Update on Nitrogen Management Field Studies with Strawberries and Leafy Vegetables

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CAPCA Central Coast Meeting
Nipomo, CA
December 2, 2009

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

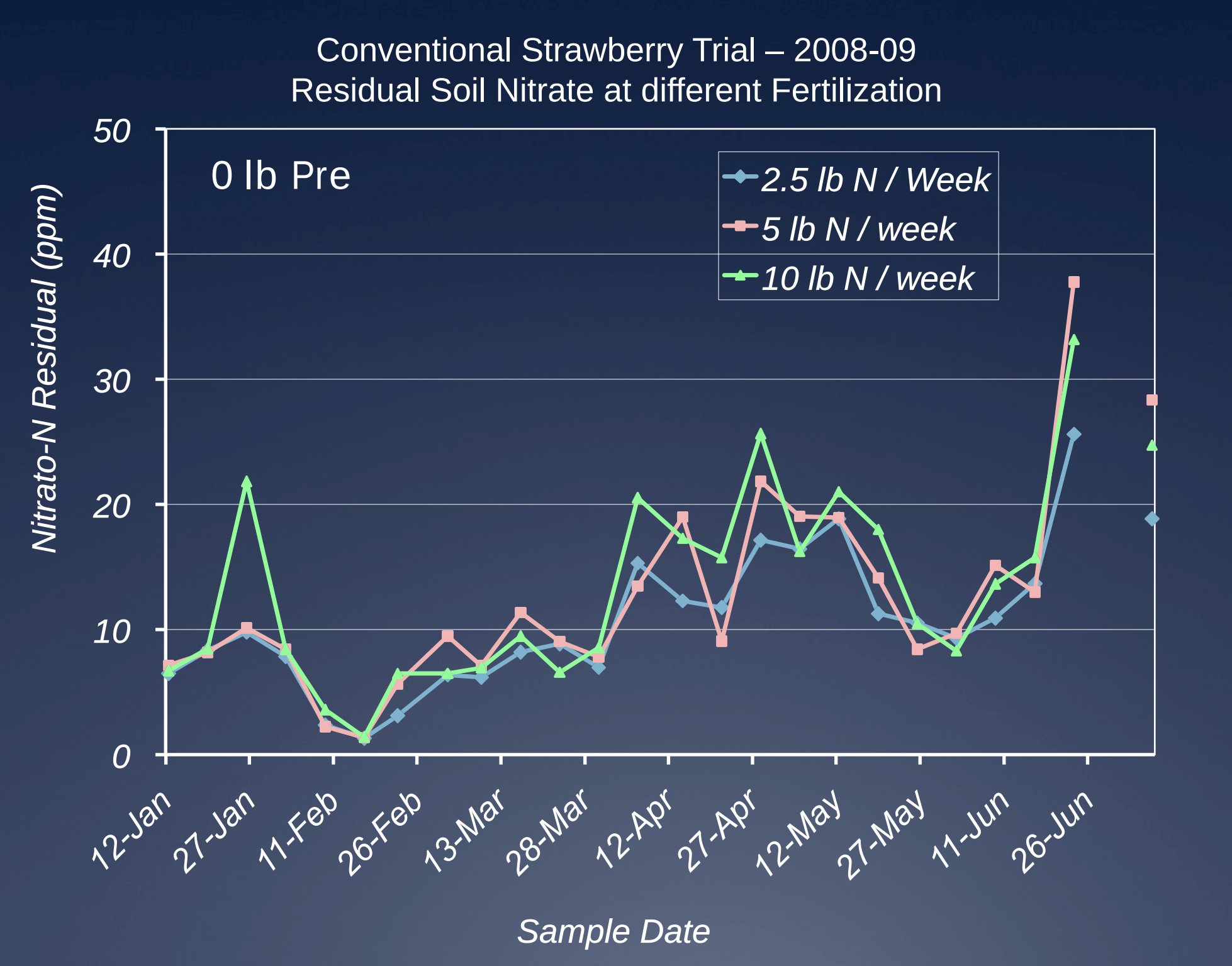
Three Pre plant CR N rates

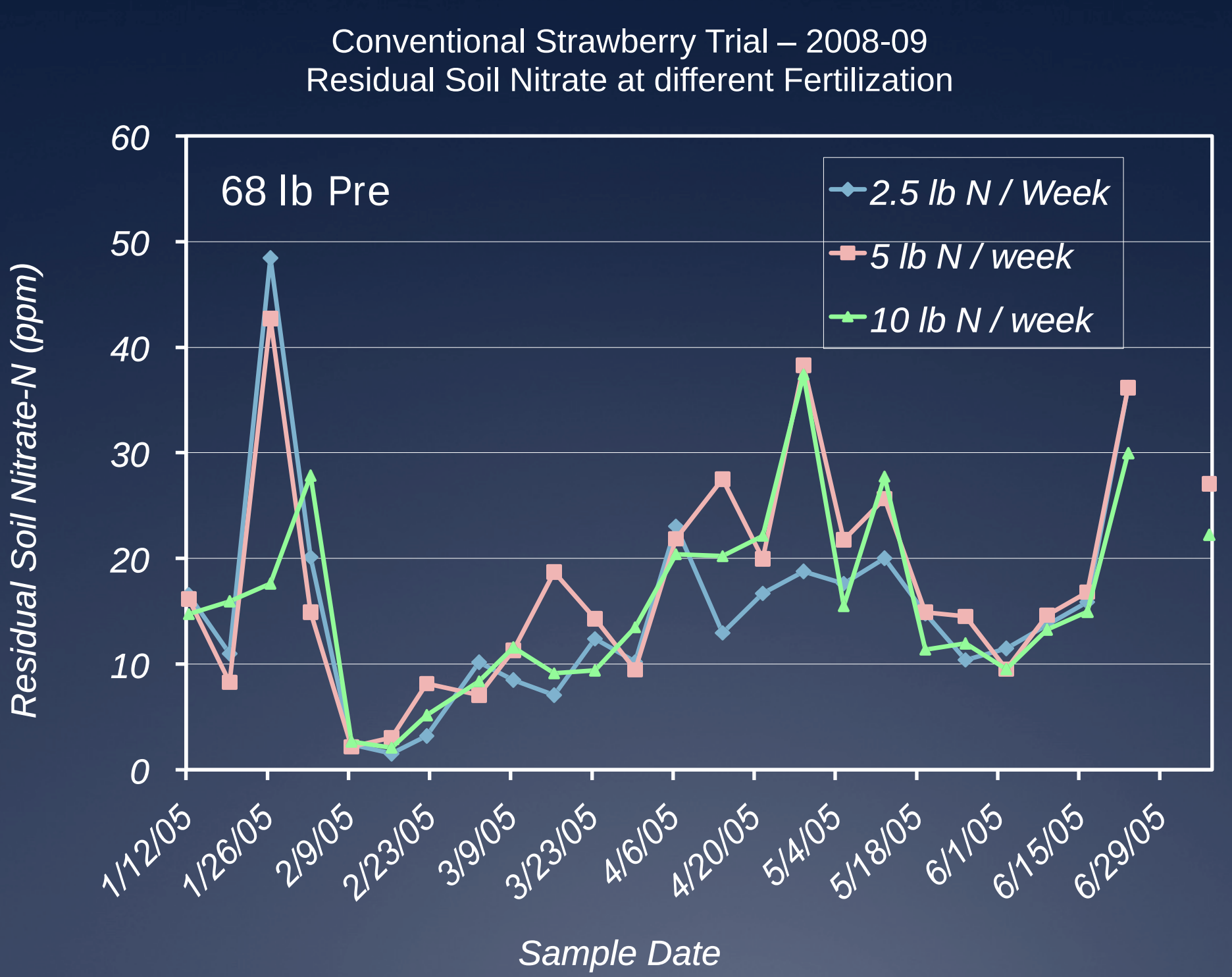
- *0*
- *65 lb N (350 lb / A 18-4-8)*
- *130 lb N (700 lb / A 18-4-8)*

