

Managing Runoff during the Growing Season and Winter



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Runoff Effects During the Year

Irrigation season

Field erosion

Loss of fine silts, clays, and organic matter

Water quality effects (sediment, nutrients, pesticides)

Sediment management costs

Food safety risks and costs

Increased pumping costs



Storm season

Ditch erosion

Flooding

Reduced recharge from rainfall



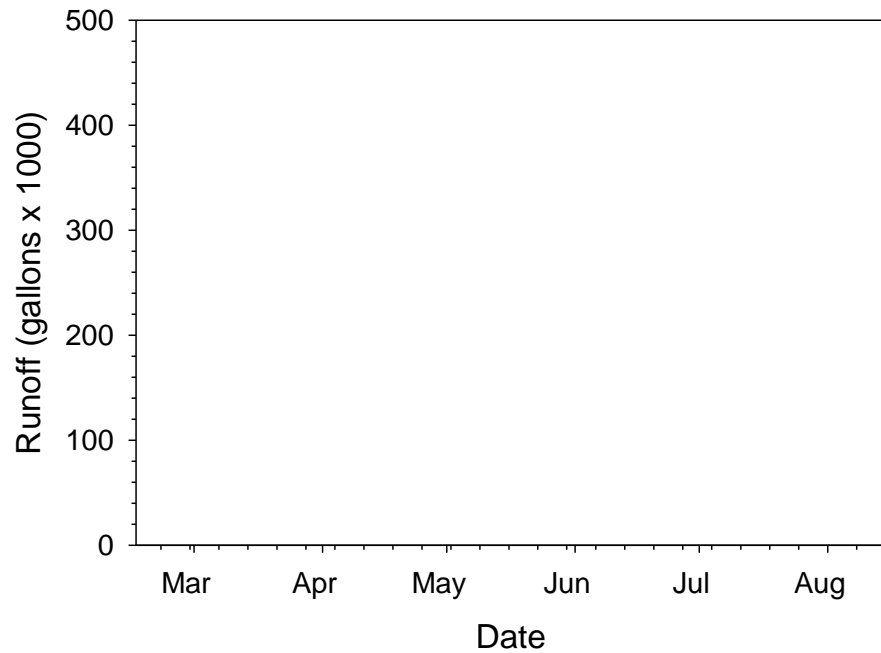
Improving irrigation management reduces runoff:

- Increase application uniformity
- Fix leaks
- Improve scheduling
- Use drip



How much irrigation runoff occurs during a growing season?

- >7 million gallons (21.5 acre-ft) of runoff measured in a single farm ditch
- **106 tons** of sediment





Use of drip reduces runoff

- **Crop establishment**
- **Post establishment**

Overhead sprinklers are needed for irrigating high density leafy vegetables



For some soil types overhead sprinklers frequently cause run-off



- **Nutrients**
- **Sediments**
- **Pesticides**

Retaining Runoff

Basin



Pond



- Settle out suspended sediments
- Infiltrate runoff
- Reuse of runoff may require treatment for food safety
- Sediment removal costs

Soil erosion and suspended sediment in run-off can be reduced using Polyacrylamide (PAM)

Linear PAM

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

PAM applicator treats 1500 gpm at the well



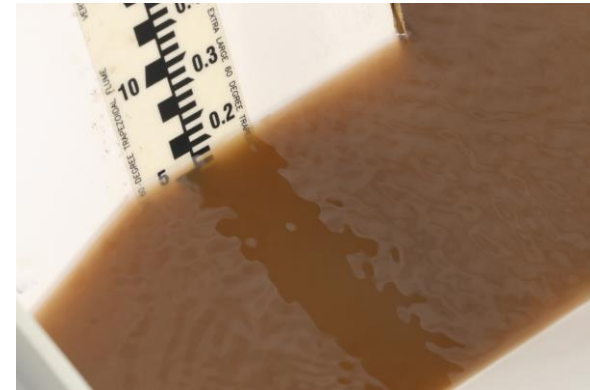


Turbidity and suspended solids were reduced using PAM by 95% and 90% in 4 on-farm trials

