


Impact of Low-Residue Winter Cover Crops on Sediment and Nutrient Loss

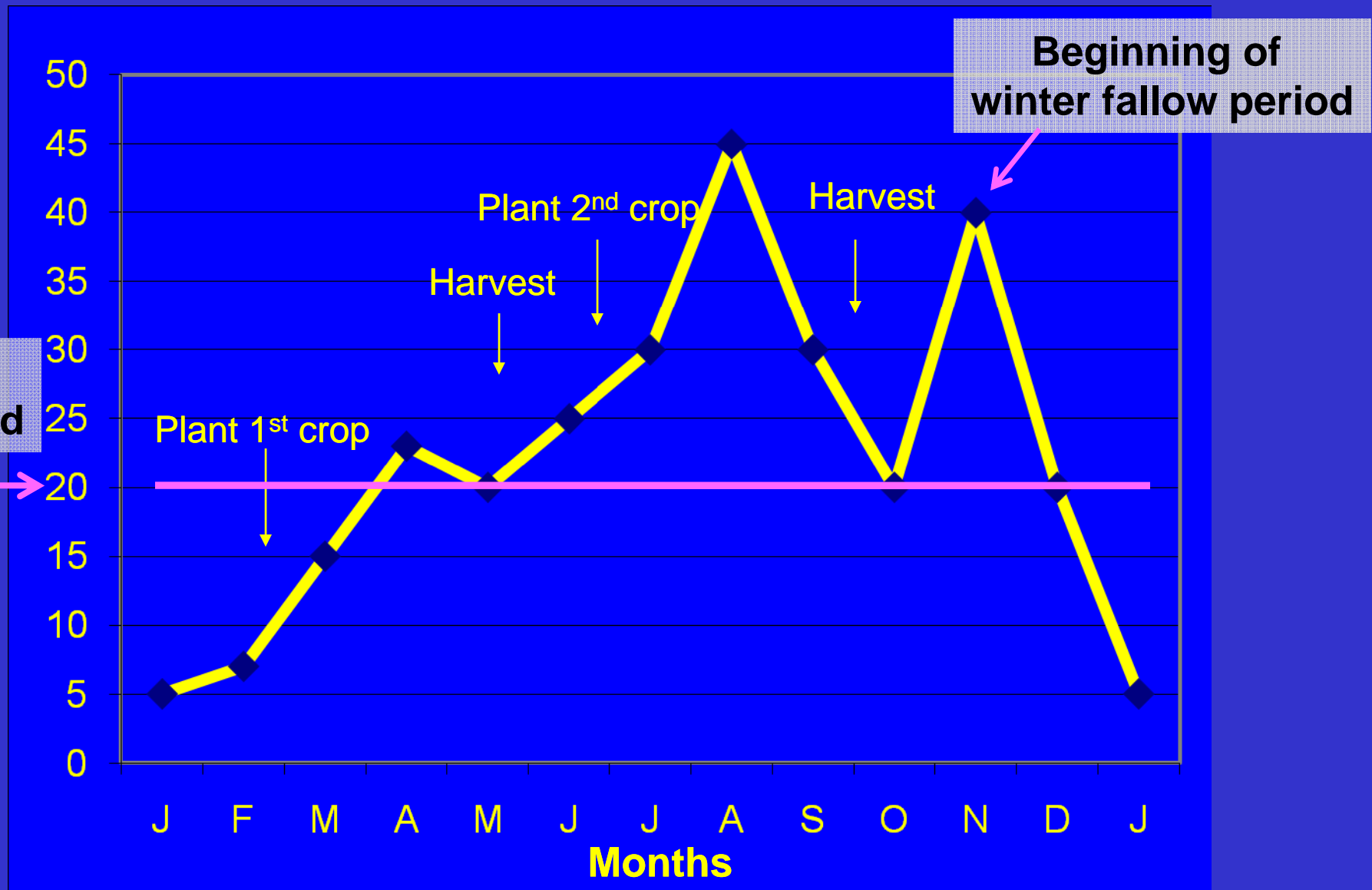


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Water Quality Issues are Key Factors Motivating Investigations into Ways to Reduce Sediment and Nutrient Loads Leaving Agricultural Fields



