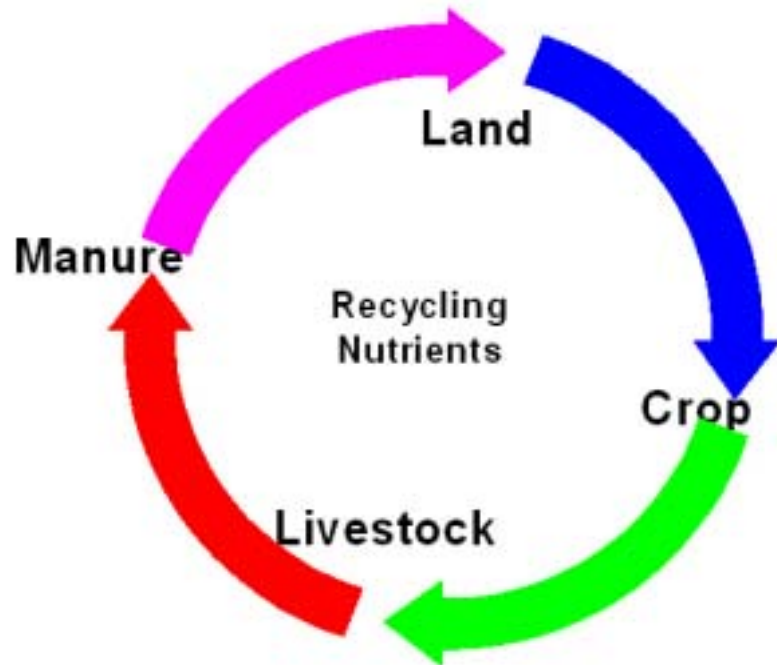
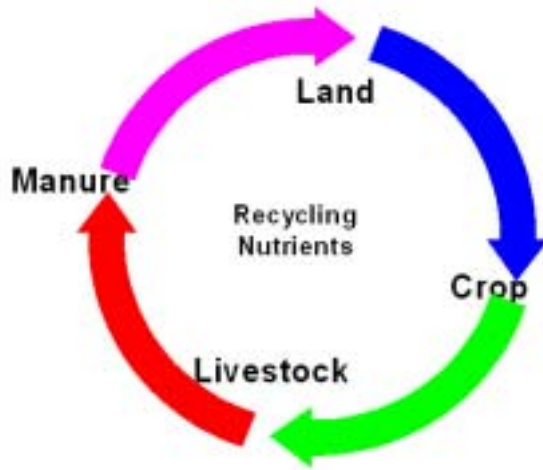


Module 7: Manure Utilization

■ By Hailin Zhang





If utilized properly, manure is an excellent resource of plant nutrients and soil organic matter. Manure utilization recycles nutrients back to the land.

Objectives

The purpose of this module is to

- Learn the different components of a manure utilization plan.
- Understand the importance of nutrient management to environmental quality.

Topics of Discussion

- Components of a manure utilization plan
- The importance of nutrient management for agriculture and the environment
- Land application record keeping

Manure Utilization Plan

- A manure utilization plan addresses:
 - ◆ Manure produced on the farm.
 - ◆ How manure is utilized.
 - ◆ Other nutrients used on the farm.
 - ◆ Farm practices to prevent nutrient loss from manured fields.

