Tools for Improving Irrigation Management

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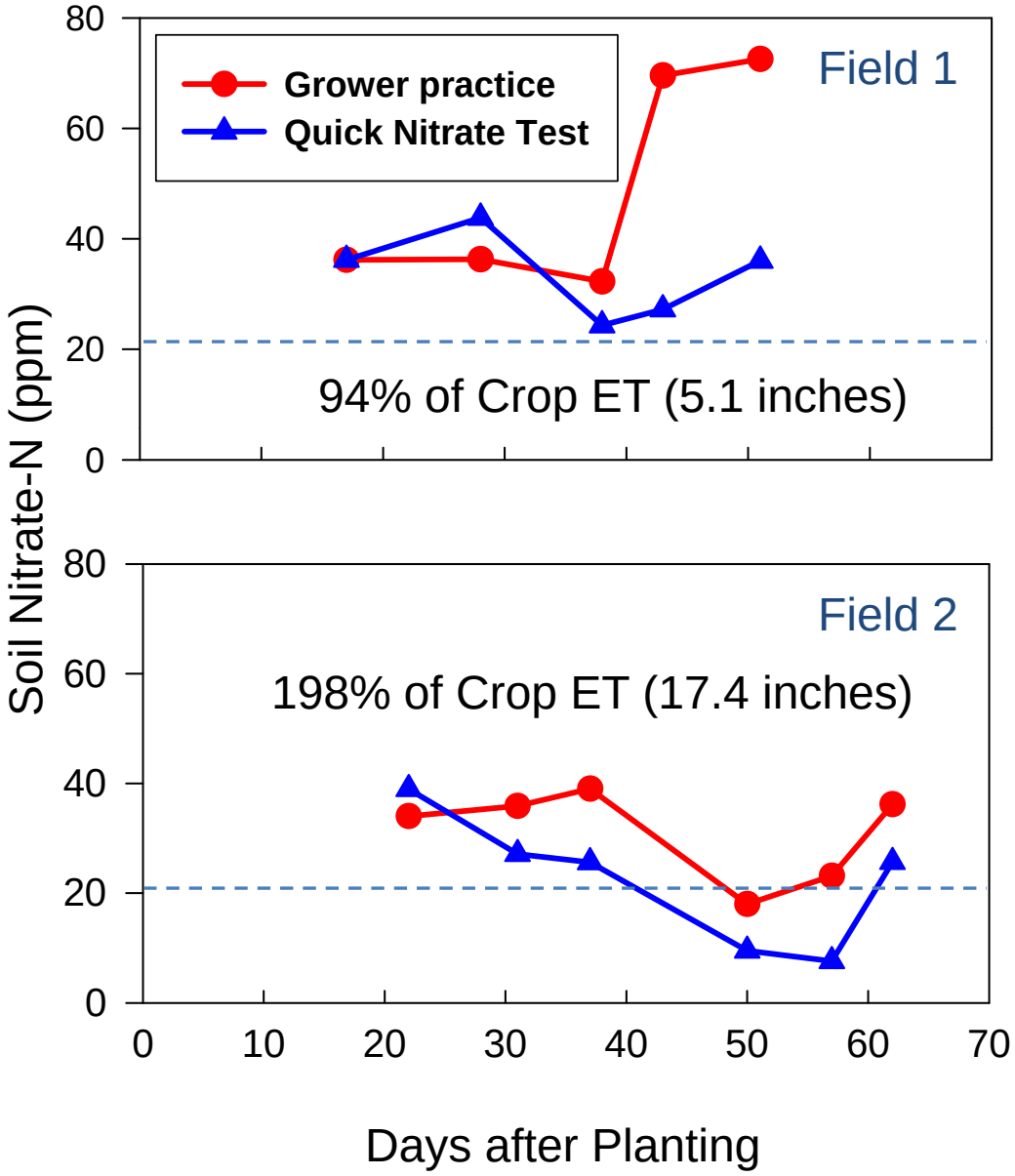
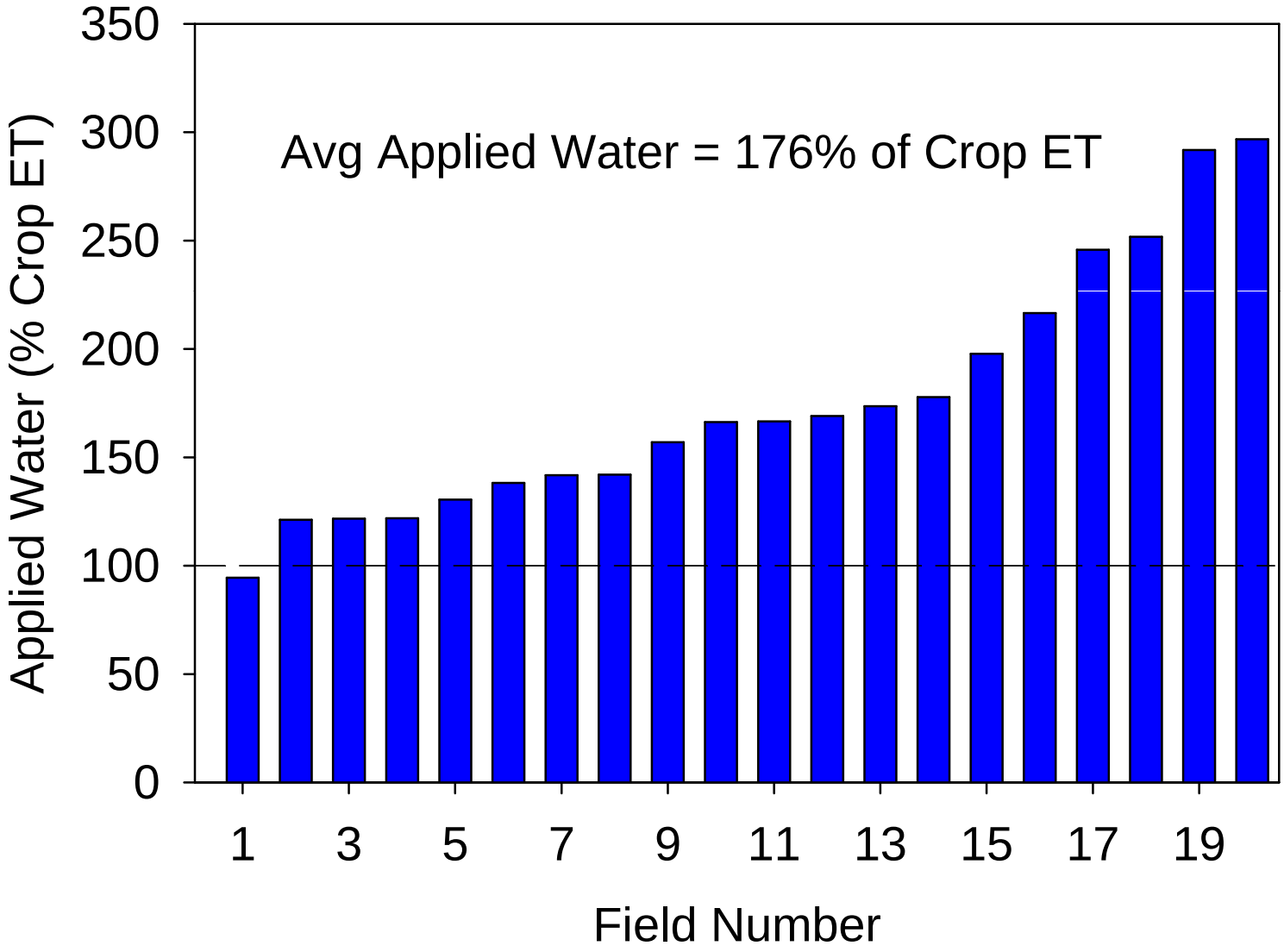
Nitrogen fertilizer and irrigation interactions



