Best Management Practices to Minimize Nutrient Losses from Manured Fields

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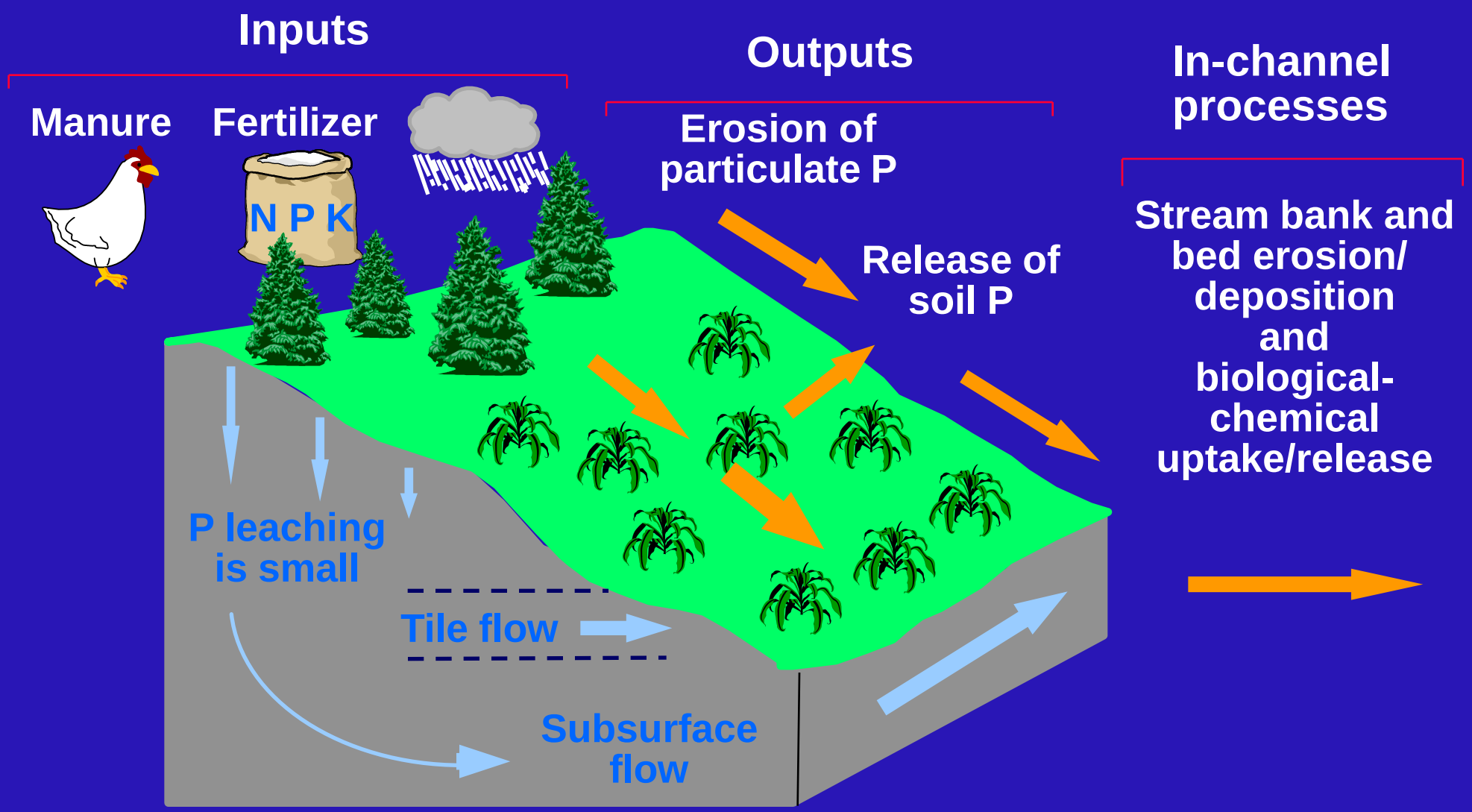
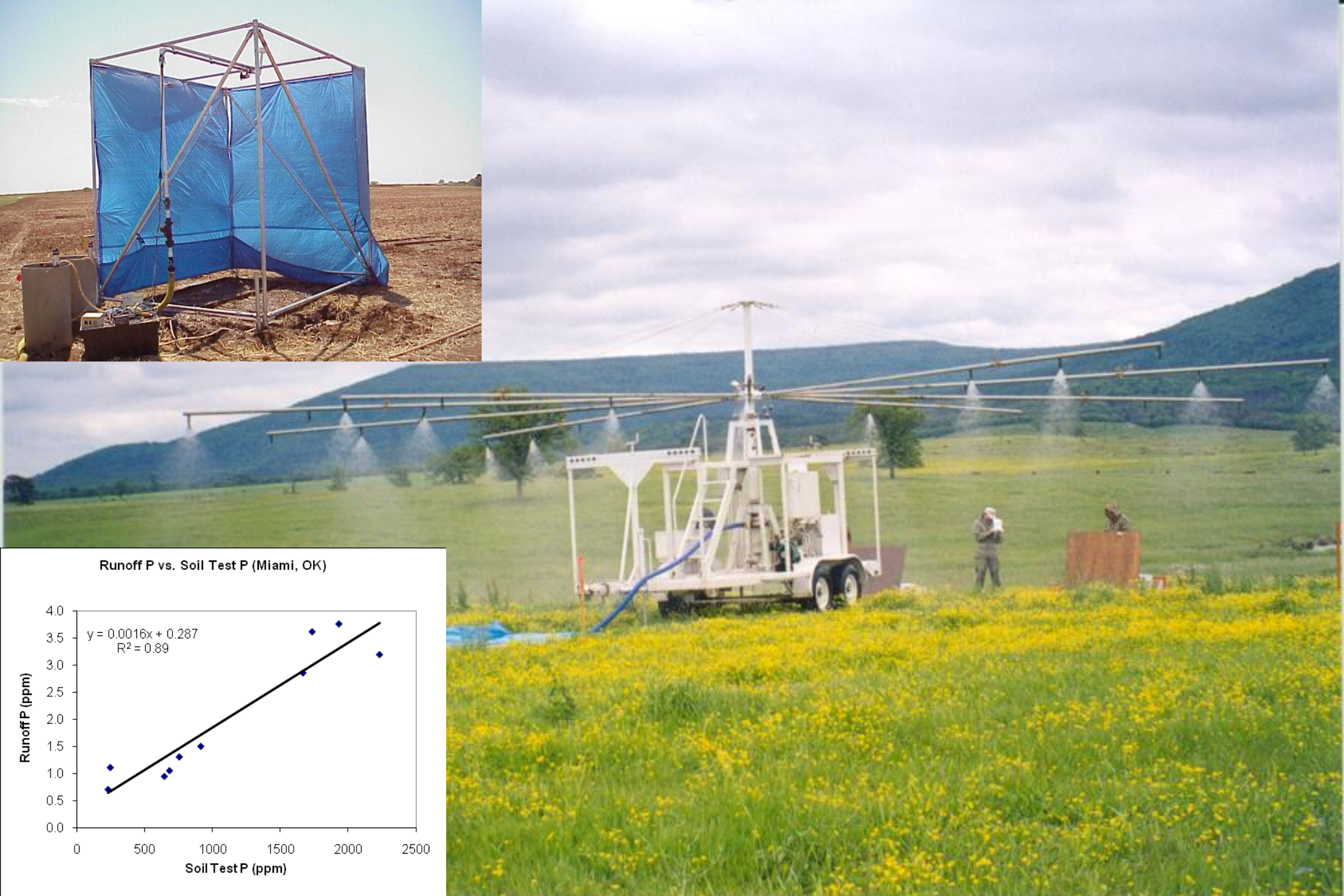
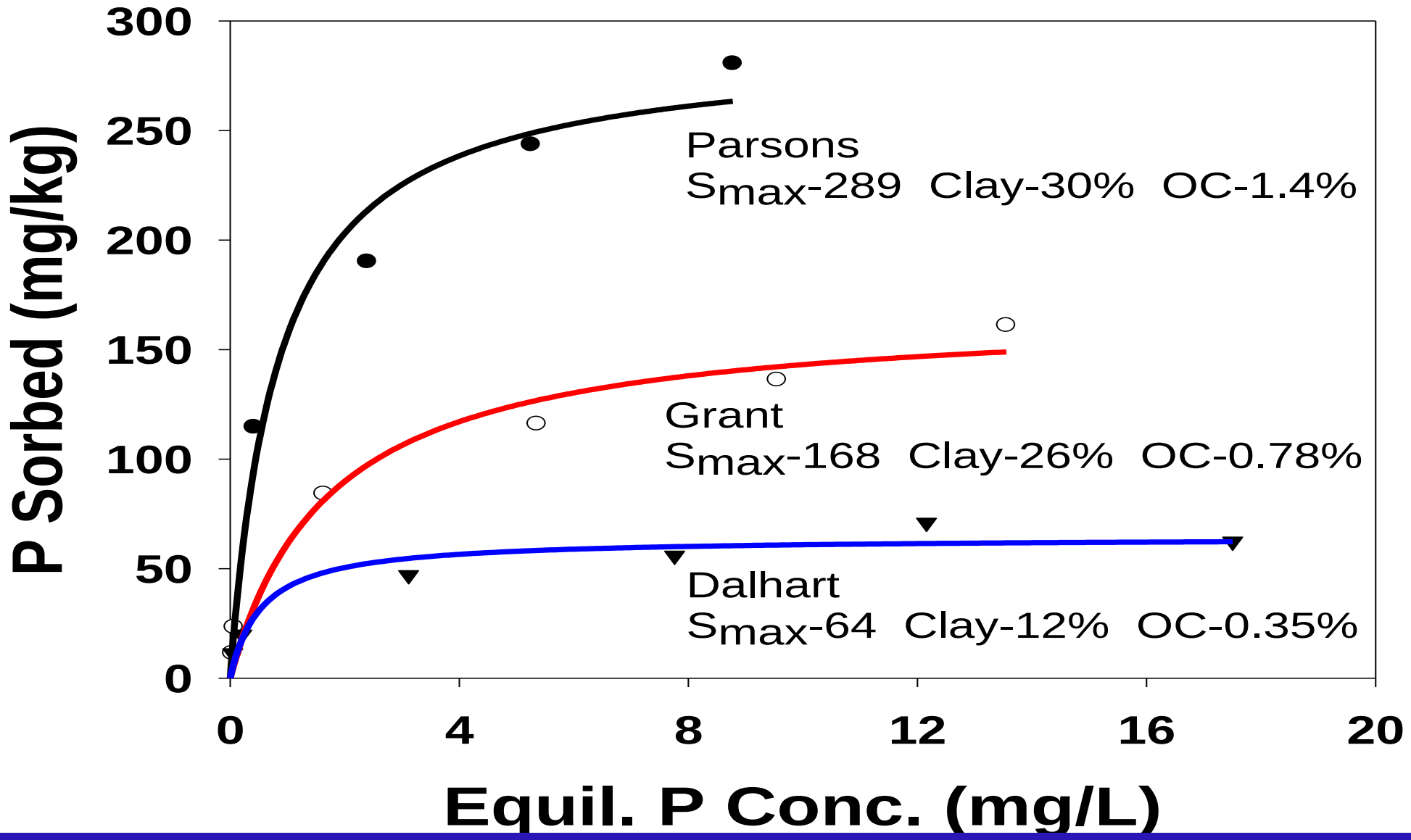
Pathways of P Transport

