



# Utilization of Biosolids for Pasture Fertilization

57<sup>th</sup> Annual Beef Short Course

Maria L. Silveira

UF/IFAS Range Cattle REC

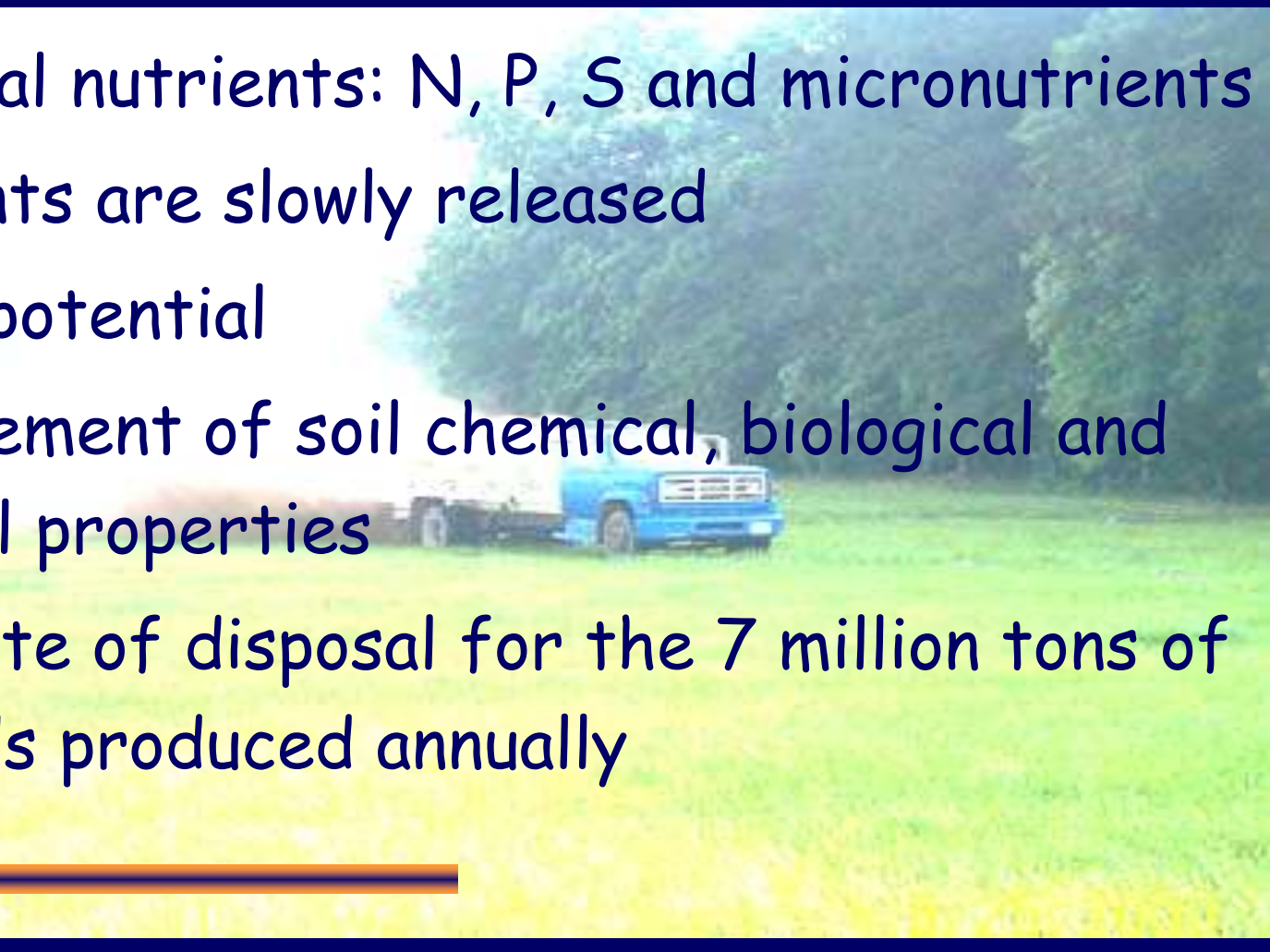
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# Benefits of Biosolids Land Application

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- ✓ Essential nutrients: N, P, S and micronutrients
  - ✓ Nutrients are slowly released
  - ✓ Liming potential
  - ✓ Enhancement of soil chemical, biological and physical properties
  - ✓ Key route of disposal for the 7 million tons of biosolids produced annually
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# What are “Biosolids”?