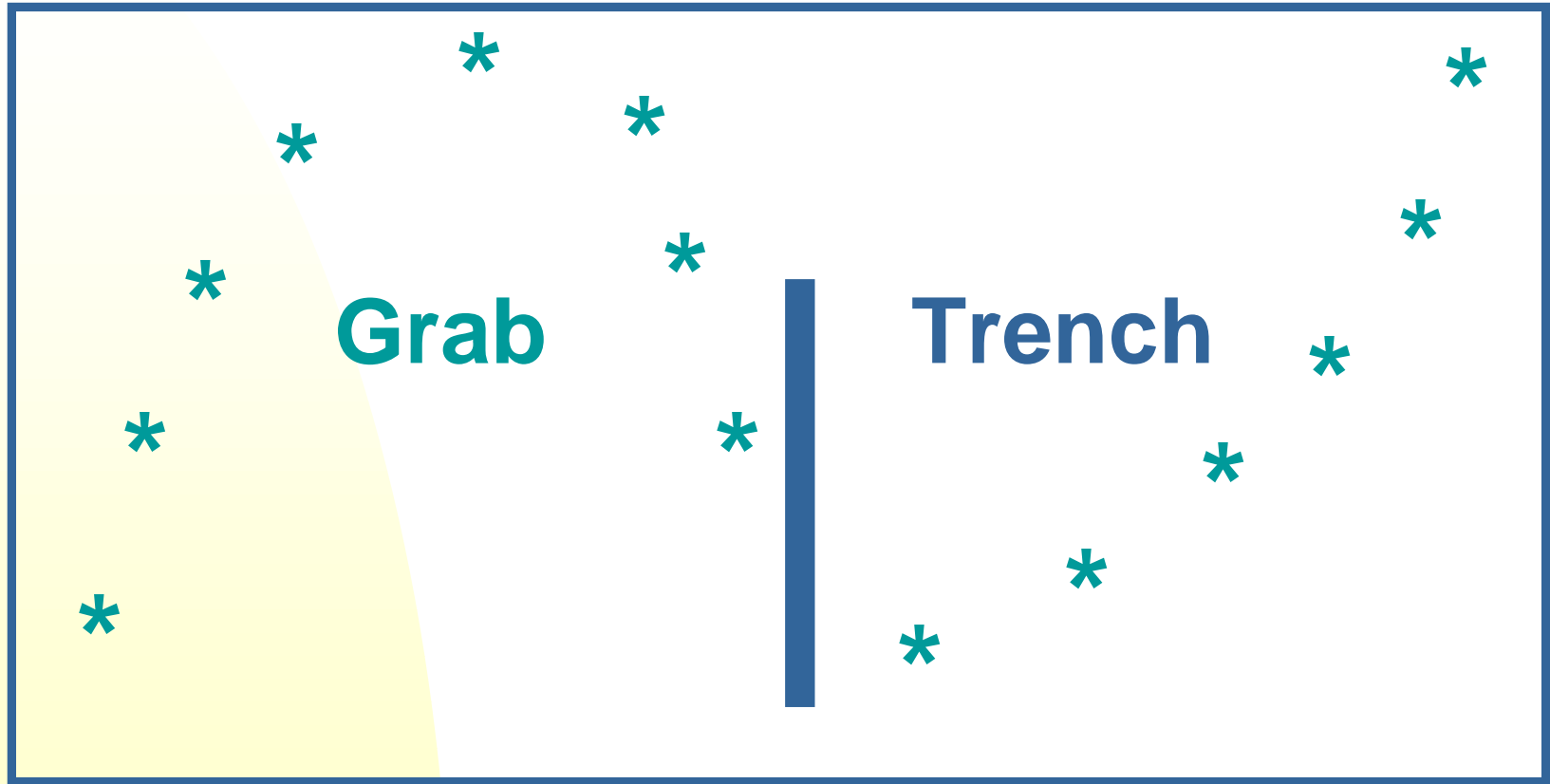
Components of a Manure Utilization Plan

- Manure production on the farm
- Manure nutrient availability
- Crop nutrient requirements
- Manure application rates
- Best management practices
- Record keeping

Total Nutrients in the Manure Produced on the Farm

- Calculate from actual farm records showing cleanout volumes and manure analysis data (It is critical to have representative samples.).
- Calculate from available tables based on number of animals.

Sampling in a Poultry House Using Trench or Zigzag Methods in Order to Have a Representative Sample



Logo

Stockpiled Feedlot Manure



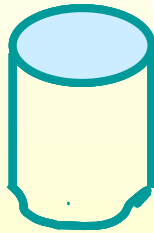
To make a composite sample, take multiple points from piles or lots.

Logo

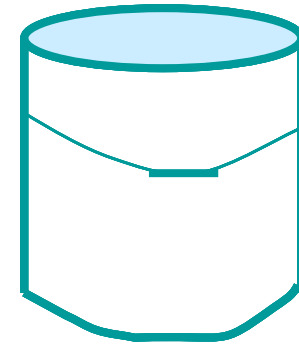
Liquid Waste Sampling Device



**Wooden
pole
10' long**



Plastic cup



Plastic container

Logo

Manure Nutrient Availability

- Not all nutrients in manure are available to plants in the year of application.
- Nutrients in manure are in both organic and inorganic forms.
- Organic nutrients must be mineralized into inorganic forms before plant uptake.
- To meet crop nutrient needs, you need to know nutrient availability.

