2008

Pesticide Safety 2008 - Nutrient Management BMPs Phosphorus

Carolyn J. DeMoranville
University of Massachusetts - Amherst, carolynd@umext.umass.edu

Nutrient Management BMPs
Phosphorus

Carolyn DeMoranville
UMass Amherst Cranberry Station

Topics to be covered

- Phosphorus reduction
  - Monitoring tissue levels
- Water quality
  - Data from P reduction
  - Flood handling BMP

Background – why P reduction?

- Nationally, cranberry farmers, like all farmers, are being pressured to develop nutrient management plans
- P management has become the primary issue for cranberry planning on the environmental side
- Cranberry farming involves discharging surface water into streams, pond, and lakes – most of these are P limited

Background

- Since growers apply based on N requirements, P applications may be in excess
- Actual P requirement based on plant composition/ growth is low
  - “trash” plus 200 bbl crop removes 4.2 lb P/acre
- Soil testing is problematic for planning due to lack of calibration ability – acid soils

Background

- Tissue testing should be a better tool (established standard value of 0.1 to 0.2%)
- For best planning, a target P application range should also be established
- If growers are exceeding the target range - the nutrient management plan would call for a reduction strategy

Recommended target

- No more than 20 lb P/acre
- This is ~45 lb/a P_2O_5 (what's on the bag)

Calculations

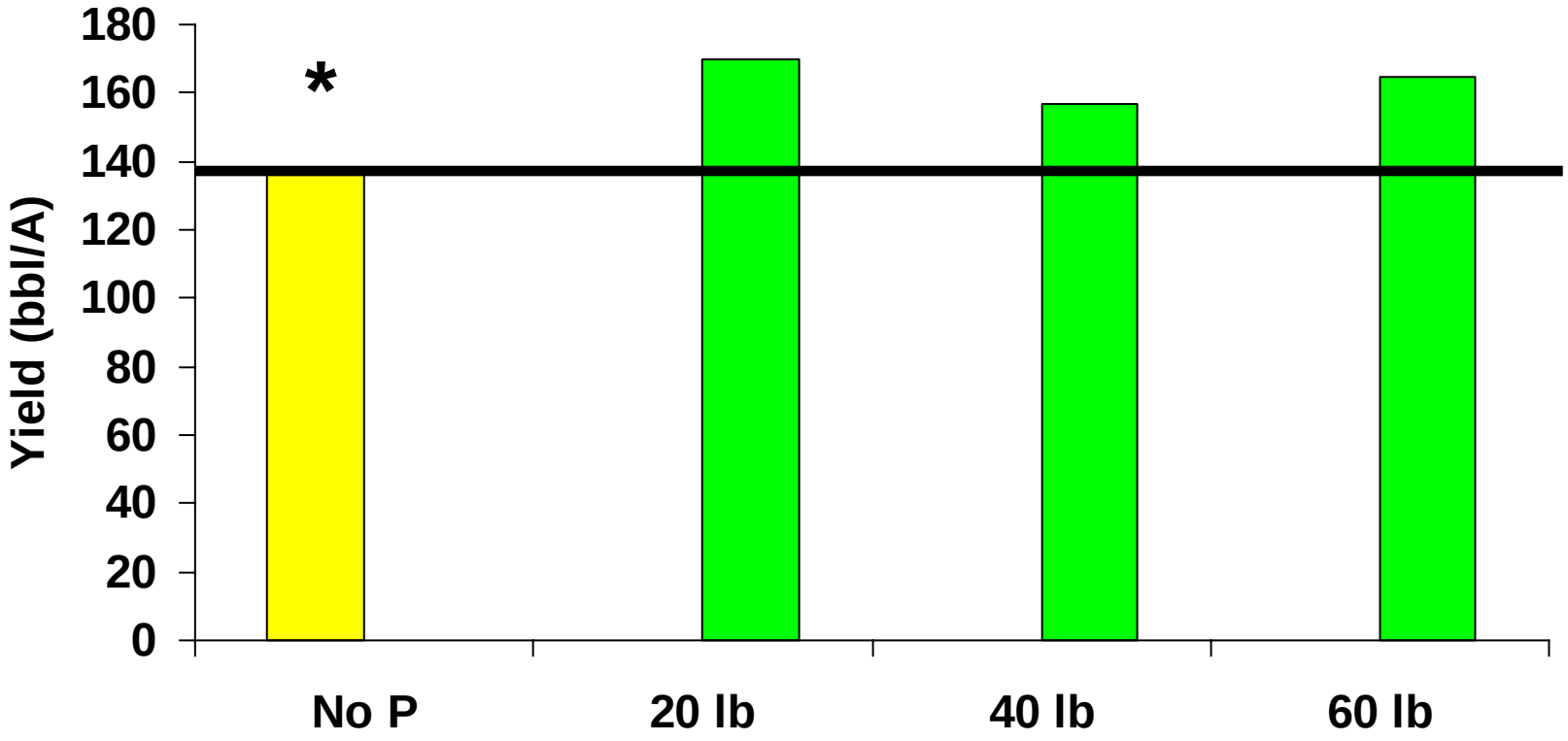
- The number on the bag is <u>not</u> actual P!!

$$P \xrightarrow{\text{X } 2.29} P_2O_5$$

$$P_2O_5 \xrightarrow{\text{X } 0.44} P$$

What's on the bag!

