

Evaluating Irrigation System Efficiency on the Central Coast



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Run-off



**Deep
Percolation**



Tile Drainage

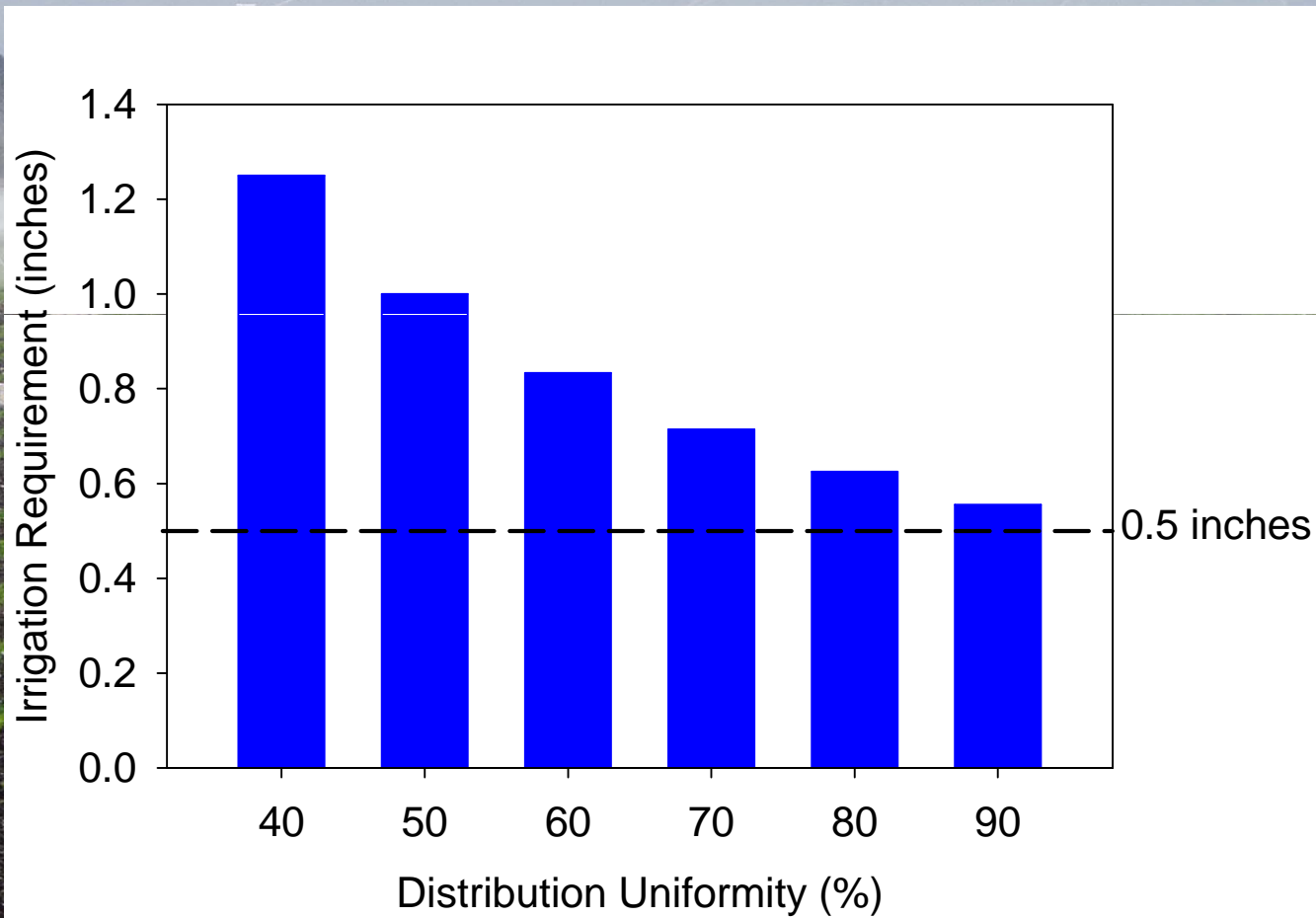
Coastal crops: berries and vegetables



Moderate soil moisture deficits can cause yield loss



Can we irrigate more efficiently?



