EFFECT OF NITROGEN RATE ON YIELD OF TOMATO GROWN WITH SEEPAGE IRRIGATION AND RECLAIMED WATER

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Introduction

- Failing in the proper disposal of the millions of gallons of wastewater produced every day can negatively impact the Florida drinking water supply, wildlife, and the environment.

- There are 4,130 permitted domestic or industrial wastewater facilities in Florida. These wastewater facilities can discharge wastewater either to ground water or surface water.

Wastewater Definition

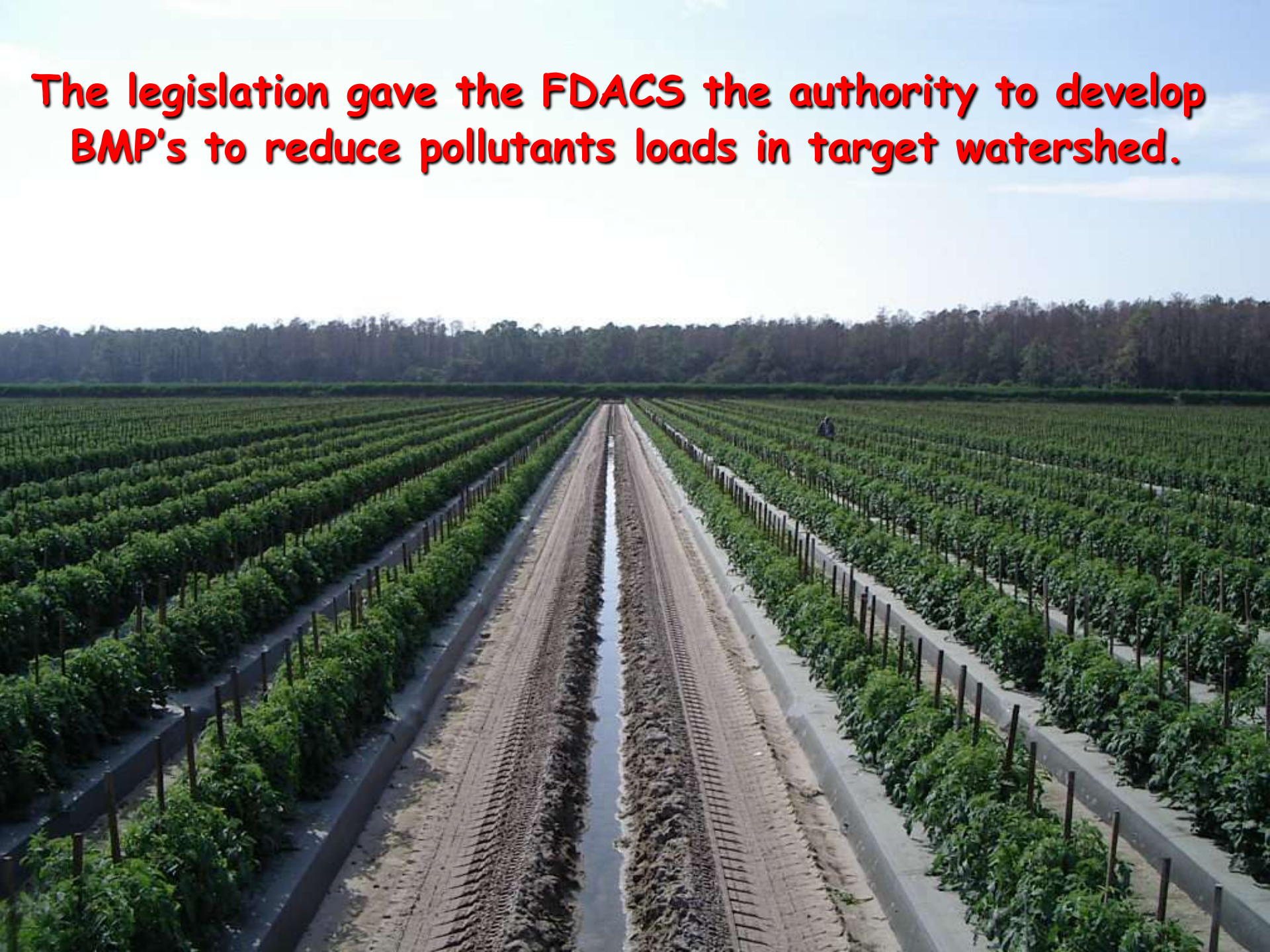
- Water reuse involves taking wastewater, giving it a high degree of treatment, and using the resulting high-quality reclaimed water for a new, beneficial purpose.
- Extensive treatment and disinfection ensure that public health and the environment are protected.