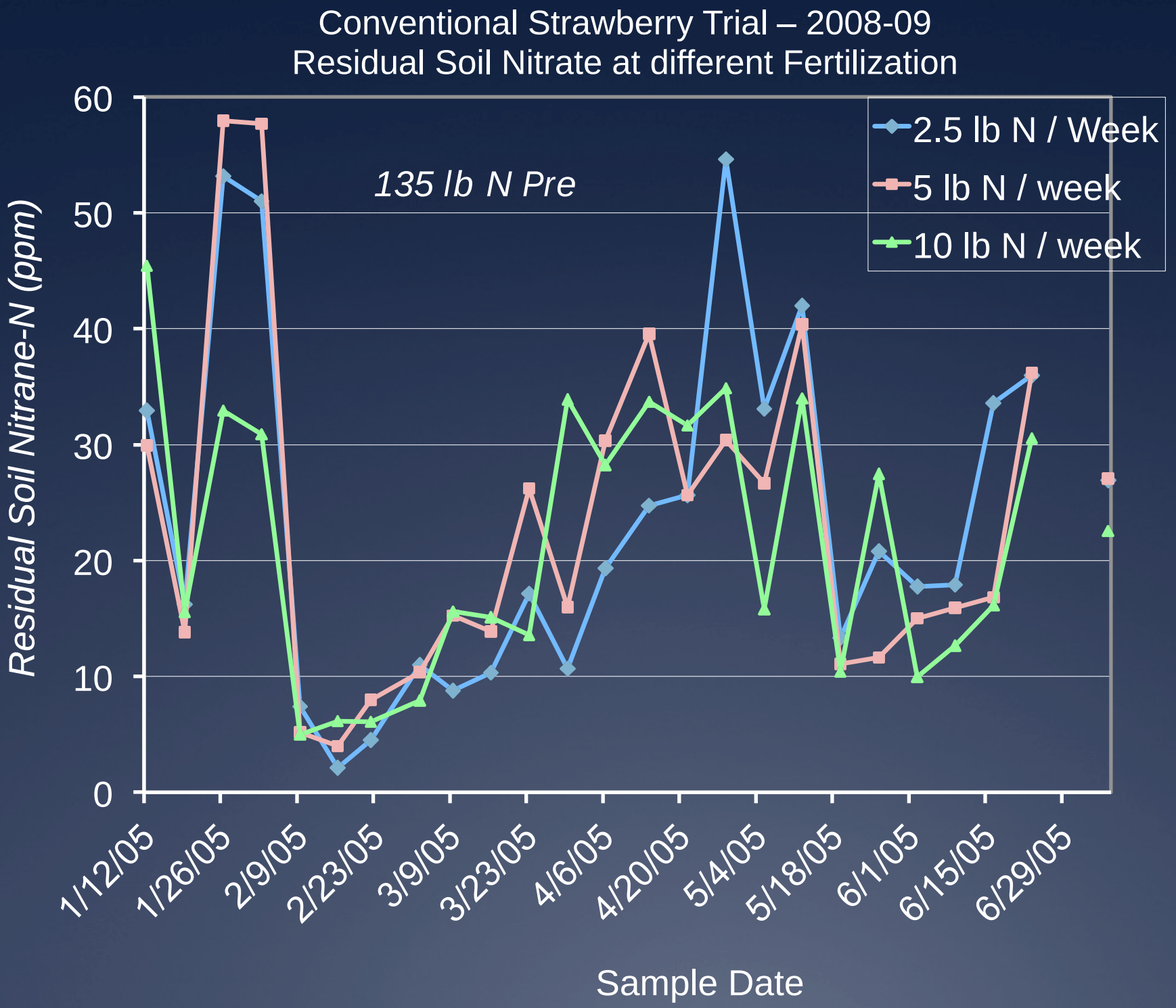
Weekly Applications of 2.5, 5, 10 lb N

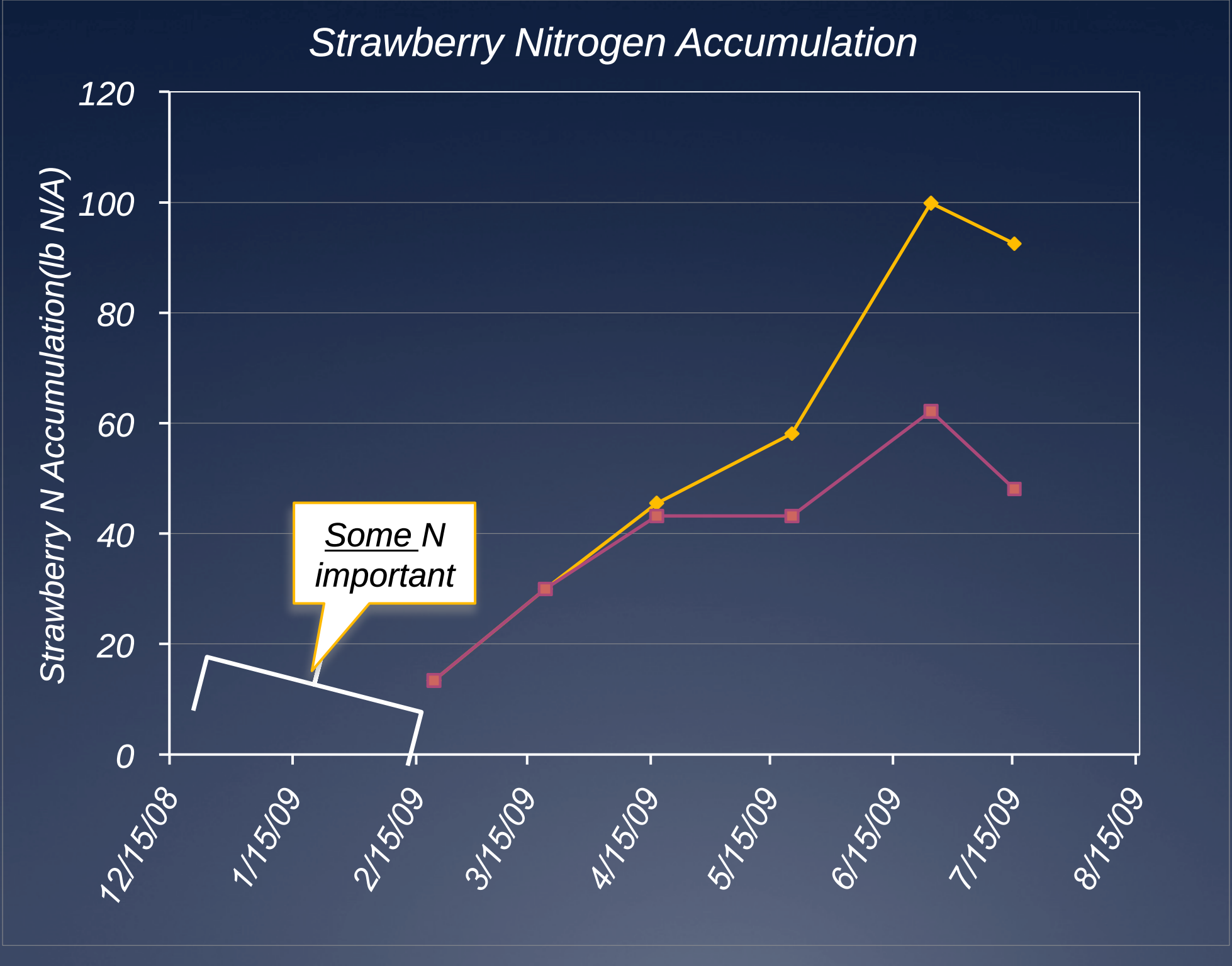
Measures:

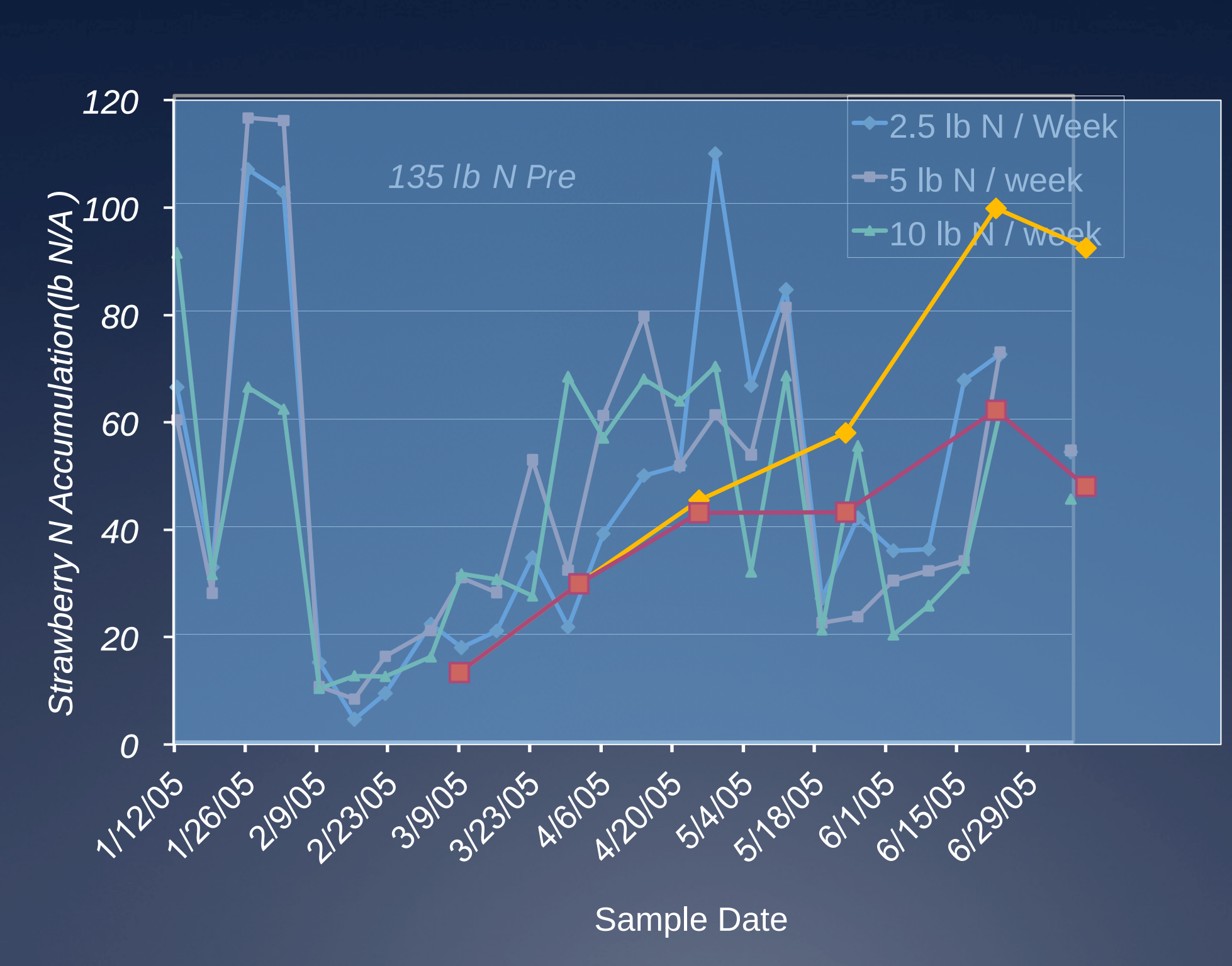
- *Weekly soil residual nitrate-N*
- *Seasonal plant growth and N uptake*
- *Yield*