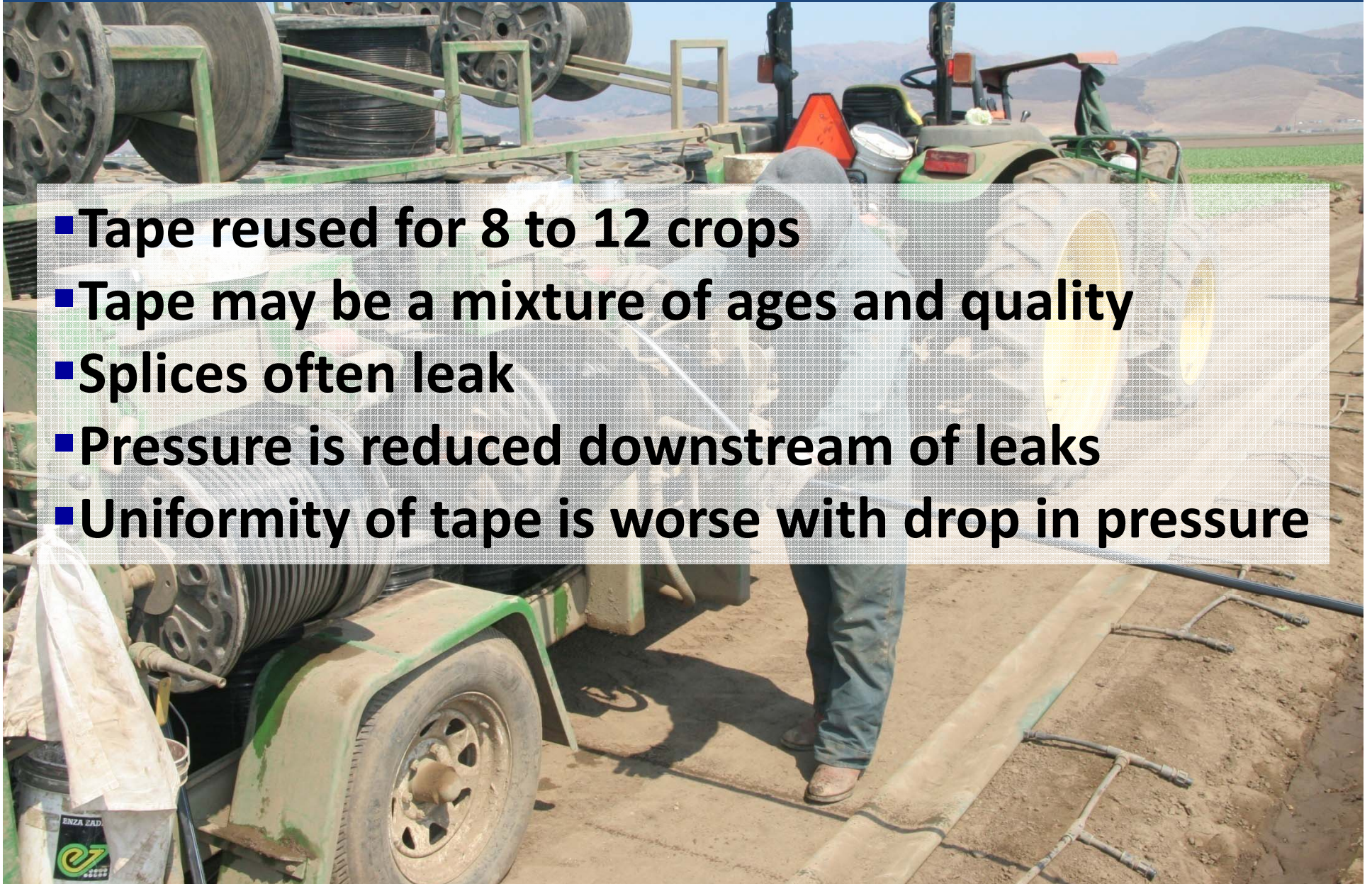
Is drip more efficient?

- reduces evaporative losses and run-off
- improves irrigation uniformity
- improves timing of fertilizer applications