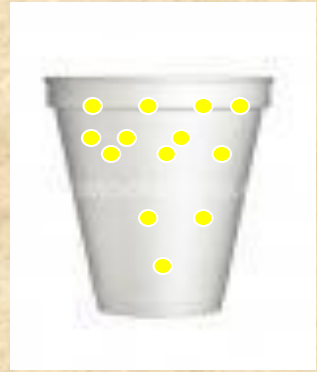




Runoff P vs. Soil Test P (Miami, OK)
y = 0.0016x + 0.287
R² = 0.89
Runoff P (ppm)
Soil Test P (ppm)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
500
1000
1500
2000
2500

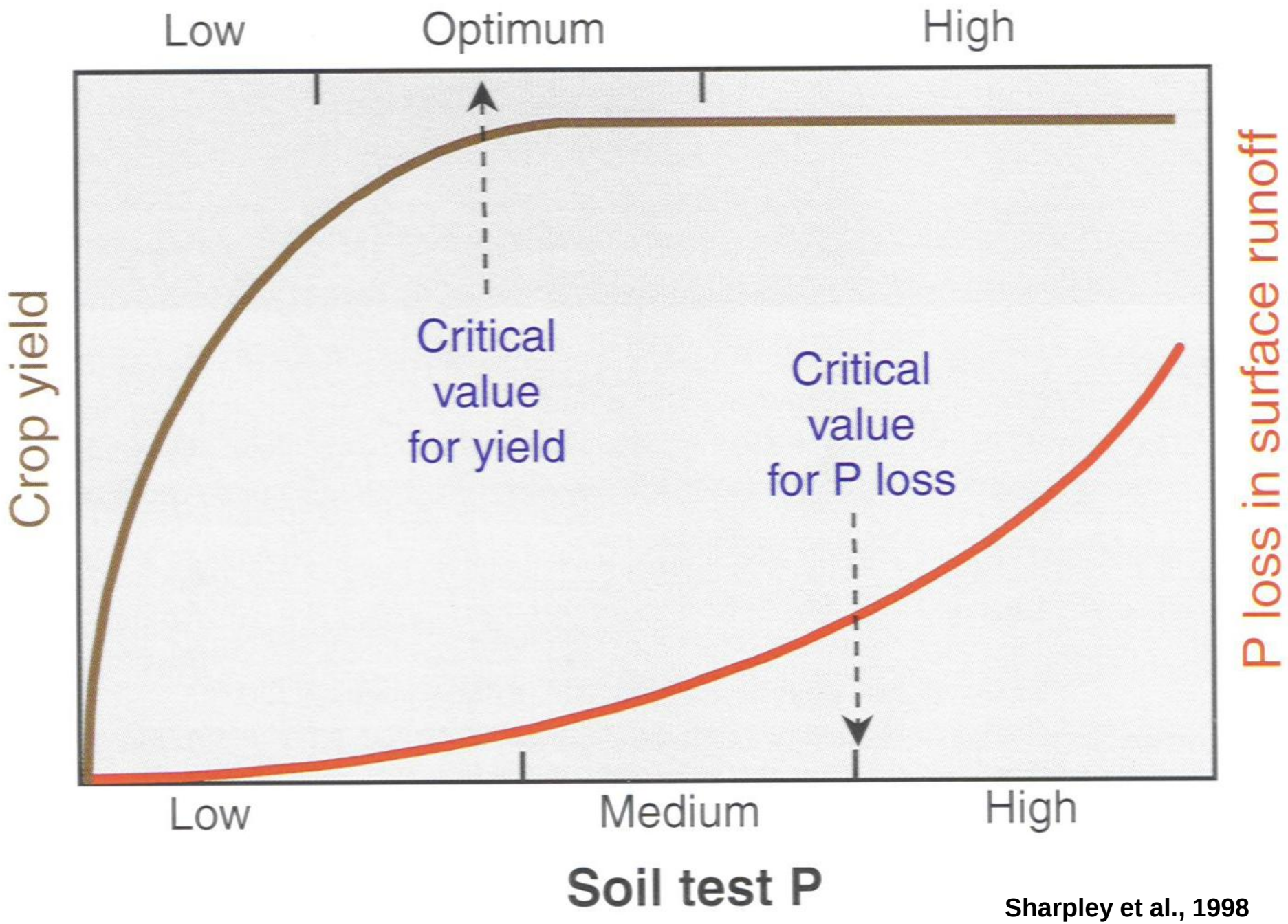
P Sorption Capacity For 3 Soils





Low sorption capacity soil
sandy, low clay soil

High sorption capacity soil
high clay (Al / Mn oxide)



Sharpley et al., 1998

Reducing P Going to Streams & Lakes

- Manure management
- Soil Management
  - Reduce buildup of STP (don't apply to soils already high)
  - Time application for lower risk
  - Choose sites for lower risk
  - Remove P with crop
  - Employ other BMPs to Minimize P transport

