# What's in your bag?

## Calculating N-P-K

## Nutrient Management BMPs

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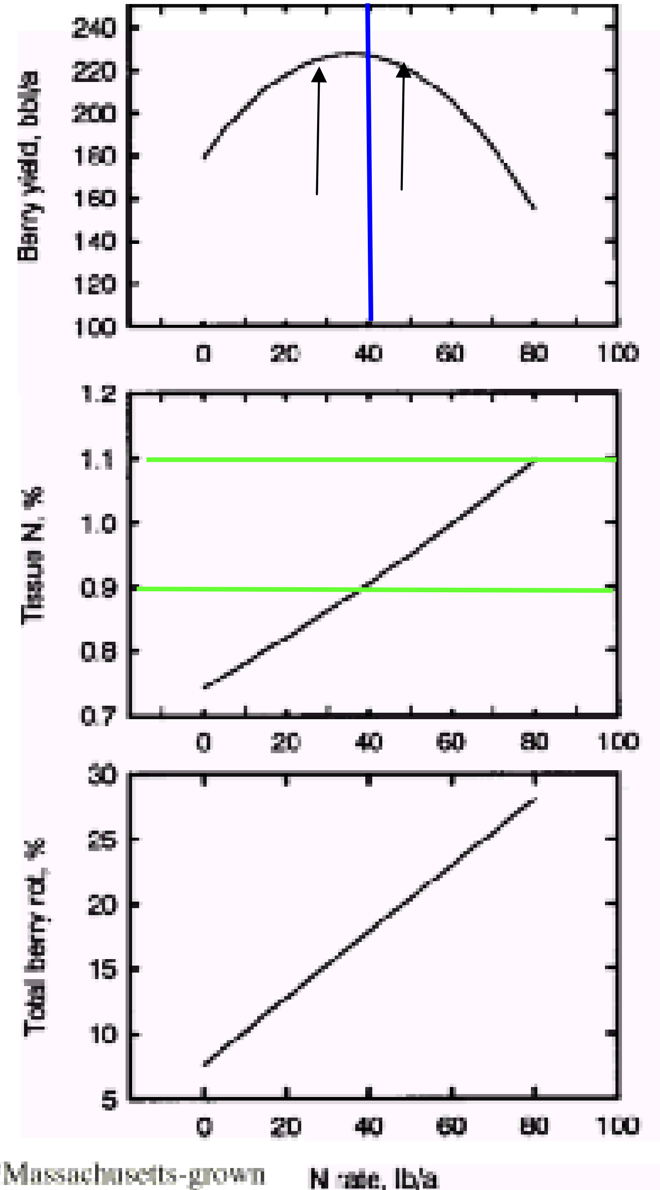
# Topics to be covered

- Choosing N rates
- Comparing available fertilizers
- How to calculate application rate
  - Nitrogen
  - Phosphorus
  - Potassium
- Calculations for supplements and liquids
- Phosphorus reduction
  - Monitoring tissue levels
- Water quality
  - Data from P reduction
  - Flood handling BMP

# Nitrogen and Cranberries

- Nitrogen is arguably the most important fertilizer element applied to cranberries.
- Most growers base their fertilizer program on the amount of N they think the bog needs
- There is a body of research on N needs and rates

## Figure 11.—Yield, tissue N, and rot of cranberries with various N fertilizer rates.*



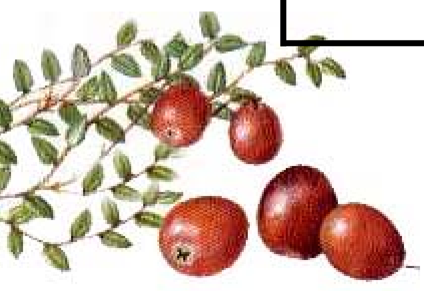

*Massachusetts-grown 'Stevens'

# Optimal N rate (lbs/a)

| | |
|---|---|
| Davenport - all | 20 |
| Davenport - S in WI | 40 |
| Hart et al. - Cr in OR | 40 |
| Hart et al. - S in OR | 60 |
| DeMoranville - EB in MA | 30 |
| Davenport/DeMoranville - S in MA | 20-60 |