Treatment	Applied N fertilizer (lb/Acre)
Grower	192
QNT	135

Treatment	Applied N fertilizer (lb/Acre)
Grower	302
QNT	160

Applied Water as Percentage of Crop ET



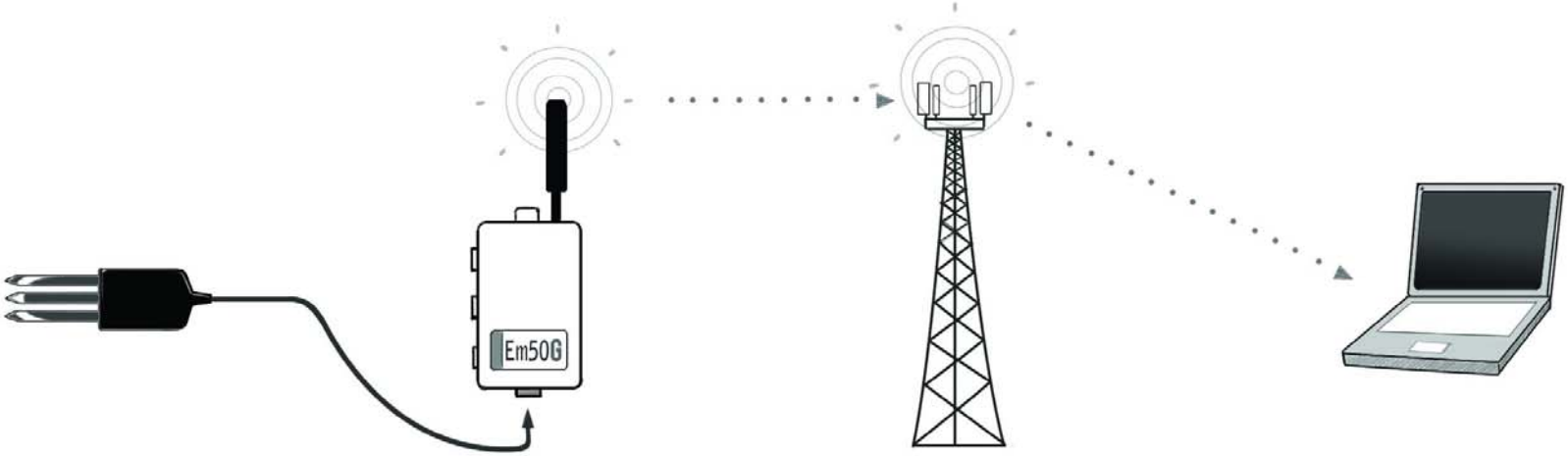
What's new in irrigation scheduling?

- Soil moisture sensors
- Flow meters
- Crop ET
- Irrigation scheduling software
- Irrigation Mobile Lab Services

Dataloggers improve ease of data collection:

- View trends in data
- Interface with multiple sensors
- Built in connectivity

Data Connectivity has improved:



Radio
Cell phone
Satellite
Internet

Data Connectivity: Commercial services

- Hortau
- ClimateMinder
- Ranch Systems
- Puresense
- CropSense (John Deere)
- Decagon
- Irrometer
- Onset Computer
- Spectrum Technology