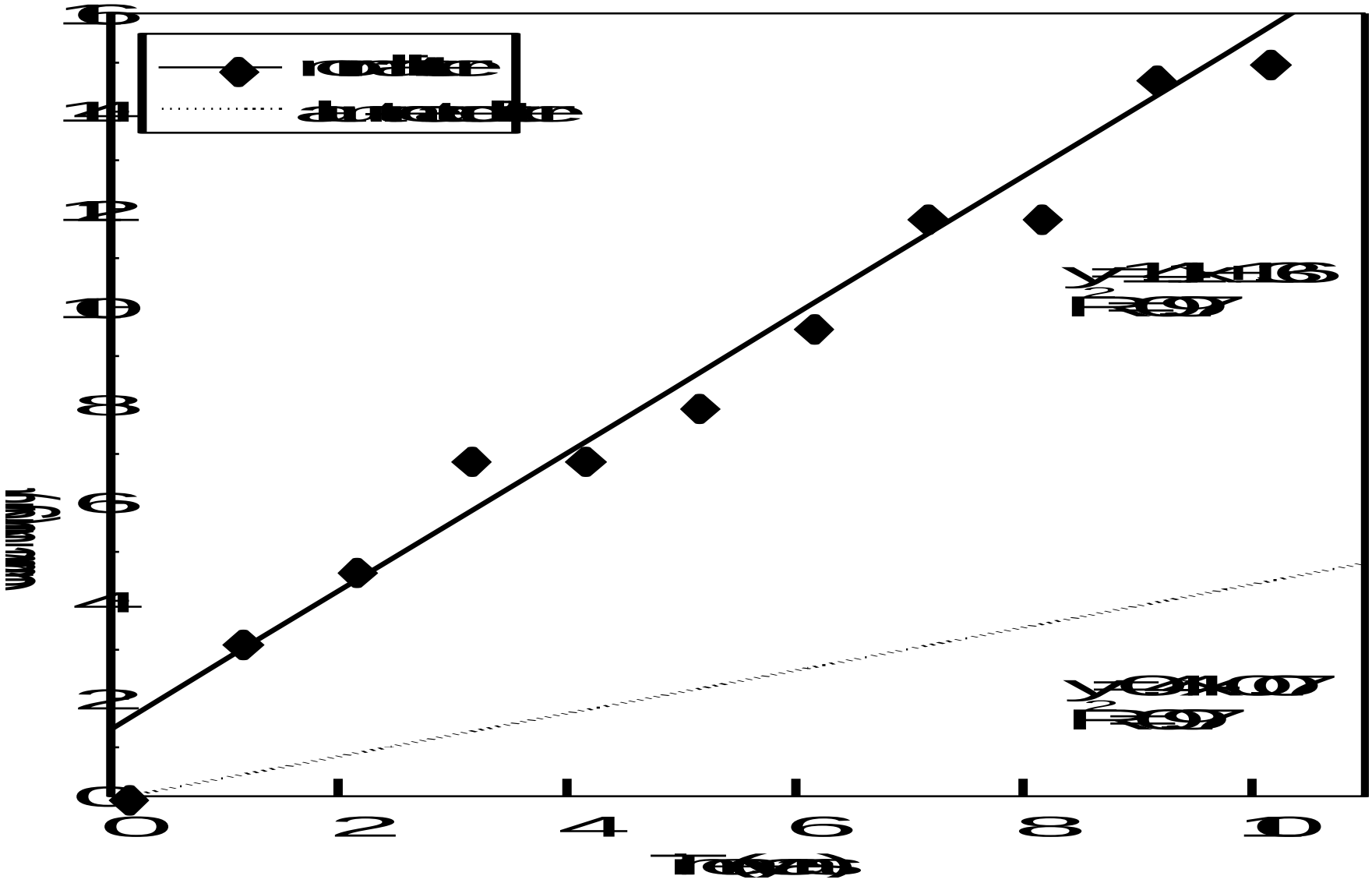
Manure Management Strategies

Alum Applied to Poultry Litter

- Reduce ammonia volatilization
- Reduce water soluble P

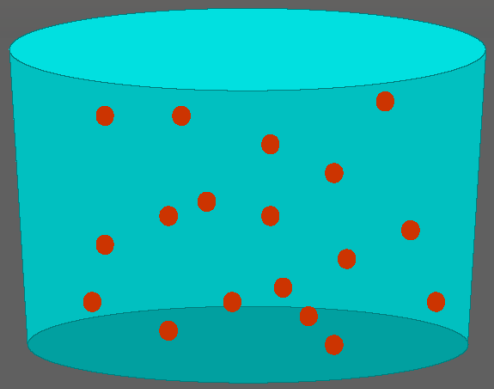
P. More

P runoff from normal litter was 340% higher than alum-treated litter



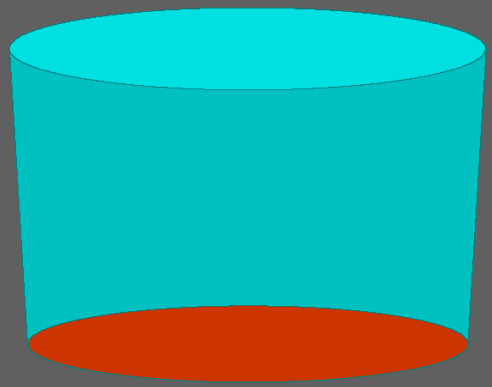
P. More

Municipal Water Treatment Residuals



Coagulant

Fe or Al oxide



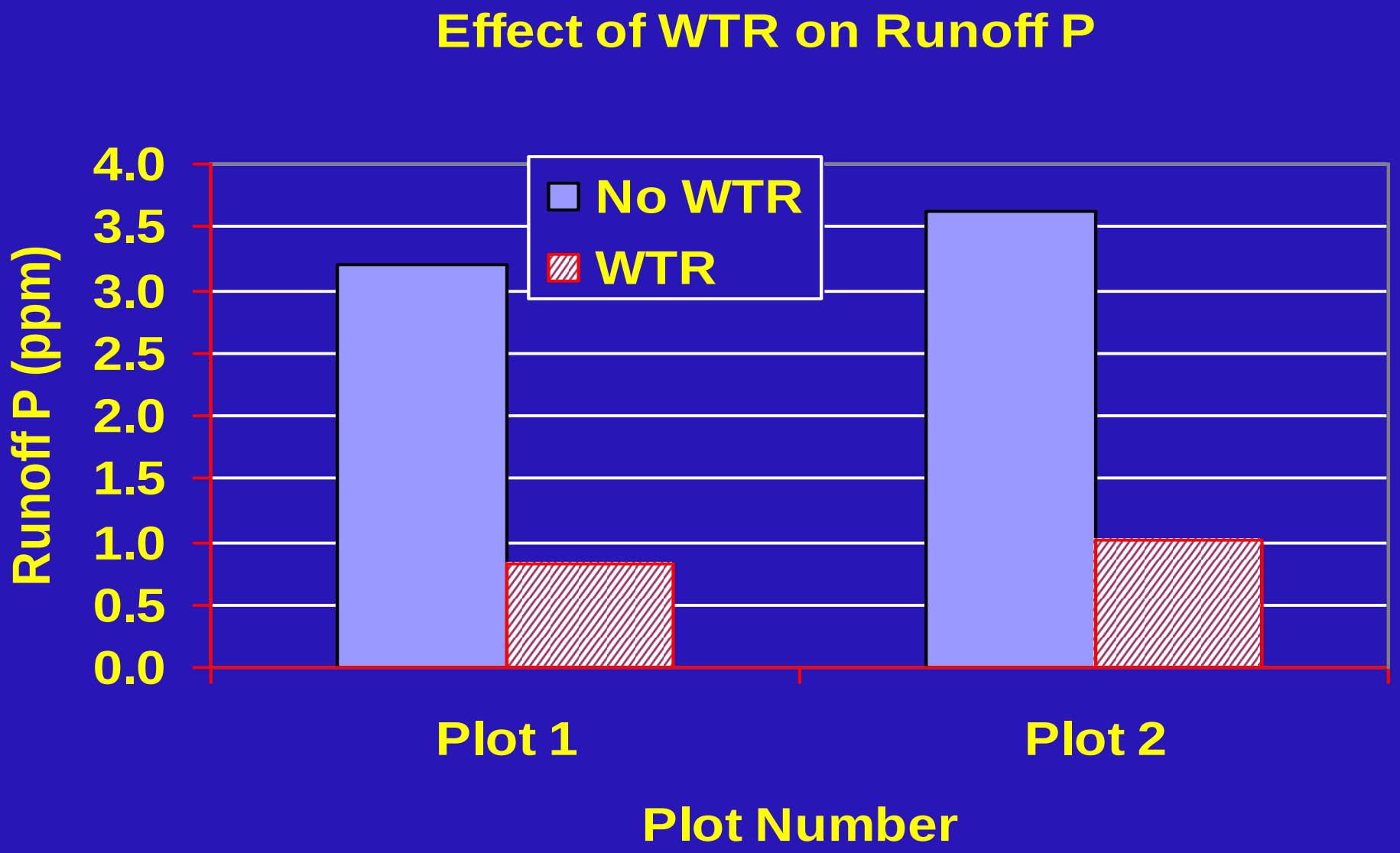
Source water with suspended sediment

Clarified raw water

WTR is “soil-like” material

Most WTR is landfilled

Amend litter and soil to reduce P solubility



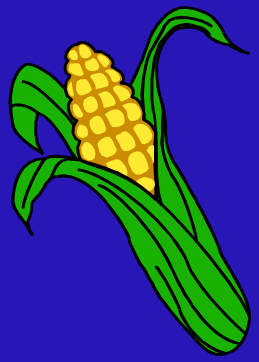
Soil Management Strategies

P-Based Manure Application

- Based on agronomic P requirement
- Soil test P threshold
- P Loss (risk) Index (assessment) ratings

