Tuning up your drip irrigation system: pressure regulation, system design, and scheduling.

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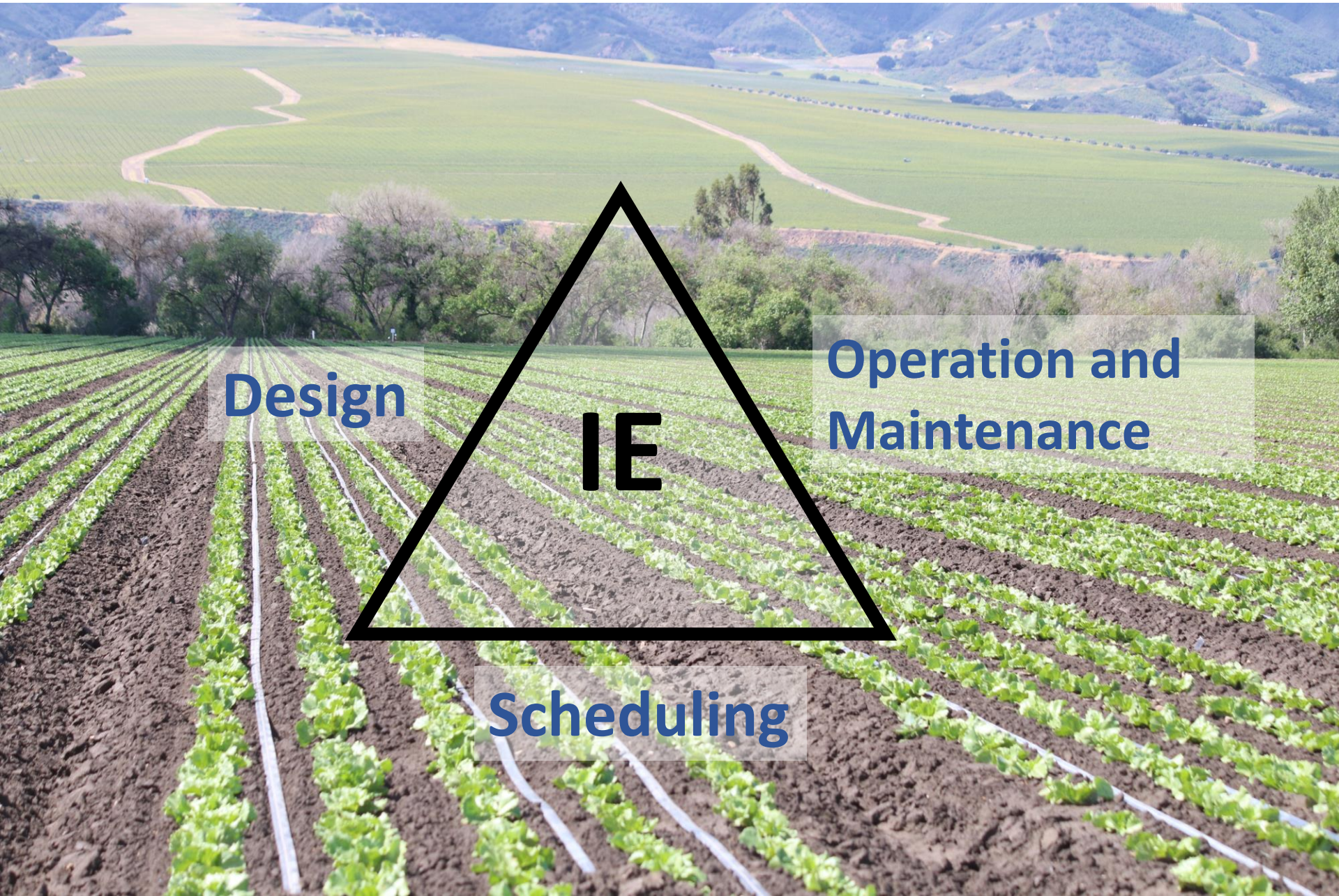
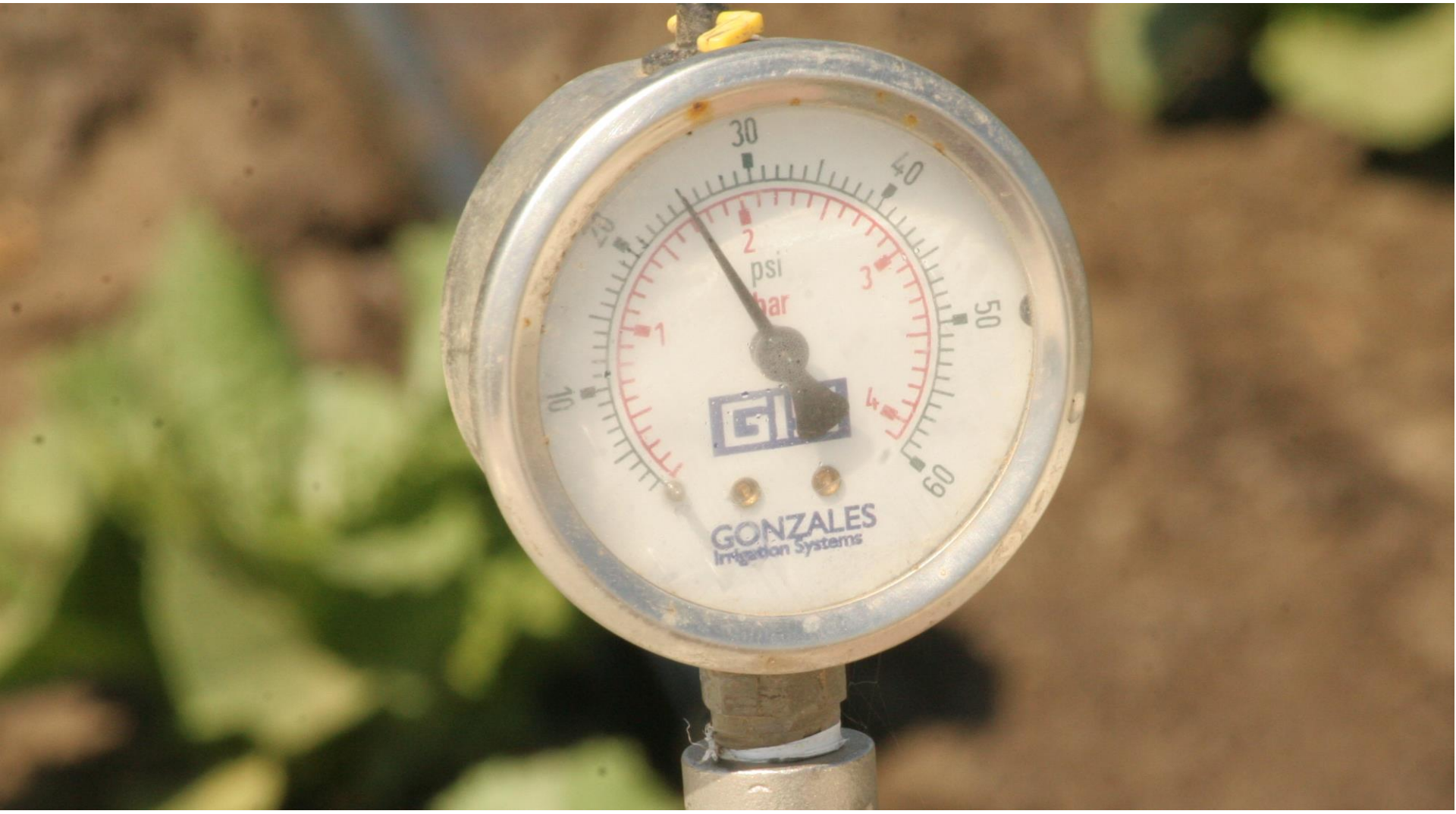
Benefits of a high Irrigation Efficiency

