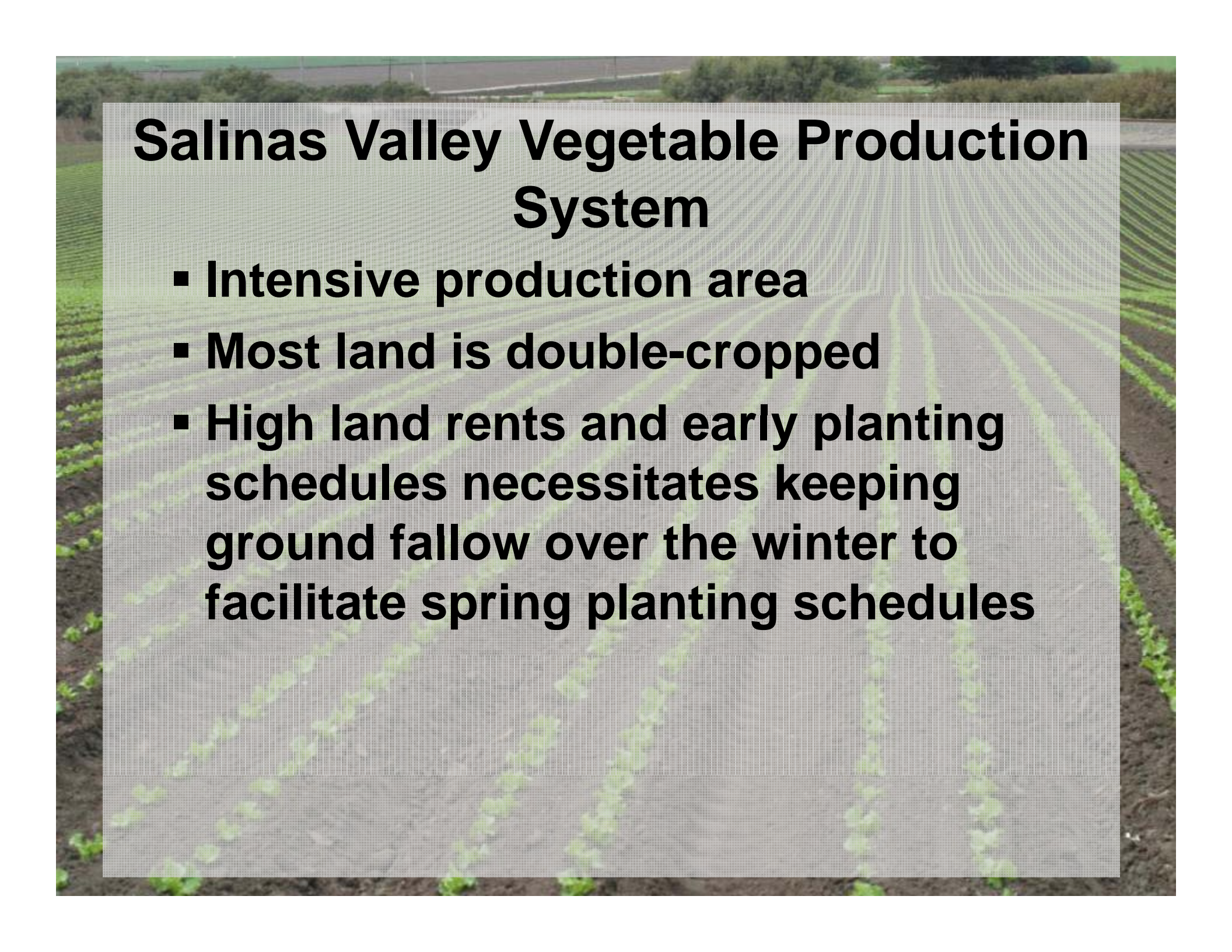





# **Impact of Cover Crops on Nutrient and Sediment Loss from Vegetable Production Fields**

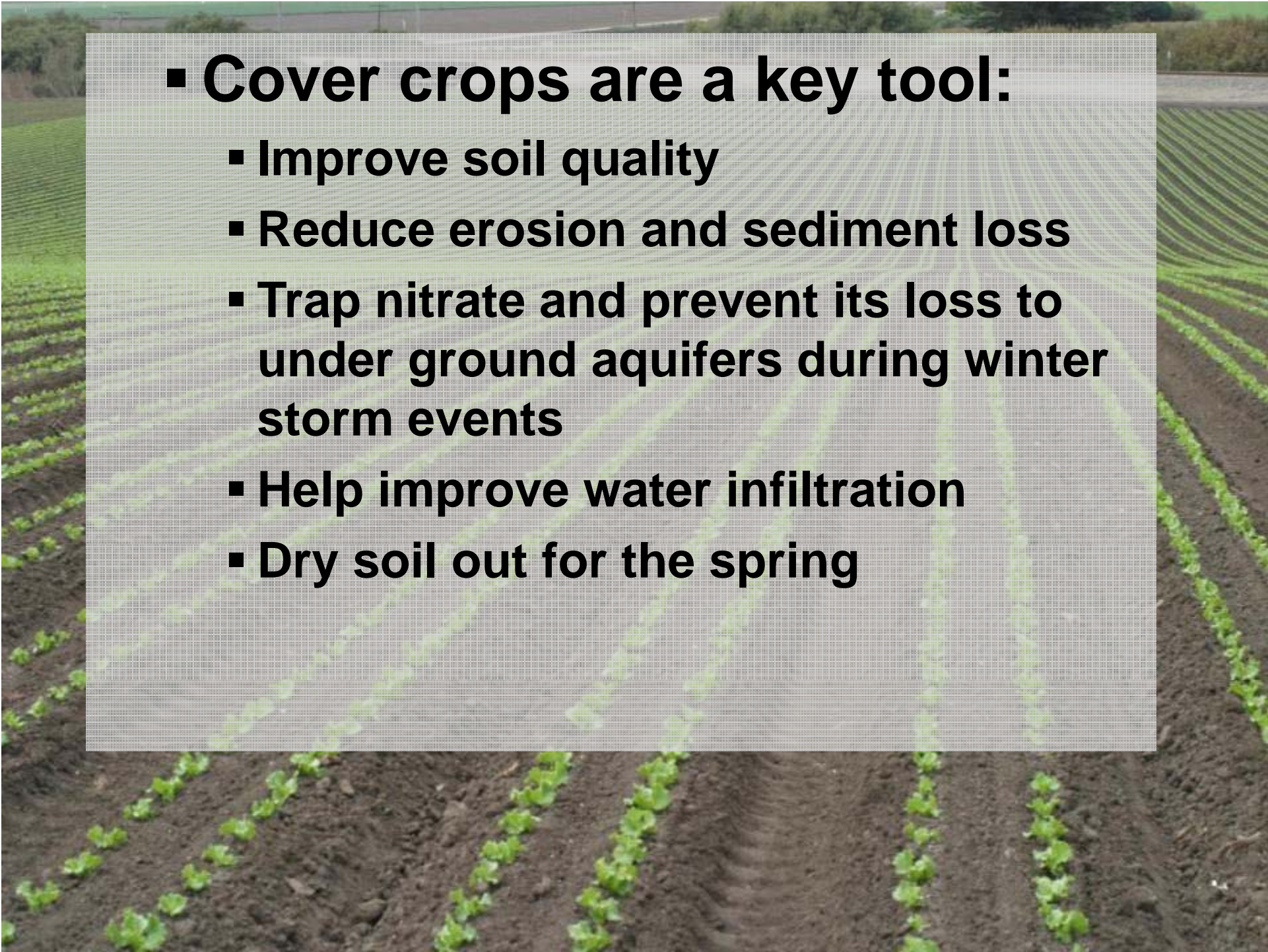
**Richard Smith and Michael Cahn  
University of California Cooperative Extension  
Monterey County**

