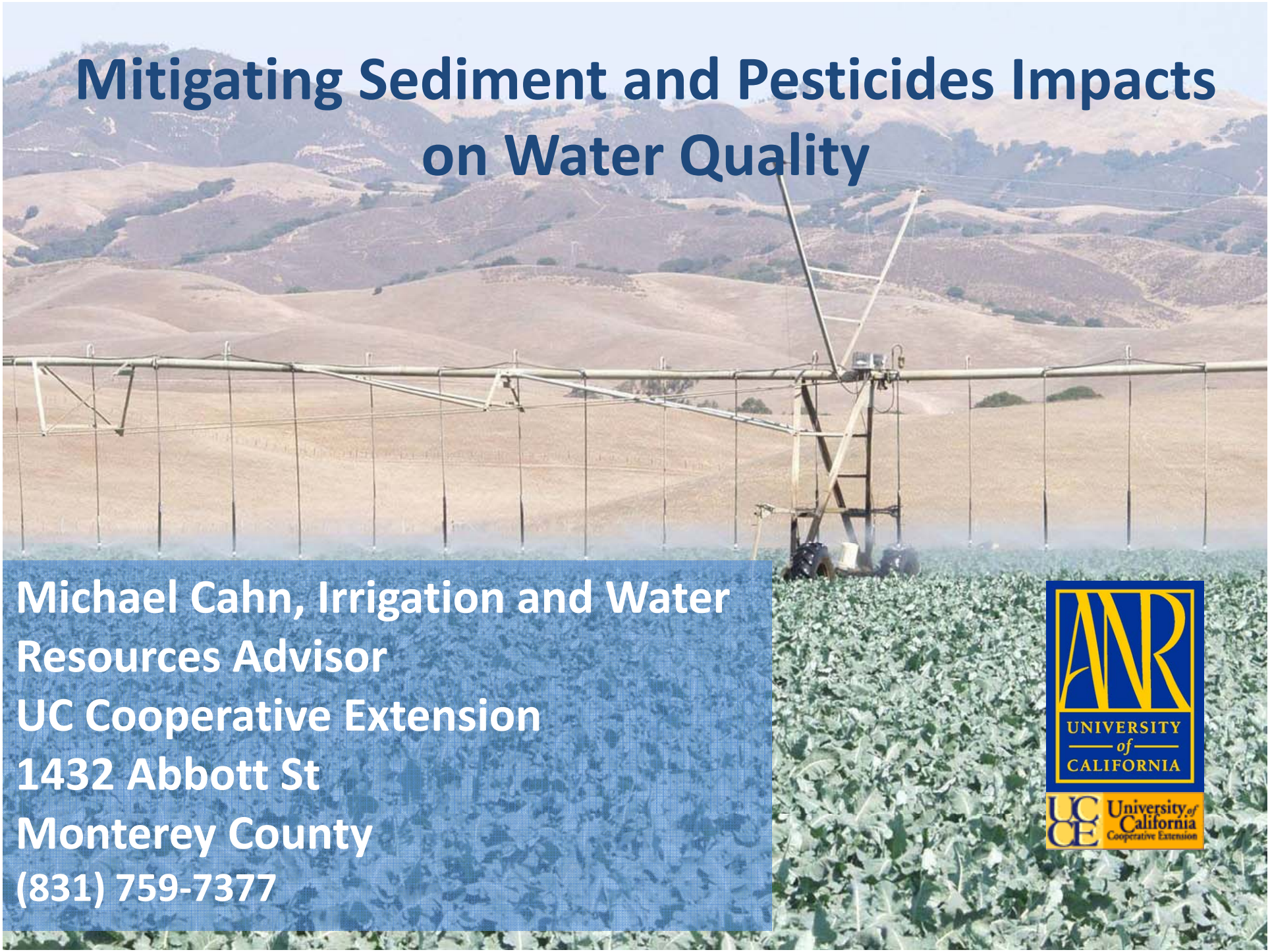
Mitigating Sediment and Pesticides Impacts on Water Quality



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Regulatory Process

State Porter Cologne Water Quality Control Act:

- Discharge Permit
- Agricultural Discharge Waiver (Agricultural Order)