- **Conserve water**
- **Fertigate uniformly**
- **Minimize nutrient losses**
- **Save Money**

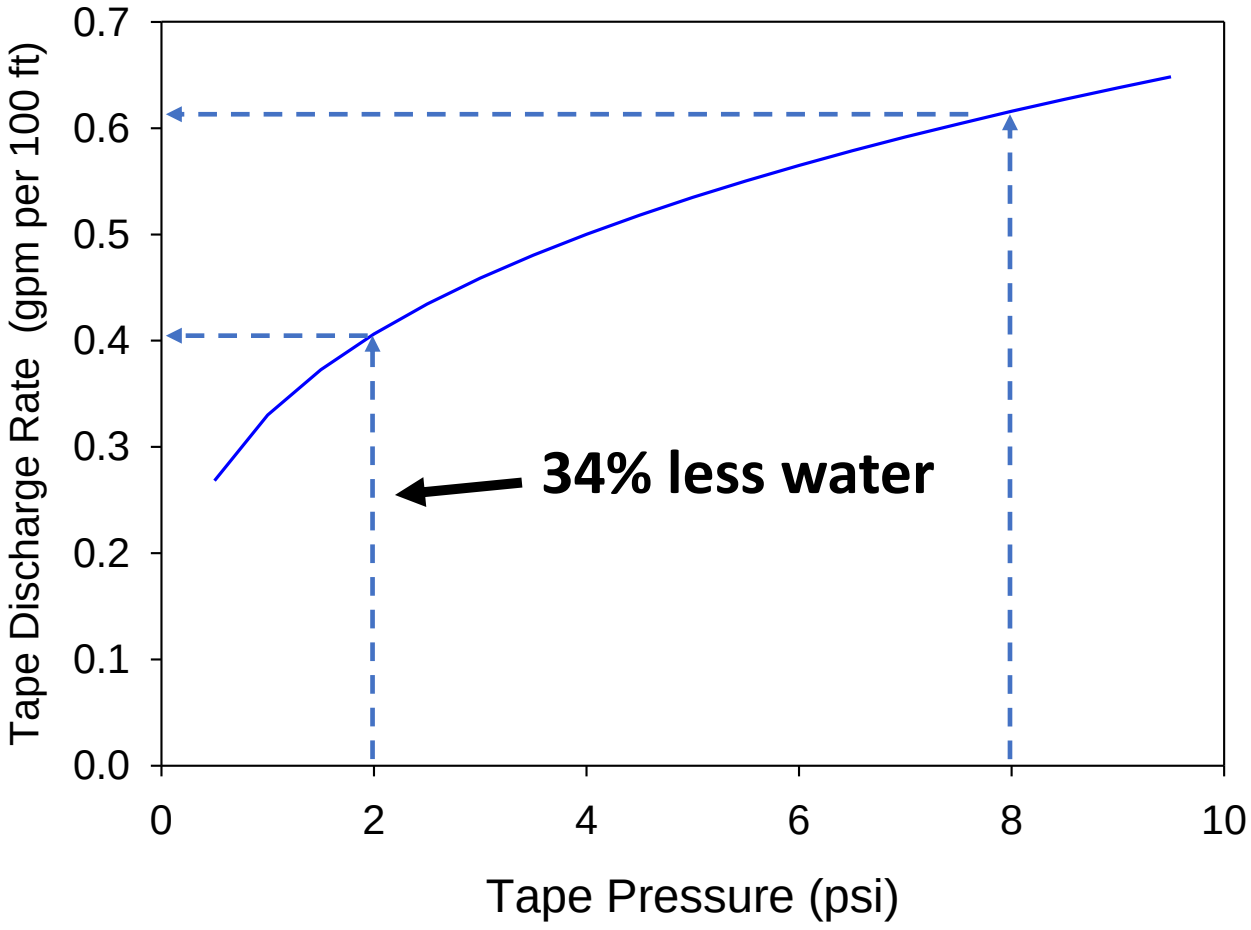
3 Sides to Achieving High Irrigation Efficiency



Management of Pressure is Key to Achieving a High Application Uniformity with Drip