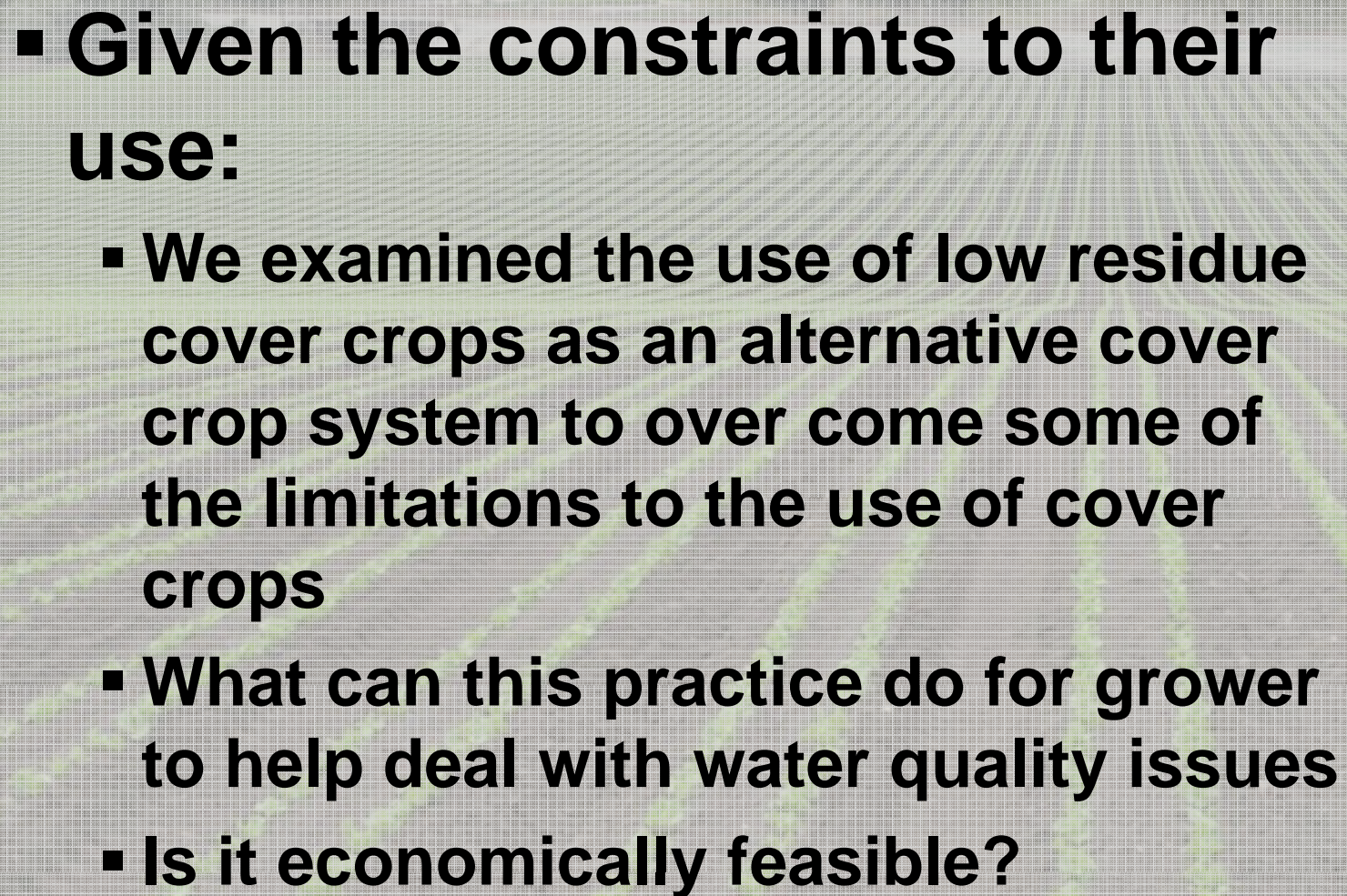
A photograph of a vegetable field in the Salinas Valley. The field is filled with rows of young green plants, likely lettuce or similar leafy greens, planted in neat, parallel lines. The soil is dark and appears to be well-maintained. In the background, there are more rows of plants and some trees, suggesting a large-scale agricultural operation. The overall scene is a typical view of a vegetable production system in this region.

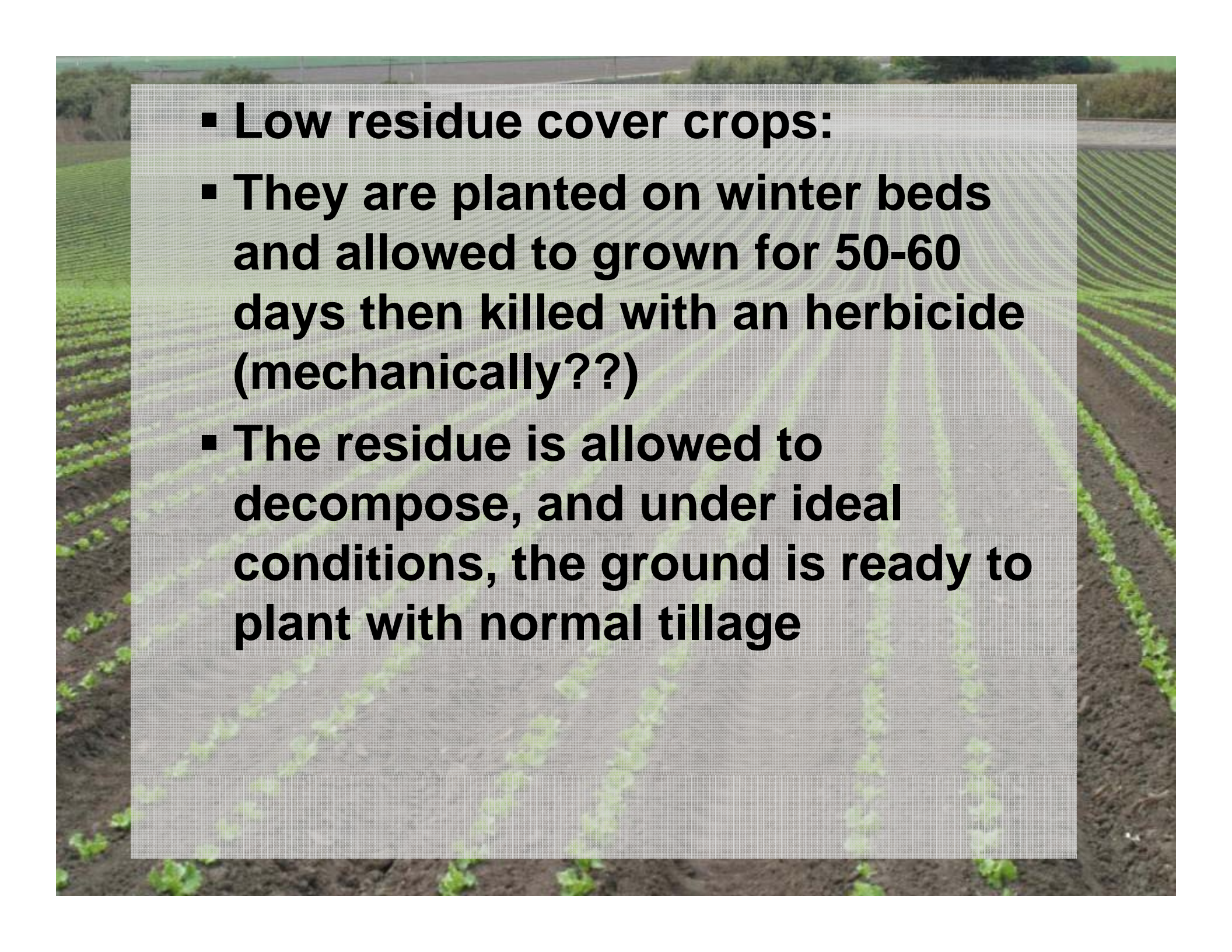
# **Salinas Valley Vegetable Production System**