- Biosolids are the by-product of the treatment of domestic sewage
- Sewage sludge undergoes pathogen control treatment that meet regulatory requirements
- Sewage sludge that is disposed of by landfill or incineration is NOT considered biosolids

# Are all Biosolids Materials the Same?

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- Biosolids characteristics vary considerably
- Federal regulation: 40 code of Federal Regulations (CFR) Part 503. Enforced by EPA
- State regulation: Chapter 62-640, FL Administrative Code (FAC) regulations. Regulated by FL-DEP.
- Two types of residuals: Class A (AA) or Class B

# Are all Biosolids Materials the Same?

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Class A and Class B refer to the pathogen level.

Class A = Class AA (Florida)

Both materials are required to meet strict pollutant criteria.

# Types of Biosolids

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## Class AA (exceptional quality)

- contain minute levels of pathogens
- no restrictions (bagged and marketed to the public)

## Class B

- contain small, but compliant amounts of bacteria
  - restrictions for crop harvest, grazing animals (30-d restriction), and public contact
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# U.S. EPA Part 503 Regulatory Limits

Metal	Part 503 ceiling concentration (ppm)
As	75
Cd	85
Cu	4,300
Pb	840
Hg	57
Mo	75
Ni	420
Se	100
Zn	7,500

# U.S. EPA Part 503 Regulatory Limits

Metal	Part 503 ceiling concentration (ppm)	Pollutant concentration limits for AA biosolids (ppm)
As	75	41
Cd	85	39
Cu	4,300	1,500
Pb	840	300
Hg	57	17
Mo	75	---
Ni	420	420
Se	100	36
Zn	7,500	2,800



# Typical Biosolids Chemical Composition

Characteristic	Anaerobically Digested	Lime Stabilized	Pelletized
Solids (%)	25	25	92
Nitrogen (%)	5.6	3.8	2.4
Phosphorus (%)	2.2	1.0	2.7
Potassium (%)	0.2	0.4	---
pH	8	12	12
Copper (ppm)	566	236	100
Zinc (ppm)	1484	321	100

# Biosolids “dilemma”

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- ✓ N-based rates provide excess P
- ✓ N availability

# Plant Available N in Various Biosolids Materials

Time after application	Lime stabilized	Aerobically digested	Anerobically digested	Composted
Years	Plant available N (%)			
0-1	30-40	30-40	20-30	10-15
1-2	15	15	10	5
2-3	7	8	5	3

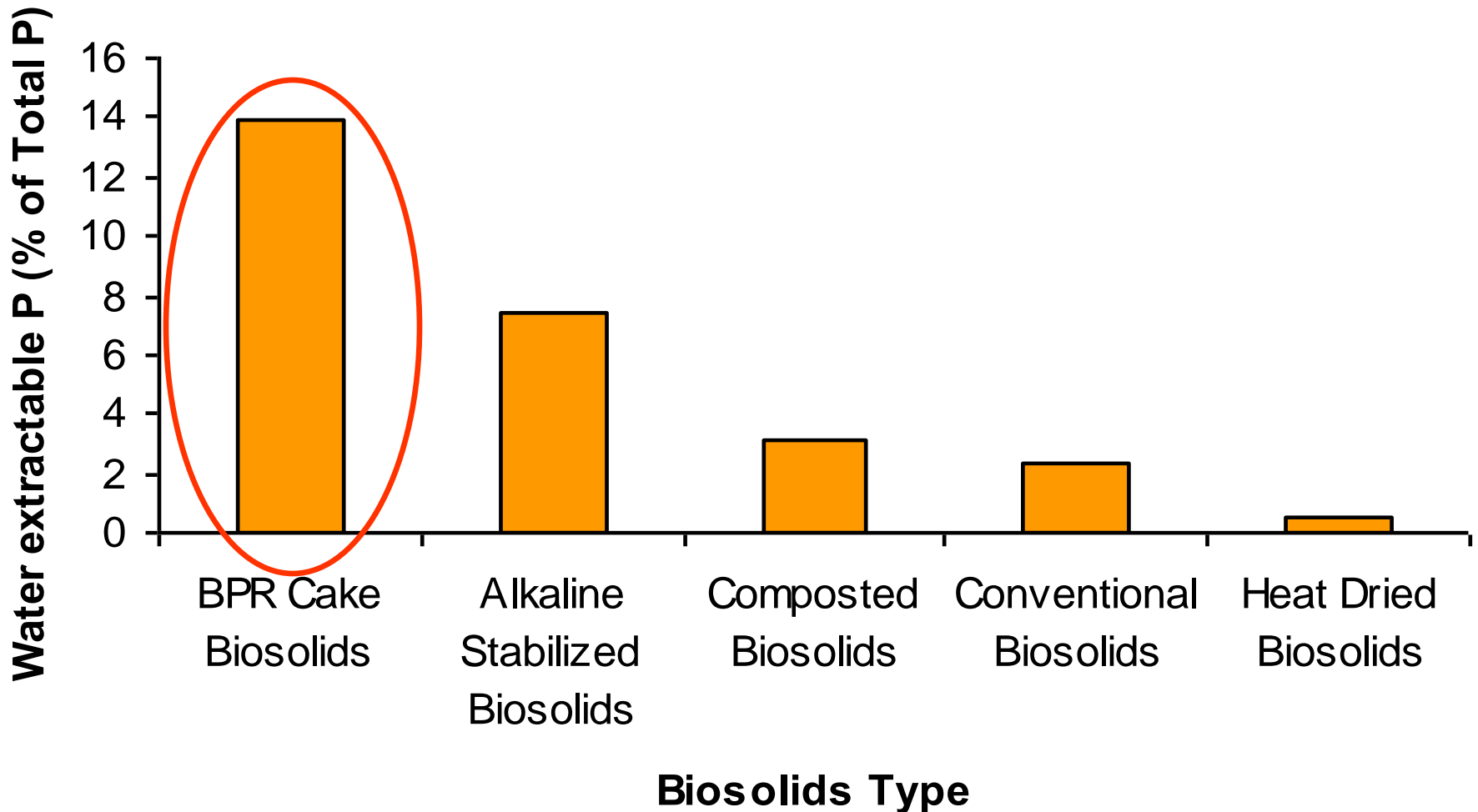
# Biosolids “dilemma”

