

# What is Manure *Really* Worth?

## Maximizing the Economic Benefits of Manure

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Minnesota Pollution  
Control Agency

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# **What is Manure *Really* Worth?**

## **Maximizing the Economic Benefits of Manure**

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Michael Schmitt, and Jose A. Hernandez**



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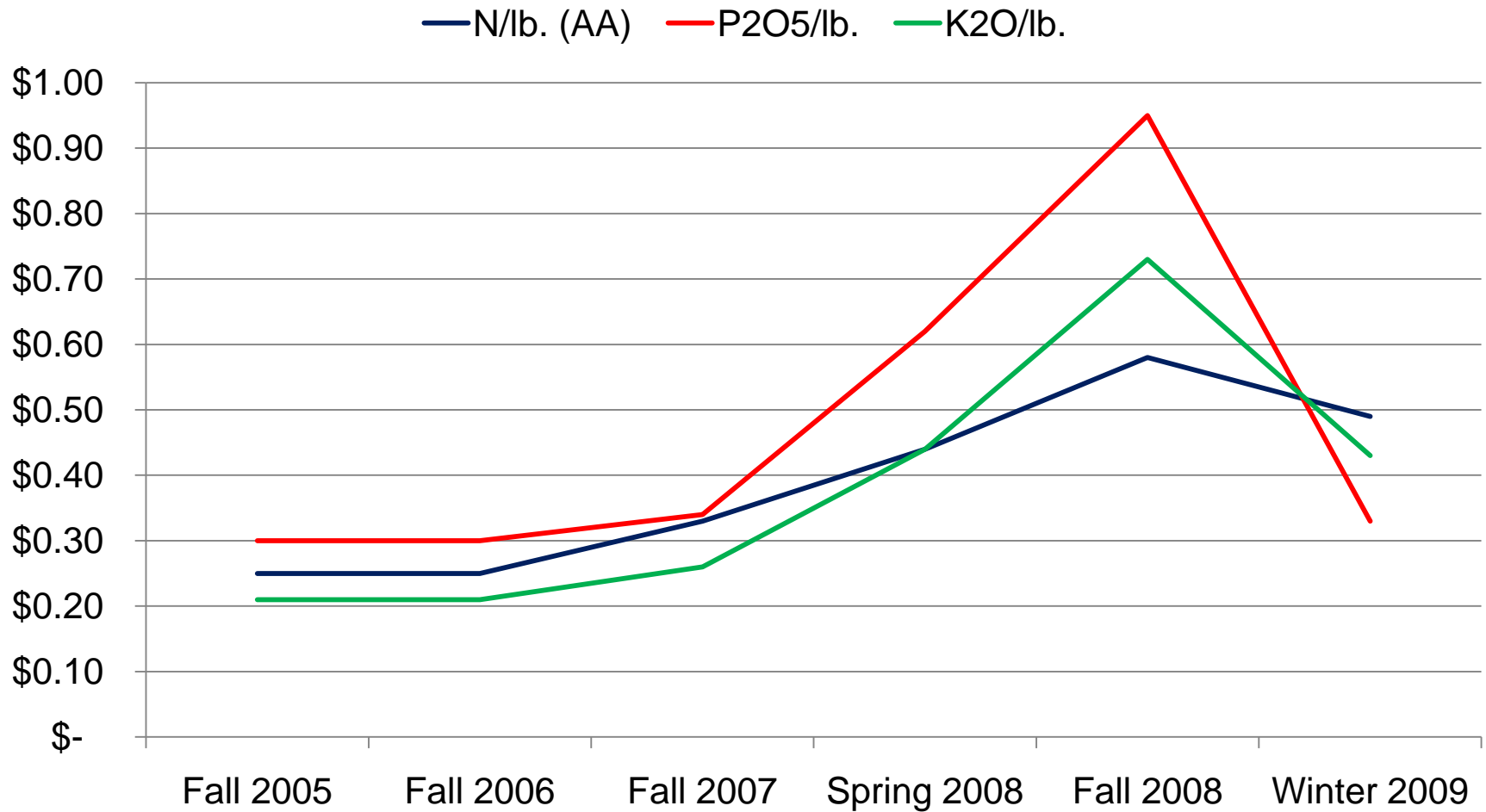
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# Goals