- **Intensive production area**
- **Most land is double-cropped**
- **High land rents and early planting schedules necessitates keeping ground fallow over the winter to facilitate spring planting schedules**

- 
- **First plantings of lettuce occur in December/January**
  - **A cover crop can potentially disrupt early planting operations**
  - **As a result, <5% of vegetable ground is cover cropped**

- 
- **Cover crops are a key tool:**
    - **Improve soil quality**
    - **Reduce erosion and sediment loss**
    - **Trap nitrate and prevent its loss to under ground aquifers during winter storm events**
    - **Help improve water infiltration**
    - **Dry soil out for the spring**

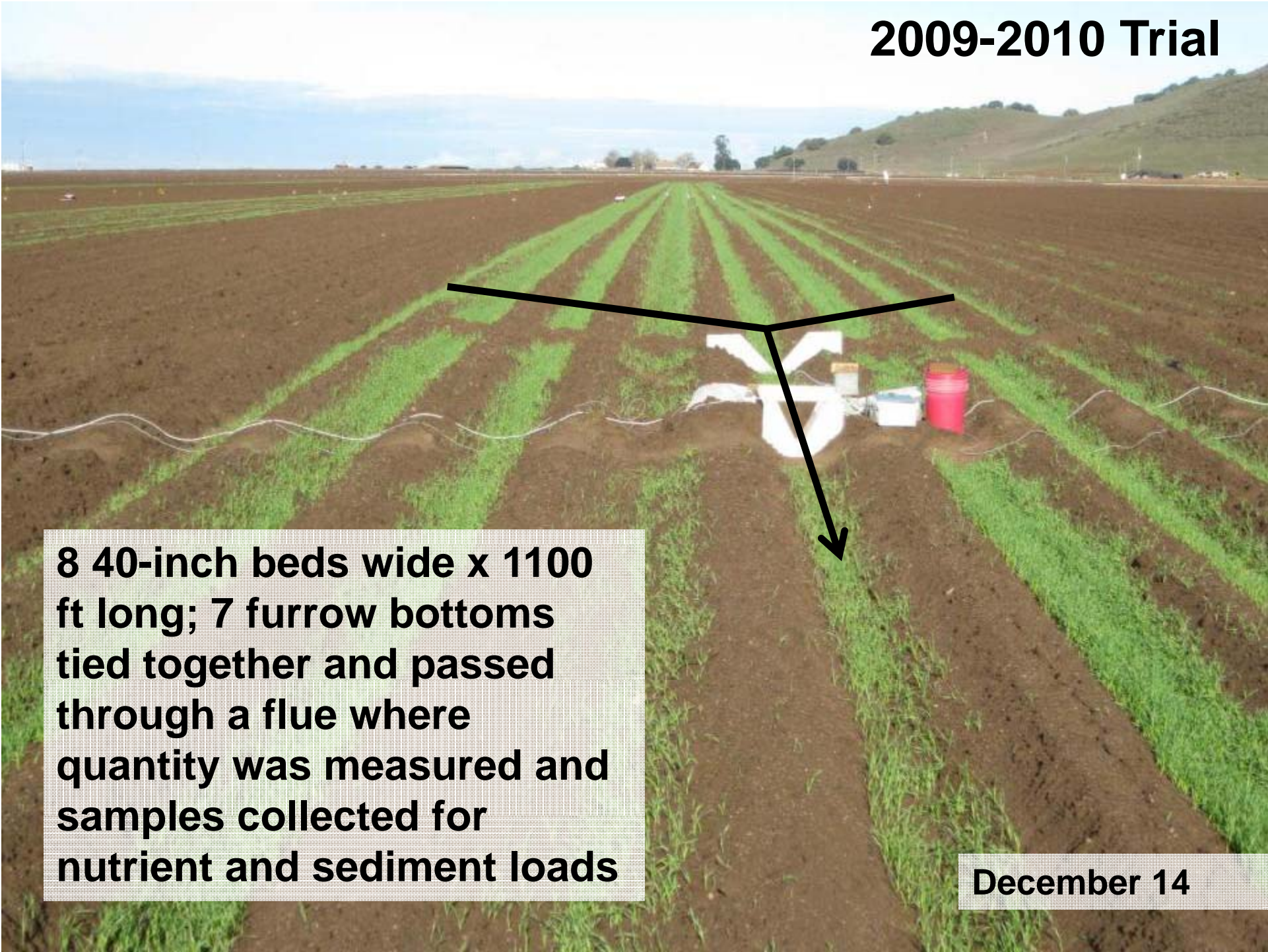
- 
- **Given the constraints to their use:**
    - **We examined the use of low residue cover crops as an alternative cover crop system to overcome some of the limitations to the use of cover crops**
    - **What can this practice do for grower to help deal with water quality issues**
    - **Is it economically feasible?**

- 
- **Low residue cover crops:**
  - **They are planted on winter beds and allowed to grow for 50-60 days then killed with an herbicide (mechanically??)**
  - **The residue is allowed to decompose, and under ideal conditions, the ground is ready to plant with normal tillage**

# **Trials Over the Past Three Winters**

- Winter dormant triticale planted in furrow only**
- Cereal rye broadcast on beds and furrows**
- Cover crops were killed with glyphosate at approximately 55 days after germination to manageable biomass accumulation**

