

# Strategies to Optimize Irrigation Management in Strawberry Production

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# Regulations on N management have become stricter

**Table C.1-3. Compliance Dates for Nitrogen Discharge Targets and Limits**

	Compliance Date		
		Target	500
	Target	400	12/31/2025
	Limit	300	12/31/2027
<b>Compliance Pathway 1</b>	Limit	200	12/31/2031
$A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) + A_{IRR} - R =$	Limit	150	12/31/2036
	Limit	100	12/31/2041
	Limit	50	12/31/2051

# Account for all sources of nitrogen

- Residual mineral N in soil (Nitrate and ammonium)
- N in irrigation water
- Nitrogen mineralization from soil, amendments, and previous crop residues

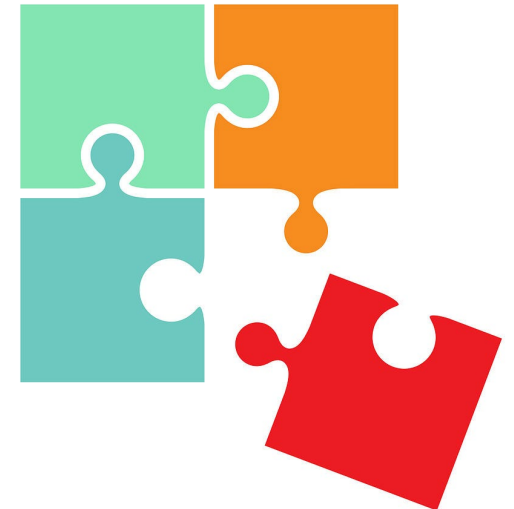
soil



water



crop residue





**Water management will be critical as N fertilizer rates are reduced**







# Benefits of a High Irrigation Efficiency

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- **Minimize nutrient losses**
- **Fertigate uniformly**
- **Conserve water**
- **Improved salinity management**
- **Better yield and quality**
- **Save money**



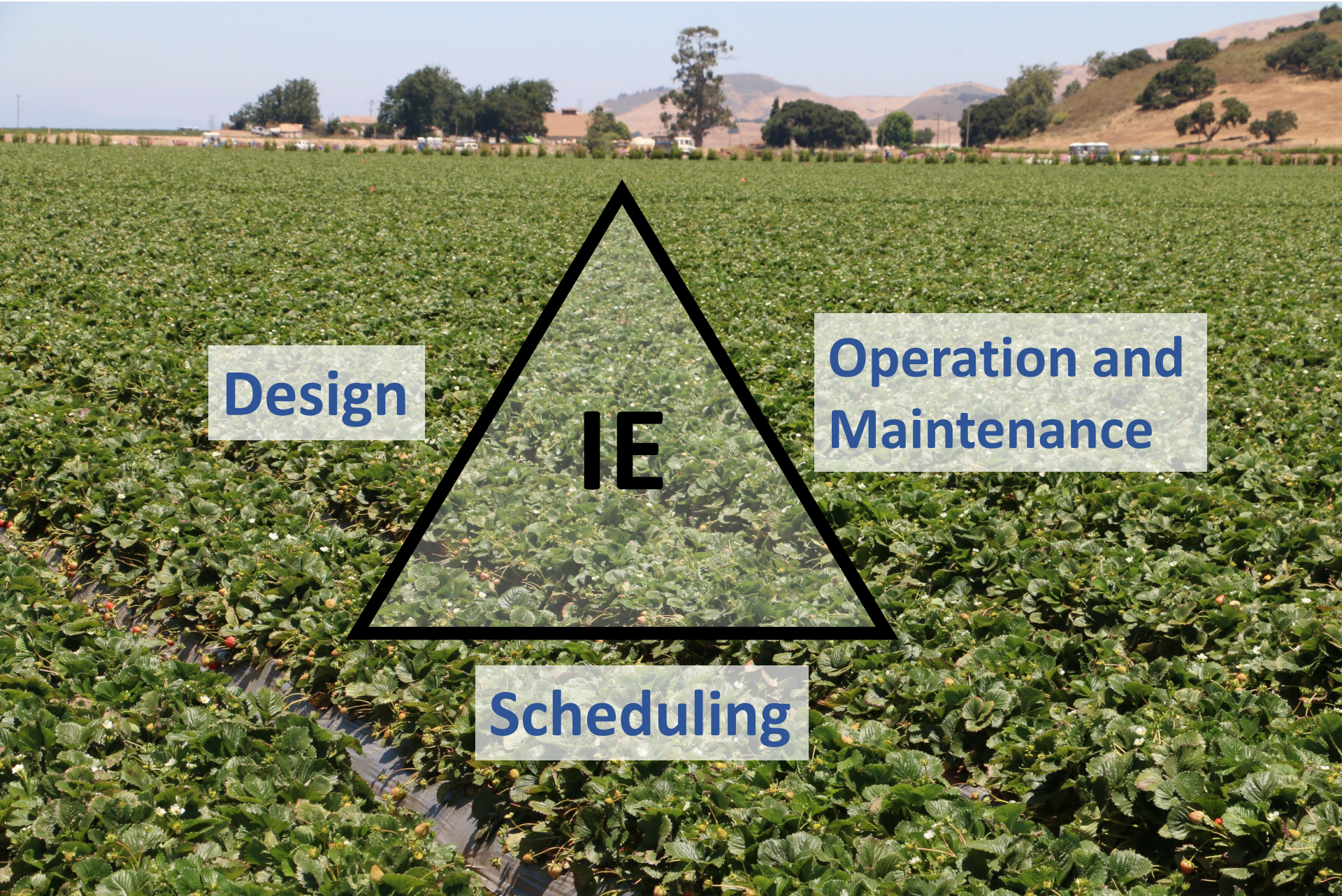
# 3 Sides to Achieving High Irrigation Efficiency