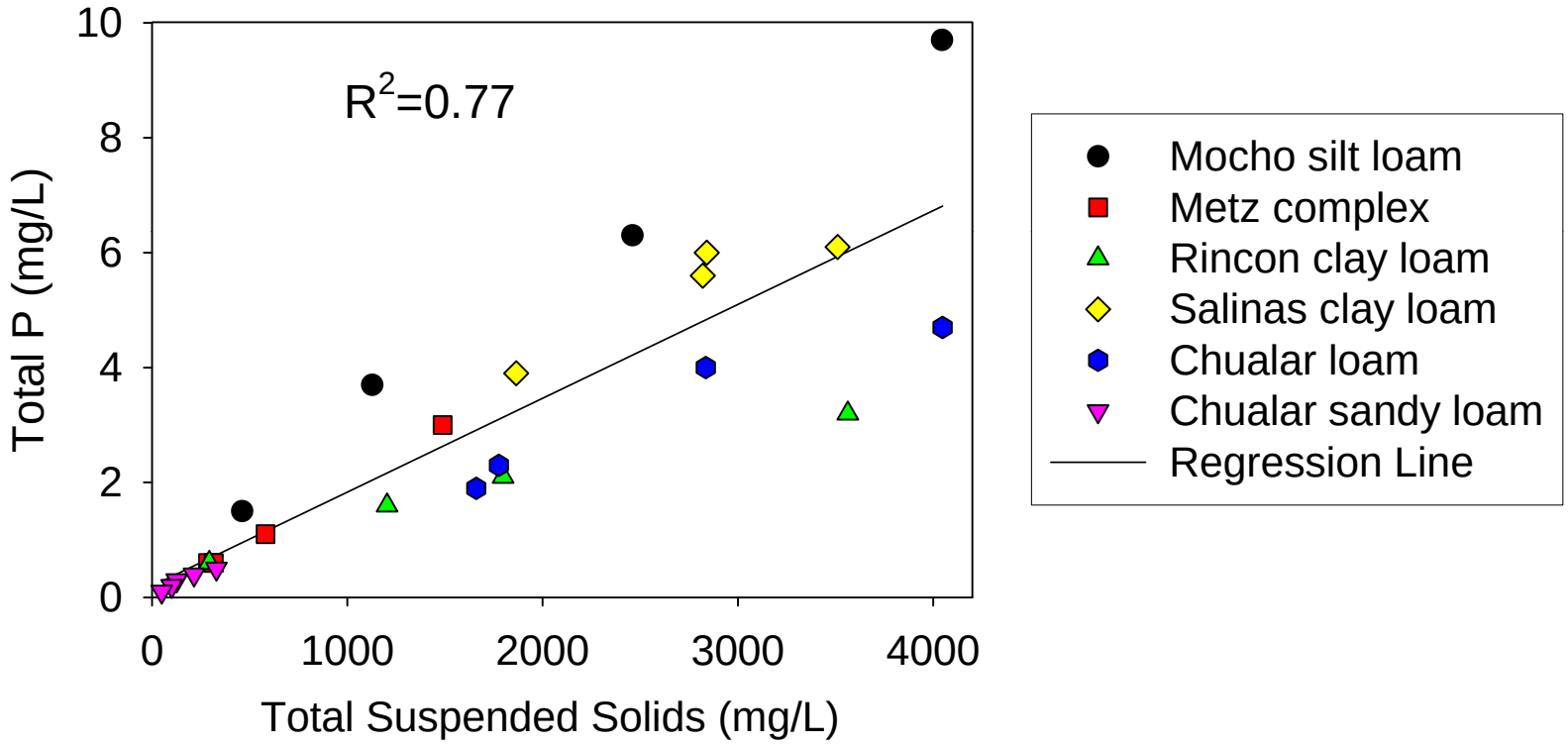
Federal Clean Water Act:

- 303d list of impaired water bodies
- Total Maximum Daily Load

Sediment and Turbidity impairments (2010 303d TMDL list)

- Sediment: Elkhorn slough, Pajaro River watershed.
- Turbidity: Chualar creek, Gabilan Creek, Quail creek, Reclamation canal, Old Salinas river, Lower and upper Salinas River, Tembladero slough

Total P concentration in Run-off is linked to the Sediment concentration



Pyrethroid Pesticides

- Cause of sediment toxicity in the Lower Salinas Watershed
- Label Re-evaluation
- Vegetative Buffer requirement (10 ft) between field and aquatic habitat