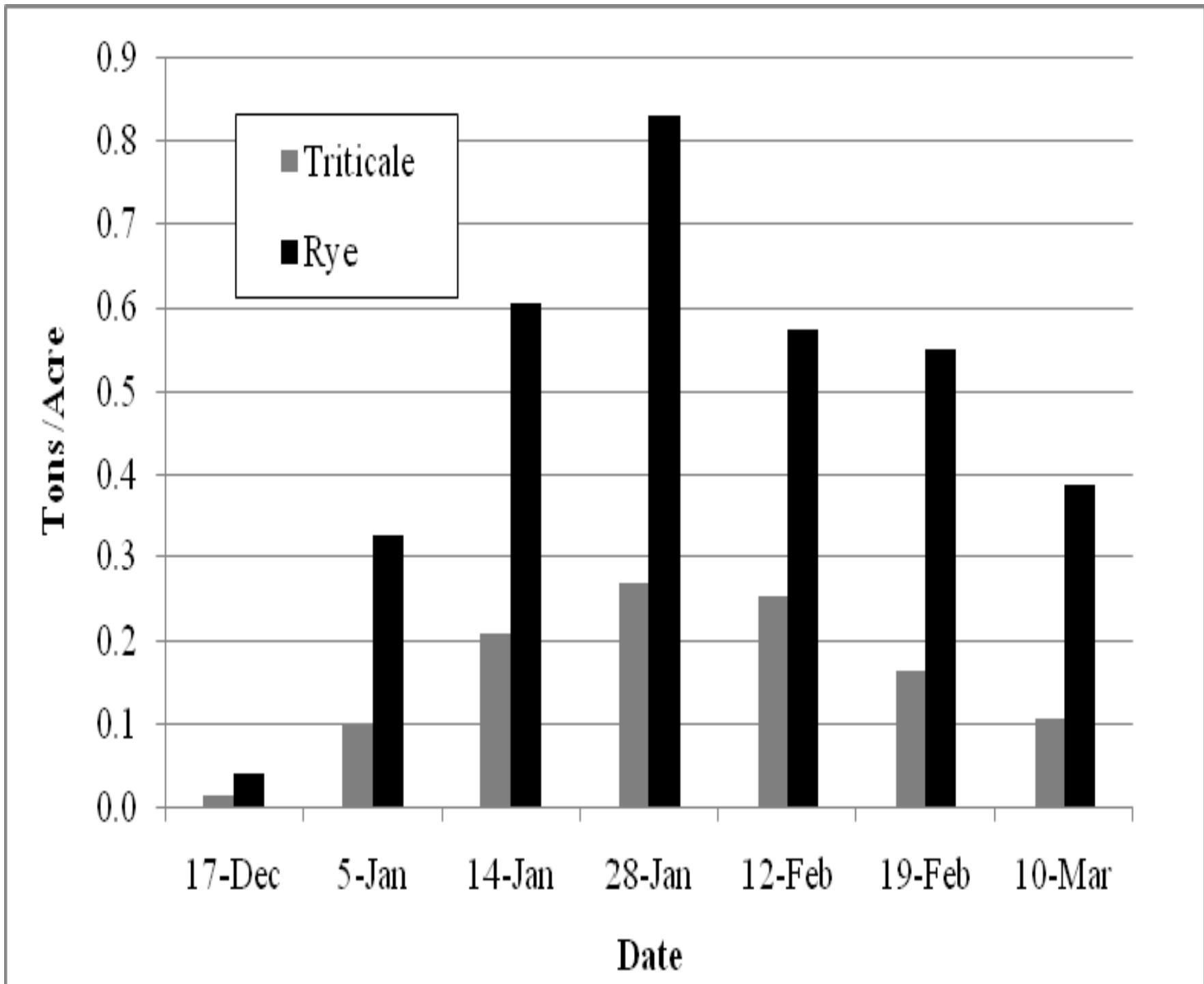
## 2009-2010 Trial

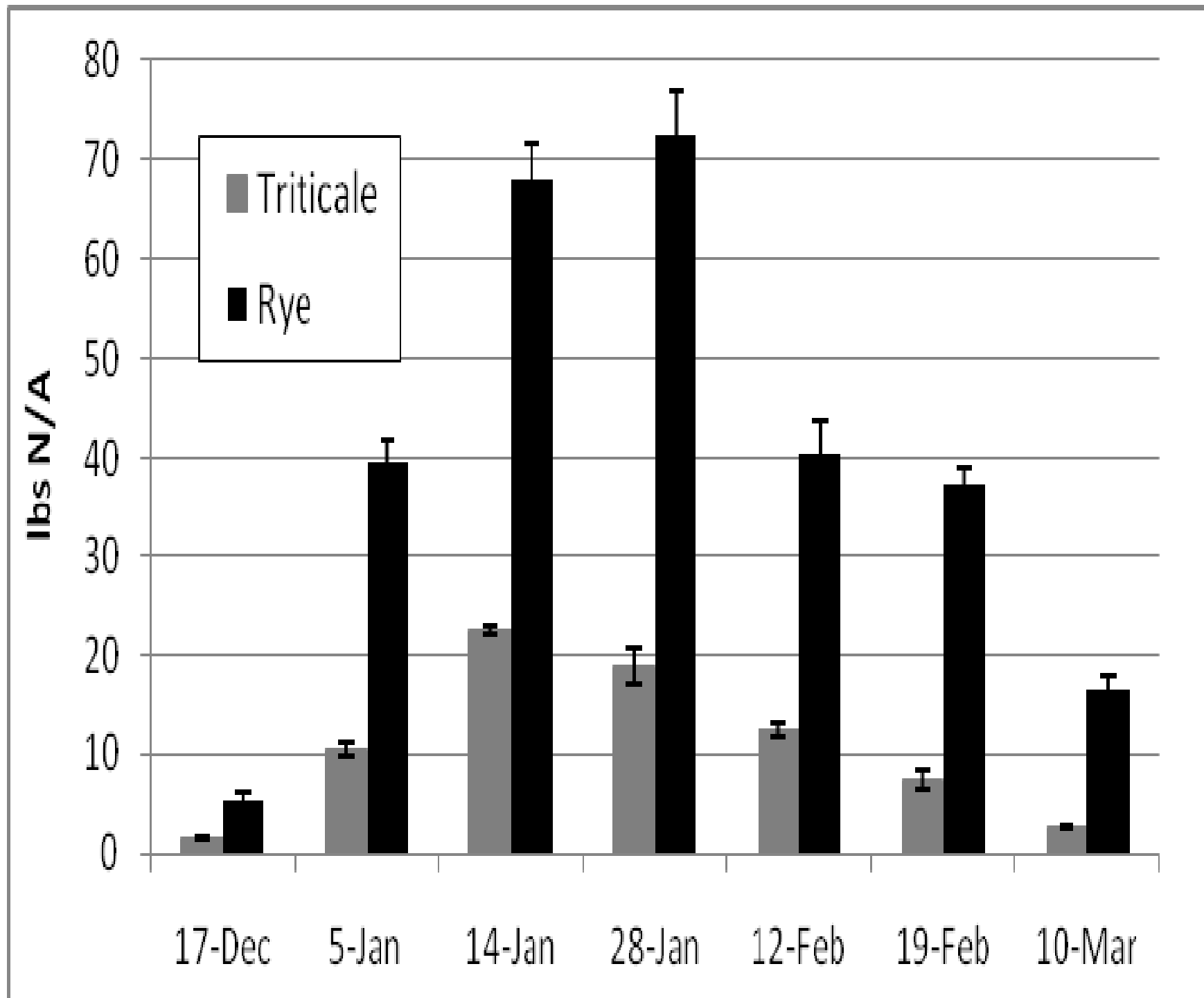


8 40-inch beds wide x 1100 ft long; 7 furrow bottoms tied together and passed through a flue where quantity was measured and samples collected for nutrient and sediment loads

