension Center	Hopland
Intermountain Research & Extension Center	Tulelake
Kearney Ag Research & Extension Center	Parlier
Lindcove Research & Extension Center	Exeter
Sierra Foothill Research & Extension Center	Browns Valley
South Coast Research & Extension Center	Irvine
West Side Research & Extension Center	Five Points

UC Ag & Natural Resources Vision 2025

- Improve Water Quality, Quantity, and Security
- Enhance Competitive, Sustainable Food Systems
- Increase Science Literacy in Natural Resources, Agriculture, and Nutrition
- Enhance Sustainable Natural Ecosystems
- Enhance the Health of Californians and California's Agricultural Economy
- Provide for Healthy Families and Communities
- Ensure Safe and Secure Food Supplies
- Manage Endemic and Invasive Pests and Diseases
- Improve Energy Security and Green Technologies

http://ucanr.edu/files/907.pdf

YORKER
NATIVE SON
SHALOM
Local News
Water Service Areas



3 generations of Bender Almond Growers @ field meeting in their orchard, ½ mile west of Bender Ave. (Shafter)

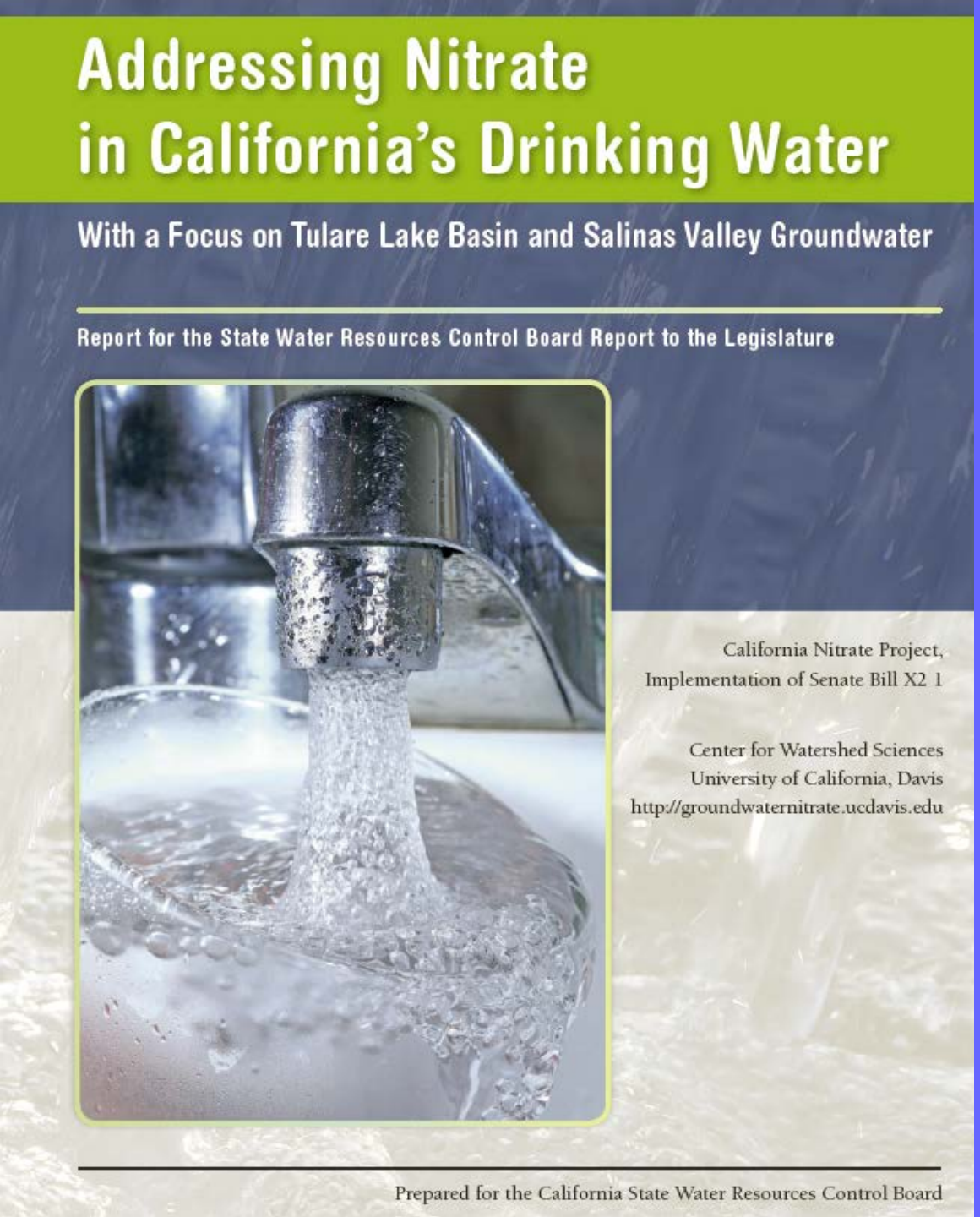
UC Ag & Natural Resources (Nos. Personnel Listed)

Water Quality

- 32 Advisors and Specialists
- 68 Faculty and Staff
- (unknown number retired, dead)

Irrigation

- 20 Advisors and Specialists
- 24 Faculty and Staff
- (7 retired, 2 dead)



Thomas Harter is not listed under water quality or irrigation, but groundwater & hydrology

So how do I look into the crop rootzone to optimize my field water & fertilizer budget?

UNIVERSITY of CALIFORNIA COOPERATIVE EXTENSION

Balancing Efficiency & Salinity Control in the Field

Blake Sanden - Irrigation/Agronomy Advisor, Kern County

Kern Almond & Irrigation Workshop March 28, 2012

Water Demand & Fertigation Options for Almonds in the SJV

Kern Almond & Irrigation Workshop March 28, 2012

UCCE 1031 S. Mt. Vernon Ave, Bakersfield CA 93307

Blake Sanden – Irrigation Advisor, Kern County
http://cekern.ucdavis.edu/Irrigation_Management/

The soil & irrigation system are the "ESSENTIAL" integrating factors for creating an optimal water balance.

California crops sit most firmly on a chair with 4 legs!

Crop

LIFE CYCLE & WATER USE (ET)
ROOTING CHARACTERISTICS
DESIRED STRUCTURE / SPACING
HARVEST REQUIREMENTS
FIELD TRAFFIC

Water

SOURCE / SUPPLY
SALTS / QUALITY
REQUIRED AMENDMENTS
COST

System

IRRIGATION METHOD
DISTRIBUTION PATTERN
IRRIGATION FREQUENCY
MONITORING
MAINTENANCE / REPAIR
OPERATING COST
CAPITAL COST

Soil

TOPOGRAPHY
TEXTURE
INFILTRATION RATE
DRAINAGE
SALTS / QUALITY
AMENDMENTS / COST

“Essential” is just the basics, right?
So can flood irrigation with 8 inch
alfalfa valves @ 200 gpm be optimal?

What about 18 inch
valves @ 2000 gpm?

Micro-irrigation system capable of injecting fertilizer and applying 0.6 to 1.5 inches/day

