Using Vegetation and Polymers for Control of Nutrients, Sediments, and Bacteria in Irrigation Run-off

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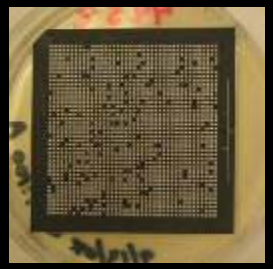
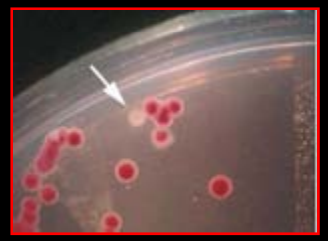
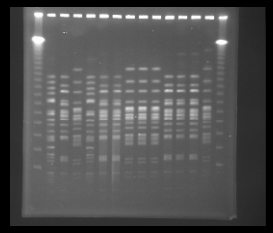
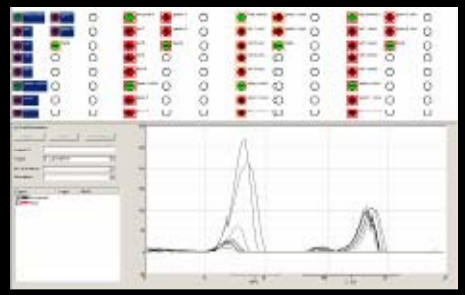