December 14



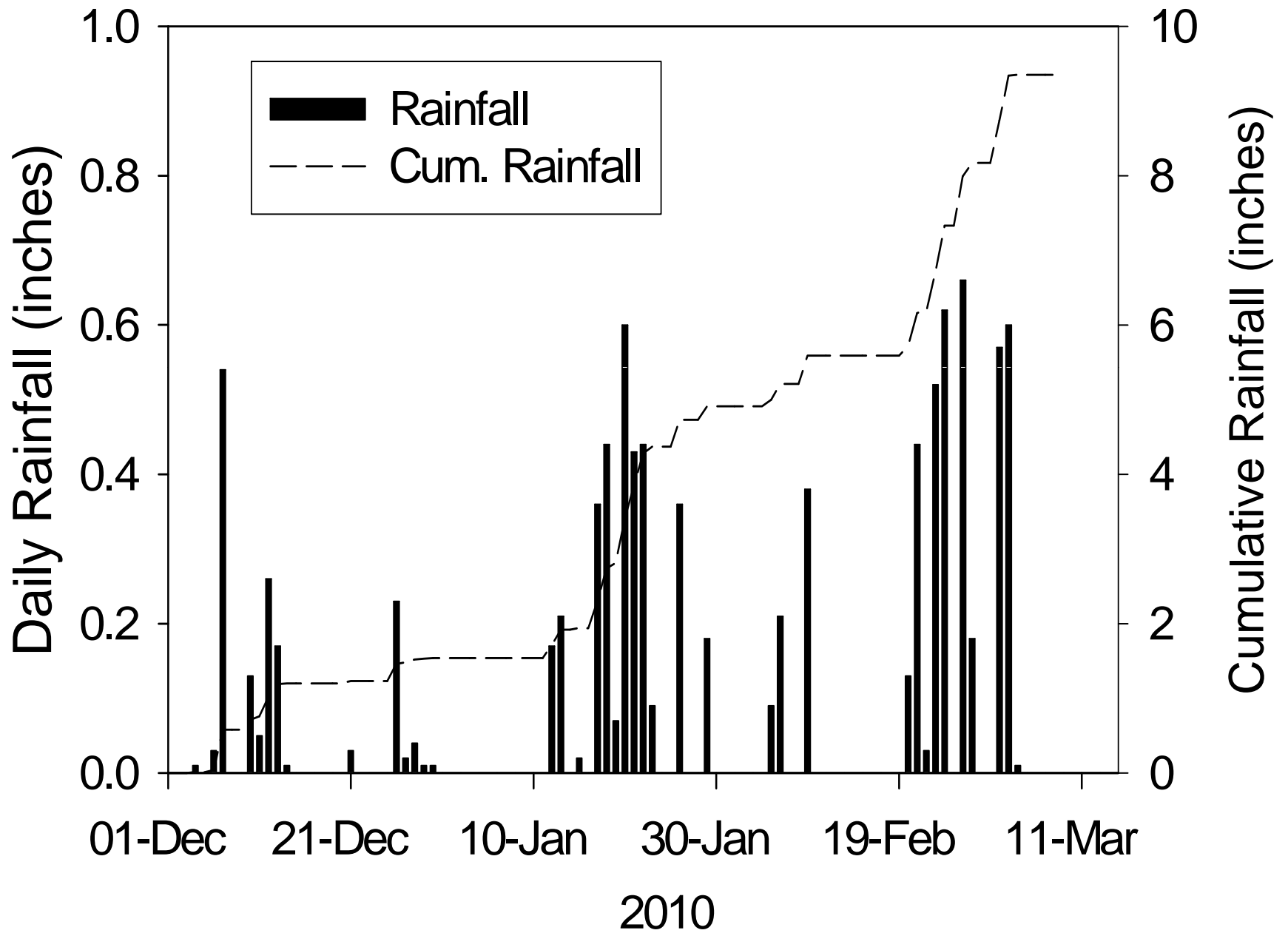


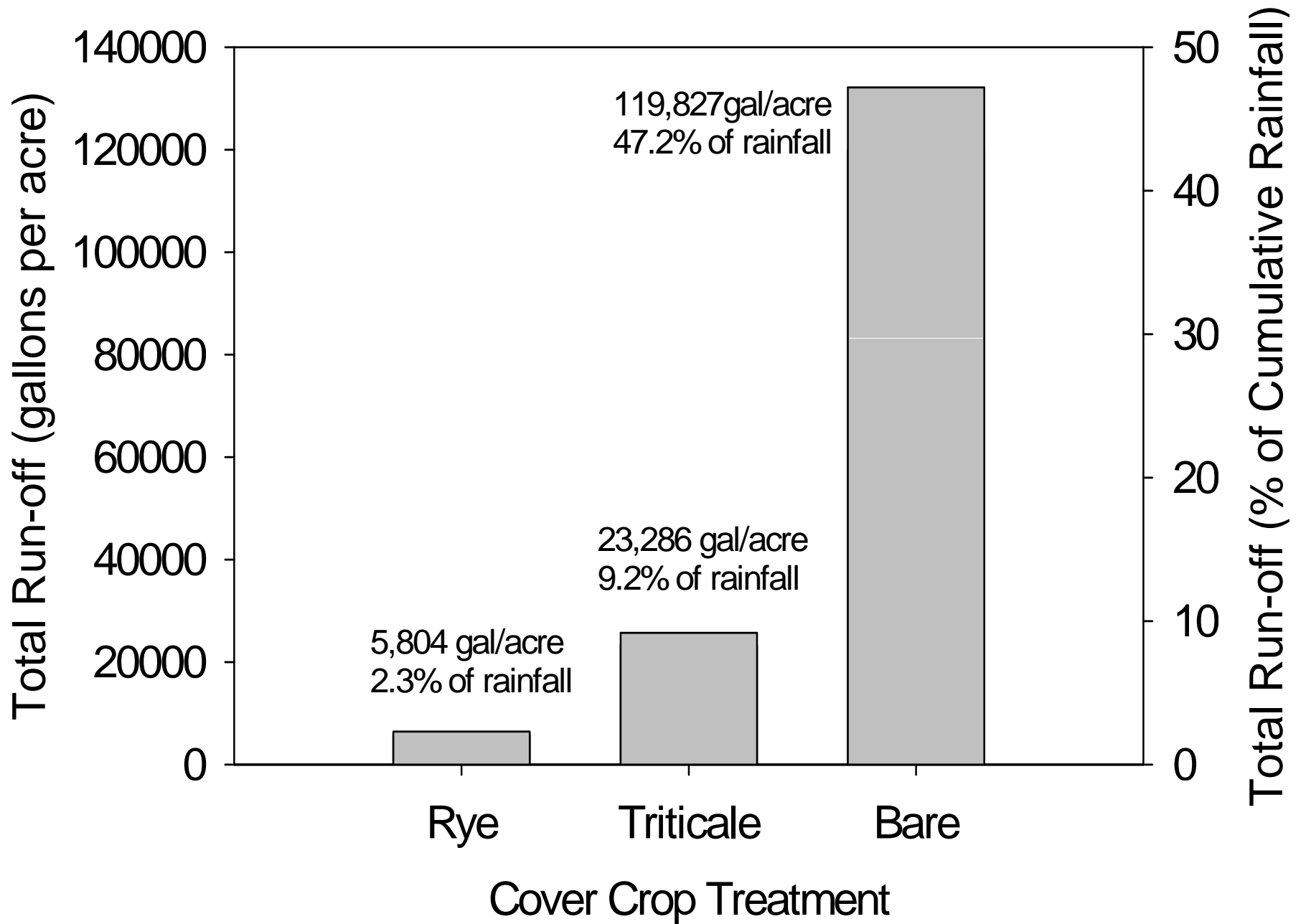


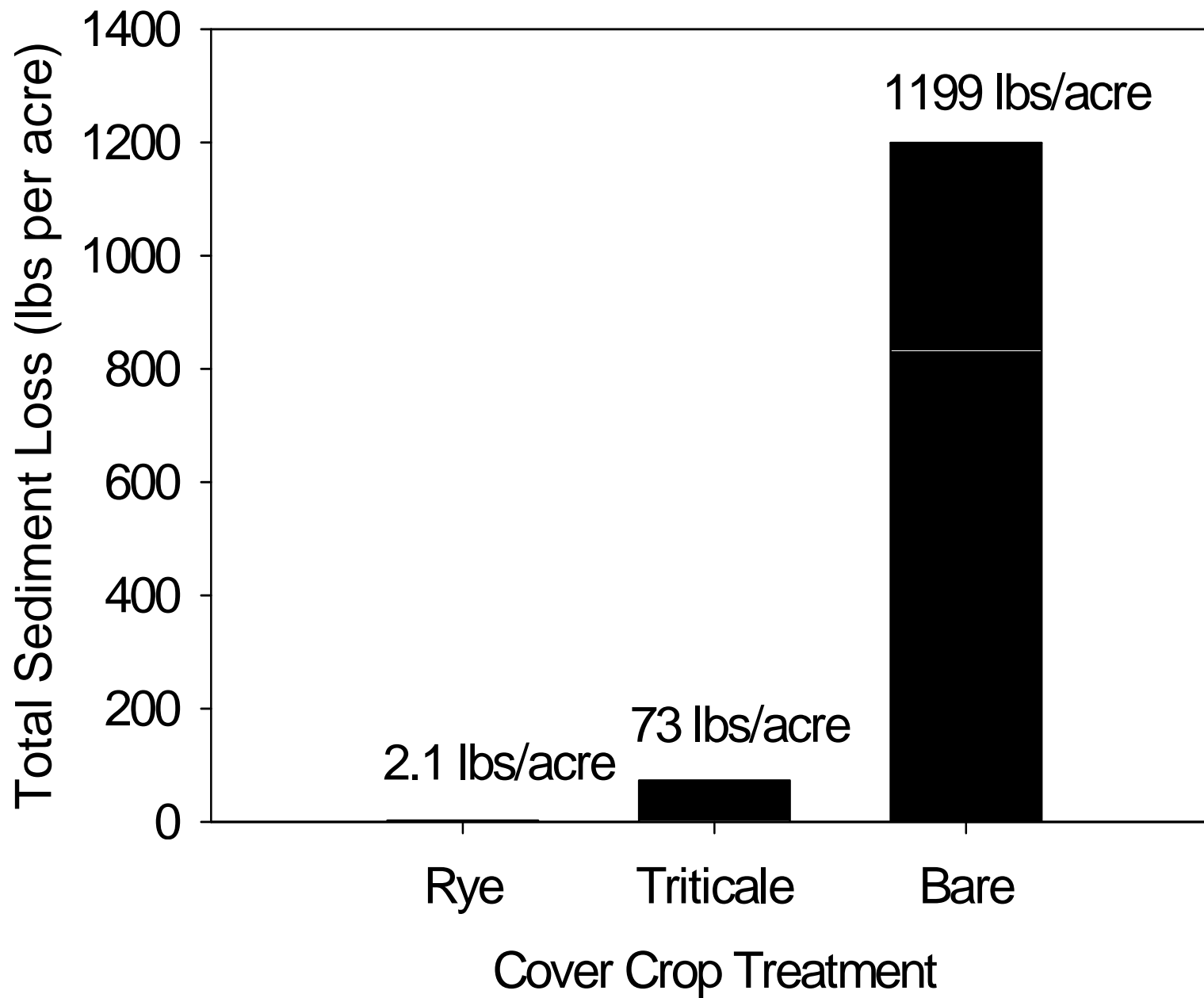
# Nitrogen and Low Residue Cover Crops