N to P_2O_5 Ratio

Plants

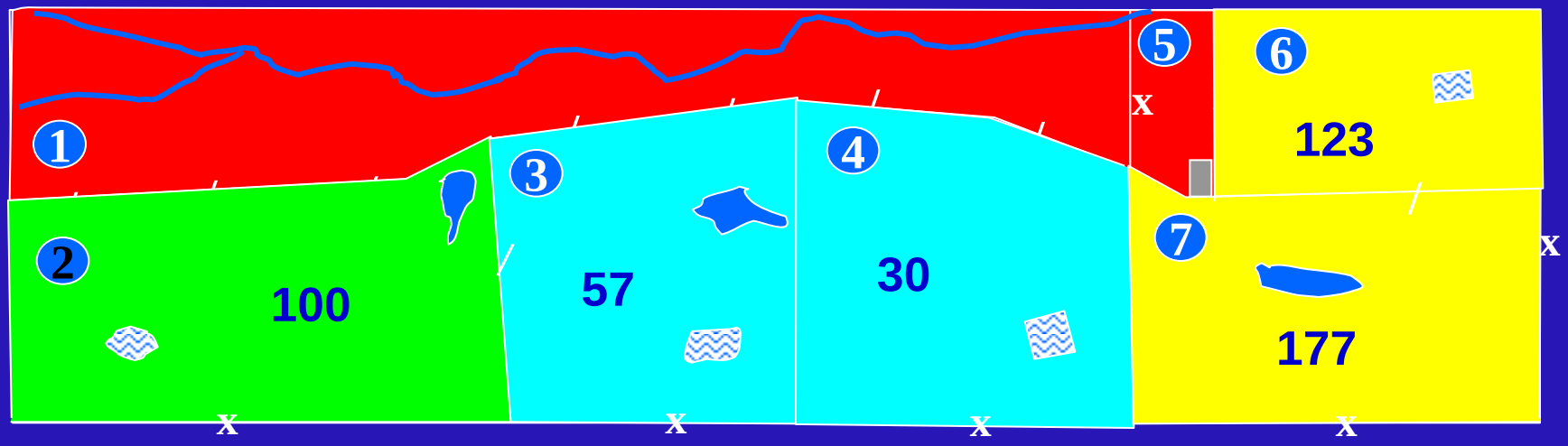


4-8 to 1

Litter

1 to 1

Soil testing guides where to apply fertilizer and manure

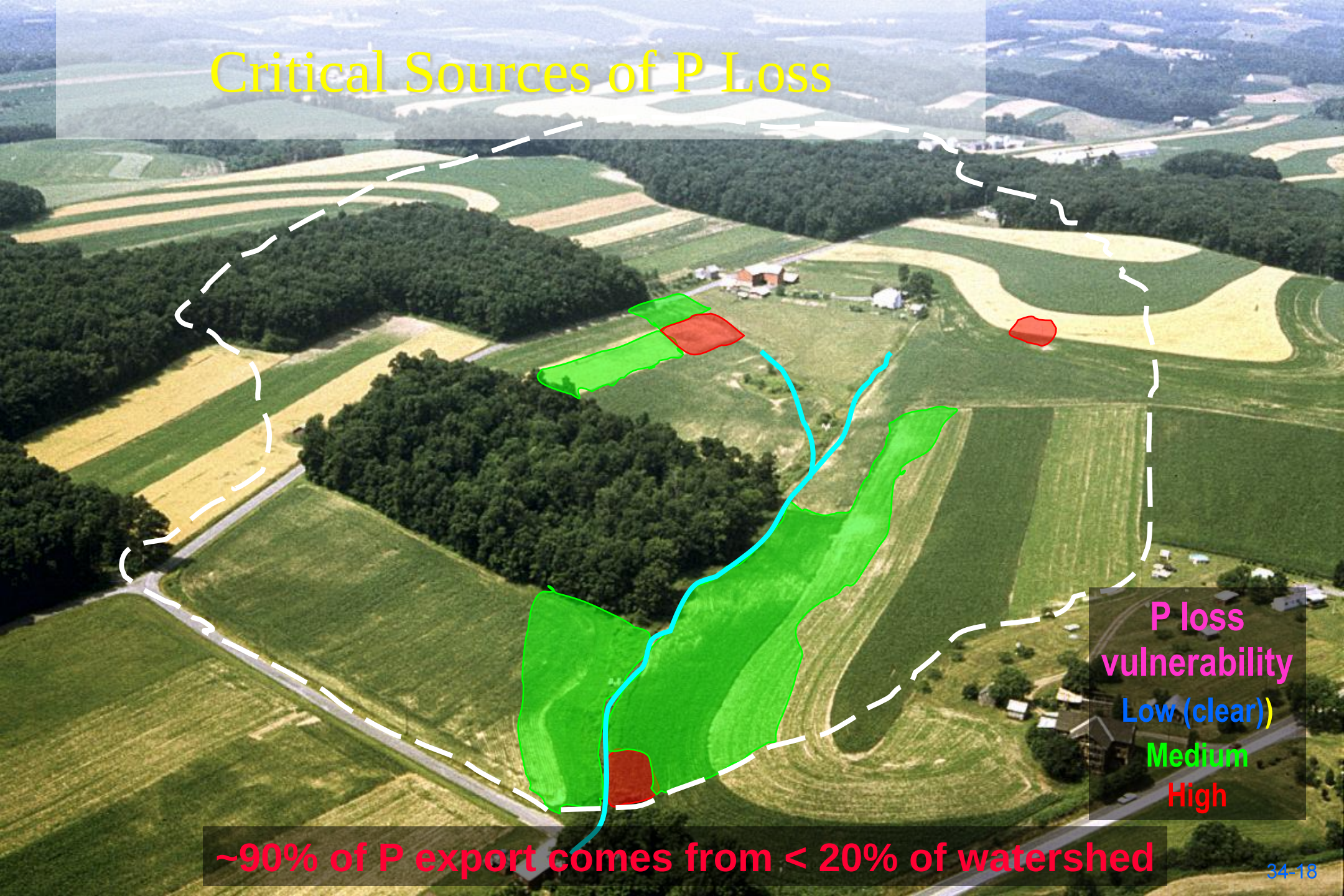


STP	
	0-65
	65-120
	120-250

STP	
	250 - 400
	400+ or no application

Soil Test Phosphorus

Critical Sources of P Loss



~90% of P export comes from < 20% of watershed

Potential Land Application Problems

Fields with sub-surface drainage tiles

Fields with highly erodible soils

Fields that are snow covered or frozen

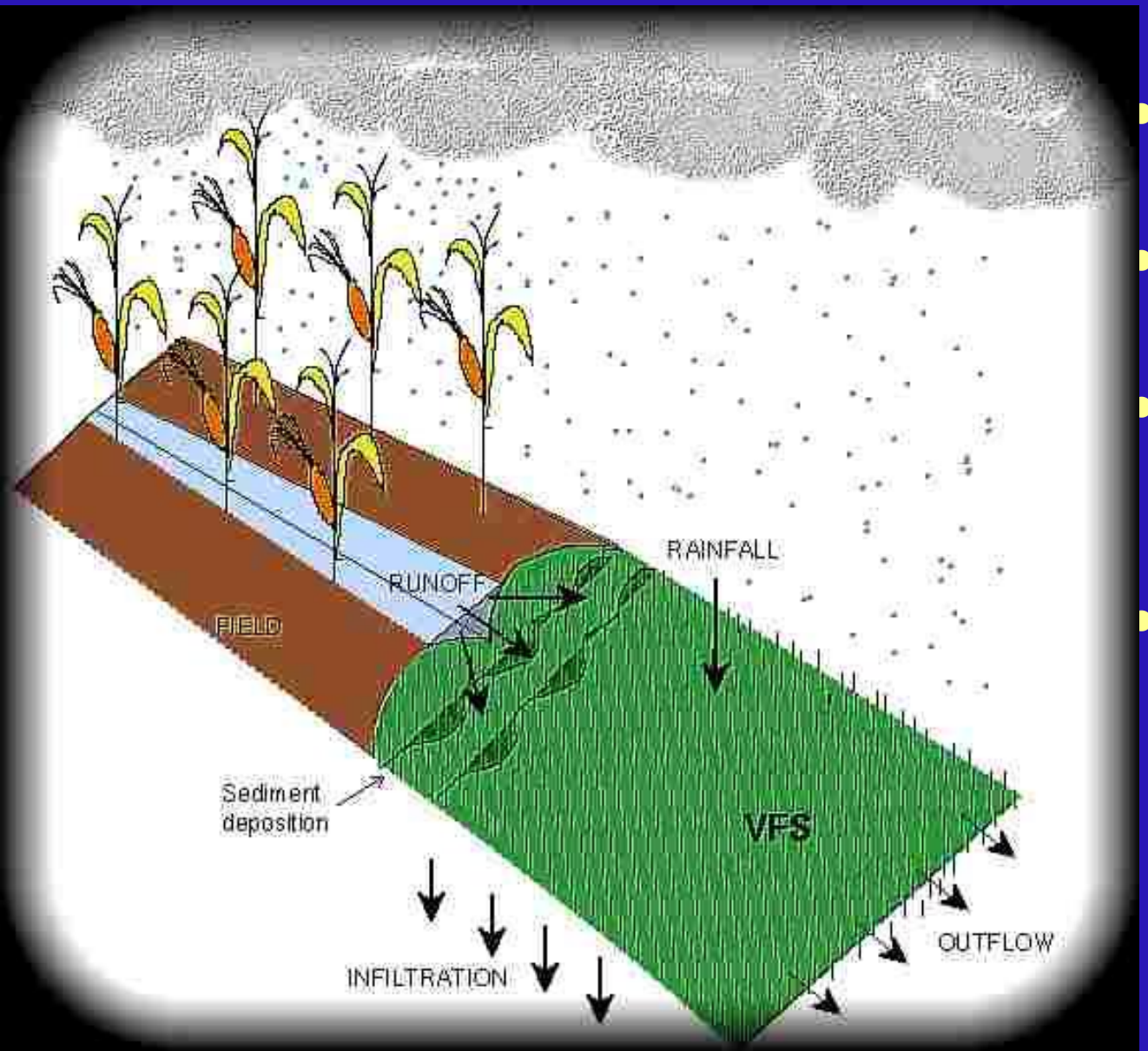
Application Equipment

- Equipment is used for nutrient management not waste disposal
- Equipment calibration