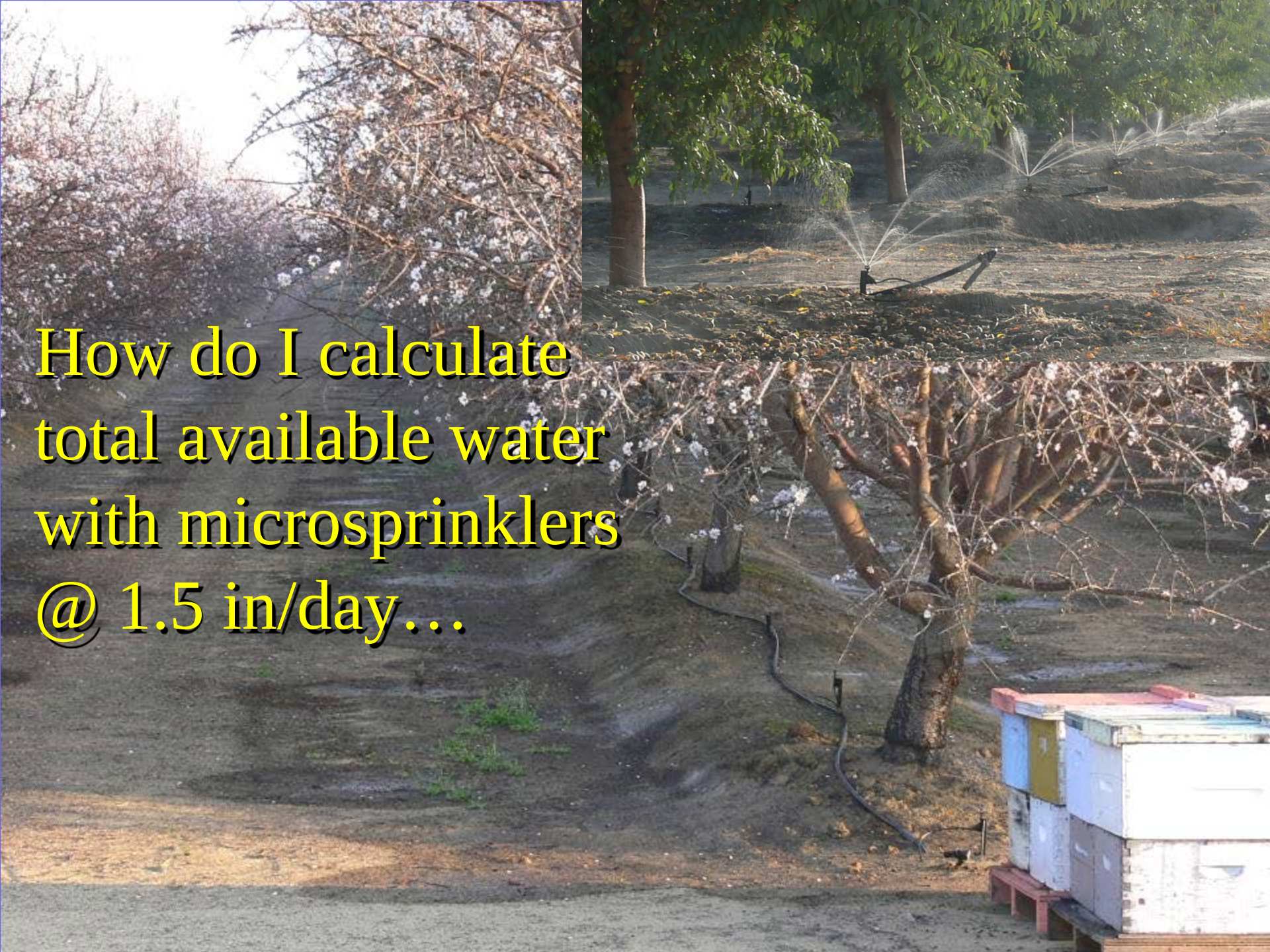
… or do you need this
kind of system…

… and this much technology?

YES …

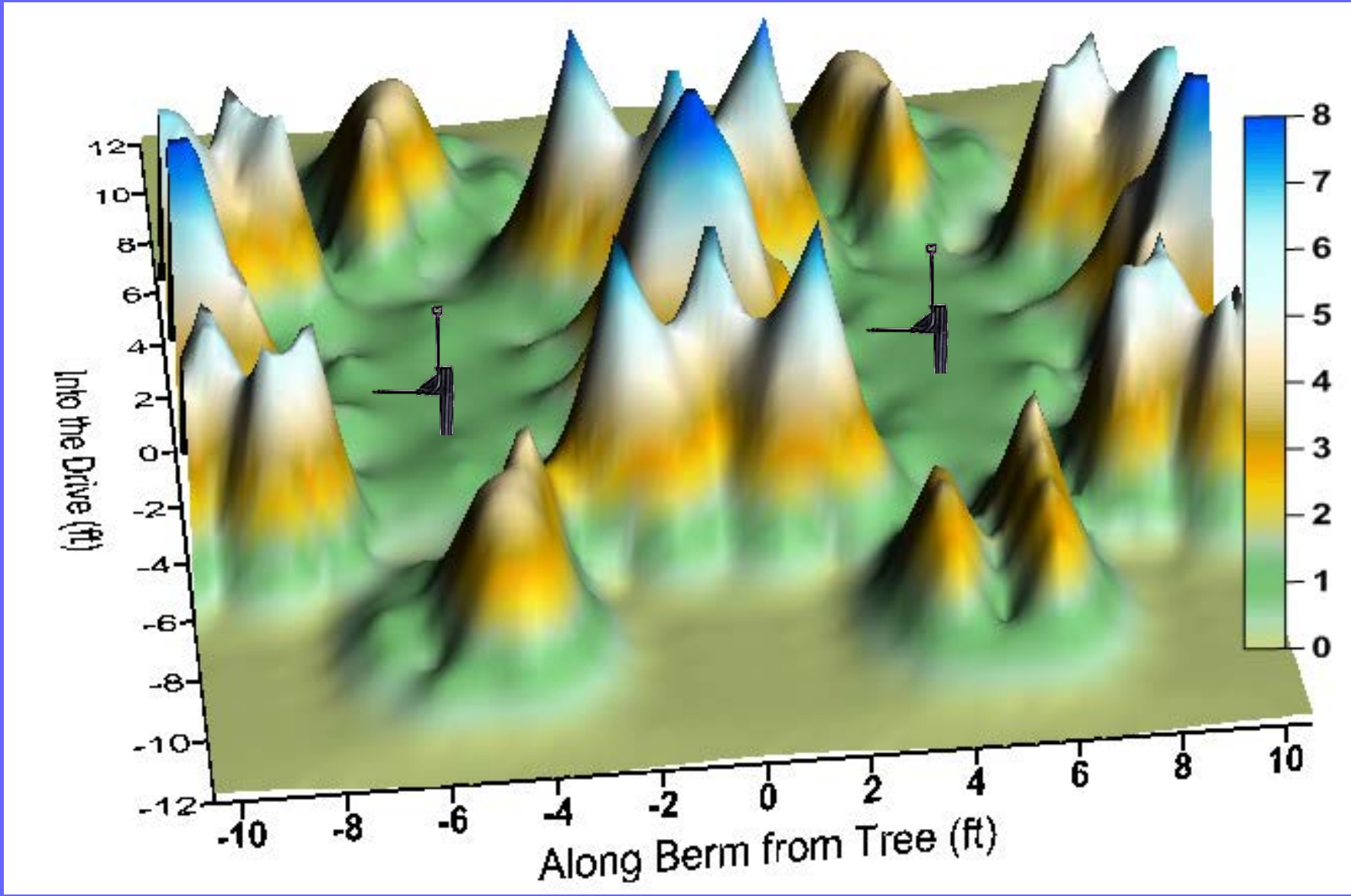
NO …

DEPENDS.



How do I calculate total available water with microsprinklers @ 1.5 in/day…

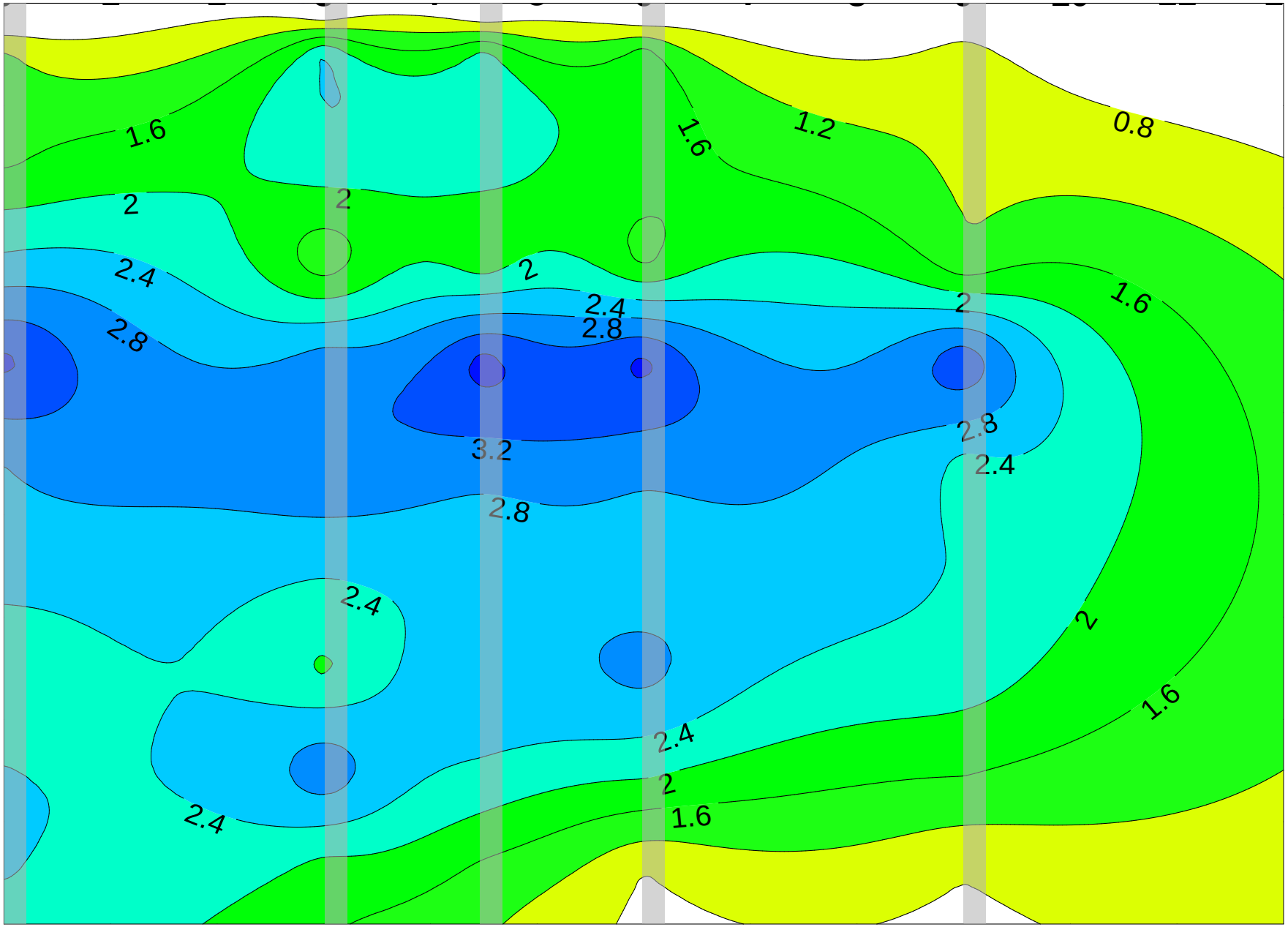
Interpolated pattern of applied water from 2 Fanjets/tree