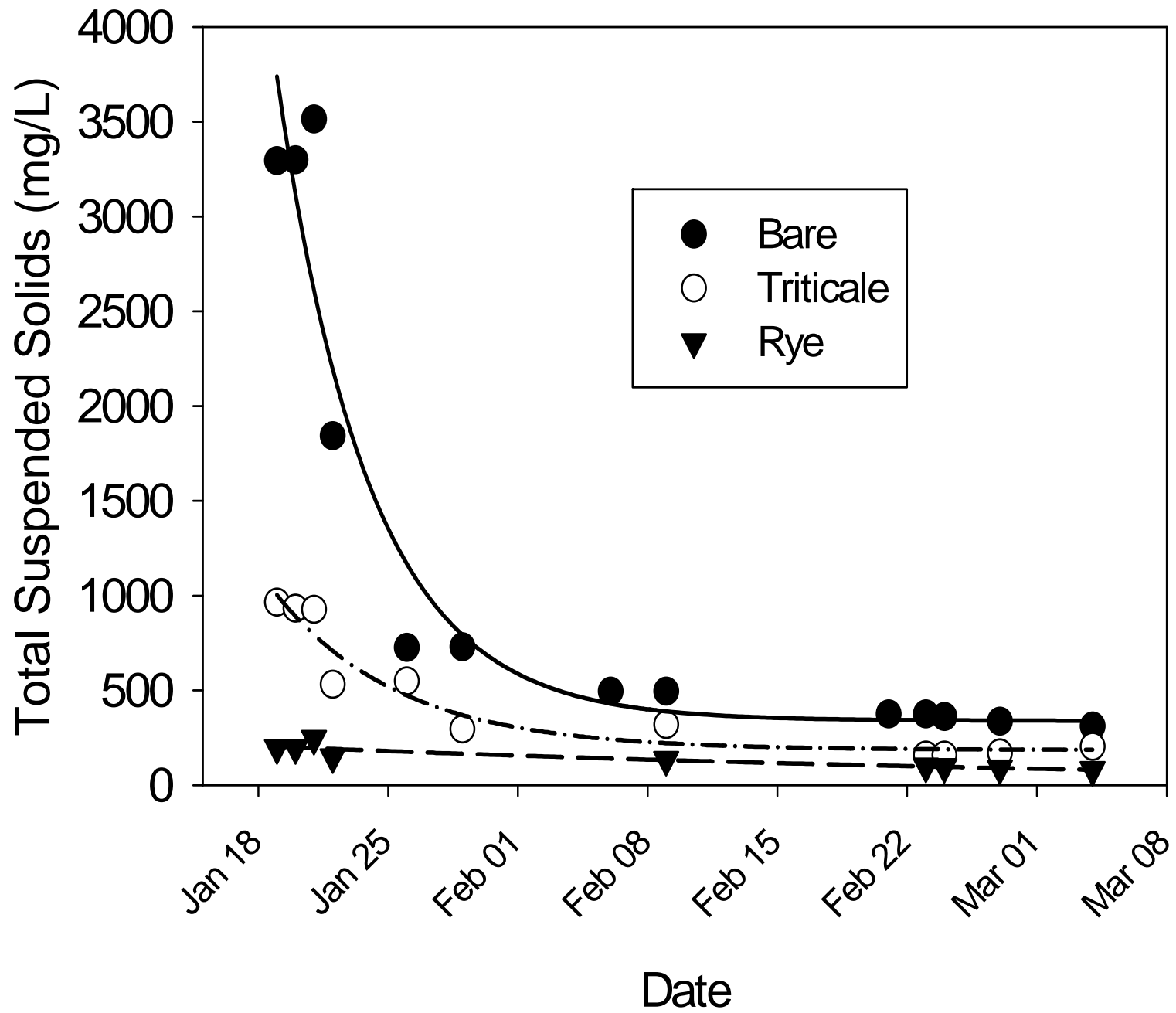
- Low residue cover crops do not sequester as much nitrogen as full-term cover crops
- They also begin to “leak” the nitrogen quickly after killing