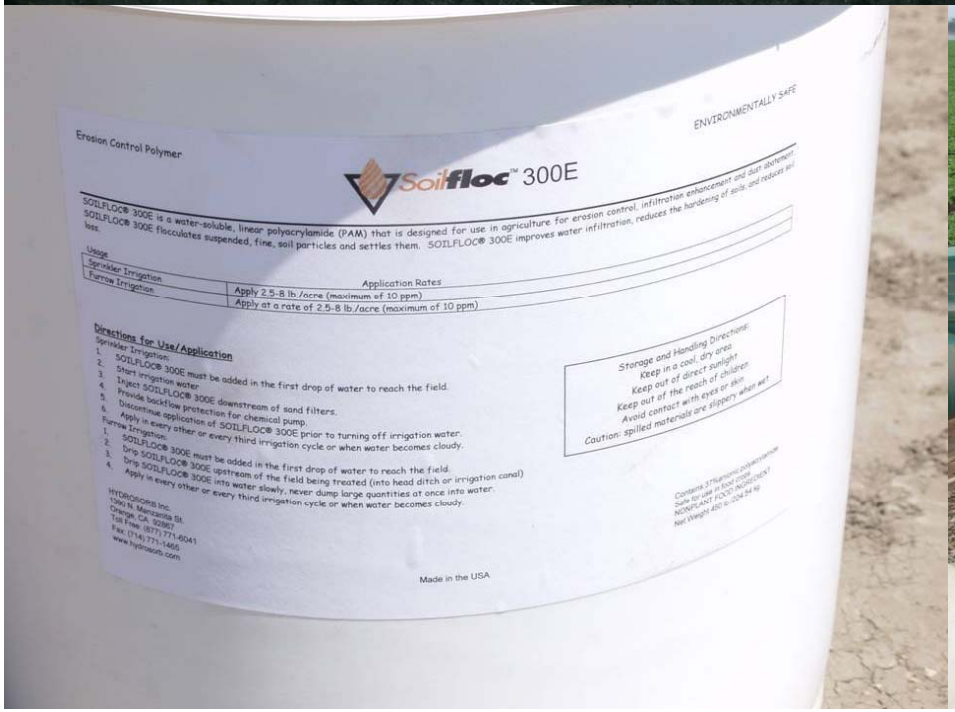


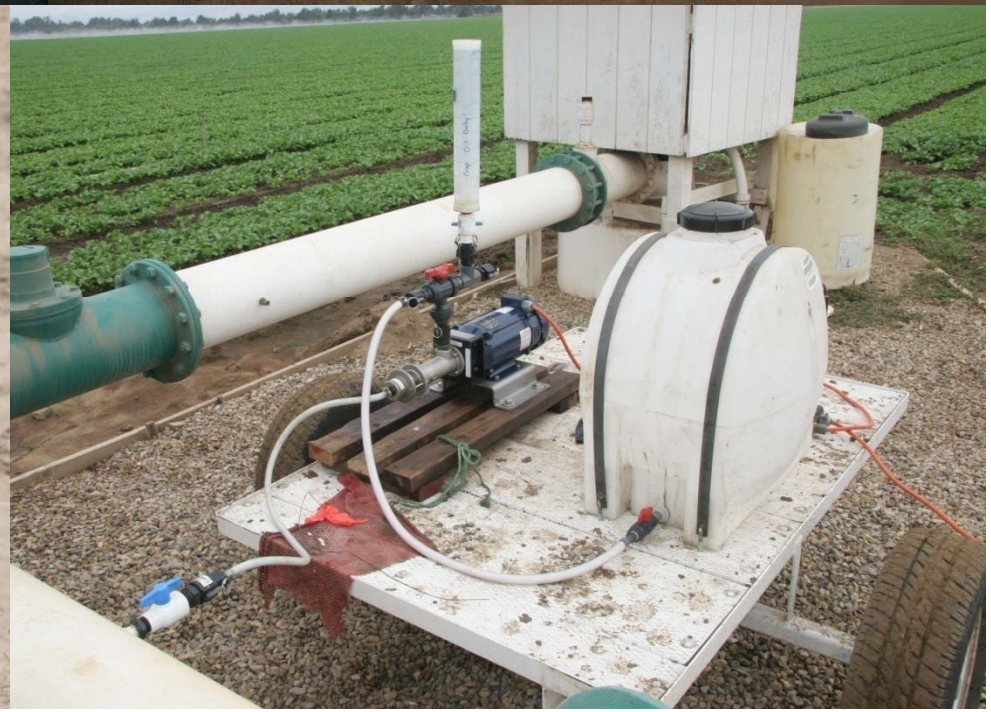
Objective

Evaluate effectiveness of vegetated ditches and polymers to reduce nutrients, sediments, and bacteria in irrigation run-off

Vegetated Waterways

Polyacrylamide (PAM)





Procedures

- USDA Spence Research Farm
- Chualar sandy loam
- Crop = head lettuce (variety sniper)
- 4 plots of 0.9 acres
- Irrigated with overhead solid-set sprinklers (1.25-1.5 inches per irrigation)
- Run-off averaged 50 gal/min

