

The Georgia P-Index

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Overview

- Regulatory background
- Phosphorus and water quality
- Phosphorus in soil
- Phosphorus in manures
- Pathways for P loss
- Determining the risk of P loss

Regulatory Background

- New state regulations require that CNMPs meet NRCS standards
- Starting Fall 2001, NRCS standard requires:
 - considering risk that P loss from a field receiving manure will reach sensitive waters
 - if risk is high, reduce manure application rate or use BMP's to reduce risk

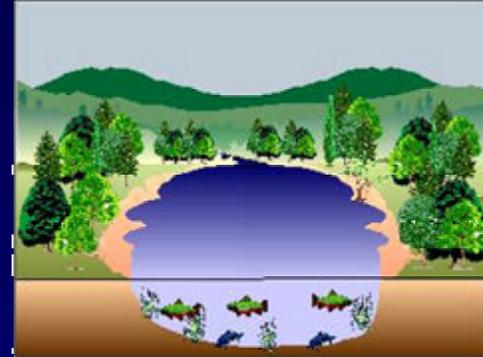
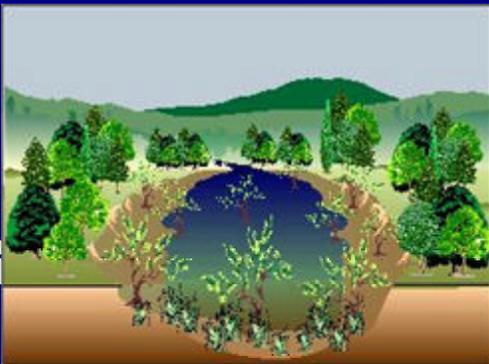
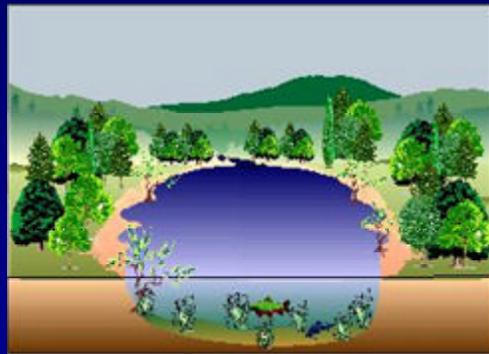
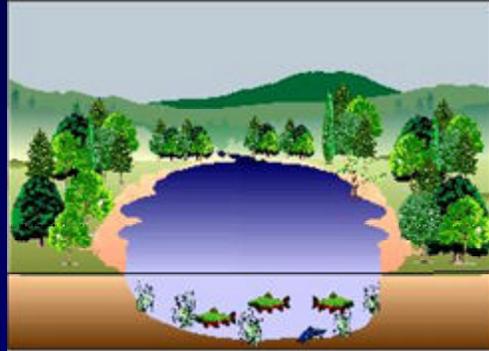
Phosphorus and Water Quality

- Eutrophication: natural aging of lakes and streams due to nutrient enrichment
- Increased aquatic weeds, algal growth, low oxygen levels, fish kills, and bad-tasting water (*geosmin*)
- High levels of nutrients cause accelerated eutrophication
- Lakes are more sensitive than streams
- Fresh water more sensitive to P than N