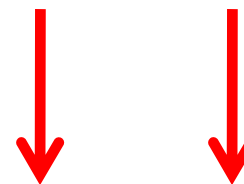




# Nutrient Loss in Surface Water from Cover Crop Treatments

Treatment	Total N	Ammonium-N	Nitrate-N	Soluble-P	Total P	K
	----- lbs/acre -----					
Rye	0.21	0.05	0.04	0.17	0.20	0.80
Triticale	0.60	0.05	0.03	0.24	0.47	1.30
Control	4.78	0.12	0.49	1.06	3.71	4.12
	----- % reduction in loss compared to control -----					
Rye	96	59	92	84	95	81
Triticale	87	58	93	78	87	69

# Leached Ions in Cover Crop Treatments (lbs/A)



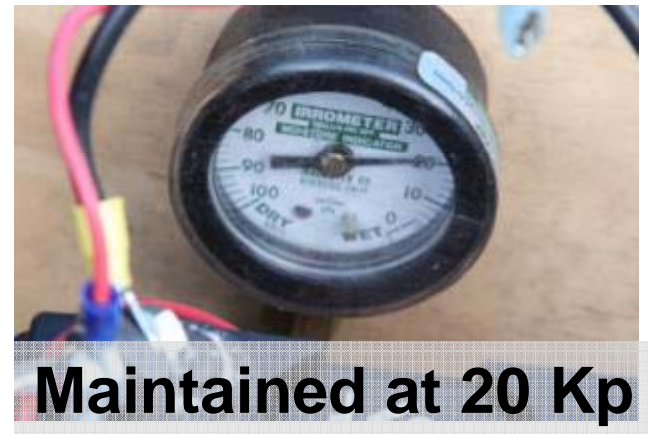
Treatment	Potassium	Calcium	Magnesium	Sodium	Chloride	Sulfate	Nitrate
Bare fallow	9	133	32	88	158	36	69
Low residue Triticale Trios 102	18	216	55	178	275	60	110
Low residue Rye AGS 104	16	226	63	191	289	69	111