… or account for "subbing" in a double-line drip?

TREE

DRIP HOSE



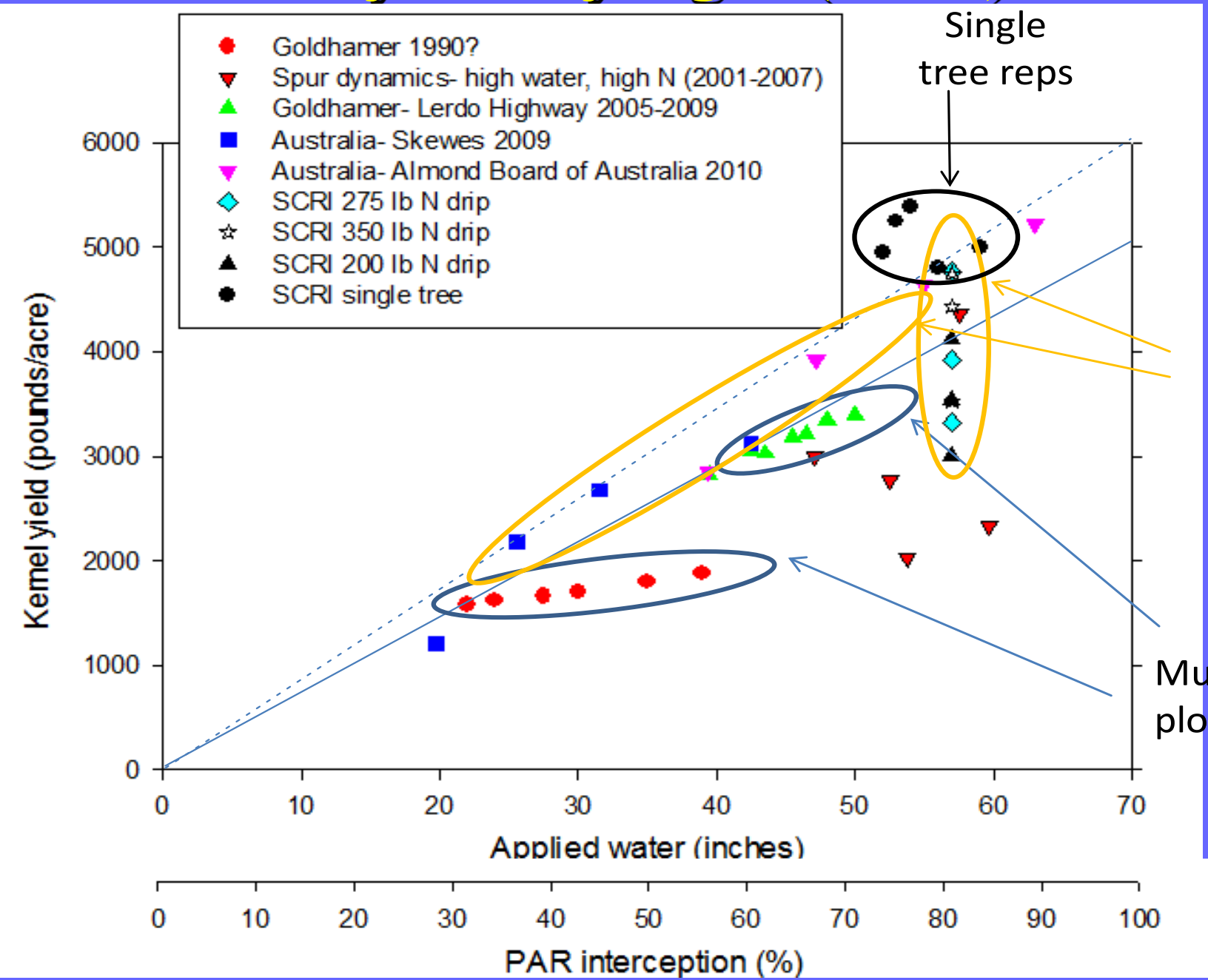
A variety of loggers can be used for various sensors: Costs from $100 (Hobo) to $5,000 (Campbell)

Soil Moisture Monitoring in Peppers, Squash and Snap Beans on Drip Tape

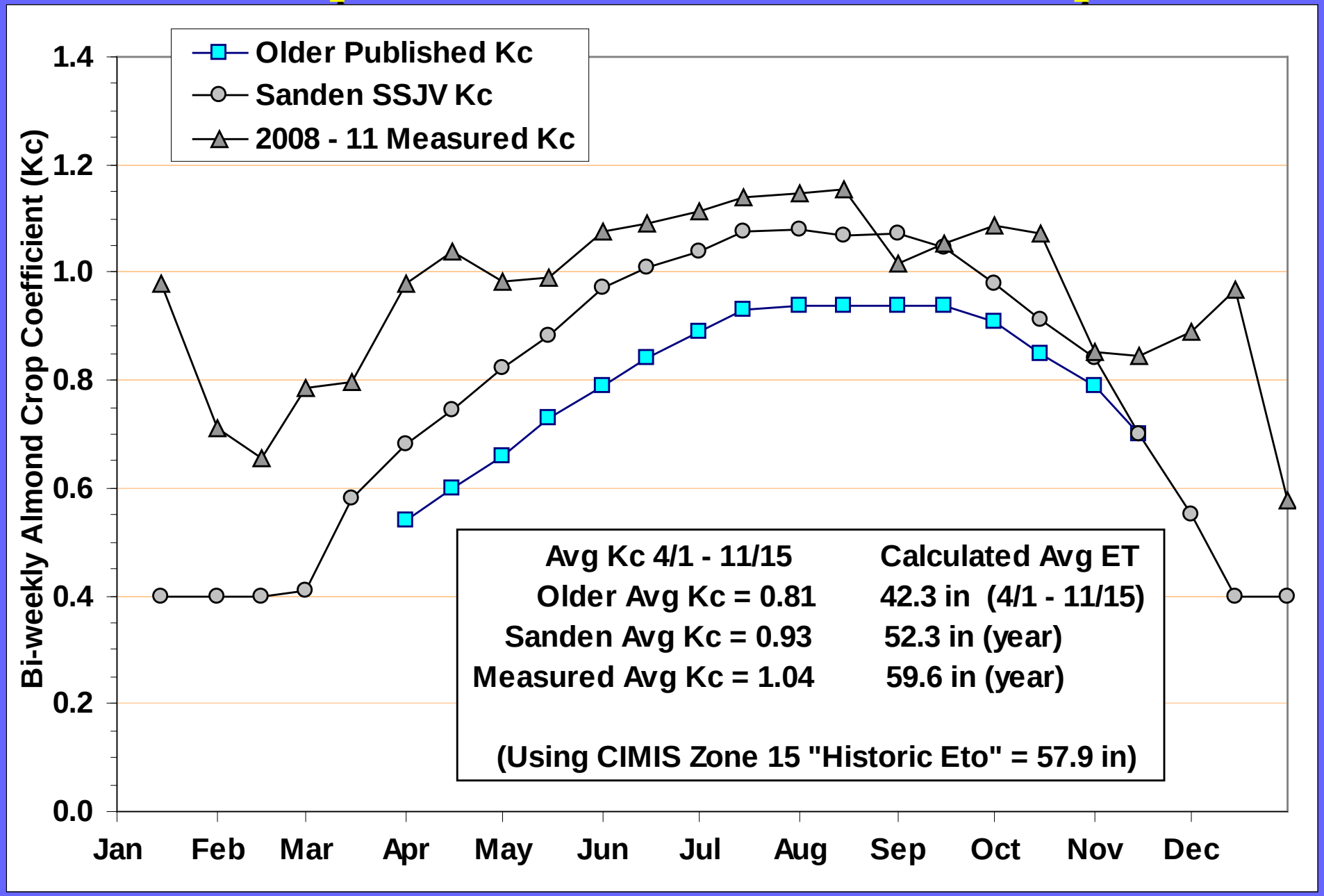
Watermark blocks at 12 & 24 inch depth between buried drip tape and plant row

Soil Moisture Monitoring in Citrus

Almond yield by light (PAR) & water



What are optimal almond Kc's and crop ET?