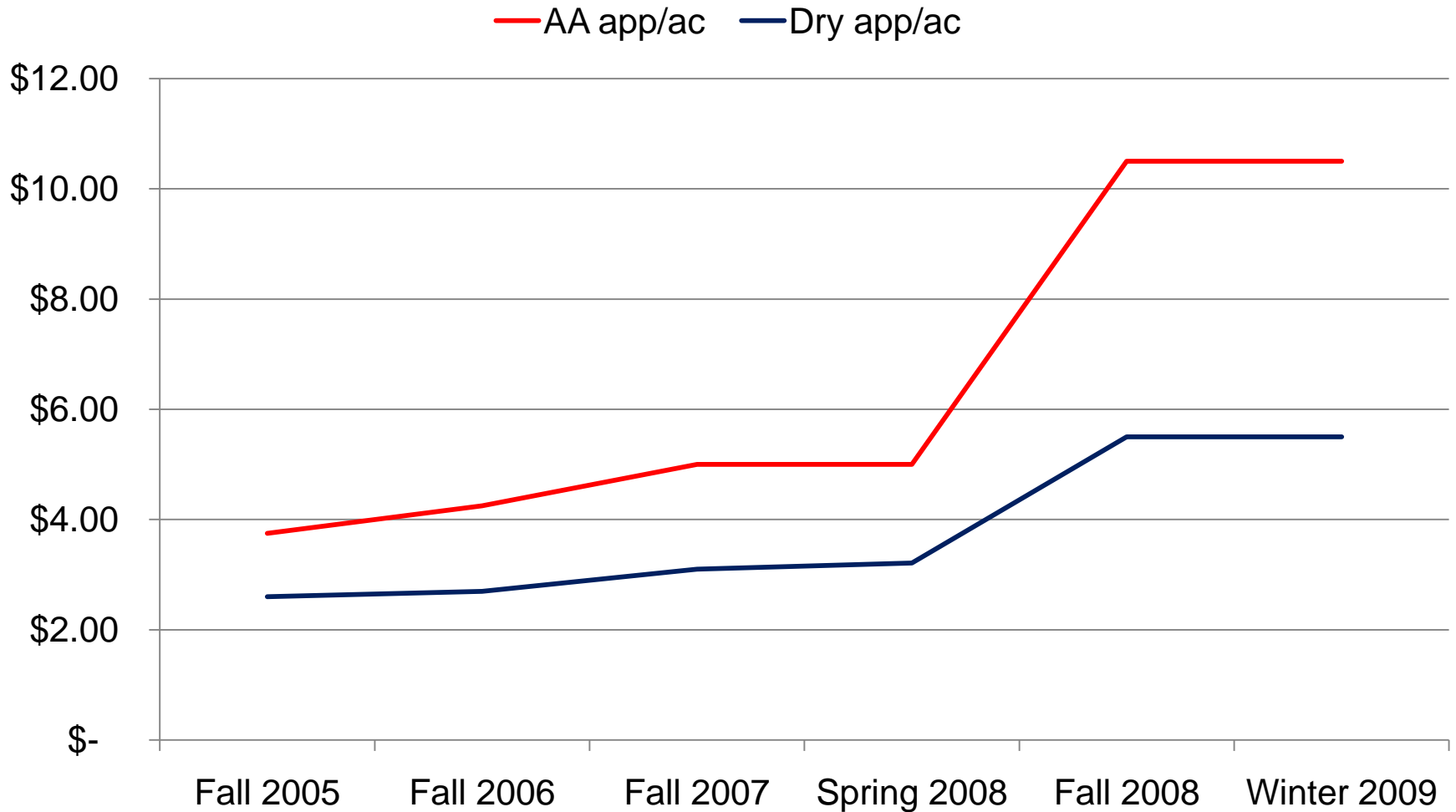
- Understand how to determine what the \$ value is for a given amount of manure...
- in so doing recognize ways to adjust management to increase that amount...
- and benefit both economically and environmentally



# Fertilizer Prices



# Fertilizer Prices



# Calculations Involve:

- **Economic Principles**  
(constant and objective-fertilizer replacement and other value influences minus cost of application)
- **Agronomic Factors**  
(partially subjective/some perceptions)




# Economics/Environment/Management

- Maximizing manure value has a positive environmental benefit (efficient use of nutrients).
- Approaching manure management in an economic context requires looking at all aspects of manure management.



