Update on Nitrogen Management Field Studies with Strawberries and Leafy Vegetables

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Background / Overview

- *Nitrogen has a major effect on vigor, production and harvest quality of fruits and vegetables.*
- *Historically, rates of application and need for high N utilization efficiency not important because of low cost.*
- *Cheap insurance and ample application considered inexpensive insurance.*

Background / Overview

- *N considered a contaminant in ground and surface waters*
- *Spikes in N costs – closely tied to energy cost*
- *Organic N sources for organic production are always expensive and uncertain.*

Situation

- *Negatively charged nitrate molecule most abundant in agricultural fields and moves freely with water*
  to manage N need to manage fertilization and water

- *Measure 15 ppm soil nitrate N on a dry soil basis*
  = 3 – 5 TIMES that amount in solution – so root zone and effluent concentration is much higher than measure of soil N

- *Need to match N application to crop need*
  total and timing of application

Managing Nitrogen Efficiency?

- *Optimize N loading at the field end*
- *Minimize water leaving the root zone*


07/29/2009

Strawberry Study -2008- 09

Albion Variety

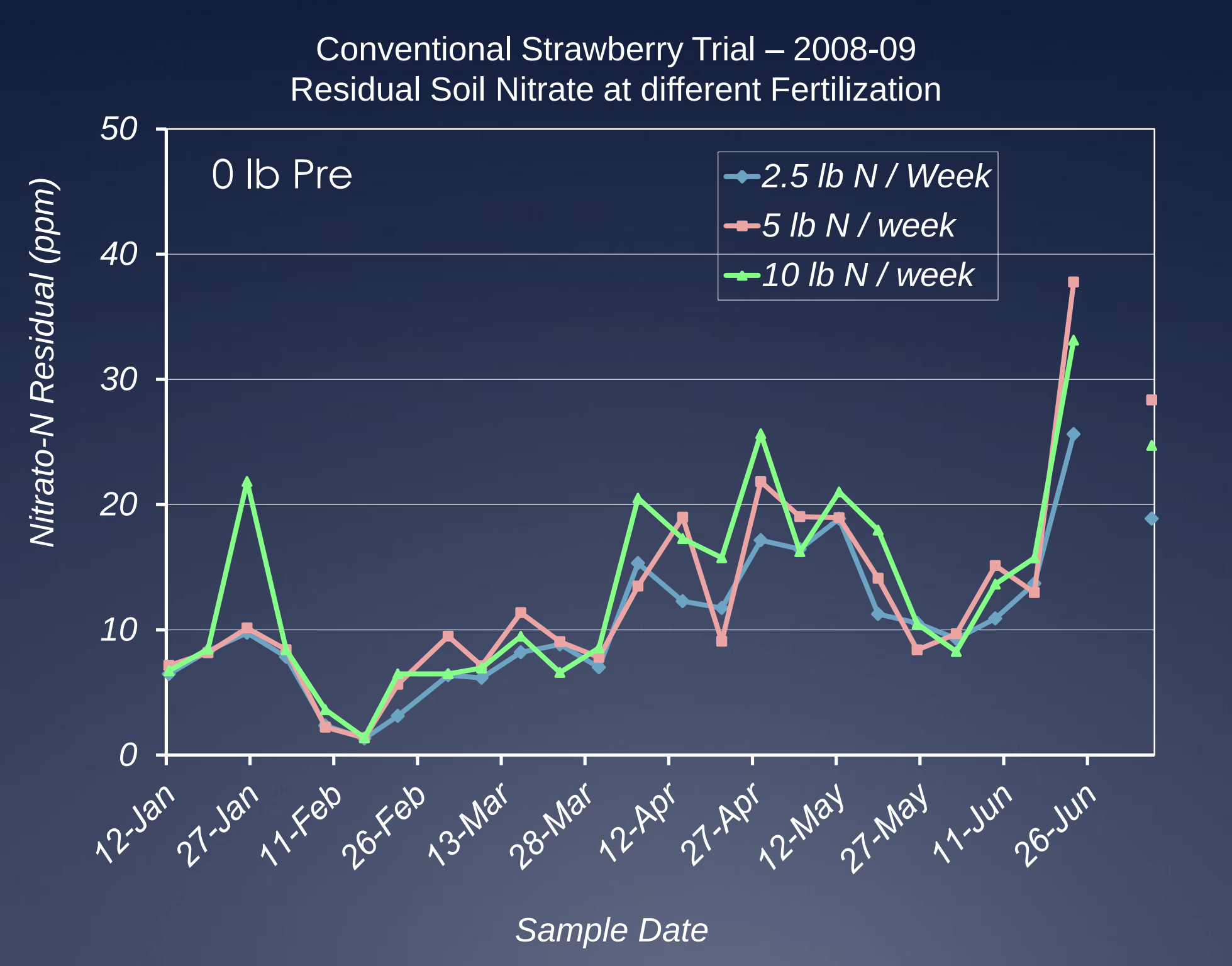
Three Pre plant CR N rates

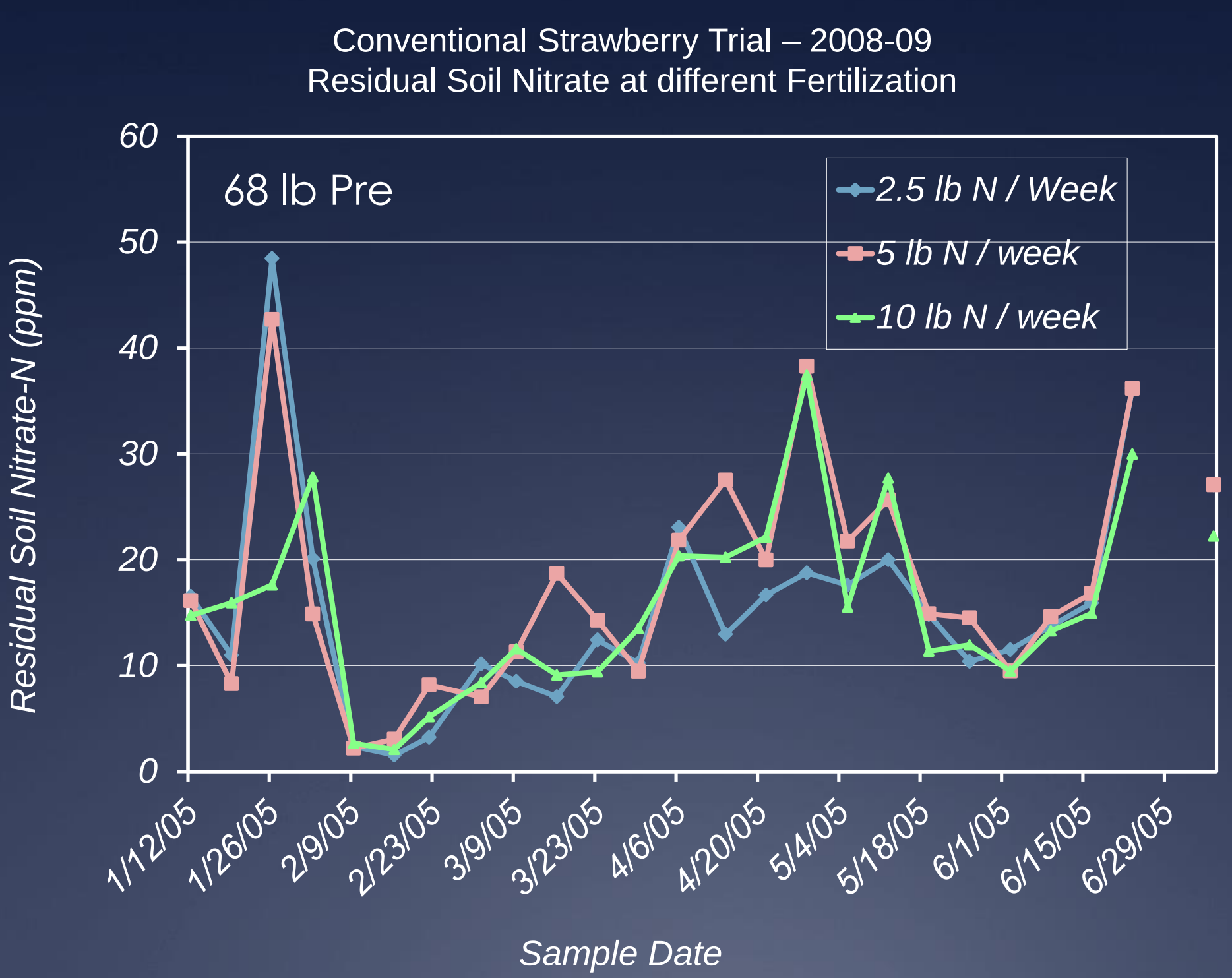
- *0*
- *65 lb N (350 lb / A 18-4-8)*
- *130 lb N (700 lb / A 18-4-8)*