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- ✓ P-based rates very low (~1-2 T/A)
  - Impractical
  - Uneconomical
  - Require greater land area
  - Require supplemental N

# Phosphorus Availability in Various Biosolids Materials



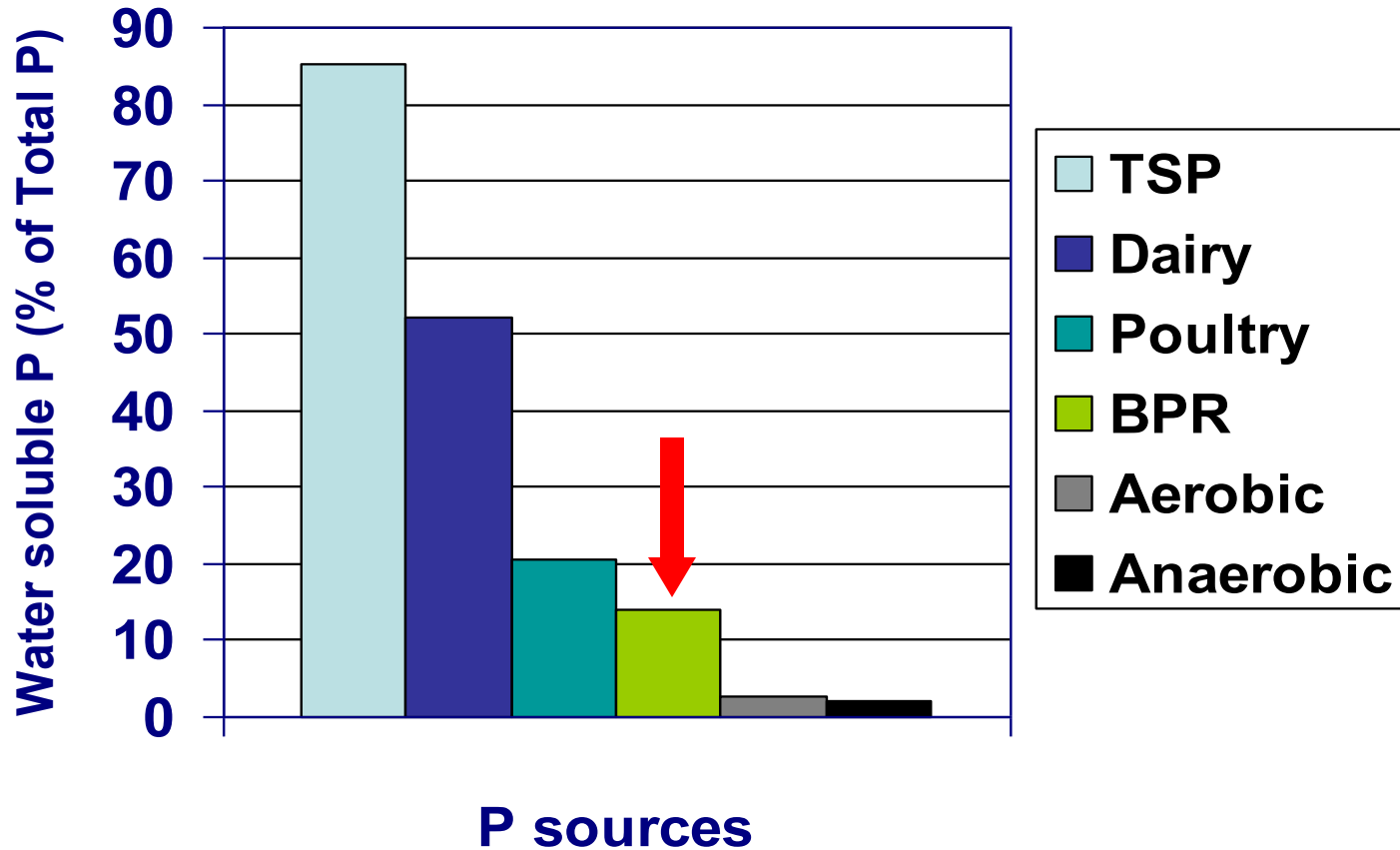
Source: Brandt et al. (2004)

