

# Irrigation Evaluations of Santa Clara County Pepper Production



**Michael Cahn**  
**Irrigation and Water Resources Advisor**  
**University of California, Cooperative, Monterey Co**

# Why improve irrigation management?

- Maximize production and quality
- Conserve fertilizer
- Conserve water
- Water quality: ground and surface water

# Optimizing Pepper Production



**Moderate soil moisture deficits can cause yield loss**

# Principal Irrigation Strategies for Pepper

- Subsurface drip
- High distribution uniformity (> 85%)
- Frequent irrigations (< 3 day intervals)
- Soil moisture tensions < 20 cbars
- Apply more than 100% of crop ET

**Irrigation Efficiency =**

**Water Requirement of Crop**

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**Total Amount of Water Applied**

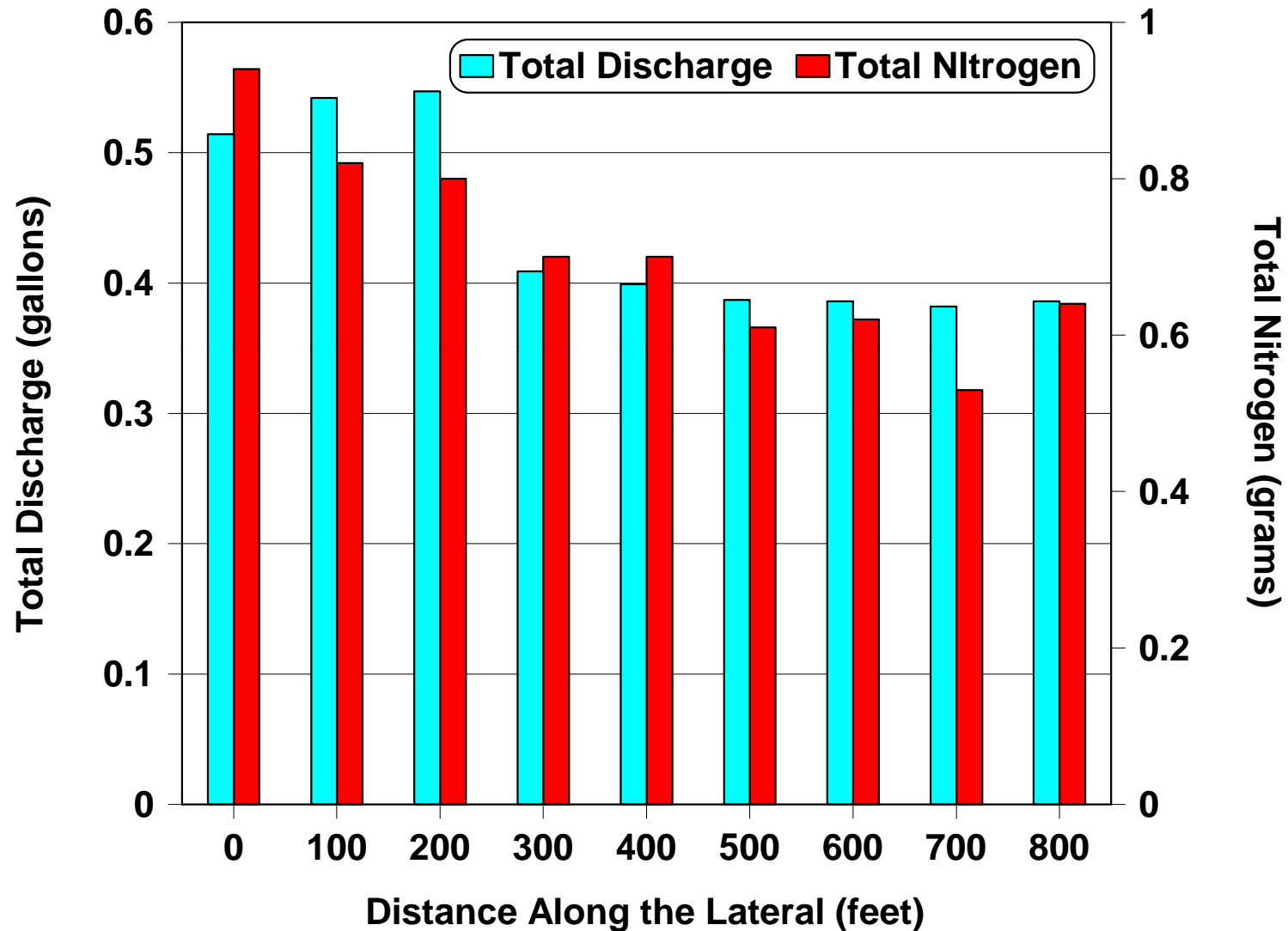
**Irrigation Requirement =**

**Water Requirement of Crop**

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**Distribution Uniformity**

# Effect of non-uniformity on fertigation



B. Hanson 1998

# Piloting an Irrigation Efficiency Program in Santa Clara County

- Joint effort of Central Coast Ag Water Coalition, Farm Bureau , UCCE, and Santa Clara Valley Water Agency
- Turf, tomatoes, peppers, cherries, wine grapes, flowers (greenhouse)
- Subsurface drip, surface drip, overhead sprinklers, micro sprinklers, hand watering