Chemigation Initiative

REQUIRED CHEMIGATION SAFETY DEVICES

Equipment Required on the Irrigation Pipeline

(A) Check Valve

(B) Low Pressure Drain

(C) Air/Vacuum Relief Valve

Alternative for (A), (B), and (C): Gooseneck Pipe Loop

(D) Pressure Switch

Required Power and System Interlocks

(E) Interlocking System Controls

Equipment Required on the Injection Line

(F) Solenoid Operated Valve

Alternatives:

a. 10-psi Check Valve*

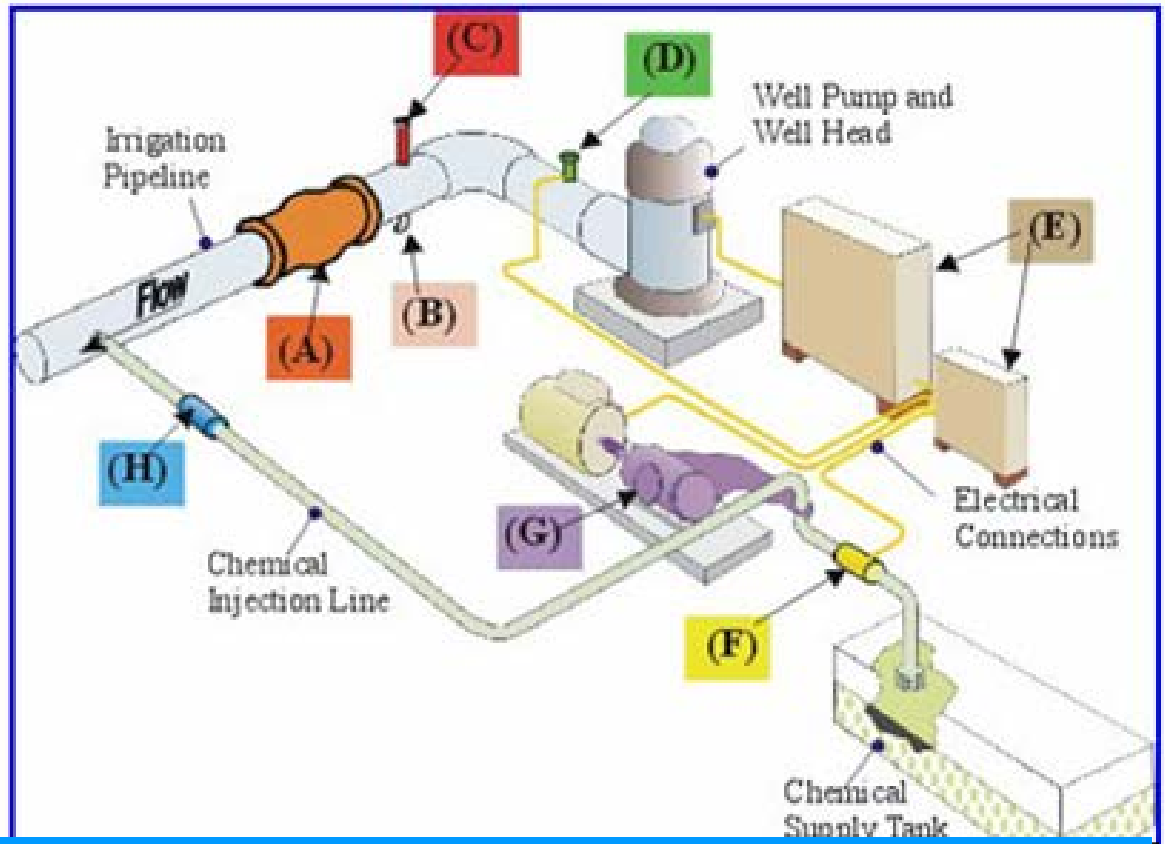
b. Hydraulically Operated Valve

c. Vacuum Relief Valve*

(G) Chemical Injection Pump

Alternative: Venturi Injector

(H) Injection Line Check Valve**



Chemigation/Backflow Prevention
http://www.cdpr.ca.gov/docs/gwp/chem/chemdevices.htm

CHLORINE

RAIN BIRD

Chemigation: Getting It Uniform

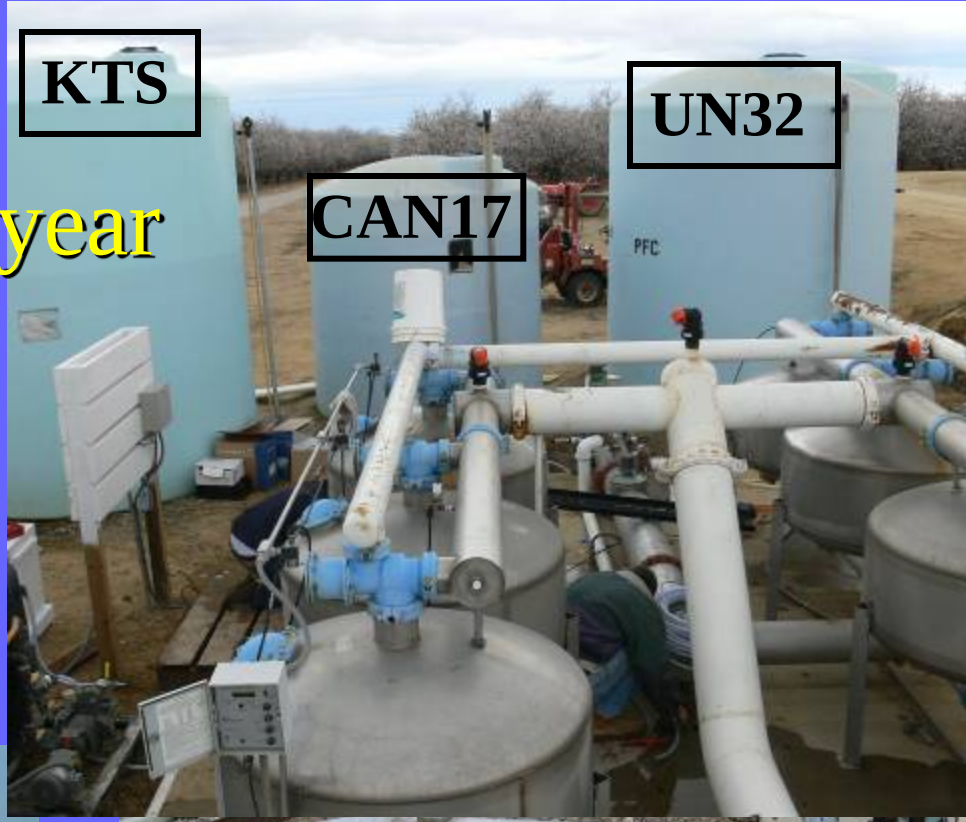
- **<u>Check Emitters</u>:** different emitters have different pressure to flow curves. Not all 1 gph emitters are created equal.

Injection nipple on well casing dribbling chemicals directly into groundwater.