Approaches to Irrigation Scheduling

Weather-based

Plant-based

Soil-based

Coastal crops: berries and vegetables

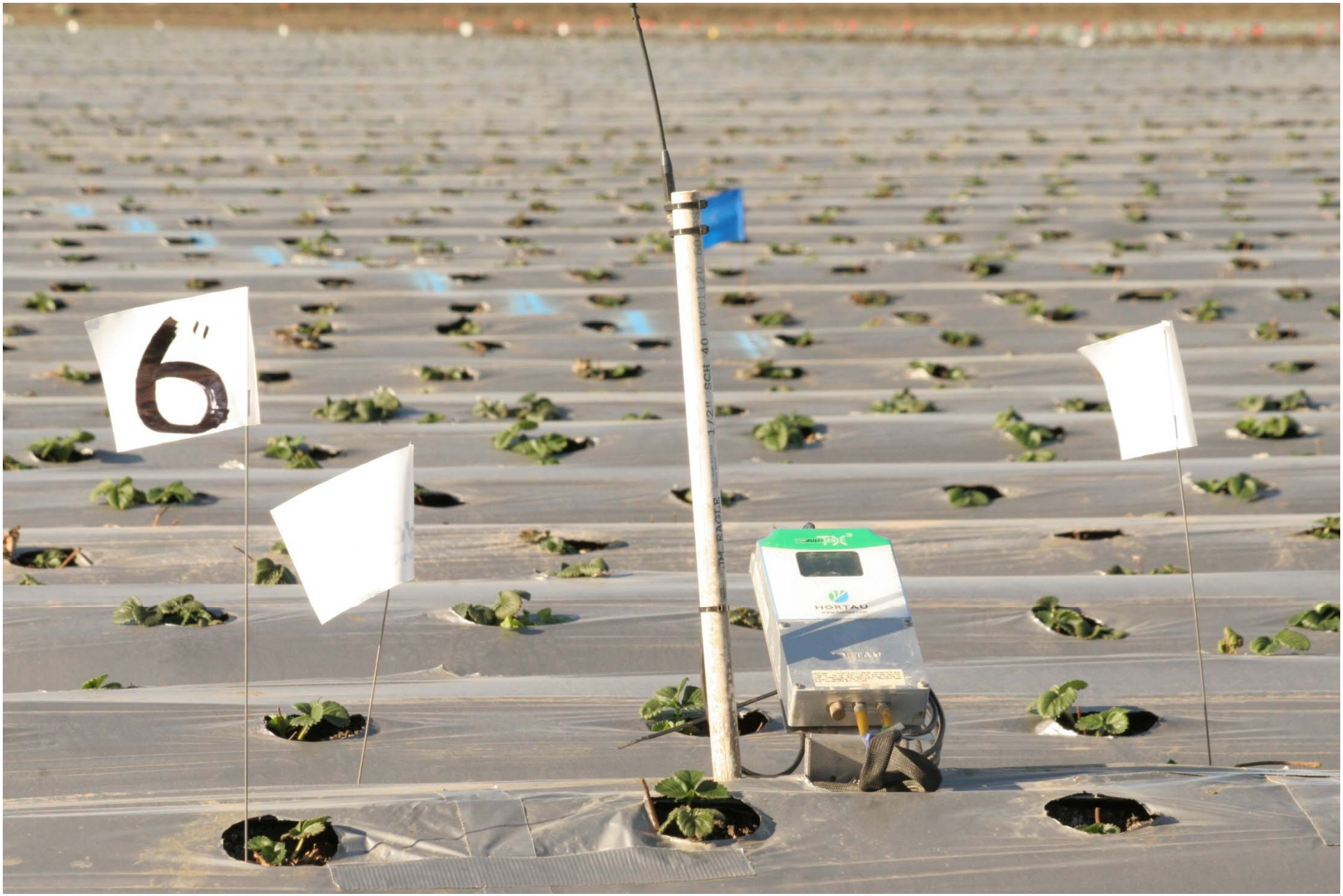
Moderate soil moisture deficits can cause yield loss

Tensiometers monitor the matric potential (tension) of the soil

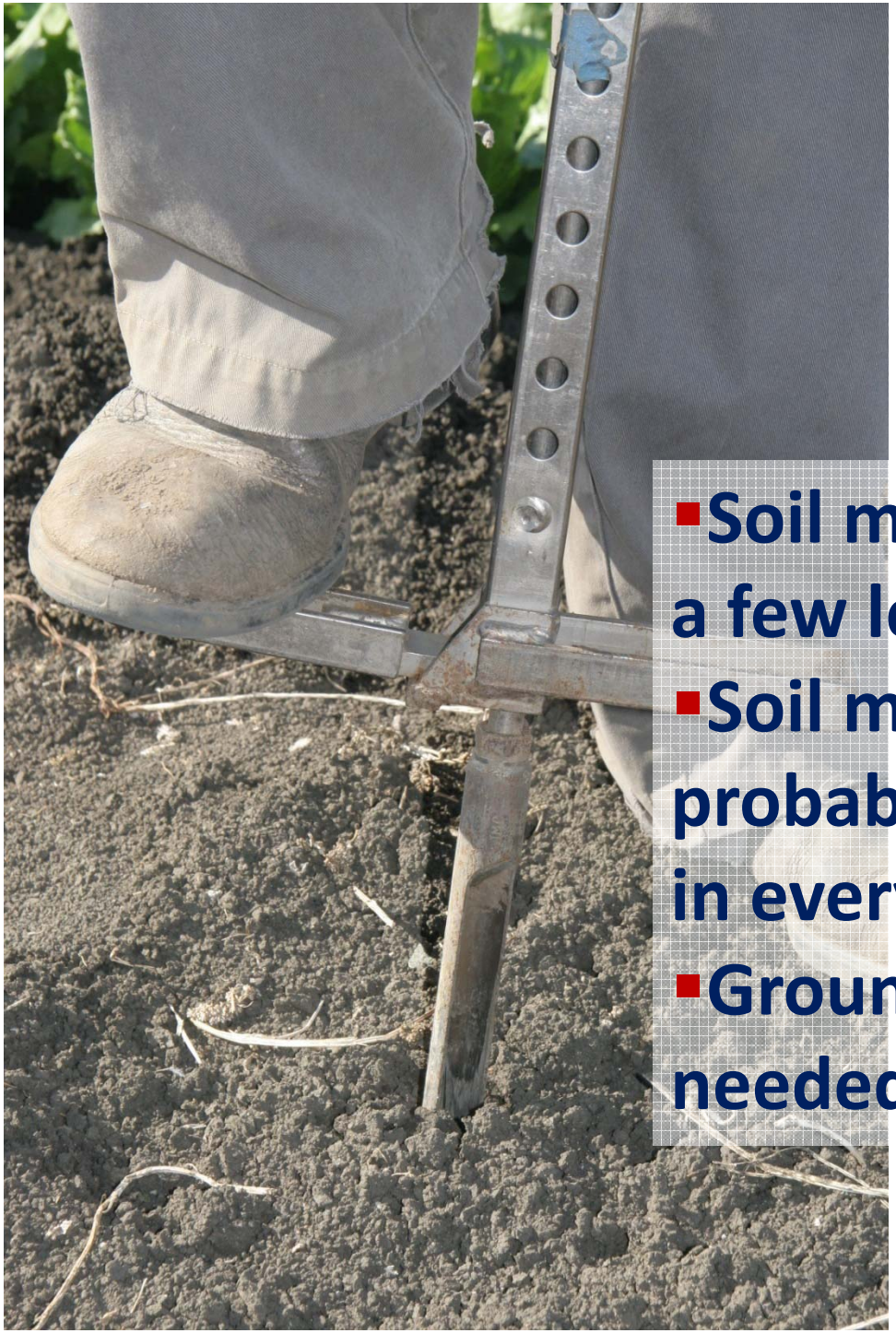
Measurement of soil moisture that is most related to water status in a plant

ClimateMinder with Irrometer tensiometers

Hortau tensiometer system



Watermark granular matrix blocks: Soil moisture tension: 0 to 200 cbars



Don’t give up your soil probes and shovels yet:

- Soil moisture sensors monitor a few locations within a field
- Soil moisture sensors are probably not affordable to use in every field
- Ground truthing is still needed

Volumetric soil moisture sensors






- Many manufacturers and models
- Most interface with dataloggers
- Most useful for evaluating relative changes in soil moisture