**Design**

**IE**

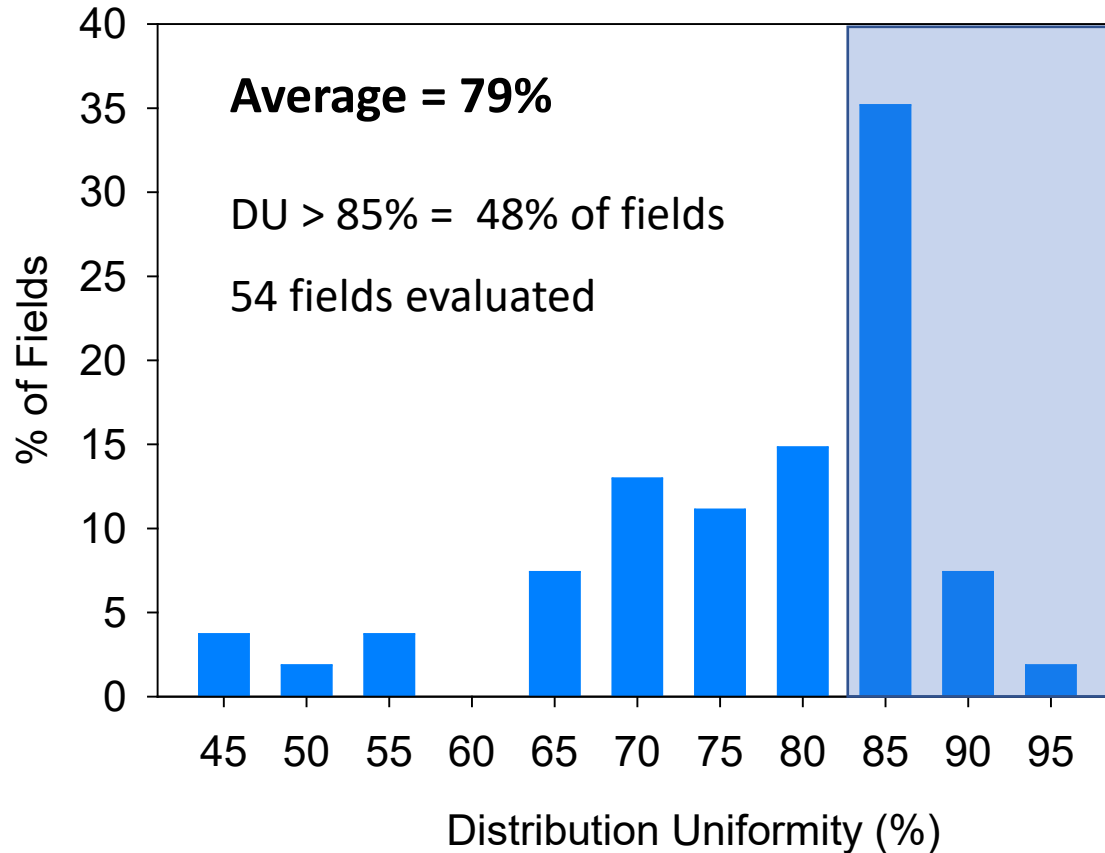
**Operation and  
Maintenance**

**Scheduling**





# Application uniformity of strawberry drip systems (2012-2016)



# **Design problems identified in Strawberry**

- **Excessive pressure loss across hose leads**
- **Hose leads are different lengths**
- **Excessive pressure loss along submains**
- **Slope caused excessive pressure variation**
- **Diameter of submain was too small for flow rate**
- **Mix of tape with different flow rates within block**
- **Block area too large for system flow rate**
- **Low area of field excessively wet**