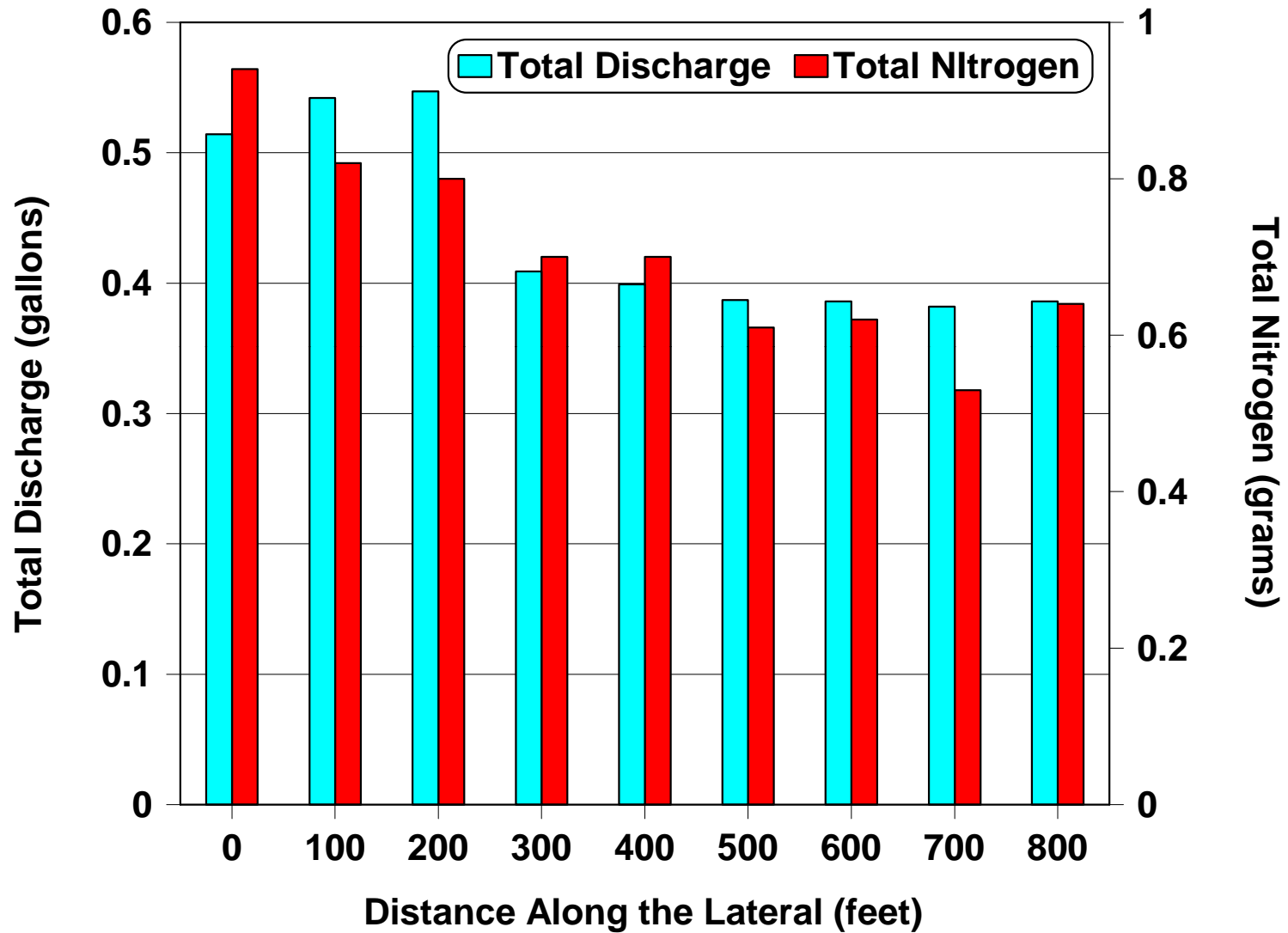


Retrieve and Reuse

- Tape reused for 8 to 12 crops
- Tape may be a mixture of ages and quality
- Splices often leak
- Pressure is reduced downstream of leaks
- Uniformity of tape is worse with drop in pressure



Effect of non-uniformity on fertigation



B. Hanson 1998

Central Coast Irrigation Efficiency Program Goals:

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

- **Help growers solve irrigation challenges**
- **Build local expertise in irrigation and nutrient management**
- **Address regional agriculture and economic challenges**
- **Connect growers to a network of agency resources**

Ingredients for a self-sustaining irrigation efficiency program on the Central Coast:

- **Technical capacity**
- **High quality of services**
- **Regional coordination**
- **Funding**

Irrigation Efficiency Projects

- 2009-11 Pilot program in Santa Clara County
- 2012 Central Coast Ag Water Coalition and RCD of Monterey County
- 2012-13 CA Leafy Greens Fertigation Evaluations
- 2013 Strawberry Commission + ?

Components of the Irrigation Efficiency Program in Santa Clara County

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

Standard Operating Procedures

- Subsurface drip, surface drip, overhead sprinklers, wheel line sprinklers, linear-move lines, micro sprinklers
- Turf, cool season vegetables, warm season vegetables (tomatoes, peppers, squash), Trees (cherries), wine grapes, flowers (greenhouse), Asian vegetables (greenhouse)

Regional coordination of irrigation efficiency programs on the Central Coast

Outcomes:

- standardize when possible
- share expertise
- exchange tools
- seek regional funding