No difference among P rates, all > 0 rate



DeMoranville and Davenport, 1997

Yield comparisons – field scale P reduction

	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

Compare formulations

- High P ratio
  - 5-15-30
  - 3-13-26
  - 12-24-12

- Low P ratio
  - 15-15-15
  - 10-12-24
  - 18-8-12 (custom)
  - 18-8-18 (custom)

Advantage of 18-8-18:

Fewer pounds to apply (based on N requirement)

Lower application cost

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

mean mg/L 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

Net P loading from bog systems (organic soil)

lb/a/yr

	PO4		TP	
Bog/year	**in discharge**	**minus incoming**	**in discharge**	**minus incoming**
EH 2002	1.11	1.02	1.64	1.15
EH 2003	1.82	1.78	2.84	2.31
EH 2004	0.82	0.74	1.09	0.53
PV 2002	3.53	2.67	4.58	2.94
PV 2003	3.68	2.99	5.14	3.22
PV 2004	3.20	2.62	3.92	2.16

Net P loading from bog systems (mineral soil)

lb/a/yr

	PO4		TP	
Bog/year	**in discharge**	**minus incoming**	**in discharge**	**minus incoming**
M-K 2002	0.49	0.35	1.02	0.01
M-K 2003	0.69	0.32	1.42	0.05
M-K 2004	0.94	0.01	1.66	-1.10
ASH 2002	0.51	0.45	1.09	0.24
ASH 2003	0.40	0.26	1.32	-0.56
ASH 2004	1.09	0.95	1.97	0.17

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

Calculations

- 45 lb N using 12-24-12

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 bag number converted to a decimal

0.44 converts P_2O_5 to actual P

How to implement P reduction?

Calculating amounts to apply changing from known practice example #1

Currently using 375 lb/acre 12-24-12

Fertilizer contains 12% N

375 lbs contains 45 lbs N [375 x (12 x 0.01)]

New choice is 18-8-18 – still want 45 lbs N

Use 250 lbs [45 / (18 x 0.01)]

How much P is in that?

Calculations

- How much P?

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 bag number converted to a decimal

0.44 converts P_2O_5 to actual P

Calculation examples are also in the 2008 Chart Book

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 tissue sampling
  - Tissue to ‘catch’ a problem before yield declines
  - Also yield can be up or down due to other factors