# Reasons to Accurately Determine Manure Value

- Manure Impact in Cash Flow Projections
- Manure Sale/Transfer Values 
- Maximize Crop/Livestock Profitability
- Economic & Environmental Compatibility



# Manure/Commercial Fertilizer Difference

- Nutrients in commercial fertilizer are priced per unit, plus a small application fee.
- Nutrients in manure are usually “purchased/utilized” with application costs.  
(Issues like nutrient availability, nutrient ratio, crop need, nutrient concentration, field location, etc., complicate value determination.)



# Manure Management Issues

## □ Manure's Economic Value:

- Fertilizer Replacement Savings
  - f:nutrients NOT purchased
- ✓ Depends on Field, Not Manure
- ✓ Nutrients = Fertilizer -- NO!
- ✓ Don't rely on soil's "bank"



# Manure Management Issues

## □ Manure's Economic Value:

- In(de)crease in Crop Yield/Quality
  - f:soil quality, nutrient, compaction, etc.
- ✓ Generally a NET Effect (+7-10%)
- ✓ Long-term Investment
- ✓ Very Subtle Differences



# Manure Management Issues

## ❑ Manure's Economic Value:

- Cost of hauling/applying
  - f: application method and distance
- ✓ Distance = Expense
- ✓ N stabilizers may not be economical
- ✓ Minimize Management Losses



# Manure Management Issues

## □ Manure's Economic Value:

- ✓ Fertilizer Replacement Savings
  - f:nutrients NOT purchased
- ✓ In(de)crease in Crop Yield/Quality
  - f:soil quality, nutrients, compaction, etc.
- ✓ Cost of hauling/applying
  - f:application method and distance



Net Economic Impact of Manure =  
(usually on a per acre basis)

Value of Year 1 Fertilizer & Application  
Costs Replaced

+ Residual Value (Mostly Year 2 if any)

+/- Yield (or other) Response/Cost

– Manure Application Costs



# Spreadsheet Resources

- Manurwkst
  - <http://www.apec.umn.edu/faculty/wlazarus/>
  - <http://www.apec.umn.edu/faculty/wlazarus/documents/manurwkst.xls>
  - Or search for “**MANURWKST**”



# Spreadsheet Steps

- Step 1: Determine The Value of Nutrients Needed for First Year Crop Production.
- Step 2: Calculate the Value of Required Nutrients That Are Applied With Manure (for First Year Crop Production)
- Step 3: Calculate the Value of Applied Nutrients That Will Replace Second Year Purchases Or Are Desired to Improve Soil Fertility Levels



# Spreadsheet Steps

- Step 4: Adjust For Yield or Other Factors
- Step 5: Subtract Application Costs
- Step 6: Calculate Total Net Value of Manure Application Per Acre, Per 1000 Gallons, per Animal, or for Facility or Operation



# MANURWKST DEMONSTRATION



# How to Maximize Manure Value:

## Value of Year 1 Fertilizer & Application Costs Replaced (Replacement of nutrients that would have been purchased)

- Apply for nitrogen requiring crop.
- Apply to crops & fields that need  $P_2O_5$  &  $K_2O$  (Low soil test level fields).
- Consider lower rates ( $P_2O_5$  &  $K_2O$  level) with supplemental commercial N (often increases efficiency of nutrient use).
- Incorporate manure at application time (reduces N volatilization losses).
- Manure nutrient concentration (high density manure requires less gallons or tons to haul to meet crop need (therefore less application cost)). Avoid dilution if possible.
- Develop a multi year set of manure tests for each barn to better estimate nutrient levels in manure.



# How to Maximize Manure Value:

## + Residual Value

Apply to low soil testing fields ( $P_2O_5$  &  $K_2O$ ) that need fertility increase and 2nd year nutrient application (that you would have purchased).

## +/- Yield (or other) Response

Apply to fields that do not have a recent manure history (low organic matter, etc.).



# How to Maximize Manure Value:

## – Manure Application Costs

- Many factors are fixed.
- Use application equipment that has a range of application levels and that can be calibrated so that application accuracy is achieved.
- Avoid over-application (over-application wastes nutrients and increases application costs).



# Manure Value is Reduced by:

- **Over Application (wasting N)**
- **No  $P_2O_5$  and/or  $K_2O$  Need (wasting P & K)**
- **Low Nutrient Manure (high app cost)**
- **Under Applied N (yield loss?)**
- **Surface Application (volatilization)**
- **Crop Selection (wasted N)**



# Variability of Nutrients in Manure in Southeast MN, 1990-92

Specie	Nutrient	Average	Range
		lbs/1000 gal	
Dairy	N	29	10 – 47
	P2O5	15	6 – 28
	K2O	24	11 – 38
Swine	N	48	7 – 107
	P2O5	28	3 – 64
	K2O	21	7 – 51

Manure tests aren't always perfect but they are the best option.