Reporting the data

2010 Santa Clara Irrigation Efficiency Project - ~~Water~~

Irrigation Efficiency Report



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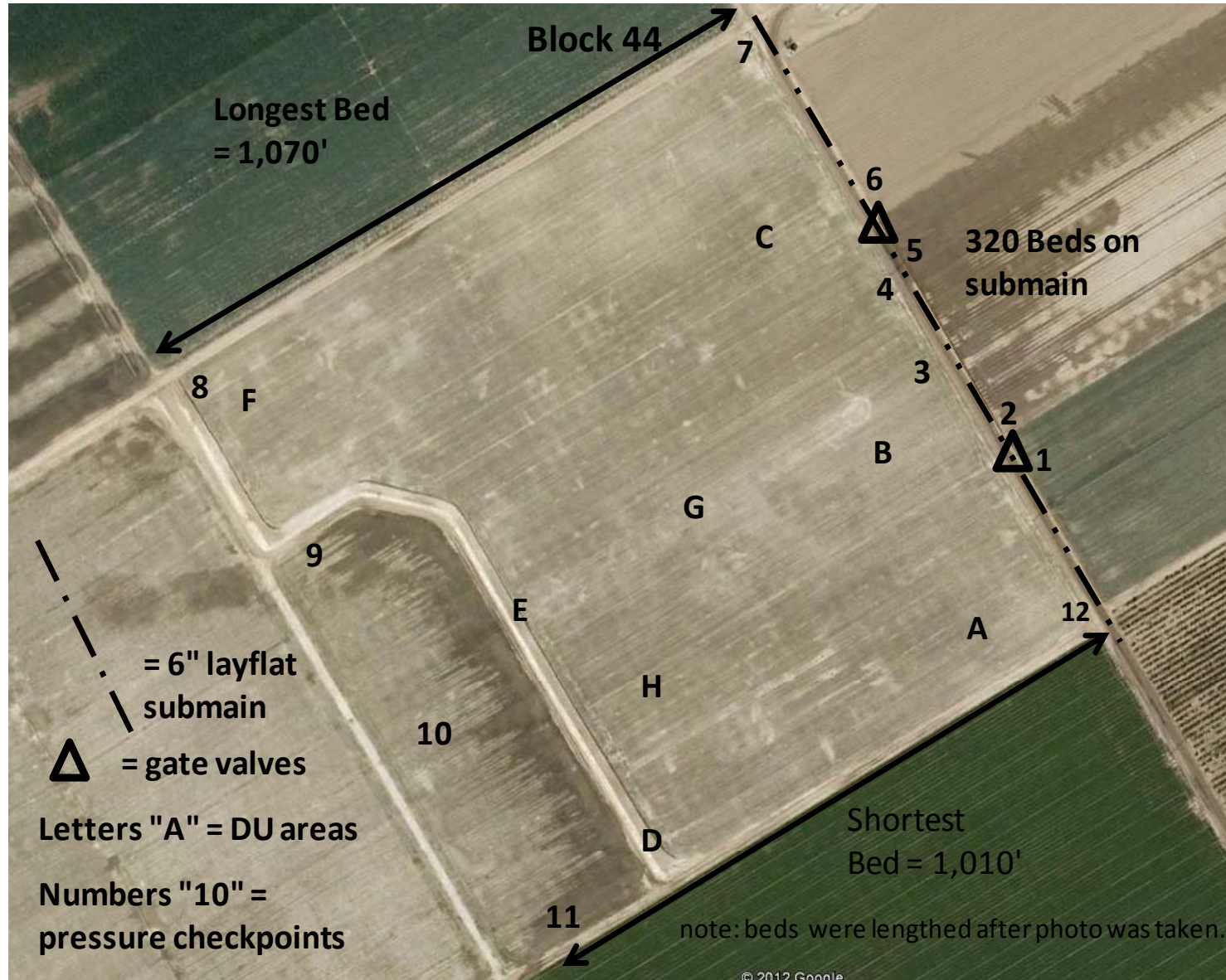
One of the 2010 Santa Clara Irrigation Efficiency Project's cooperative efforts between the Santa Clara County, Fresno, San Joaquin, Contra Costa, Santa Barbara, and Stanislaus Counties Resource Conservation Districts and the Central Valley Agricultural Water Quality Coalition. Made possible by funding from the Santa Clara Valley Water District.