Residual Nitrate-Nitrogen in Soil Over Growing Season (two crops of lettuce)



Smith and Schulbach, 1996

Lettuce and Winter Rotational Crops

Acres Trends (thousands of acres)

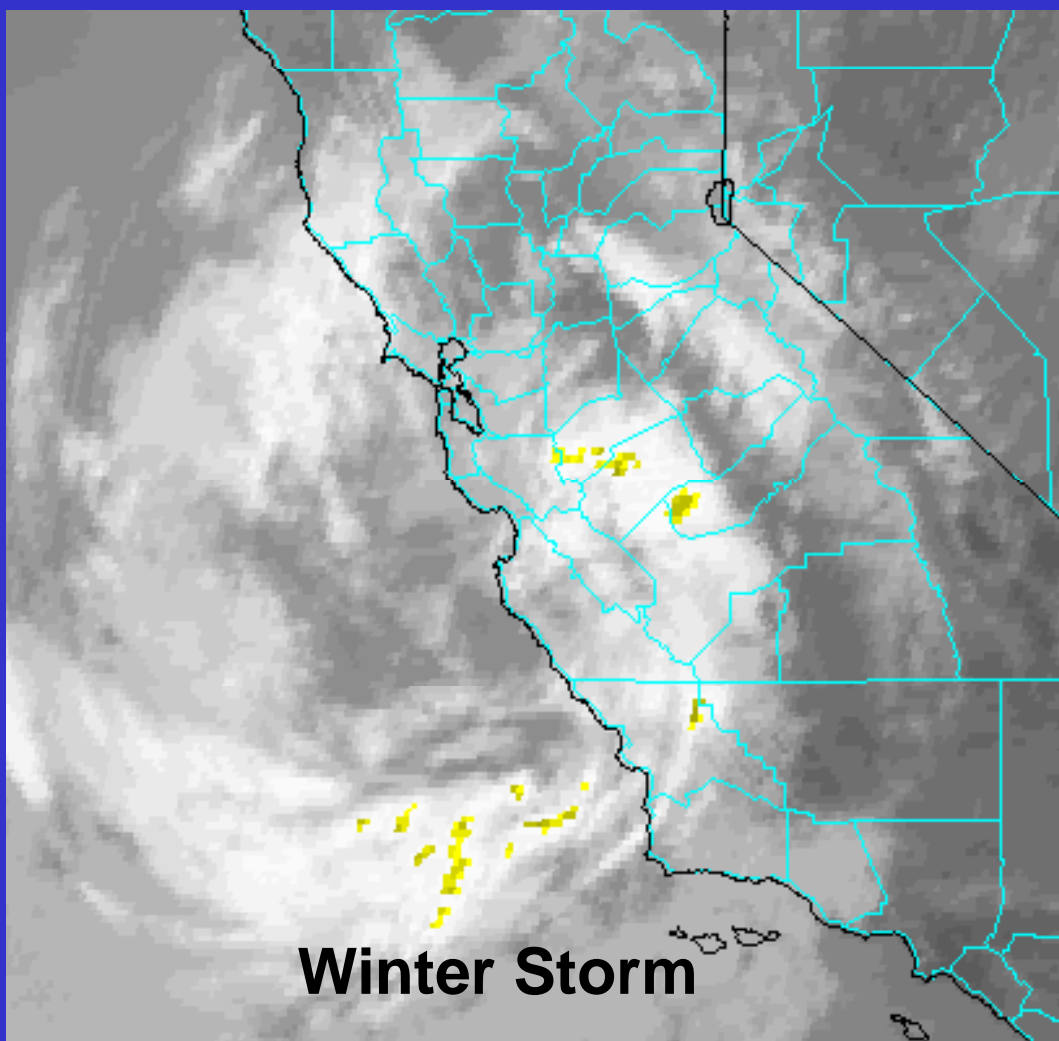
Date	Lettuce	Small Grains	Sugar Beets
1950	68	63	24
1960	50	67	20
1970	55	63	14
1980	62	51	11
1990	58	14	3
2000	106	6	0
2008	150	10	0