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

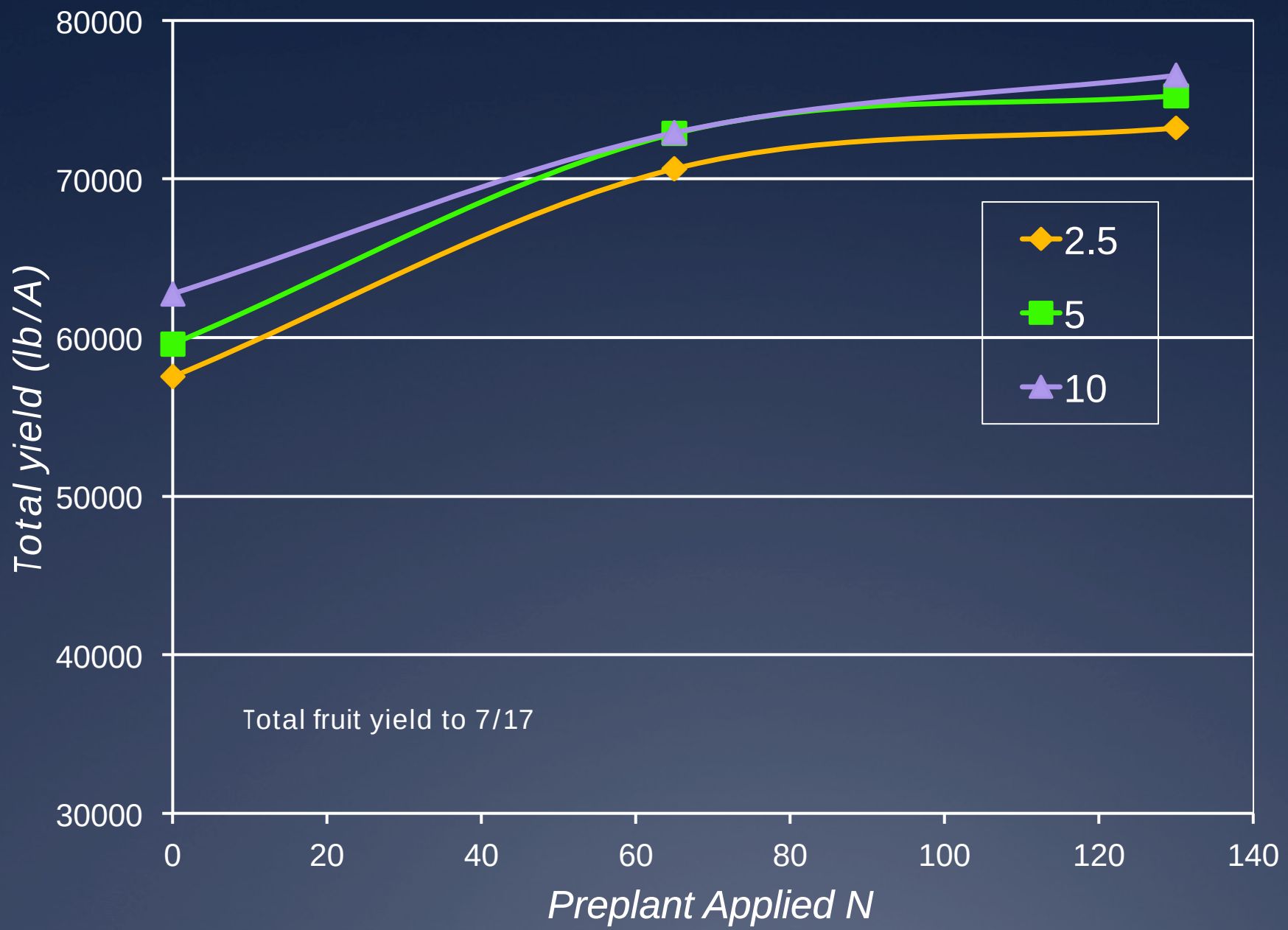

Conventional Strawberry Trial – 2008-09
Residual Soil Nitrate at different Fertilization
68 lb Pre
2.5 lb N / Week
5 lb N / week
10 lb N / week
Residual Soil Nitrate-N (ppm)
60
50
40
30
20
10
0
1/12/05
1/26/05
2/9/05
2/23/05
3/9/05
3/23/05
4/6/05
4/20/05
5/4/05
5/18/05
6/1/05
6/15/05
6/29/05
Sample Date