PAM



Untreated



| | Turbidity | | | Total Suspended Solids | | |
|---------|------------------------------|-----|-----------|------------------------|-----|-----------|
| | Untreated | PAM | Reduction | Untreated | PAM | Reduction |
| | ----- NTU ¹ ----- | | % | ----- mg/L ----- | | % |
| Trial 1 | 1219 | 89 | 93 | 796 | 106 | 87 |
| Trial 2 | 1156 | 95 | 92 | 577 | 86 | 85 |
| Trial 3 | 411 | 12 | 97 | 466 | 36 | 92 |
| Trial 4 | 1374 | 28 | 98 | 1256 | 60 | 95 |
| Average | 1040 | 56 | 95 | 774 | 72 | 90 |

¹Nephelometric turbidity units

PAM ditch applicator



Average Nutrient and Sediment Concentration of Runoff Upstream and Downstream of PAM ditch applicators during 2022 (29 paired samples)

| Location | Total N | PO ₄ -P | Total P | Total Suspended | |
|------------------|---------|--------------------|---------|-----------------|-----------|
| | | | | Sediment | Turbidity |
| ----- mg/L ----- | | | | | NTU |
| Upstream | 6.7 | 1.2 | 9.0 | 3819 | 4362 |
| Downstream | 2.7 | 0.8 | 1.0 | 60 | 20 |
| % Reduction | 60.1 | 30.9 | 89.0 | 98.4 | 99.5 |



Weirs can be used to level ditches, settle out sediment and prevent winter storm erosion



Level ditch = slower flow and less erosion



Drop: dissipates energy that erodes ditch

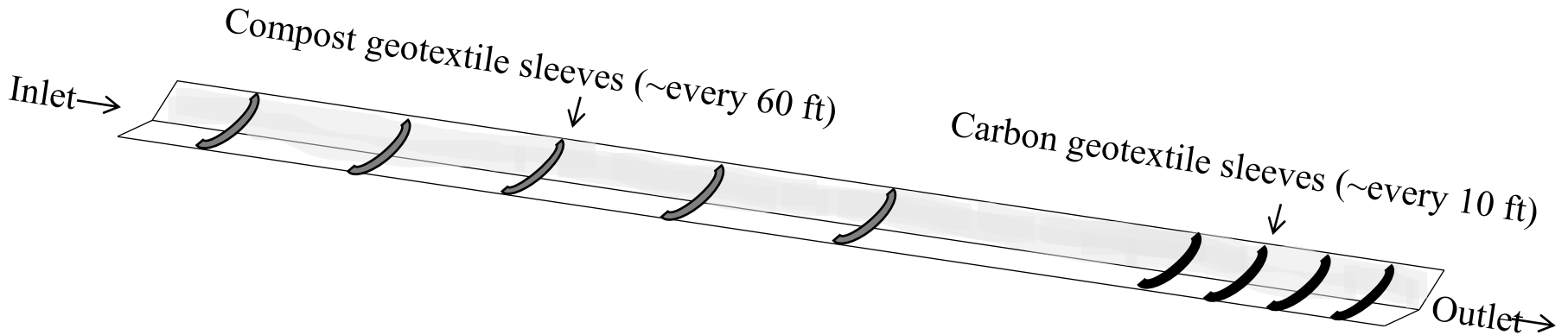
Improve waterways to infiltrate and treat run-off