Natural Process

Accelerated by land use

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CENTURIES

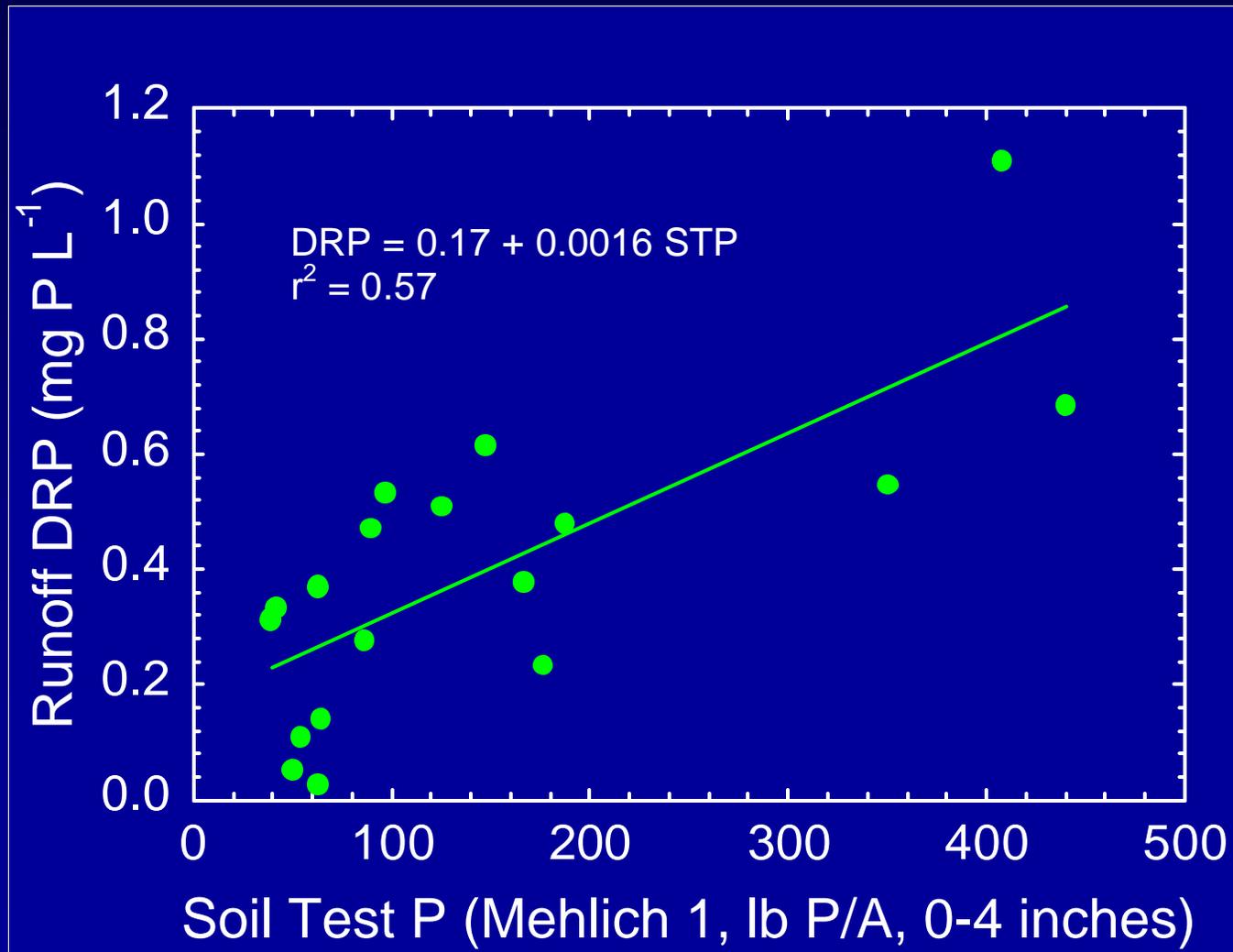


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Phosphorus and Water Quality

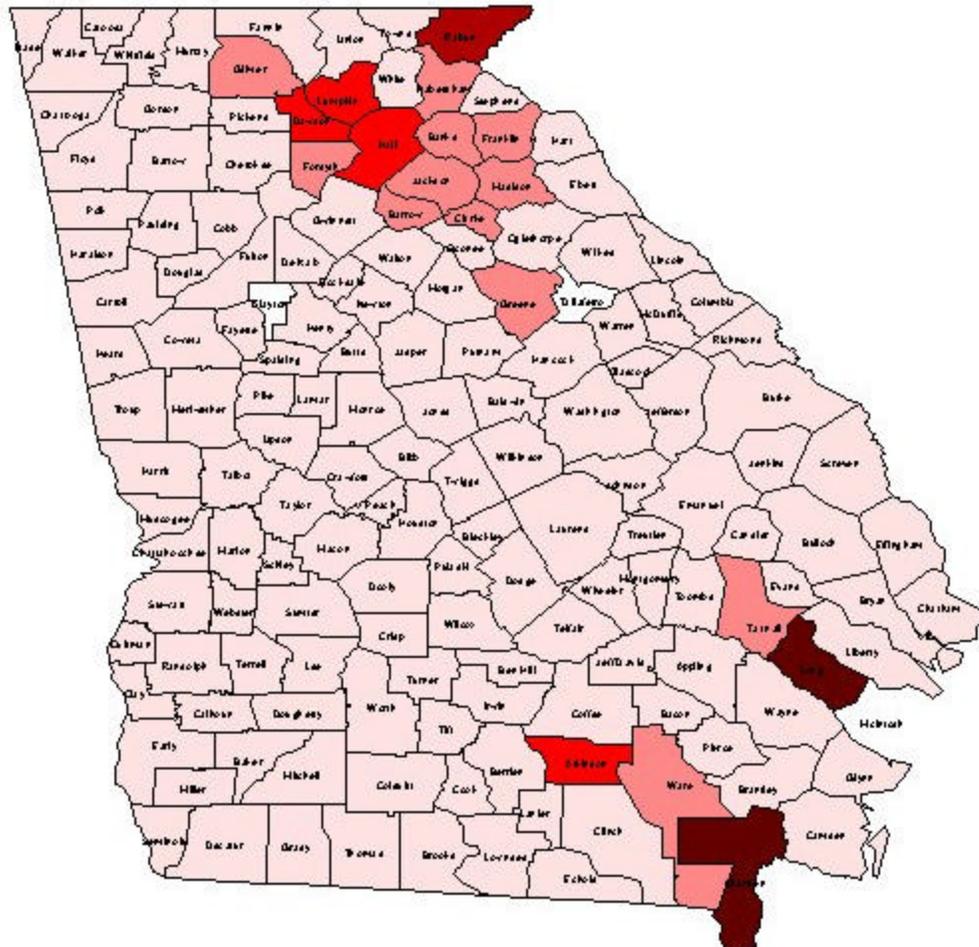
- Tulsa, OK filed suit in December 2001 against 6 poultry processors
- Processors have farms in the watersheds of two lakes (Eucha and Spavinaw) which supply drinking water to Tulsa
- Taste and odor problems caused by algal growth
- Tulsa spent > \$4 million to correct problem