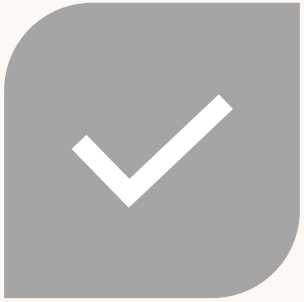


Discharge rate of drip tape varies with pressure



Factors that increase pressure variation

ELEVATION CHANGE



UNDERSIZED FITTINGS AND PIPE

DRIP LINES ARE TOO LONG

2.3 feet of elevation change = 1 psi

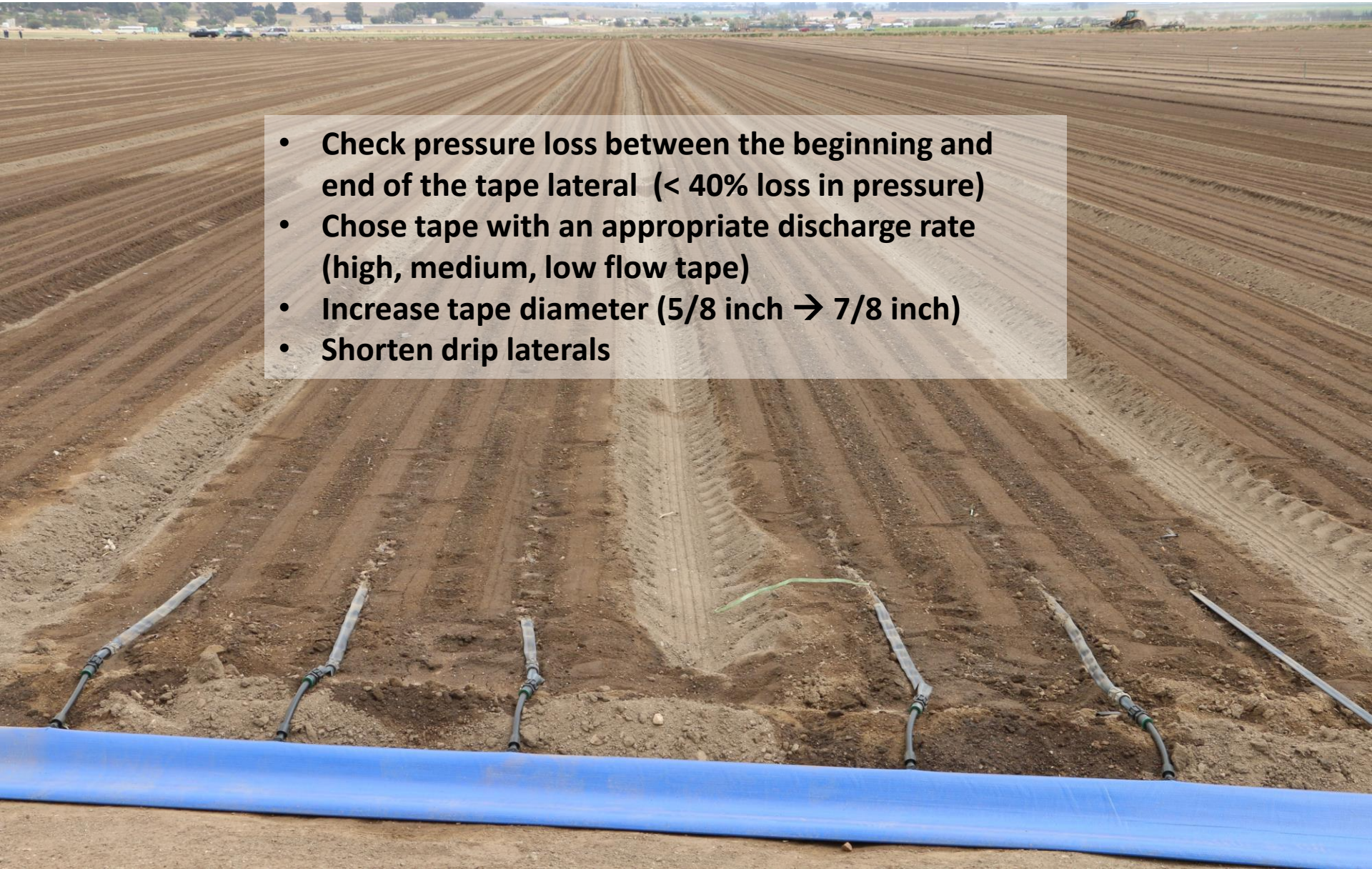
Or a 10 ft change in elevation would affect the pressure by 4.3 psi

Pressure Loss in Mains and Submains (psi loss per 100 ft)

Pipe Diameter (inches)	flow rate (gal/min)										
	25	50	75	100	125	150	175	200	300	400	500
1.5	3	13	27	--	--	--	--	--	--	--	--
2.0	1	3	7	11	17	24	--	--	--	--	--
2.5	0	1	2	4	6	8	11	14	29	--	--
3.0	0	0	1	2	2	3	4	6	12	20	31
3.5	0	0	0	1	1	2	2	3	6	10	14
4.0	0	0	0	0	1	1	1	1	3	5	8
5.0	0	0	0	0	0	0	0	0	1	2	3
6.0	0	0	0	0	0	0	0	0	0	1	1

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

Assure that the pressure loss along the length of the drip lines is not excessive