Carbon socks can remove soluble pesticides

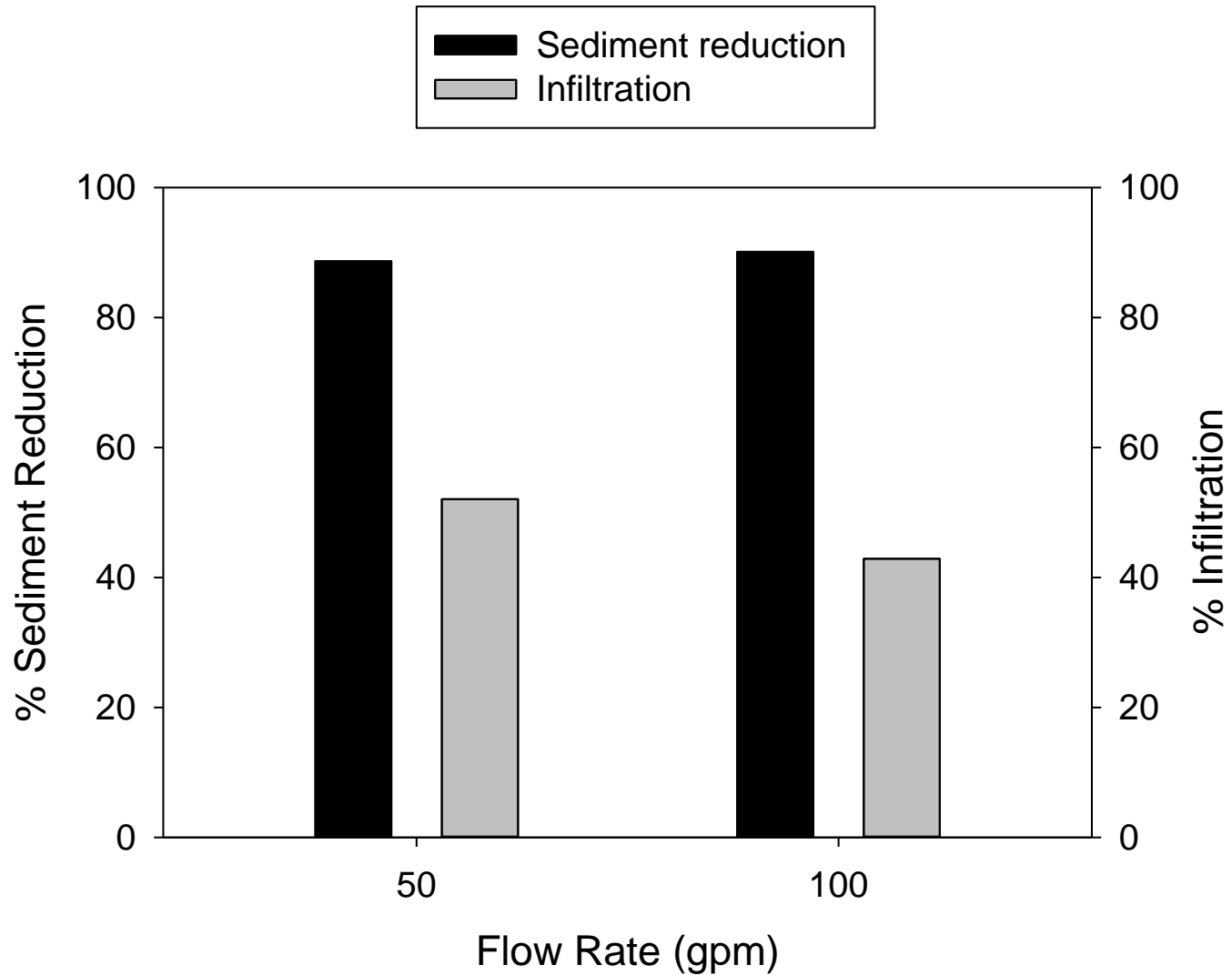


Integrated Vegetated Ditch for Mitigating Soluble and Sediment Bound Pesticides



- Vegetation slows flow allowing time for suspended sediments to settle and run-off to infiltrate.
- Soluble pesticides bind to vegetation, compost and activated carbon socks

Vegetated Ditch: Reduction in Sediment Load and Run-off



Simulated run-off passing through geotextile sleeves (socks) filled with granular activated carbon



Permethrin and Imidacloprid concentration reduced 92 to 94%



Sediment traps prevent sand and silt from clogging vegetated ditch



Managing storm water run-off



About 5% of the row crop land in the Salinas Valley is cover cropped during the winter