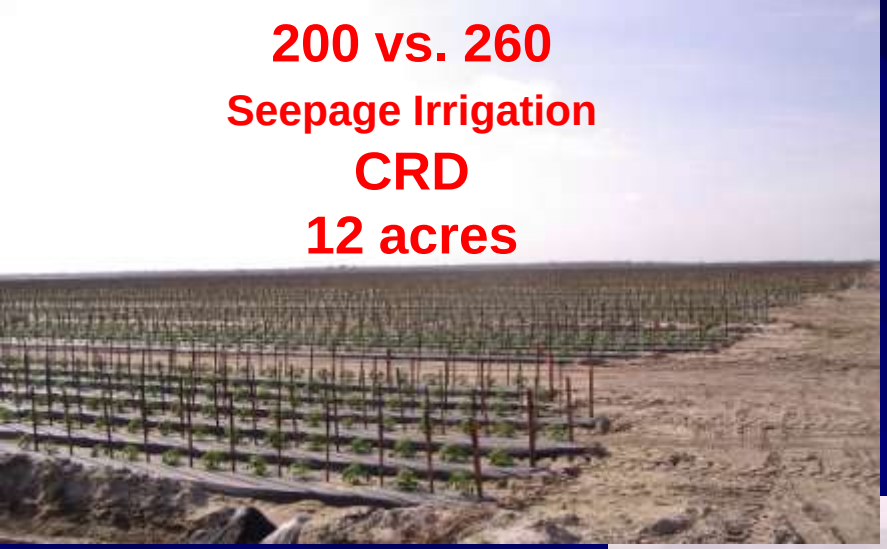
Introduction

- The Florida DEP has developed a comprehensive reclaimed wastewater reuse program with a compressive program of rules and regulations.

- Reclaimed water may contain up to 9.9 ppm NO_3-N there by making irrigation water a hidden source of N.

The legislation gave the FDACS the authority to develop BMP's to reduce pollutants loads in target watershed.




200 vs. 260
Seepage Irrigation
CRD
12 acres


200 vs. 320
Seepage Irrigation
CRD
18 acres


200 vs 240
Seep
Irrigation
CRD
30 acres


200 vs 300
Drip Irrigation
50 acres


200 vs. 330
Drip
Irrigation
35 acres

Objectives

- To evaluate the effect of multiple N fertilizer rates under the use of reclaimed wastewater for seepage irrigated tomatoes on petiole N sap, fruit yield and post-harvest quality.

Multiple N rate trial Palmetto

- Spring 2006/seepage
- FL 47
- 8 N rates 20, 60, 120, 180, 240, 300, 360, 420 lb/acre
- Bottom mix 20 lb/acre
- K_2O = 590 lb/acre
- RCBD 4 reps (3 beds…20')