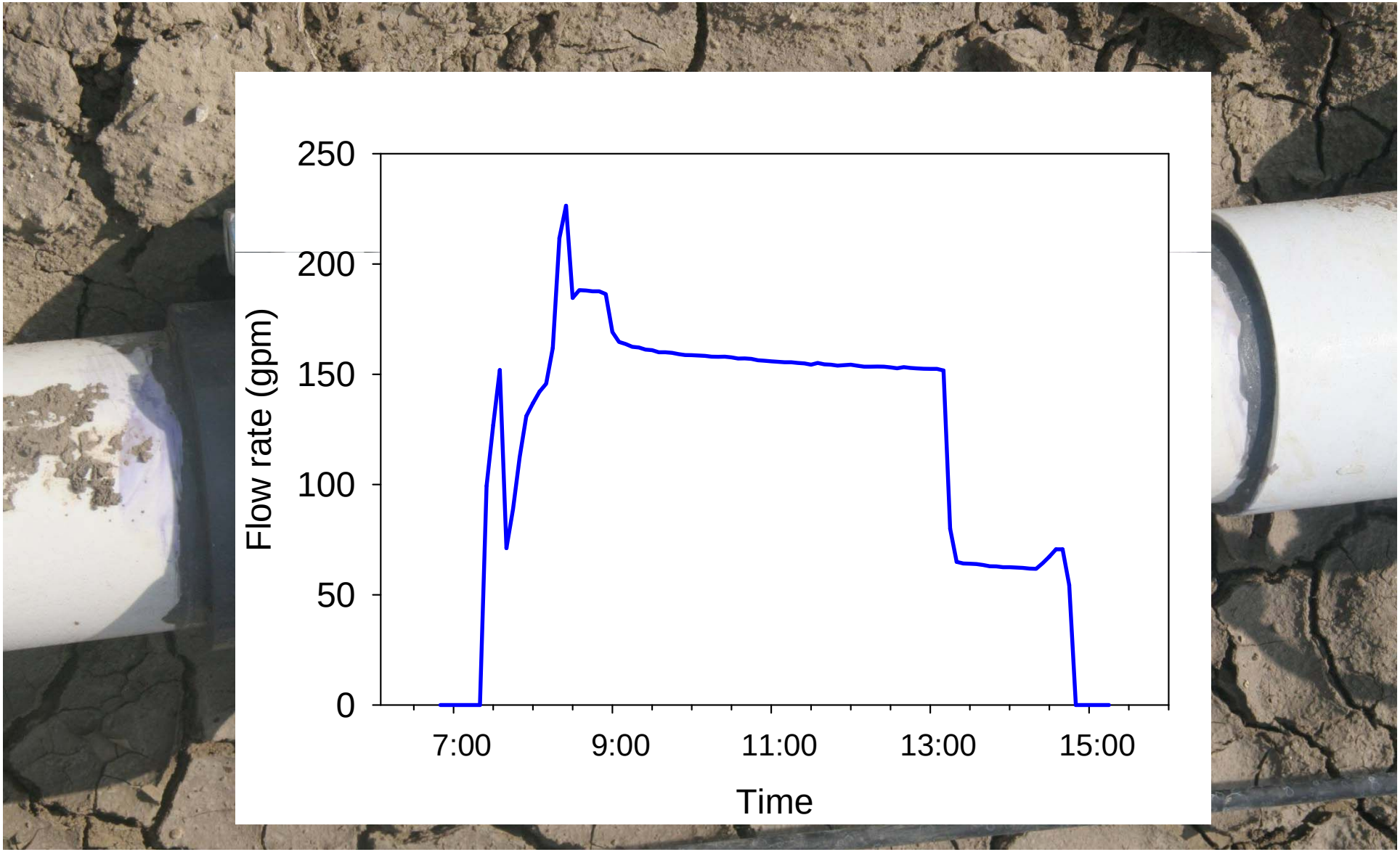

Decagon 10HS

Volumetric Soil Moisture Sensor

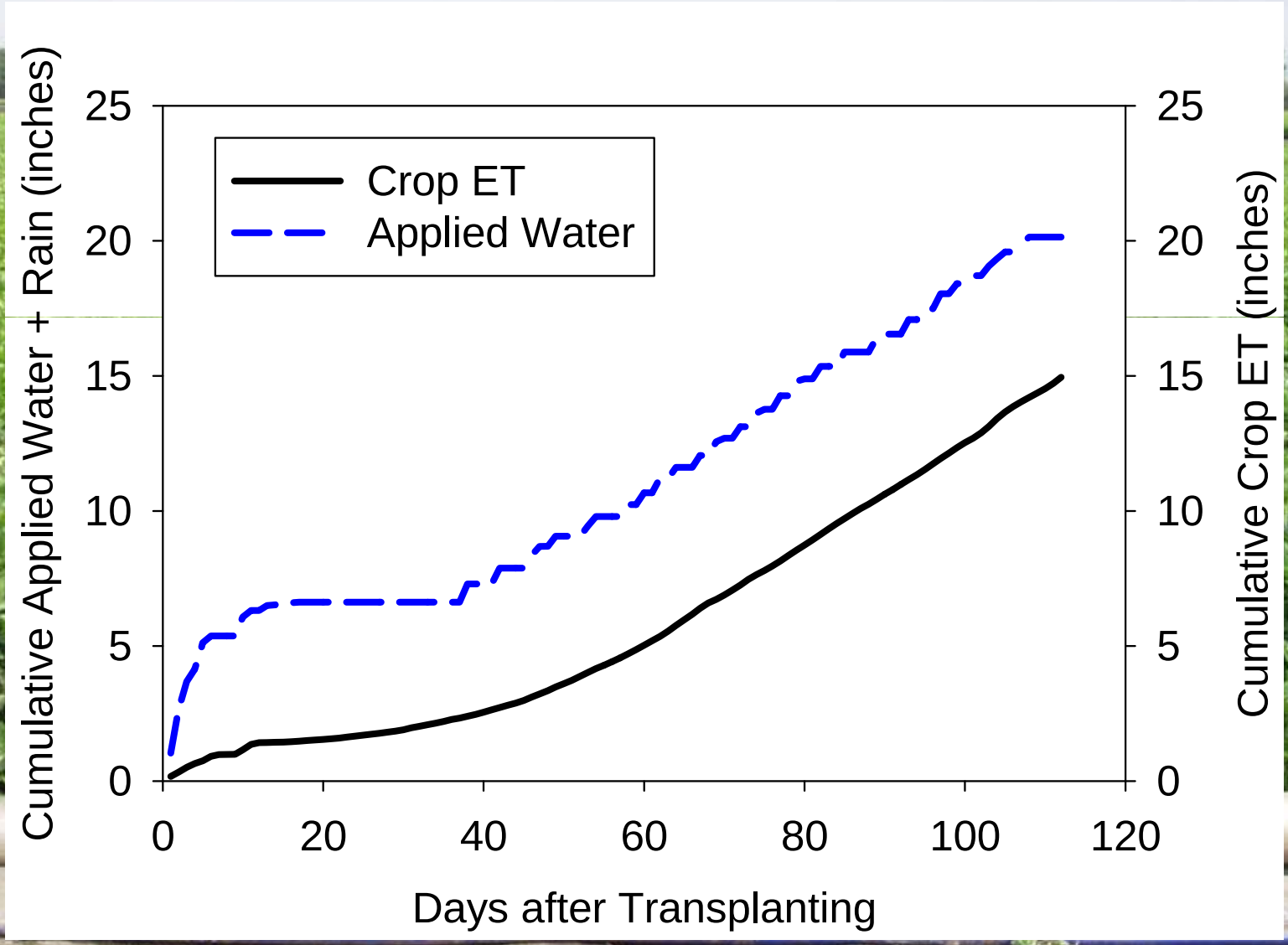
How much water did you apply?