Low-Residue Cover Crops for Controlling Runoff

Triticale planted in Furrows

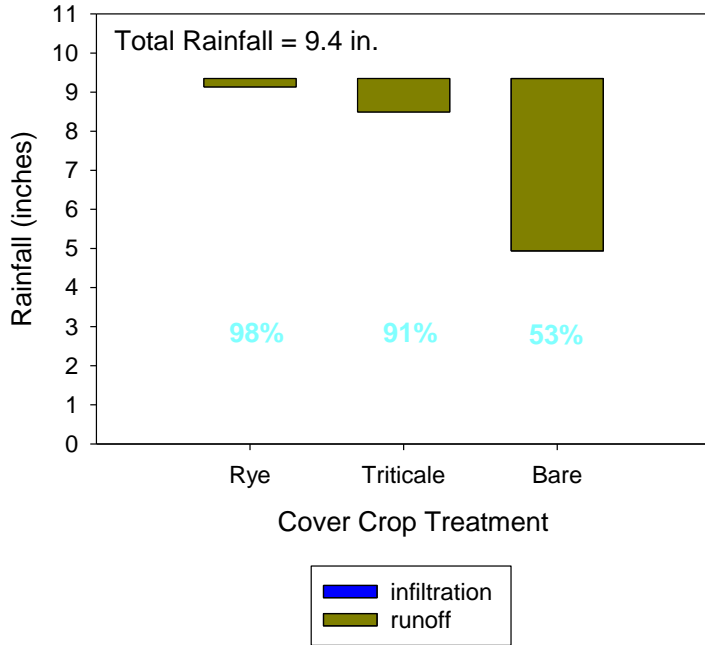
Merced Rye planted in Furrows and Beds

Herbicide Application 60 Days after Planting

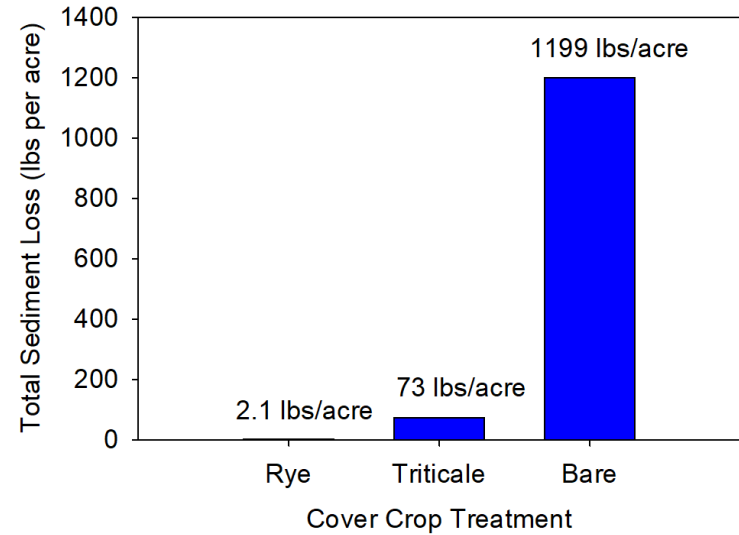


Low residue cover crops reduced runoff and soil erosion

Storm Water Recharge and Runoff



Soil Erosion



Currently evaluating the use of Sudangrass and Sorghum sudangrass for winter low biomass cover crops