Chlorpyrifos and Diazinon

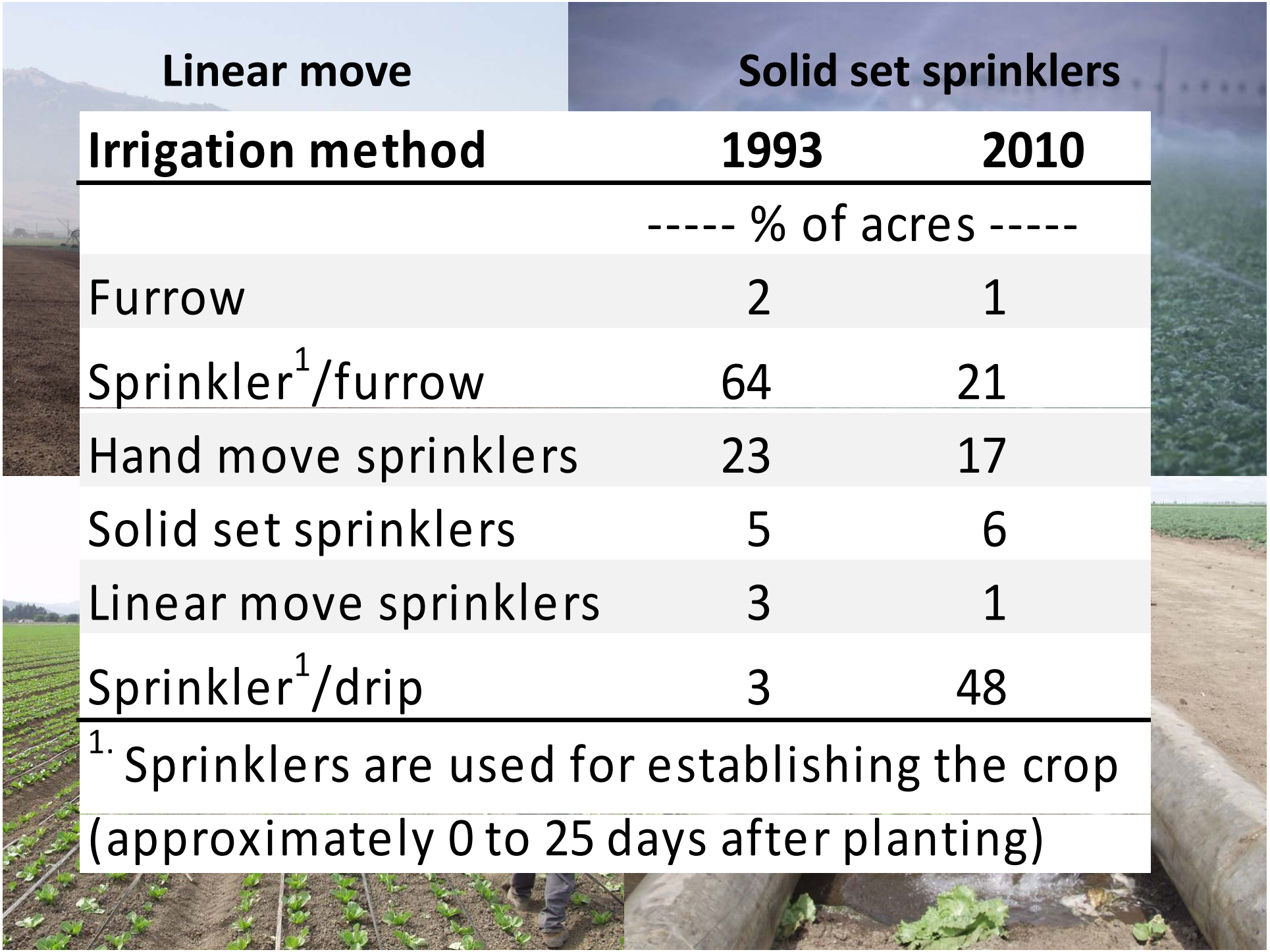
Water quality TMDL proposed for Lower Salinas watershed (chlorpyrifos, diazinon), January 2010

Proposed water quality targets:

- Chlorpyrifos:
  - Acute toxicity, 25 ppt (ng/L)
  - Chronic toxicity 15 ppt (ng/L)
- Diazinon:
  - Acute toxicity, 160 ppt (ng/L)
  - Chronic toxicity 100 ppt (ng/L)

Strategies for mitigating sediment and pesticides

- Minimize run-off and load
- Retain and treat/dispose run-off



Irrigation method	1993	2010
	----- % of acres -----	
Furrow	2	1
Sprinkler[1]/furrow	64	21
Hand move sprinklers	23	17
Solid set sprinklers	5	6
Linear move sprinklers	3	1
Sprinkler[1]/drip	3	48

[1.] Sprinklers are used for establishing the crop (approximately 0 to 25 days after planting)