Two Harvests
5/6, 6/6, 6/7 and culls

Data Collection

Wells-Water Tables

Sap Nitrate-NO_3- K


20


60


1 ½
months
Farm # 4
120


160


240


300


320-G


360


420


20


60


2 months
Farm # 4
120


160


240


300


320-G


360


420


20


60


2 ½ months
Farm # 4
120


180


240


300


320


360

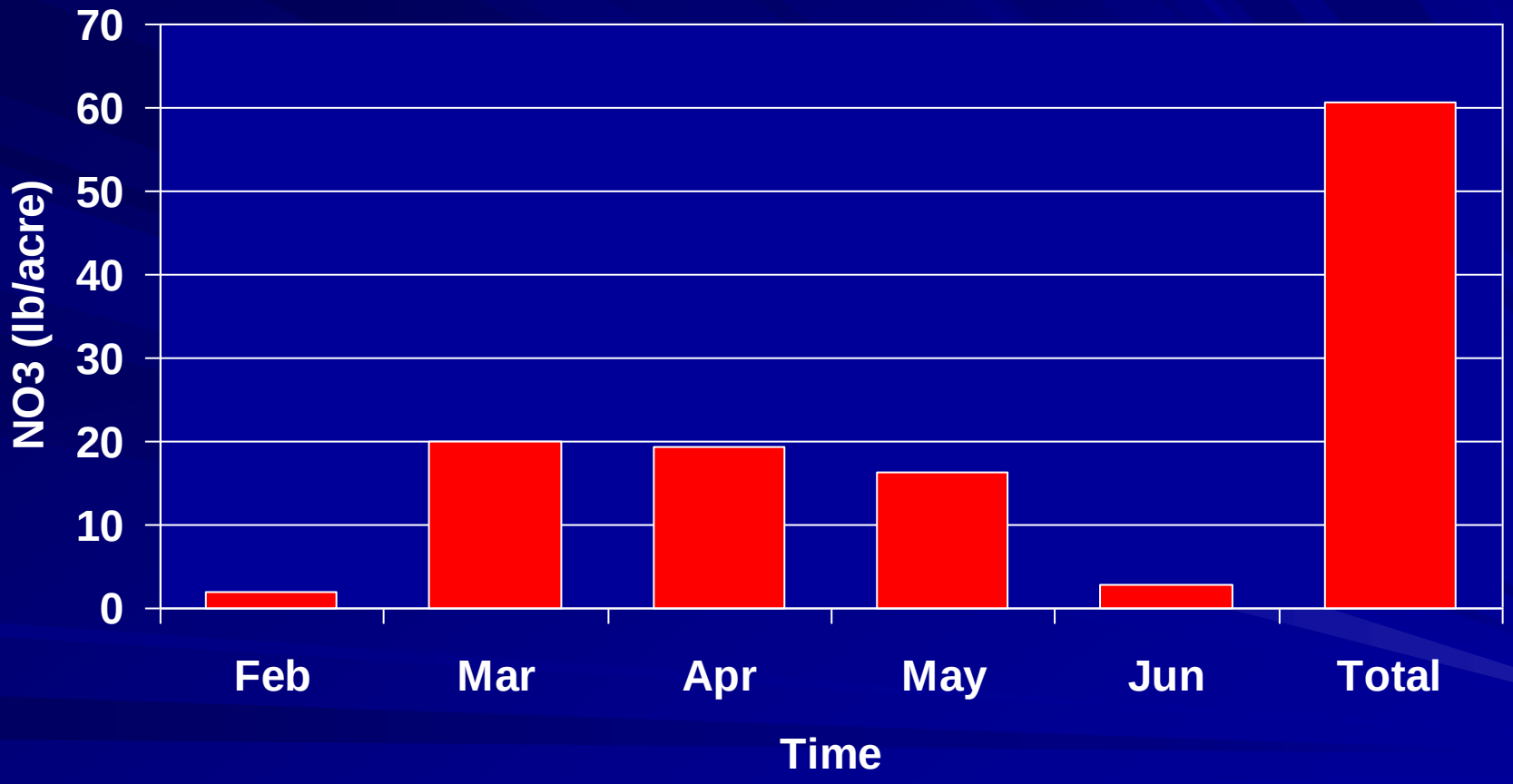

420


3 months
Farm # 4
20
60
120
180
240
300
360
420
5/17/06

Monthly average N-sources from reclaim water (Manatee County)

Month	NO_3-N	NH_3	TKN
	----------(ppm)----------		
February	4.00	0.193	1.39
March	9.40	0.173	1.56
April	8.50	0.191	1.54
May	7.63	0.163	1.23
Average	**8.11**	**0.17**	**1.41**