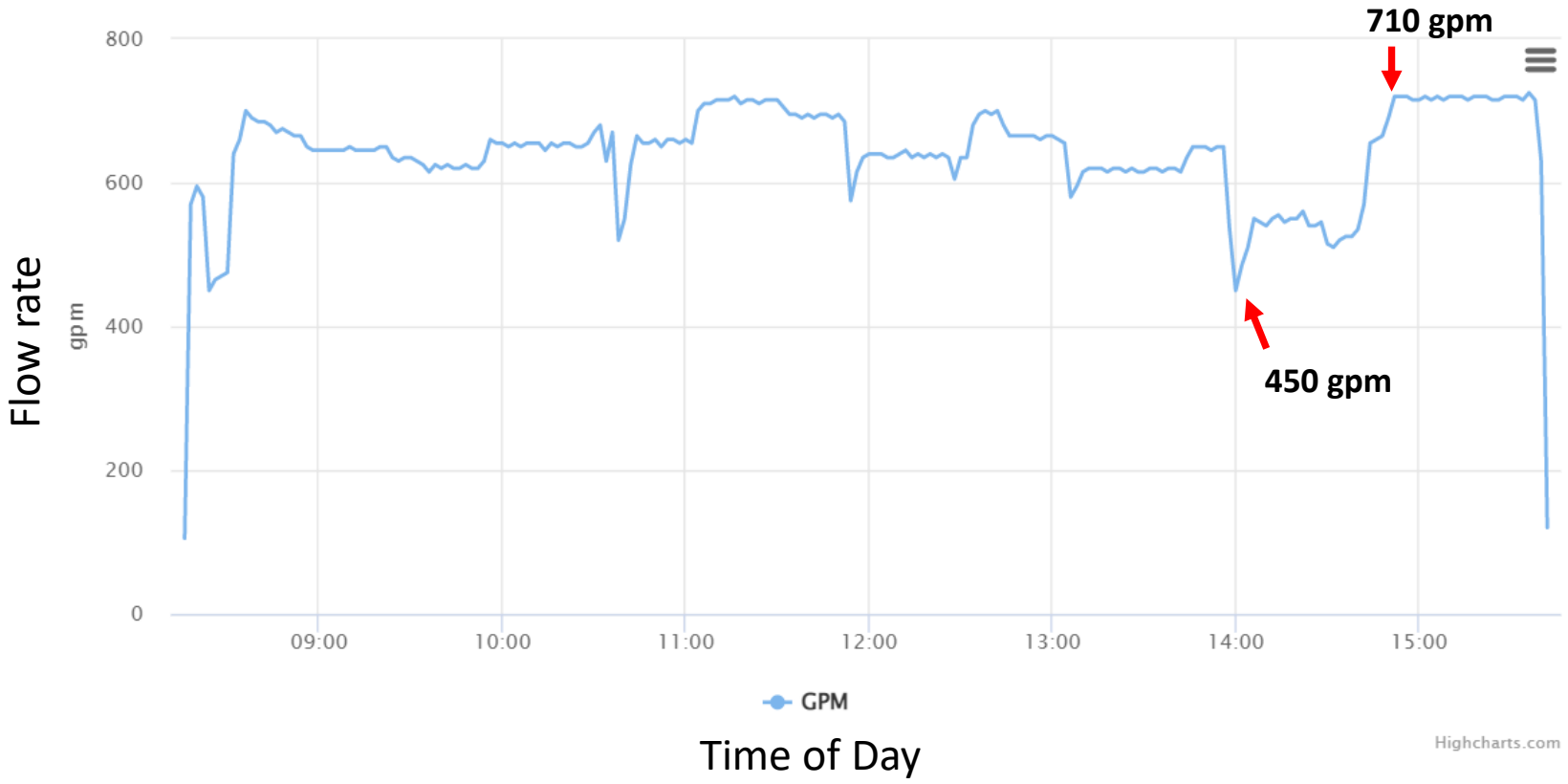


- Check pressure loss between the beginning and end of the tape lateral (< 40% loss in pressure)
- Chose tape with an appropriate discharge rate (high, medium, low flow tape)
- Increase tape diameter (5/8 inch → 7/8 inch)
- Shorten drip laterals

For very long beds (>1000 ft): Placing the submain a third of the way down the field minimized pressure differences and improved distribution uniformity

Many irrigators adjust a valve to regulate pressure of drip systems

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



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

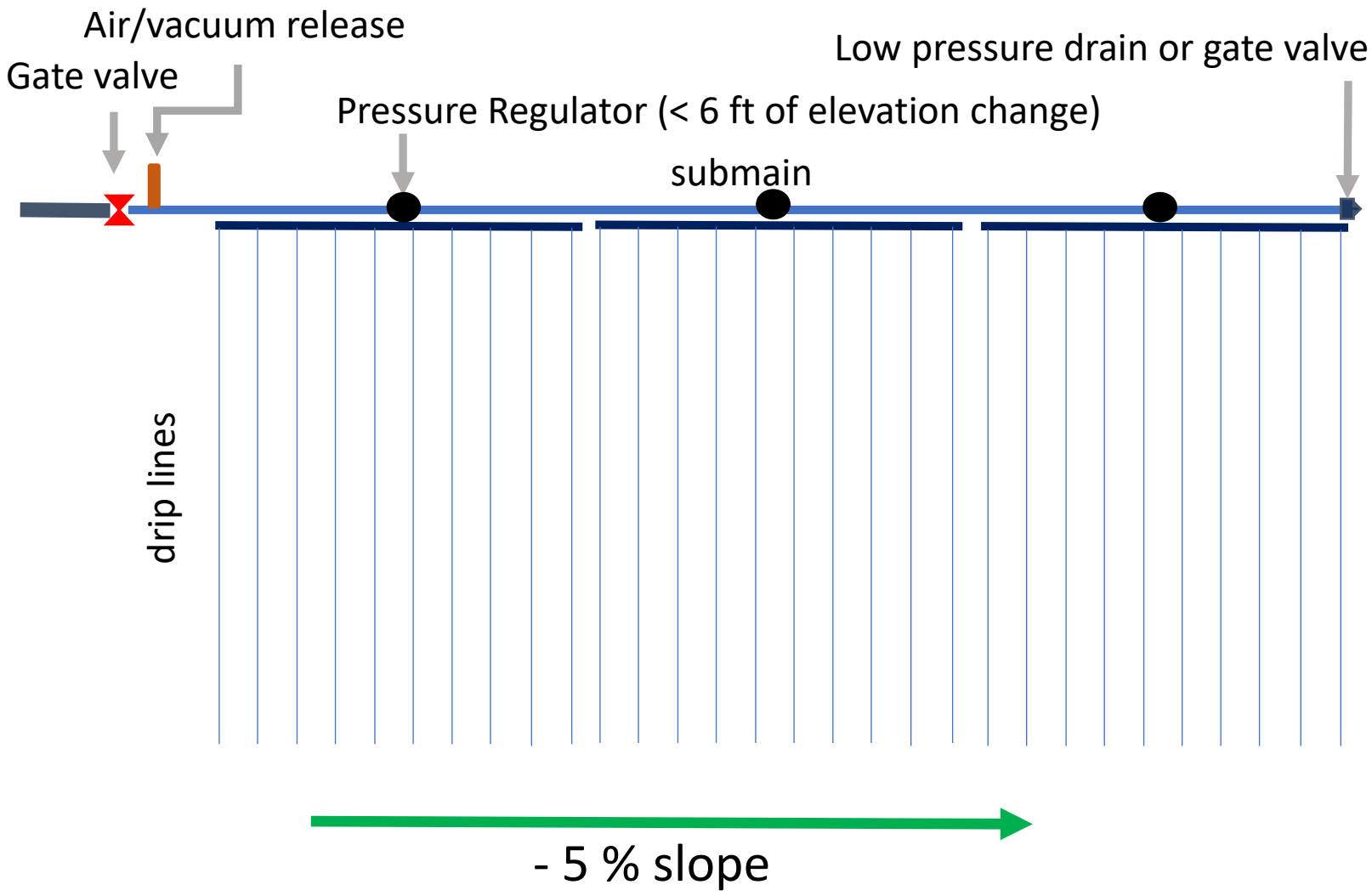
Periodically check the calibration of all pressure gauges