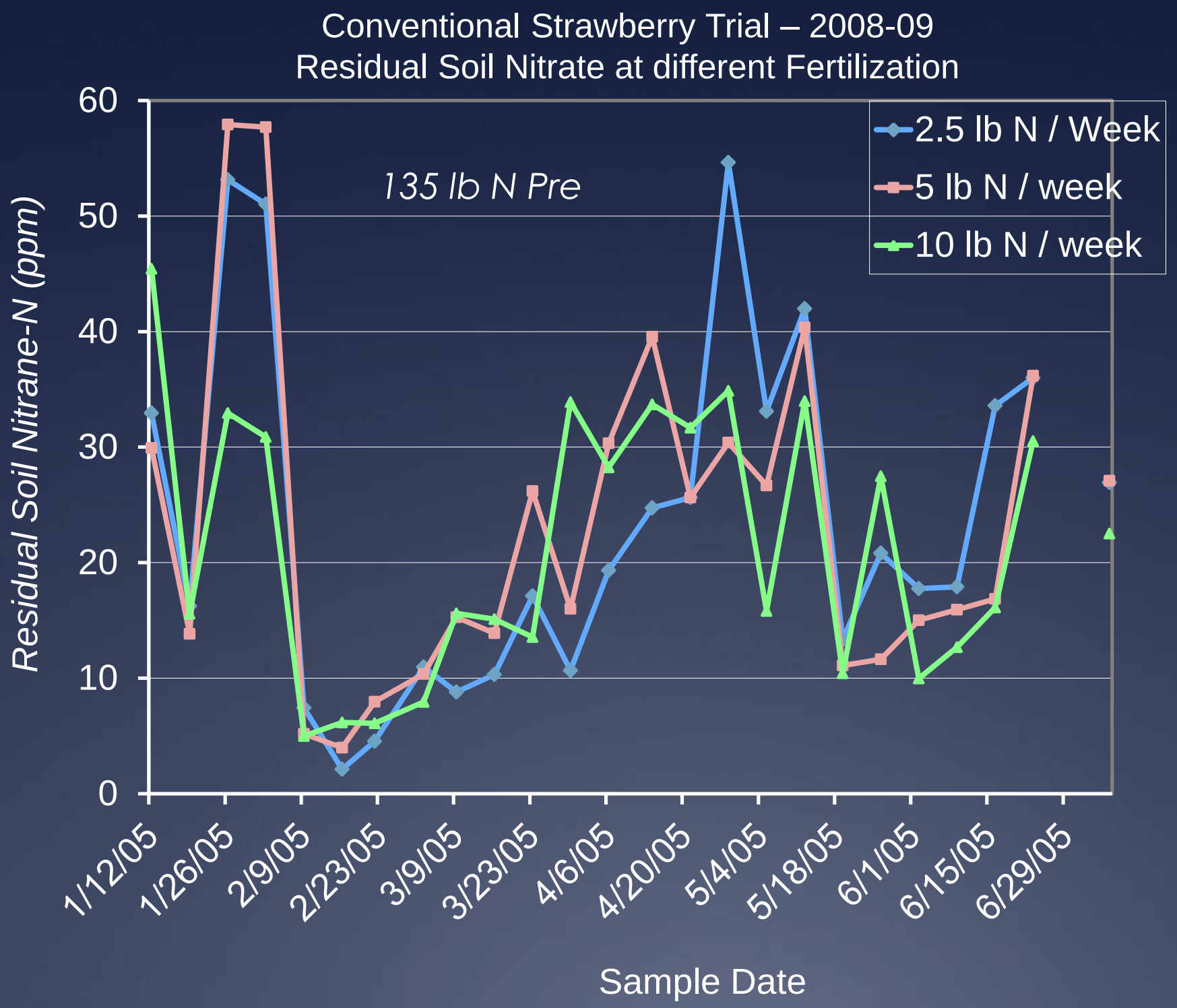
Weekly Applications of 2.5, 5, 10 lb N

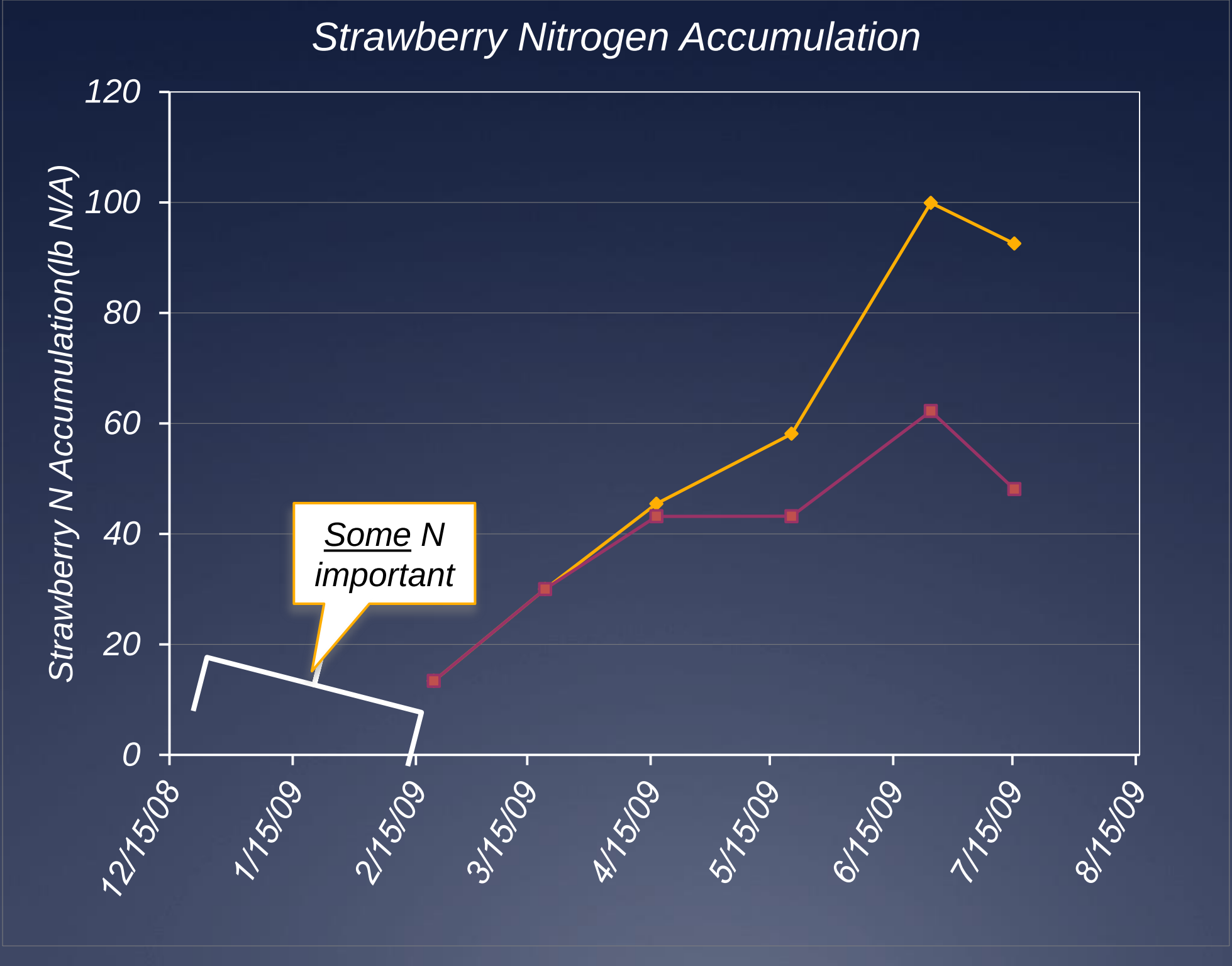
Measures:

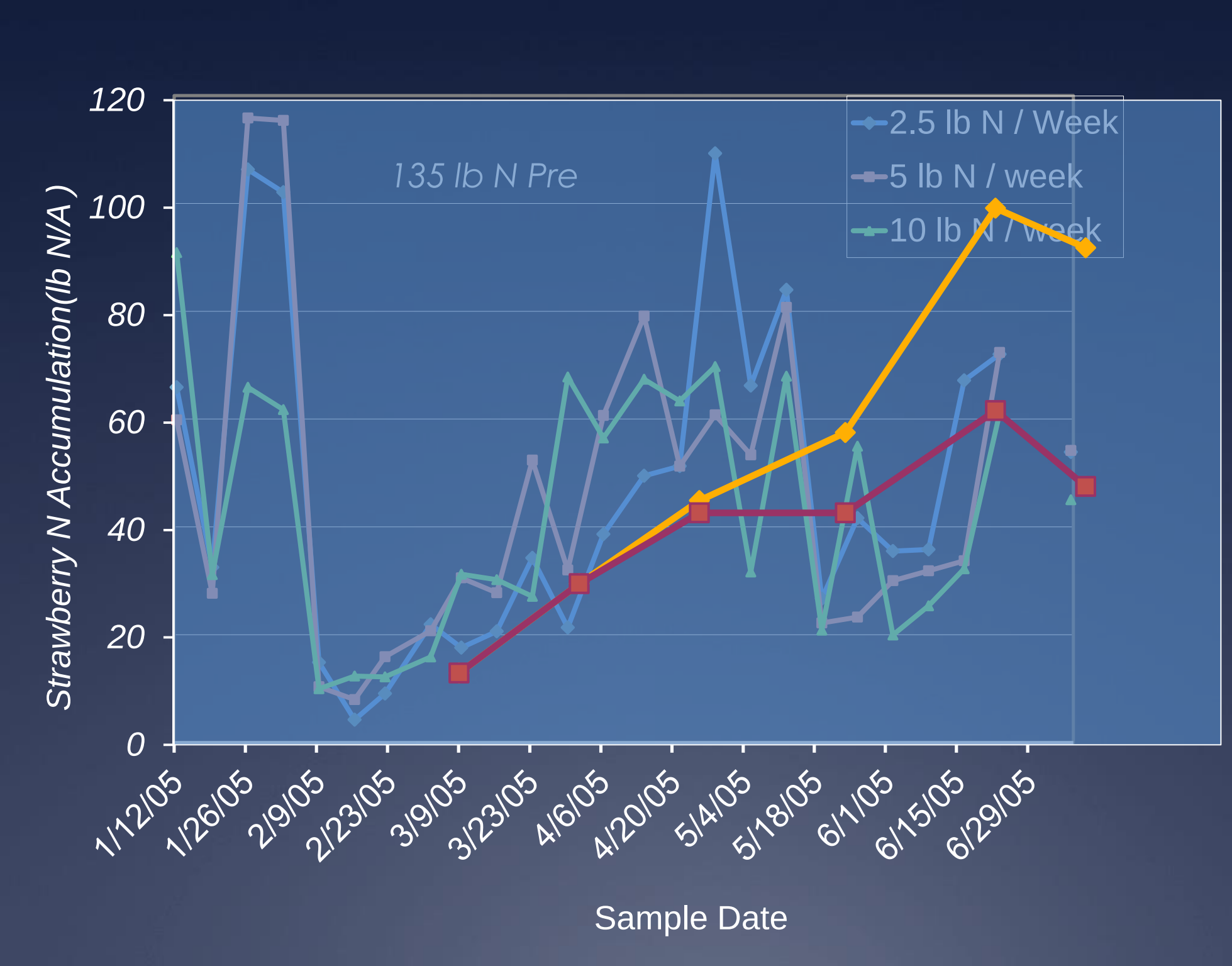
- *Weekly soil residual nitrate-N*
- *Seasonal plant growth and N uptake*
- *Yield*


Conventional Strawberry Trial – 2008-09
Residual Soil Nitrate at different Fertilization
0 lb Pre
2.5 lb N / Week
5 lb N / week
10 lb N / week
Nitrato-N Residual (ppm)
50
40
30
20
10
0
12-Jan
27-Jan
11-Feb
26-Feb
13-Mar
28-Mar
12-Apr
27-Apr
12-May
27-May
11-Jun
26-Jun
Sample Date