  - Verify actual application rates
  - Evaluate application uniformity
- Annual calibration

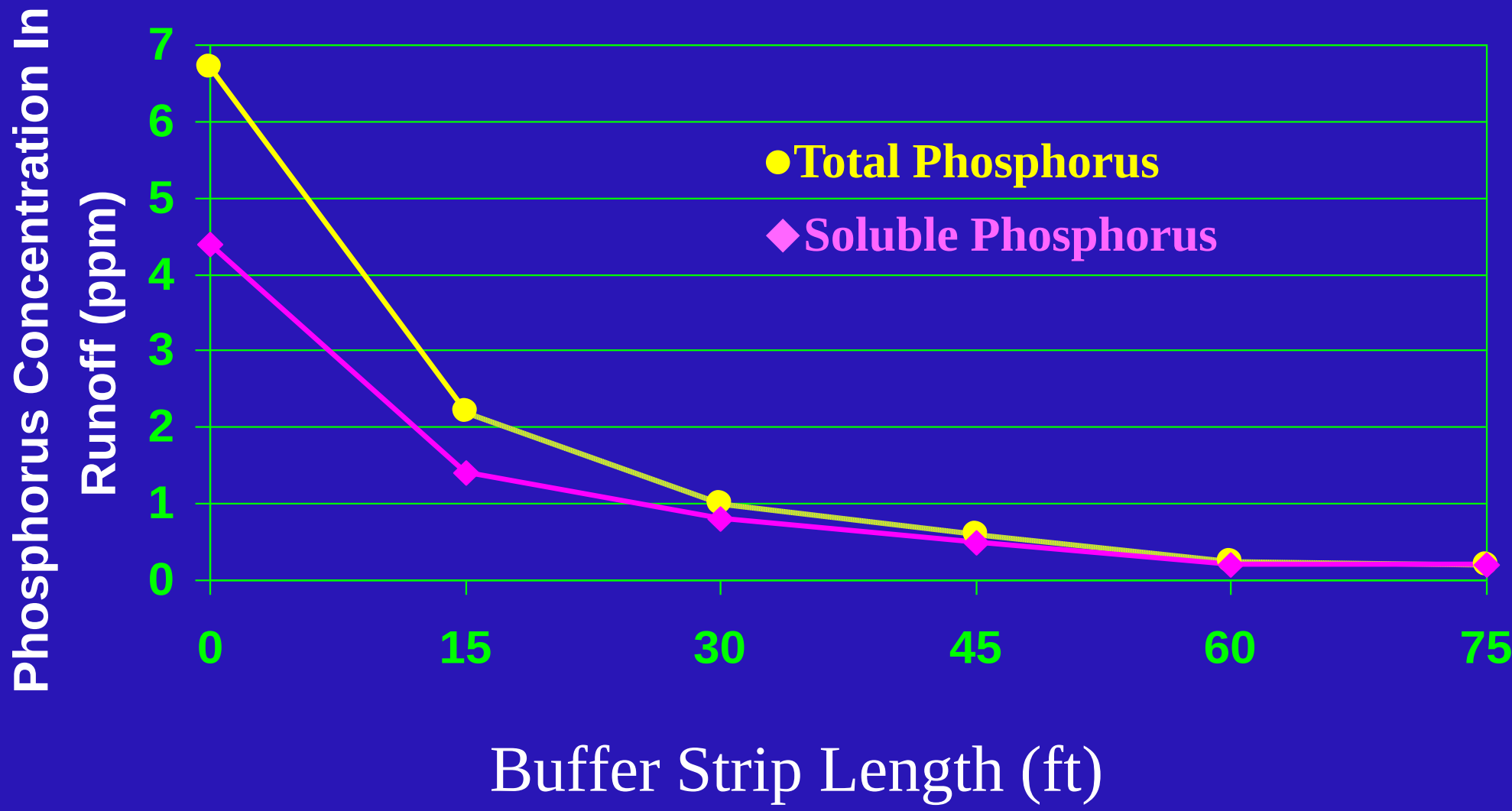
Buffers

- Are there no grassed, vegetated buffers between cropland and surface waters?
- Are they poorly or not vegetated?
- Is manure applied within 100' of surface water w/o a vegetated buffer?

Vegetative Filter Strips



- Reduces Surface Runoff
- Increases Infiltration of Runoff and Nutrients
- Promotes Sediment Deposition and Filtering
- Provides Uptake of Nutrients by Plants


Phosphorus Concentration In Runoff (ppm)
7
6
5
4
3
2
1
0
Total Phosphorus
Soluble Phosphorus
0
15
30
45
60
75
Buffer Strip Length (ft)