# **Central Coast Irrigation Evaluation Program Goal:**

**Provide a technical service that can address the needs of a sophisticated agriculture system**

- **Build local expertise**
- **Experienced in irrigation/nutrient management**
- **Knowledge of regional agriculture and economic challenges**
- **Connected to network of agency resources**

# **Components of the Irrigation Efficiency Program in Santa Clara County**

- **Uniformity evaluation**
- **System design and operation audit**
- **Scheduling evaluation**

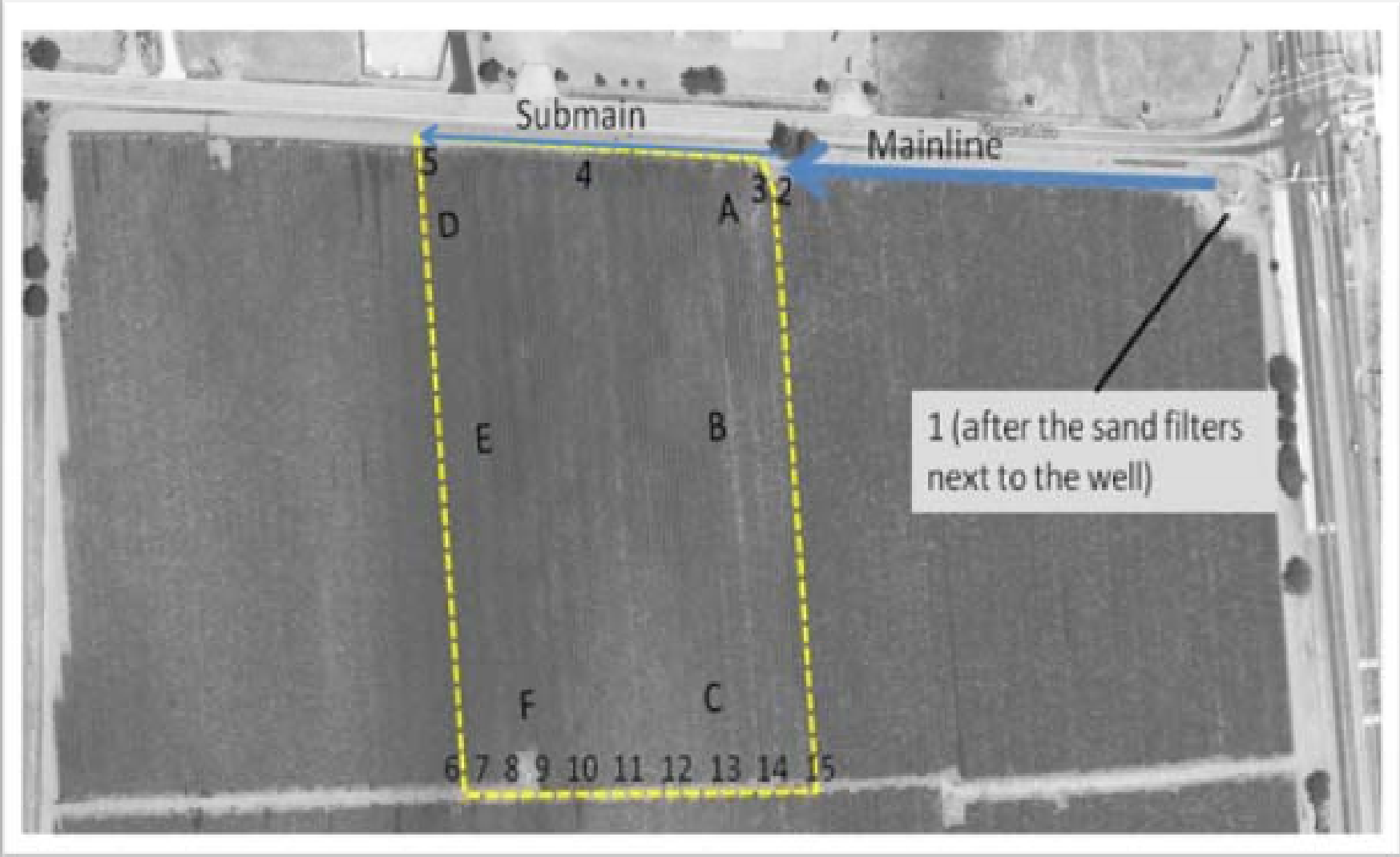
# Irrigation Efficiency Report



Part of the 2009 Santa Clara Irrigation Efficiency Project, a cooperative effort between ten Santa Clara County Farmers, Santa Clara County Farm Bureau, University of California Cooperative Extension, and the Central Coast Agricultural Water quality Coalition. Made possible by funding from the Santa Clara Valley Water District.