- Useful to the grower
- Useful to an irrigation designer



Evaluation of Distribution Uniformity

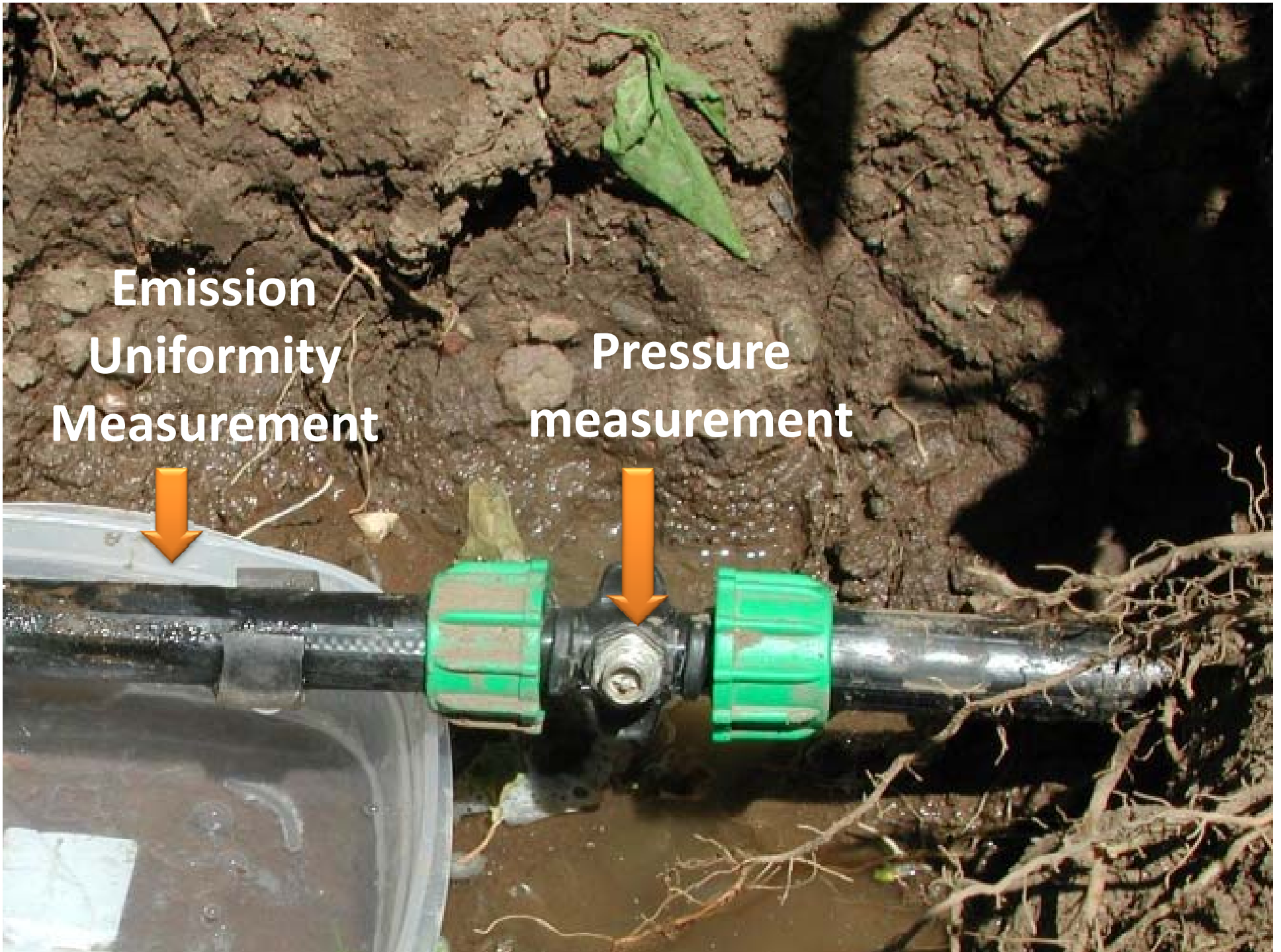


Follow the water from the source to the furthest point of the irrigation system

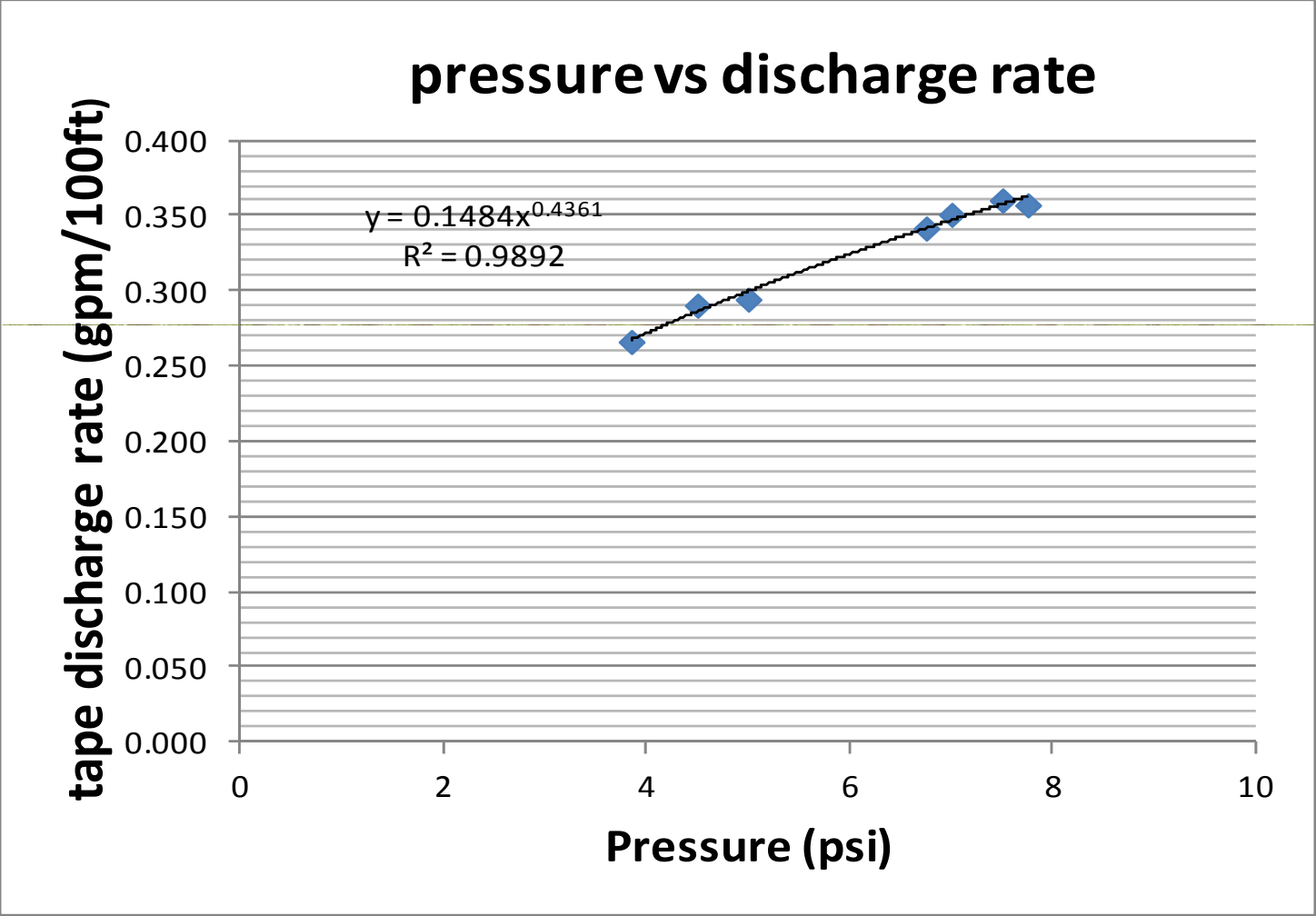


Emission
Uniformity
Measurement

Pressure
measurement



Variation in Pressure Reduces Drip Uniformity



Irrigation System Uniformity (2006 -2013)