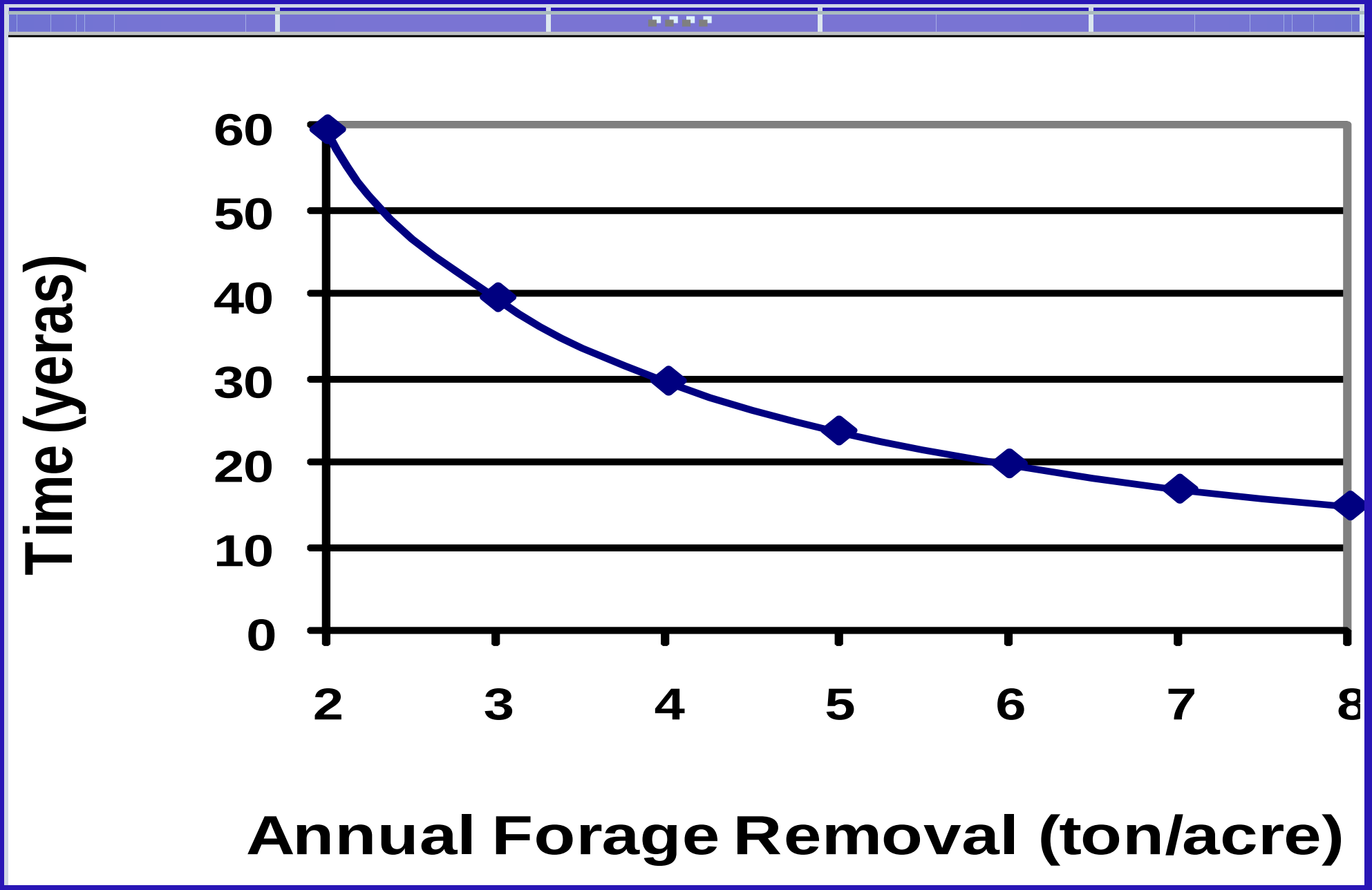
Phytoremediation

- Plant and harvest high yielding and high P forages
- It does remove P but it is slow to reduce soil P once it's already very high

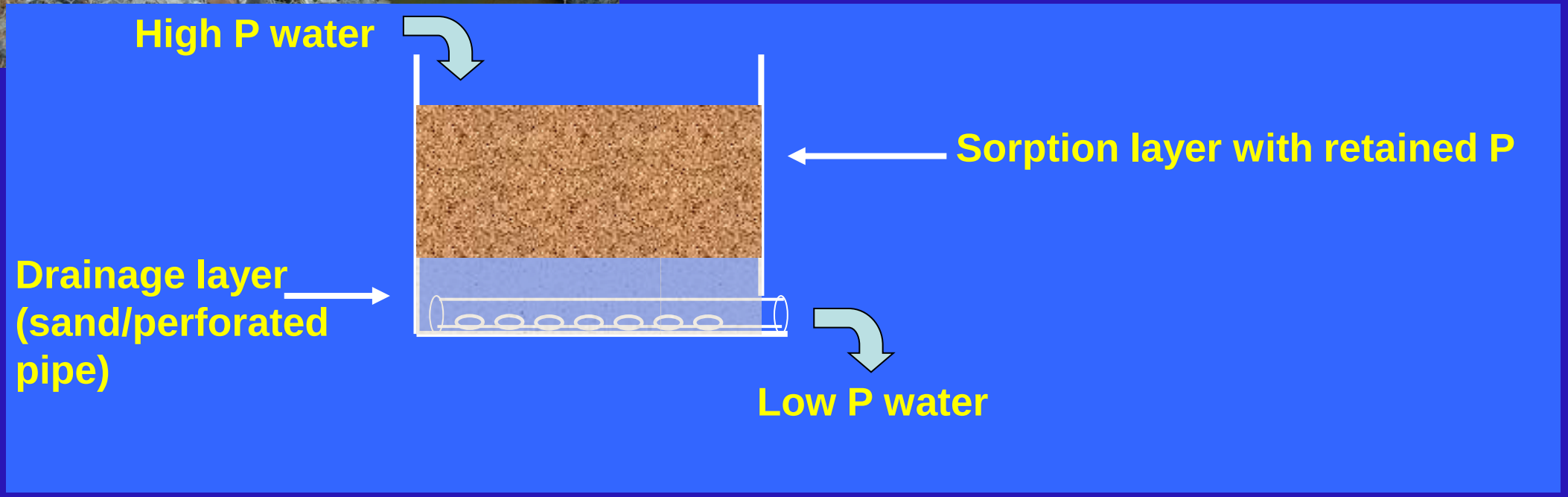
Approximate quantities of nutrients removed under grazing and haying systems			
System	Nutrient Removal (lbs/ac)		
	N	P_2O_5	K_2O
Grazing	12.5	7.8	0.9
Crabgrass	223	103	202
Bermudagrass	250	64	216

Both warm and cool season grasses?