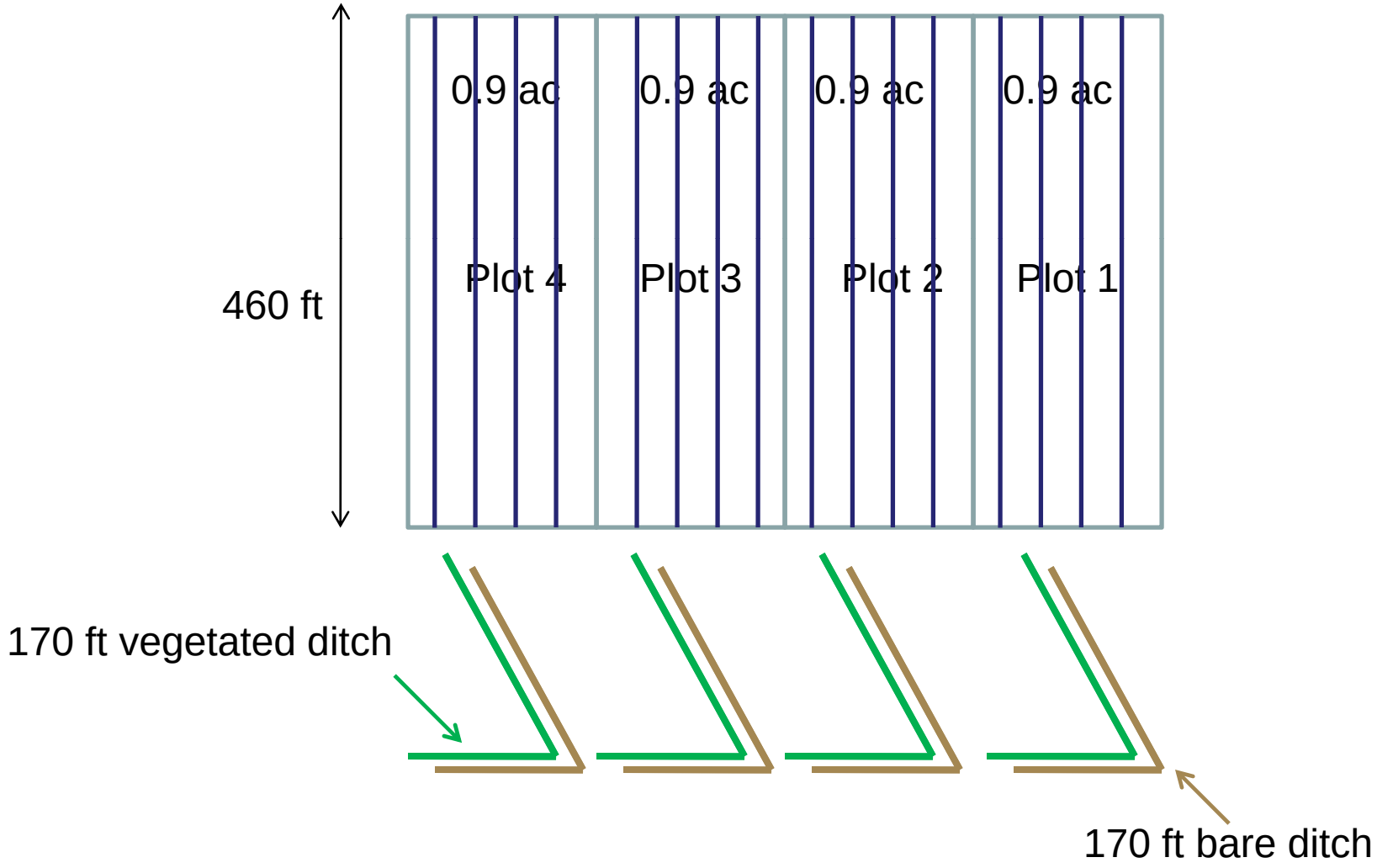
- Vegetated ditches planted Aug 3, 2007
- First germination water: Oct 9
- Thinned: Oct 26
- Sidedressed and cultivated Oct 29
- First trial irrigation: Oct 31

Latin Square Cross-over Design

E. Coli Inoculum

- Mixture of 3 generic E. coli^{rif}
- Salinas isolates
- Distinct DNA fingerprint
- Sand-based carrier
- Inoculum conc = 10^{10} cfu/ml (2007) 10^{8} cfu/ml (2008)
- 150 g per tea bag, 1 bag per furrow x 20 furrows per plot
- Bags remove after 1st irrigation