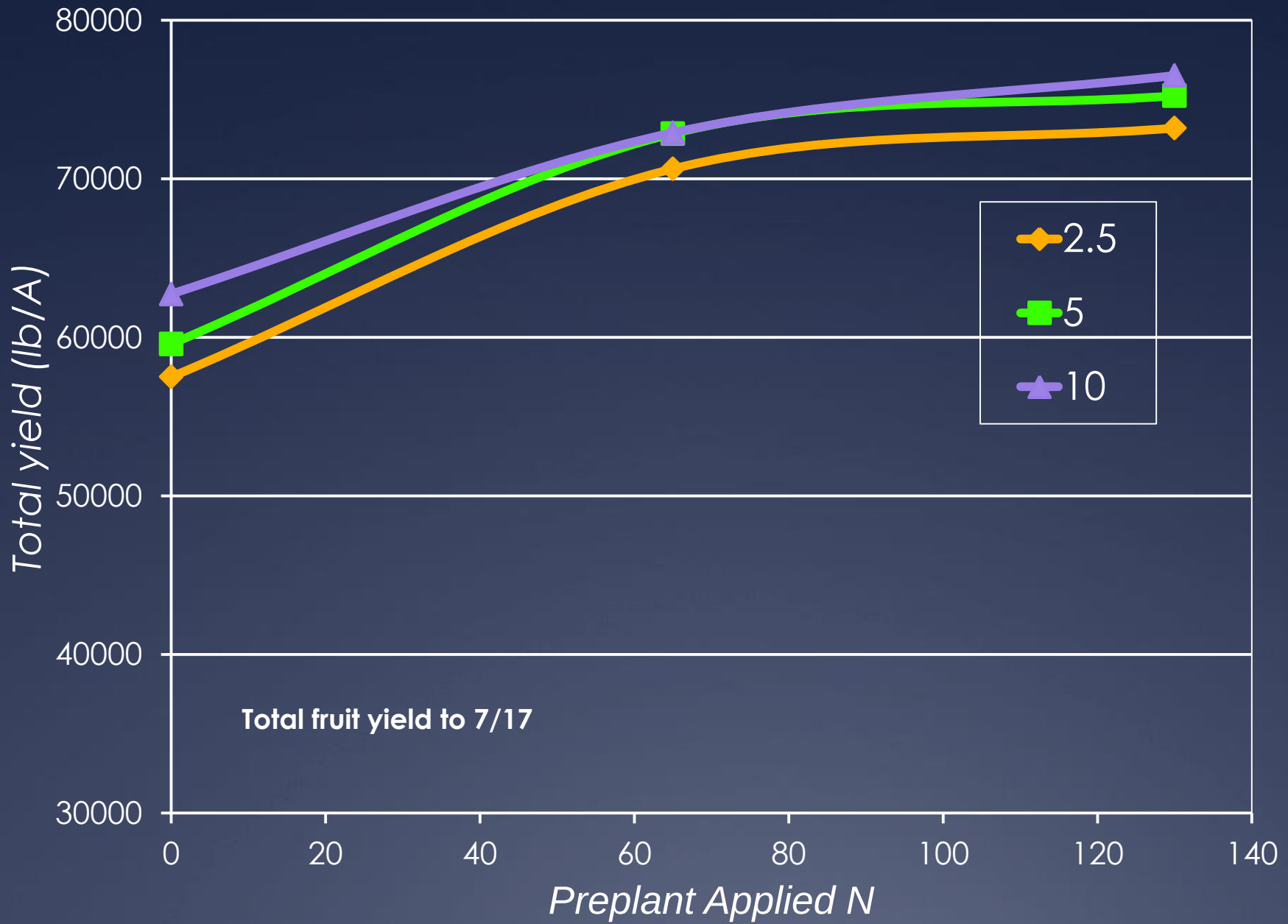

Conventional Strawberry Trial – 2008-09
Residual Soil Nitrate at different Fertilization
68 lb Pre
2.5 lb N / Week
5 lb N / week
10 lb N / week
Residual Soil Nitrate-N (ppm)
60
50
40
30
20
10
0
1/12/05
1/26/05
2/9/05
2/23/05
3/9/05
3/23/05
4/6/05
4/20/05
5/4/05
5/18/05
6/1/05
6/15/05
6/29/05
Sample Date


Conventional Strawberry Trial – 2008-09
Residual Soil Nitrate at different Fertilization
135 lb N Pre
2.5 lb N / Week
5 lb N / week
10 lb N / week
Residual Soil Nitrane-N (ppm)
60
50
40
30
20
10
0
1/12/05
1/26/05
2/9/05
2/23/05
3/9/05
3/23/05
4/6/05
4/20/05
5/4/05
5/18/05
6/1/05
6/15/05
6/29/05
Sample Date


Strawberry Nitrogen Accumulation
Strawberry N Accumulation(lb N/A)
120
100
80
60
40
20
0
12/15/08
1/15/09
2/15/09
3/15/09
4/15/09
5/15/09
6/15/09
7/15/09
8/15/09
Some N important


120
100
80
60
40
20
0
Strawberry N Accumulation(lb N/A)
135 lb N Pre
2.5 lb N / Week
5 lb N / week
10 lb N / week
1/12/05
1/26/05
2/9/05
2/23/05
3/9/05
3/23/05
4/6/05
4/20/05
5/4/05
5/18/05
6/1/05
6/15/05
6/29/05
Sample Date