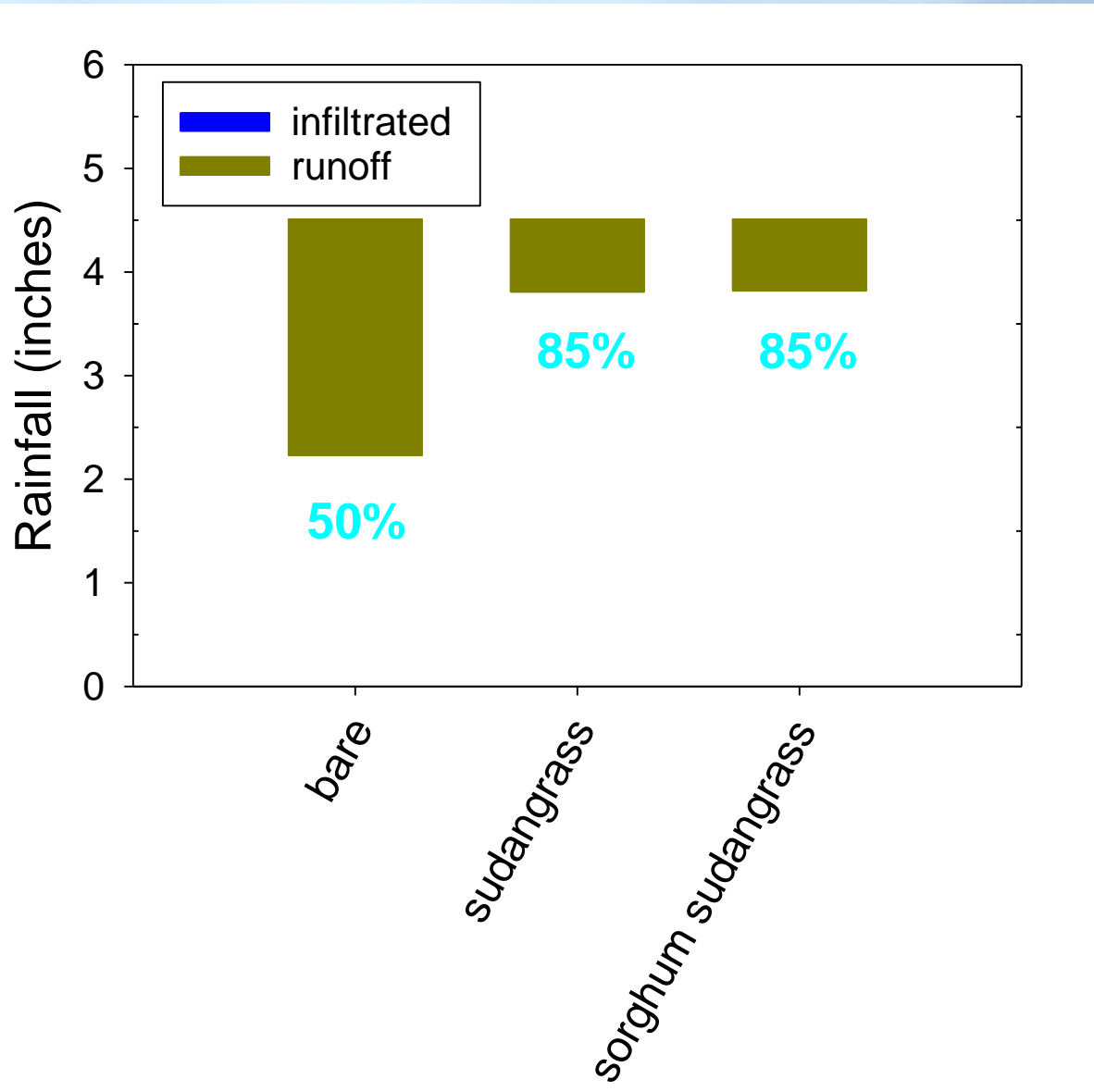


Cold weather and frost limits growth of Sudangrass

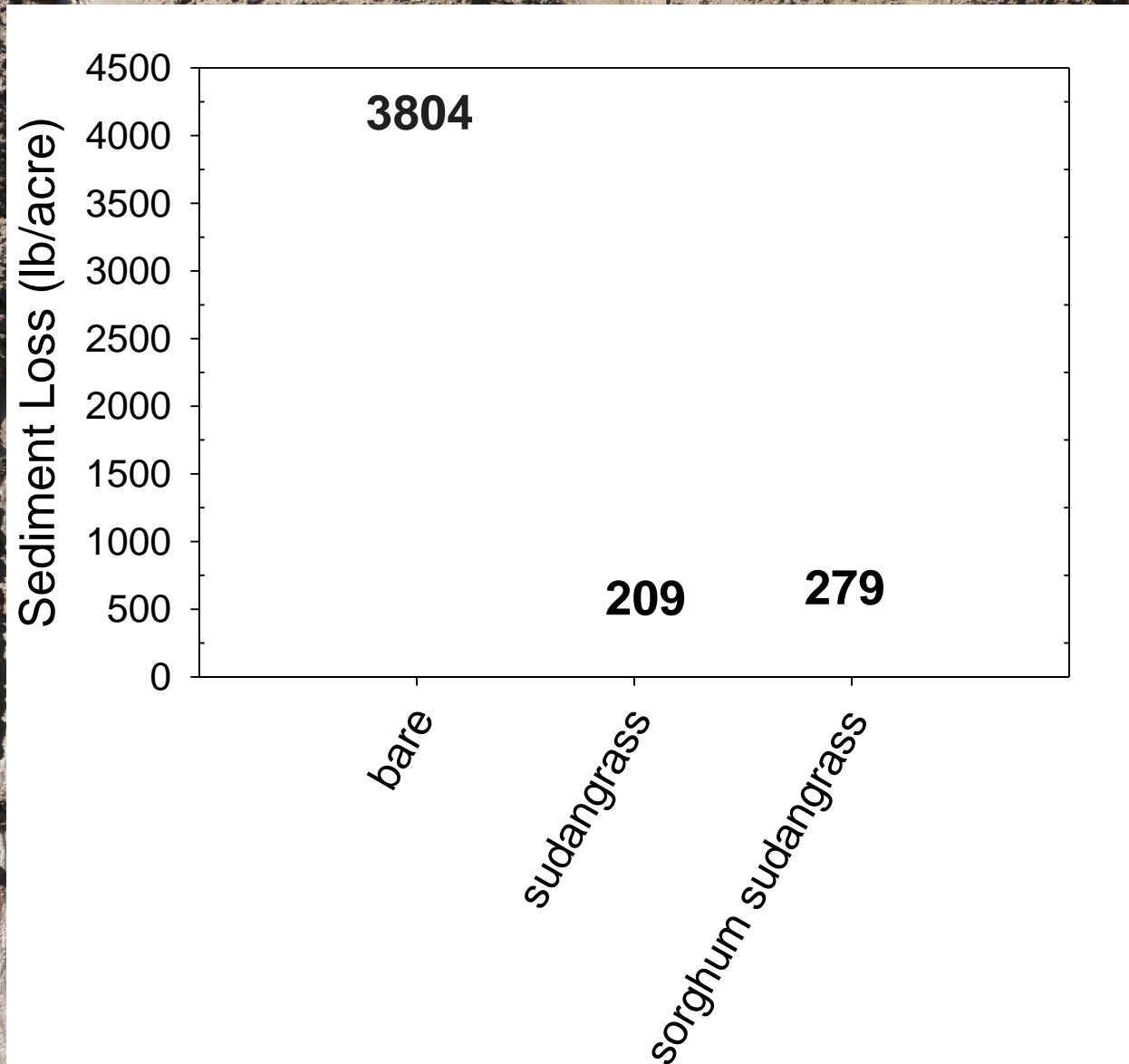