Salinas Valley Cover Crop Benefits:

- **Reduces nitrate leaching**
 - * **Biomass can contain up to 200 lbs N/A**
 - * **Keeps it in the soil organic matter fraction**
- **Reducing loss of nutrients and soil from erosion**
- **Improve soil physical & biological properties**



The benefits of cover crops are known, but there are barriers to their use:



- High land rents
- Risk of missing spring planting schedules
- Lost opportunity for growing cash crops
- Direct cost (\$150 to \$200/A)
- Working wet soils in spring



Small seeded crops need a fine seedbed with no residue. In Salinas lettuce is planted for continuous harvest from March to November



Approximately 5% of vegetable acreage in the Salinas Valley is winter cover cropped. No deep rooted rotational crops (wheat/sugar beets)

Low-Residue Cover Crops

- **Because of the benefits that cover crops provide, but their low usage**
- **We were interested in finding a way to include cover crops in the intensive rotations of the Salinas Valley**

Low-Residue Cover Crops

- We began working with cover crop strategies that had manageable levels of biomass
- The concept is to provide a cover crop that would not interfere with spring planting schedules
- This project evaluated the level of benefits provided by low-residue cover crops

Low-Residue Cover Crops

- The cover crops are killed while they are still small and there is time for the residue to decompose before the field is prepared for planting

Low-Residue Cover Crop Strategies

- **Furrow bottom cover crop**
 - **Trios 102 winter dormant cover that grows slow and remains low growing to reduce management costs**
- **Full cover crops killed early in the growth cycle after sufficient biomass had been achieved**
 - **Fast growing cover crops such as rye, oats, etc and killed with herbicides when they have achieved <0.5 ton/A of dry biomass**

2008-09 Trial

- **Worked in a commercial vegetable production field**
- **Plots were 1280 feet long x eight 40-inch beds wide**
- **Plots were seeded on Nov 18 and seed was lillistoned on Nov 19. Seed was germinated by rain on Nov 26**
 - **Cereal Rye 'AG104' broadcast**
 - **Triticale 'Trios 102' applied to furrow bottom**

2008-09 Trial

Treatment	Spray Date	Days after germination	Material
Cereal Rye AG104	January 20	55	2% glyphosate
Triticale Trios 102	February 4	70	2% glyphosate 1 pt/A Goal
Bare Fallow*	January 20	55	1 pt/A paraquat