Phosphorus in Runoff



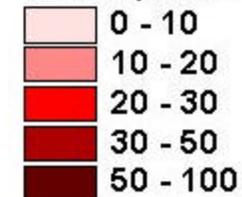
Schroeder et al., 2002

Phosphorus by County

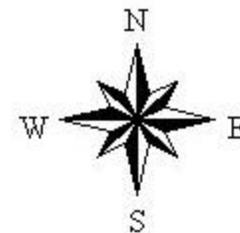


Pastures/Hayfields

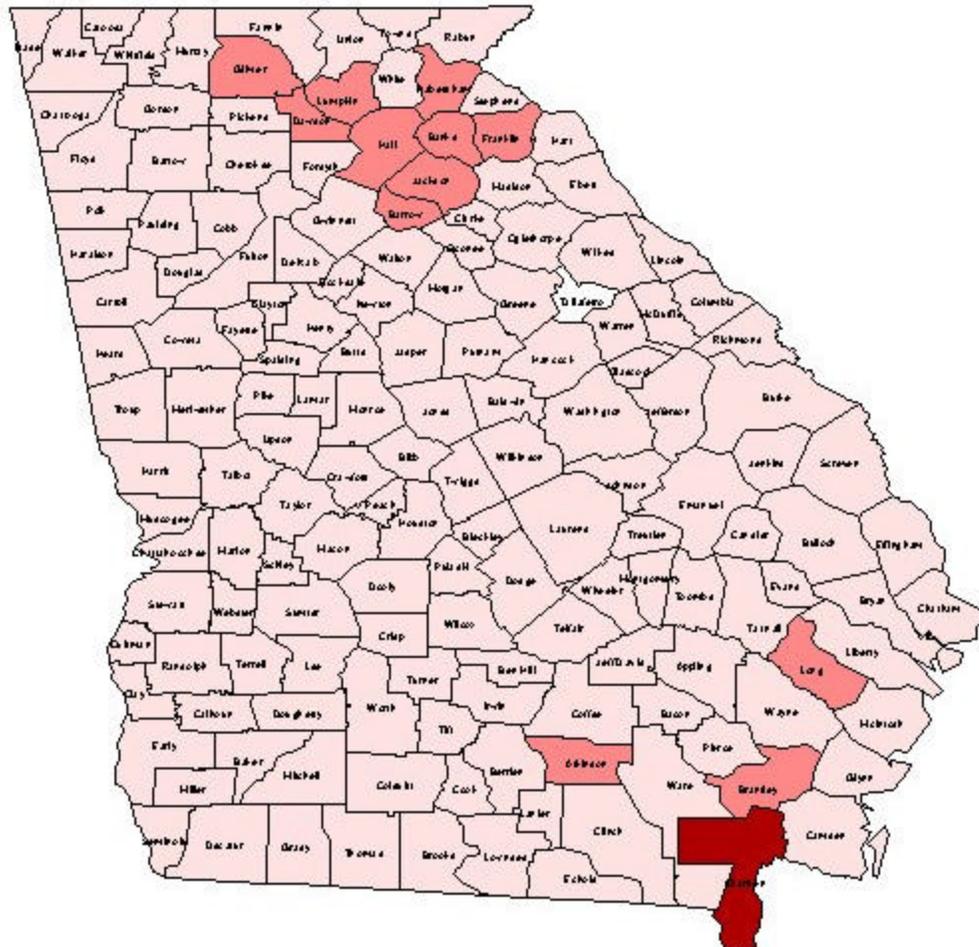
% Samples >450 lbs/acre



100 0 100 200 Miles

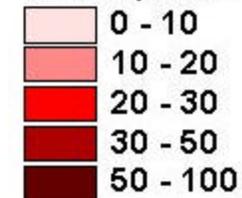


Phosphorus by County

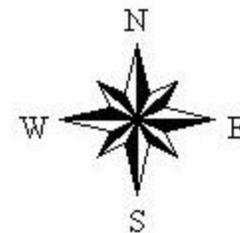


Agronomic Crops

% Samples >450 lbs/acre



100 0 100 200 Miles



Phosphorus in Manures

- ❖ Overapplication of P with inorganic fertilizers is unlikely because of cost