Nitrogen Availability to Crops

30%-70% of total in the first year after application

- Inorganic N: 100% available

$\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$

- Organic N: 50% available

Decomposition--> NH_4^+ --> NO_3^-

Some will stay in the soil.

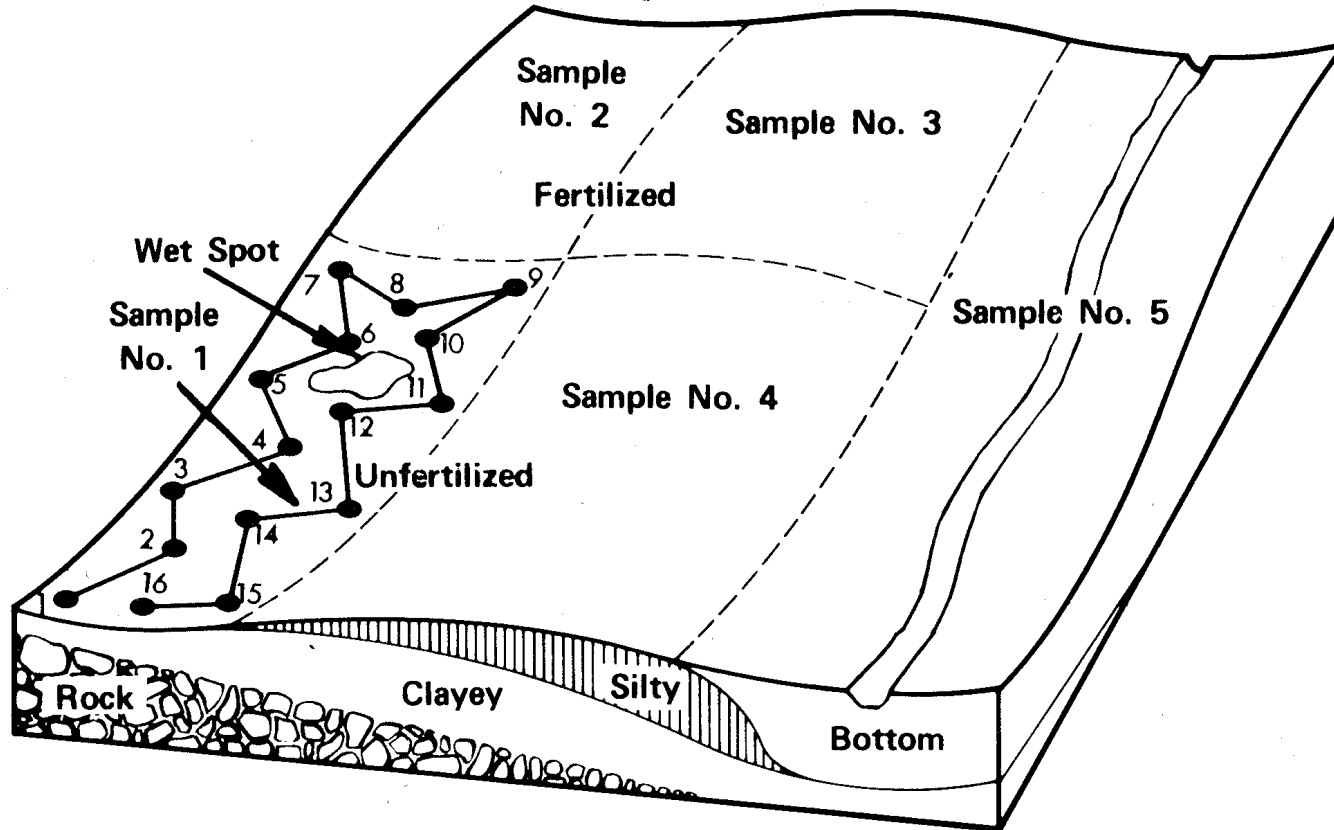
Availability of P and K to Crops

- Phosphorous: 80%-100% available
- Potassium: 80%-100% available

Crop Nutrient Requirements

- The amount of nutrients to apply should be based on crop type and a *realistic crop yield goal*.
- This realistic yield goal is a function of soil type, climatic condition, and management inputs.
- A soil test or other extension publication should provide some basic nutrient needs.