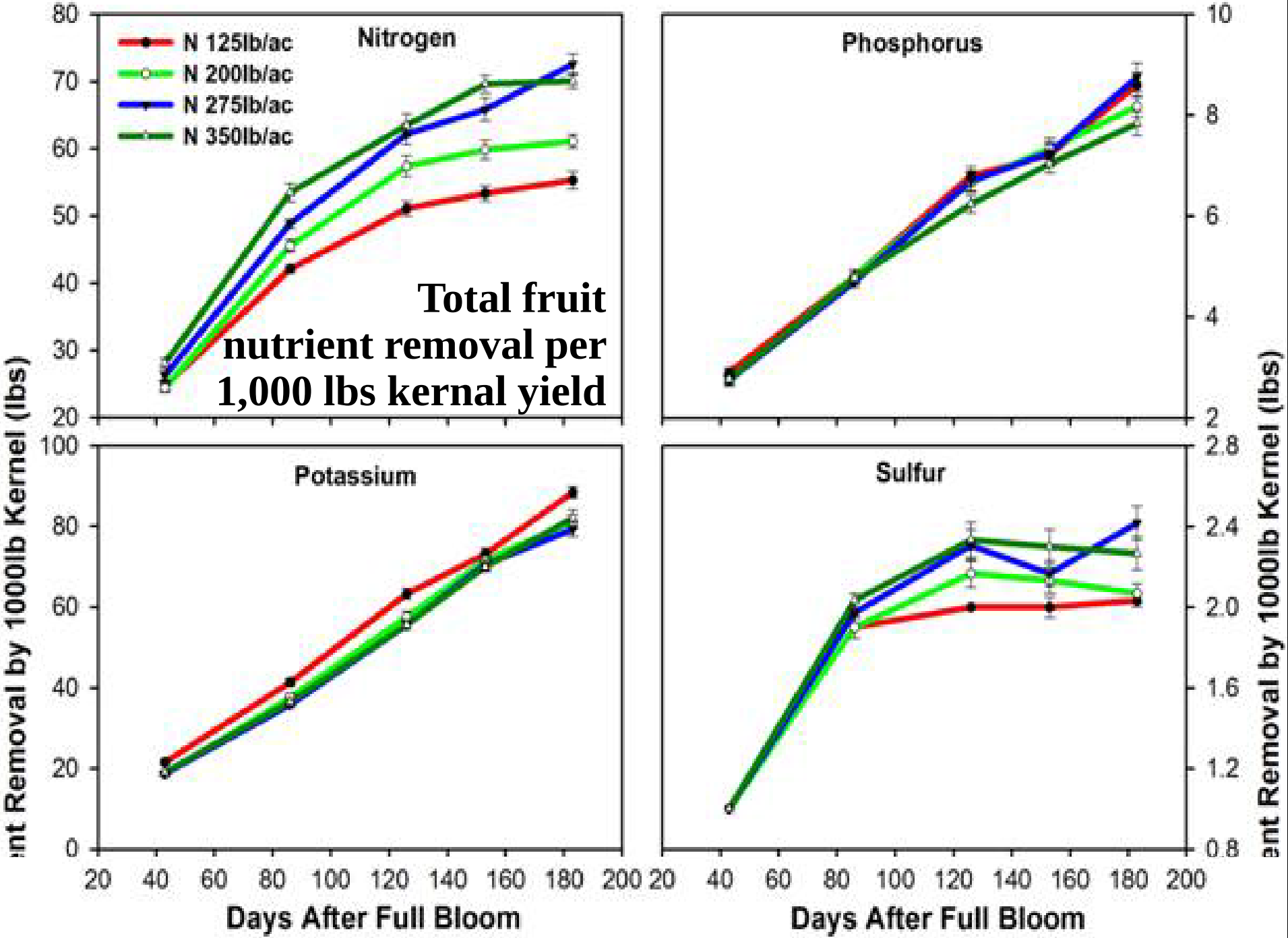
Main fertility trial:

Direct injection 4 times/year

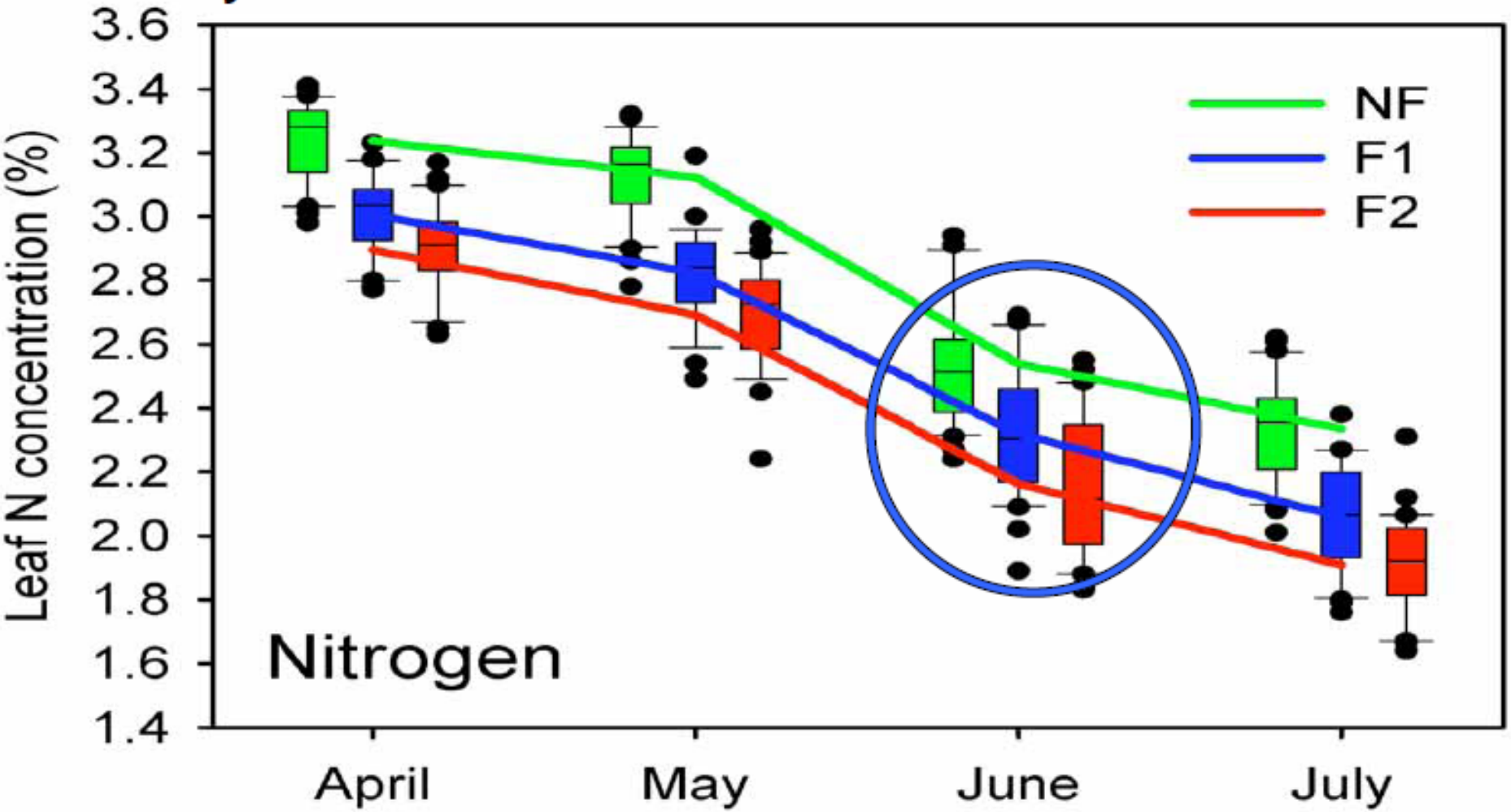
Bloom	20%
April	30%
June	30%
Post Harvest	20%



2011 installation of 5 Grundfos dosing pumps for “spoon-feed” fertigation trial


Nitrogen
N 125lb/ac
N 200lb/ac
N 275lb/ac
N 350lb/ac
Phosphorus
Potassium
Sulfur
Total fruit nutrient removal per 1,000 lbs kernal yield
nt Removal by 1000lb Kernel (lbs)
Days After Full Bloom
Days After Full Bloom