Field Plot Layout



Vegetated Ditch
Creeping Wild Rye and Red Fescue

Aug 2007 **Sept 2007** **Sept 2008**

Bacteriological Analysis

Samples

- **1L** Control furrows before treatment
- **1L** from PRE and POST Autosampler

Recovery

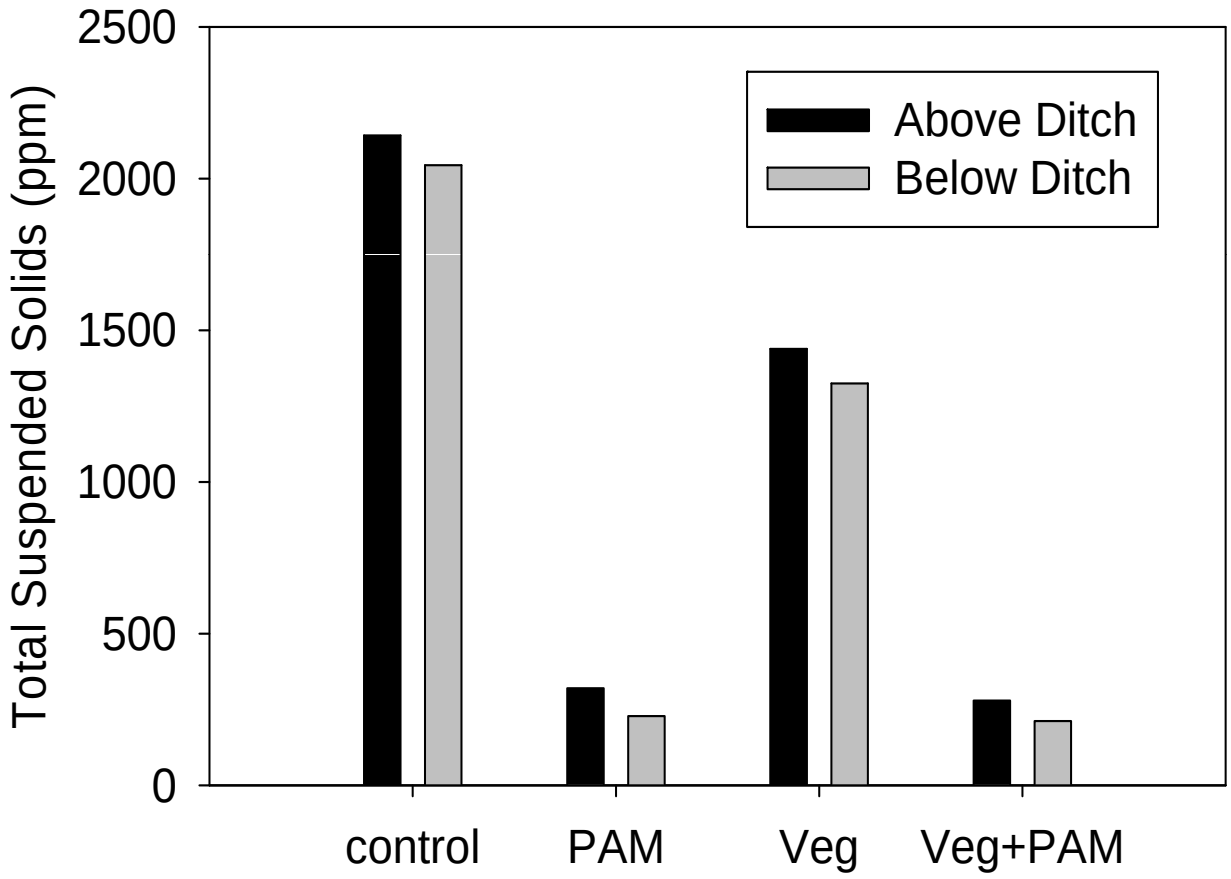
- Background (*E.coli* and Coliforms)
  - Quanti-tray (MPN/100 ml)
- E. coli rif
  - NeoGrid Membrane filtration
  - ECC+*rif*
  - MPN/10 ml

