

# **Practical Soil Nitrate Testing and Fertilizer Management**

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# **New Reality of Growing Cool Season Vegetables in Salinas**

- **Global fluctuations in fertilizer prices**
- **Less public understanding and sympathy to grower's issues**
- **More public pressure pushing for tighter restrictions in growing crops:**
  - **RWQCB Staff recommendations for the Conditional Waiver**

**PRELIMINARY DRAFT  
STAFF RECOMMENDATIONS  
FOR AN  
AGRICULTURAL ORDER**

**CONDITIONALLY WAIVING INDIVIDUAL WASTE  
DISCHARGE REQUIREMENTS  
FOR DISCHARGES  
FROM IRRIGATED LANDS**

**Preliminary Draft Report**

**CENTRAL COAST REGIONAL  
WATER QUALITY CONTROL BOARD**

*February 1, 2010*



**Listed nitrate  
from agriculture  
as key source  
of pollution  
of local surface  
and ground waters**

## FARMING CLOSER TO THE EDGE

Richard Smith, Michael Cahn and Tim Hartz, University of California Farm Advisors  
Monterey County and Extension Vegetable Specialist, UC, Davis.

This year we observed that vegetable producers on the Central Coast, confronted with economic and regulatory challenges, are rethinking their fertilization practices. Specifically the spike in fertilizer prices in 2008 caused growers to consider reducing rates of nitrogen (N), phosphorus (P) and potassium (K) fertilizers to minimize costs. In addition, proposed changes to the conditional agricultural discharge waiver proposed by the Regional Water Quality Control Board may

annually with standard soil tests. In the vegetable production areas of the central coast, soil pH values are generally above 6.2 and the Olsen bicarbonate extractions test is the appropriate test for evaluating soil P status. Table 2 shows adequacy values for P. Soil P is less available when soils are cold during winter and early spring and at planting applications of low rates of P such as 20-30 lbs/A of P<sub>2</sub>O<sub>5</sub> may improve growth of lettuce. These low rates are equal to the amount of P that is removed by a lettuce crop and de-

**Monterey County Crop Notes  
July/August, 2009**

# Issues Affecting the Adoption of Strategies to Farm Closer to the Edge

## May Slow Adoption


- High value of lettuce
- Relatively low cost of nitrogen fertilizer
- Traditional fertilizer programs (tried and true)

## May Increase Adoption

- 2008 Spike in fertilizer prices
- 2010 Draft Recommendations to the Regional Water Quality Control Board

# Fertilizer Costs for Romaine Lettuce

Six row 80-inch beds\*

Application	Costs/A
<b>At listing in fall</b> 8-8-8 <u>50 lbs N/A</u>	<b>220</b>
<b>Anti crustant</b> <u>20 lbs N/A</u>	<b>127</b>
<b>Sidedress</b> UN 32 <u>120 lbs N/A</u>	 <b>77</b> <3% of production costs
<b>Total</b>	<b>\$424</b>

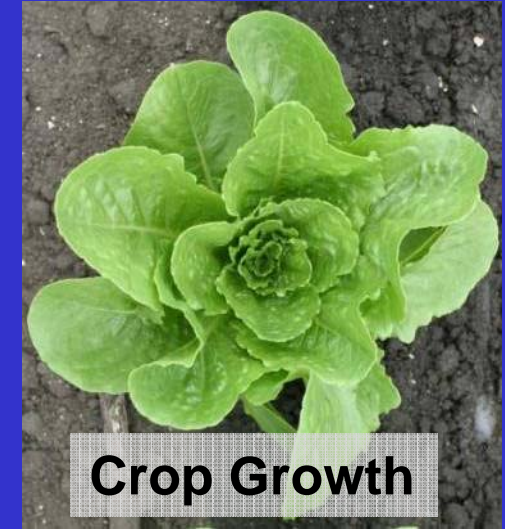
\*2009 Sample Costs to Produce Romaine Hearts