# Nitrogen fertilizer sources

| Fertilizer | %N | | Fertilizer | %N |
|---|---|---|---|---|
| Ammonium sulfate | 21 | | Ammonium nitrate | 34 |
| Urea | 45-46 | | UAN | 32 |
| MAP | 11 | | | |
| DAP | 18 | | Blends | varied |
| Amm.PolyP (liquid) | 10 | | | |
| | | | | |



# Common choices

- NPK ammoniated
- NPK blends
- NPK slow release
  - IBDU
  - MU
  - Osmocote
- Ammonium sulfate
- Urea
- All of these are granular
- Some liquids
  - fish

# How to calculate nitrogen

- First number on the bag is the percent N in the fertilizer
  - eg. 12-24-12 is 12% N
- To calculate pounds of N in a certain amount of fertilizer
  - Pounds of fertilizer x first number as a decimal
  - eg. 200 lbs 12-24-12 has 24 lbs N

    200 x (12 x 0.01) = 24

# How to calculate N

- To calculate how much fertilizer to use to get a set number of pounds of N
  - Pounds of N / first number as a decimal
  - eg. 40 lbs of N needed using 12-24-12

    40 / (12 x 0.01) = 333

# Calculating amounts to apply starting from scratch

- Decide on N rate (season)
- Decide on split
- Decide on product
- Calculate amount of product to apply for each timing

# Calculating amounts to apply starting from scratch – example

30 lb N/acre 20% in May; 80% bloom

12-24-12 for both applications

N = 12%, as a decimal = 0.12 (multiply first number by 0.01)

May: 20% of 30 lb = [20 x 0.01] x 30 = 6 lbs N

lbs 12-24-12: 6 / 0.12 = 50 lbs fertilizer/acre

Bloom: 80% of 30 lb = [80 x 0.01] x 30 = 24 lbs N

lbs 12-24-12: 24 / 0.12 = 200 lbs fertilizer/acre

Total fertilizer = 250 lbs

# Calculating amounts to apply changing from known practice

- What is your current material and fertilizer rate?
- How much N did that contain?
- Decide on new product
- Calculate amount of that product to apply based on previous N rate and split rate

# Calculating amounts to apply changing from known practice example

Currently using 300 lb/acre 12-24-12

Fertilizer contains 12% N

300 lbs contains 36 lbs N  [300 x (12 x 0.01)]

New choice is 18-8-18 – still want 36 lbs N

Use 200 lbs  [36 / (18 x 0.01)]

# That’s the N – how about P?

- Generally added with N in an N-P-K formulation
- Can be applied independently as super-P or triple super-P (new plantings)
- Those forms can be blended into N-P-K also

# Other P fertilizers used in custom blending

- MAP (11-49-0)
  - Monoammonium phosphate
  - Forms an acidic zone around the particles in the soil
- DAP (18-47-0)
  - Diammonium phosphate
  - Used in lowbush blueberry production
  - Provides more N
- Ammonium polyphosphate (10-34-0)
  - Liquid used to make ammoniated materials

# Phosphorus fertilizer sources

| Fertilizer | %N | %$P_2O_5$ | lb P actual in 100 lb |
|---|---|---|---|
| Super P | 0 | 21 | 9.2 |
| Triple Super P | 0 | 45 | 19.8 |
| MAP | 11 | 49 | 21.6 |
| DAP | 18 | 47 | 20.7 |
| Amm.POLY (liquid) | 10 | 34 | 15 |
| Rock P | 0 | 34 | 15 |

# Calculating phosphorus

- The second number on the bag is <u>not</u> actual P!!

$$P \xrightarrow{\times\ 2.29} P_2O_5$$

$$P_2O_5 \xrightarrow{\times\ 0.44} P$$

What's on the bag!

# Calculations

- Example #1 – 45 lb N

I used 375 lb/acre 12-24-12 – how much P?

375 x 0.24 x 0.44 = 39.6 lb/acre

0.24 is the second bag number converted to a decimal
[24 x 0.01 = 0.24]

0.44 converts $P_2O_5$ to actual P

# Calculations

- Example #2 – 45 lb N

I used 250 lb/acre 18-8-18 – how much P?

250 x 0.08 x 0.44 = 8.8 lb/acre

0.08 is the second bag number converted to a decimal
[8 x 0.01 = 0.08]

0.44 converts $P_2O_5$ to actual P

# Calculations

- Example #3 – 45 lb N

I used 300 lb/acre 15-15-15 – how much P?