- ❖ Over-application of P with manures is very likely because of N/P ratio

Phosphorus in Manures

● Crops need $N/P = 8$

● 8 lbs N/1 lb P

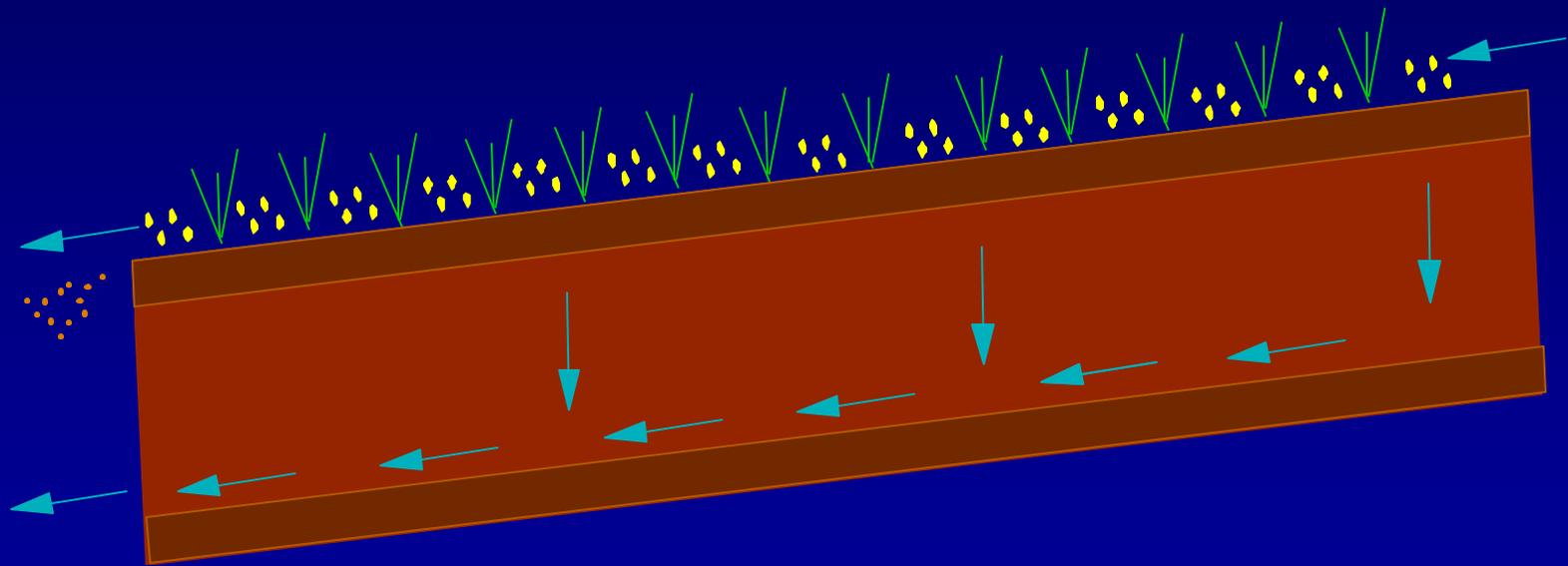
● Broiler litter has $N/P = 1.2$

● 8 lbs N/6.7 lbs of P

Phosphorus in Manures

- In Georgia, most of the broiler litter is surface-applied to grasslands
- Manure on the soil surface is exposed to surface runoff
- P in runoff from grasslands is controlled by P on the soil surface