Winter cereal

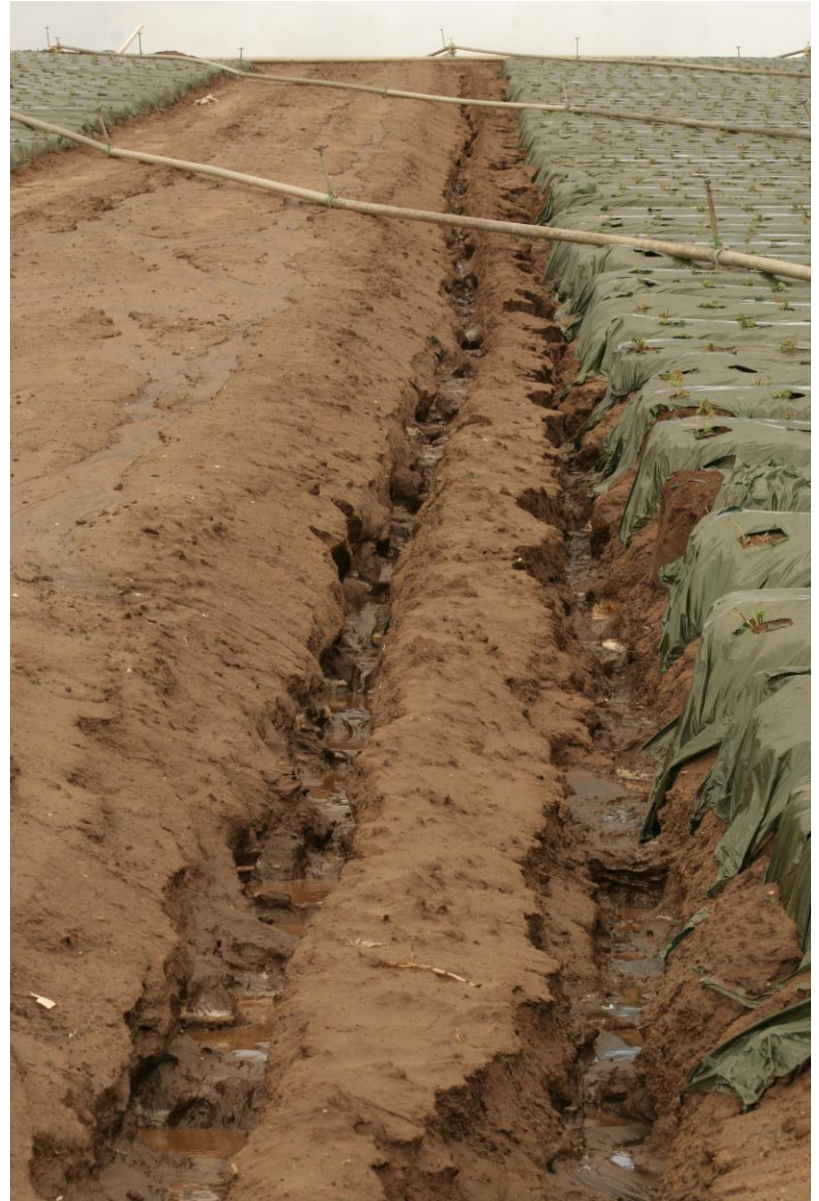
Preliminary data show a 70% reduction in runoff volume