Drip on cole crops

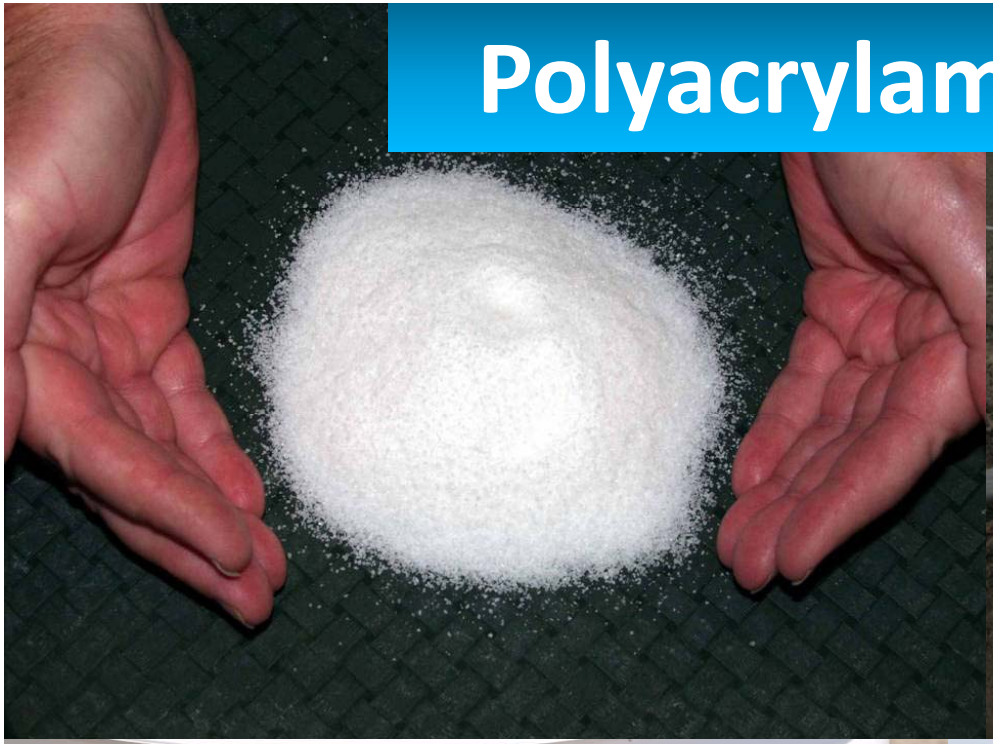
Stand Establishment of Vegetables

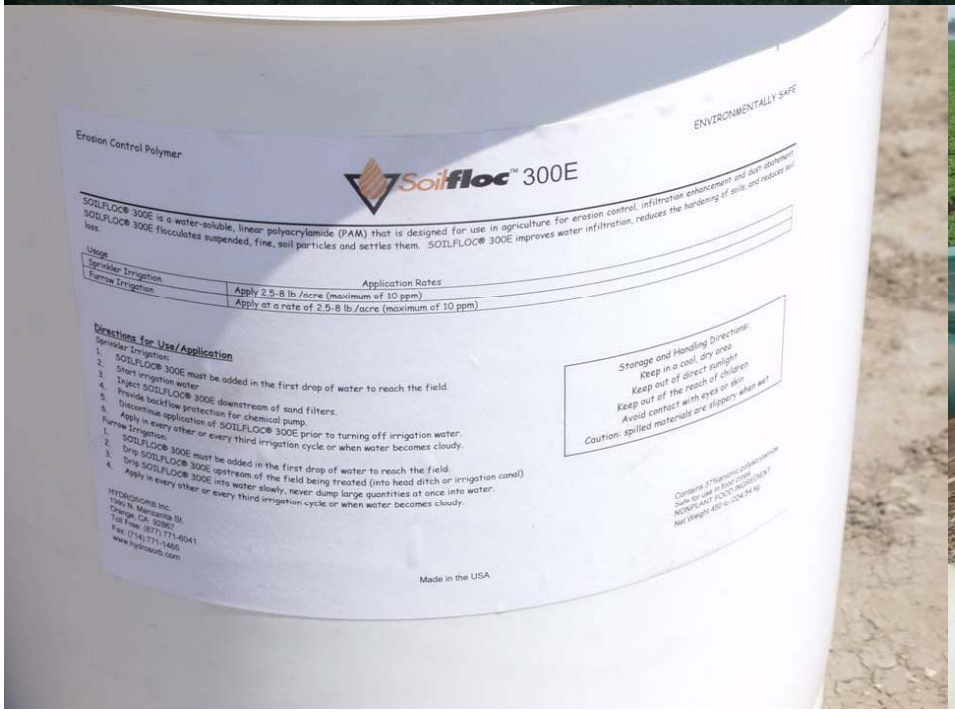
Drip Establishment of Vegetable Crops

