

**Protecting Water Quality:
Practices for Managing Irrigation and Storm Water
Run-off**



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**Challenges to implementing
water quality practices**

- cost
- effectiveness of practice
- address multiple impairments
- food safety conflicts
- conflicts with production practices

**Water Quality Risks Vary with Different
Commodities**



Stand Establishment of Vegetables

Run-off = 0 to 30% of Applied Water

Sediment Basin



Polyacrylamide used for Soil Conservation

Linear PAM

- Water soluble
- Molecular weight: 12-15 Mg mol⁻¹;
- Charge: moderately anionic (15-20%)

$$\left[\begin{array}{c} \text{H} & \text{H} \\ | & | \\ -\text{C} & -\text{C}- \\ | & | \\ \text{H} & \text{C} \\ & | \\ & \text{O} \end{array} \right]_x \left[\begin{array}{c} \text{H} & \text{H} \\ | & | \\ -\text{C} & -\text{C}- \\ | & | \\ \text{H} & \text{C} \\ & | \\ & \text{O} \end{array} \right]_y$$


Summary of Split-Field Trials (2005)

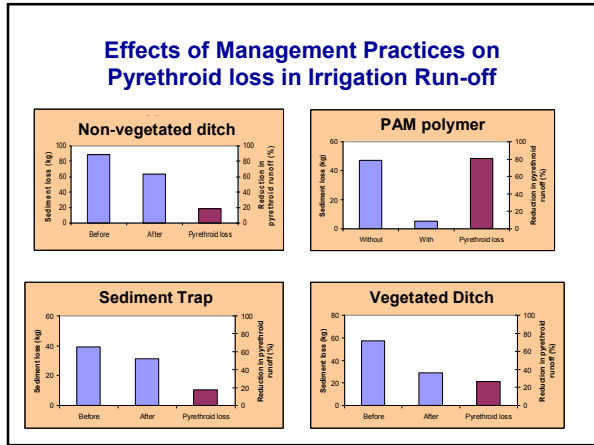
Treatment	Total N	NO ₃ -N	P (Total)	P (Soluble)	Total Suspended Solids	Turbidity NTU
-----Watsonville (Clay loam)-----						
PAM (5 ppm)	0.8	58.6	1.2	1.2	47	33
Control	2.9	48.4	2.0	0.9	652	1289
-----Salinas (sandy loam)-----						
PAM (5ppm)	1.4	1.7	0.7	0.7	72	63
Control	4.2	1.7	1.9	0.7	985	2291
-----Salinas (sandy loam)-----						
PAM (10 ppm)	2.7	1.3	0.4	0.2	179	108
Control	5.5	1.8	2.4	0.5	1332	3536
-----Oracular (loamy sand)-----						
Pam (5 ppm)	2.3	2.7	1.9	0.8	646	218
Control	11.8	6.5	8.2	2.1	3870	503
-----Santa Maria-----						
Pam (5 ppm)	1.6	14.78	0.6	0.51	60	13
Control	7.0	17.02	10.1	0.95	5930	4417
-----Gilroy (silt loam)-----						
Pam (4 ppm)	1.2	8.1	1.0	0.9	74	42
Control	4.0	6.5	3.5	1.2	2057	2408

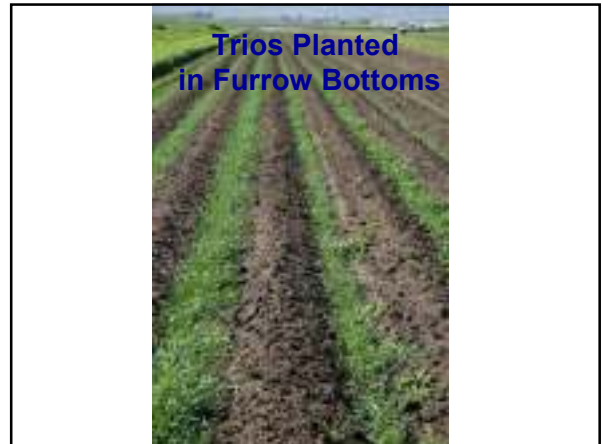
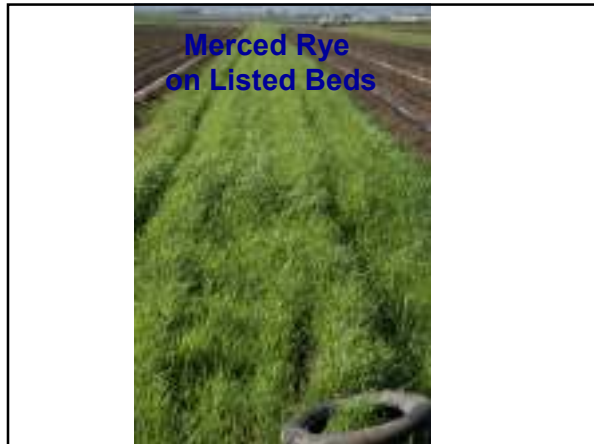




Concentration of Nutrients and Sediments in Sprinkler Run-off

Treatment Description	Total N	NO3-N	Total Soluble P		Total Suspended Solids	Turbidity NTU
			P	P		
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