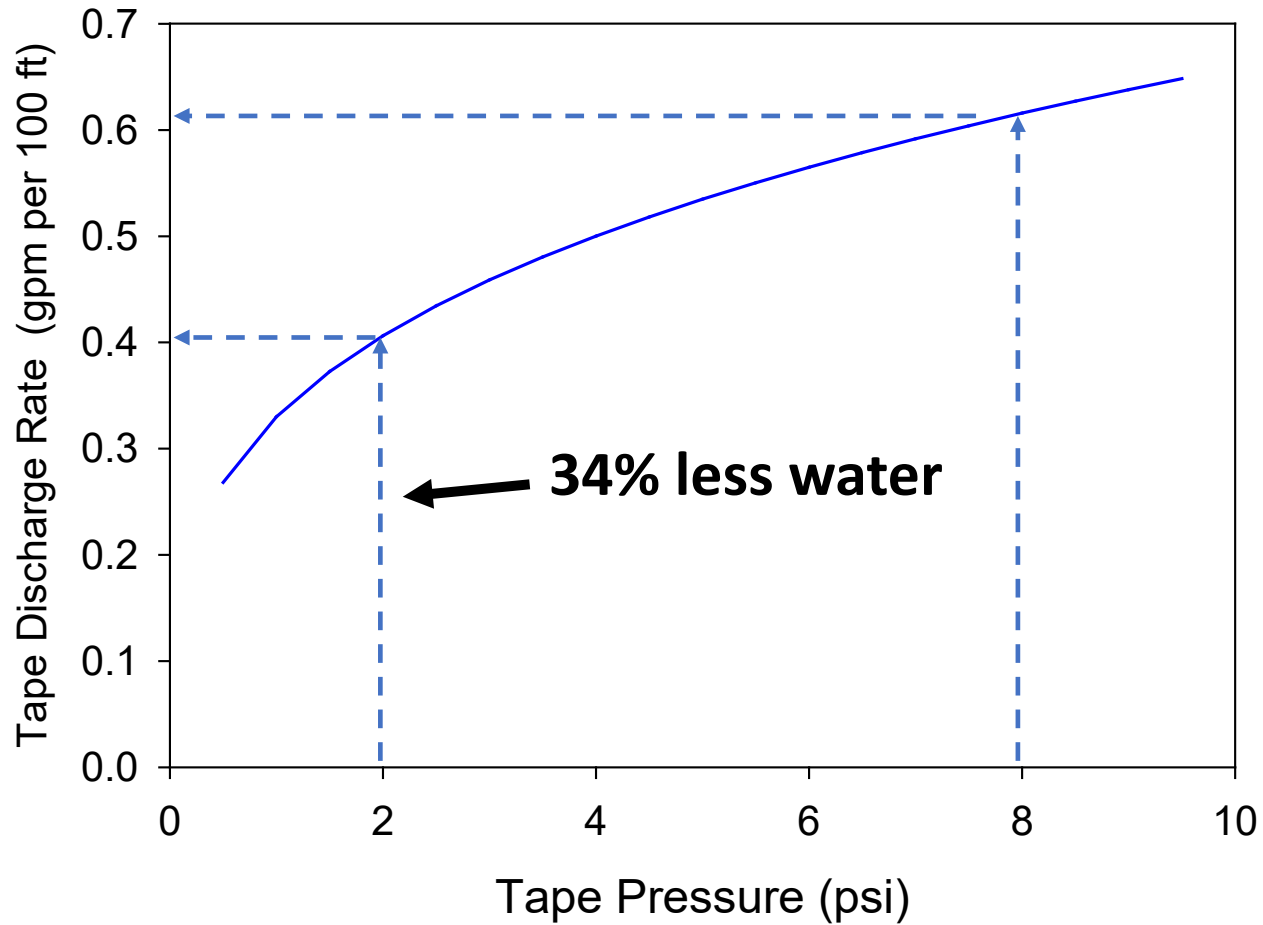


# Pressure is the key to drip irrigation



- ✓ Right pressure
- ✓ Consistent pressure

# Discharge rate of drip tape varies with pressure





## Monitoring pressure is more complicated than it seems



- Mechanical pressure gauges on an irrigation system are often inaccurate, in the wrong location, or broken.
- New mechanical pressure gauges may be inaccurate by as much as 1 to 2 psi (10% to 20% error for tape at 10 psi).