Flow meters are not just for wells

Seametric magnetic flow meter



Applied Water *vs.* Crop Evapotranspiration



Evapotranspiration

Ranch System

CIMIS weather station

Atmometer

Evapotranspiration can be estimated using CIMIS weather stations:

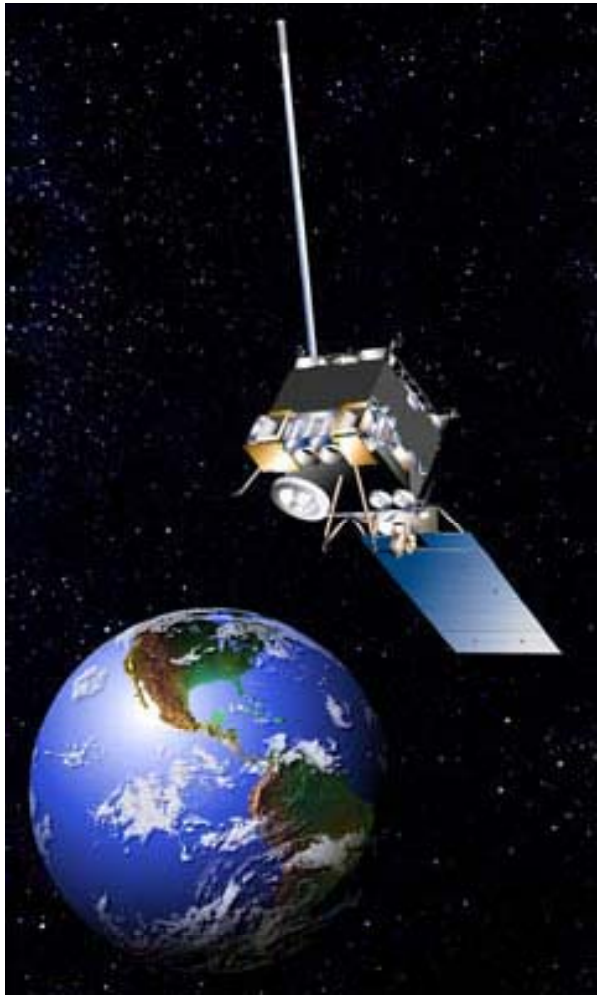
- **Solar Radiation**
- **Wind Speed**
- **Relative Humidity**
- **Air Temperature**

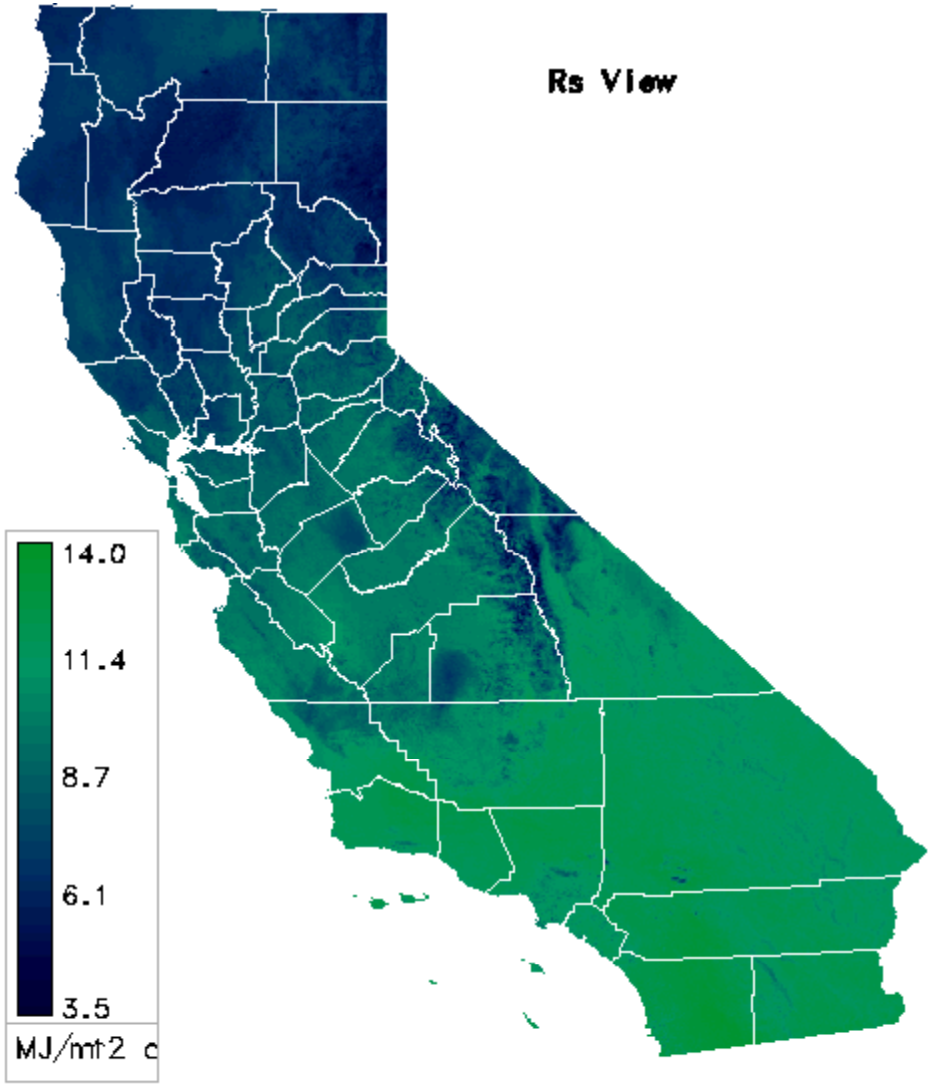
Active CIMIS Stations:

Watsonville West II (209)
Pajaro (129)
Green Valley Rd (111)
Castroville (19)
North Salinas (116)
South Salinas (89)

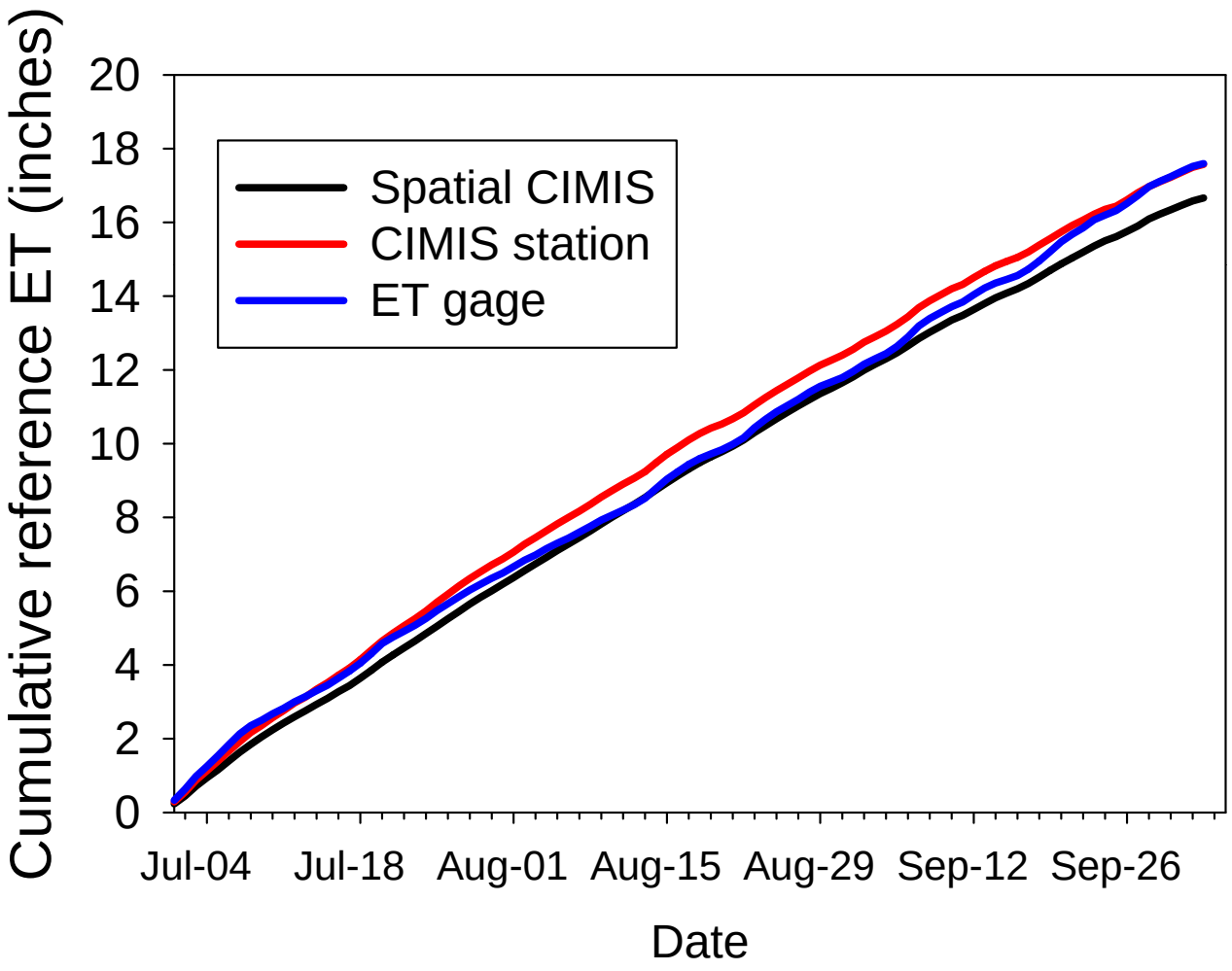
wwwcimis.water.ca.gov

Spatial CIMIS ETo Reporting



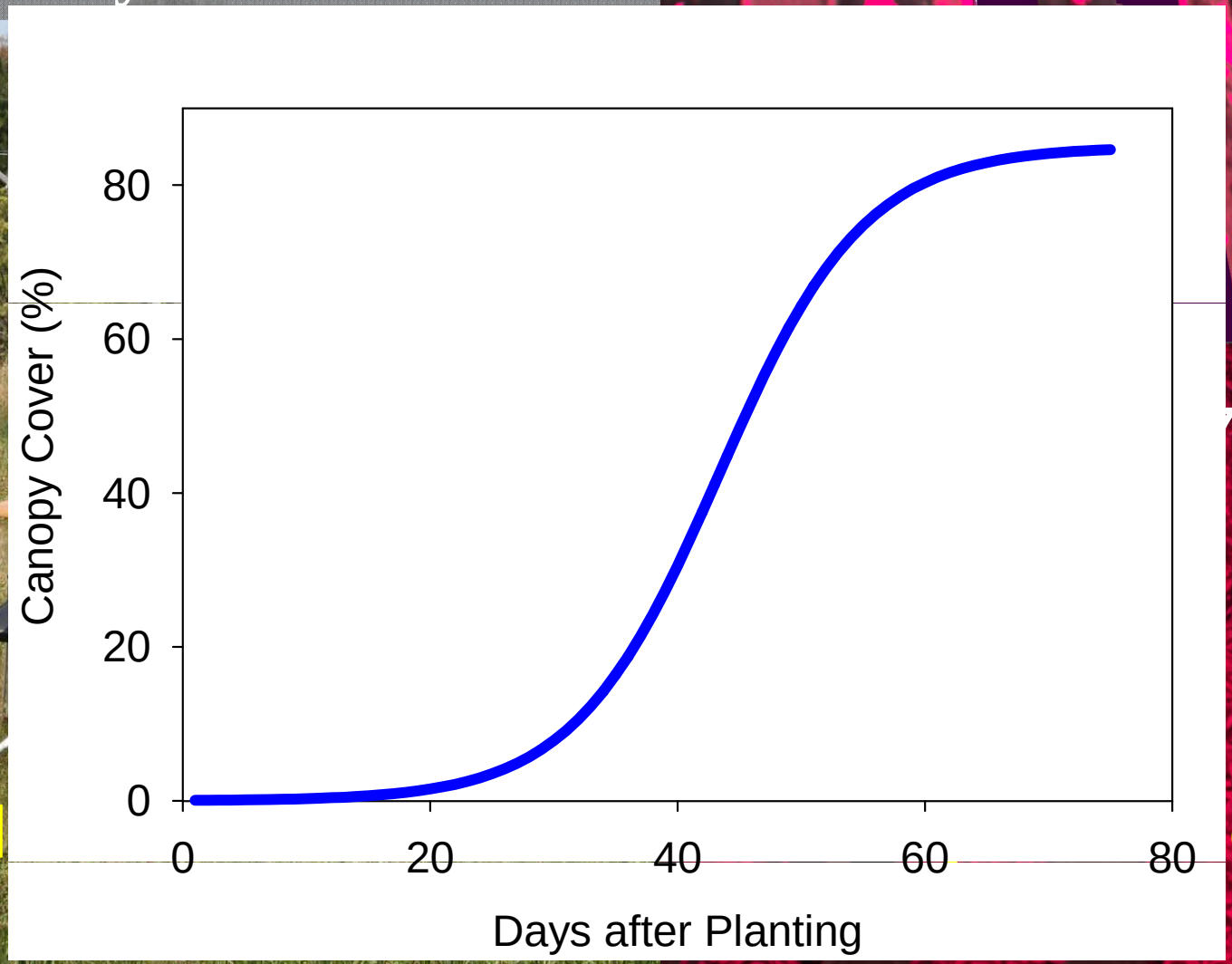


Comparison of different methods of estimated ETo (Gilroy Ca)



$ET_{crop} = ET_{ref} \times K_{crop}$

K_c can vary from 0.1 to 1.2



8% canopy 29 DAP

77 DAP

CIM cient

CropManage

Web-based Irrigation and N management software for lettuce

ucanr.org/cropmanage

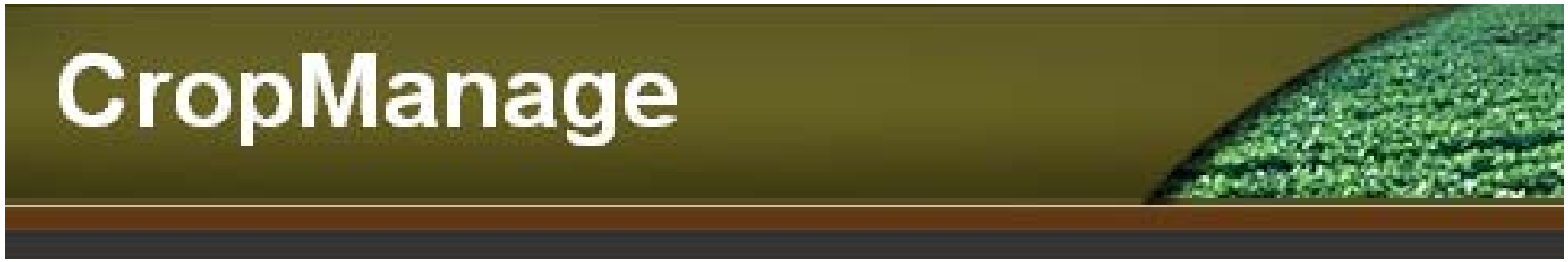
CropManage Web-based software:

Assist growers in managing water and nitrogen fertilizer using information from multiple sources

- ✓Soil tests
- ✓Weather data (CIMIS ETo)
- ✓Soil physical characteristics
- ✓Crop models
- ✓Flow meter
- ✓Soil moisture sensors

Main features:

- ✓Maintain and share irrigation, fertilizer, and soil test records within a farming operation.
- ✓Manage information for multiple fields and ranches
- ✓Guide irrigation schedule using CIMIS evapotranspiration data and crop models
- ✓Guide nitrogen fertilization decisions based on crop uptake model and quick nitrate test



Ranch List

Select a Ranch to work in from the list below.

- Bondenson
- Fanoe