Pathways for Phosphorus Loss



Determining the Risk of P Loss

- Georgia task force appointed with NRCS, ARS, and University personnel
- Decided to use P-index
- P-Index takes SOURCE and TRANSPORT factors into account

Sources of Phosphorus

- Soil P (soil test P – lb/A)
- Fertilizer P
 - Rate (lb P_2O_5/A)
 - Method of application (banded, incorporated, or surface applied)
- Organic P (lb P_2O_5/A)
 - Rate (lb P_2O_5/A)
 - Type of organic P (poultry, dairy, or swine – fresh manure, litter, or slurry)
 - Method of application (banded, incorporated, or surface applied)

Microsoft Excel - Georgia Index 1.2b

File Edit View Insert Format Tools Data Window Help

C33 = Suggested Management

Version 1.2b

<i>Press Buttons</i>	<i>Variable</i>	<i>Enter Value in Column</i>	
<i>Below for Help</i>	Today's Date	27-Jul-01	Field ID
P-Index Info	Operator	Miguel Cabrera	
Crop	Crop	Tall Fescue Pasture	
Field ID	Field ID	ET1	Sources of Phosphorus
Soil Test P	Soil Test P (Mehlich 1; lb P/A)	450	
Inorganic P	Fertilizer P (lb P2O5/A)	0	
Inorg. P Method	Fertilizer P Method (Table 2)		
Organic P	Organic P (lb P2O5/A)	300	
Organic P Type	Type of Organic P (Table 1)	0.3	
Organic P Method	Organic P Method (Table 2)	Surface applied, not incorporated, Dec-Feb	
Runoff	Curve Number for Runoff	70	Phosphorus Transport
Hydrologic Group	Hydrologic Soil Group	B	
Erosion	Yearly Erosion (ton/A/year)	0.1	
Water Table	Depth to Water Table (feet)	15	
Buffer	Vegetated Buffer Width (feet)	0	BMP's
STP of Buffer	Soil Test P of Buffer (lb P/A)	250	
P Index	Category	Suggested Management	
89	High	Reduce value below 75	
	Clear All	Print Page	

Georgia P Index /

Transport of Phosphorus

- Surface runoff (curve number)
- Leaching (hydrologic soil group)
- Erosion (ton/A/year)

Microsoft Excel - Georgia Index 1.2b

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Georgia P Index /

BMP's to Reduce P Losses

- Alter feed ration to reduce P in manure
- Add *alum* to reduce soluble P in manure
- Don't apply manure when runoff is likely
- Incorporate or inject manures
- Avoid artificially drained fields
- Use grass filters and stream-side buffers
- Use practices that reduce runoff and erosion

Georgia P Index Categories

P index range	Category	Interpretation
0 to <40	Low	N-based NMP is usually satisfactory.
40 to <75	Medium	Use conservation practices and P applications that maintain a P Index < 75.
75 to <100	High	Add conservation practices or reduce P applications to achieve a P Index < 75.
100 or greater	Very High	Add conservation practices or reduce P applications to achieve a P Index < 100 in the short term. Develop a management plan with the goal of achieving a P Index < 75 within 5 years.

Example: Broiler Litter

- Hay field
- Sources of P
 - Soil test P = 450 lb/A
 - 5 tons broiler litter/A in Dec & Feb (300 lb P_2O_5 /A)
- Transport
 - Curve number = 70
 - Hydrologic group = B
 - Erosion = 0.1 ton/A/year
 - Depth to water table = 15 ft
- BMP's
 - No vegetated buffer
- Result = 89 (high – reduce below 75)

Microsoft Excel - Georgia Index 1.2b

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Georgia P Index /

Example: Broiler Litter

- Add a buffer

- 5 ft of vegetated buffer

- Soil test P of buffer = 250 lb P/A

- Result = 72 (medium – OK)

Version 1.2b

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Buffer	Vegetated Buffer Width (feet)	5	BMP's
STP of Buffer	Soil Test P of Buffer (lb P/A)	250	
P Index	Category	Suggested Management	
72	Medium	Maintain below 75	
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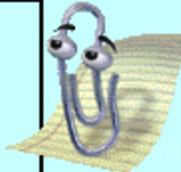