# Phosphorus Availability in Various Biosolids Materials

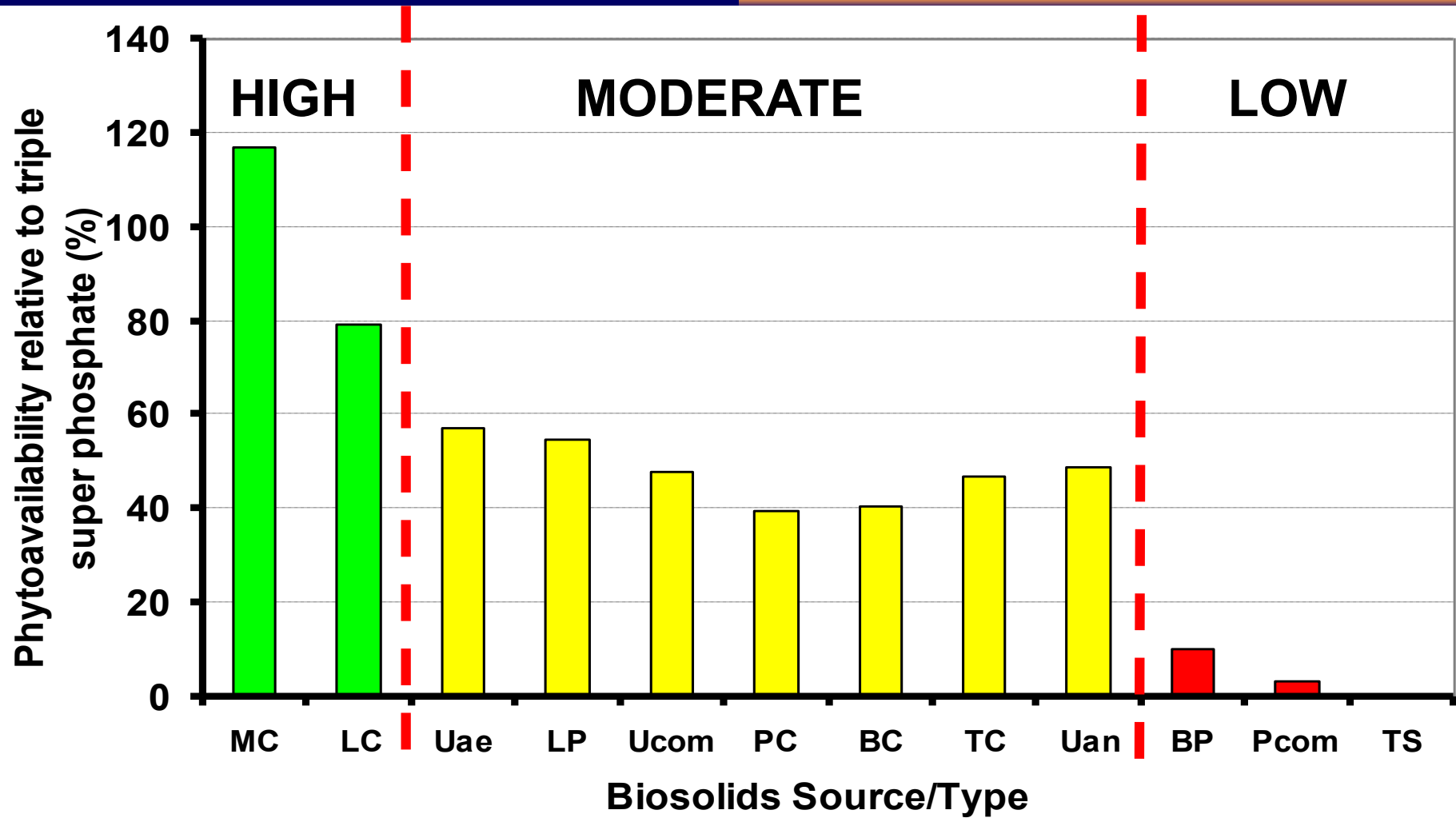
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- P availability depends on biosolids treatments
- Biological nutrient removal (BNR) processes increase P availability in biosolids
- Heat-drying and Al and Fe additions reduce P availability
- Despite the greater P solubility, BNP still have less soluble P than most manure and fertilizers