Time needed to reduce STP by 100 using plants



Drainage Ditch Management



Poultry Litter Subsurfer

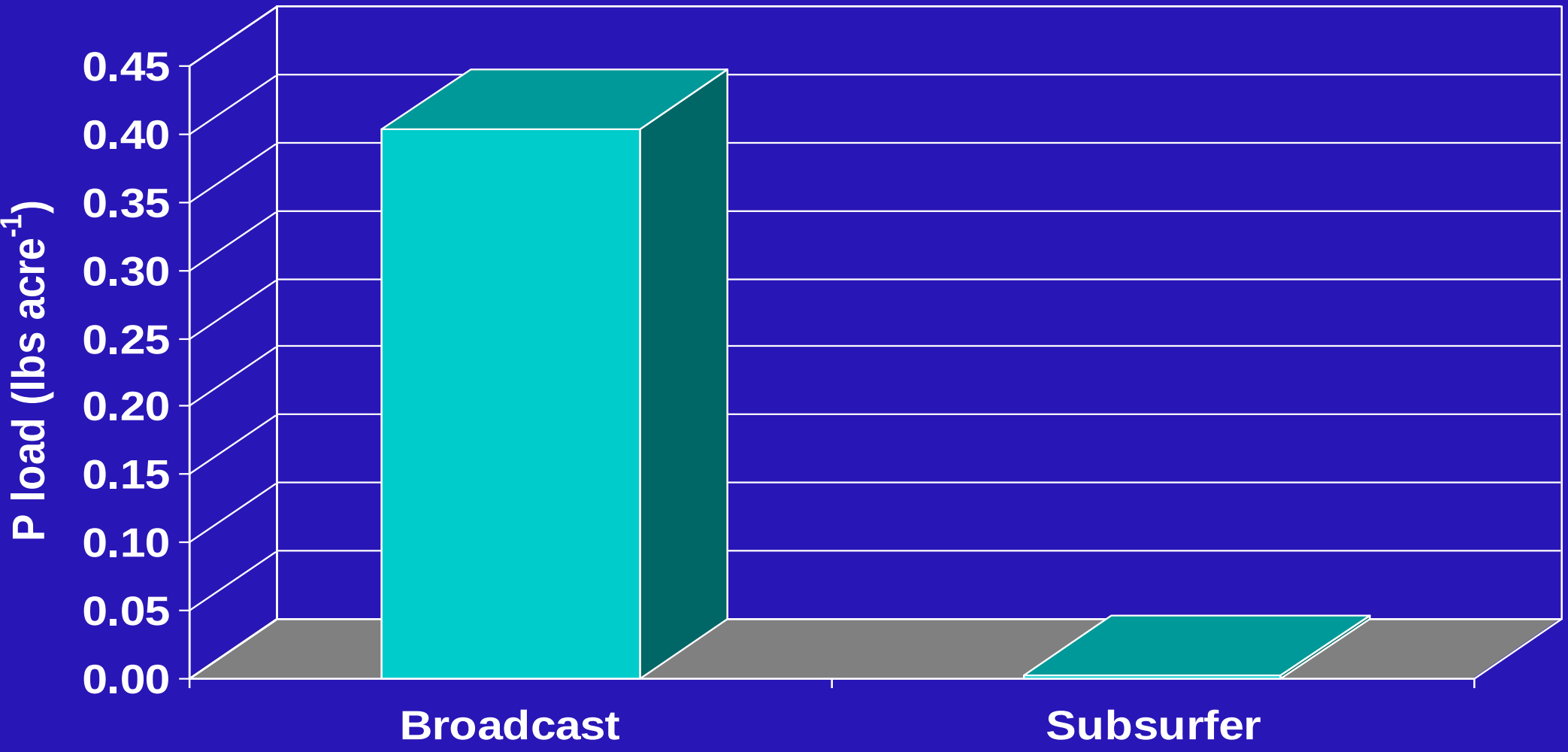
How it works:

- Discs open slots
- Pulverized litter (internal patented mechanism) is delivered to the slot
- Closing wheels seal the soil surface
- Can be adjusted to meet a variety of rates
- Greater accuracy and precision across a range of rates

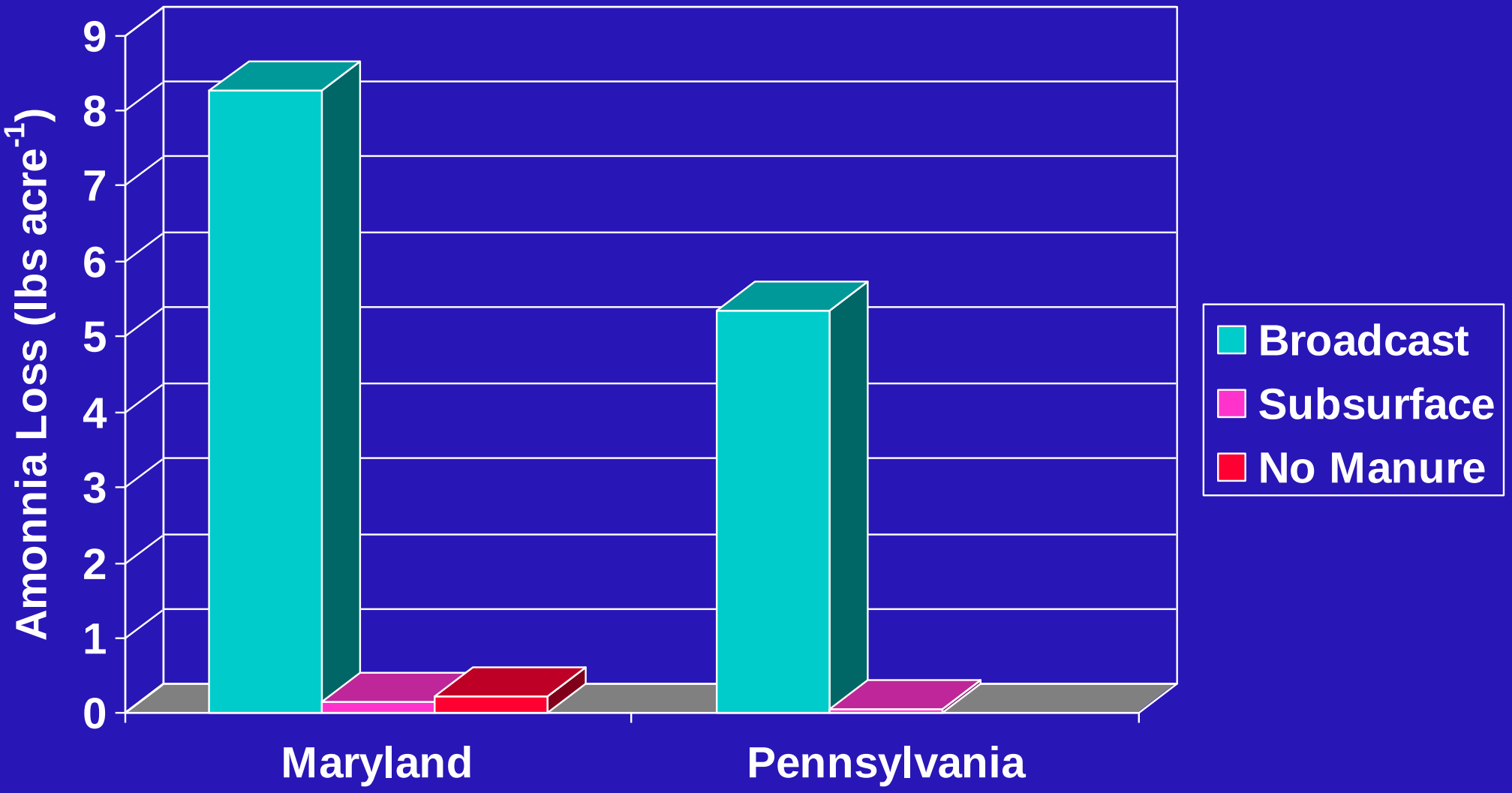
No litter is left on the surface.


Subsurface band

Phosphorus Loss in Runoff



Ammonia Loss



Summary

- Animal manure is an excellent nutrient source and soil conditioner
- Over applying or mismanaging manured fields may result in high nutrient losses
- Manure can be managed to reduce nutrient solubility
- A number of BMPs are available to minimize nutrient loss from manured fields.