Collect a Representative Soil Sample.



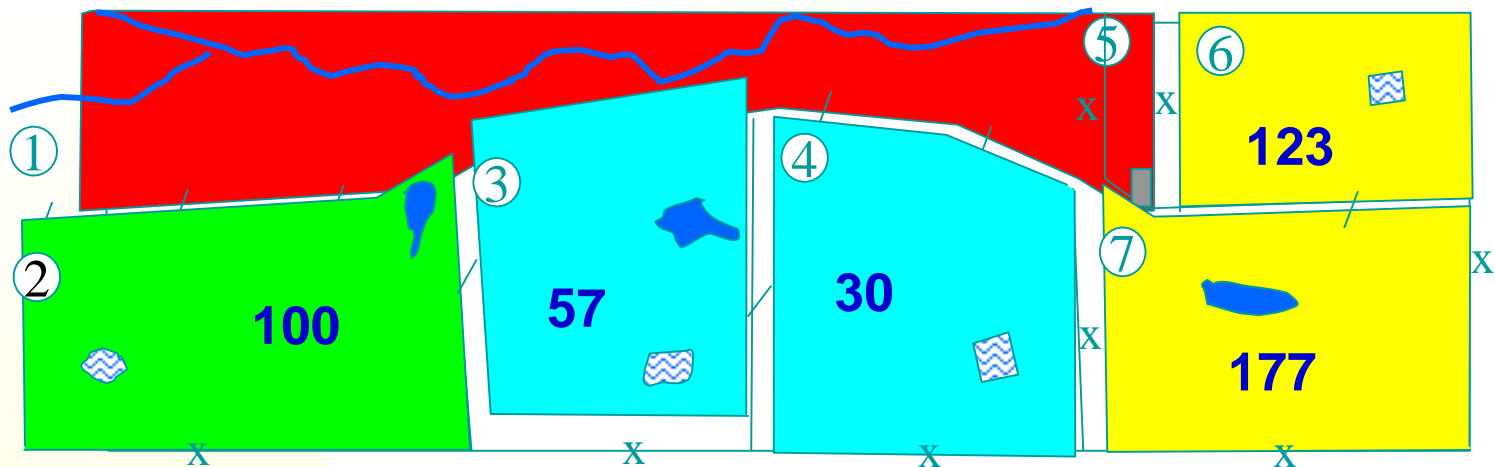
Logo

Check with Extension Educators for Specific Soil Sampling Guidelines for your State.



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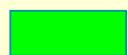
Apply Manure to Fields with Lowest Soil Test Values First (Watch for State Regulations.)



Soil Test P



0-65



65-120 adequate



120-250

Soil Test P



250 - 400



400+

no application

Logo

Manure Application Rates

- The following example shows how much manure should be applied agronomically based on crop needs.
- However, the maximum amount of manure allowed varies by state regulations or rules. P risk index, e.g., is widely used to limit application.

Manure Application Rate Calculation Work Sheet

1. Nutrient needs of crop
(lbs/acre, from soil test report)

N	=	180
P ₂ O ₅	=	45

2. Total nutrients in the effluent
(lb/1,000 gal, from manure analysis report)

N	=	5.2
P ₂ O ₅	=	1.3

Manure Application Rate Calculation Work Sheet (continued)

**3. Available nutrients in the effluent (lb/1,000 gal)
Assume 50% N and 90% P available**

**N = 2.6
P₂O₅ = 1.2**

4. Calculate manure rates to supply crop N and P₂O₅ needs (1,000 gal/acre).

**N = 69
P₂O₅ = 38**

Manure Application Rate Calculation Work Sheet (continued)