# Map locations of all measurements



# Distribution Uniformity Evaluation



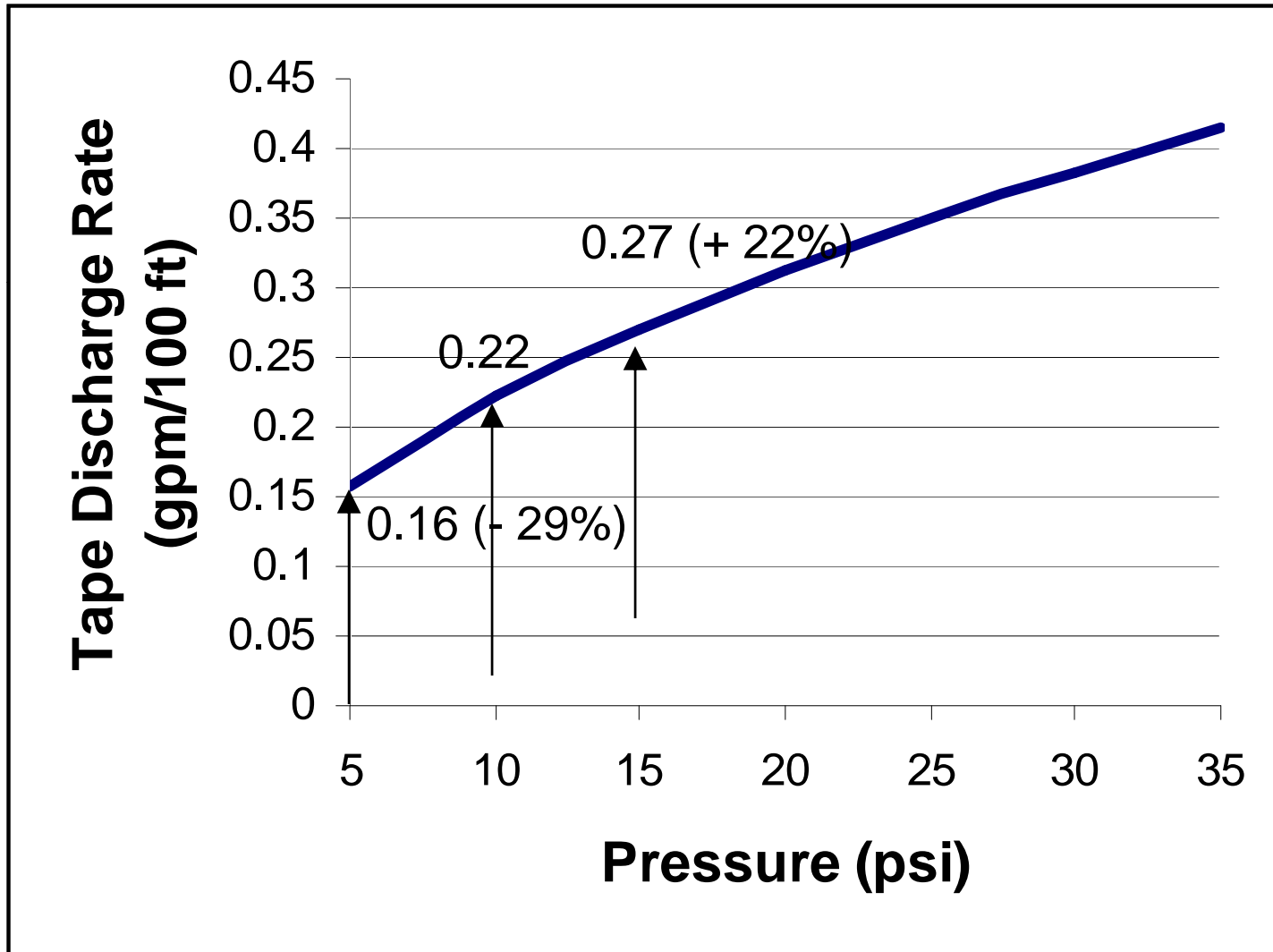
# Distribution Uniformity Evaluations

Location	Field 1	Field 2
	DU lowest quarter	
head	79	79
middle	85	91
Tail	89	94
Overall	85	88