# Soluble P Concentrations in Fertilizer, Manures, and Biosolids



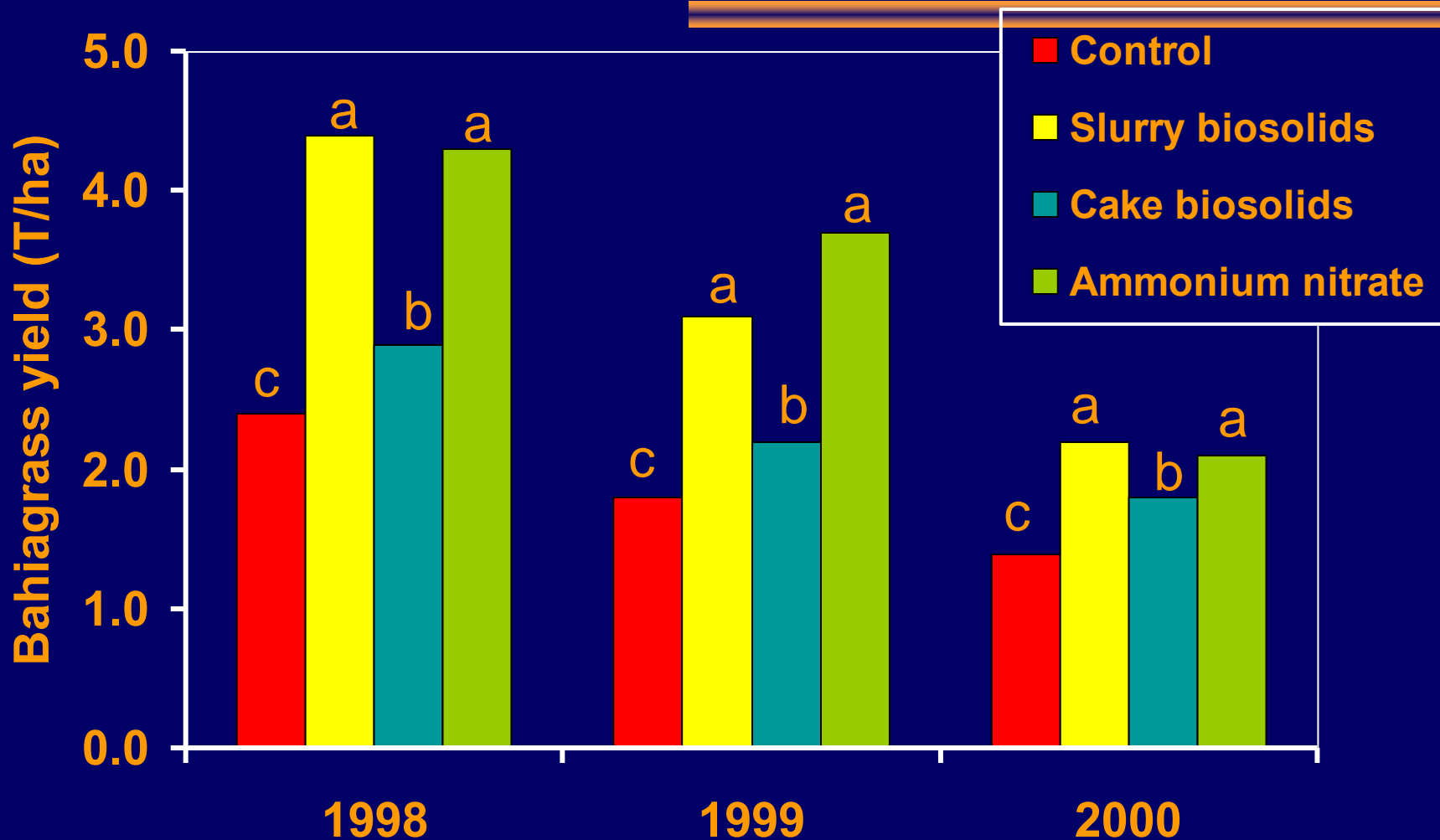
# Phosphorus Availability in Various Biosolids Materials