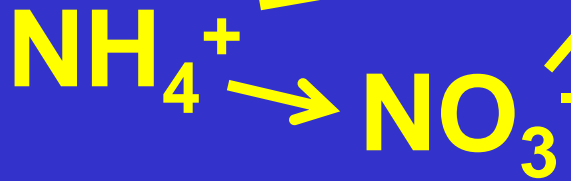
Crop Residue

# Fertilizer

Urea,  $\text{NH}_4^+$ ,  $\text{NO}_3^-$



Crop Growth



Organic Matter  
1000 – 3000 lbs N/A

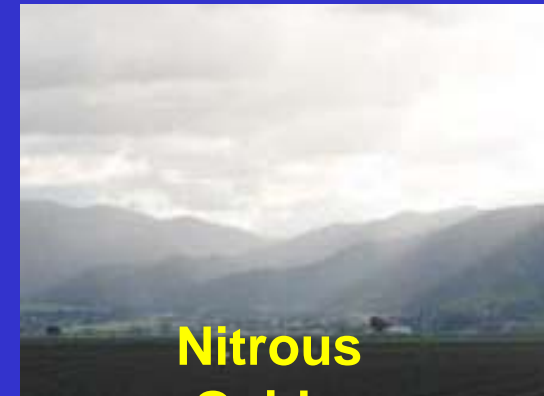
## Nitrate Losses



Runoff



Ground Water



Nitrous Oxide

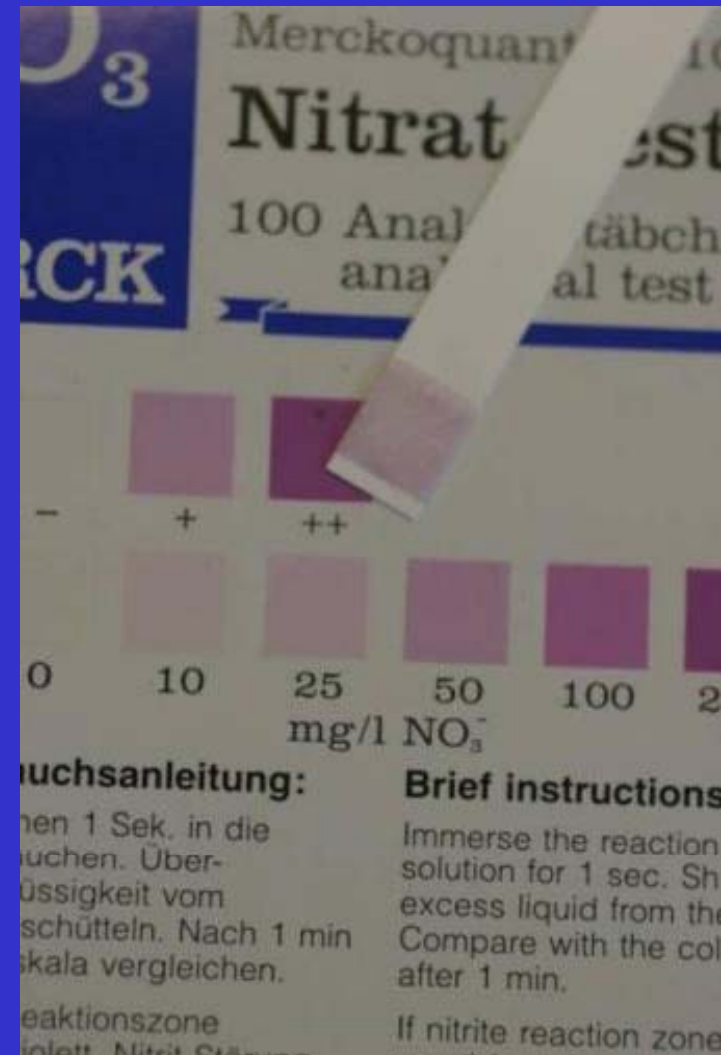
# Other Issues

- **Lettuce is a relatively shallow rooted crop that can be an inefficient user of fertilizer N**
- **High nitrogen uptake over 30 days (post thinning to harvest)**
- **Nitrate is highly leachable**
- **Irrigation efficiency is key for reducing nitrate leaching**
- **Lack of good deep rooted winter rotations that can utilize residual nitrogen**