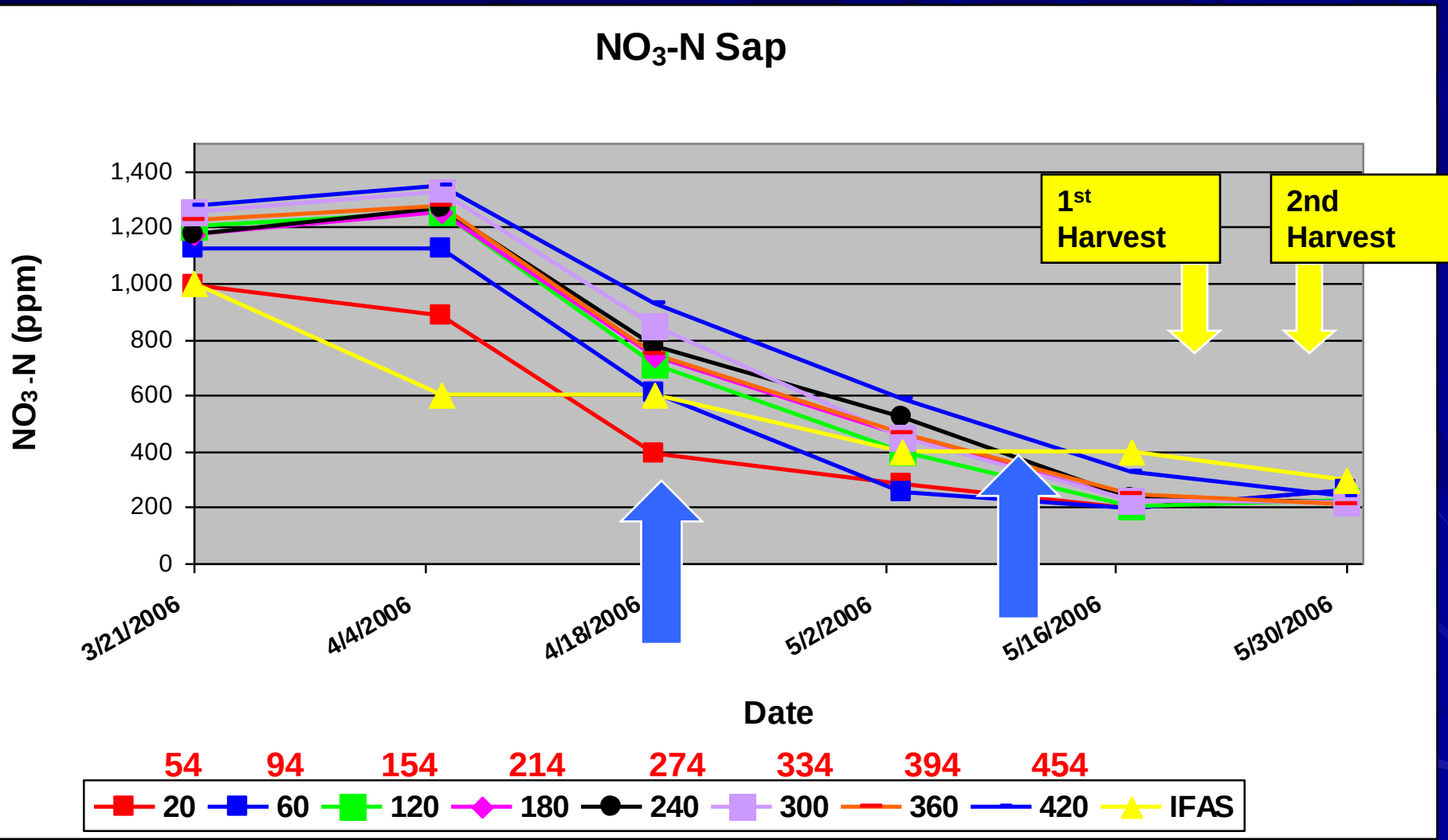
Reclaim Effluent NO_3

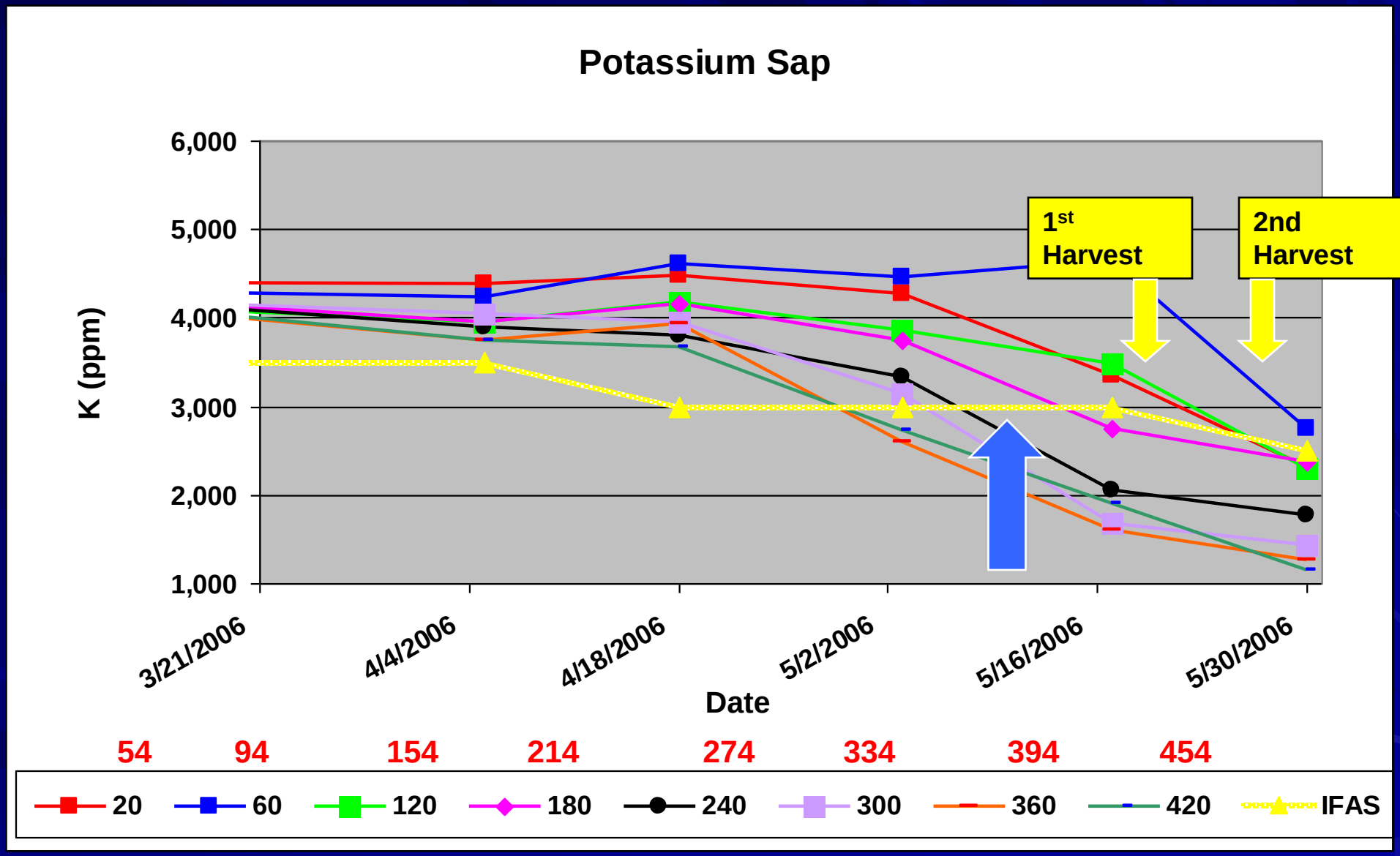


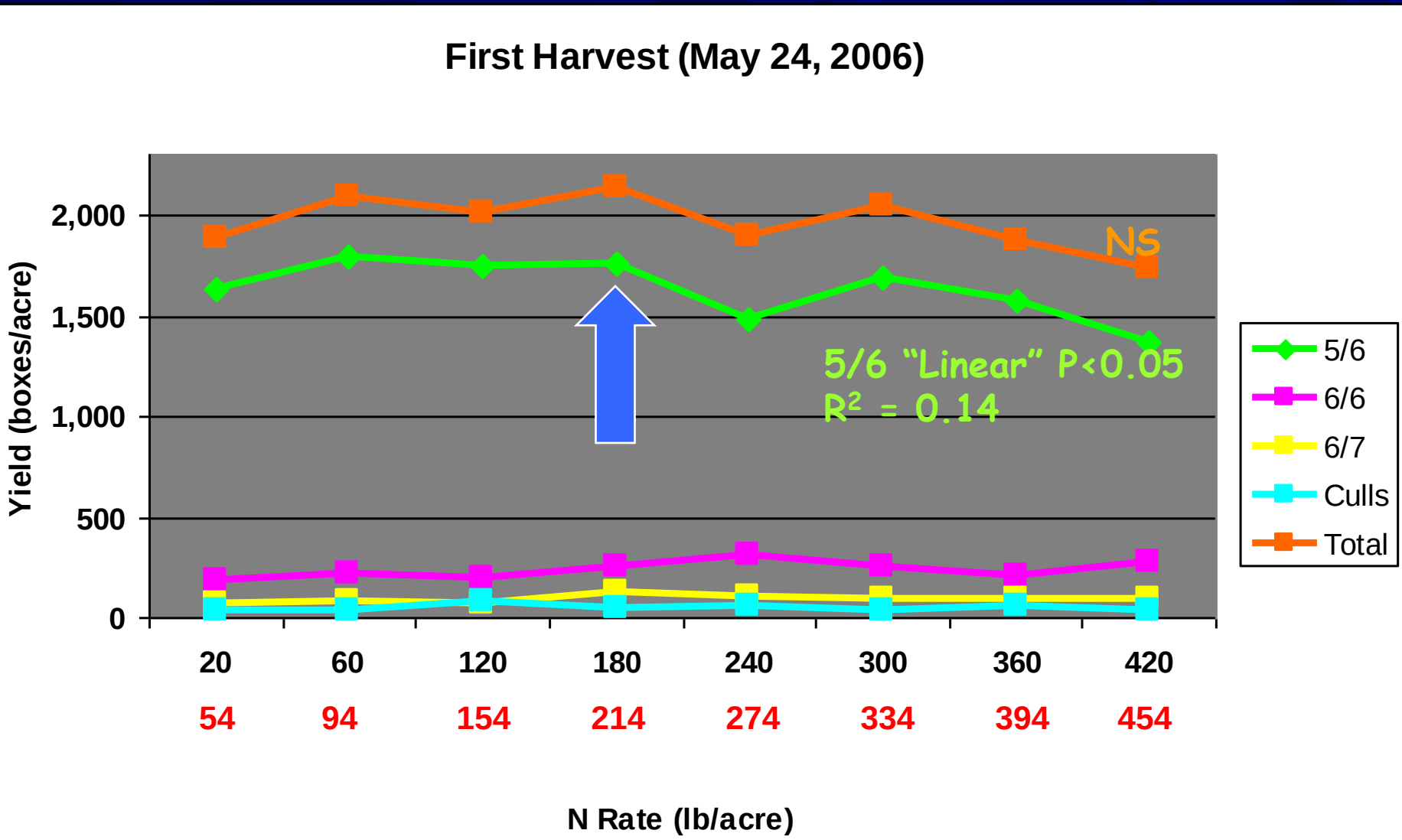
8,310 gal/acre/day

Nitrogen Sources

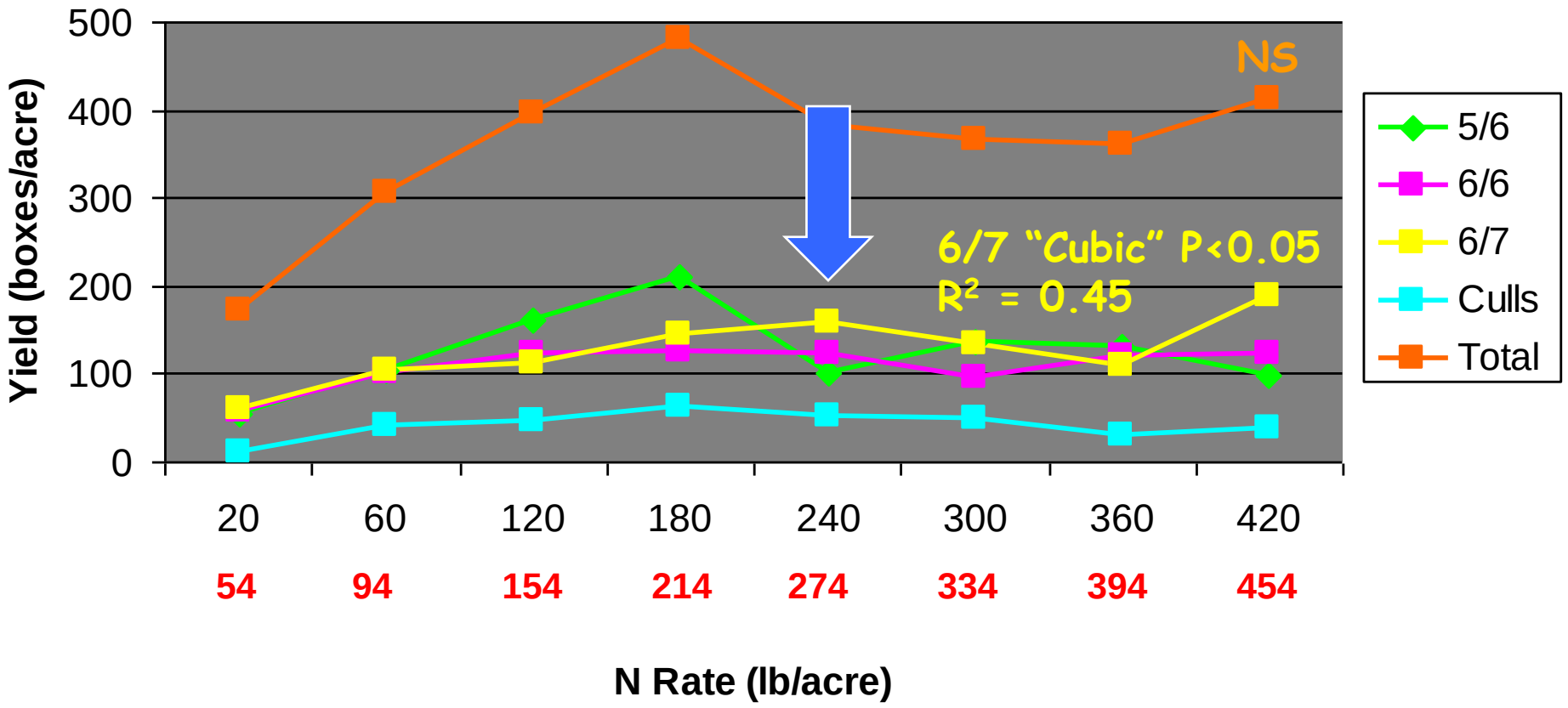
Nitrogen Sources	N Rate (lb N/acre)
Reclaim Eff N-NO_3	61
Reclaim Eff N-NH_3^+	1.3
Reclaim Eff TKN	5.4
Total	**67**
50 % available for plants	**34**
Estimated N Released (2.8% OM)	22
Nitrogen from the air	15
Fertilizer (bottom mix)	20
Total	**91**


NO3-N Sap
NO3-N (ppm)
1,400
1,200
1,000
800
600
400
200
0
1st Harvest
2nd Harvest
3/21/2006
4/4/2006
4/18/2006
5/2/2006
5/16/2006
5/30/2006
Date
54
94
154
214
274
334
394
454
20
60
120
180
240
300
360
420
IFAS