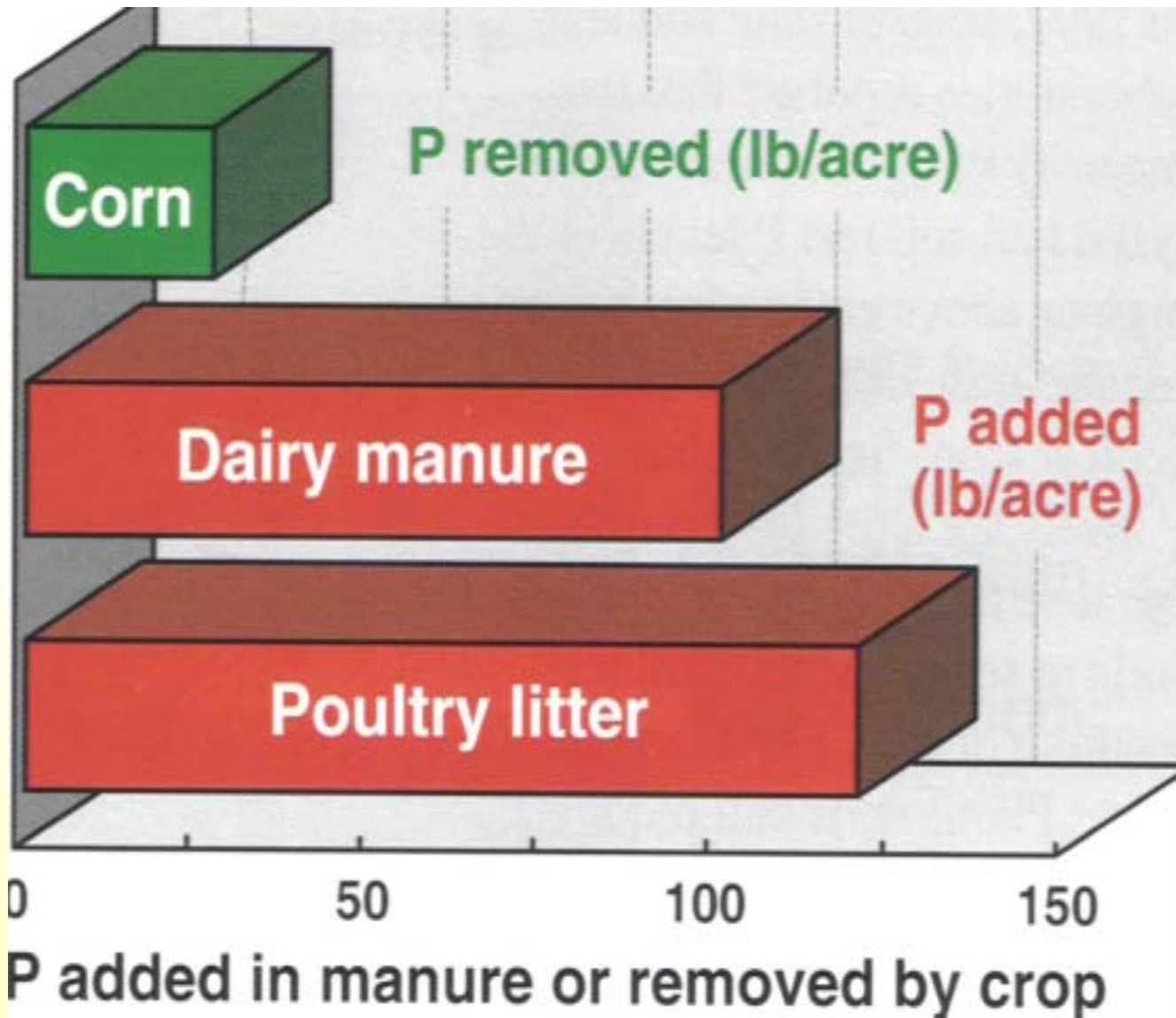
5.	Choose between N or P₂O₅ application rate (1,000 gal/acre)	(Based on N)	(Based on P)
		Rate = 69	Rate = 38
	Depth of irrigation (acre-inch)	Rate = 2.6	Rate = 1.4
6.	Determine amount nutrients applied at chosen rate (lbs/acre)	N = 180 P ₂ O ₅ = 83	N = 97 P ₂ O ₅ = 45
7.	Determine supplemental nutrients (lbs/acre) and nutrients over applied	N = 0 P ₂ O ₅ = 38	N = - 83 P ₂ O ₅ = 0

Which Nutrient to Base Application Rate on?