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

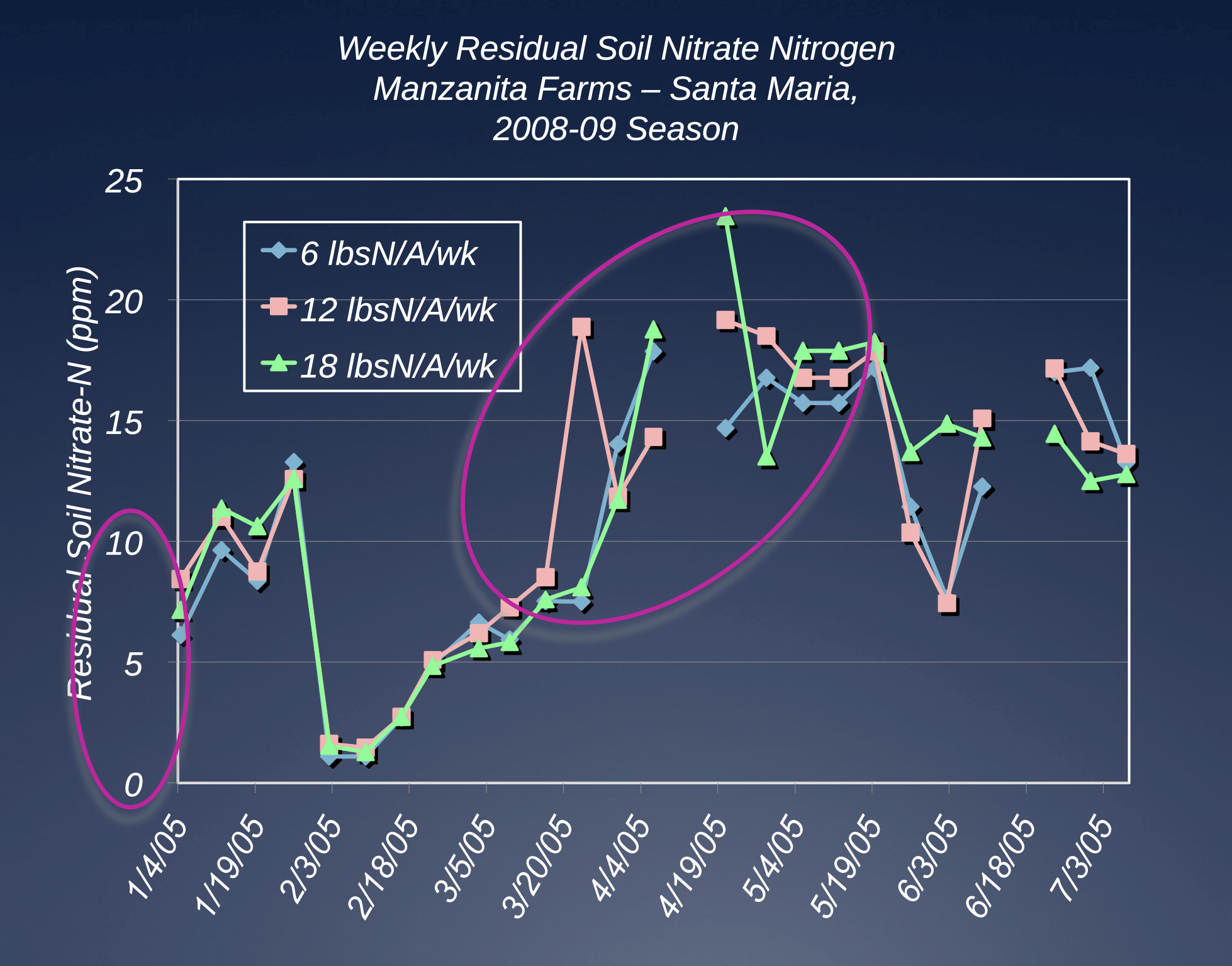
Three organic N sources

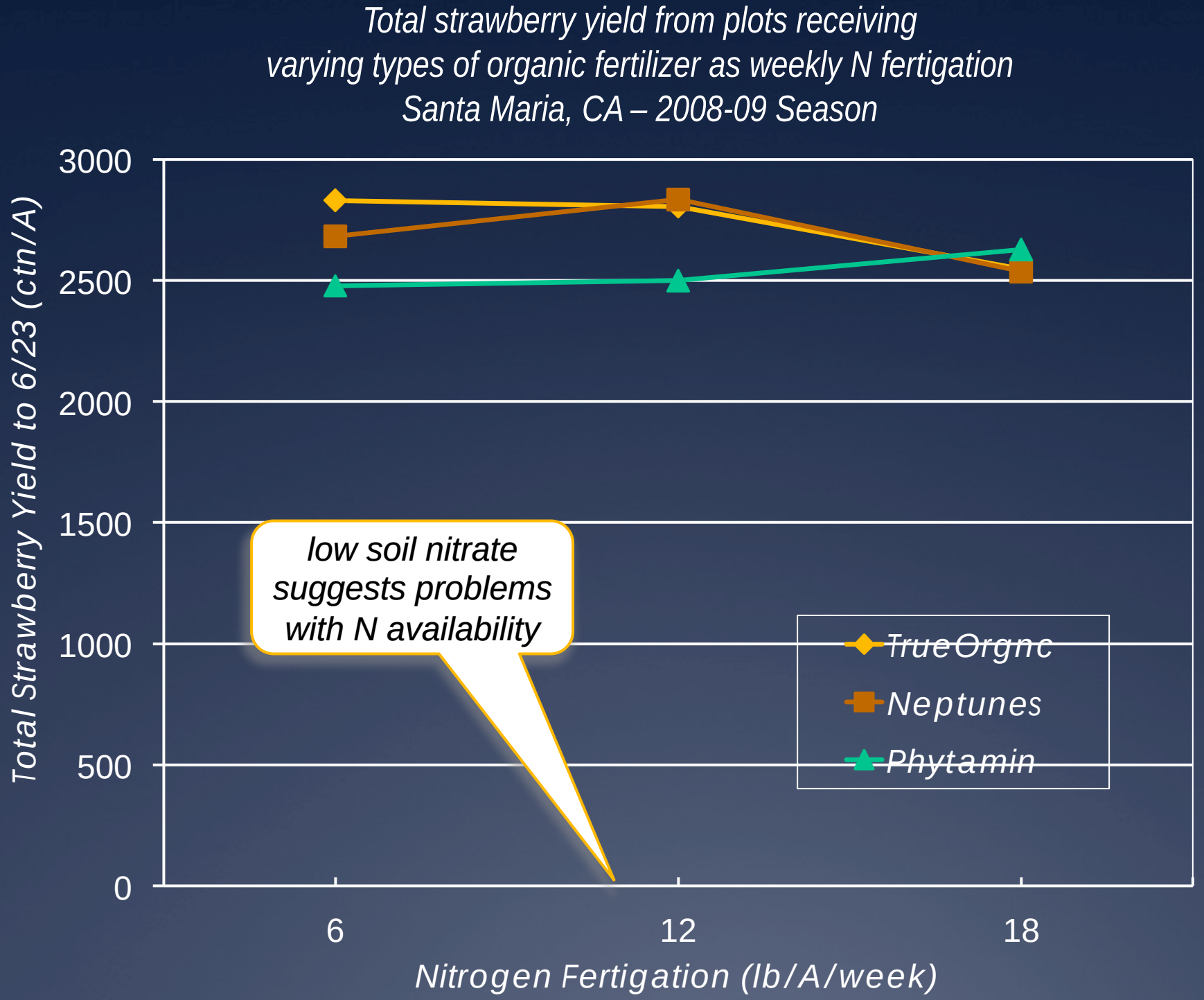
- *True Organic (started with Agrilizer_*
- *Neptune's Harvest (started with Nitriboost)*
- *Phytamin 801*