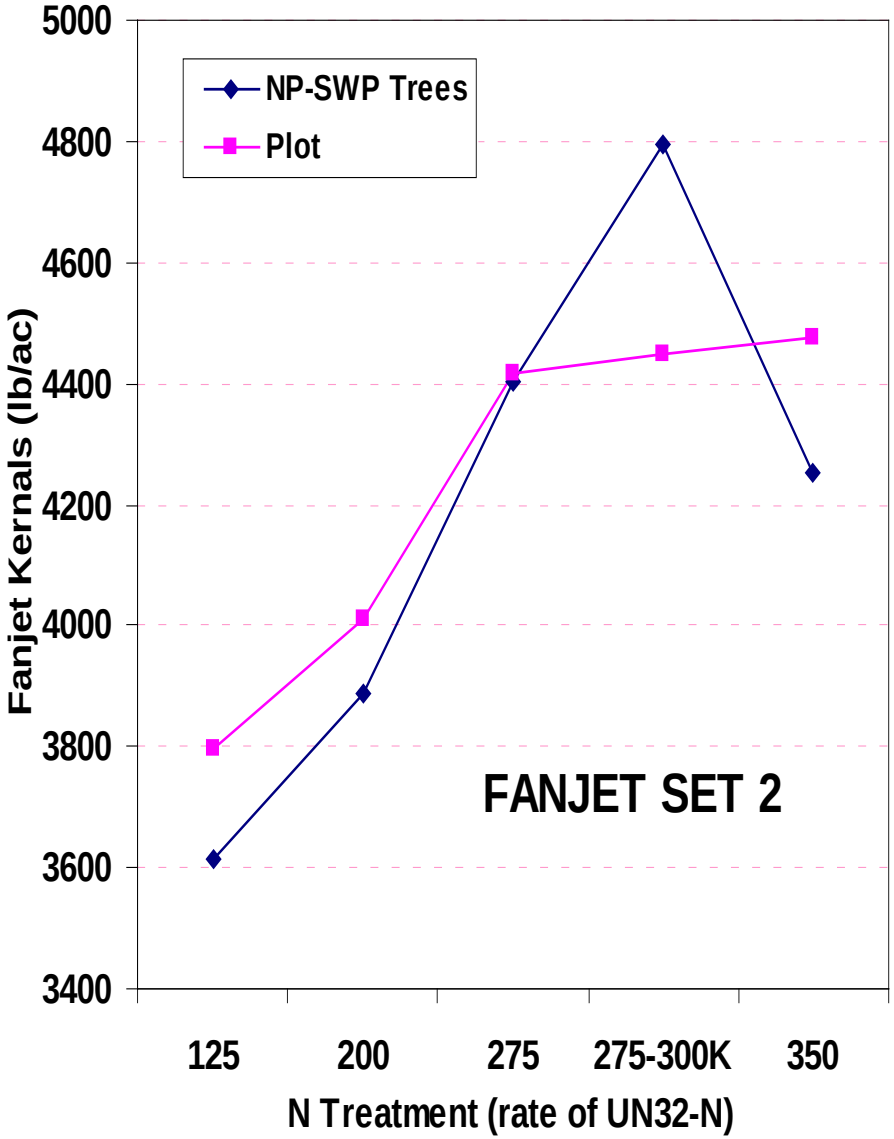
Critical Values are based on July/August sample. Early season CV's have not been validated.

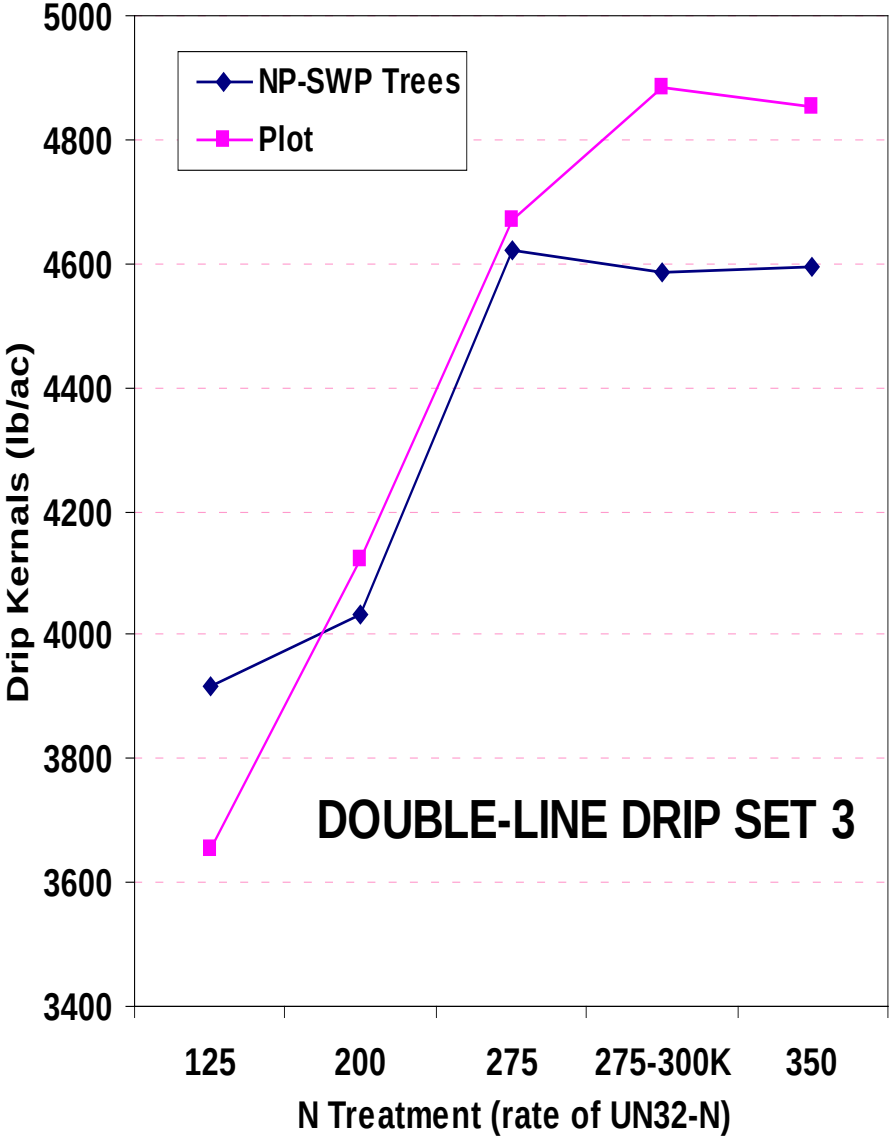


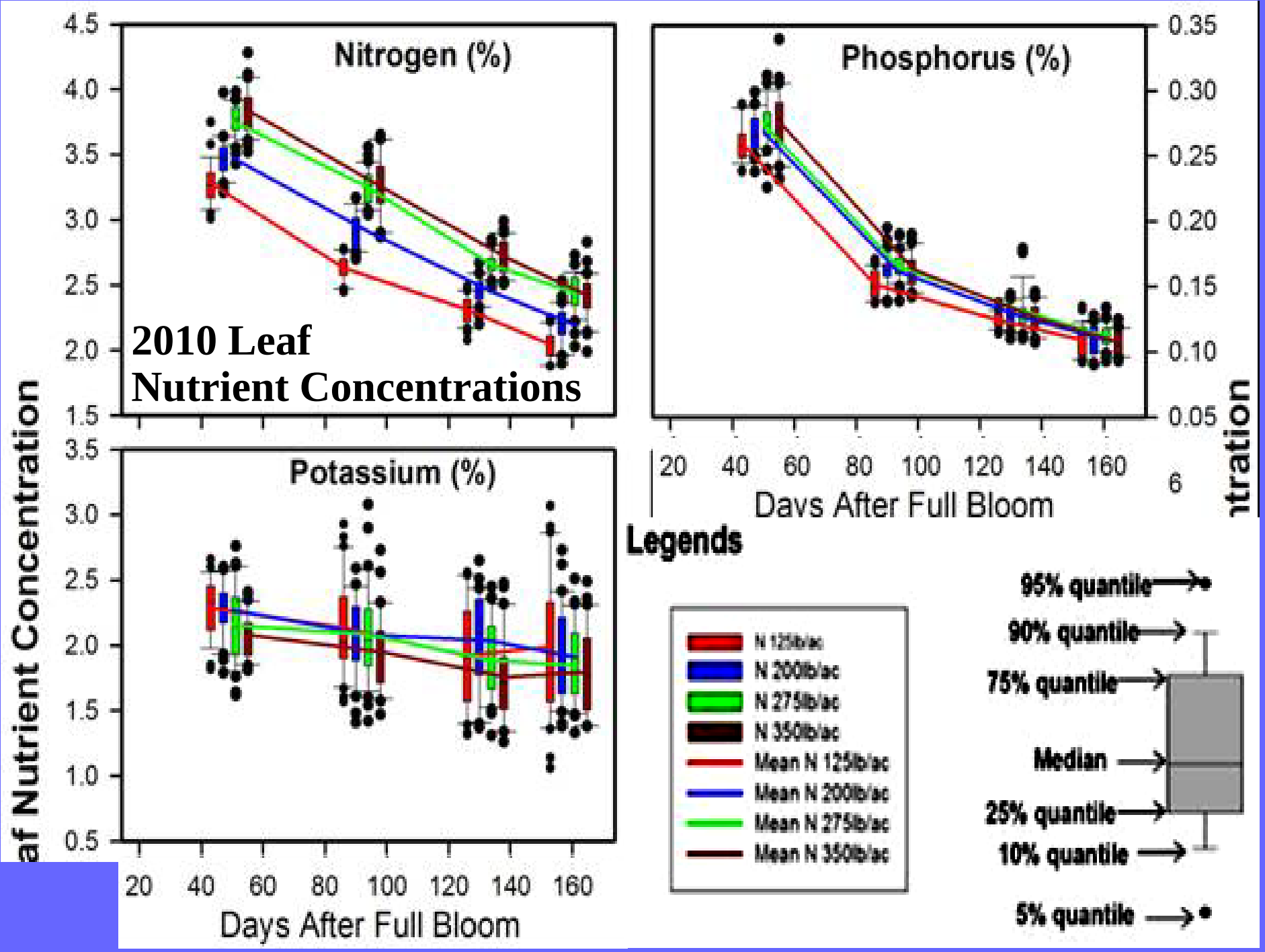
Current Practice: Late summer sample. Too late for current season response. Too early for next season planning (yield potential is defined by winter and spring weather)

Challenge: Develop early season sampling and interpretation methodologies.