Pressure regulators can help

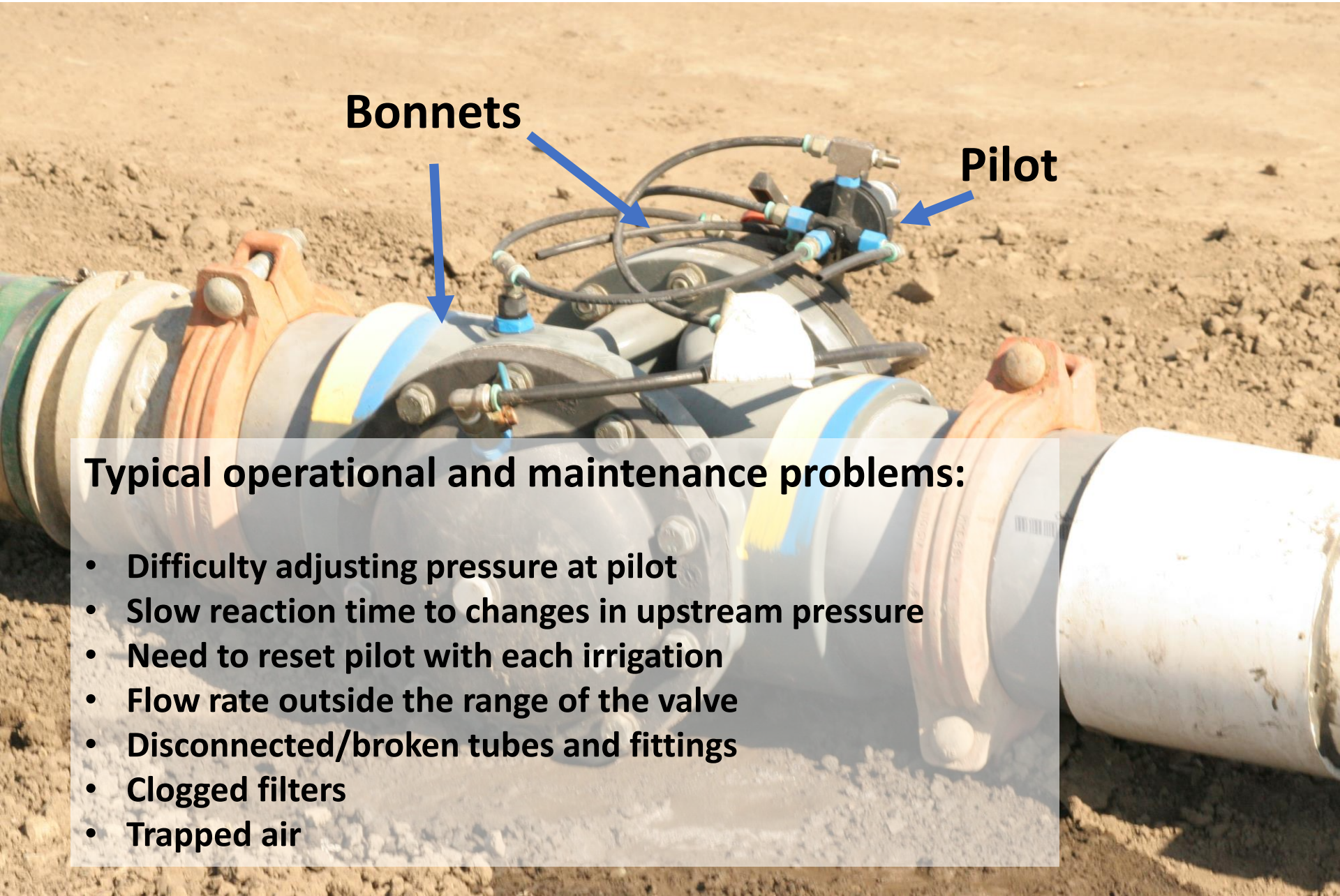
Non adjustable Pressure Regulators

- Up to 3-inch diameter
- Suitable for a limited range of flowrates (< 80 gpm)
- Durable (few parts)
- Fast reacting to changes in upstream pressure
- Maintain a consistent pressure downstream if within the flow rate range

Designing a submain along a slope



Adjustable pressure reducing valve (PRV)



Typical operational and maintenance problems:

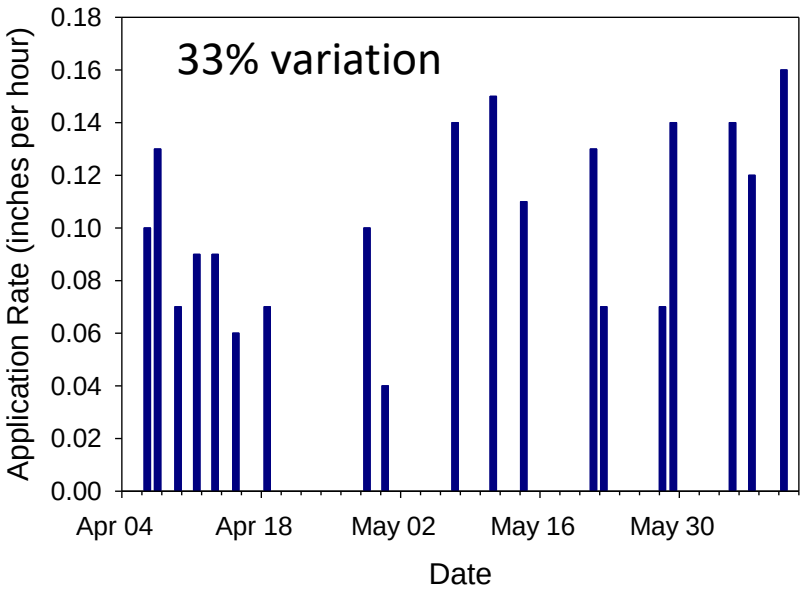
- Difficulty adjusting pressure at pilot
- Slow reaction time to changes in upstream pressure
- Need to reset pilot with each irrigation
- Flow rate outside the range of the valve
- Disconnected/broken tubes and fittings
- Clogged filters
- Trapped air