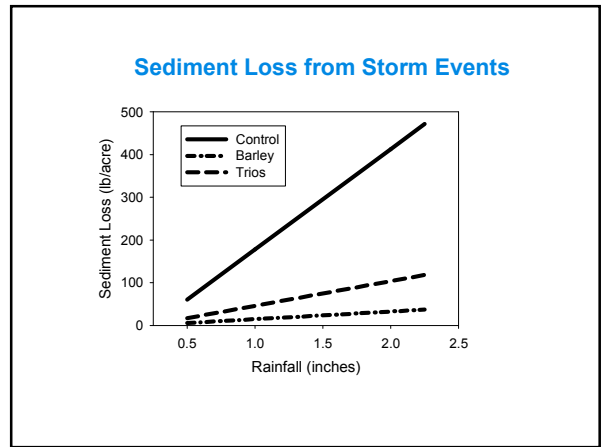
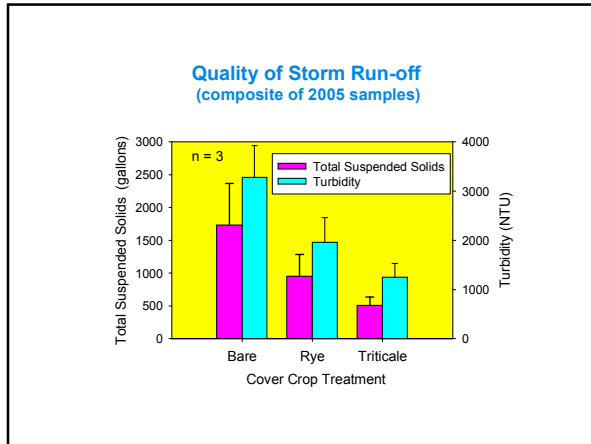


Nutrient and Sediment Concentration in Storm Run-off

Treatment	Total Suspended Solids		Total-P	Ortho-P	Total		
	ppm	NTU ^a			Kjeldahl N	NH ₄ -N	NO ₃ -N
bare (control)	1419	4449	4.4	1.57	8.0	0.12	7.48
full cover	342	917	1.9	1.12	3.0	0.07	0.37
furrow bottom	841	2377	3.3	1.70	5.7	0.34	2.29
furrow dike	978	4296	4.5	1.76	7.9	0.10	6.55
F-test (p > F) ^b	0.012	0.001	0.001	0.0002	0.004	0.023	0.001
Treatment contrasts	F-test (p > F) ^c			F-test (p > F) ^c			
control vs vegetation	0.003	0.0004	0.001	0.040	0.003	NS	0.0002
control vs furrow dike	NS ^d	NS	NS	0.070	NS	NS	NS

^a low NTU (Nephelometric turbidity units) indicates less turbidity
^b probability of obtaining an F-statistic greater than the computed value
^c not statistically different at p < 0.10 level





Storm Run-off Quality in Strawberries

Treatment	Total Suspended Solids		Total-P	Ortho-P	Total Kjeldahl N		
	ppm	NTU ¹			ppm	NH ₄ -N	NO ₃ -N
Bare (control)	2380	3444	3.62	1.0	6.5	0.08	0.50
Barley	415	669	3.20	2.5	5.3	1.38	0.47
Trios	425	742	1.86	1.2	2.3	0.32	0.41
F-test (p > F) ²	<.0001	0.0002	0.0192	0.006	0.0012	0.004	NS
Treatment contrasts	F-test (p > F) ²						
control vs vegetation	0.0001	0.0001	0.036	0.019	0.003	0.011	NS
barley vs trios	NS ²	NS	0.024	0.006	0.002	0.005	NS

¹ low NTU (Nephelometric turbidity units) indicate less turbidity
² probability of obtaining an F-statistic greater than the computed value
³ not statistically different at p < 0.10 level

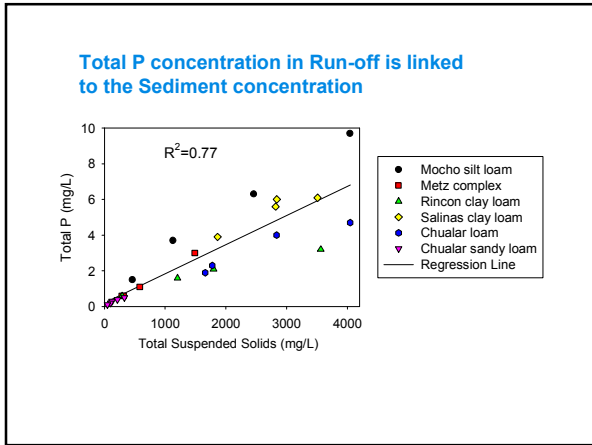
Summary

- ✓ Levels of nutrients and sediments in agricultural run-off are often sufficiently high to impair surface water quality.
- ✓ The shift to drip irrigation and use of PAM could dramatically reduce irrigation run-off impacts on water quality
- ✓ Control of storm run-off is a more difficult challenge than irrigation run-off and will likely require increase use of vegetation in fields and in drainage ditches



Concentration of Nutrients and Sediment in Run-off from Sprinkler Irrigated Fields

Range	Total N	NO3-N	P (total)	P (soluble)	Total Suspended Sediments	Turbidity
				mg/L		NTU
Low	2.9	1.7	1.3	0.5	433	503
High	11.8	48.4	10.1	2.1	6500	6821
Average	5.9	13.4	4.5	1.0	2514	2971



Split-Field Comparisons Using PAM

Reduction in Nutrient and Sediment Concentration

Range	Total Kjeldahl N	NO3-N	P (Total)	P (Soluble)	Total Suspended Solids	Turbidity
			% reduction			
Average	69.5	9.0	72.0	25.3	91.8	91.0
Min	51.4	-24.3	42.5	-32.8	83.3	56.6
Max	80.5	58.9	94.1	60.6	99.0	99.7