2011 Nonpareil Yields – Fertility/Irrigation Trial



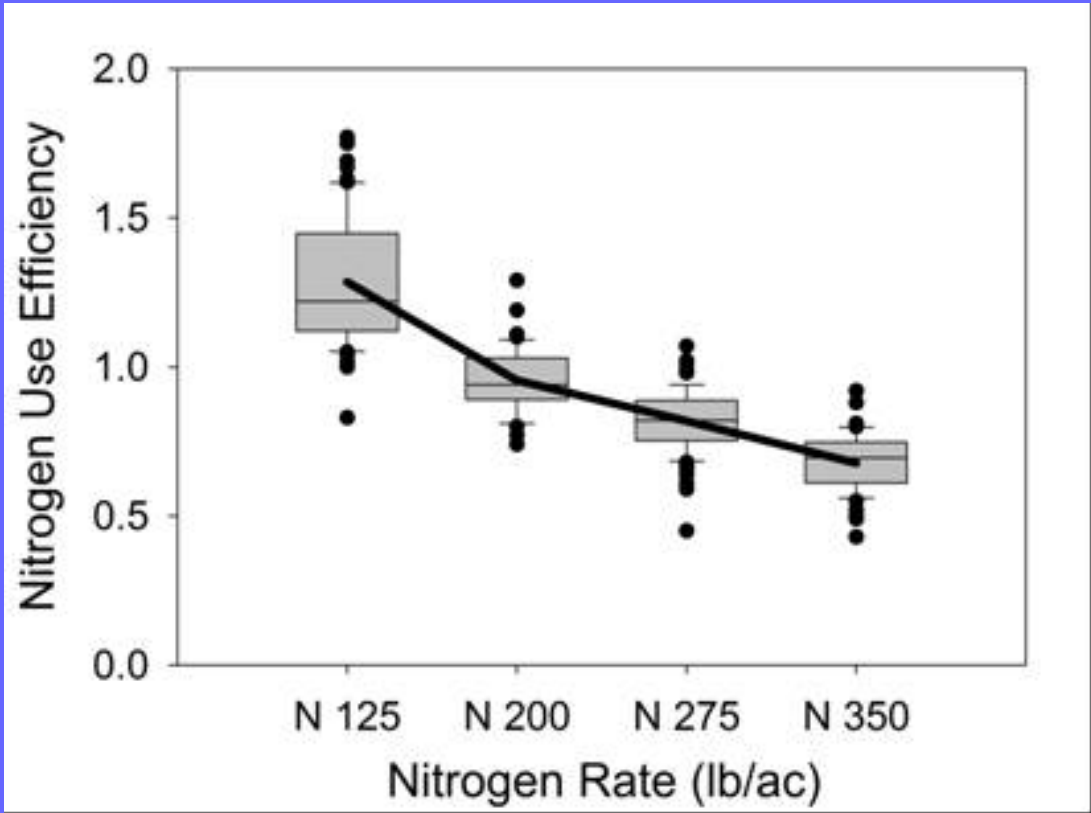



2010 Leaf
Nutrient Concentrations
Nitrogen (%)
Phosphorus (%)
Potassium (%)
Days After Full Bloom
Legends
N 125lb/ac
N 200lb/ac
N 275lb/ac
N 350lb/ac
Mean N 125lb/ac
Mean N 200lb/ac
Mean N 275lb/ac
Mean N 350lb/ac
95% quantile
90% quantile
75% quantile
Median
25% quantile
10% quantile
5% quantile

Pounds of nutrient removed in whole fruit per 1000 lbs of kernals

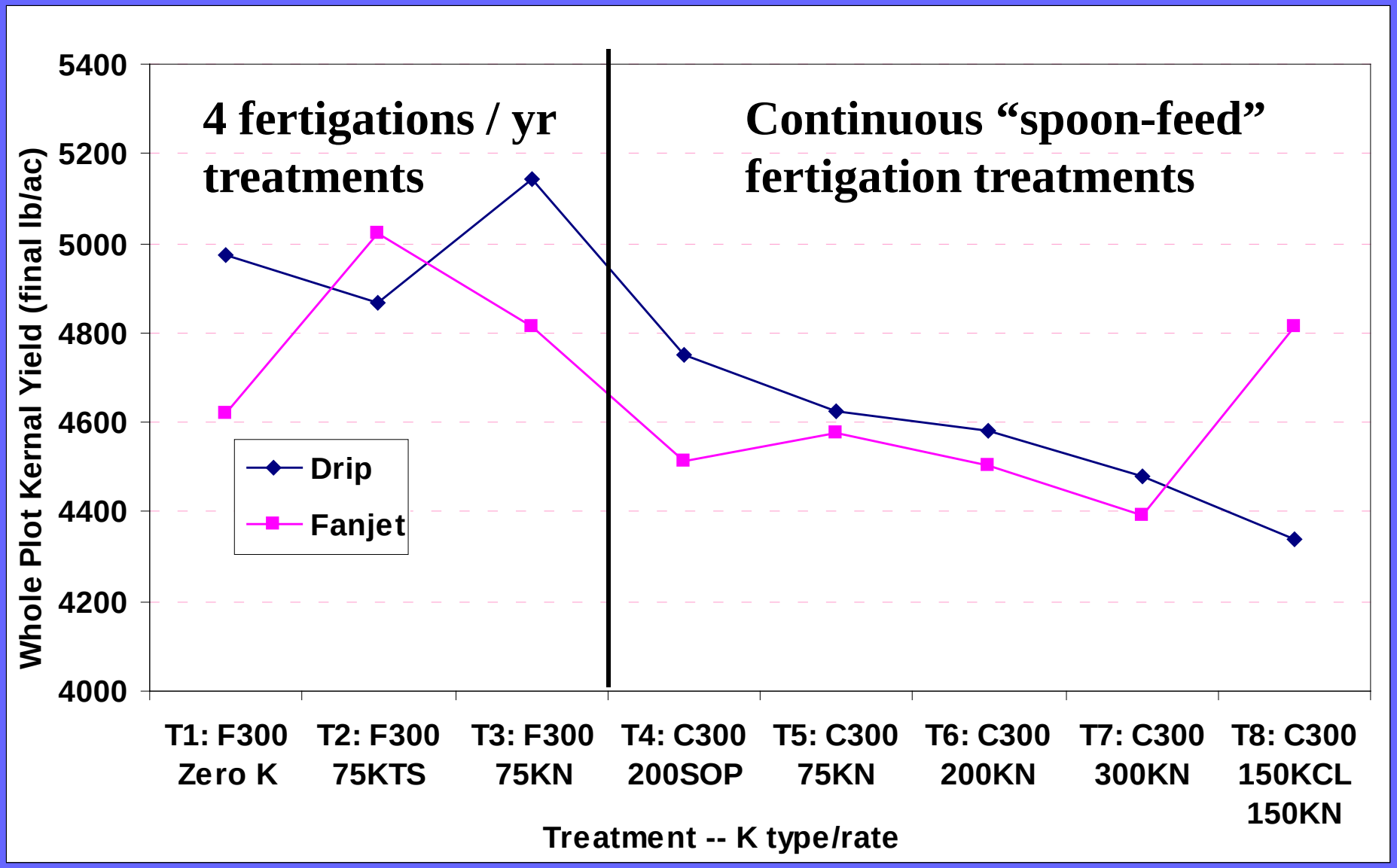
	N Rate (lb/ac)		4,000 lb
	125	350	Kernals
N	53	66	264
P	8.4	7.4	29.6
K	80	75	300

Actual cumulative N-use efficiency from 2008 to 2010 for all N rates (81% NUE @ 275 lb/ac N)