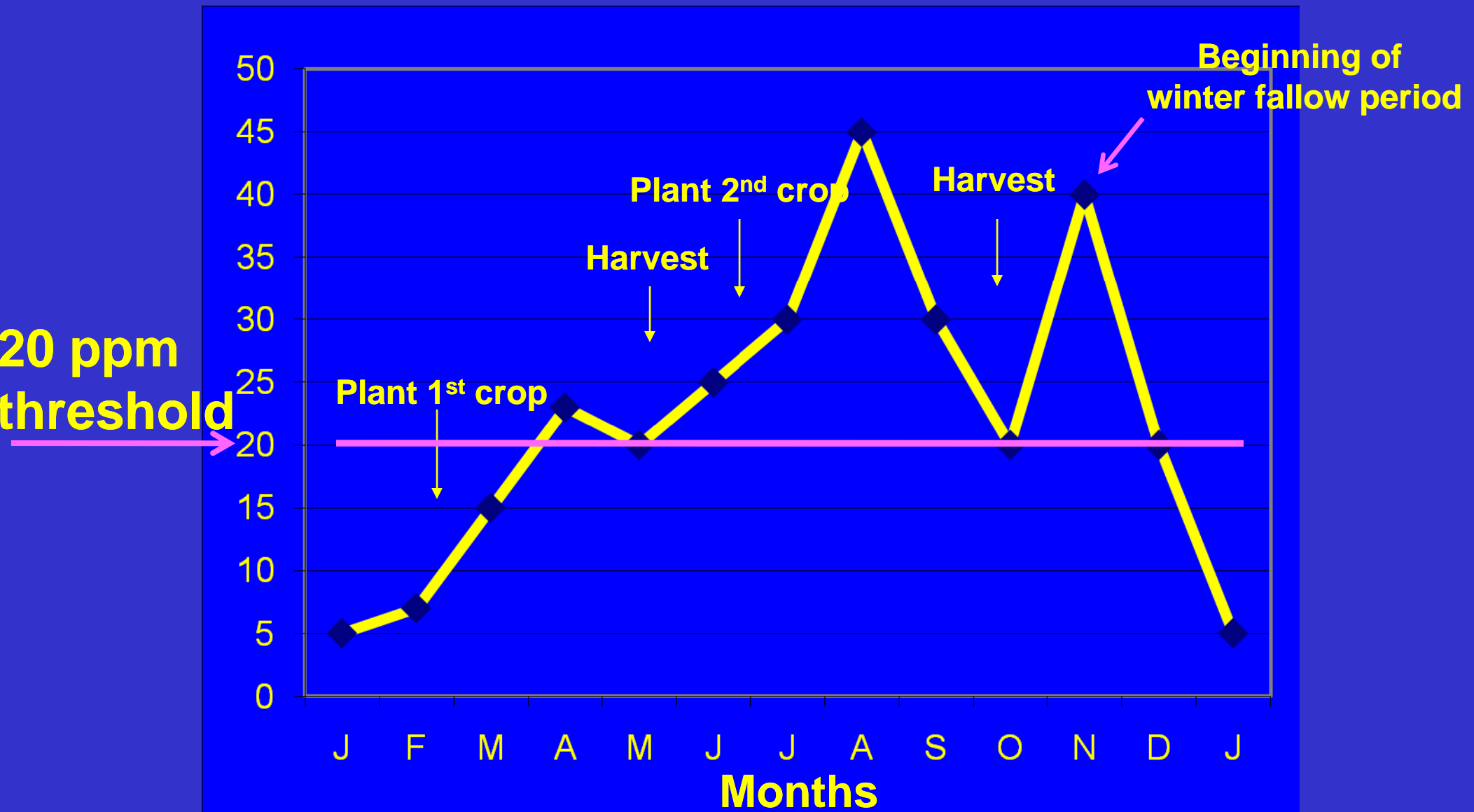


- **Conducted five commercial scale trials with Mike Cahn over the last two years**
- **We measured the impact of irrigation and fertilizer application on nitrate-N nutrition of the crop**
- **Through these trials I became a grower and struggled with many of the issues that you might deal with in making fertilizer decisions based on measurements of residual soil nitrate**