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

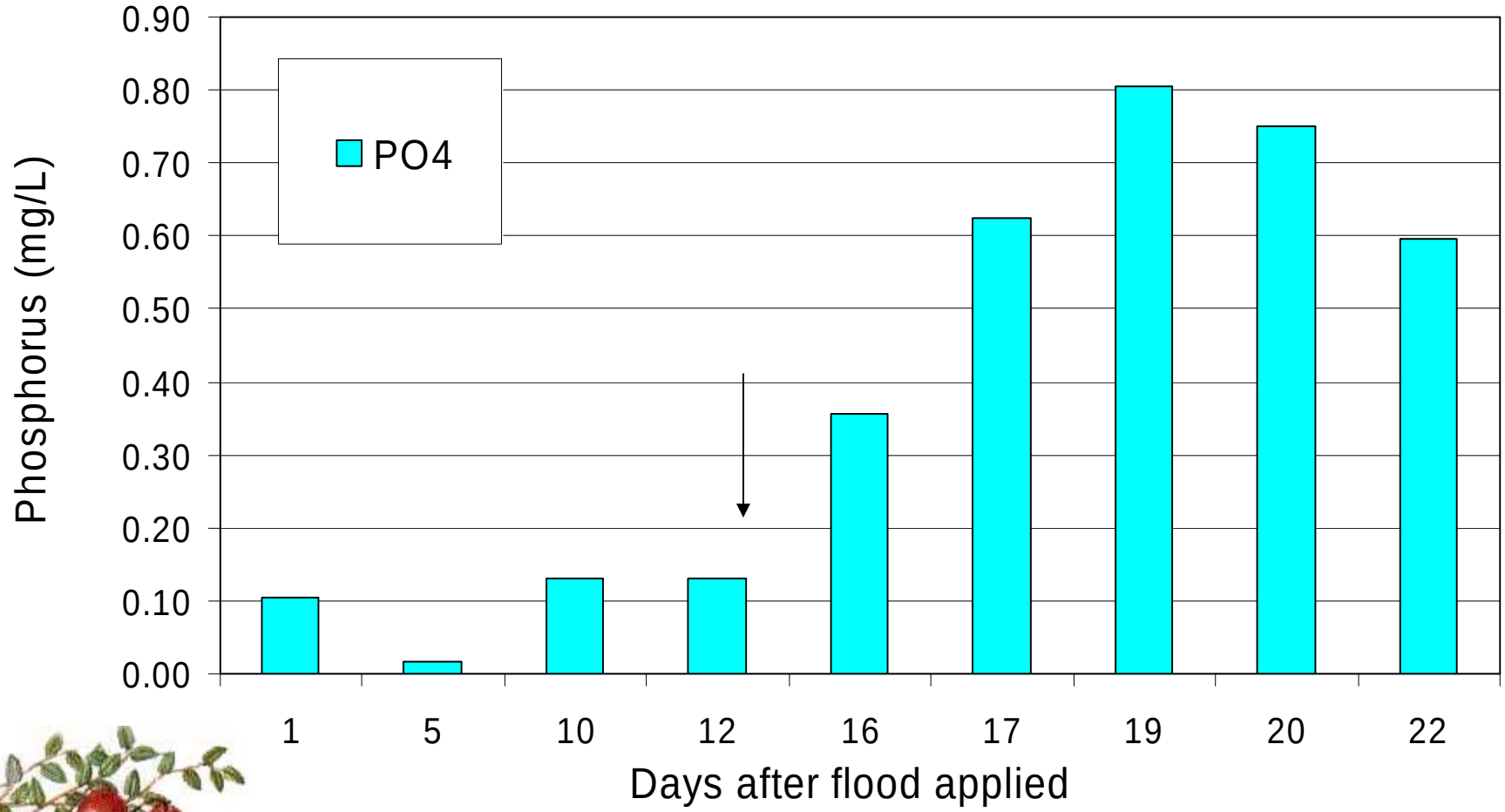
0.12 – 0.15% -- test again in 2-3 years

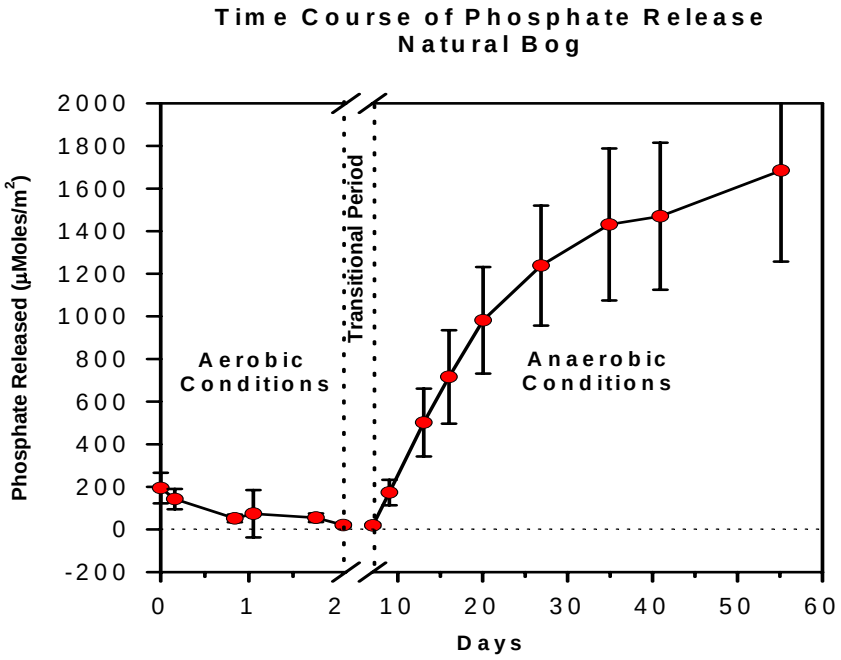
0.16% or greater – test again in 3-4 years

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 at 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