# Leached Ions in Cover Crop Treatments (lbs/A)

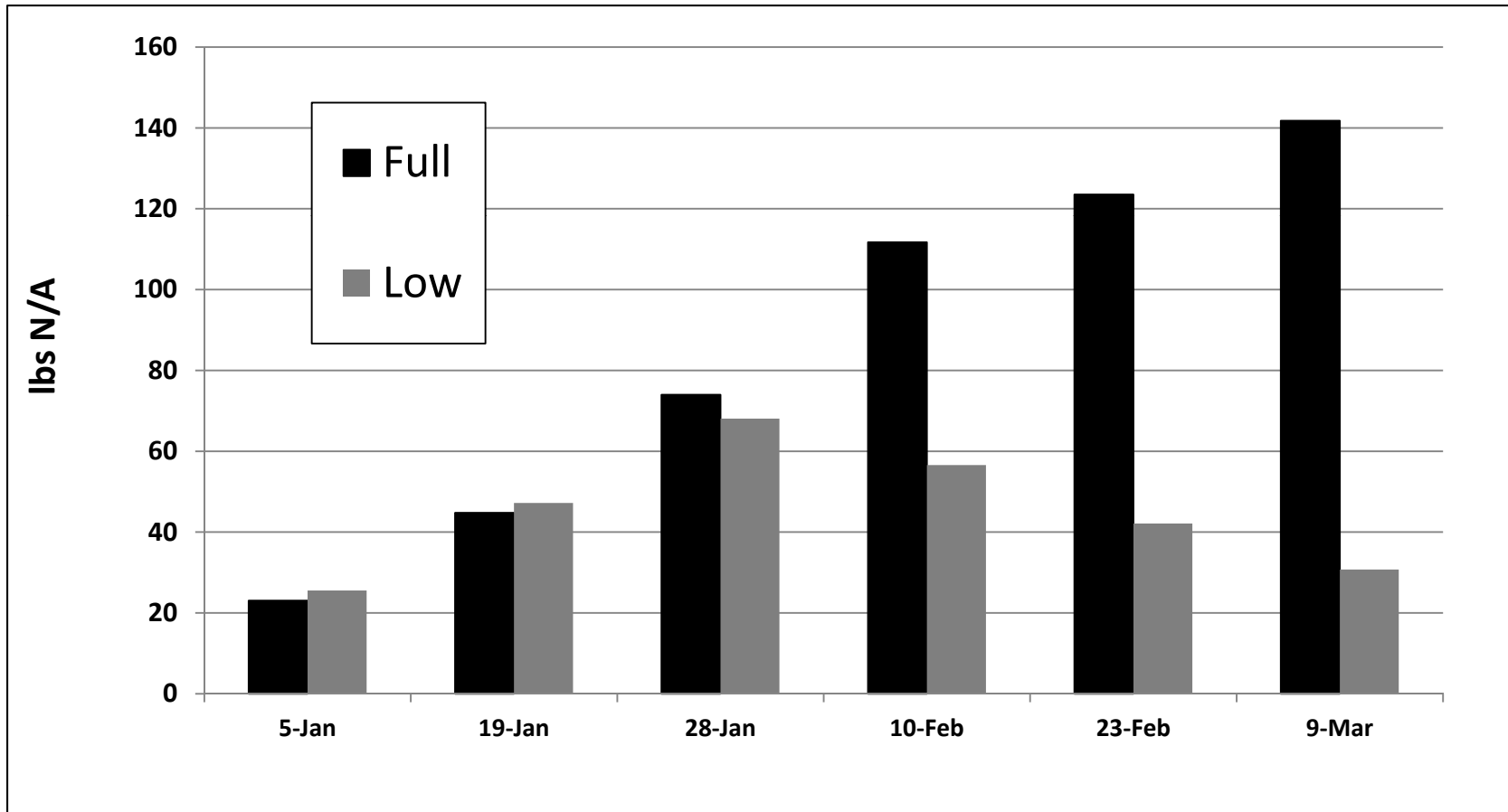


Treatment	Potassium	Calcium	Magnesium	Sodium	Chloride	Sulfate	Nitrate
Bare fallow	9	133	32	88	158	36	69
Low residue Triticale Trios 102	18	216	55	178	275	60	110
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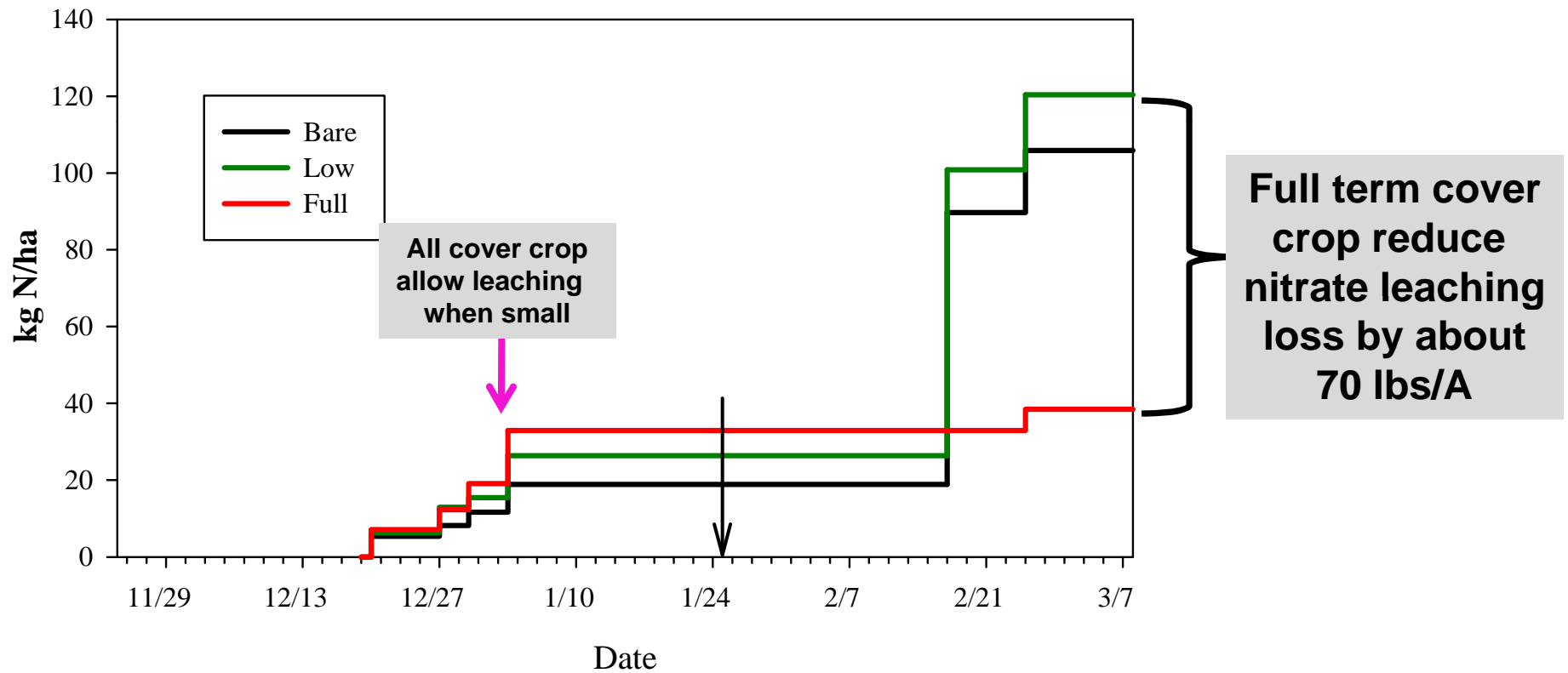
# Nitrate Leaching from Full-term and Low-residue Cover Crops



# Nitrogen in Cover Crop Biomass pounds/A



# Low Residue Cover Crop Have Minimal Effect on Nitrate Leaching



# Problems Encountered on 80-inch Beds in 2010 – 2011 Trial



- **Adjacent strawberry field**
- **Needed to use a grass selective herbicide, but it killed the cover crop very slowly**
- **Did not kill broadleaf weeds which later became problems**
- **Dry weather reduced residue decomposition**

# Problems Encountered on 80-inch Beds in 2011



- As a result, the trial was terminated early in order for the grower to be able to prepare the beds and stay on his planting schedule
- This was an important lesson on what can go wrong

# Ways to Resolve the Problems



- 40-inch beds should be the focus of this practice
- If planting on 80-inch beds, just plant the furrow bottom
- Do not plant seed too deep
- Aggressively manage weeds
- Kill cover crop on time

# Costs

Treatment	Seed cost	Cultivation for weed control <sup>2</sup>	Glyphosate @ 1 gallon/A	Glyphosate application \$/A	Total Cost/A
Bare	0.0	17.0	0.0	0.0	17.0
Triticale '888'	41.0	0.0	40.0	20.0	101.0
Rye 'AG104'	44.1	0.0	40.0	20.0	104.1

# **Conclusions and Recommendations**

- **Low residue cover crops are able to significantly reduce surface water runoff, sediment and nutrient loss during in surface water during winter storm events**
- **Target this technique to soils with high runoff and sediment loss potential (e.g. eastside of the Salinas Valley)**
- **They greatly increased water infiltration into the soil, thereby providing a cultural practice that can increase ground water recharge and move accumulated salts out of the soil profile**
- **Establish as early as possible to provide protection from early rains**

# **Conclusions and Recommendations**

- **They must be killed before they produce too much biomass that would disrupt subsequent planting operations – keep in mind that once killed they still provide effective sediment loss reduction and increased infiltration for a good amount of time**
- **They are only able to accumulate moderate amounts of nitrate from the soil and may not reduce nitrate leaching in storms later in the cover crop growth cycle**

# Conclusions and Recommendations

- **Planting cover crops just in the furrow bottom may be the safest approach to using these cover crops so that they do not disrupt subsequent vegetable planting operations (especially true on 80 inch beds)**
- **Furrow bottom plantings on 40 inch beds occupy about 1/3 of the area of the field, and you can calculate your seeding rate accordingly**
- **However, given the difficulties of planting the furrow, it is advisable to a higher seeding rate to get an adequate plant population and early ground cover**

# **Acknowledgements**

- **Monterey Community Foundation**
- **California Department of Food and Agriculture, Fertilizer Research and Education Program**
- **D'Arrigo Brothers and Sea Mist Farms**

Go to YouTube and type in "Cover Crops Salinas"



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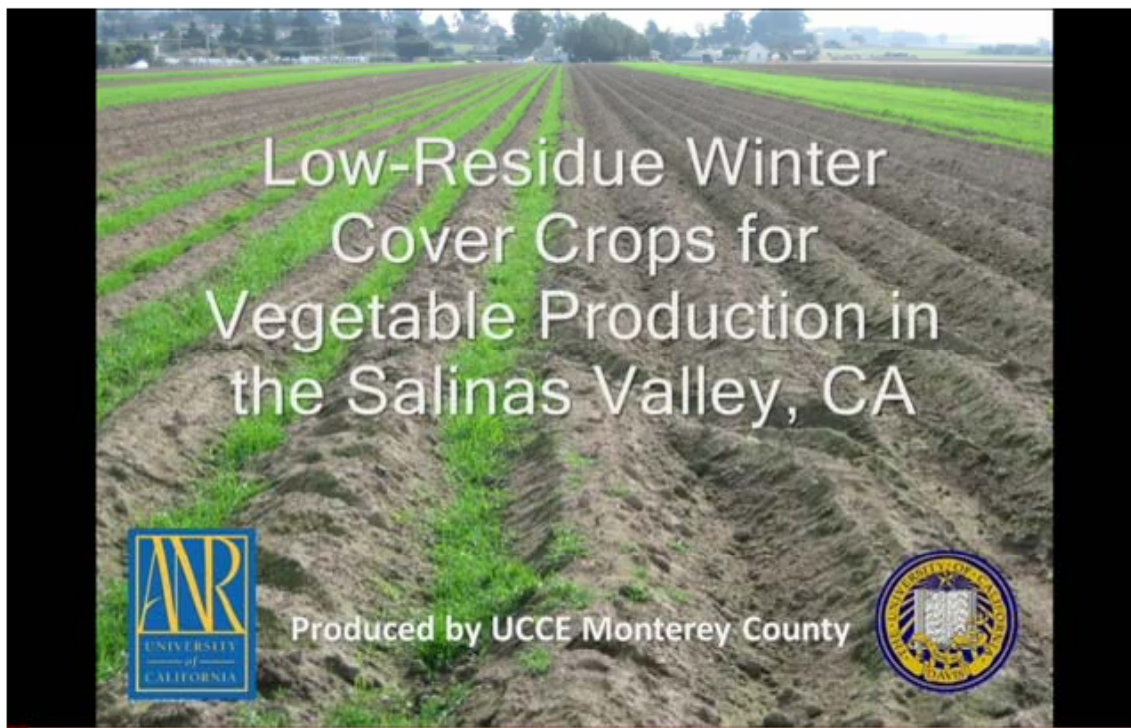
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### Low-residue crop trial

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#### Suggestions



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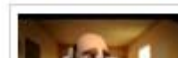
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