- Gabilan Ranch
- Home
- Ikeda Bros Ranch 37
- Martella UC trial
- Molera
- Test Ranch
- Whalebone Ranch

CropManage

Ranch Home | Ranch List | Help

Ranch/Field: TEST Bondenson

Plantings

Showing ALL Plantings

Planting	Wet Date	Lot	Action
1 Romaine	6/8/2011	1	edit planting
bondenson 1	8/1/2011	1	edit planting
bondenson 2	8/1/2011	1	edit planting
Romaine 2	6/1/2011	2	edit planting
Molera planting 1	6/14/2011	4	edit planting

- New Planting
- View Current Plantings
- Import Export Options

CropManage

Ranch Home | Planting Home | Ranch List | Help

Ranch/Field: TEST Bondenson, Lot 1, clay loam
Planting: 1 Romaine, 14 acres
Crop: Romaine 6 row, 80 inch bed, 6/8-8/24/11

Planting

Soil Summary

Sample Date	Crop Stage	Soil N (ppm)	Soil Mineral N (lb/acre)
6/8/11	Pre-irrigation	37.50	111.94
6/30/11	Pre-thinning	22.50	67.16
7/4/11	Post-thinning	15.00	44.78

New Soil Sample

Fertilizer Summary

Fertilizer Date	Crop Stage	Soil Test N (ppm)	Fertilizer N Recommended (lb N/acre)	Cumulative Uptake N	Fertilizer	Applied N (lb N/acre)	Applied Fertilizer
6/8/11	Pre-irrigation	37.50	0.0	0.00	18-0-0 Dry	0.0	0.0 lbs/acre
7/5/11	Pre-thinning	22.50	0.0	7.60	UAN28	2.8	0.9 gallons/acre
7/12/11	Post-thinning	15.00	21.7	12.00	UAN30	25.0	7.7 gallons/acre