# Accounting for Residual Nitrogen



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

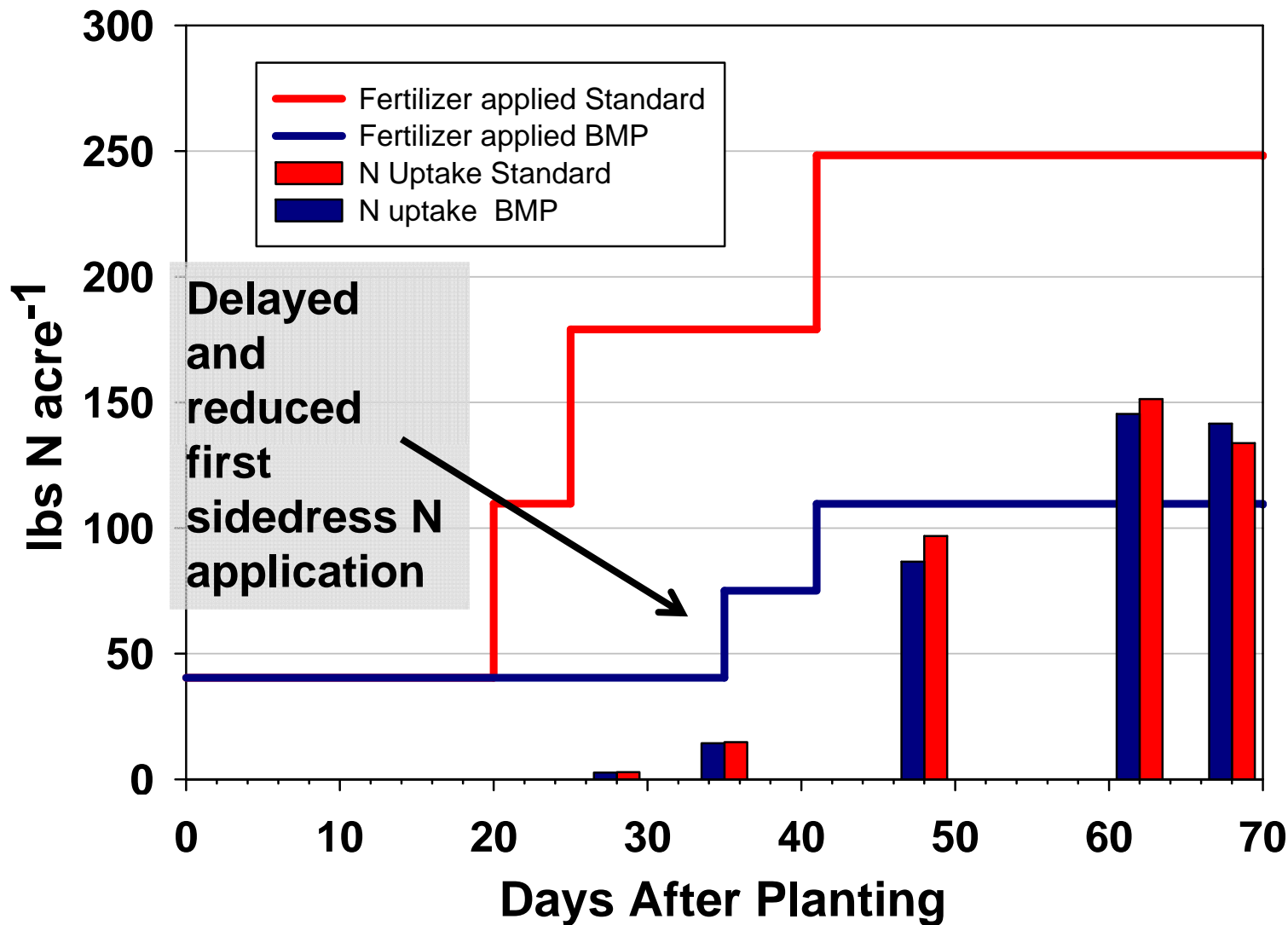


Smith and Schulbach, 1996

# Nitrogen Uptake Patterns

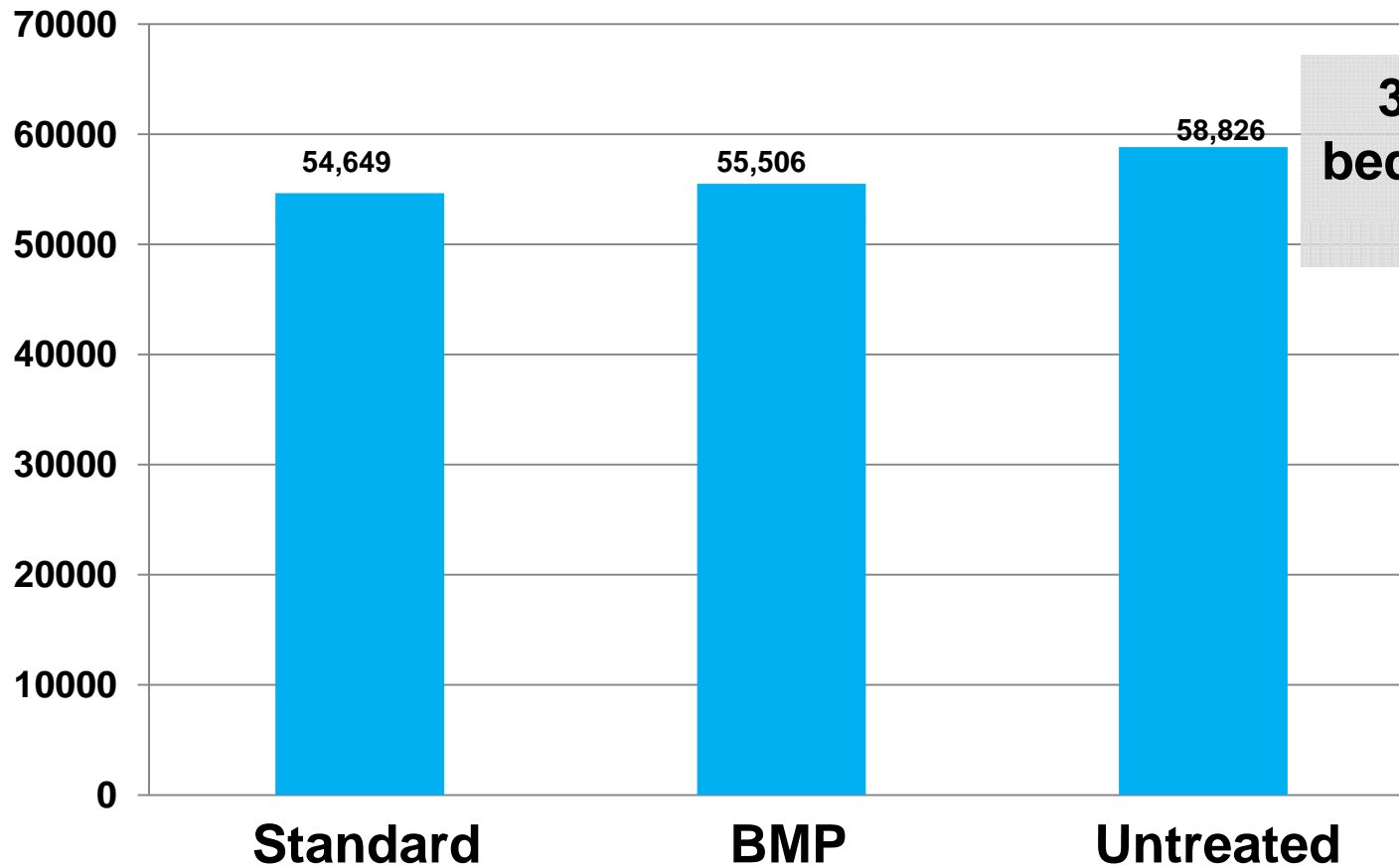
- **Lettuce at thinning (app. 30 days after planting) contained only 5-8 lbs N/A**
- **Relying on the nitrate quick test gave good confidence in the need for fertilizer needs at that growth stage**
- **We were able to reduce and delay initial nitrogen applications without jeopardizing yields**