# Use Schrader valves and calibrated pressure gauges



# Factors that increase pressure variation



**ELEVATION  
CHANGE**



**UNDERSIZED  
FITTINGS AND PIPE**



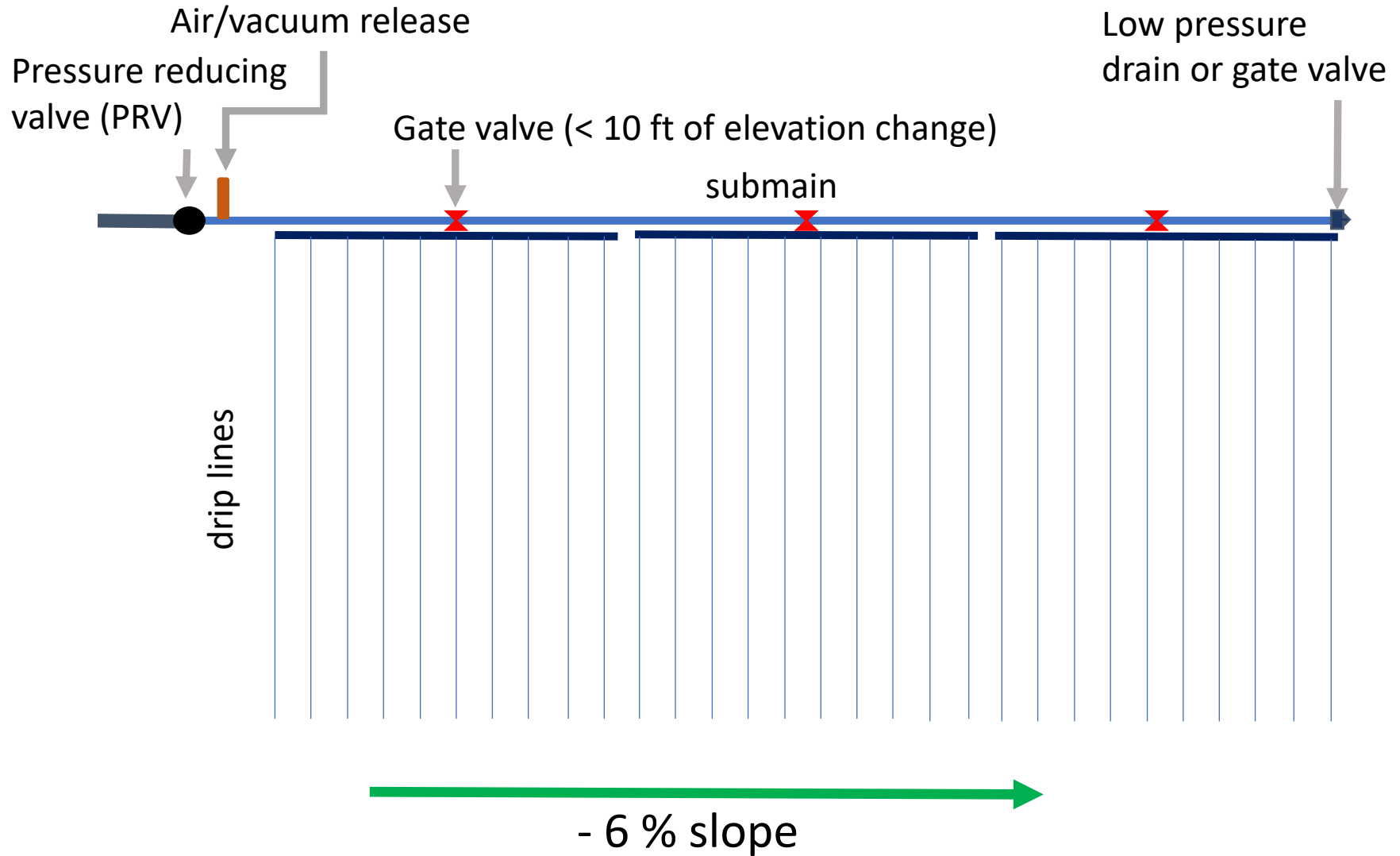
**PRESSURE LOSS IN  
DRIP LATERALS**





2.3 feet of elevation change = 1 psi

# Designing a submain along a slope





# Undersized connections between the main and submain can cause excessive pressure loss







# Connections between submain and drip tape



**1 to 3 psi loss across the polyethylene leads (spaghetti) is typical**

- **Large diameter lead minimizes pressure losses**
- **All leads should have a similar length**
- **One lead per drip line**