300 x 0.15 x 0.44 = 19.8 lb/acre

0.15 is the second bag number converted to a decimal

[15 x 0.01 = 0.15]

0.44 converts $P_2O_5$ to actual P

# Calculating potassium

- The third number on the bag is <u>not</u> actual K!!

$$K \xrightarrow{\times 1.20} K_2O$$

$$K_2O \xrightarrow{\times 0.83} K$$

What's on the bag!

# Calculations

- Example – 45 lb N

I used 375 lb/acre 12-24-12 – how much K?

375 x 0.12 x 0.83 = 37.4 lb/acre

0.12 is the third bag number converted to a decimal
[12 x 0.01 = 0.12]

0.83 converts $K_2O$ to actual K

# Calculating seasonal budgets

- For each application – run the N, P, and K calculations
- Add all applications for the season
- Include fall applications in the following season
  - eg.  2007 season includes fall 2006 and all pre-harvest 2007 applications
  - If using fish as fall fertilizer pre-harvest – count that in the next year

# Liquids and supplements

- Anything that comes as granular or powder (even if you dissolve it and chemigate) – use the calculations as we just went over
- Liquids require a conversion from volume to weight to calculate pound of N, P, and K

# Example Fish 2-4-2

- Determine the weight of a gallon of the product in pounds or use the weight of a gallon of water as an estimate (8.34 lb/gal)
- Pounds N, P, K per gallon applied =

  8.34 x 0.02 = 0.17 lb N per gal

  8.34 x 0.04 x 0.44 = 0.15 lb P per gal

  8.34 x 0.02 x 0.83 = 0.14 lb K per gal
- Multiply these figures by the number of gallons applied to get total pounds of N, P, and K

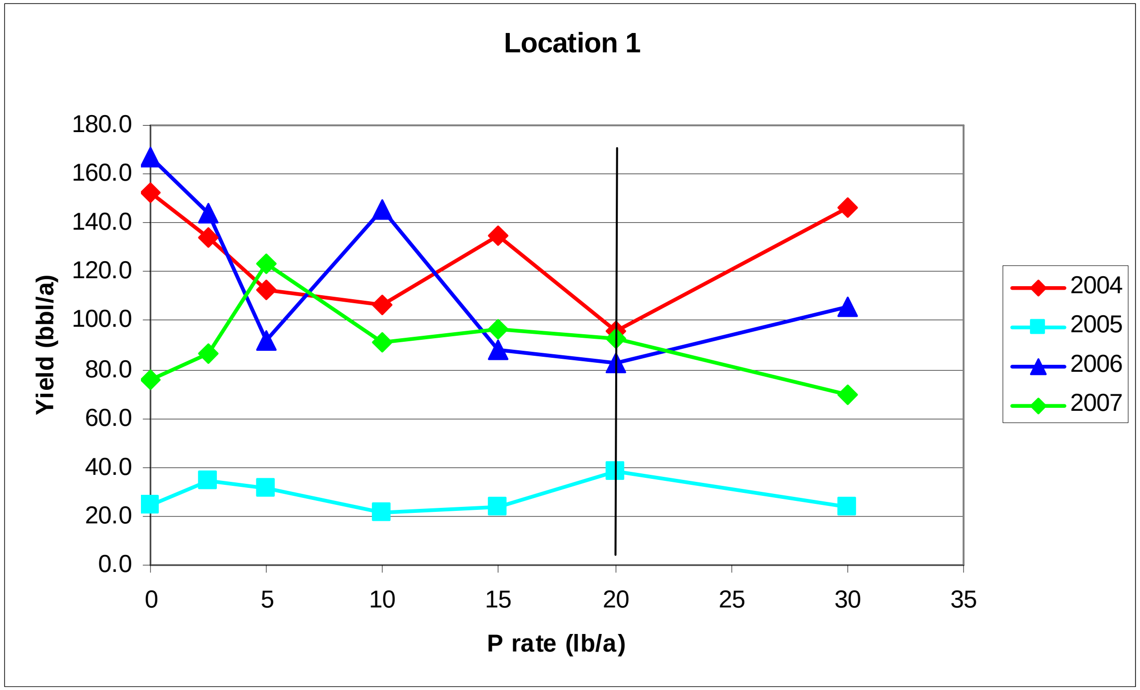
Calculation examples are in the 2008 Chart Book – coming soon