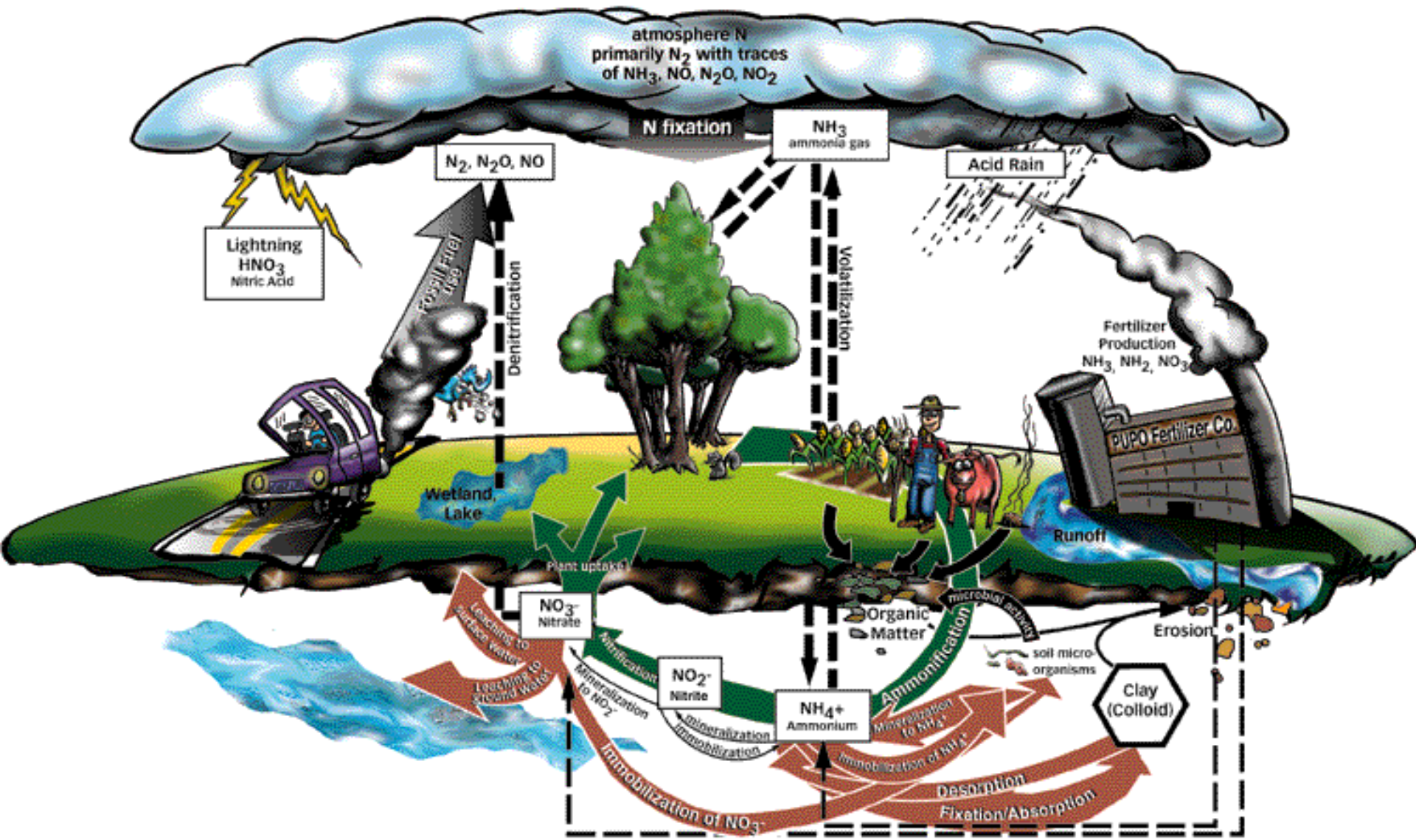


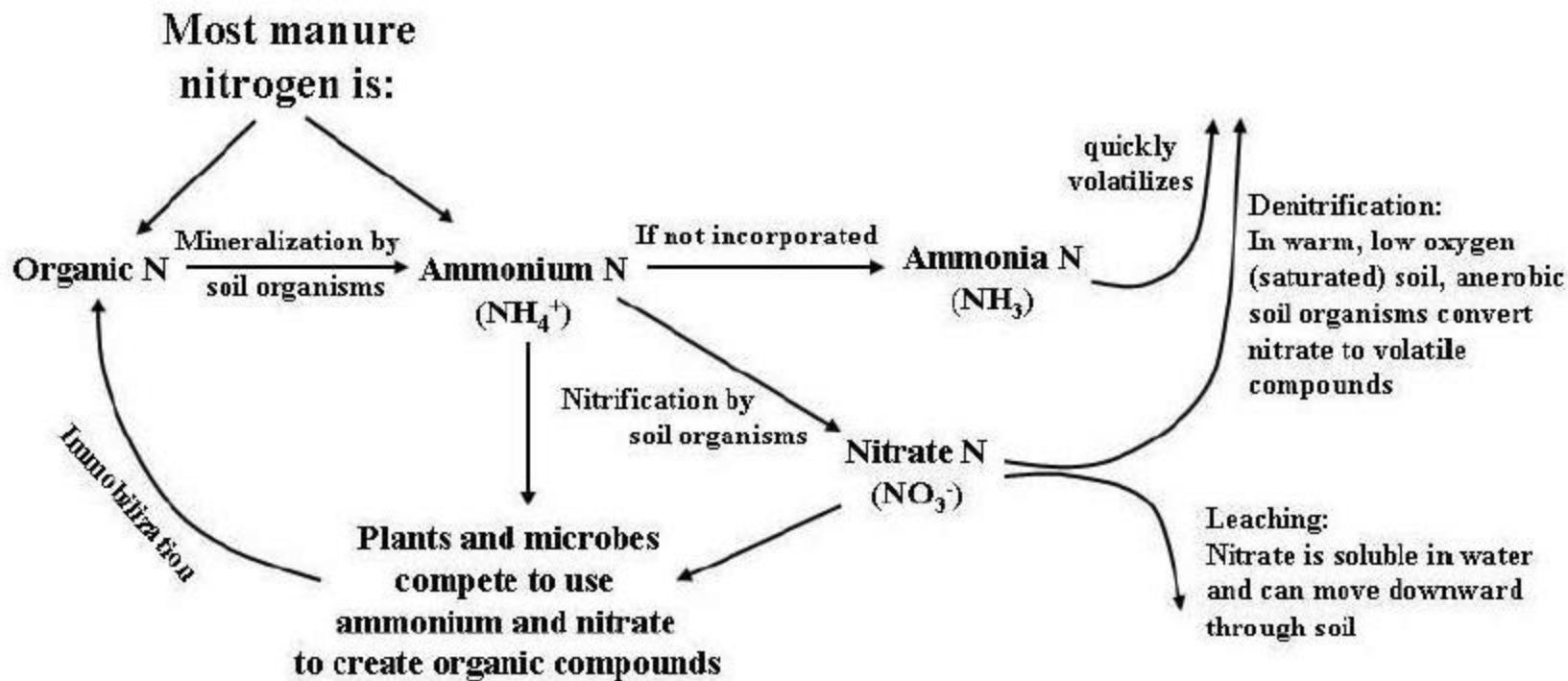
# Reference for Step 2, Line 21

## Table A4. Nitrogen availability and loss as affected by method of manure application and animal species

Adapted from: Manure Planning and Record Keeping Guide, BU-6957, University of Minnesota Extension Service, 2001

Year Available	Broadcast Incorporation Timing			Injection		
	None to 96	12 to 96 hrs.	< 12 hrs.	Sweep	Knife	
% of Total Nitrogen Available Per Year						
<b>Beef</b>						
Year 1	25	45	60	60	50	
Year 2	25	25	25	25	25	
<i>Lost</i>	40	20	5	5	10	
<b>Dairy</b>						
Year 1	20	40	55	55	50	
Year 2	25	25	25	25	25	
<i>Lost</i>	40	20	10	5	10	
<b>Swine</b>						
Year 1	35	55	75	80	70	
Year 2	15	15	15	15	15	
<i>Lost</i>	50	30	10	5	15	
<b>Poultry</b>						
Year 1	45	55	70	NA	NA	
Year 2	25	25	25	NA	NA	
<i>Lost</i>	30	20	5			





*Figure 2. Nitrogen components of manure and some transformations that occur in the soil.*



**Table 3. Nitrogen rate guidelines for growing corn when manure is used**

Previous Crop <sup>1</sup>	Soil/Field Productivity Potential <sup>2</sup>	
	Highly Productive Sites	Medium Productive Sites
	----- lbs. N/acre -----	
Corn	130 - 180	130
Soybean	100 - 140	100

<sup>1</sup> For previous crops other than corn or soybeans use the corn following corn rate guideline and subtract any previous crop N credits.