# 2008 Trial No. 1 – Second Crop



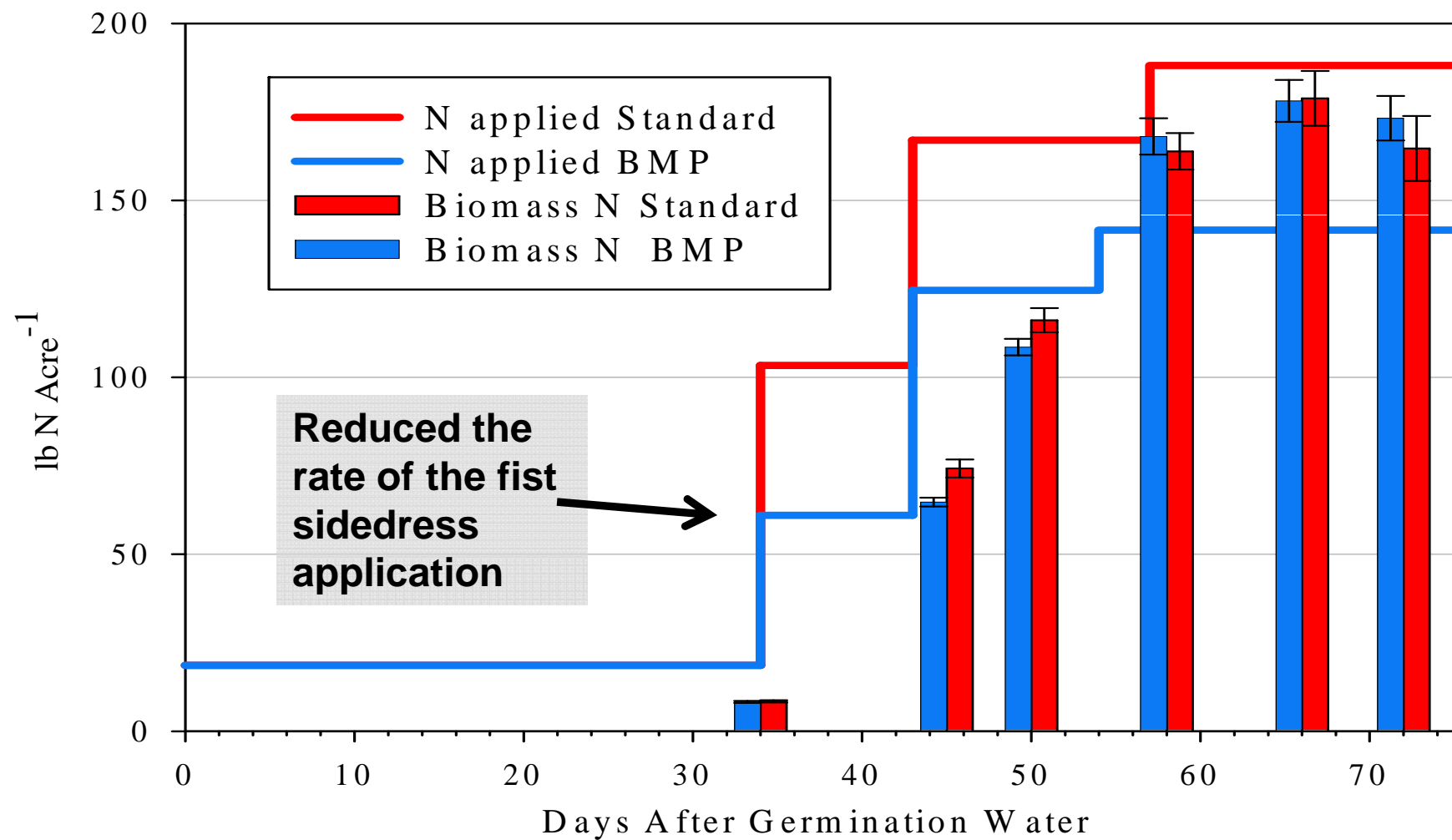
Given levels of residual nitrate, we probably could have eliminated all sidedress applications but I chose the cautious route of simply cutting back on nitrogen applications