# Phosphorus reduction and monitoring

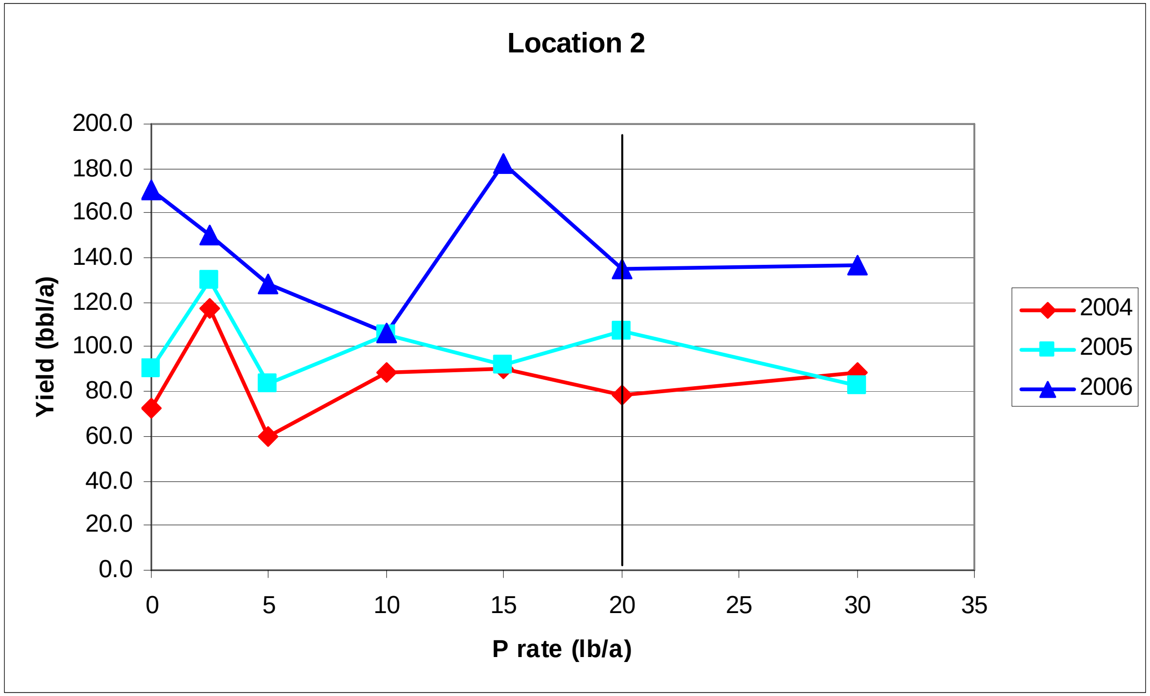
- Plot and whole farm research shows P reduction is viable
- But for how long and how do we monitor?
- Yield records and <u>tissue sampling</u>
  - Tissue to ‘catch’ a problem before yield declines
  - Also yield can be up or down due to other factors

# Massachusetts plot research

# 2004-2007

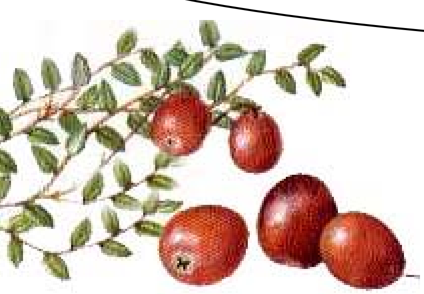



Loc. 1 had tissue P below std. range




# Yield comparisons – field scale

| | EH | | PV | |
|---|---|---|---|---|
| **Year** | **P rate** | **Yield** | **P rate** | **Yield** |
| 2002 | 17.8 | 117 | 24.8 | 117 |
| 2003 | 14.3 | 119 | 22.3 | 119 |
| 2004 | 5.6 | 172 | 17.3 | 195 |
| 2005 | 16.5 | 190 | 24.0 | 121 |
| 2006 | 6.4 | 162 | 5.7 | 244 |
| pre-reduction | 17.8 | 117 | 22.1 | 138 |
| post-reduction | 10.7 | 161 | 5.7 | 244 |