- Usually, only one of the many nutrients can be applied at a rate that meets the needs of a specific crop.
- The application rate should be limited by the nutrient that causes the greatest problems to the plant or the environment when over applied.

For This Example,

- P is over applied if the rate is based on crop N needs.
- On the other hand, commercial fertilizer is needed to supplement N requirement if the rate is based on crop P needs.
- The P-based approach is more environmentally friendly but requires more land base to receive manure.



Logo

Crop Selection

- Crops vary in their needs for nutrients.
- High-yielding perennial grass species are easy to manage and can remove significant amount of nutrients.
- Summer and winter inter-cropping systems need to be considered.

Time of Application

- Applying manure at the proper time for crop needs is crucial.
- Proper timing is as important as proper application rates.
- Nutrients that are not used by crops are subject to runoff, volatilization, and leaching, with negative environmental consequences.

Time of Application (continued)

- Be familiar with crop nutrient needs and the best times for nutrient applications.
- In warmer climates, try to apply no sooner than 30 days prior to planting or perennial crops breaking dormancy.
- Be aware of special crop needs and restrictions for feeding crops to humans or animals.

Time of Application (continued)

- If you are using starter fertilizers, make sure you subtract that amount from the manure application rates.
- Manure applications may be dictated by storage volume; make sure there is adequate storage available so that manure applications can be made based on crop needs, not just the need to empty the manure storage pit or lagoon.

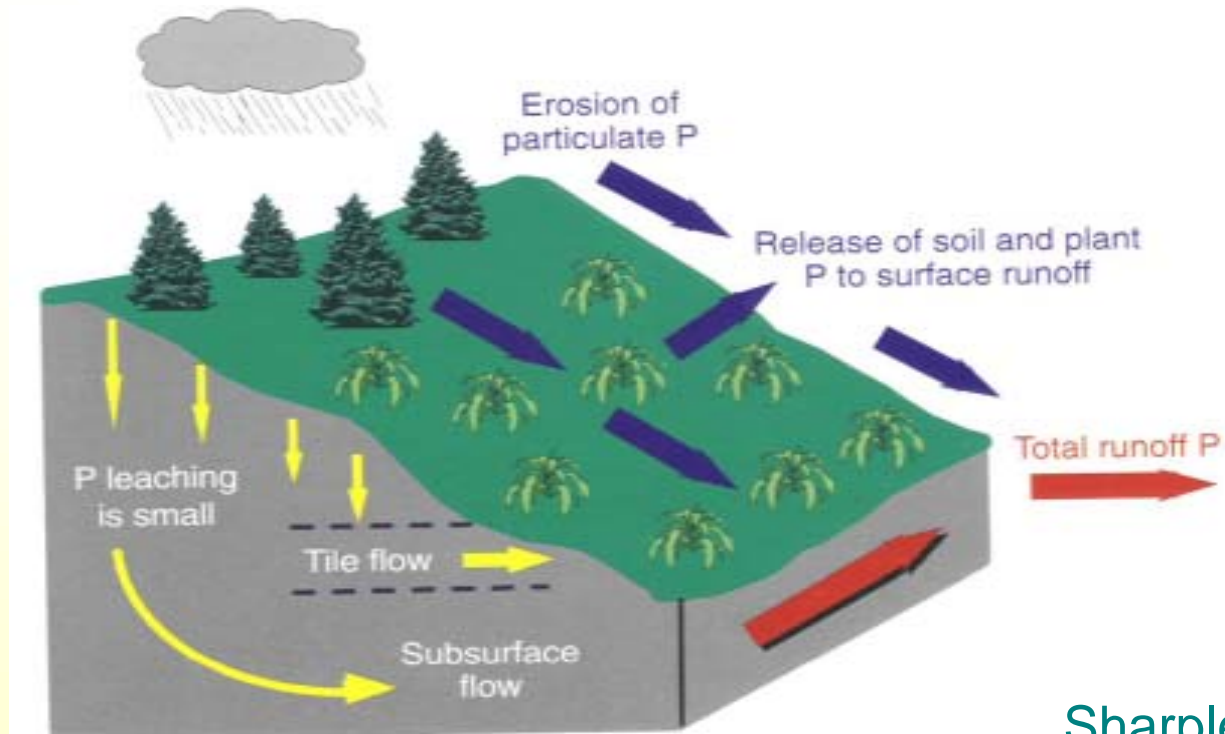
Placement

- Placement affects manure nutrient availability and potential to leave the site.
- Manure should be applied uniformly.
- If possible, incorporate manure into the soil.