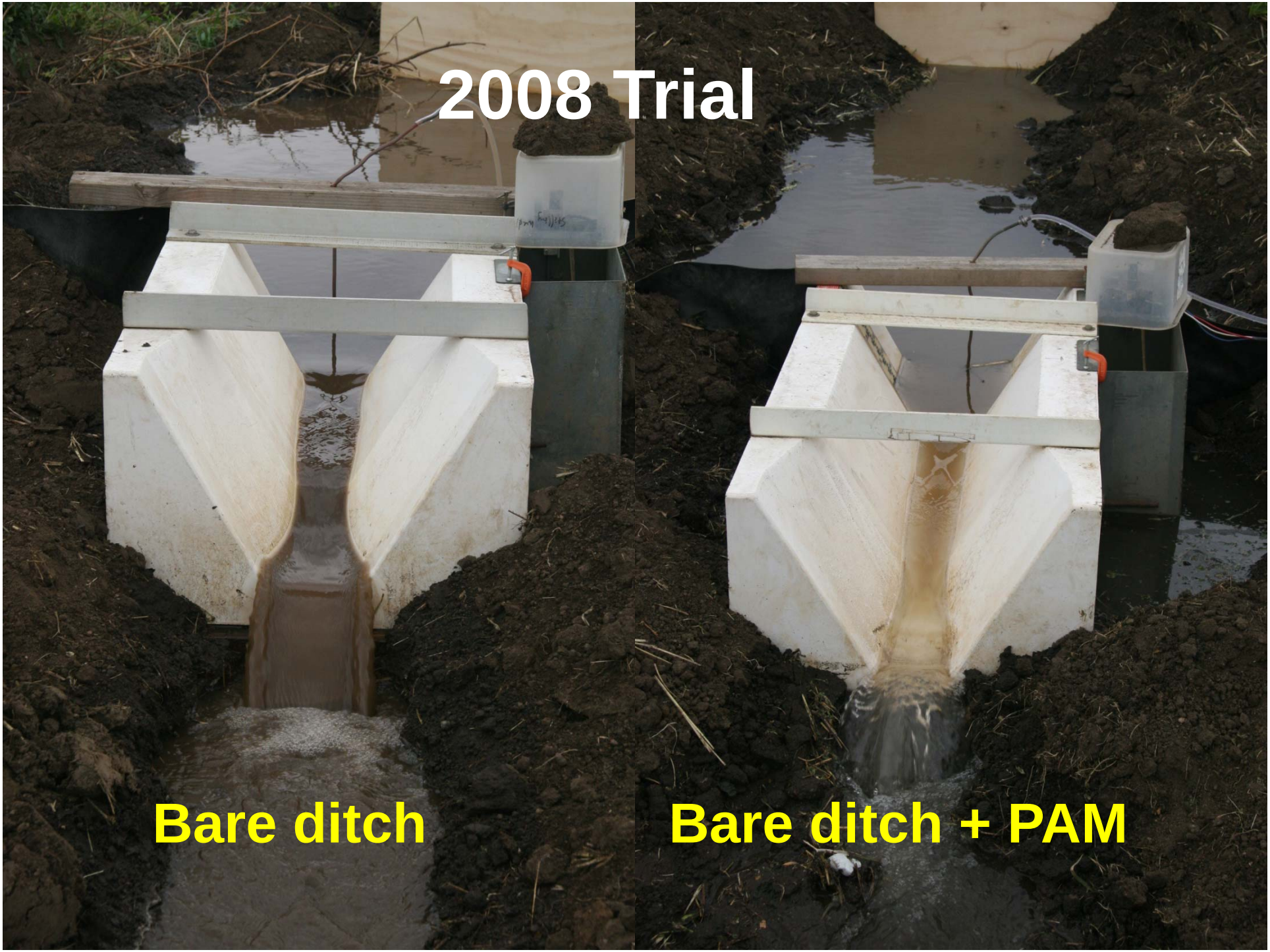

2007 Trial
Bare ditch


2007 Trial
Bare ditch
Bare ditch + PAM


2007 Trial
Vegetated ditch