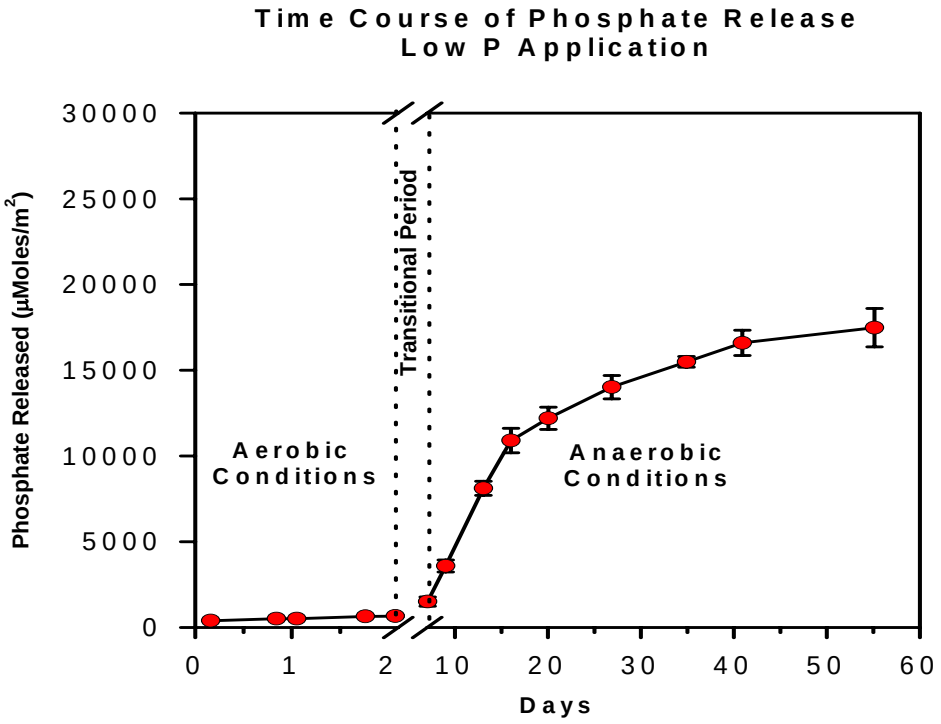


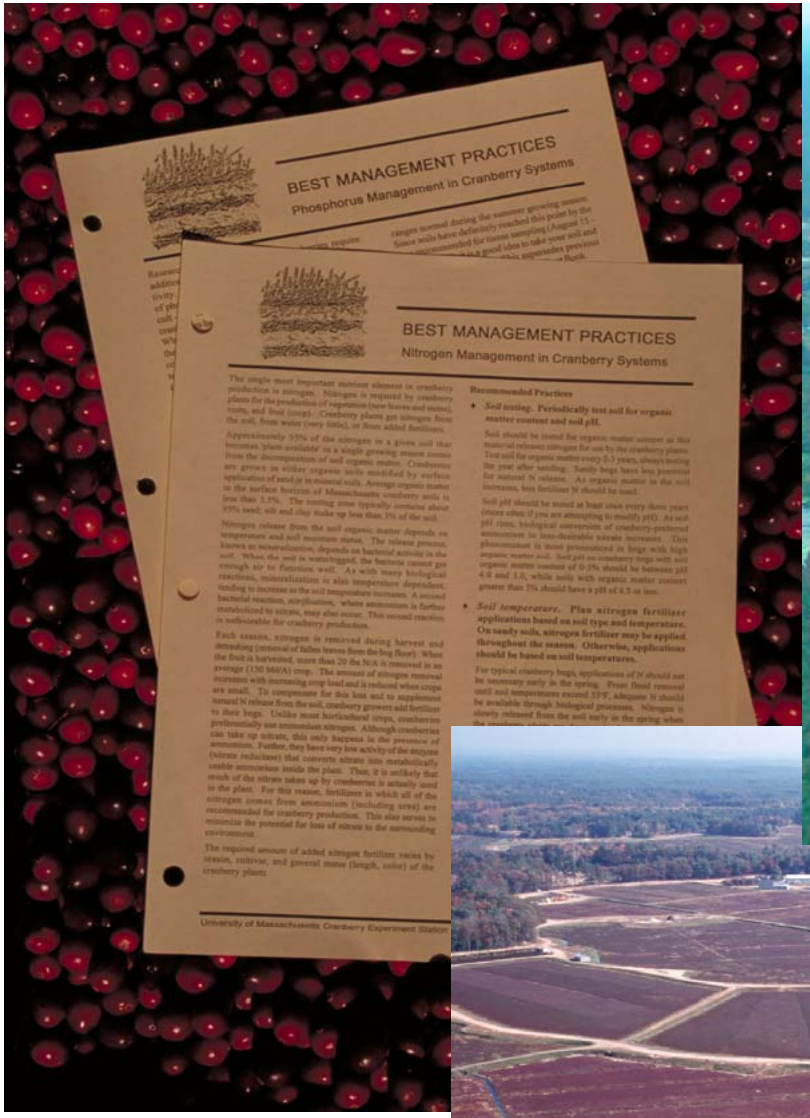


P Release increased with amount of P Fertilization

Total P Release primarily when soil became anoxic
(rapid rise after day 10)

10 fold difference in release




BEST MANAGEMENT PRACTICES
Phosphorus Management in Cranberry Systems
BEST MANAGEMENT PRACTICES
Nitrogen Management in Cranberry Systems
Recommended Practices
University of Massachusetts Cranberry Experiment Station

Questions?