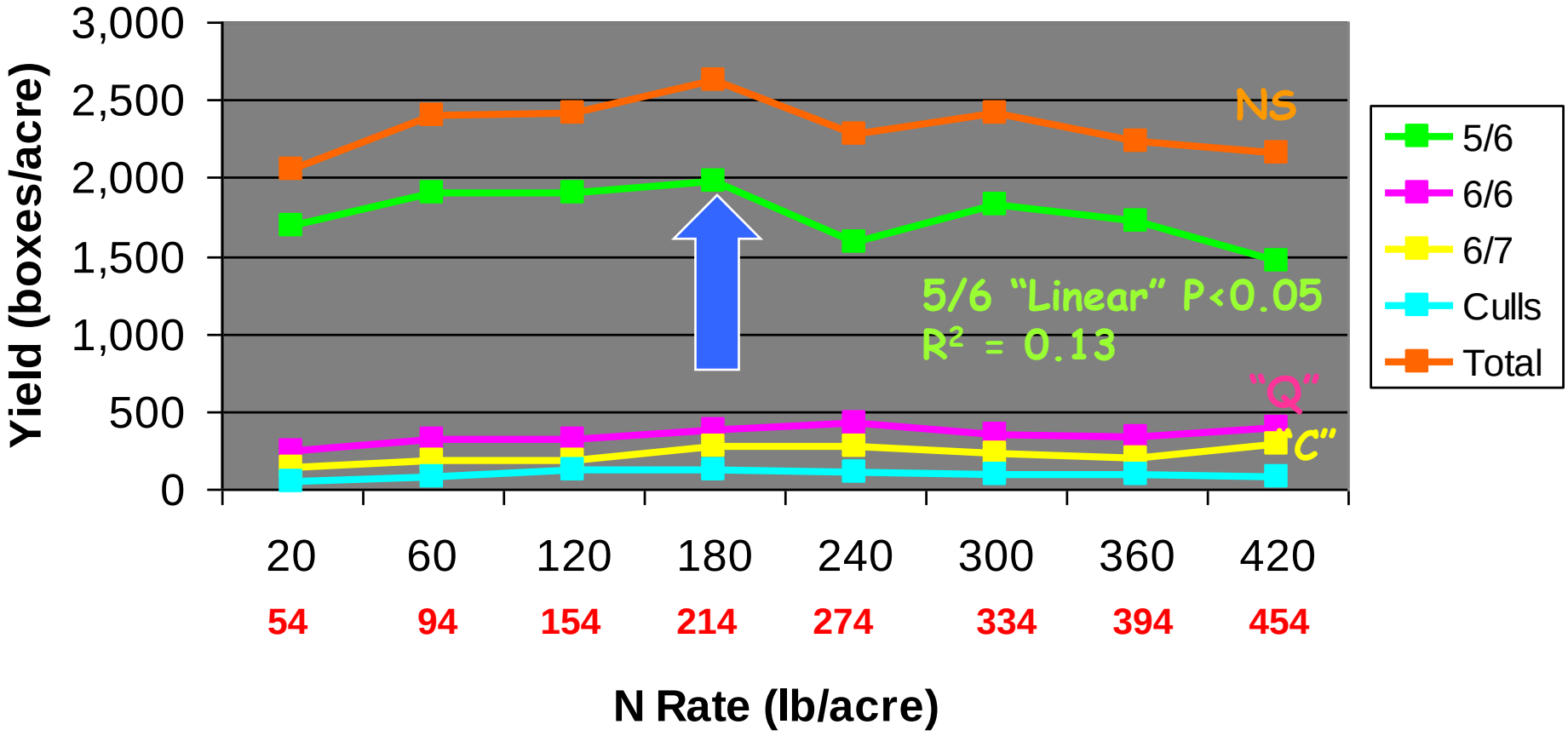

Potassium Sap
6,000
5,000
4,000
3,000
2,000
1,000
K (ppm)
1st Harvest
2nd Harvest
3/21/2006
4/4/2006
4/18/2006
5/2/2006
5/16/2006
5/30/2006
Date
54
94
154
214
274
334
394
454
20
60
120
180
240
300
360
420
IFAS


First Harvest (May 24, 2006)
Yield (boxes/acre)
2,000
1,500
1,000
500
0
NS
5/6 "Linear" P<0.05
R² = 0.14
5/6
6/6
6/7
Culls
Total
20
60
120
180
240
300
360
420
54
94
154
214
274
334
394
454
N Rate (lb/acre)

Second Harvest (June 7, 2006)