New Fertilizing

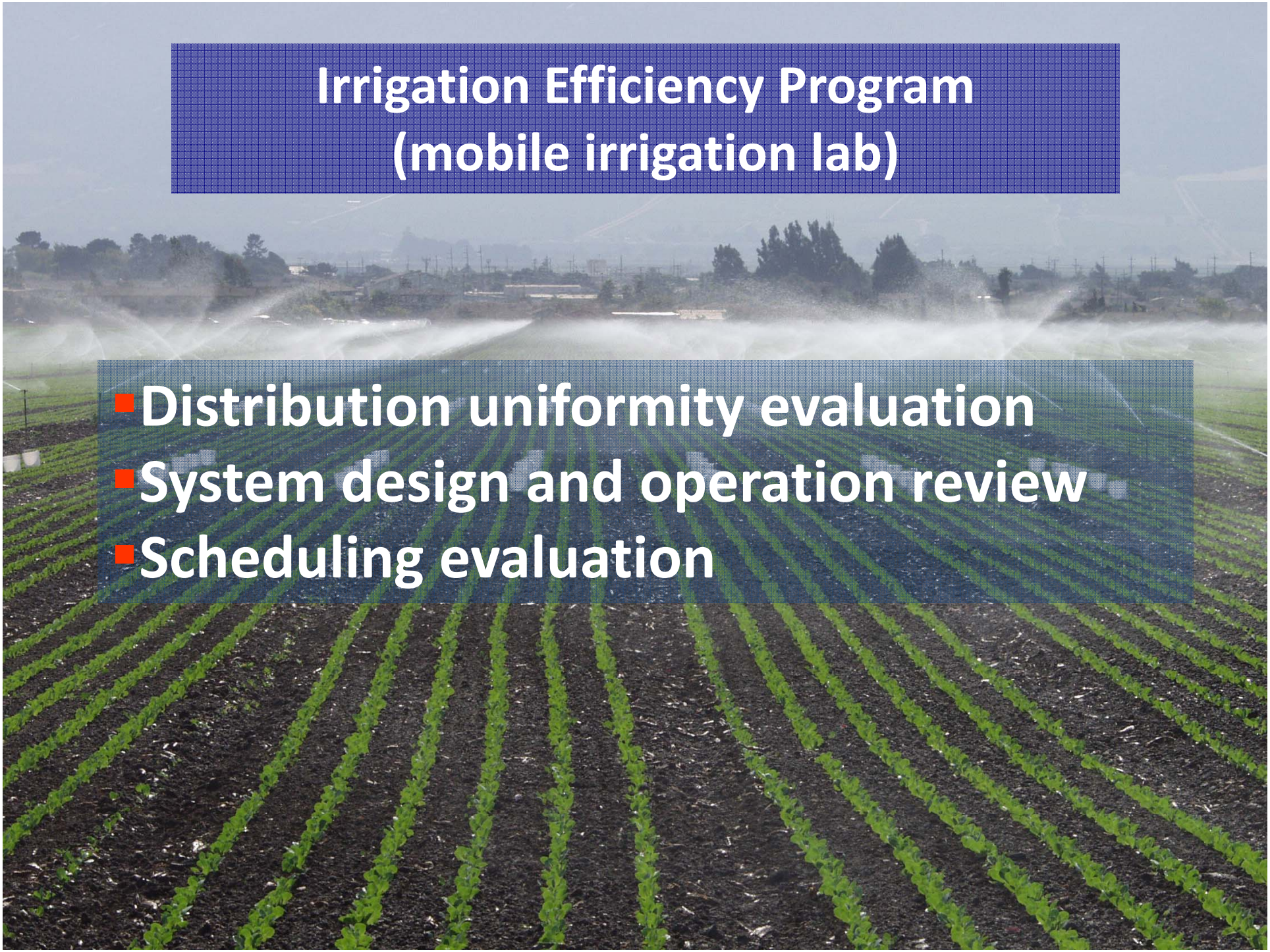
Watering Summary

Water Date	Irrigation Method	Irrigation Interval (days)	Recommended Irrigation Interval (days)	Recommended Irrigation Time (hrs)	Recommended Irrigation Amount (in)	Water Applied (in)	Cumulative Water Applied (in)	Cumulative ETc (in)
6/8/11	Sprinkler	0	N/A	N/A	N/A	1.00 in	1.00	0.14
6/10/11	Sprinkler	2	2.3	0.70 hrs	0.21 in	0.75 in	1.75	0.27
6/12/11	Sprinkler	2	2.5	0.63 hrs	0.19 in	1.00 in	2.75	0.43
6/22/11	Sprinkler	10	7.2	1.11 hrs	0.33 in	0.00 in	2.75	0.63
7/2/11	Sprinkler	10	8.1	0.33 hrs	0.10 in	0.50 in	3.25	0.95
7/8/11	Drip	6	5.8	4.15 hrs	0.42 in	1.00 in	4.25	1.17
7/12/11	Drip	4	12.8	1.45 hrs	0.14 in	0.80 in	5.05	1.30
7/18/11	Drip	6	7.3	3.90 hrs	0.39 in	0.40 in	5.45	1.74

CropManage

Water Date		Water Date	Irrigation Method	Water Applied (in)	Cumulative Water Applied (in)	Cumulative ETc (in)	mmended ion Amount (in)
9/3/11	S	9/3/11	Sprinkler	0.70 in	0.70	0.13	
9/4/11	S	9/4/11	Sprinkler	0.20 in	0.90	0.26	
9/5/11	S	9/5/11	Sprinkler	0.20 in	1.10	0.41	
9/7/11	S	9/7/11	Sprinkler	0.25 in	1.35	0.71	
9/8/11	S	9/8/11	Sprinkler	0.21 in	1.56	0.84	
9/9/11	S	9/9/11	Sprinkler	0.19 in	1.75	0.97	
9/10/11	S	9/10/11	Sprinkler	0.20 in	1.95	1.10	
9/12/11	S	9/12/11	Sprinkler	0.19 in	2.14	1.32	
9/14/11	S	9/14/11	Sprinkler	0.25 in	2.39	1.51	
9/16/11	S	9/16/11	Sprinkler	0.19 in	2.58	1.70	
9/18/11	S	9/18/11	Sprinkler	0.24 in	2.82	1.95	
9/20/11	S	9/20/11	Sprinkler	0.34 in	3.16	2.23	
9/24/11	S	9/24/11	Sprinkler	0.70 in	3.86	2.37	
9/30/11	D	9/30/11	Drip	0.77 in	4.63	2.48	

Irrigation Efficiency Program (mobile irrigation lab)



- Distribution uniformity evaluation
- System design and operation review
- Scheduling evaluation

Summary

- Water management plays a critical role in managing N fertilizer in shallow rooted vegetables
- Connectivity using radios, cell phones and the internet facilitates monitoring crop water use in real-time
- The combination of ET and soil moisture monitoring are the best approaches to evaluate irrigation scheduling in cool season vegetables and berries