# Evaluation of Pressure Uniformity



# Pressure Effects on Tape Discharge Rate



# Pressure Evaluation (Field 1)

Measurement	Time 1	Time 2	Time 3
	10:12 AM	1:37 PM	3:18 PM
main line pressure after filter (psi)	--	20.0	19.5
main/submain junction before valve (psi)	15.0	14.5	14.0
average submain pressure (psi)	12.3	11.5	10.3
variation in submain pressure measurements (%)	2.3	4.3	2.8
average tail pressure (psi)	11.3	11.0	10.1
variation in tail pressure measurements (%)	2.3	1.4	3.9
pressure loss along lateral line (psi)	1.1	0.6	0.2
average within field pressure (psi)	--	11.0	10.1
variation in within field measurements (%)	--	4.1	2.1

# Pressure Evaluation (Field 2)

Measurement	Time 1	Time 2
average submain pressure (psi)	10.7	15.3
variation in submain pressure measurements (%)	7.6	5.3
average tail pressure (psi)	11.2	12.8
variation in tail pressure measurements (%)	15.9	11.7
pressure loss along lateral line (psi)	-0.4	2.5
average within field pressure (psi)	14.0	14.1
variation in within field measurements (%)	5.8	7.5

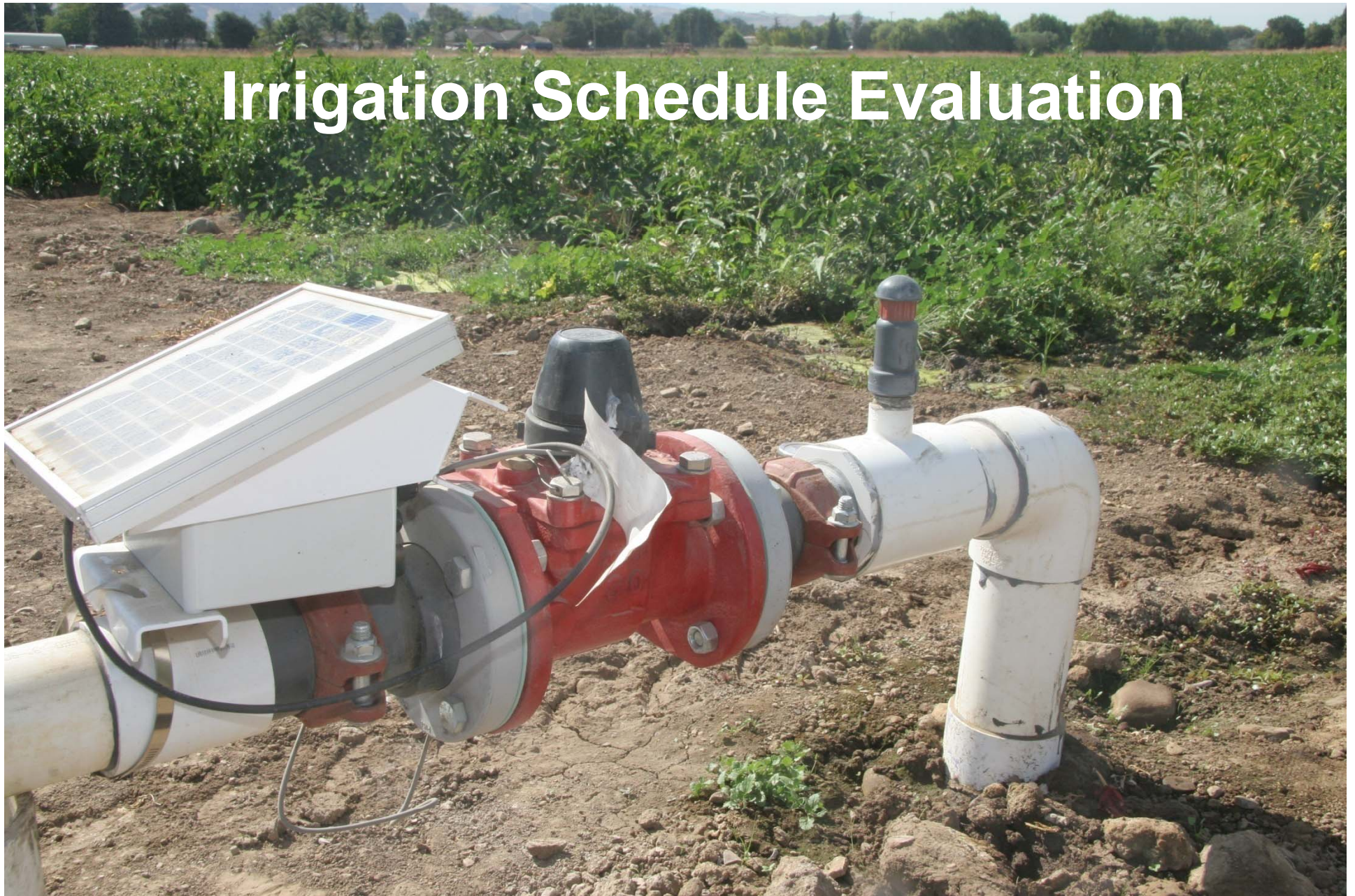
# **Distribution Evaluation and System Audit (drip systems)**