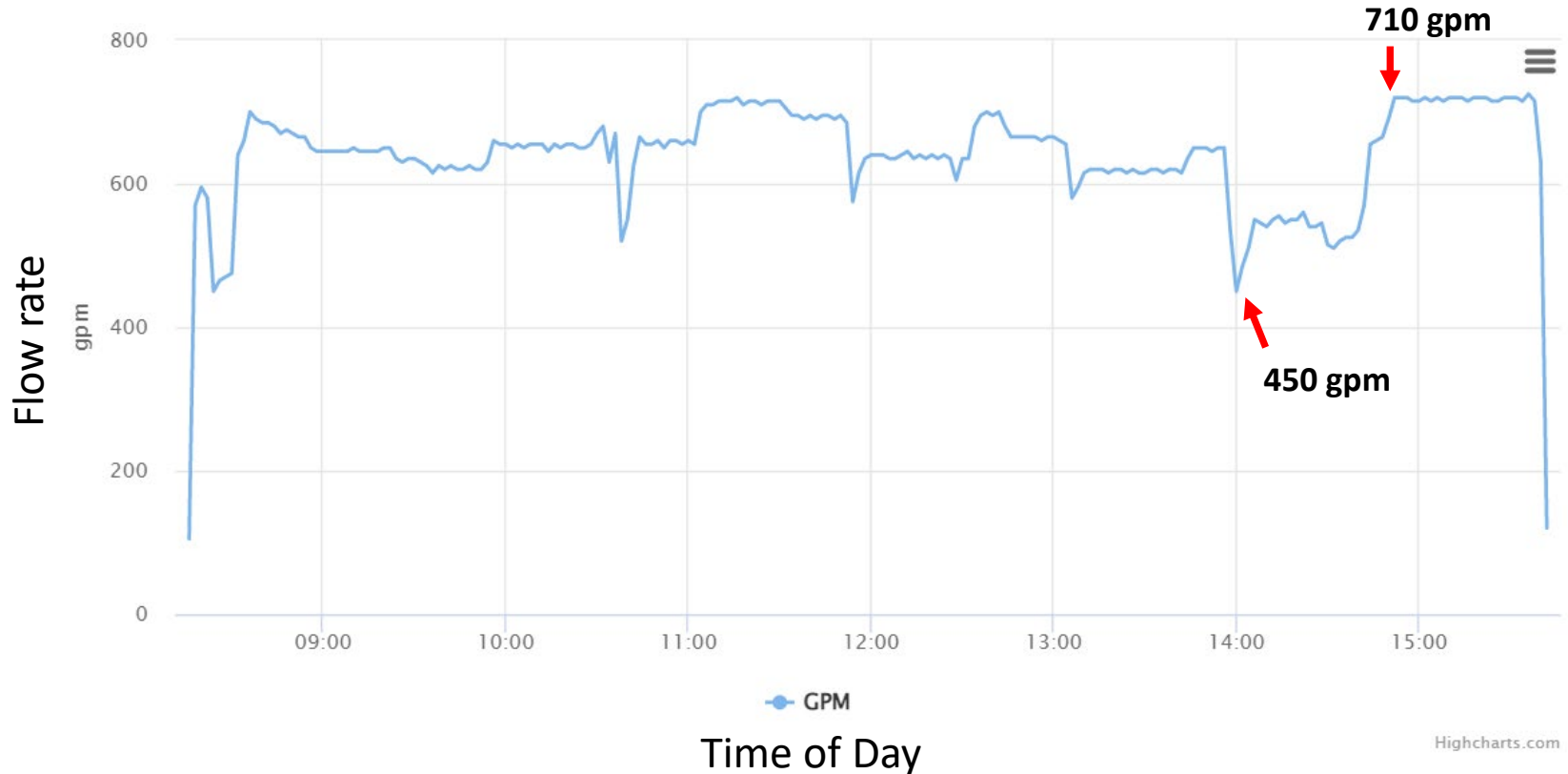


# Many irrigators regulate pressure of drip systems using a valve





# If pressure varies then the flow rate of the drip system will vary



# Use pressure reducing valves to automate pressure regulation



- ✓ **Install at main-submain connections**
- ✓ **Size for flow rate and pressure range**
- ✓ **Need sufficient upstream pressure (5 psi > downstream psi)**
- ✓ **Maintenance and training needed**