# Cored Head Lettuce Yield lbs/A



3 80-inch  
beds x length  
of field

# 2009 Trial No. 1 – First Crop



# 2009 Trial No. 1

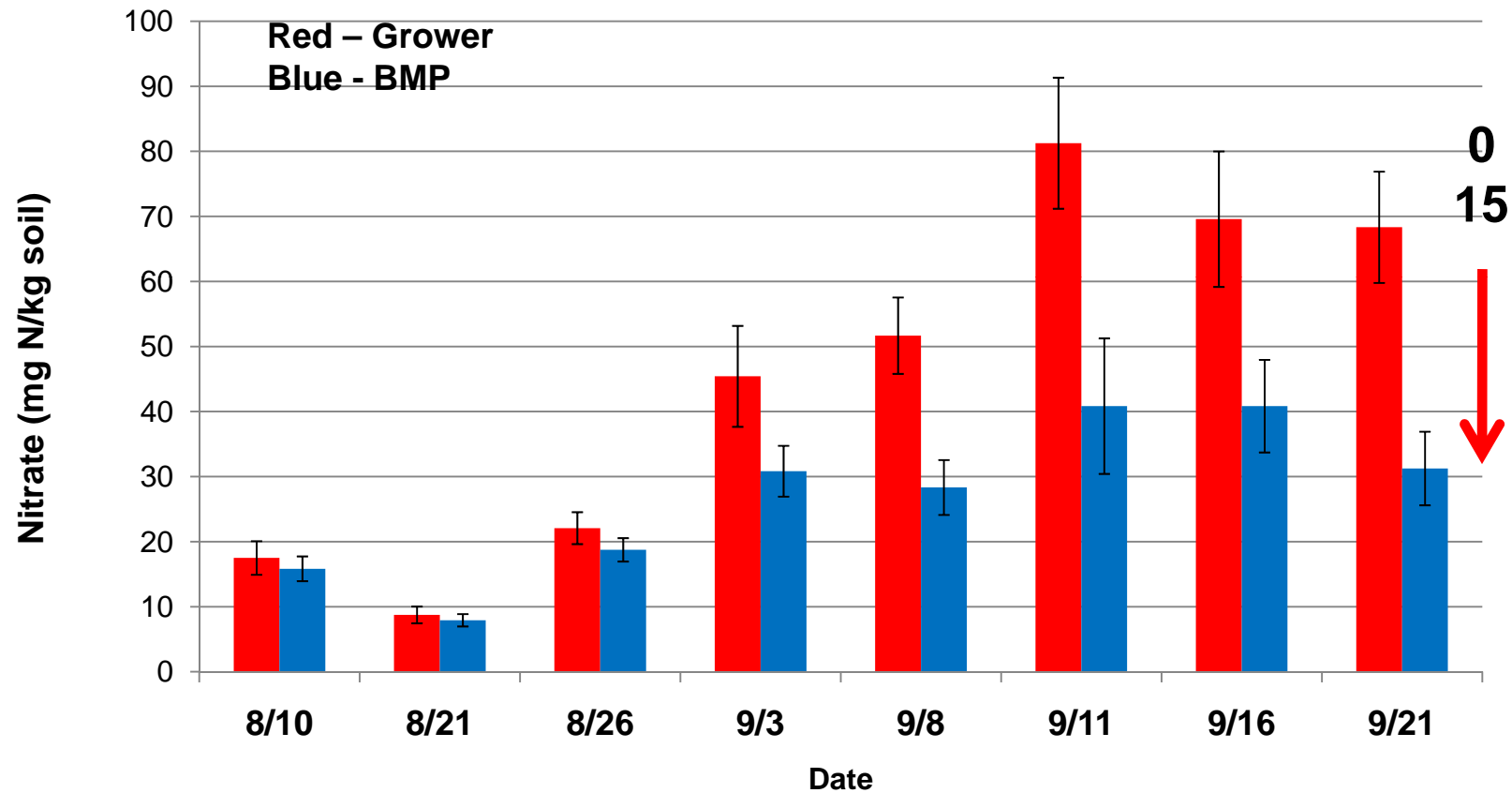
Treatment	Fertilizer N lbs/A			Total N Applied Lbs/A	Commercial Yield CFR Lbs/A
	Thinning	Early Rosette	Heading		
Grower	84.8	63.6	21.1	188.1	59,953
BMP	42.4	63.6	17.0	141.6	58,999



# Struggling with Whether to or Not to Fertilizer

- Trial No. 2 in 2009 had lower N levels in one part of the field
- May have been due to irrigation uniformity issues (more water being applied closer to the valve and possibly more leaching as a result)

# 2009 Trial No. 2 - Second Crop



# Getting Started with Managing N Fertilization Based on the Quick Tests

- Pick fields and do some trials in 2010
- Start with a 12 or 16 bed wide strip so that you can get harvest data
- Get someone that is conscientious about taking good samples and that can get the information to the decision make in a timely fashion

# Getting Started with Managing N Fertilization Based on the Quick Tests

- The key will be building a decision making structure into your operation so that the information can be efficiently incorporated into your daily operations
- It may be that the current pest management model (PCA/Grower/Forman) may be the way to effectively handle these big decisions