*** To provide weed control**

Rain Gauge

- Runoff was measured in each plot with flumes that recorded volumes of flow



Data Logger

Water Sample

Flume

December 17



Rye Trios Bare Trios Rye Bare Rye Bare Trios



January 20

February 16

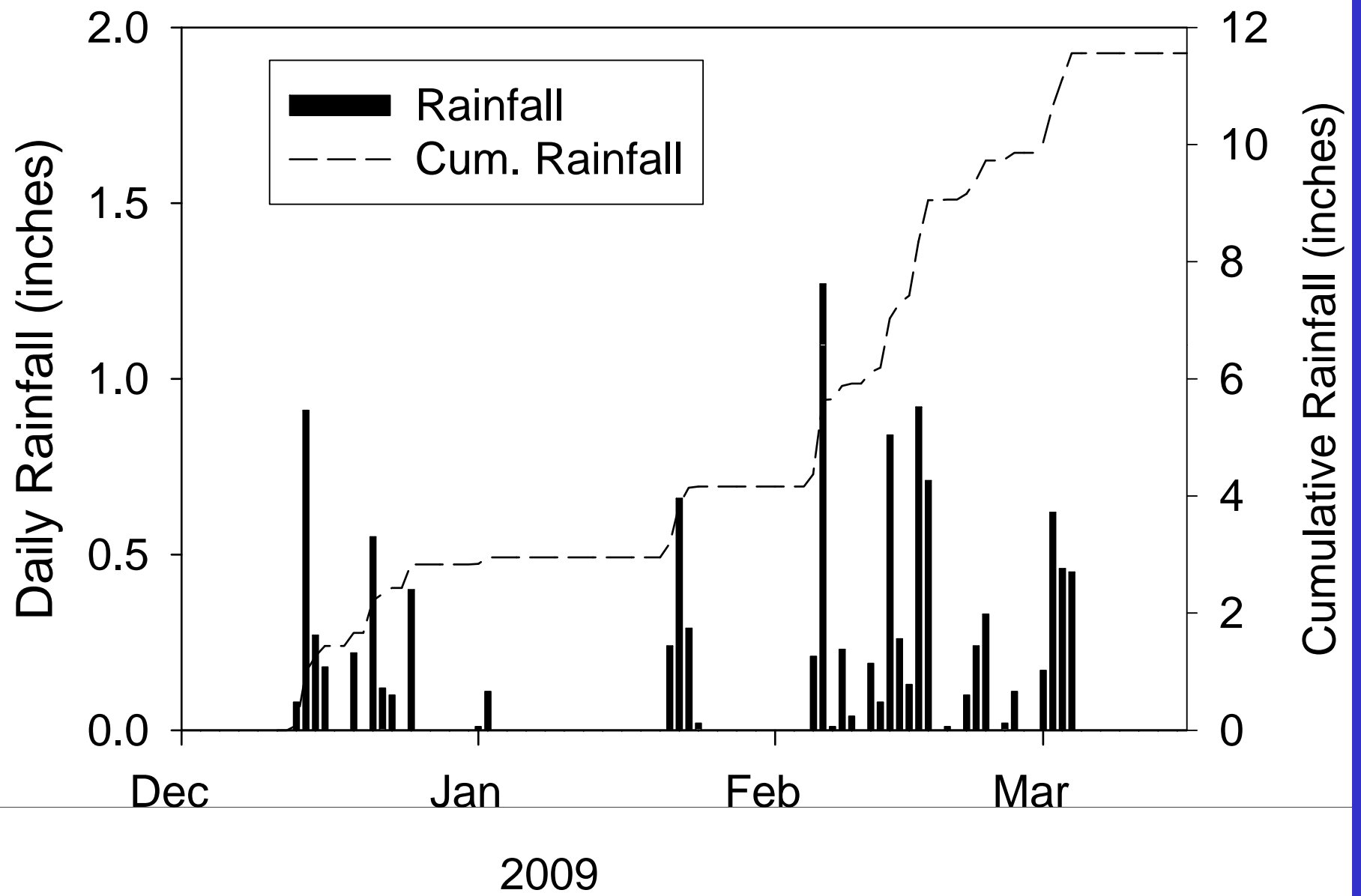
Rye

Jan 20

Trios

Feb 4



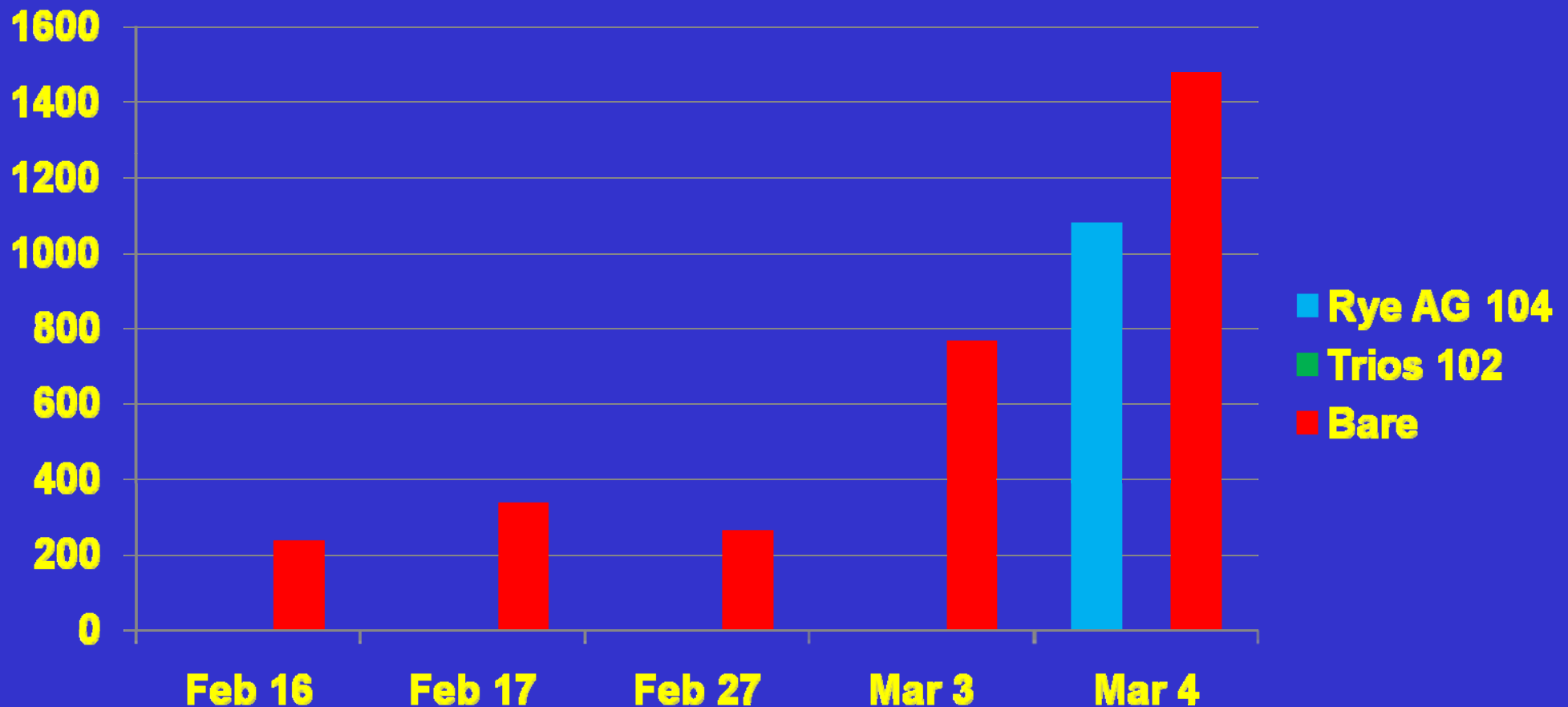




- **In the bare fallow treatment , we were able to measure runoff in five storm events**