Improved Pressure Reducing Valves for large Drip Systems

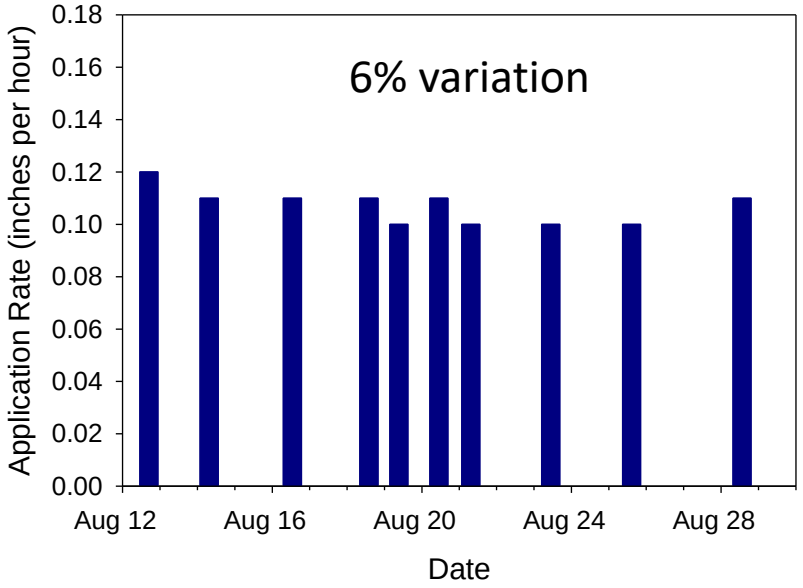
- Easy to adjust
- Suitable for a large range of flow rates
- Fast reacting to changes in upstream pressure
- Maintains a consistent pressure downstream without adjustment
- Rugged

Pressure regulating valve minimized variability in the application rate of the drip system during the growing season

No regulating valve



Regulating valve



Tools for Irrigation Scheduling

Weather (ET)-based

Plant-based

Soil-based

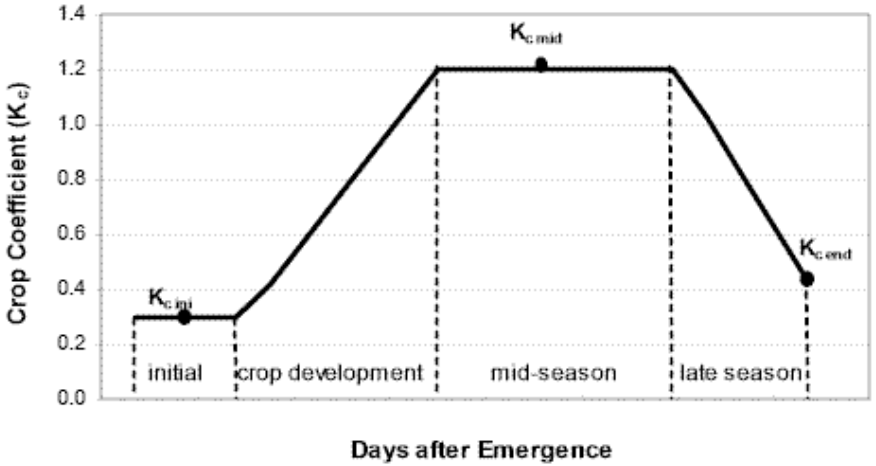
Flowmeters are useful tools for irrigation scheduling

Weather-based irrigation scheduling

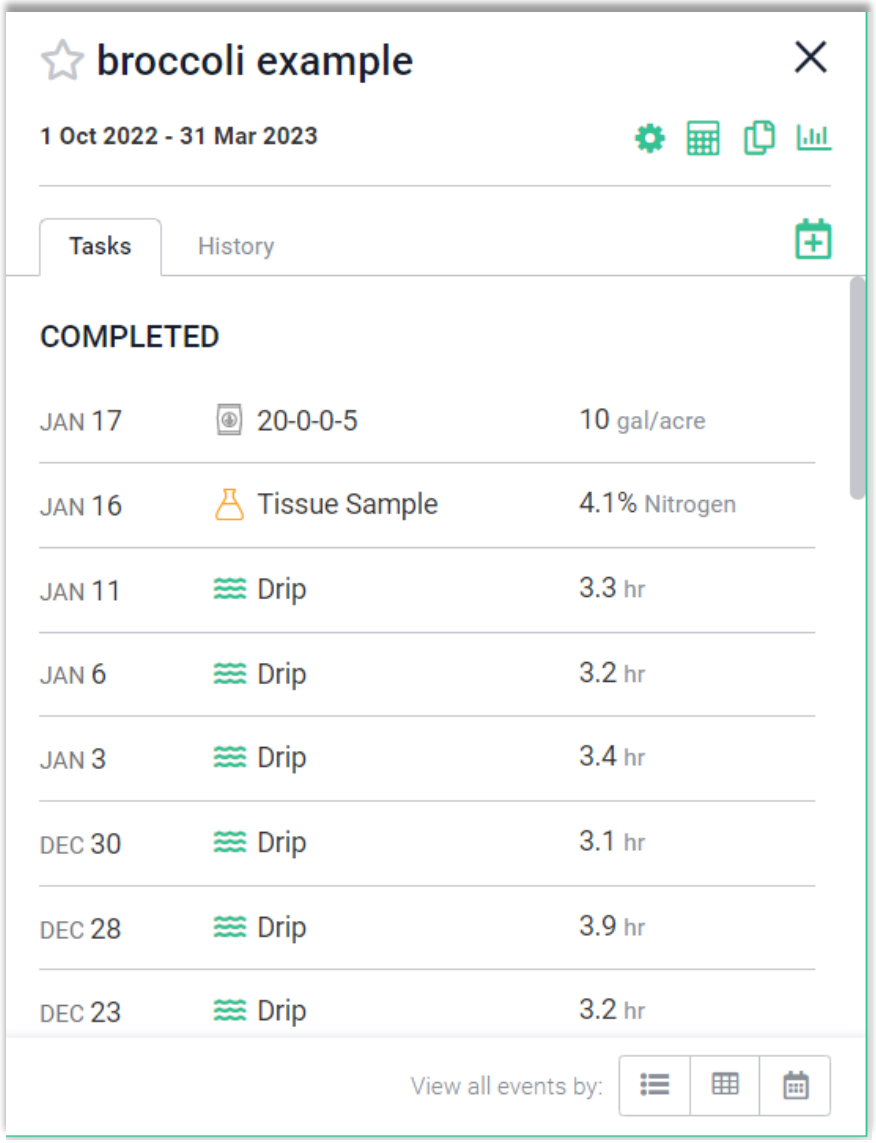
Converting Reference ET to Crop ET:

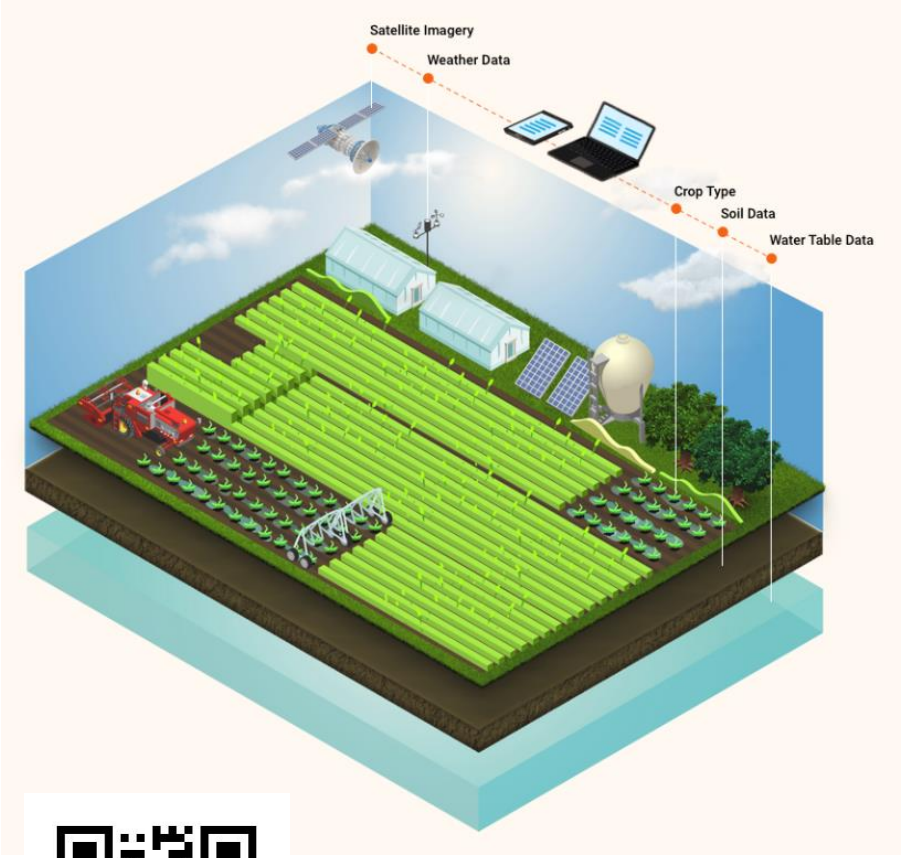
$$ET_{crop} = ET_{ref} \times K_{crop}$$

K_c can vary from 0.1 to 1.2



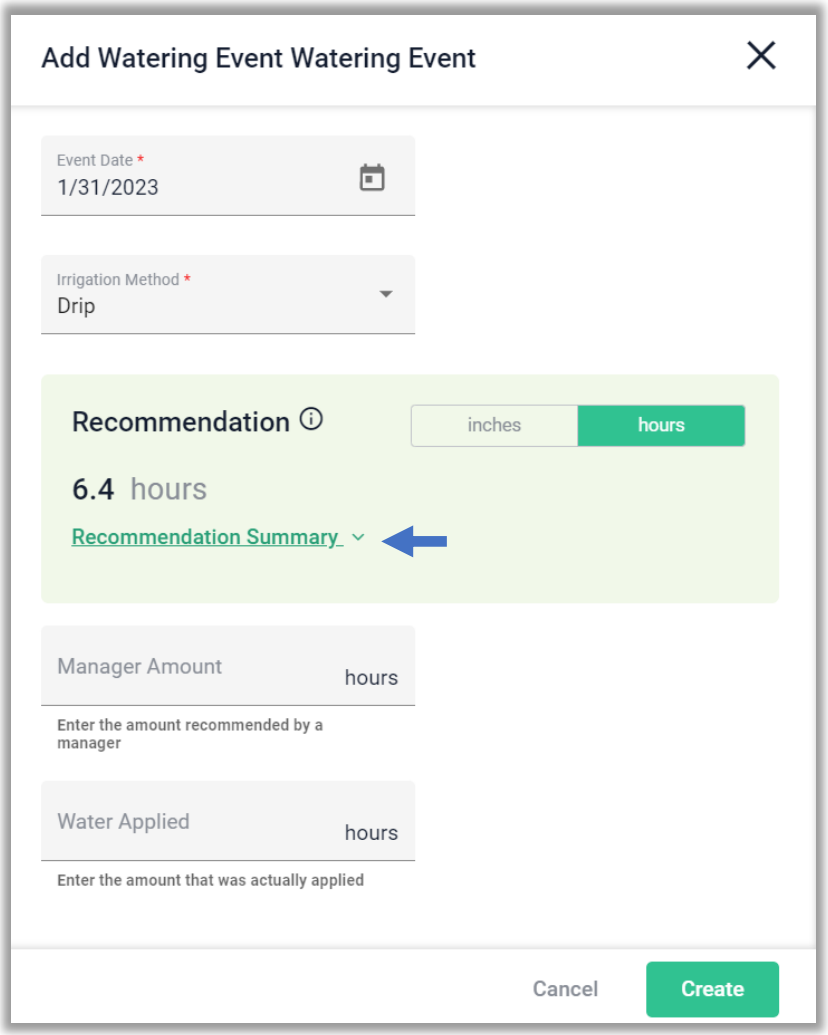
CropManage: Online irrigation and nitrogen management decision support