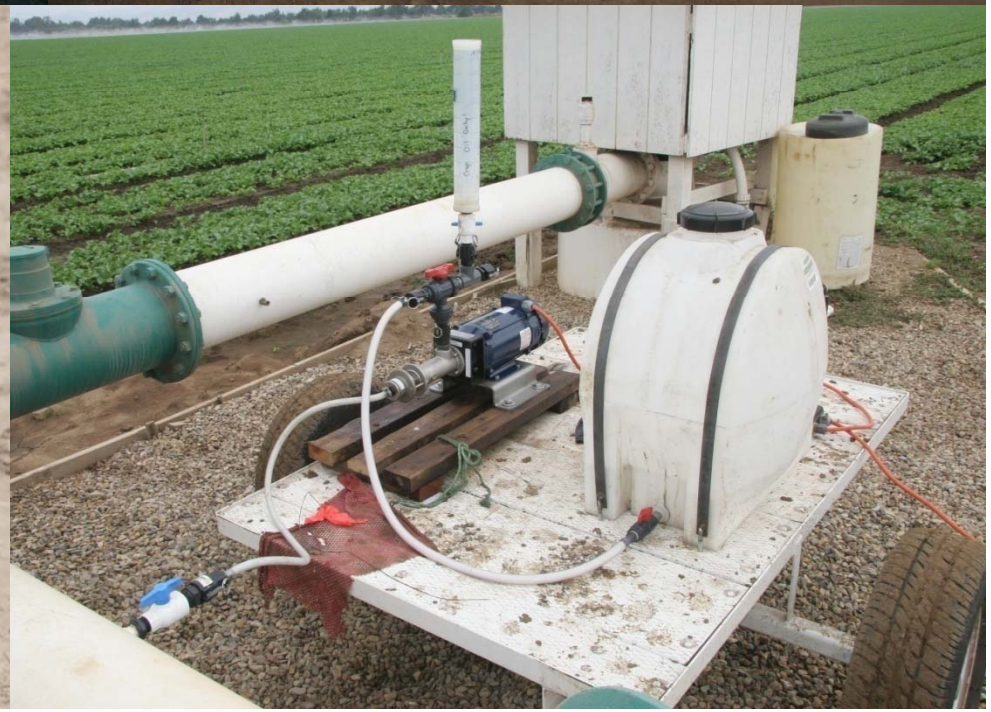
- Eliminate sprinklers
- Elimates run-off
- Reduces costs
- Success depends on soil type and placement of tape