Total Harvest



First Harvest Post-Harvest Evaluation

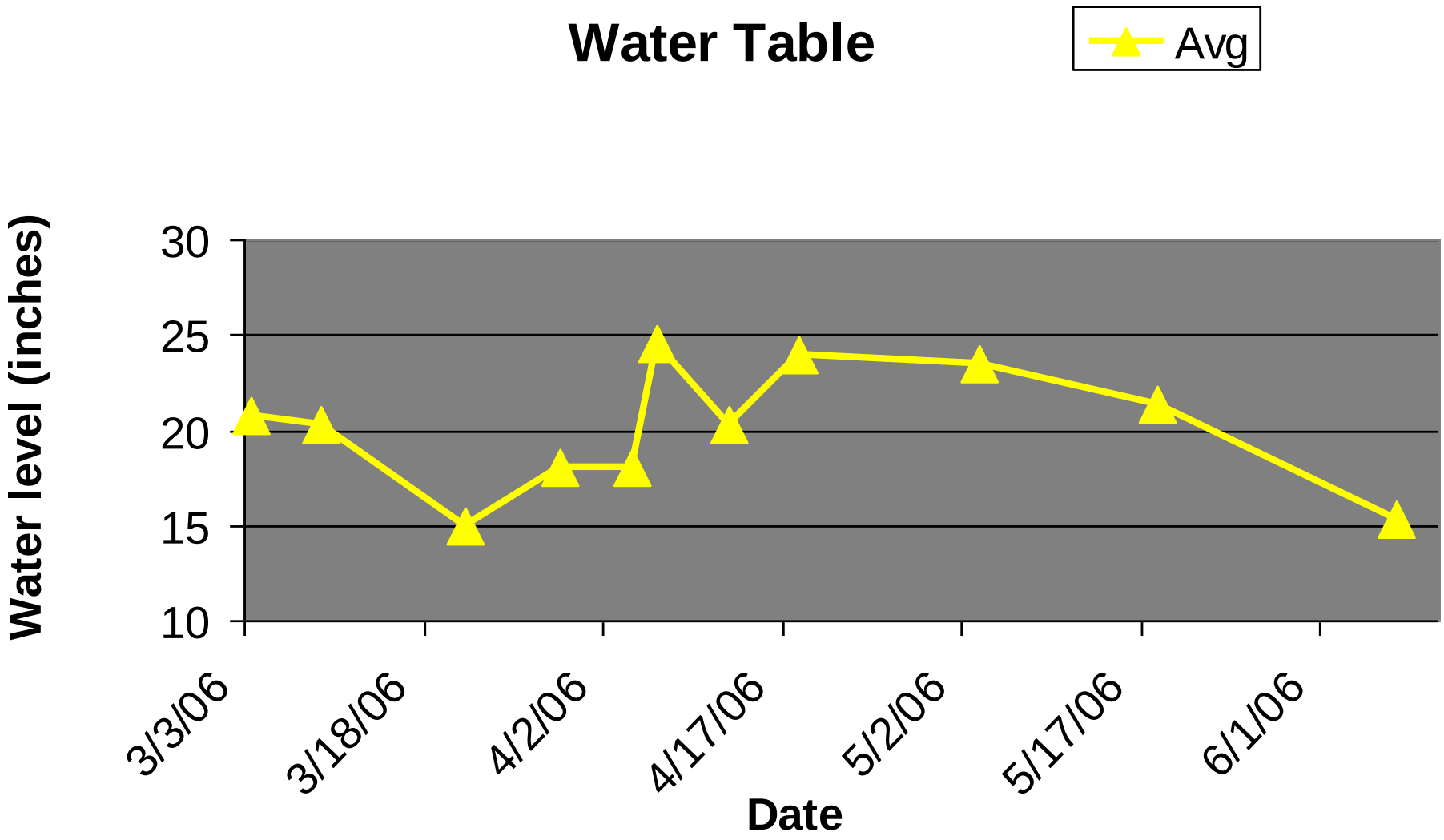
Treatment (lb/acre)	SSC*	sd***	TTA**(%)	sd	pH	sd
20	3.60	0.29	0.33	0.05	4.38	0.11
60	3.38	0.35	0.33	0.07	4.39	0.03
120	3.50	0.63	0.28	0.06	4.38	0.05
180	3.23	0.54	0.33	0.02	4.36	0.04
240	3.23	0.69	0.28	0.04	4.38	0.06
300	4.15	0.66	0.38	0.04	4.32	0.06
360	3.75	0.60	0.36	0.08	4.33	0.03
420	3.43	0.66	0.33	0.07	4.33	0.04
320-G	3.48	0.43	0.33	0.03	4.33	0.06
mean	3.53	0.29	0.33	0.03	4.35	0.03

*SSC = Soluble solids content, oBrix.
**TTA = Total titratable acidity
***Sd = Standard deviation.

Second Harvest Post-Harvest Evaluation

Treatment (lb/acre)	SSC	sd	TTA(%)	sd	pH	sd
0	4.80	0.57	0.39	0.00	4.42	0.06
60	4.03	1.20	0.36	0.06	4.42	0.04
120	4.25	1.34	0.30	0.00	4.45	0.02
180	3.80	0.96	0.34	0.06	4.40	0.02
240	3.30	2.26	0.28	0.08	4.36	0.08
300	4.65	0.35	0.39	0.02	4.39	0.01
360	3.95	1.34	0.36	0.04	4.36	0.00
420	4.75	1.77	0.35	0.13	4.42	0.16
320-G	4.50	0.14	0.36	0.08	4.44	0.11
mean	4.23	0.50	0.35	0.04	4.40	0.03

*SSC = Soluble solids content, oBrix.
**TTA = Total titratable acidity
***Sd = Standard deviation.


Water Table
Avg
Water level (inches)
30
25
20
15
10
3/3/06
3/18/06
4/2/06
4/17/06
5/2/06
5/17/06
6/1/06
Date

Conclusions

- Sap NO_3-N concentrations showed that rates lower than 100 lb/acre N were below IFAS sufficiency ranges 60 days after transplant.
- Total tomato yield, total first and second harvest did not differ among N treatments except in total and first harvest extra-large, total large and medium fruits categories.
- N treatments for soluble solids content, total titratable acidity and pH were within the range of typical values reported for 'FL-47' tomatoes.

Conclusions

- Potential season long $N\text{-}NO_3$, NH_4 and TKN contribution from reclaimed waste water were 61, 1.3 and 5.4 lb/acres, respectively. So, what is the "best" in-bed N rate under these conditions? With a 14-week-long spring tomato crop, up to 70 lb/acre of N can be contributed by reclaimed wastewater and assuming 50% can be taken up by the plants, then a net contribution of 35 lb/acre of N. At $0.41/ lb of N this may result in a cost savings of $29/acre.

- These results suggest that (1) nitrate in reclaimed water should be accounted for in the N fertilization program, and (2) tomato yields and nutritional status were more enhanced by reclaimed water at low N rates.