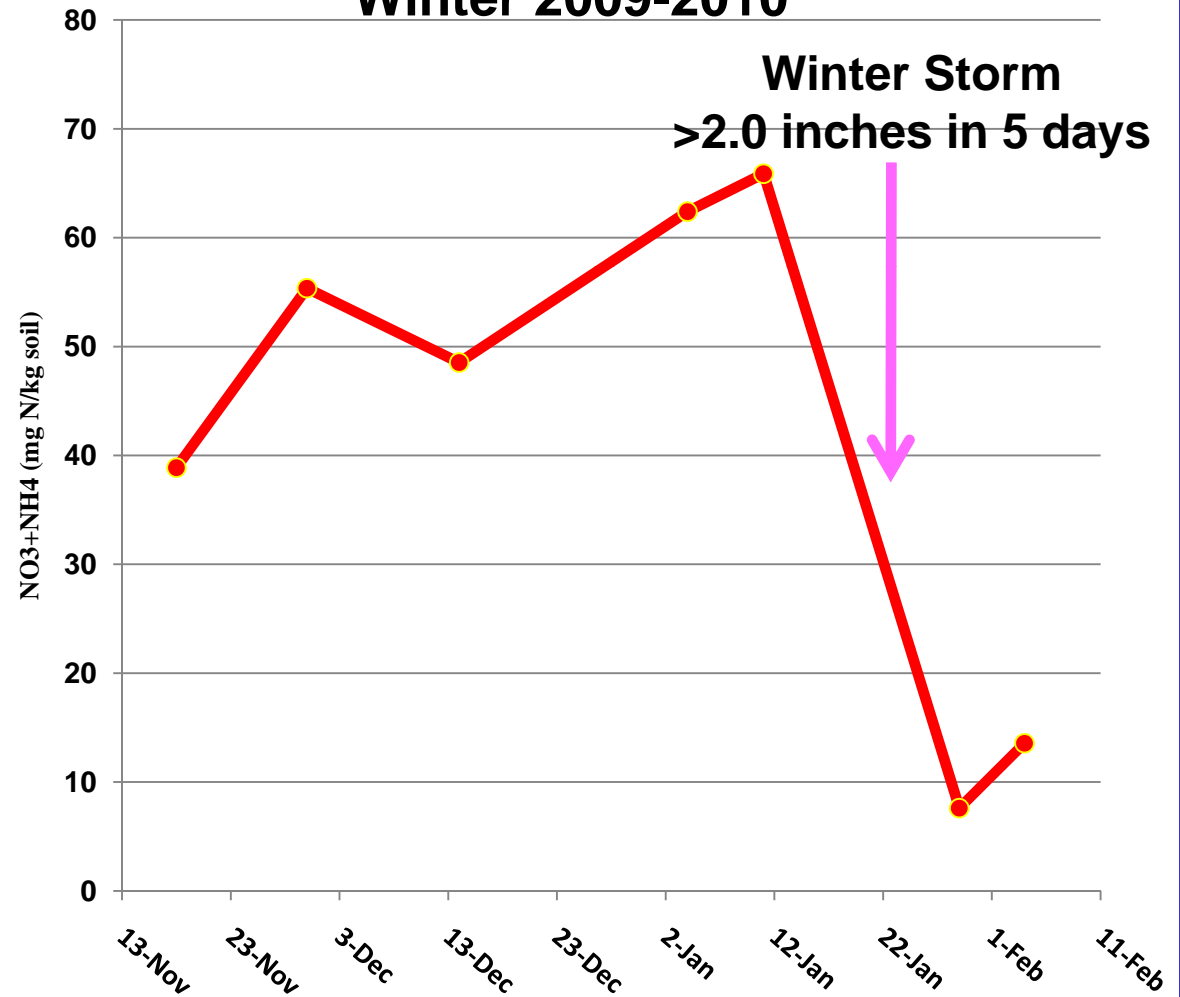
# Other Low Hanging Fruit

- **Fall applied nitrogen to fallow beds**

# Fate of Fall Applied Nitrogen to Fallow Beds



Mineral Nitrogen in Top Foot of Soil  
Winter 2009-2010



# Fall applied nitrogen to fallow beds

- Applying nitrogen in the fall is waste of money and should be minimized as much as possible

# Loss of Nitrate-N by Leaching During the Irrigation Season

One Irrigation Event 27 Days After Planting

Treatment	Applied water inch	Percolation inch	Nitrate-N Concentration in Leachate - ppm	Nitrogen loss Lbs N/A	Value of leached nitrogen
Standard	3.5	2.1	104.9	41.8	\$26
BMP	2.4	1.2	116.4	12.6	\$8



# How to Pay for the Expense of Soil Testing and Management

- Over five trials we saved an average of \$32/crop in reduced sidedress nitrogen fertilizer applications
- Fall applied fertilizer can be expensive
- Reductions in leaching can save \$\$
- The AWEPP Program may provide a means to get started in nitrate testing

# Summary

- **Over five commercial trials we reduced nitrogen fertilizer applications by 55 lbs/crop**
- **In four of five trials the yields of the BMP treatments were comparable with the standard practice**
- **These trials point to ways that growers can farm with a leaner nitrogen budget without jeopardizing yield**