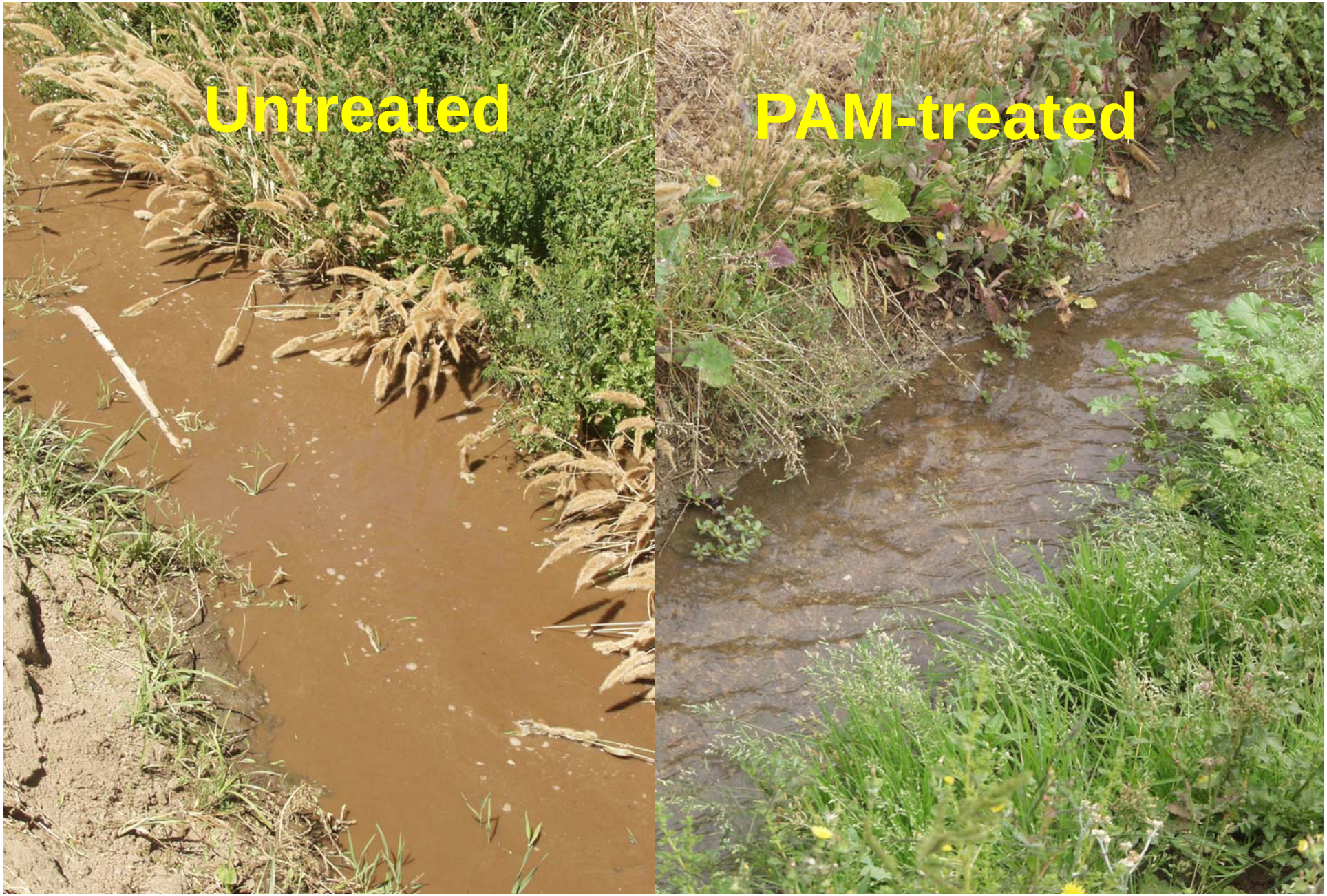
Drip is not compatible with some leafy green crops

Polyacrylamide (PAM)








Untreated
PAM-treated

Evaluation of Management Practices for reducing impacts of Pyrethroid Pesticides on Water Quality

- Don Weston, UC Berkeley
- UC Farm Advisors and Specialists
- 3 locations (UC Davis, Salinas, Chico)


Non-Vegetated Ditch
(Control)

Vegetated Ditch

Sediment Trap

PAM

Control

Mitigation practices for control of pyrethroids: Results

Sediment traps did not reduce pyrethroid or sediment concentration in the run-off

PAM reduced pyrethroid concentration in run-off by 80 to >95%

Vegetated ditches reduced pyrethroid concentrations the most at sites with low concentration of sediments in run-off

Reduction in pyrethroid concentration in run-off

Location	bare ditch	sediment trap	vegetated ditch	PAM
	-- % reduction in pyrethroid concentration ---			
Salinas	19	18	27	81
Davis	61	10	73	92
Chico	10	0	42	99
AVG	30	9	47	91

Salinas Trial:

Concentration of Nutrients and Sediments in Sprinkler Run-off

Treatment Description	Total N	NO3-N	Total P	Soluble P	Total Suspended Solids	Turbidity
	---------- ppm ----------					NTU
Untreated control	7.45	2.17	3.33	1.09	1540	4130
Sediment trap	6.15	2.42	3.03	1.18	1165	3447
Vegetated ditch	3.55	2.32	1.80	1.00	740	1689
PAM (7.5 ppm)	1.40	1.94	0.88	0.81	50	54
$LSD_{0.05}$	2.37	0.32	0.95	0.18	584	1418

Can PAM reduce Chlorpyrifos concentration in irrigation run-off?