# What is the best approach for irrigation scheduling of berries?

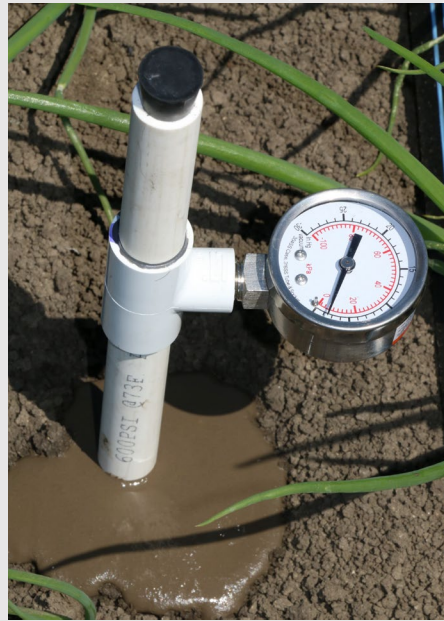
**Soil moisture:  
when?**



**Weather-based:  
how much?**



Tensiometers measure the energy that plants require to pull water from the soil pores (tension)



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



# Ten Minute Tensiometer





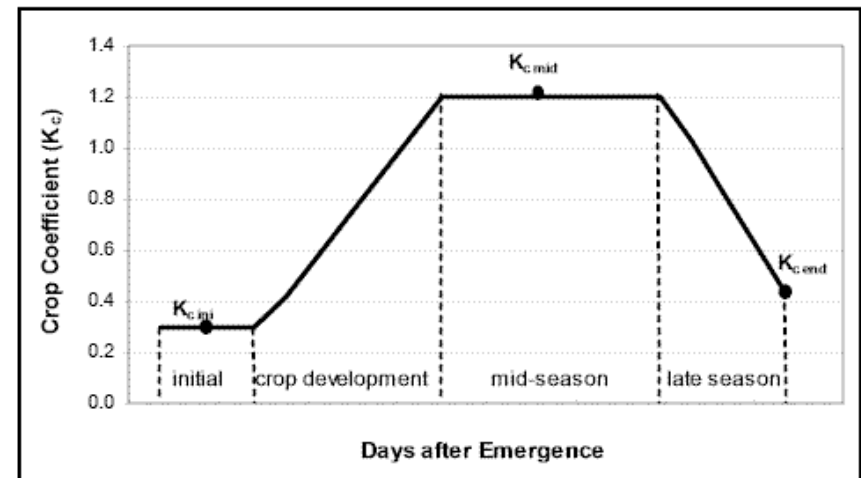
# Weather-based irrigation scheduling



Converting Reference ET to  
Crop ET:

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

$K_c$  can vary from 0.1 to 1.2





# CropManage: Online irrigation and nitrogen management decision support

☆ strawberry 3 ✕

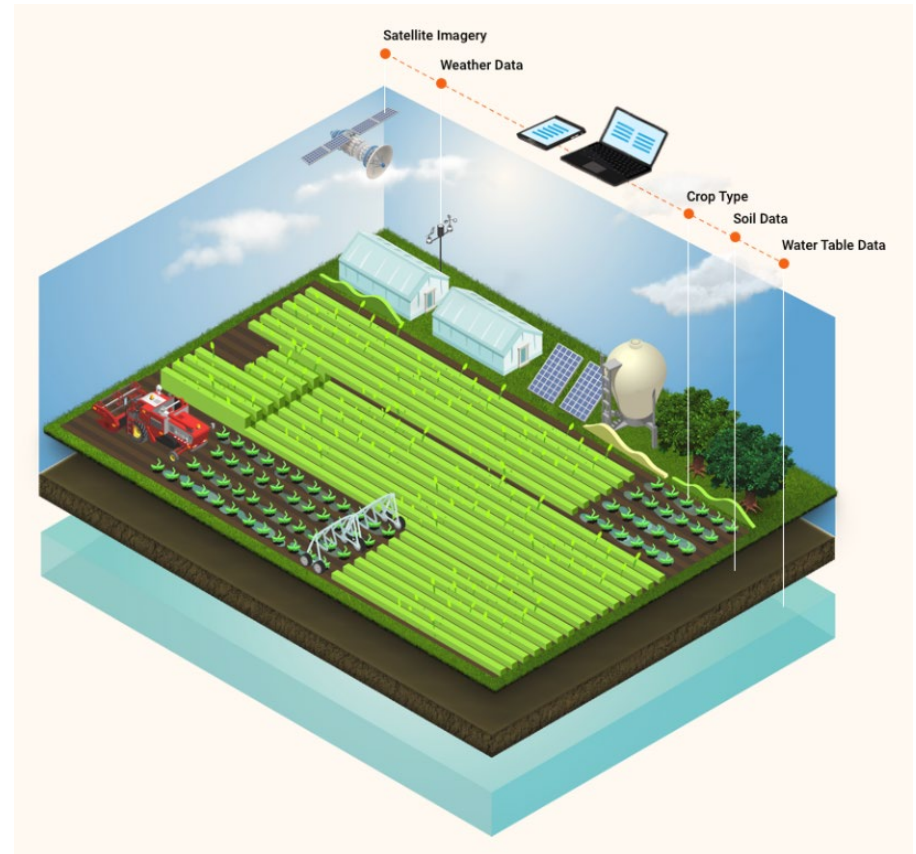
17 Nov 2022 - 25 Nov 2023 ⚙️ 📊 📄 📈

Tasks History 📅

### COMPLETED

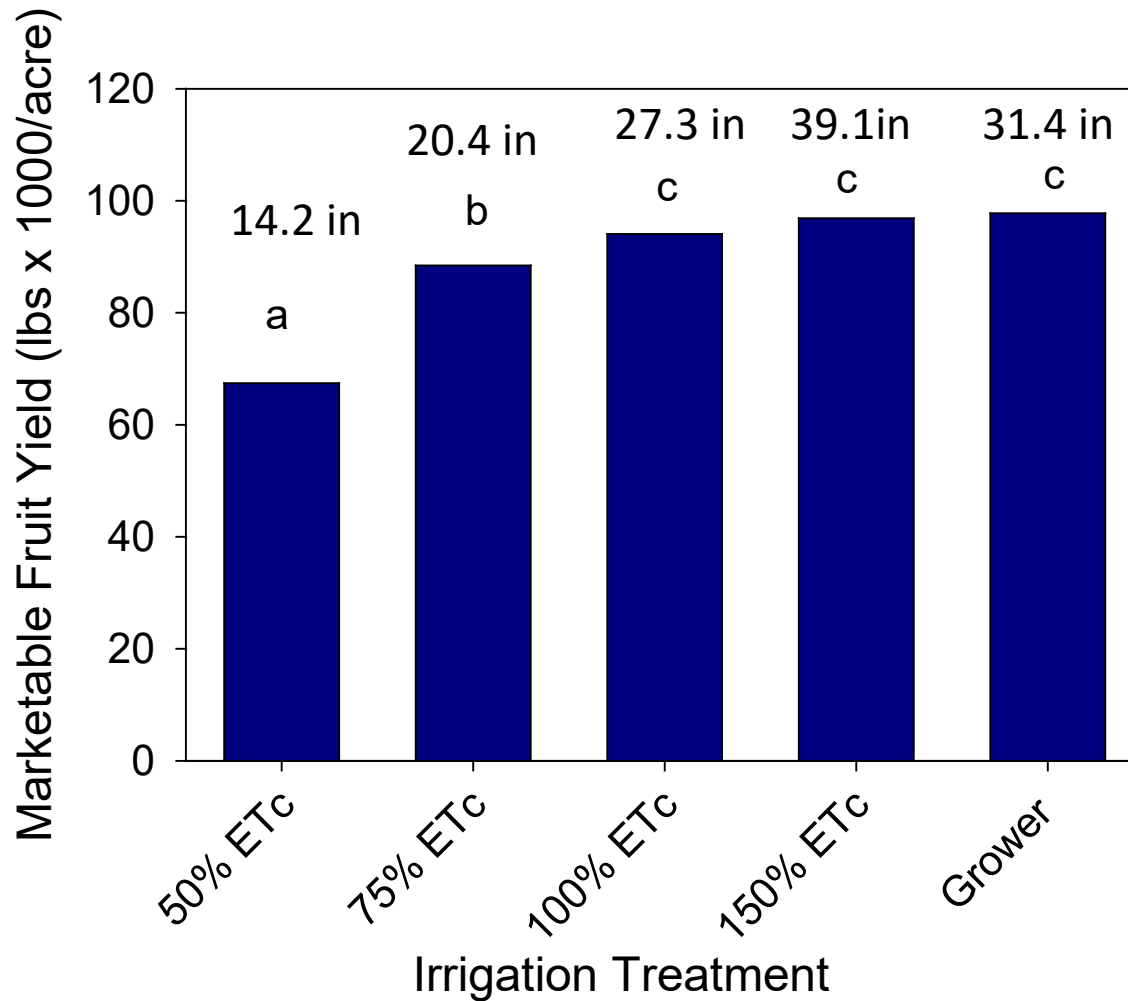
APR 6	🌊 Drip	1.1 hr
APR 4	🌊 Drip	0.9 hr
MAR 30	💧 Drip	1 hr
MAR 29	📦 CAN-17	2 gal/acre
MAR 29	🍷 Quick Nitrate Strip	11.8 ppm
FEB 17	🌊 Drip	1 hr
FEB 9	🌊 Drip	0.9 hr
FEB 2	🌊 Drip	0.7 hr
JAN 30	🌊 Drip	0.9 hr
JAN 27	🌊 Drip	0.8 hr