Summary of irrigation evaluations from 2006 to 2013 by method

Irrigation method	Number of fields	Distribution Uniformity		
		Average	Mininum	Maximum
----- % DU_{Iq} -----				
drip	65	81	23	96
sprinkler	10	66	50	86
micro-sprinkler	3	79	75	81

Irrigation System Uniformity (2006 -2012)



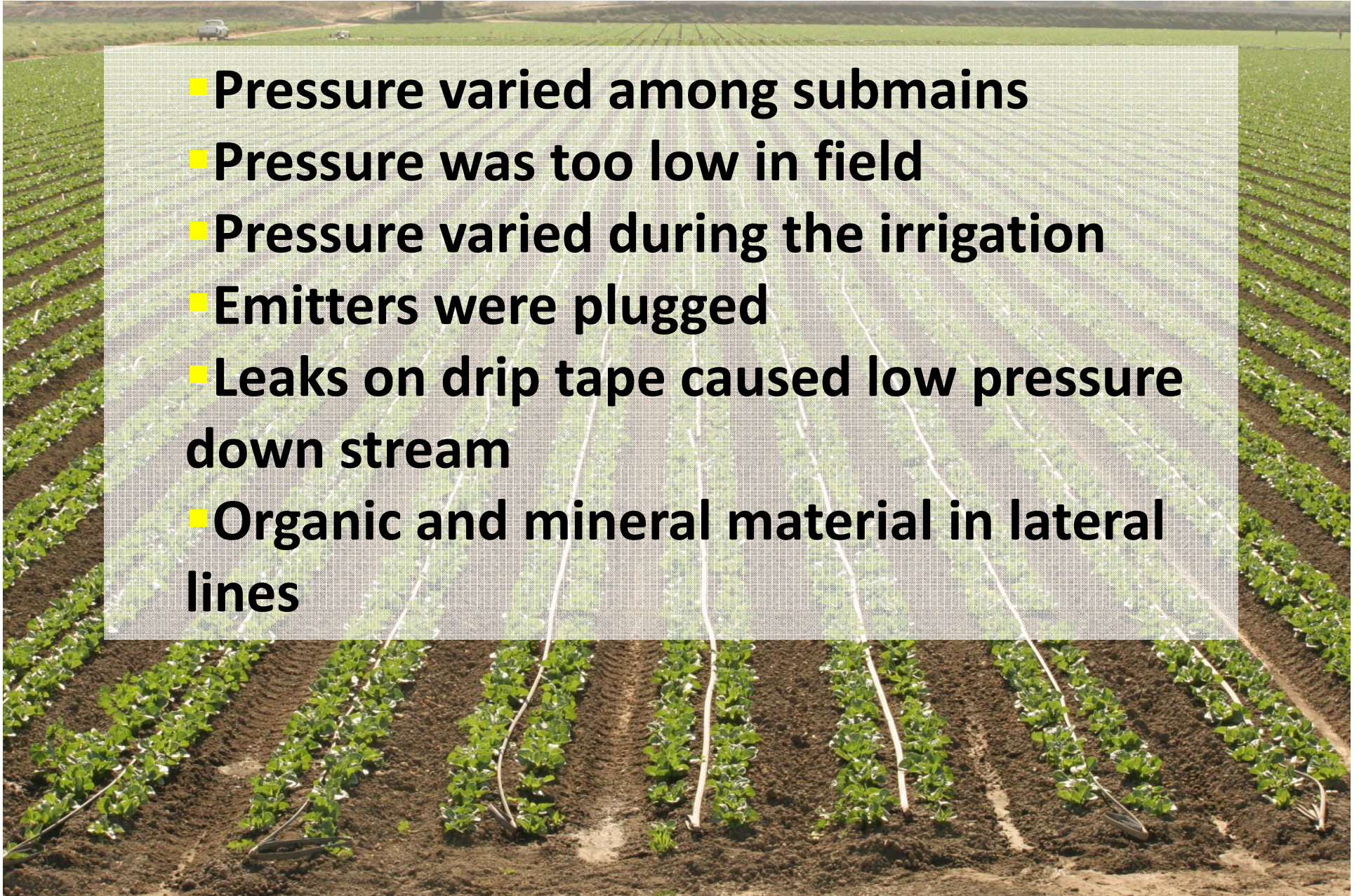
Summary of irrigation evaluations from 2006 to 2013 by crop