Weekly Applications of 6, 12, 18 lb N

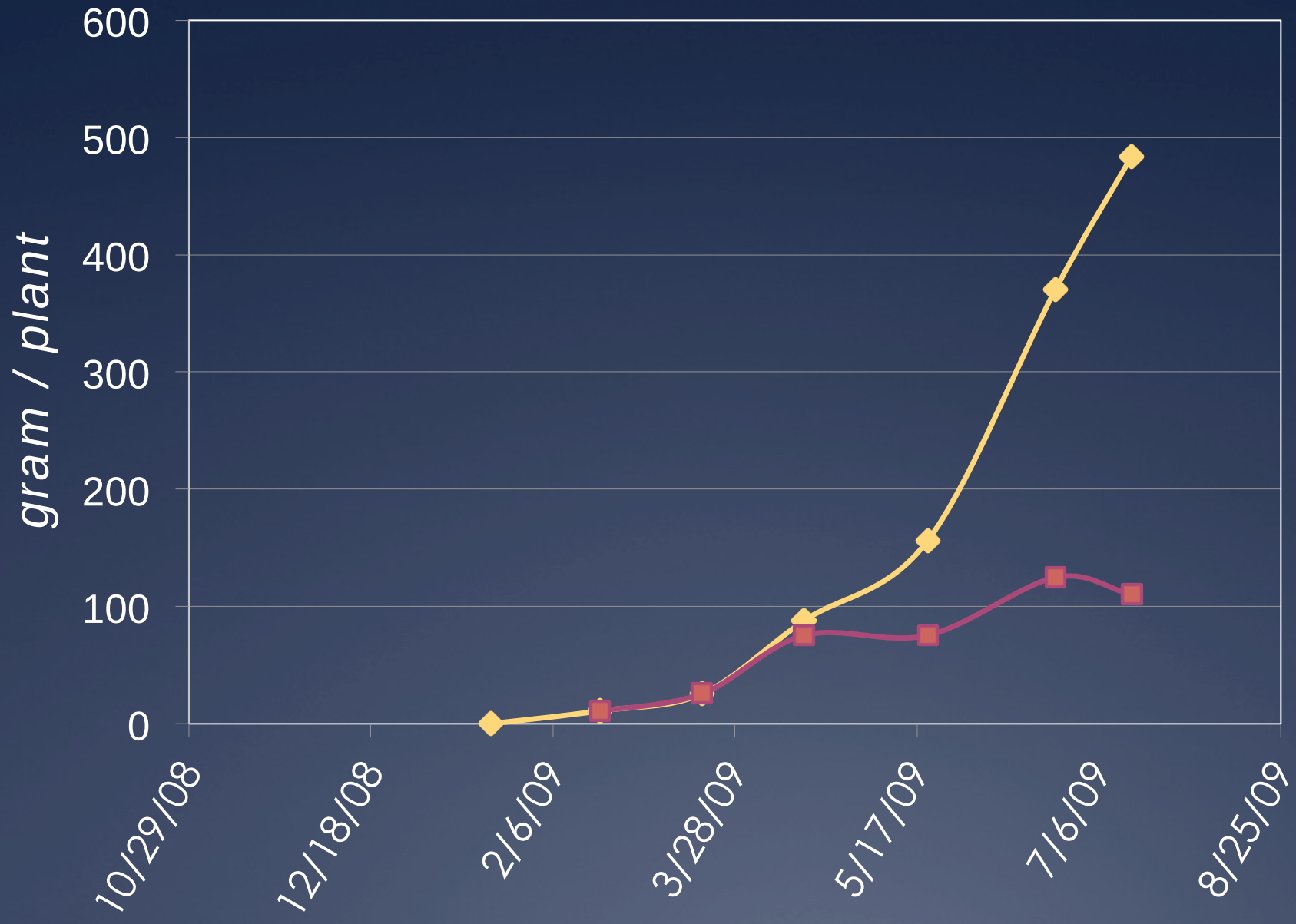
Measures:

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

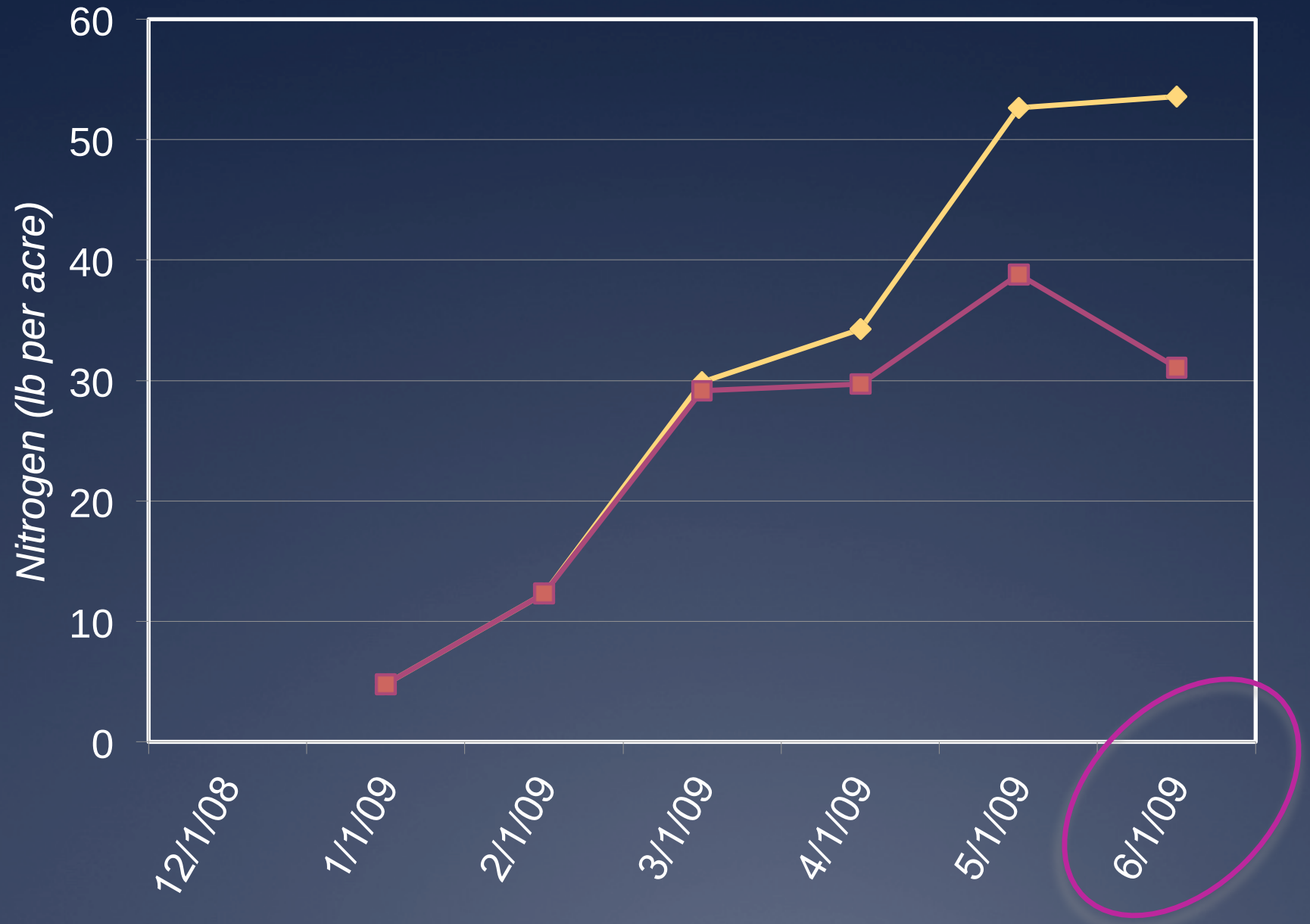

Weekly Residual Soil Nitrate Nitrogen
Manzanita Farms – Santa Maria,
2008-09 Season
Residual Soil Nitrate-N (ppm)
25
20
15
10
5
0
6 lbsN/A/wk
12 lbsN/A/wk
18 lbsN/A/wk
1/4/05
1/19/05
2/3/05
2/18/05
3/5/05
3/20/05
4/4/05
4/19/05
5/4/05
5/19/05
6/3/05
6/18/05
7/3/05