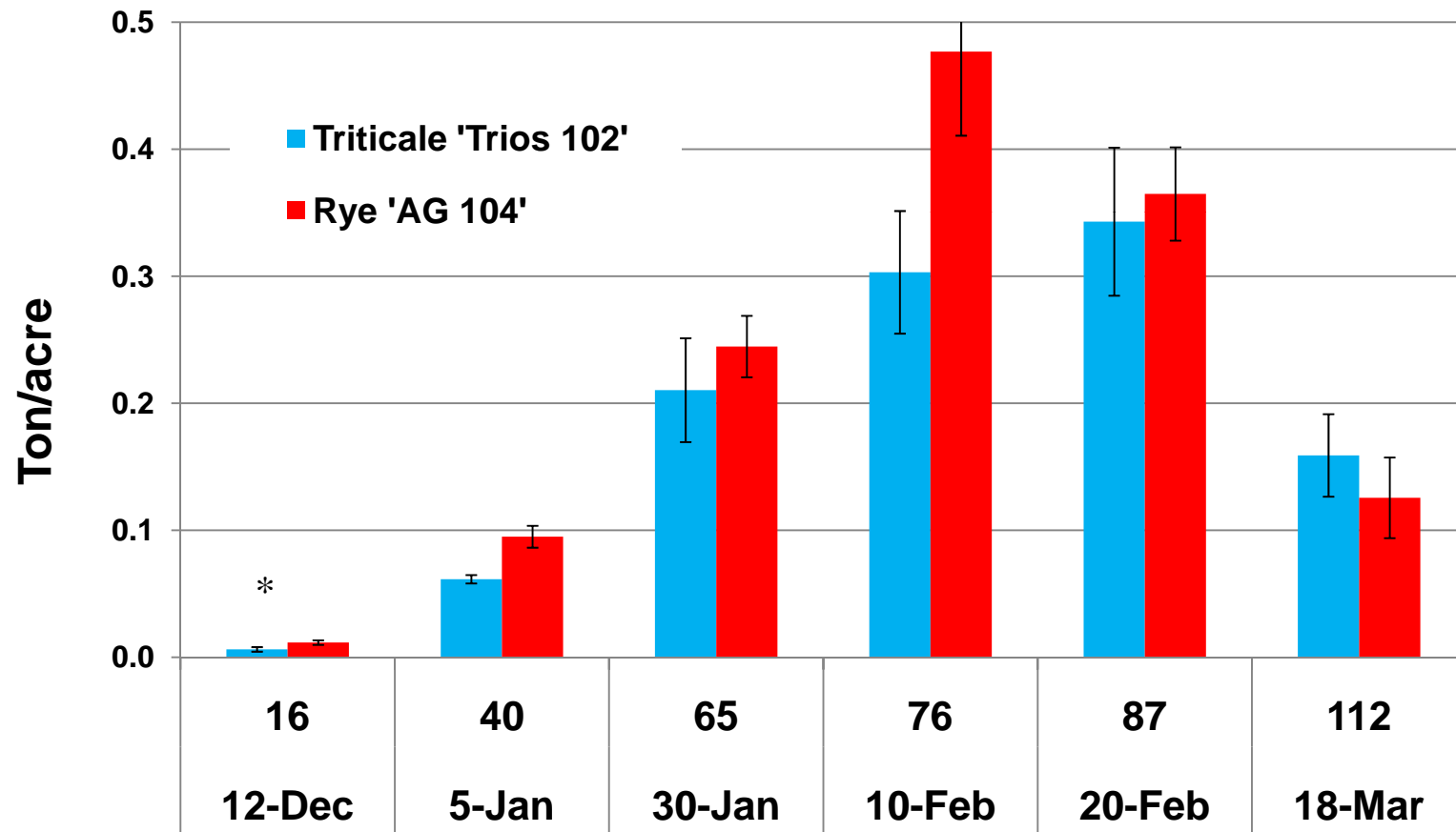


Average Run-off Volume in Five Storm Events

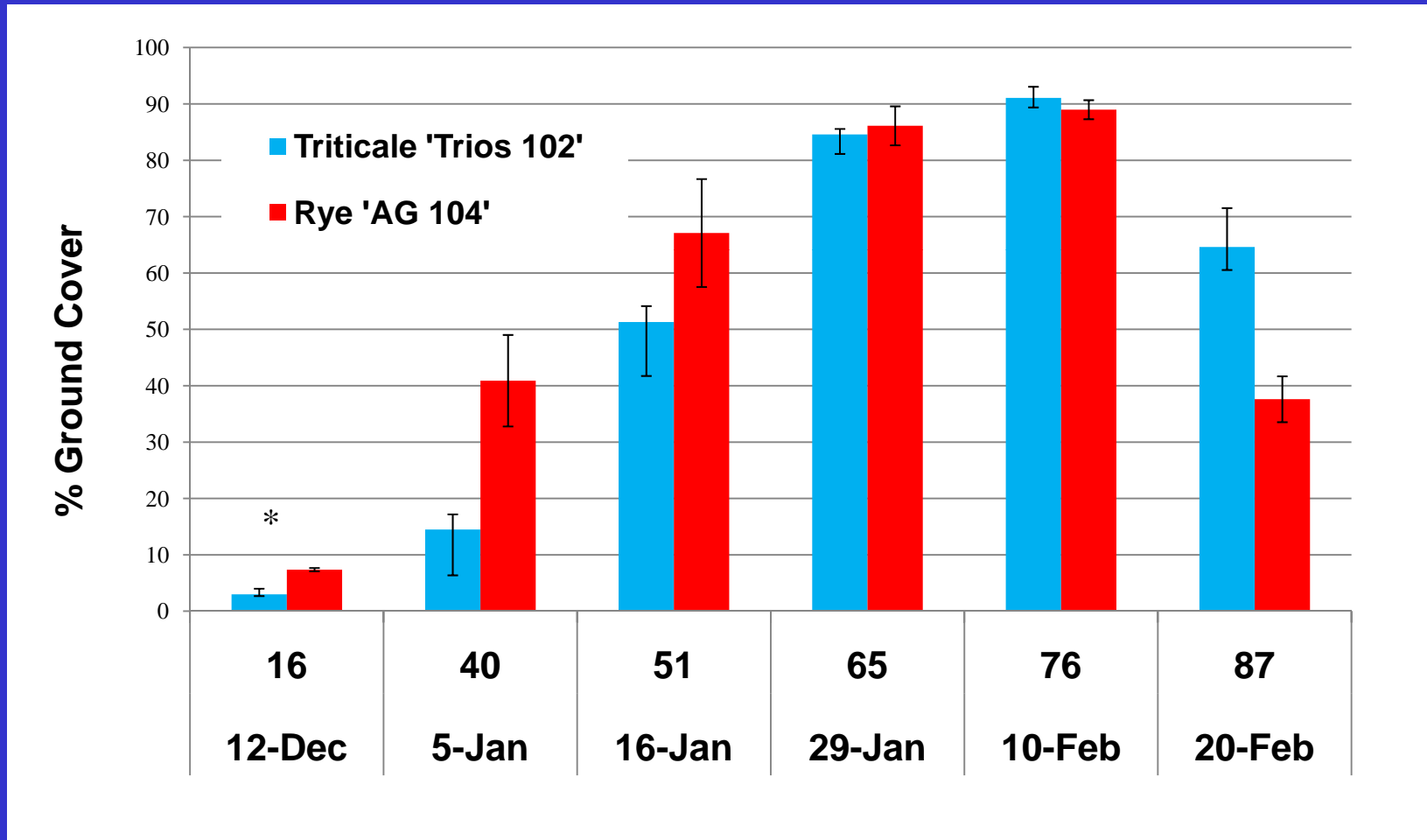


Constituent	Value	Unit
Total Nitrogen	15.5	mg/L
Ammonium-N	0.1	mg/L
Nitrate-N	0.3	mg/L
Orthophosphate	0.7	mg/L
Total Phosphate	4.7	mg/L
Potassium	1.5	mg/L
Sulfate-S	0.5	mg/L
TDS	160	mg/L
Total Suspended Solids	7023	mg/L
Turbidity	3767	NTU
pH	7.8	
EC	0.1	dS/m