Koc of select Pesticides

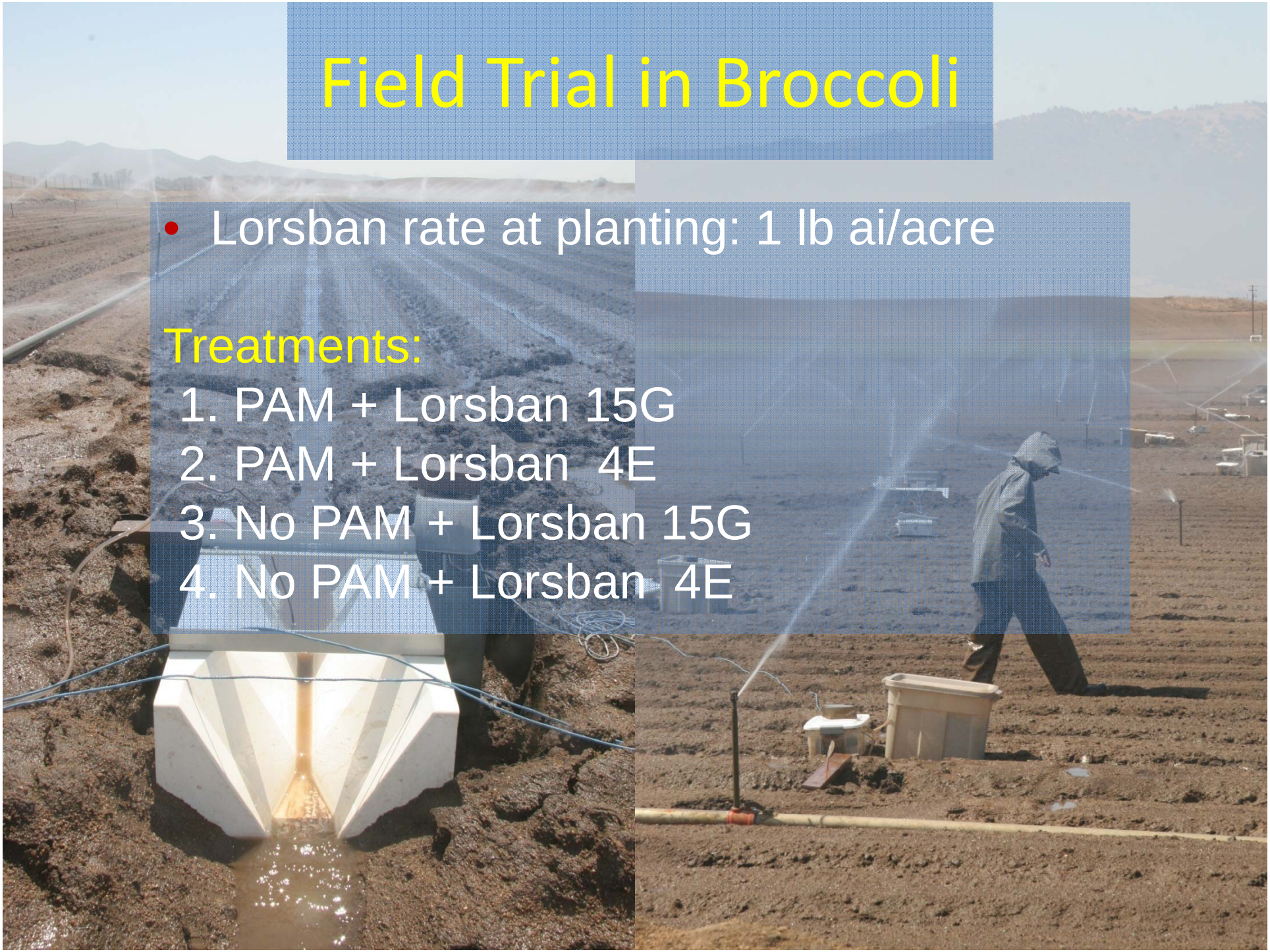
Diazinon	1000 ml/g
Chlorpyrifos	6070 ml/g
Permethrin	100,000 ml/g
Bifenthrin	240,000 ml/g
DDT	2,000,000 ml/g

Field Trial in Broccoli

- Lorsban rate at planting: 1 lb ai/acre

Treatments:

1. PAM + Lorsban 15G
2. PAM + Lorsban 4E
3. No PAM + Lorsban 15G
4. No PAM + Lorsban 4E



PAM effects on Chlorpyrifos Results

PAM did not reduce the concentration of chlorpyrifos in irrigation run-off.

PAM reduced run-off, thereby reducing the load of chlorpyrifos leaving the field.