Entrance
Exit

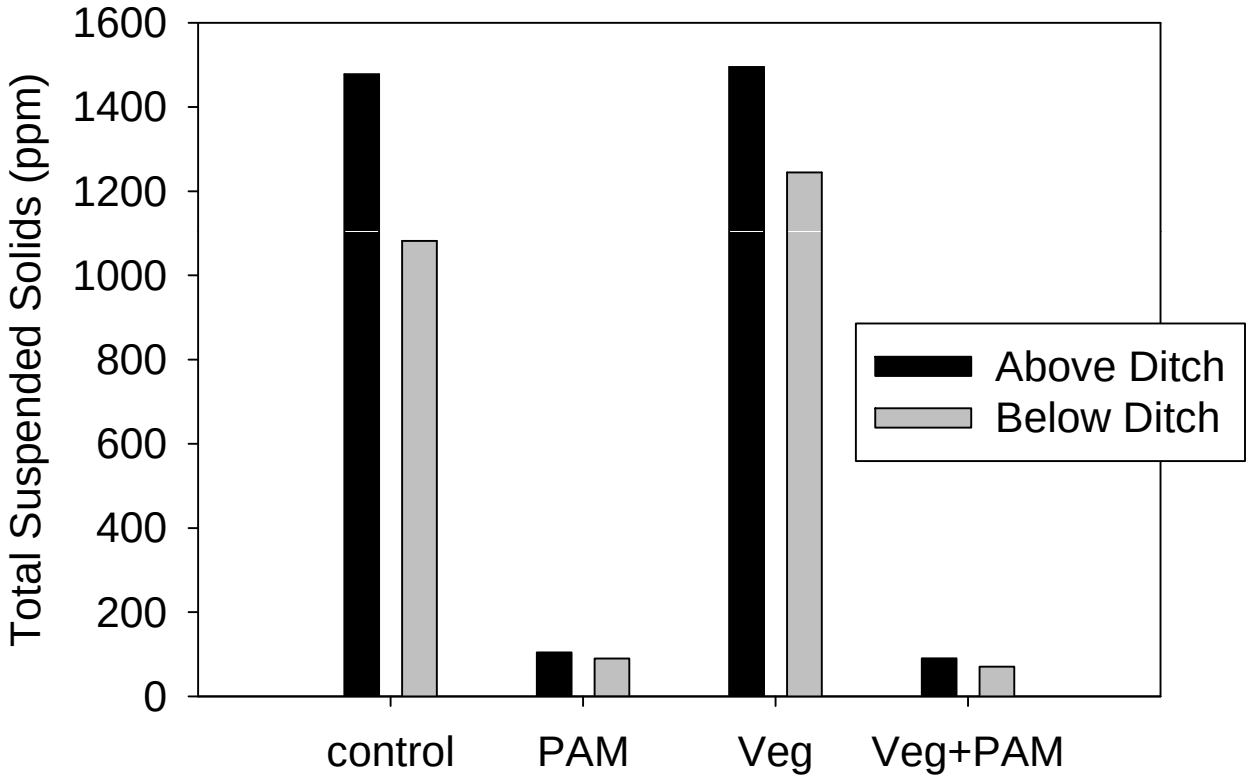
Suspended Sediment Conc. Above and Below Management Practice (2007)