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

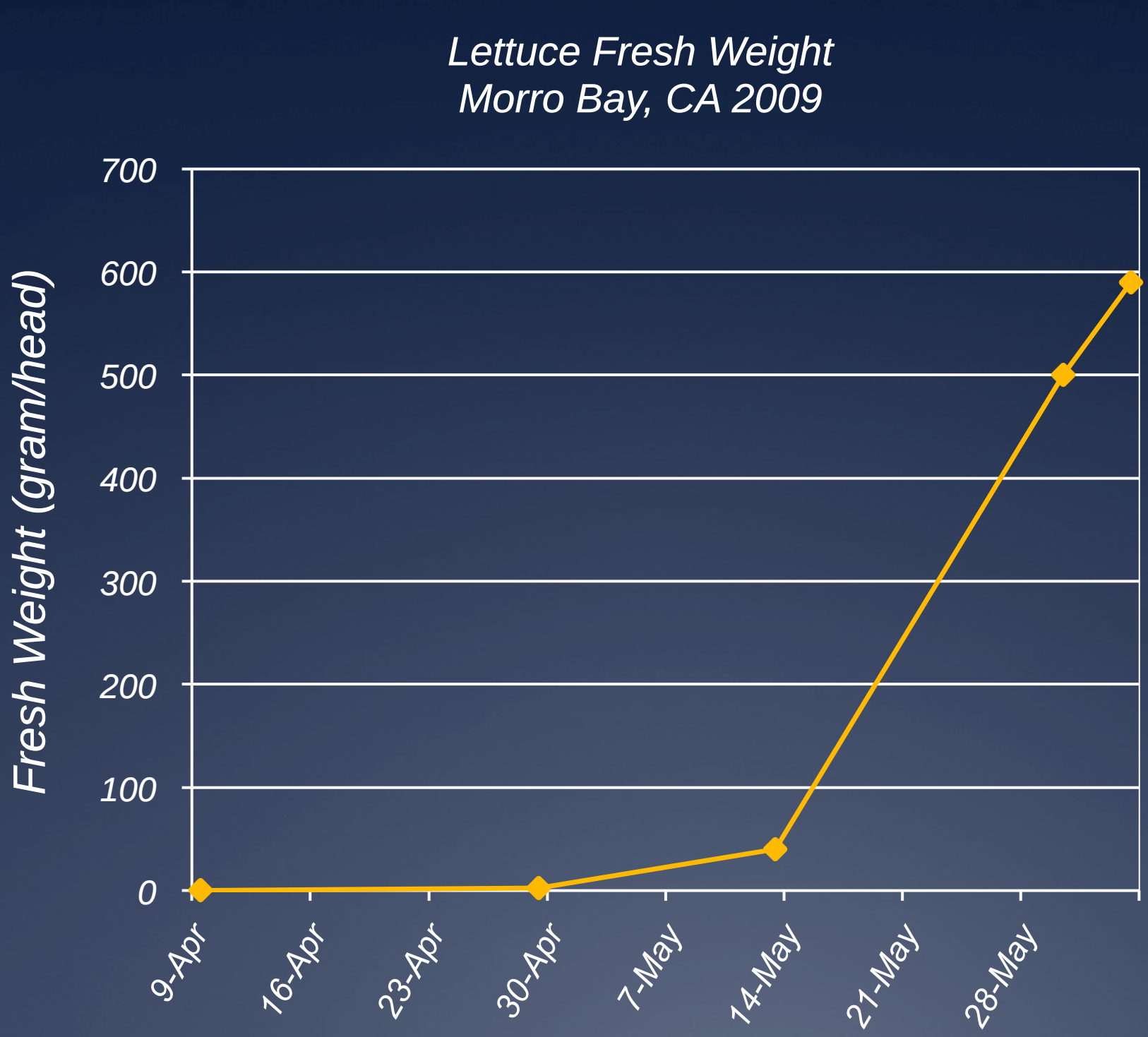
3) normal side dress

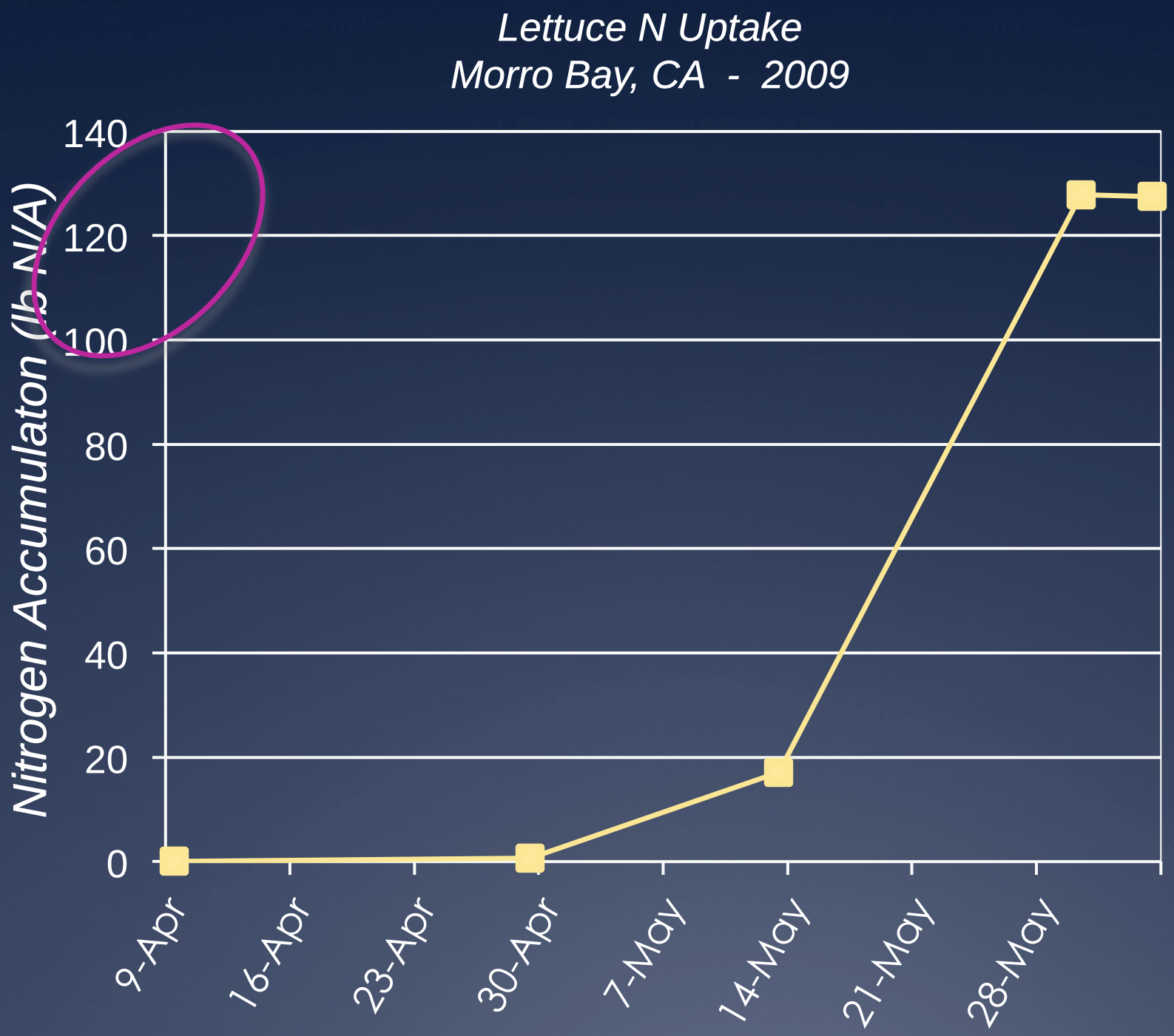
Preliminary conclusions:

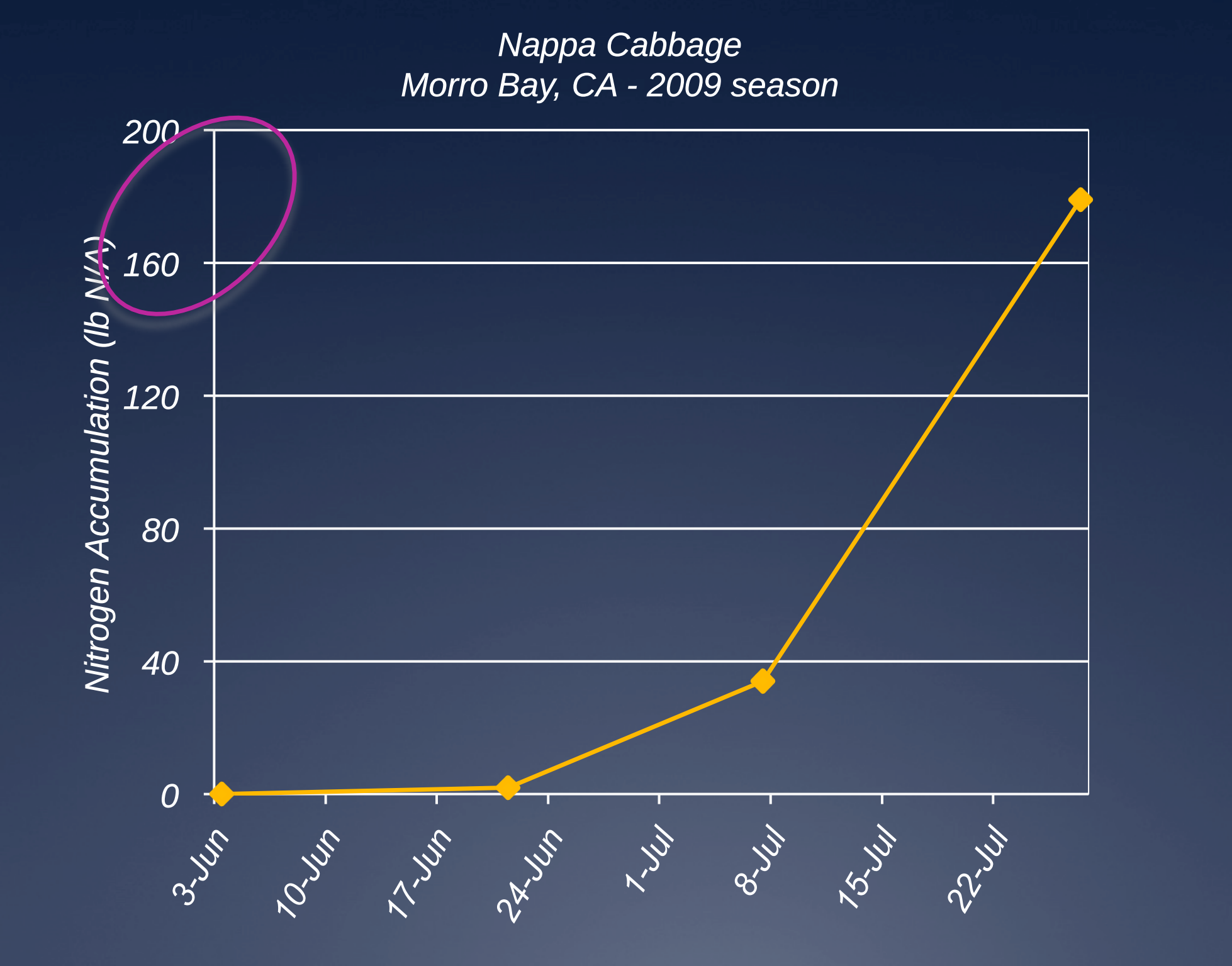
N uptake is very different from strawberry

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

USDA 2501 Program, FREP, CDFA Specialty Crop Block Grant

Additional Information

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