- **System pressure varied during the irrigation**
- **Pressure too low in tape/drip hose**
- **Leaks at submain connections**
- **Material in drip lines**
- **Plugging of emitters**

## Summary of Warm Season Vegetable Irrigation Evaluations

crop	irrigation system	DU <sub>lq</sub>	Irrigation Efficiency
		%	%
pepper	subsurface drip	88	52
pepper	subsurface drip	85	77
freshmarket tomato	subsurface drip	81	81
freshmarket tomato	surface drip	96	100
<b>Average</b>		<b>88</b>	<b>78</b>

# Irrigation Schedule Evaluation



**Evapotranspiration can be estimated using CIMIS weather stations:**

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



**Active CIMIS Stations:**

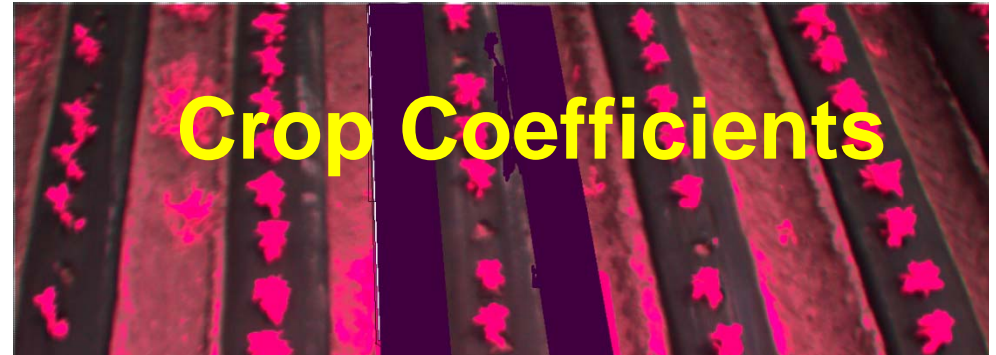
**San Benito (126)**

**San Juan Valley (143)**

**Gilroy (211)**

**[wwwcimis.water.ca.gov](http://wwwcimis.water.ca.gov)**

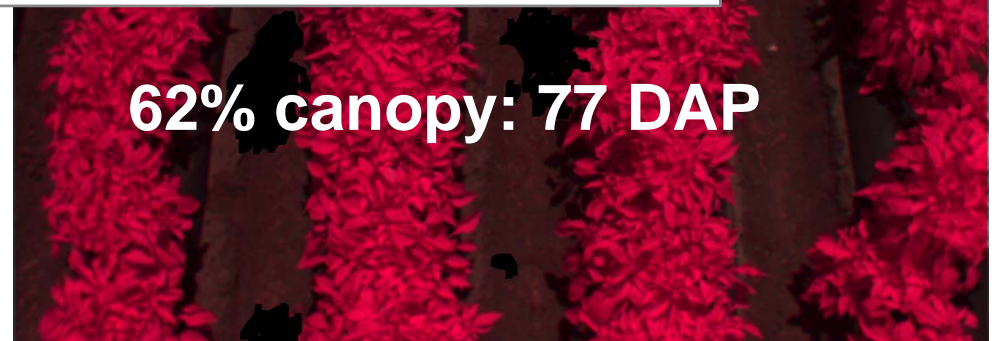
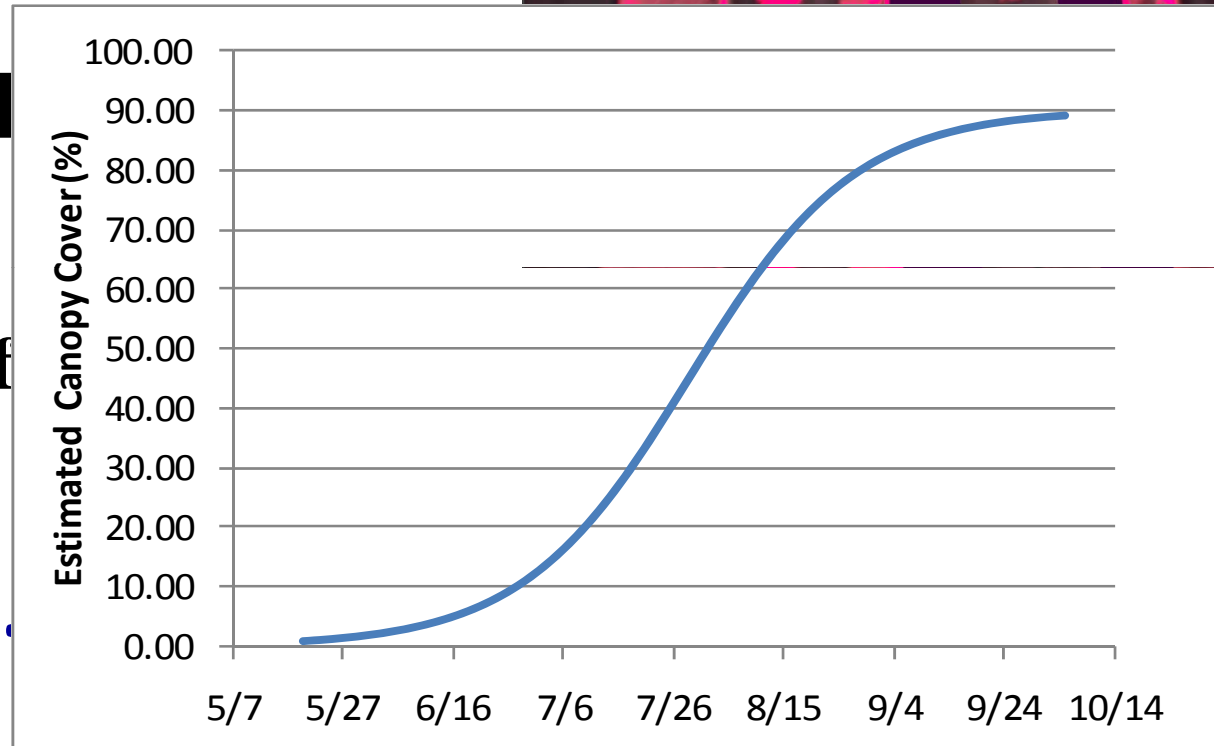
# Converting Reference ET to Crop ET:



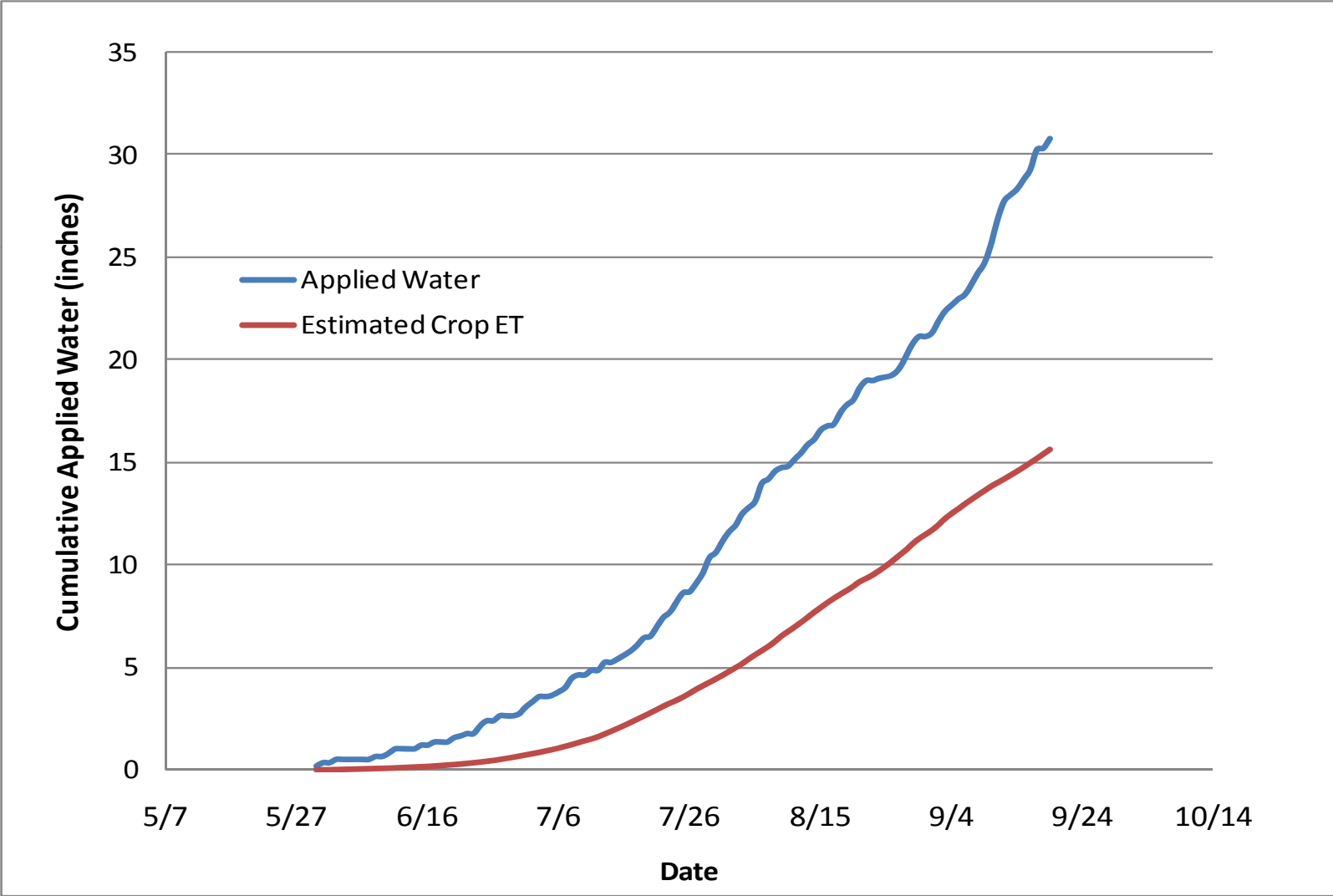
$$ET_{\text{crop}} = K_c \times ET_{\text{ref}}$$