# Tissue standard is 0.1-0.2% P

<0.1%  --- increase P rate and retest next year

0.1 – 0.11% -- stay the course but retest next year

0.12 – 0.15% -- test again in 2-3 years

0.16% or greater – test again in 3-4 years

# Why P reduction?

# Cranberry Bog Total Phosphorus

| CES/SMAST Field Expt. | **TP Fertilization (lb/a/yr)** | **TP "Storage" (lb/a/yr)** | **TP "Export" (lb/a/yr)** |
|---|---|---|---|
| **Bog ID** | **Mean 2003-04** | | |
| EH | 10.0 | -5.5 | 1.4 |
| PV | 19.8 | -14.9 | 2.7 |
| BEN | 16.8 | -13.6 | 1.2 |
| WS | 17.5 | -12.6 | 3.2 |
| M-K | 20.4 | -19.1 | -0.5** |
| ASH | 30.2 | -29.3 | -0.2** |
| Mean | 19.1 | -14.1 | 1.28 |

A Flow-through Bog was found to have a higher annual TP loss of 8.8 lb/a/yr (Howes & Teal 1995)

- Environmental benefit to P reduction
- P concentration in outlet water decreased with fertilizer reduction and was lower on mineral sites

**mean ppm TP in flood discharges**

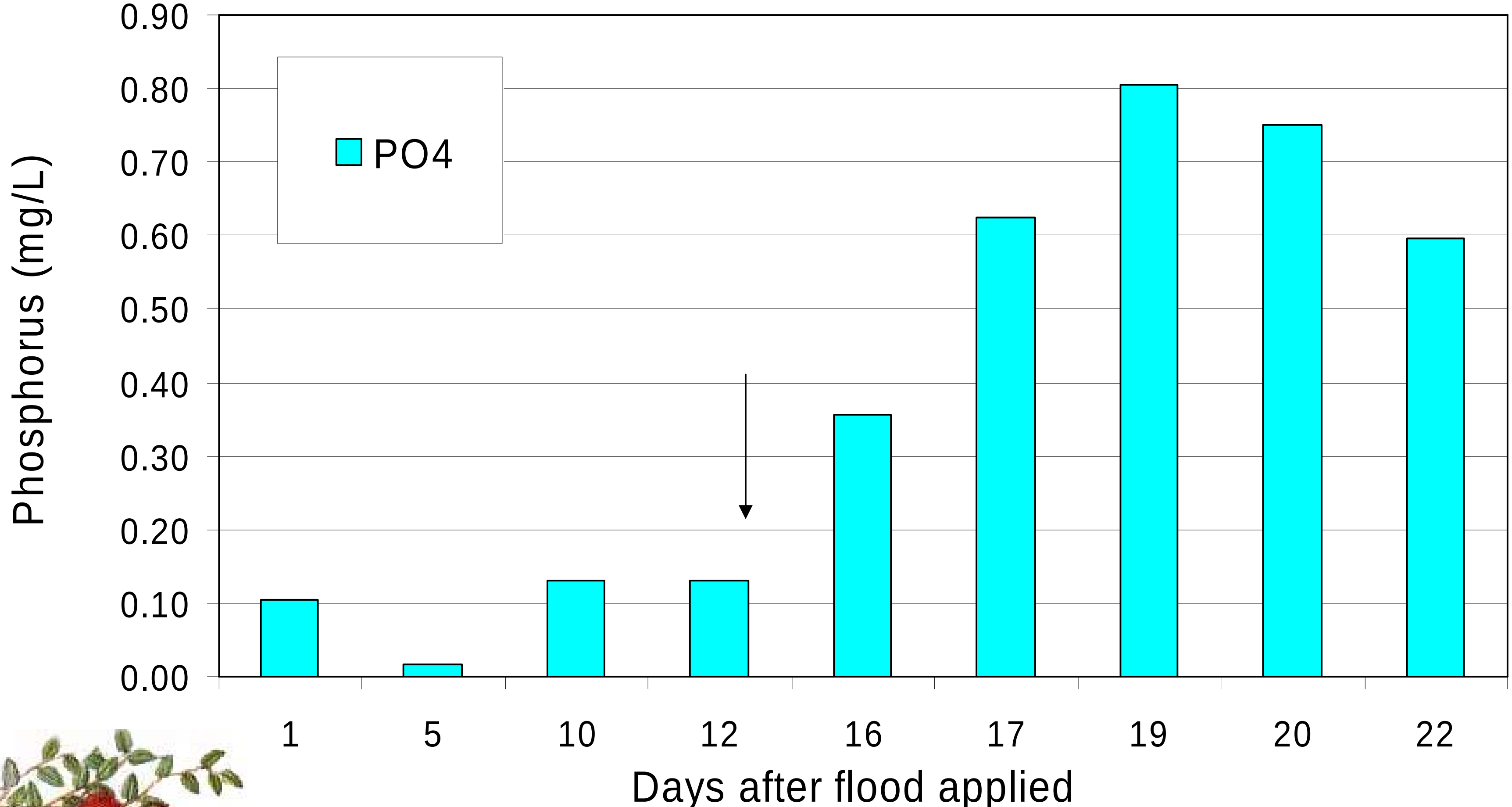
| Bog | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|
| EH | 0.377 | 0.424 | 0.237 | 0.097 |
| PV | 0.384 | 0.439 | 0.528 | 0.408 |
| M-K | 0.100 | 0.170 | 0.118 | |
| ASH | 0.109 | 0.127 | 0.147 | |