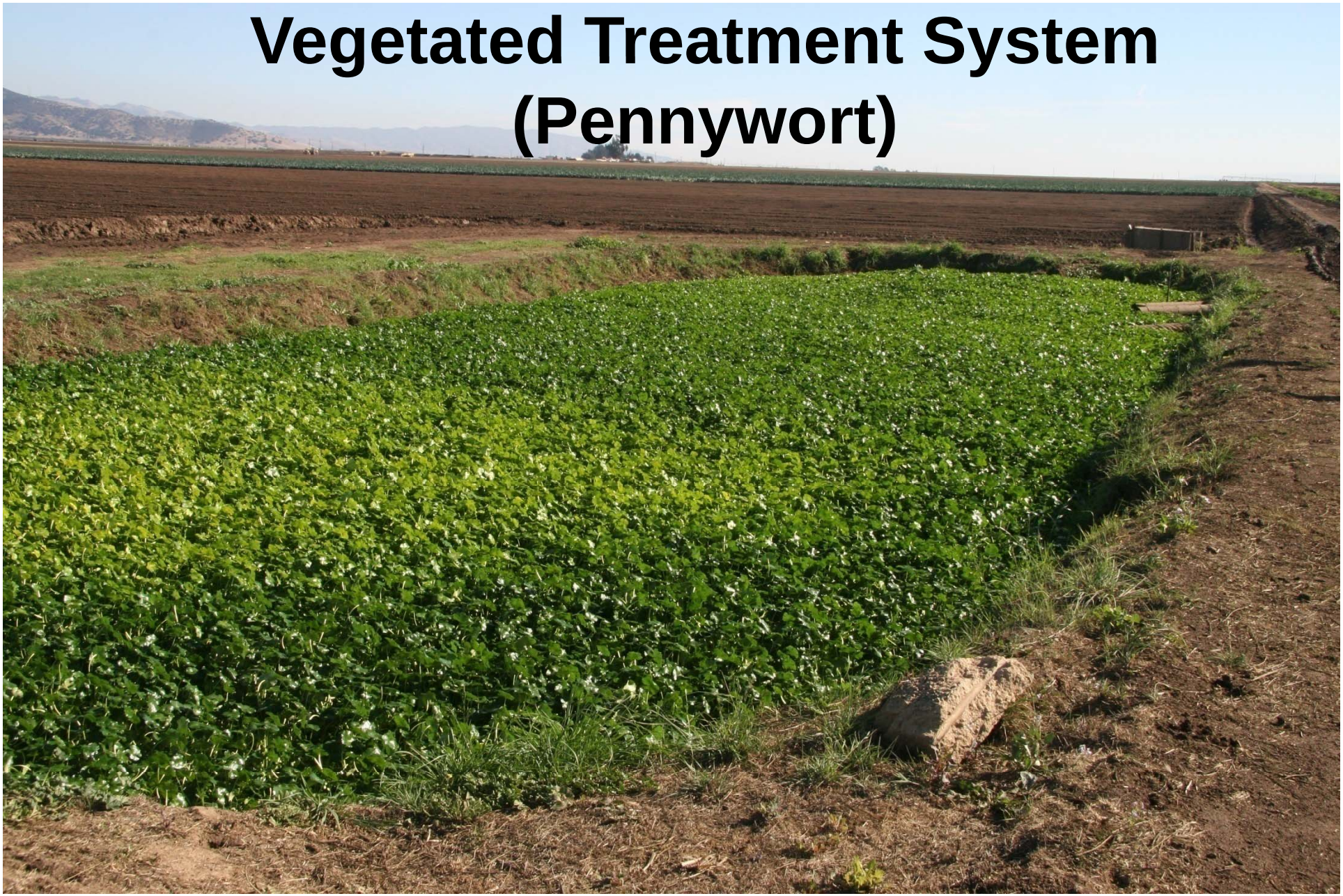
Lowest concentration of chlorpyrifos was measured in run-off from plots treated with the granular Lorsban formulation.

Other strategies for retaining and treating run-off

- Retention ponds
- Constructed wetlands, Vegetated treatment systems
- Apply captured run-off to non cropped areas of ranch
- Enzyme treatment of OP pesticides (Landguard)

Retention Pond

Vegetated Treatment System (Pennywort)




Vegetated Waterway

Landguard™ Enzyme

- Developed by CSIRO (Australian Government)
- Enzyme developed to degrade OP pesticides
- Originally used to breakdown Diazinon in sheep dip
- Used for winter dormant sprays
- Efficacy on central coast for diazinon and chlorpyrifos in irrigation run-off

Management strategies for sediment bound pesticides

- Minimize irrigation run-off
- Settle suspended sediments in retention ponds
- Use PAM to minimize suspended sediments
- Use vegetated ditches to remove suspended sediments

Management strategies for water soluble OP pesticides

- Minimize irrigation run-off
- apply tail water to non-cropped area
- Enzyme treatment (Landguard)