$K_c$  can vary f

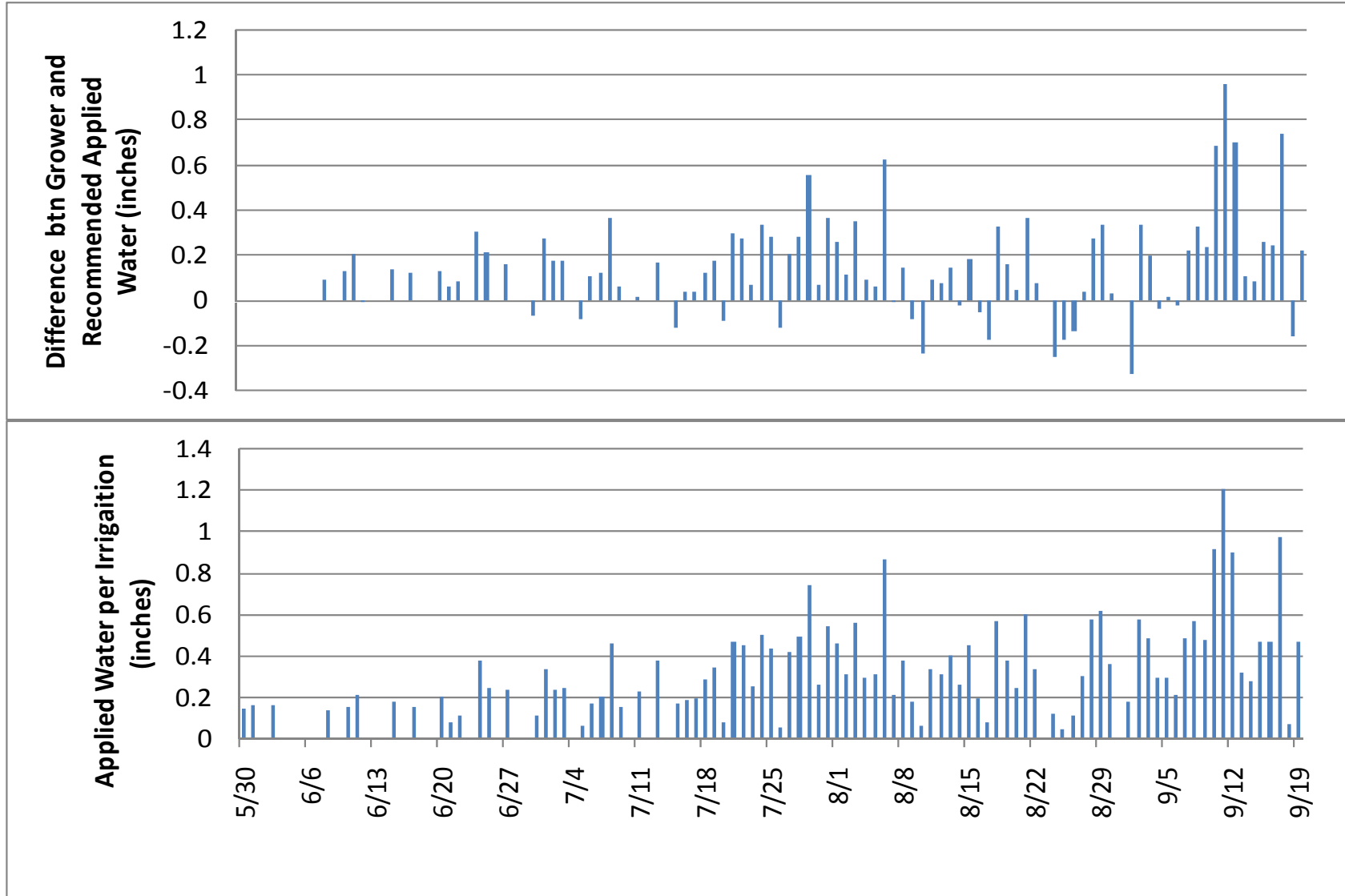
[www.cimiss.org](http://www.cimiss.org)