Biomass Trends



Percent Ground Cover Trends



March 18



Lysimeter

2 feet deep

Collection
bottle

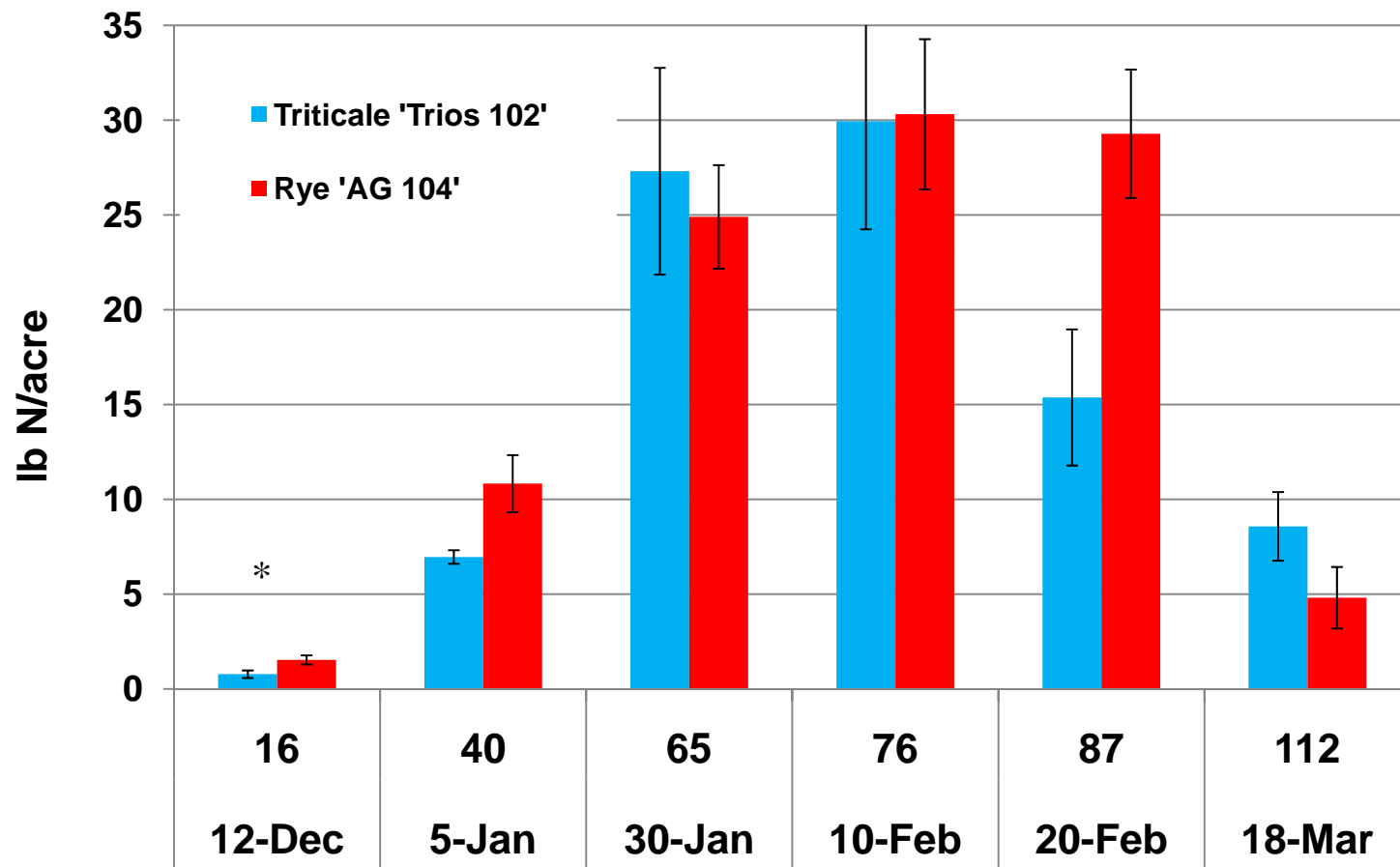
Hose to
vacuum
pump

Lysimeters were installed and maintained at suctions that approximated the flow of gravitational water. Samples of this water were analyzed for nitrate content. From the concentration of nitrate in this water and estimations of movement of water through the soil we could estimate nitrate loss

Estimated Leaching Losses of Nitrate-N Between Feb 12 - March 5

Treatment	Evaporation	Rainfall	Percolation	NO3-N in leachate ppm	Lbs N/A lost to leaching
Bare	1.6	5.45	3.7	188	155
Rye	1.6	5.45	3.8	155	132

Cover Crop Nitrogen Content Trends



Summary

- In this study the low-residue cover crop were allowed to grow to 0.3 - 0.4 tons/A
- It is possible that we could have let them grow for a longer time, but one of the issues with this technique will be timing:
 - How big to let them grow
 - When to kill them in order for the residue to decompose to acceptable levels
 - Working around rainy weather

Summary

- **Low residue cover crops were effective at reducing the quantity of runoff and the quality of the water**
- **Cover crop biomass begins to leak nitrogen when it is killed**
- **We did not observe large reductions in nitrate leaching with low residue cover crops**
- **This niche for this technique may be sites highly vulnerable to erosion**

Acknowledgements

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