Example: Broiler Litter

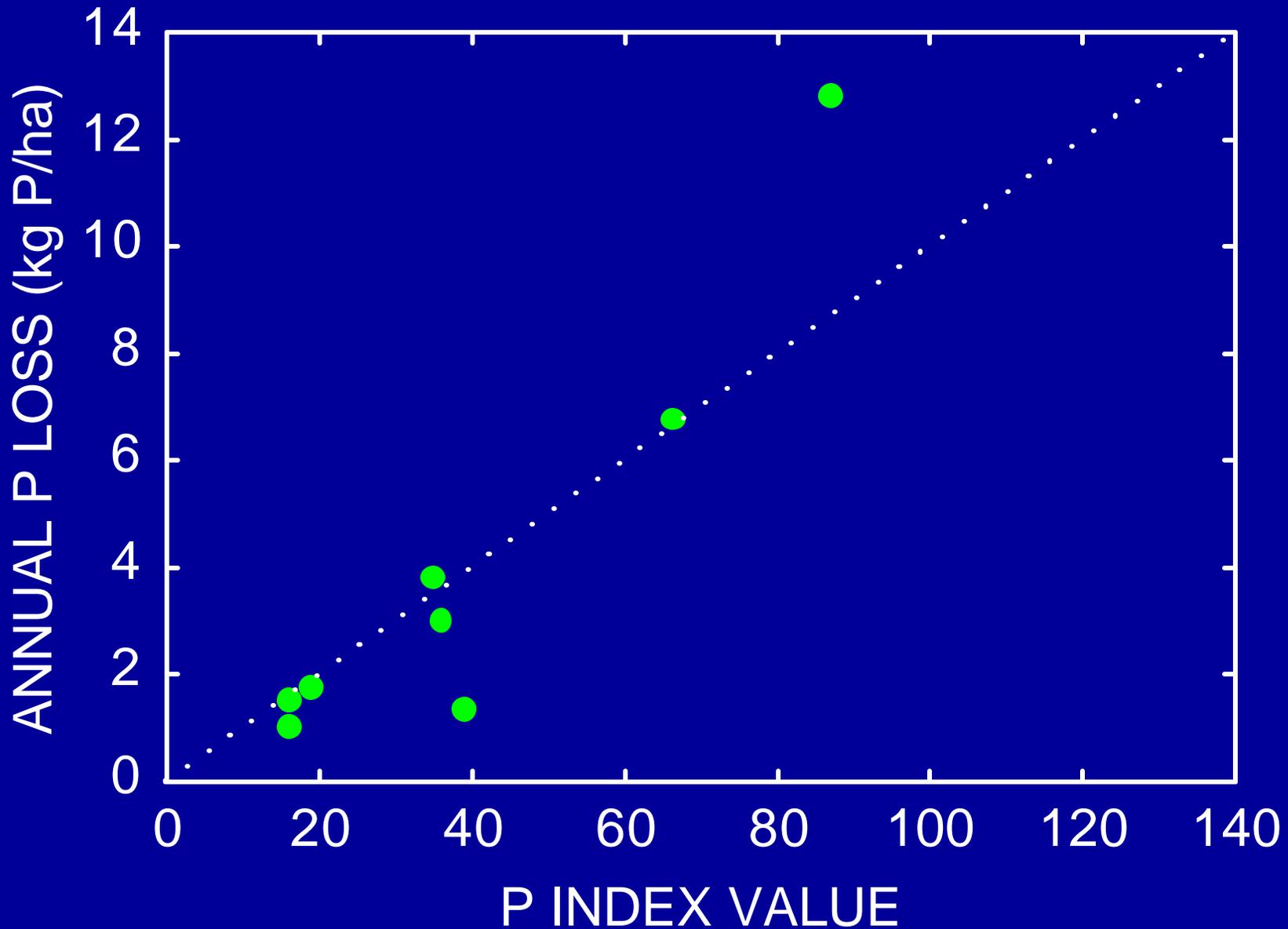
- Change application time
 - Nov & March instead of Dec & Feb
 - Result = 74 (medium – OK)

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74	Medium	Maintain below 75	
	Clear All	Print Page	



P Loss Versus P-Index Value



Future Improvements

- Identify field by:
 - County (rain)
 - Soil series (hydrologic group, runoff P vs STP)
 - Management (runoff, erosion)

Summary

- P can accelerate eutrophication
- Manures applied based on N supply lead to a buildup of soil P
- Soil P can be lost through runoff and leaching
- Risk of P loss can be assessed with the P-Index
- BMP's can be used to reduce P-Index value