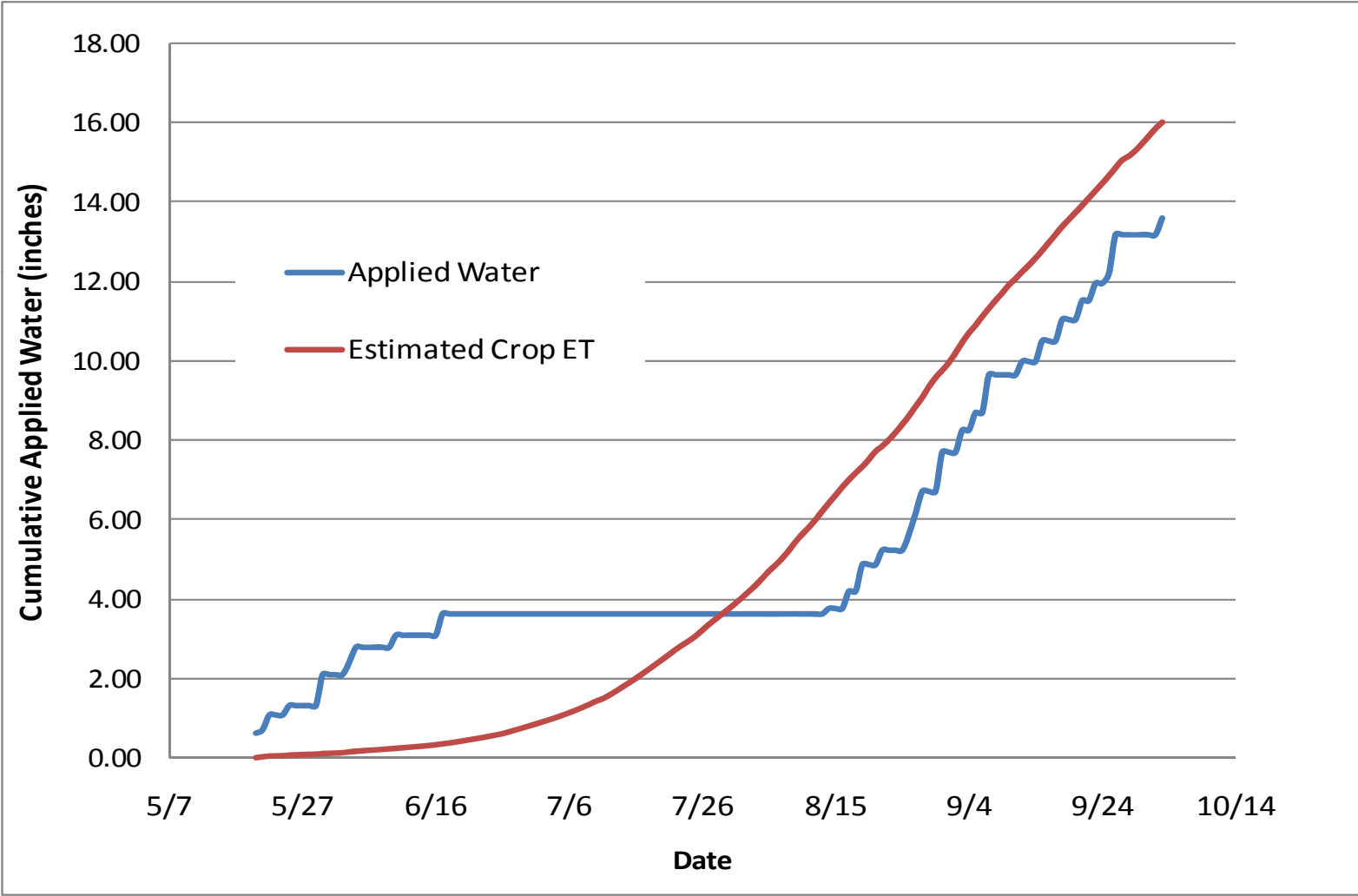
# Compare Crop Water Requirements to Applied Water (Field 2)



# Actual vs Recommended Irrigation (Field2)



# Cumulative Crop ET and Applied Water (Field 1)



# Irrigation Schedule Summary

Summary of Irrigation Schedule	Field 1	Field 2
coefficient of variation of system flow rate (%)	12	17
average flow rate (gpm)	134	215
lowest flow rate (gpm)	104	133
highest flow rate (gpm)	159	294
average irrigation amount (inches)	0.49	0.34
minimum irrigation amount (inches)	0.09	0.05
maximum irrigation amount (inches)	1.0	1.21

# Summary of Scheduling Evaluations

- Variation in flow rate among irrigation events (12% to 17%)
- Frequent irrigations (1 to 4 days)
- Applied water per irrigation (0.25 - 0.5 inches)
- Average irrigation time (6 to 9 hours)
- 130% to 190% of crop ET

## Lessons Learned

- All drip fields evaluated had high distribution uniformities
- Pressure in drip systems needs to be regulated
- Crop ET is a good cross check of the irrigation schedule to avoid over irrigating



Thank you!