Irrigation method	Number of fields	Distribution Uniformity		
		Average	Minimum	Maximum
		----- % DU_{Iq} -----		
Vegetables	29	78	46	96
Strawberries & Caneberries	17	77	23	93
Orchards & Vineyards	26	87	74	95
Greenhouses	6	68	50	92
Turf Grass	3	67	58	74



Major findings for drip evaluations:

- Pressure varied among submains
- Pressure was too low in field
- Pressure varied during the irrigation
- Emitters were plugged
- Leaks on drip tape caused low pressure down stream
- Organic and mineral material in lateral lines



Common recommendations for drip systems

- Install pressure reducing valves to maintain constant pressure
- Fix leaks or replace drip tape
- Regularly flush drip lines
- Shorten bed length or use larger diameter tape

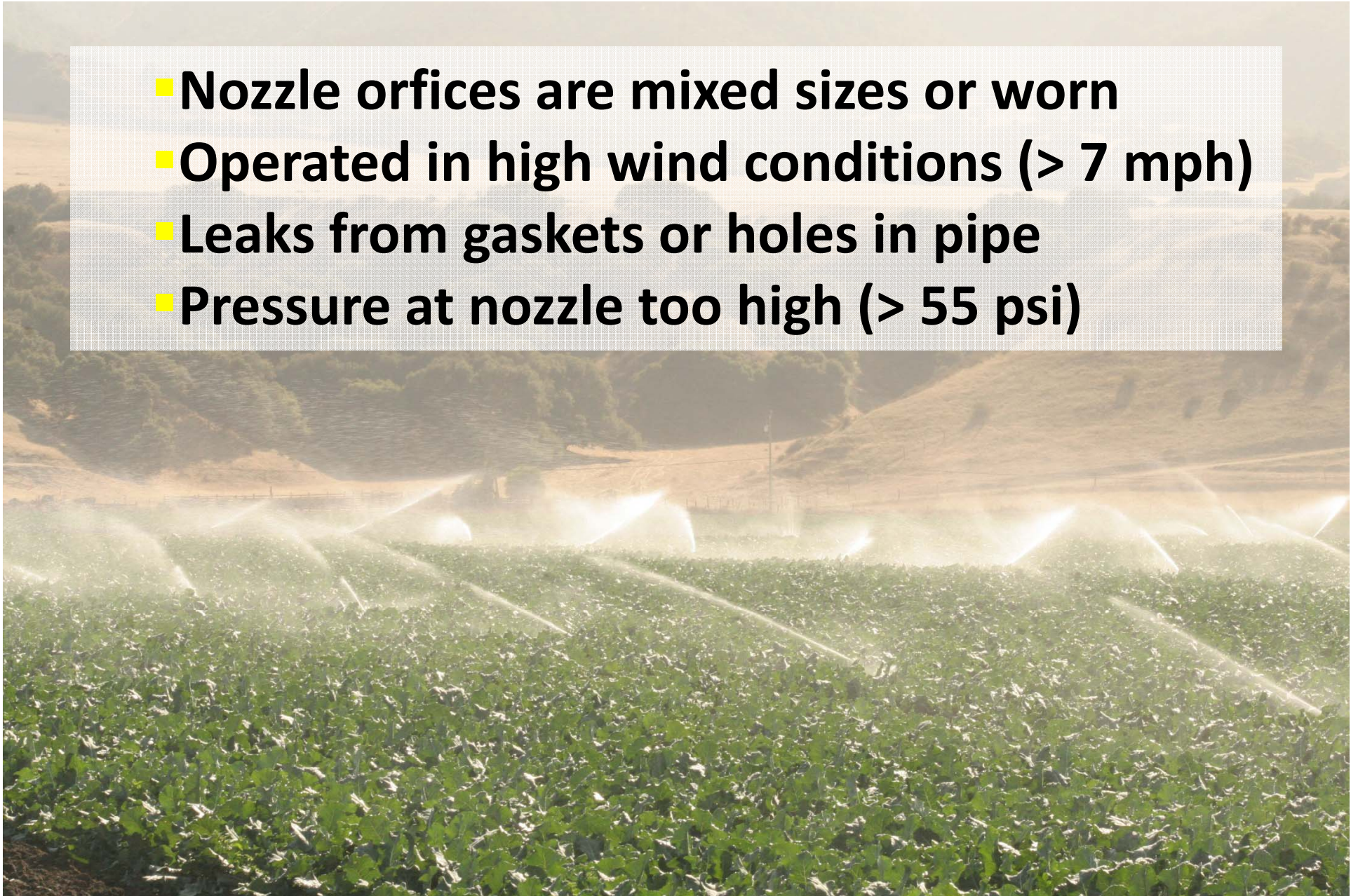


Regulate Pressure of Blocks



Major findings for sprinkler evaluations:

- Nozzle orifices are mixed sizes or worn
- Operated in high wind conditions (> 7 mph)
- Leaks from gaskets or holes in pipe
- Pressure at nozzle too high (> 55 psi)



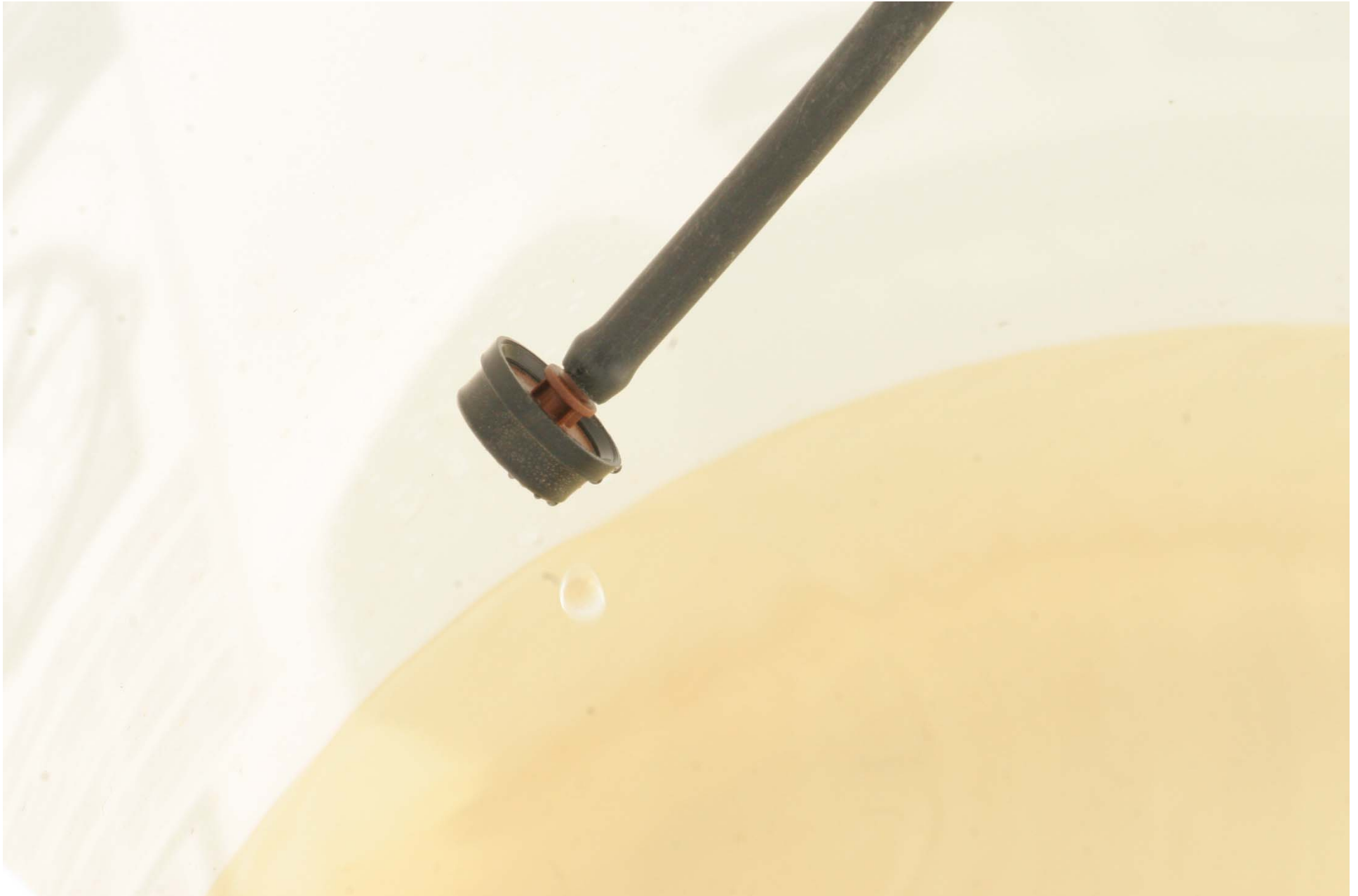
How uniform are fertigations?



Collect Irrigation water at 24 locations



Used $\frac{1}{4}$ gal per hour emitters



Pressure and emission rate of tape were monitored in each location



Summary of 6 fertigation evaluations

field#	irrigation	fertilizer	pressure	%	average
	DU	DU	DU	plugged emitters	pressure
	----- % -----				psi
1	58	54	82	6	7.2
2	75	82	87	4	4.3
3	81	73	62	1	8.3
4	80	75	89	2	13.8
5	83	74	91	3	10.8
6	46	52	79	21	4.6
average	70	68	82	6	8.2

Summary

- **Addressing water quality regulations will require improving irrigation management**
- **Increasing technical capacity to provide high quality irrigation system evaluations should be a priority on the central coast**
- **Opportunities to conduct irrigation system evaluations at a subsidized rate until the end of March**