Source: O'Connor et al. (2004)

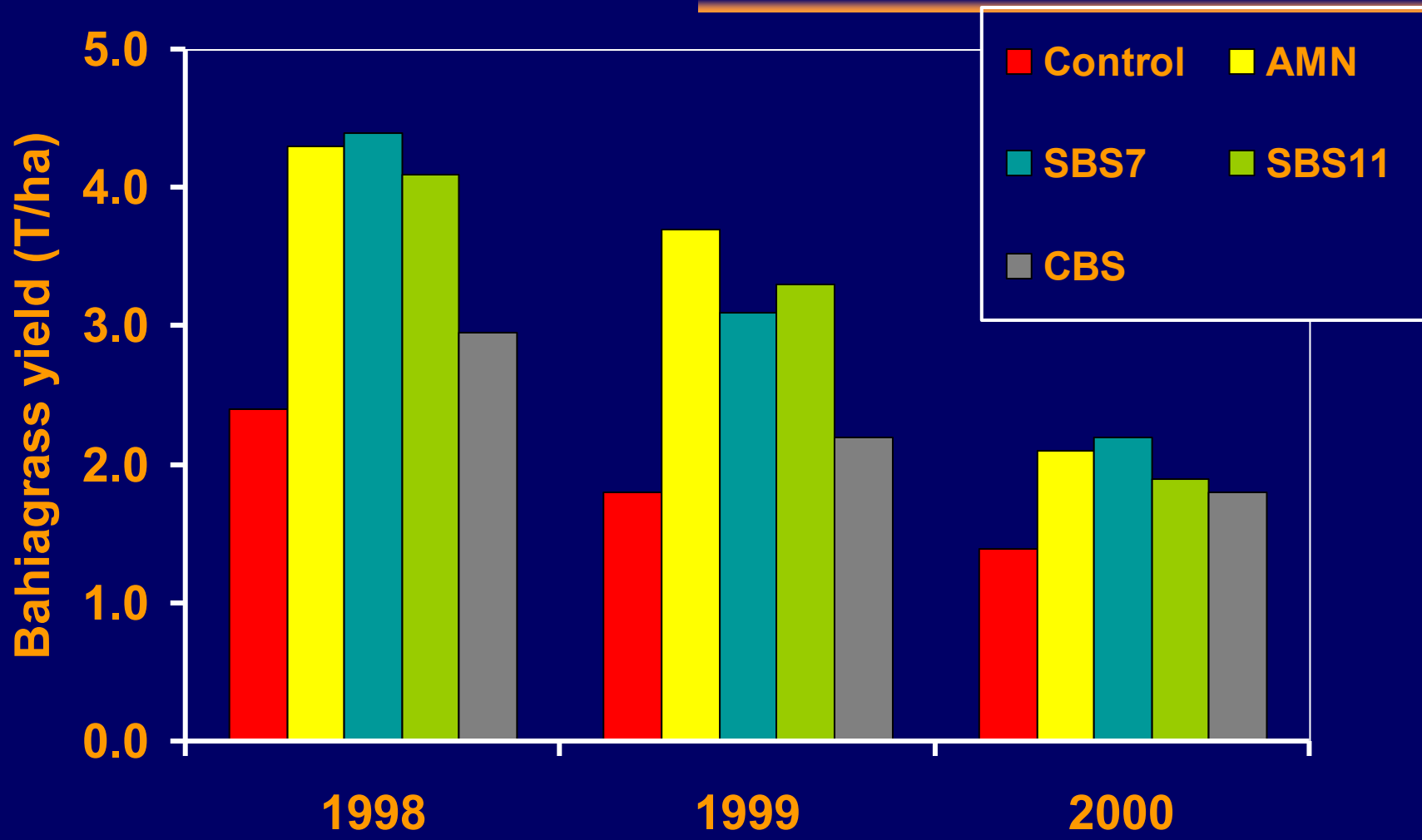


# Bahiagrass Response to Biosolids Application (80 lb N/A)



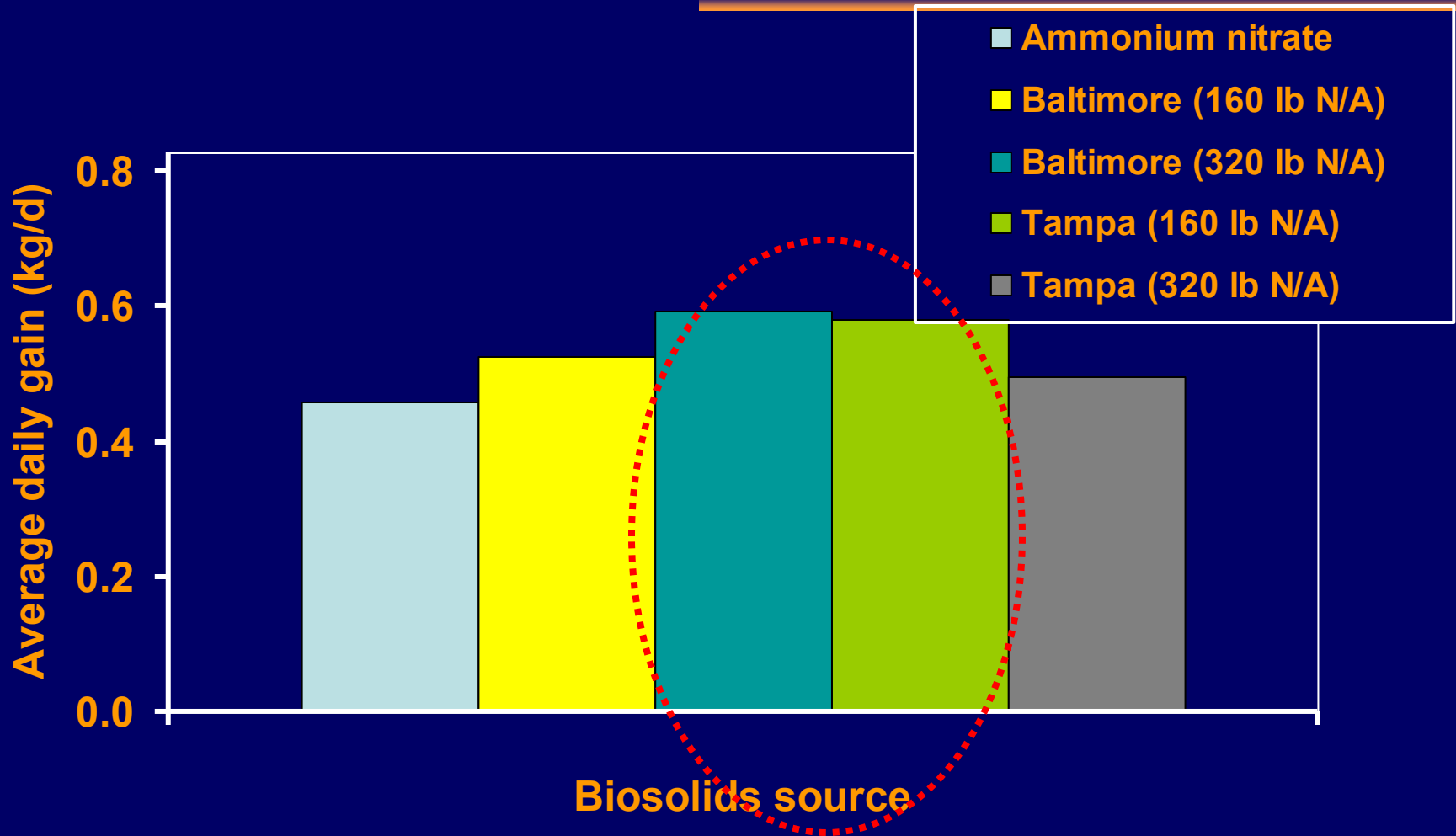
Source: Adjei and Rechcigl (2002)

# Bahiagrass Response to Class B Biosolids Application



Source: Sigua et al. (2005)

# Effects of biosolids application on performance of grazing beef heifers



Source: Tiffany et al. (2000)

# Main Concerns Relative to Land Application of Biosolids

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- ✓ Pathogen spread
- ✓ Heavy metal accumulation
- ✓ Excessive load of plant nutrients
- ✓ Odor to the neighborhood
- ✓ Environmental Regulations

Over the past 30-yr, U.S. EPA has developed guidelines for the application and use of biosolids on agricultural lands

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# Research Results

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- ✓ Vast scientific literature is available addressing the effects of land application of biosolids
  - ✓ Land application of biosolids has been proven to be a safe alternative to recycle nutrients in forage-based animal production systems and to efficiently reduce commercial fertilizer and lime application
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# Research Results