View all events by: ☰ 📅 📅



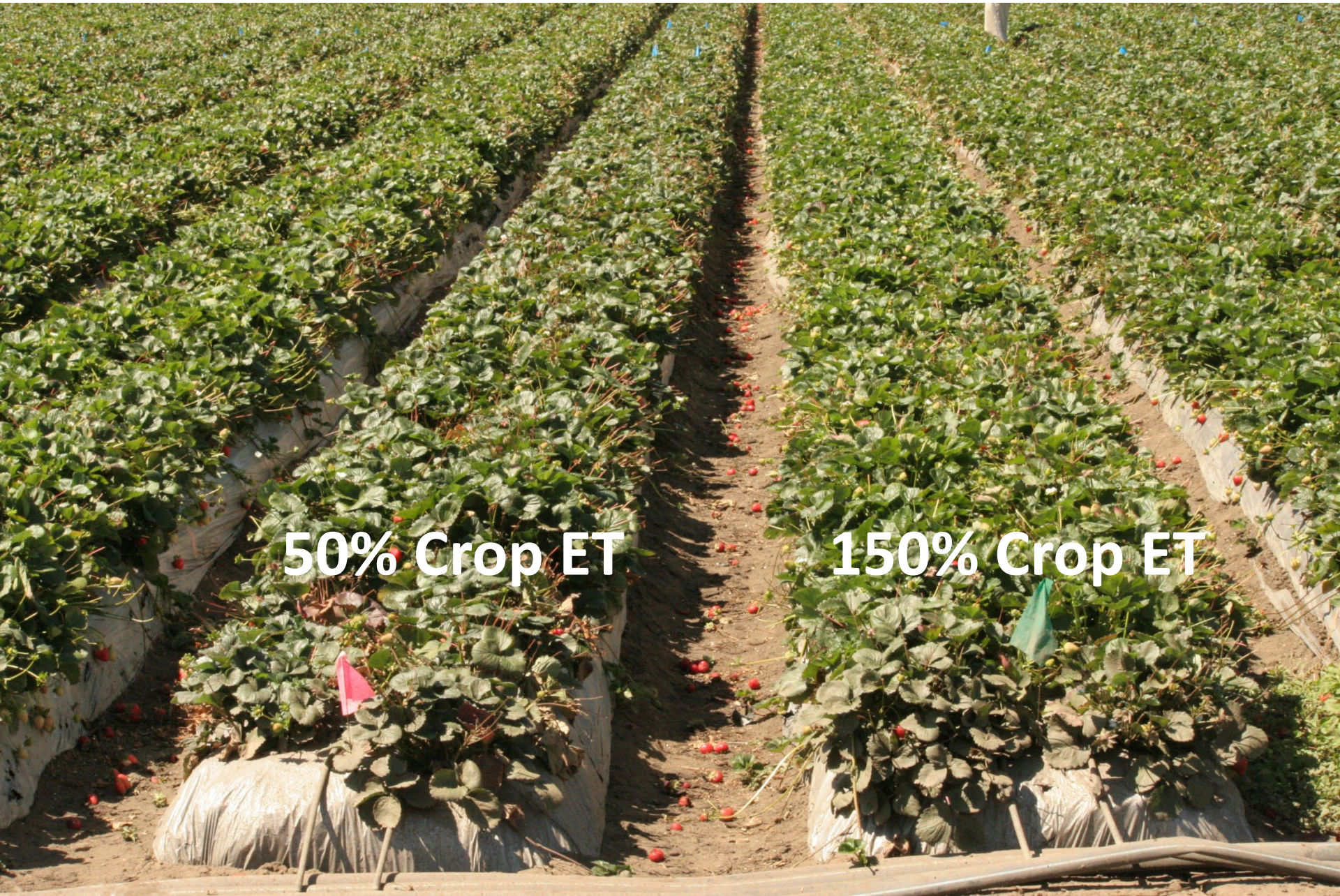
[cropmanage.ucanr.edu](http://cropmanage.ucanr.edu)

# Irrigation Effects on Marketable Fruit Yields





# Difficult to identify water stress early



**50% Crop ET**

**150% Crop ET**



# Summary

- **Growers will need to become more efficient in water and nitrogen management in the upcoming years**
- **Irrigation management is key to optimizing water use and nitrogen fertilizer.**
- **Achieving a high irrigation efficiency requires a good design, good maintenance and operation, and accurate scheduling of irrigations**