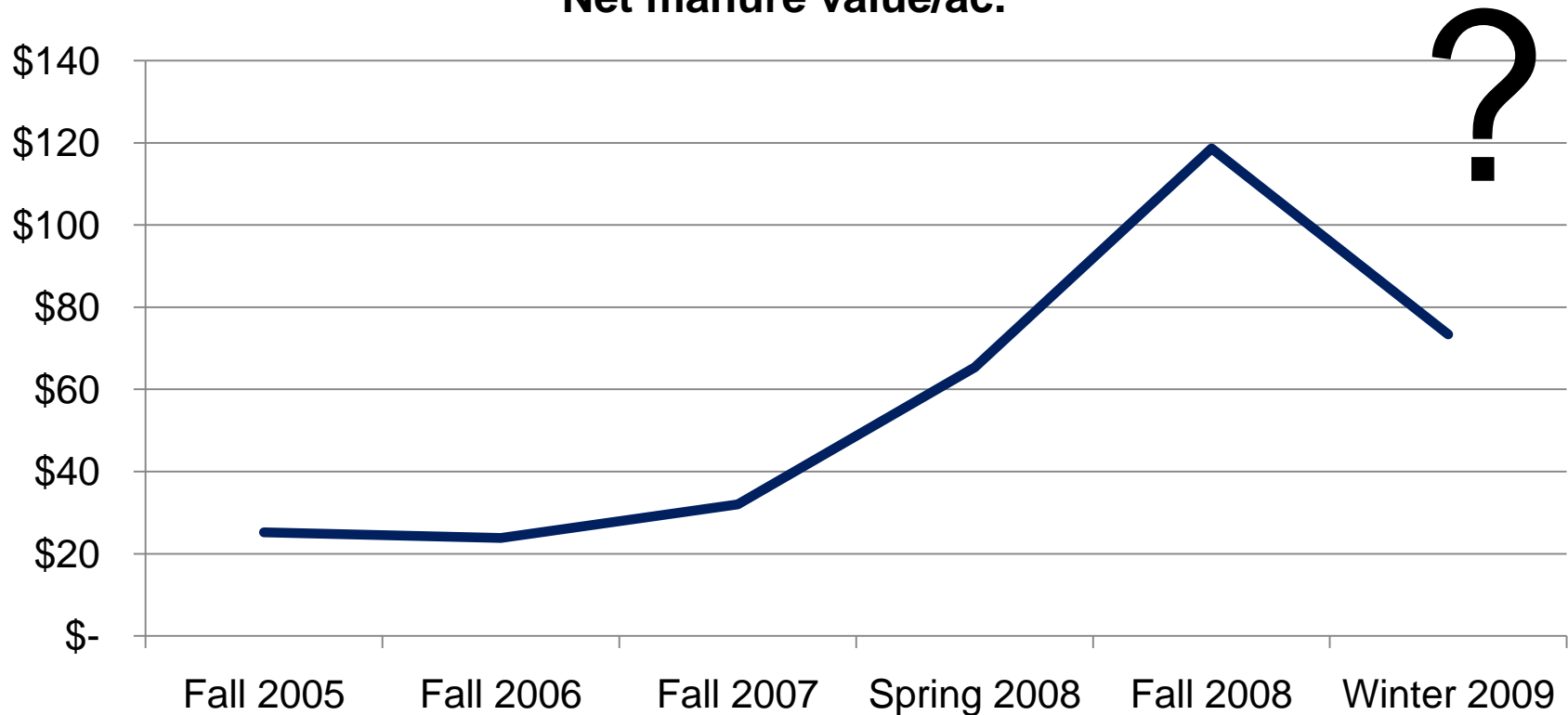
<sup>2</sup> Soil and environmental conditions that limit crop production such as erosion, poor soil drainage, restriction to root growth, short growing season, marginal growing season rainfall among others would qualify a site as having medium productivity potential.



# The bottom line...

Crop need = 140-45-40, Manure test = 45-28-29,  
\$0.012/gallon, @4000 gallon/ac

Net manure value/ac.



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