Management Strategies

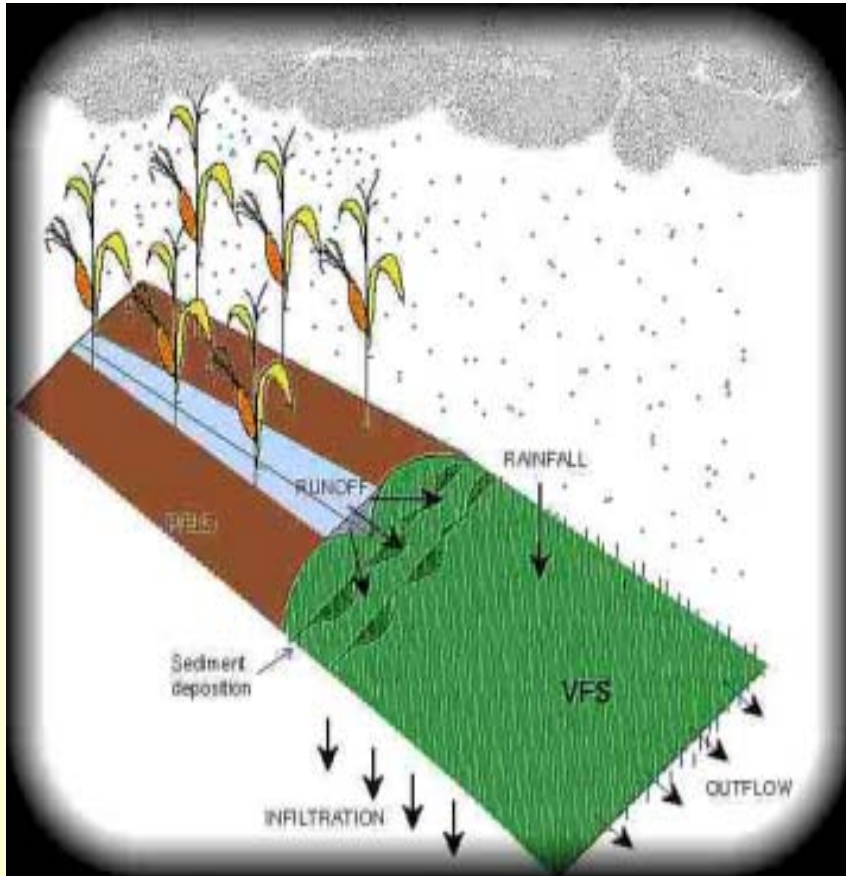
- Manure management
 - ◆ Base application rates on P needs.
 - ◆ Explore alternative uses if land is limited.
- Soil management
 - ◆ Minimize nutrients transported off site.
 - ◆ Increase nutrient removal with crops.

Nutrients can be Lost Through Runoff, Erosion, and Leaching



Sharpley et al.1998

Vegetative Filter Strips



- Reduce surface runoff.
- Increase infiltration of runoff and nutrients.
- Promote sediment deposition and filtering.
- Provide nutrient uptake by plants.

Management

- To be effective, a manure utilization plan must be reviewed and revised periodically.
- Good record keeping is necessary to make the plan work.
- Calibration of manure application equipment verifies proper application rates.
- Soil tests let you know if nutrients are building up.

Record Keeping

- Good records contribute to good decisions.
- Records reduce environmental risk.
- Decisions based on records are only as good as the data.
- Records reduce environmental and legal exposure.

Record Keeping (continued)

- A record-keeping database:
 - ◆ Helps organize good data.
 - ◆ Provides an operation and maintenance checklist.
 - ◆ Provides documentation of implemented conservation practices.

What Records Should be Kept?

- Site information
- Production information
- Permits of certificates
- Manure field application
- Internal inspection data
- Mortality disposal

Summary

- A manure utilization plan is an effective tool to ensure proper manure application.
- It must be monitored and revised frequently.
- Manure utilization plans help maximize the beneficial reuse of manure nutrients and minimize negative environmental effects.