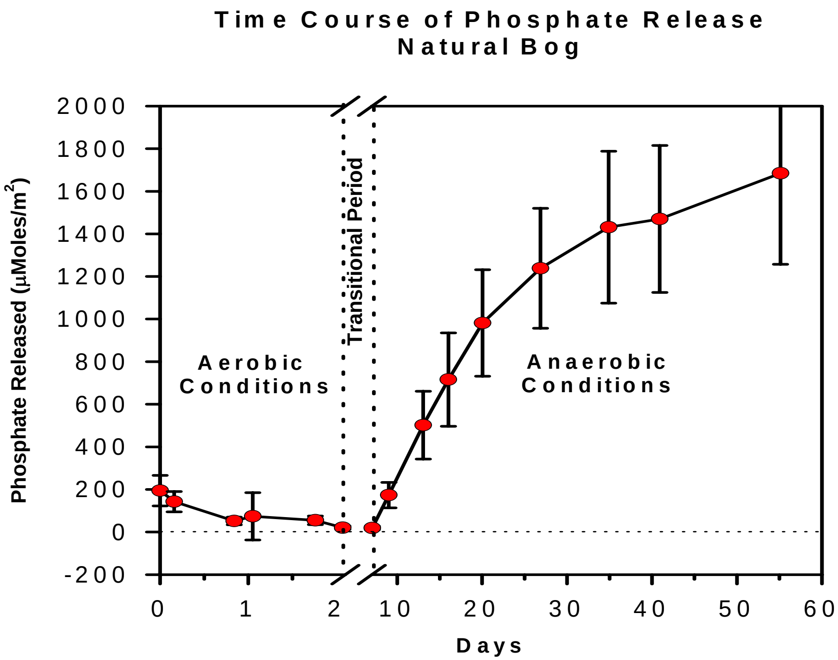
reduction

# BMPs for P reduction

- Use no more than 20 lb/acre
- At sensitive sites, reduce below 20 lb/acre
- If possible avoid discharge of water after fertilizer applications – impound or tailwater
- Flood management is critical
  - Harvest -- hold 2-4 days then discharge a moderate pace to finish by no later than day 10
  - Winter -- Release from beneath ice ASAP