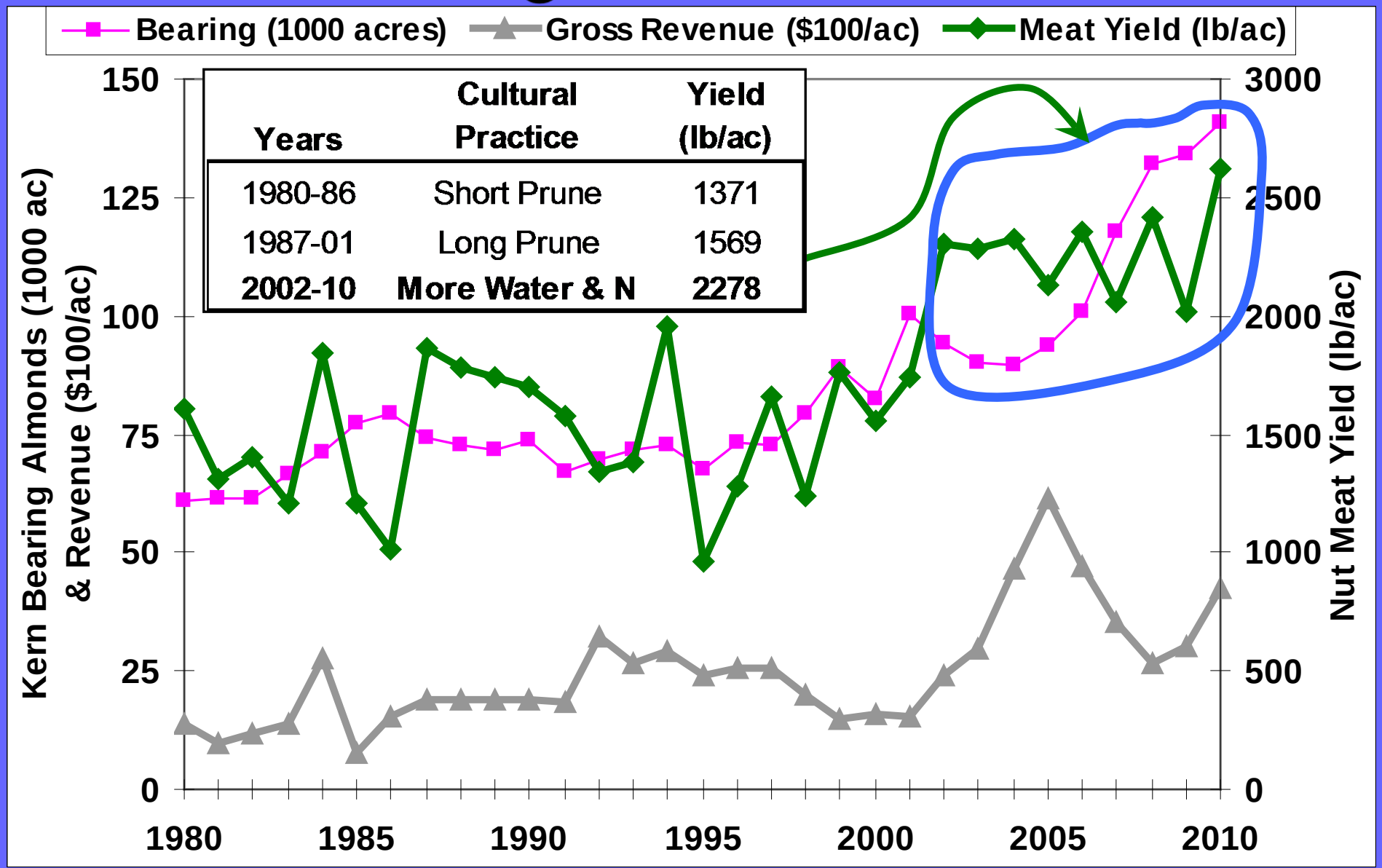


2011 installation of 5 Grundfos dosing pumps for “spoon-feed” fertigation trial

2011 Nonpareil yields for episodic vs. continuous fertigation



Changes in Kern County almond yield and acreage from 1980-2010



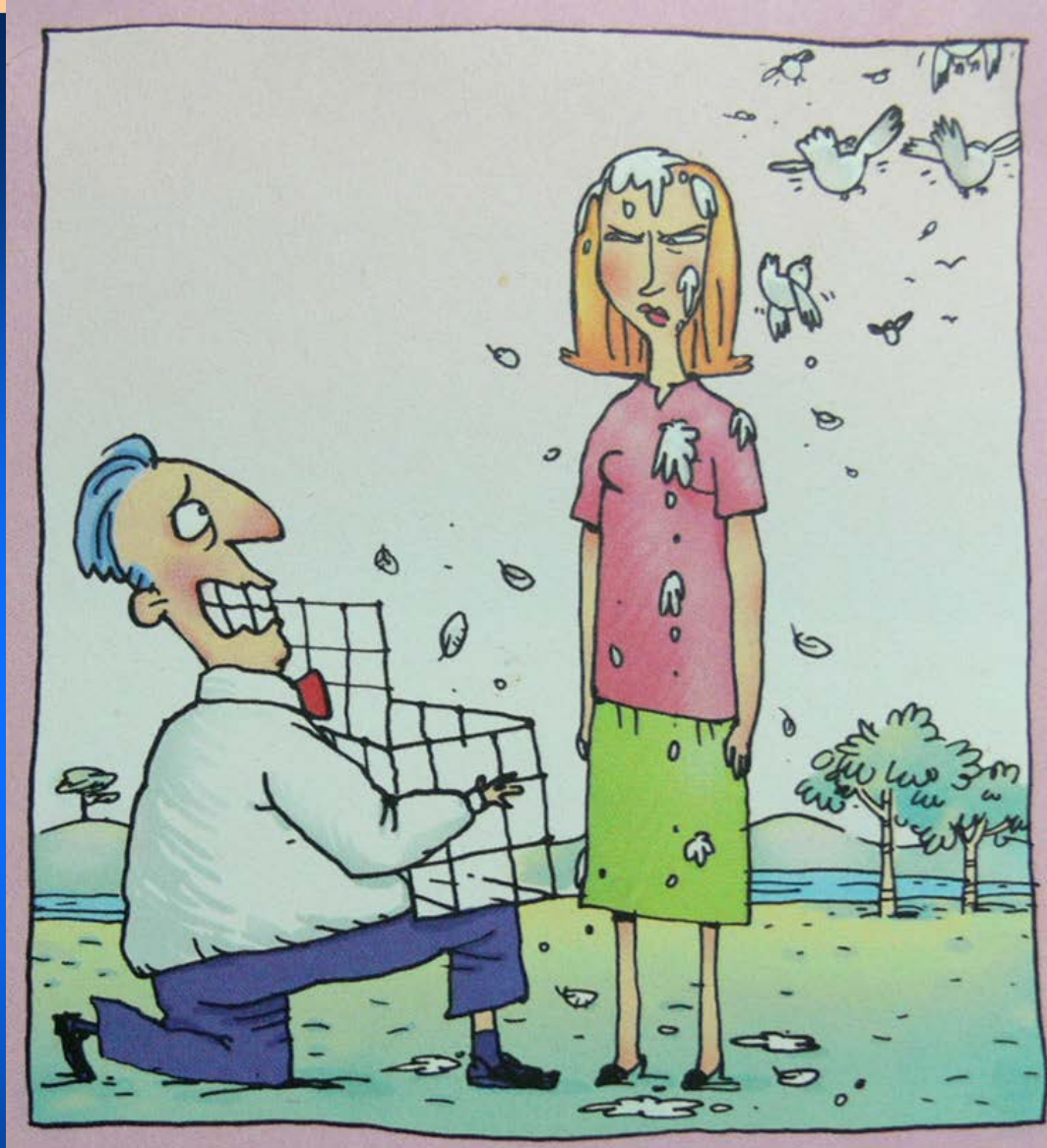
Years	Cultural Practice	Yield (lb/ac)
1980-86	Short Prune	1371
1987-01	Long Prune	1569
2002-10	**More Water & N**	**2278**

Conclusions – grower list for max efficiency

- Know soil AWHC and volumetric storage
- Know net infiltration and/or system application capacity
- Plan irrigations using “normal year” ET and CIMIS – update with real-time soil and tree water status monitoring to maximize yield & efficiency
- Match fertilizer injection rates to crop nutrient demand and realistic field yield expectations
- Sample leaf tissues and in April using new standards and adjust for deficiencies
- Understand potential pesticide irrigation/run-off problems and minimize adverse impacts

Technology is helpful, some regulation is necessary, but optimal efficiency and production is only possible by putting your boots on the ground and your shadow in the field…

…because pigeons happen despite our best plans!!



Paul's plan to deliver his valentine via carrier pigeon goes horribly wrong.