2008 Trial
Bare ditch
Bare ditch + PAM

2008 Trials

Suspended Sediment Conc. Above and Below Management Practice (2008)



Treatment Effects on Suspended Solids and Turbidity (2008)

Treatment	Total Suspended Solids		Turbidity	
	ppm		NTU	
untreated control (bare ditch)	1082	a	950	a
PAM 5 ppm (bare ditch)	90	b	104	b
vegetated ditch	1244	a	1022	a
vegetated ditch + 5 ppm PAM	71	b	84	b

93%- 90% reduction

Treatment Effects on Total Nitrogen and Phosphorus 2008

Treatment	Total Kjeldahl N		Total P	
	---------- ppm		----------	
untreated control (bare ditch)	8.4	a	3.3	a
PAM 5 ppm (bare ditch)	2.8	b	1.0	b
vegetated ditch	8.0	a	3.5	a
vegetated ditch + 5 ppm PAM	3.0	b	1.1	b

69%-65% reduction

No Signficant Differences for Soluble Forms of Nitrogen in 2007

Nitrate-N (average = 4.5 ppm)
NH_4-N (average = 1.1 ppm)

Treatment Effects on Soluble Nutrients (2008)

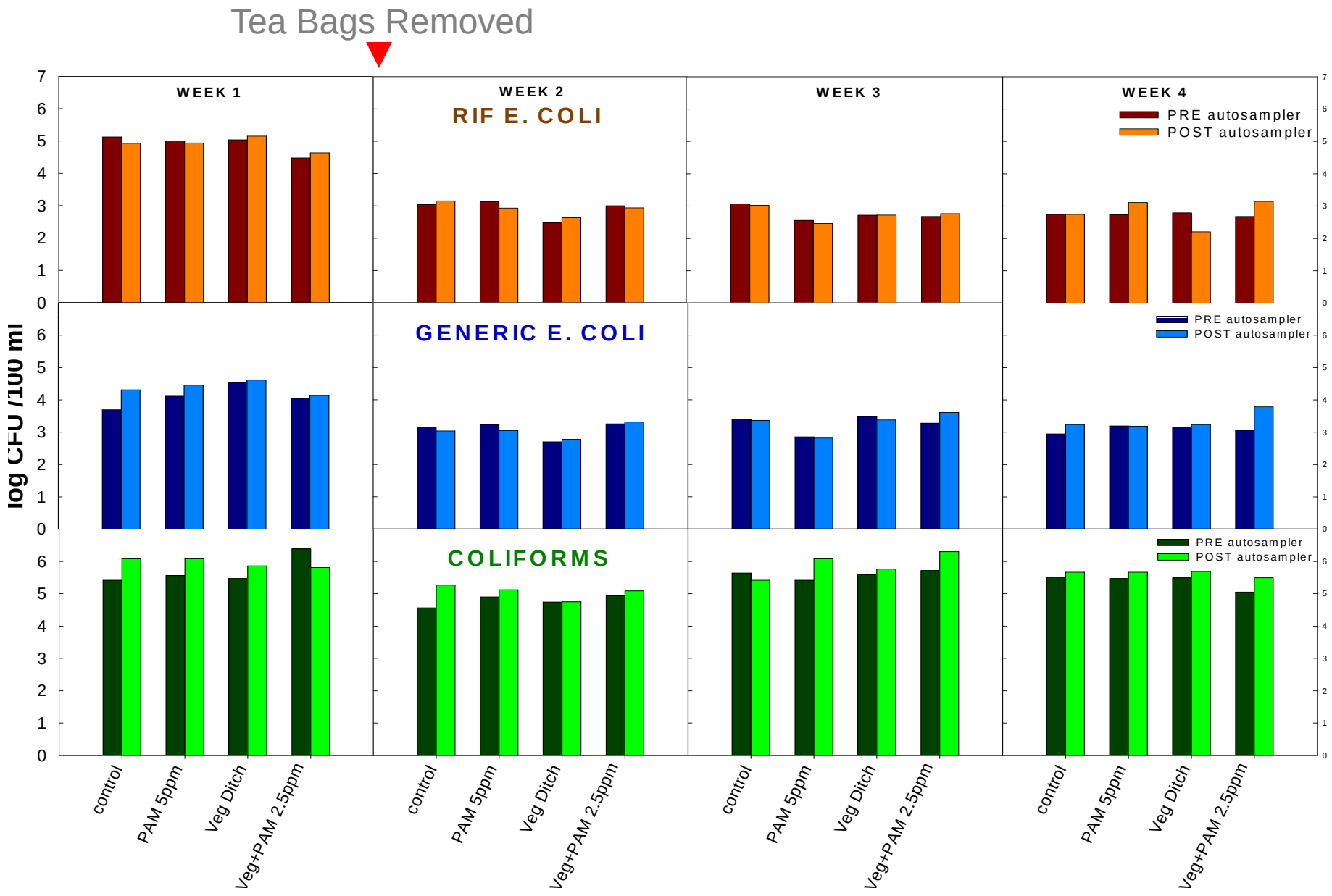
Treatment	Nitrate-N		Ammonium-N		Soluble P	
	---------- ppm ----------					
untreated control (bare ditch)	5.6	a	0.7	a	0.9	a
PAM 5 ppm (bare ditch)	4.3	b	0.2	b	0.6	b
vegetated ditch	7.4	a	0.8	a	1.1	a
vegetated ditch + 5 ppm PAM	4.9	b	0.4	b	0.8	b

20% - 50% reduction

No Treatment Effects on Run-off

Average Irrigation Application = 1.25 -1.5 inches

Treatment effects on Bacteria (2007)



No Treatment Effects on concentration of *E. coli* and Coliform in Run-off (2008)

Treatment Description	*E. coli* $_{rif}$			*E.coli*			Coliform		
	above	below	diff.	above	below	diff.	above	below	diff.
	---------- Log(MPN/100 ml) ----------								
untreated control (bare ditch)	2.3	2.2	0.1	2.7	3.2	-0.5	5.3	5.5	-0.2
PAM 5 ppm (bare ditch)	2.1	2.0	0.0	2.4	2.5	0.0	4.9	5.1	-0.2
vegetated ditch	1.9	2.3	-0.4	2.5	3.5	-1.0	5.2	5.6	-0.5
vegetated ditch + 5 ppm PAM	2.2	2.1	0.0	2.3	3.0	-0.7	4.9	5.2	-0.3
LSD $_{0.05}$	NS[x]	NS	NS	NS	NS	NS	NS	NS	NS

[x] NS = treatment differences were not statistically signficant

Summary

- Vegetation treatment did not reduce sediment or nutrient concentration in run-off
- PAM treatments averaged 93% reduction in suspended sediments
- PAM treatments averaged 65-70% reduction in Total N and Total P
- PAM treatments modestly reduced concentrations of soluble nutrients (nitrate, ammonium, soluble P)
- Neither vegetation nor polymer treatments reduced the concentration of Coliform and E. coli bacteria in run-off


Fallow
Low
Residue
Cover Crop


Thank you!