Preliminary data show about a 90% reduction in erosion



Managing storm runoff is challenging on hillside strawberries



Erosion and runoff control for strawberry on hillsides



- Orient beds with contours to minimize slope
- Line ditches with erosion control fabric (plastic)
- Capture sediment in retention basins
- Plant cover crop on roads and furrow in fall (earlier is better)

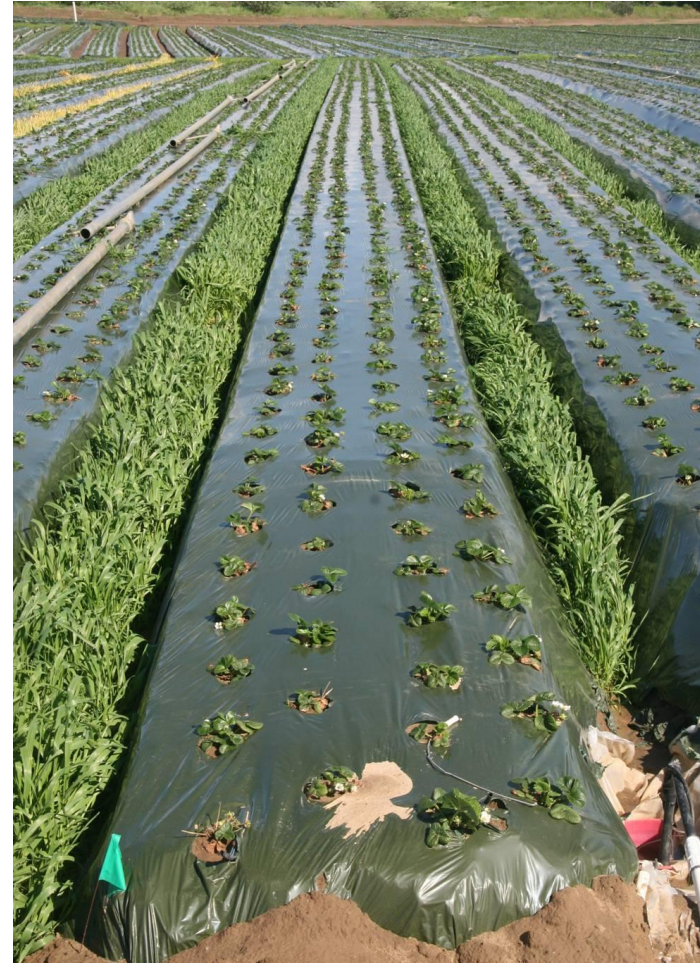


Winter Furrow Cover Crops in Strawberry

Barley + Poast Herbicide



Trios (Triticale)



- **80% Reduction in Sediments**
- **40% to 60% reduction in Total P and Total N**

Summary

There are many approaches and practices for controlling runoff during the growing and storm season

Improving irrigation management can greatly reduce runoff during the growing season

Farm ditches can be designed and managed to avoid erosion and treat runoff

Use of PAM can minimize erosion in fields irrigated with sprinklers

Low biomass cover crops can reduce erosion and runoff during the winter

Questions?