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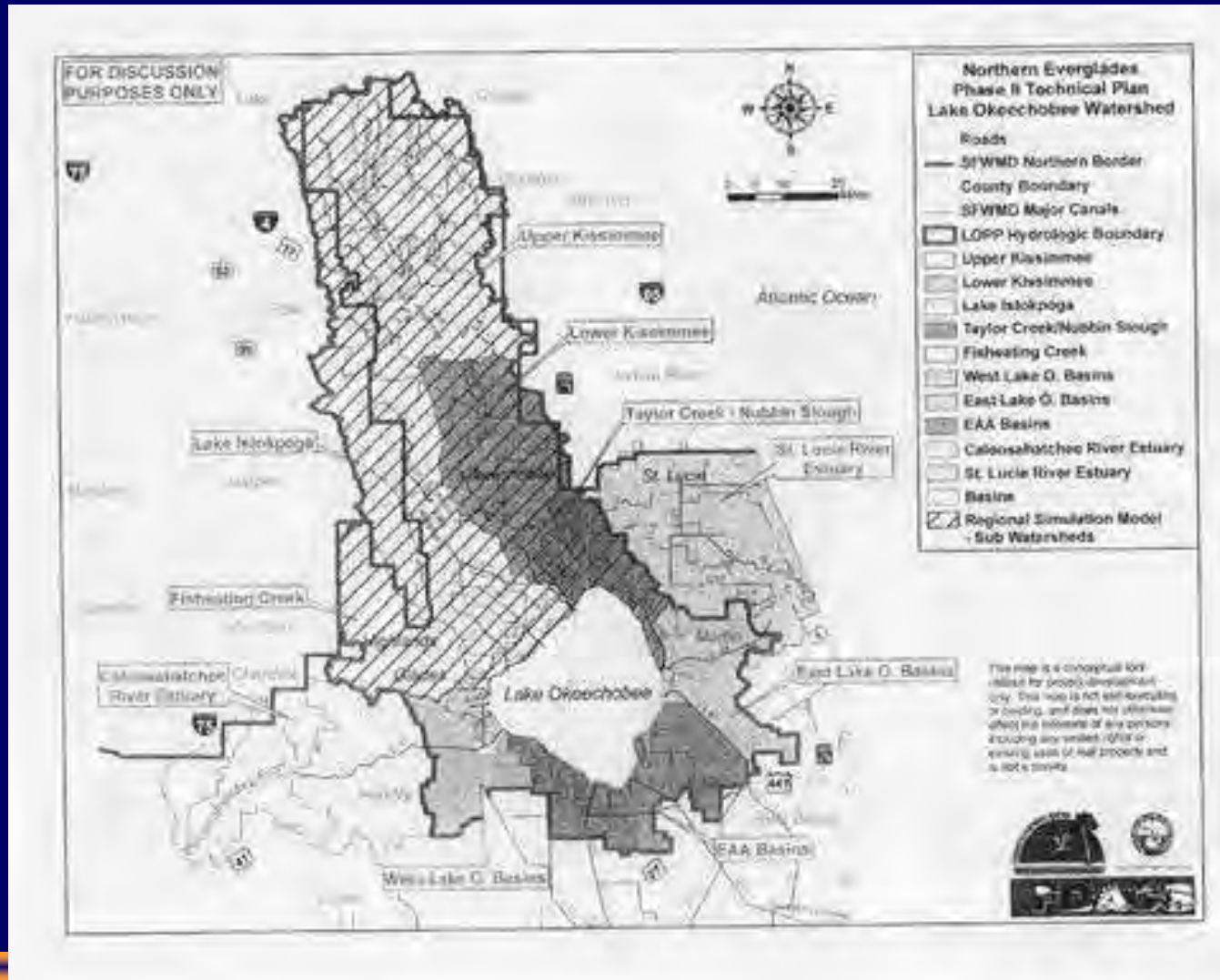
- ✓ Phosphorus continues to be the main concern related to biosolids land application. Phosphorus-based nutrient management programs will adversely impact biosolids recycling programs in the US
  - ✓ There is an urgent need to develop programs that account for differences in P loss potential among biosolids types and the characteristics of the receiving site
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# Research Results

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- ✓ More than 30 years of research has demonstrated that trace metals are currently not a concern. Heavy metal concentrations in animal manure and some fertilizers are comparable or greater than those in biosolids
- ✓ When properly applied, pathogens don't pose any treat to humans and/or animals

# Environmental Regulations





# Biosolids Regulations (senate Bill 392)

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- " After December 31, 2007, the department **may not** authorize the disposal of domestic wastewater residuals within the Lake Okeechobee watershed unless the application can affirmatively demonstrate that the phosphorus in the residuals will not add to phosphorus loadings in Lake Okeechobee or its tributaries. This demonstration shall be based on achieving a net **balance between P imports relative to exports...**"

# Biosolids Regulations (senate Bill 392)

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- " This prohibition does not apply to Class AA residuals that are market and distributed as fertilizer products in accordance with the department rule"

**Thanks !**