# Most Phosphorus Loss occurs during flooding/draining as inorganic P released from the soil



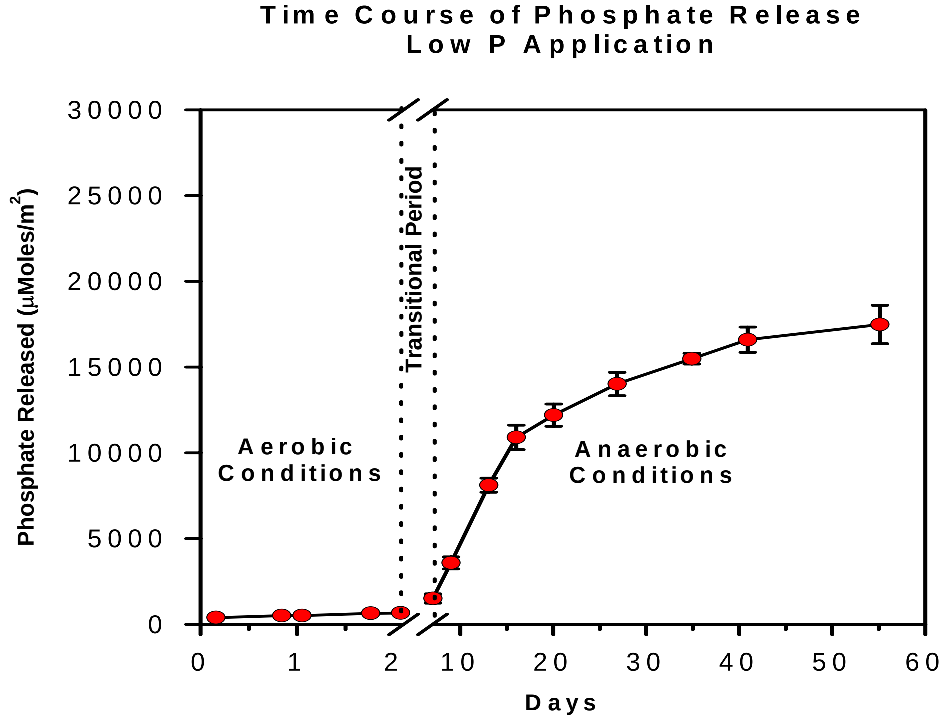



**P Release increased with amount of P Fertilization**

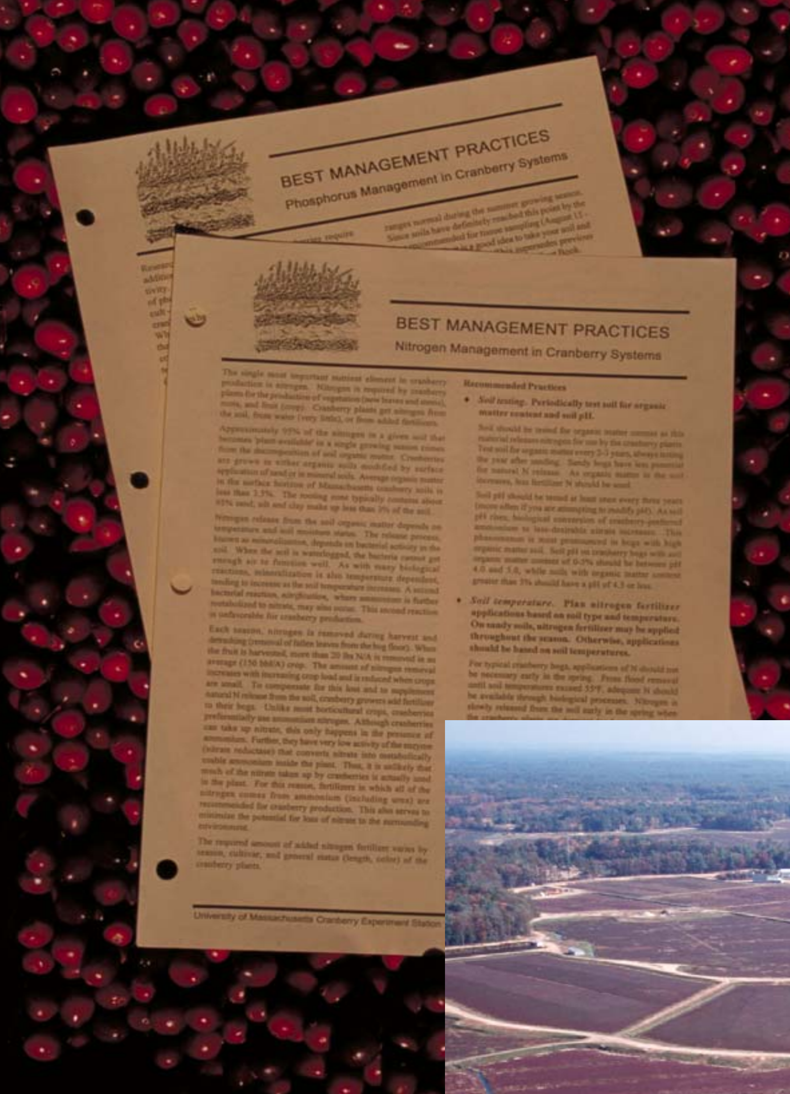
**Total P Release primarily when soil became anoxic**

***(rapid rise after day 10)***

**10 fold difference in release**




# Questions?


BEST MANAGEMENT PRACTICES
Phosphorus Management in Cranberry Systems
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