Total Strawberry Yield at Varying Preplant and In - Season N Rates



Organic Strawberry Study -2008- 09

Albion Variety

Three organic N sources

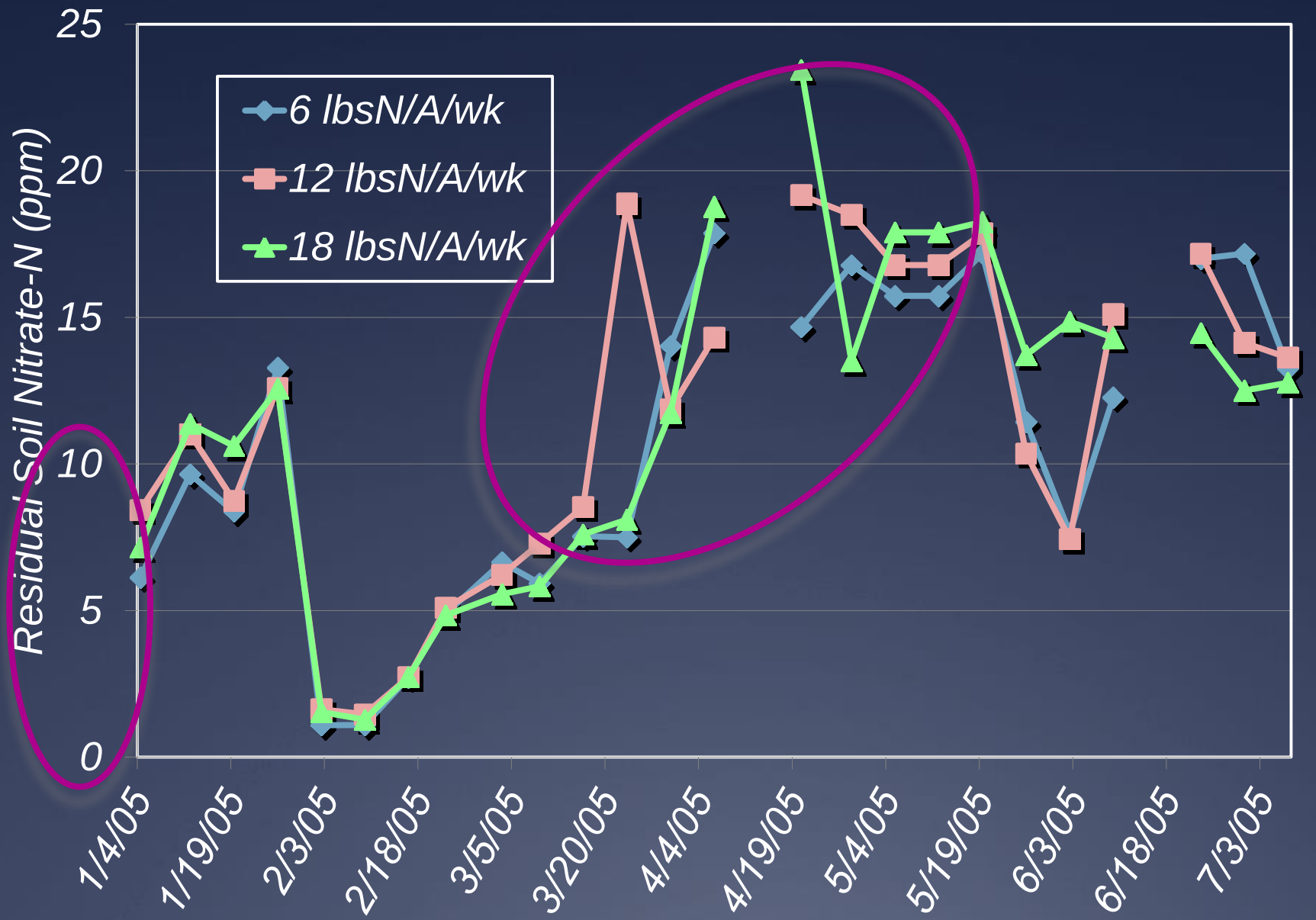
- *True Organic (started with Agrilizer_*
- *Neptune's Harvest (started with Nitriboost)*
- *Phytamin 801*

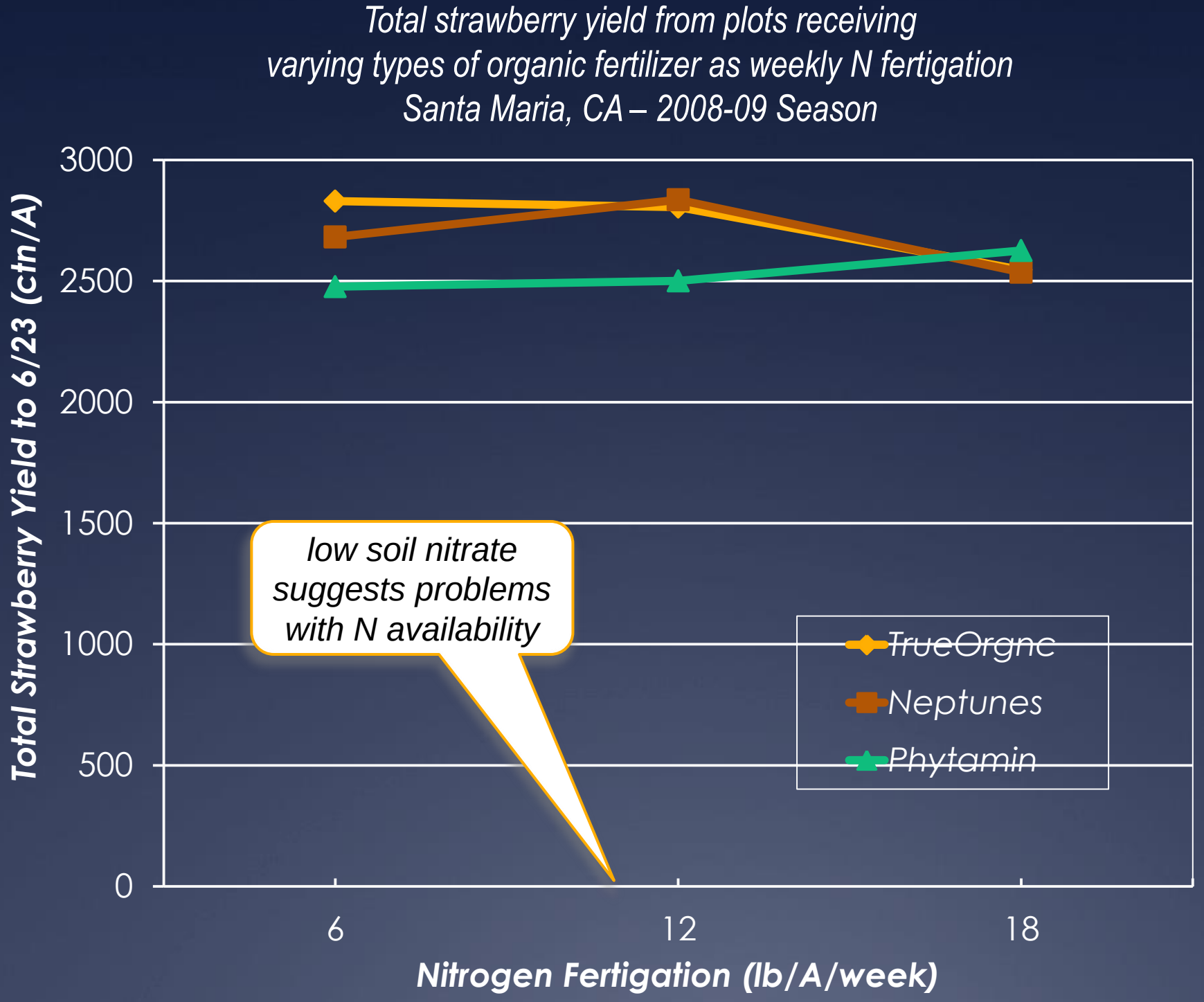
Weekly Applications of 6, 12, 18 lb N

Measures:

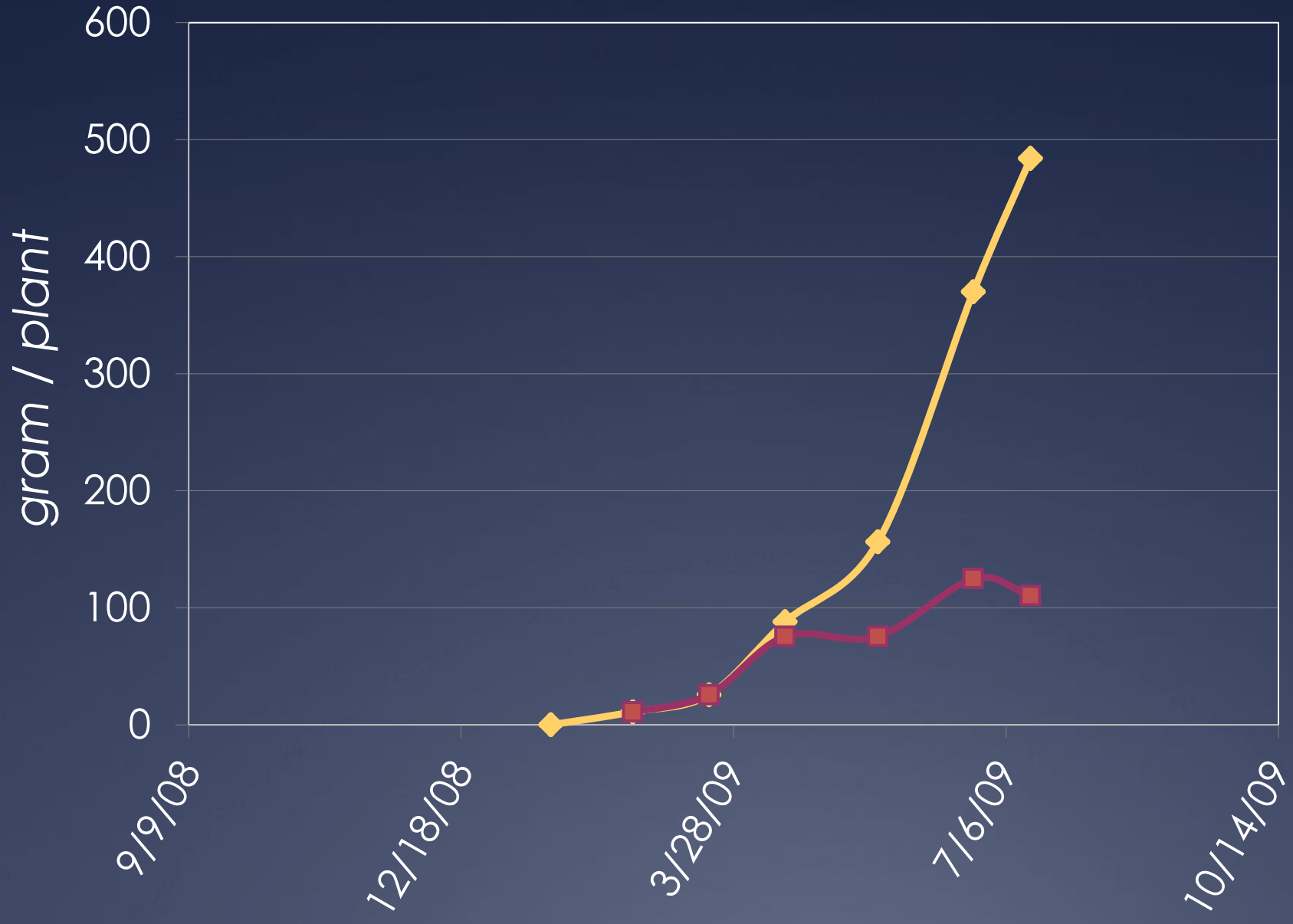
- *Weekly soil residual nitrate-N*
- *Seasonal plant growth and N uptake*
- *Yield*

Weekly Residual Soil Nitrate Nitrogen Manzanita Farms – Santa Maria, 2008-09 Season

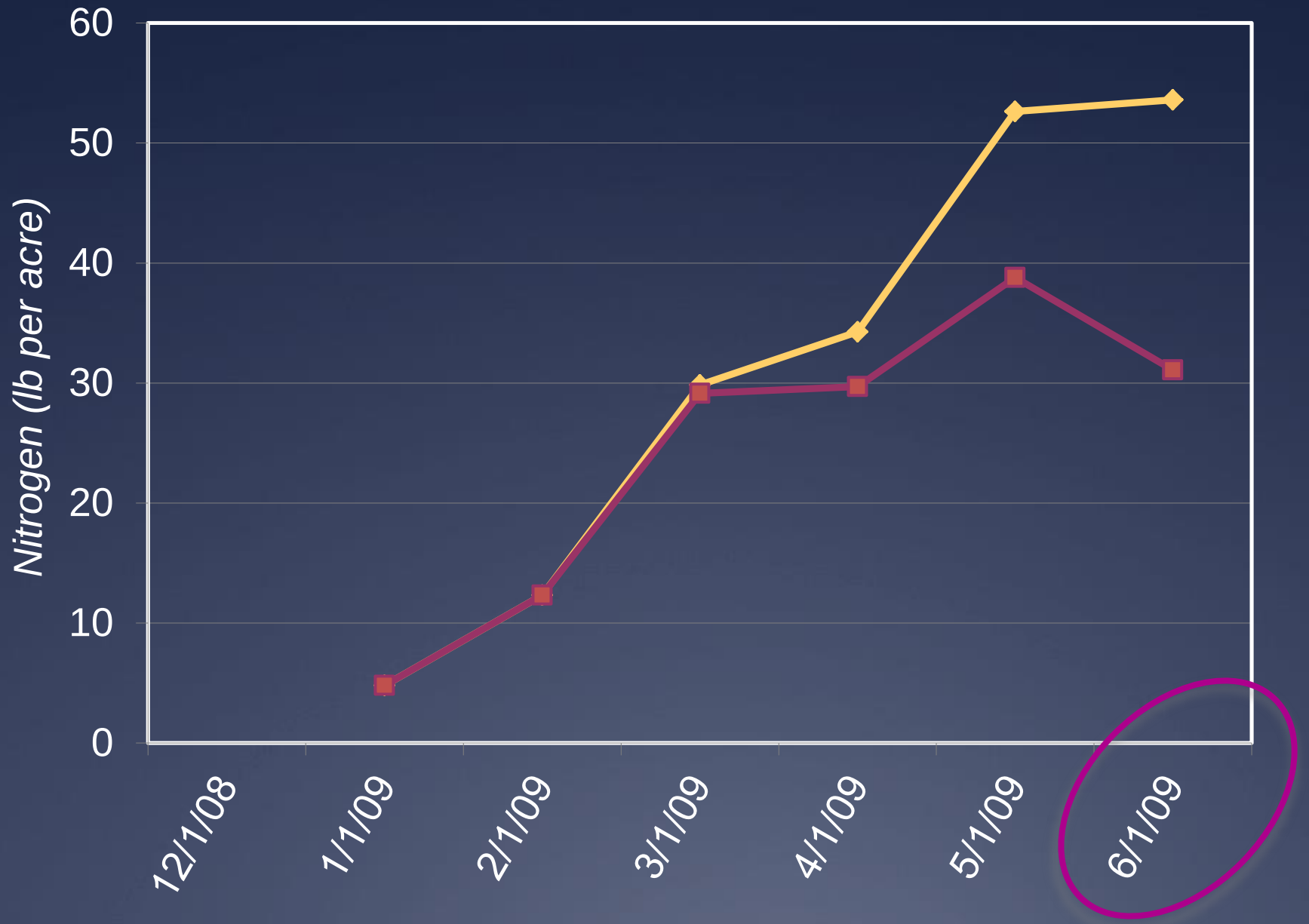



Total strawberry yield from plots receiving
varying types of organic fertilizer as weekly N fertigation
Santa Maria, CA – 2008-09 Season
Total Strawberry Yield to 6/23 (ctn/A)
3000
2500
2000
1500
1000
500
0
6
12
18
Nitrogen Fertigation (lb/A/week)
low soil nitrate suggests problems with N availability
TrueOrgnc
Neptunes
Phytamin