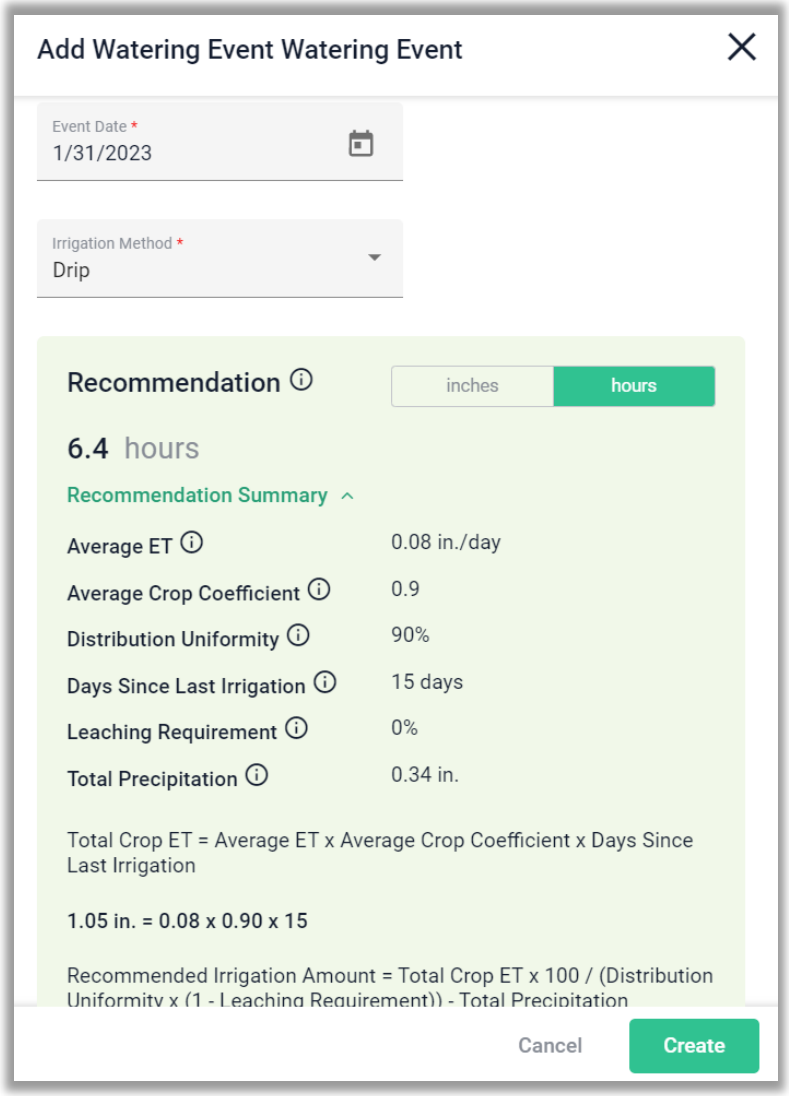




cropmanage.ucanr.edu

Using CropManage for Weather-based Irrigation Scheduling





When to irrigate?

Soil Moisture Sensors

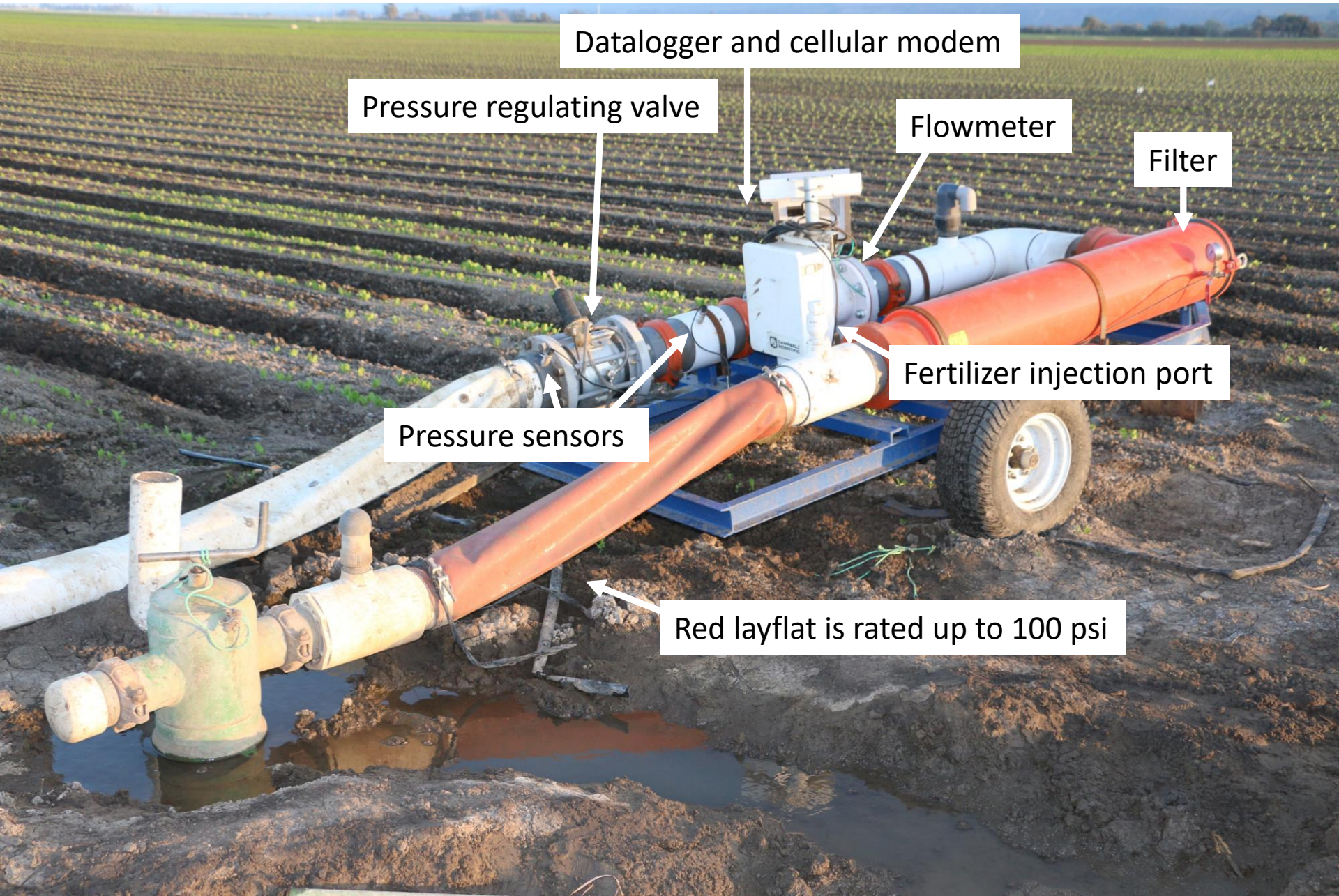
Tension

Volumetric


1"CS 1/2" SCH


600PSI @73F

An integrated, portable filter station for drip



Summary

- Achieving a high irrigation efficiency can maximize yield and quality as well as save water, fertilizer, and money.
- Design, operation and maintenance, and scheduling all affect irrigation efficiency.
- Pressure management is key to achieving high application uniformity in drip
- Tools such as flowmeters, soil moisture sensors, ET data, and calibrated pressure gauges can help you assess if you are applying water uniformly and matching irrigation applications with crop water needs.

Need Help?

- ✓ UC Cooperative Extension
- ✓ Resource Conservation District Santa Cruz County
- ✓ Resource Conservation District Monterey County

- **Irrigation system evaluations**
- **Design advice**
- **Assistance with irrigation scheduling**
- **Grant and cost share programs (SWEEP)**
- **CropManage assistance**

How to learn more:

- CropManage Workshop, Santa Clara 3/29/23