Seasonal Fresh Weight Accumulation by Organic Strawberry Plant and Fruit
Manzanita Farms – Santa Maria, 2008-09 Season



Seasonal Nitrogen Accumulation by Organic Strawberry Plant and Fruit
Manzanita Farms – Santa Maria, 2008-09 Season



Lettuce and Napa N use -2008- 09

Use of soil quick test to reduce N applications

3 treatments

if ≥ 25 ppm nitrate- N:

1) 0 application

2) ½ normal side dress

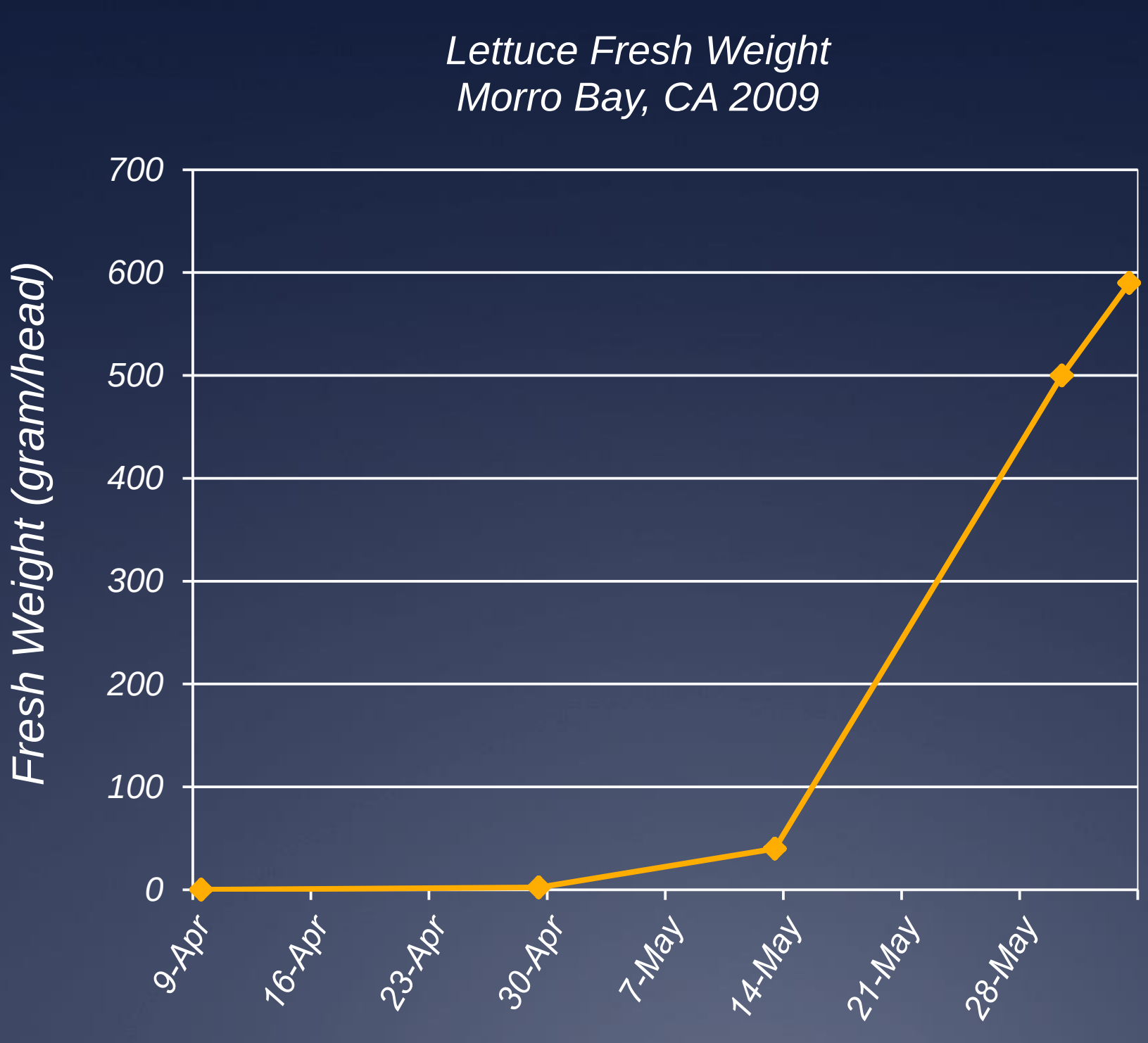
3) normal side dress

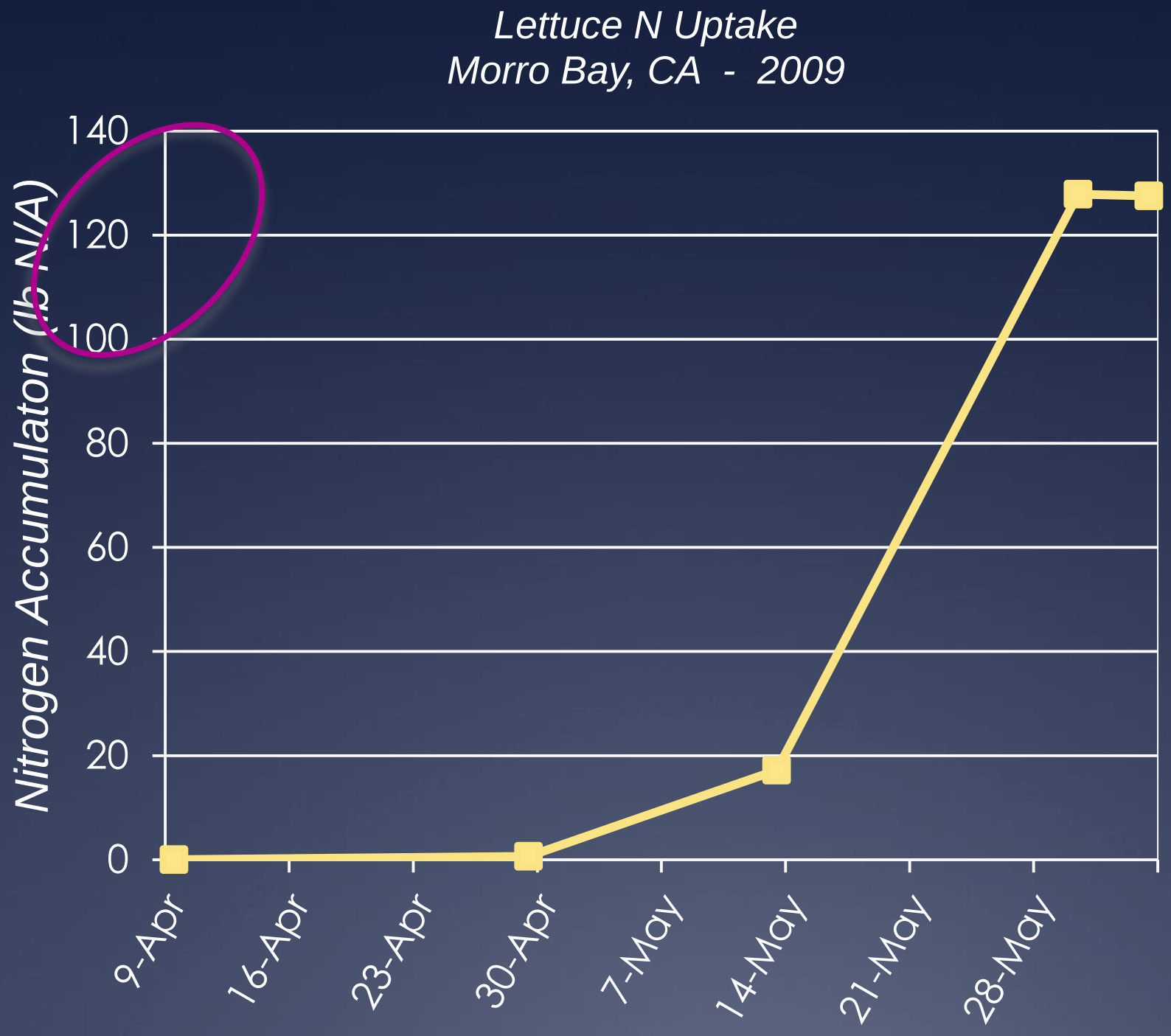
Preliminary conclusions:

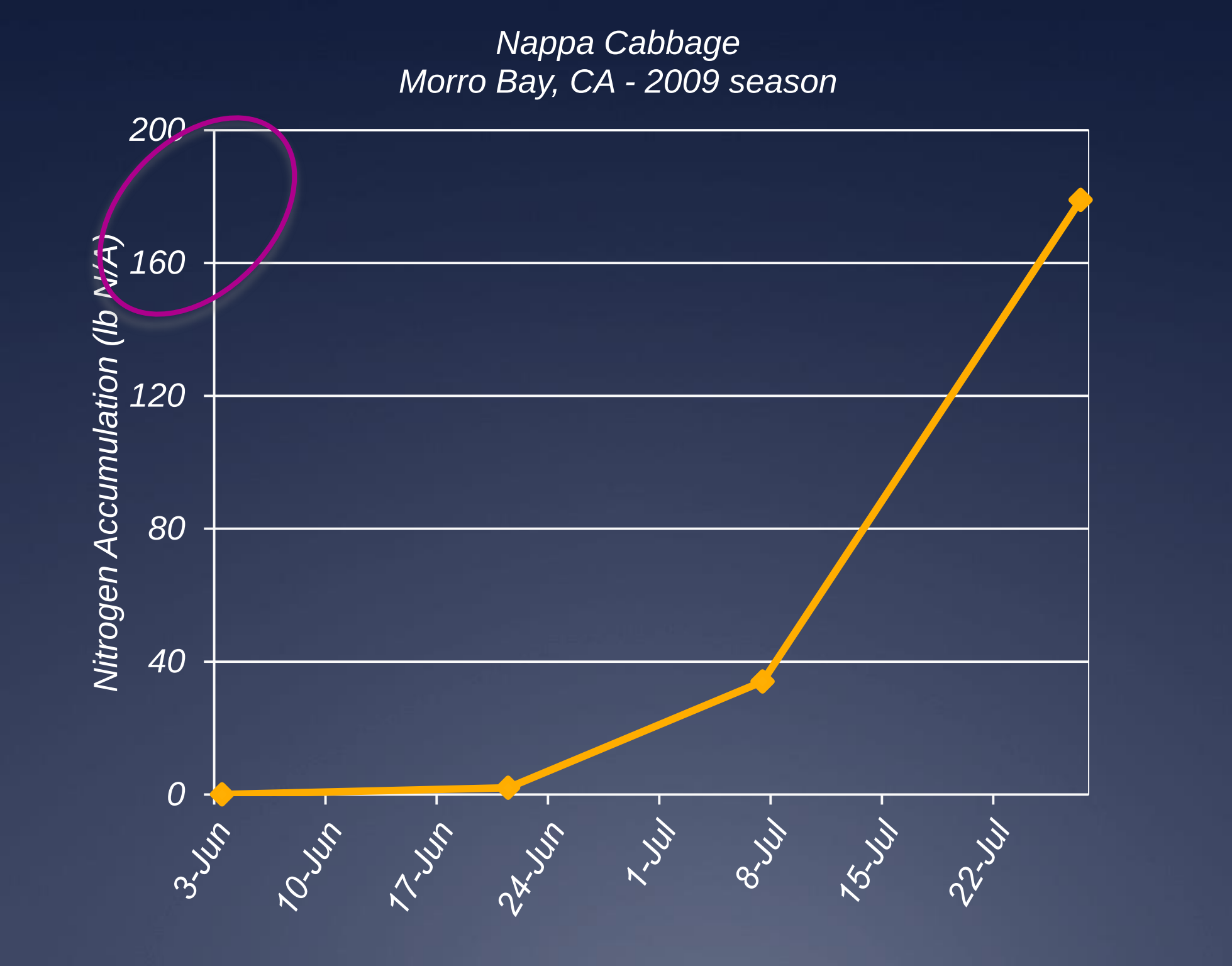
N uptake is very different from strawberry

Can eliminate pre plant

Normal N needed for at least last side-dress


Lettuce Fresh Weight
Morro Bay, CA 2009
Fresh Weight (gram/head)
700
600
500
400
300
200
100
0
9-Apr
16-Apr
23-Apr
30-Apr
7-May
14-May
21-May
28-May


Lettuce N Uptake
Morro Bay, CA - 2009
Nitrogen Accumulaton (lb N/A)
140
120
100
80
60
40
20
0
9-Apr
16-Apr
23-Apr
30-Apr
7-May
14-May
21-May
28-May


Nappa Cabbage
Morro Bay, CA - 2009 season
Nitrogen Accumulation (lb N/A)
200
160
120
80
40
0
3-Jun
10-Jun
17-Jun
24-Jun
1-Jul
8-Jul
15-Jul
22-Jul

Match N availability to crop need- strawberries

- *Transplanted strawberry N uptake about 4 lb – 10 lb N/acre*
  - first 90 days. – rainy winter period

- *During the next 20 weeks of growth, N uptake approaches 70 to 90 percent of seasonal total*
  ~ 130-150 lb N/acre

- *N uptake is steady and continuous for the entire period*

- *Current strawberry fertigation reccs for FL*
  = 0.3 lb – 0.75 lb N /acre/day

Summary

- *Many fields have excessive N in top foot and application rates often unrelated to yield.*
- *Opportunities exist to improve N use efficiency*
  - some growers are much more efficient
- *Need to match N application to plant uptake*
- *Water management also plays a role*
  - nitrate moves with water

Acknowledgements

Cachuma Resource Conservation District, Santa Maria

Dave Peck, Manzanita Berry Farm, Santa Maria

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Additional Information

Vegetable Research and Information Center (VRIC), UC Davis - Educational Modules
http://groups.ucanr.org/nutrientmanagement/index.cfm