Recognizing Manure's Full Potential Value

In this interactive workshop, participants will reveal manure's full potential by discovering the $$ and intrinsic value. We will "get our hands dirty" to learn proper techniques for manure sampling for nutrient analysis, understand the results of said analysis, and discover how to determine manure application rate. Building on these concepts, participants will then be able to calculate the $$ value of manure nutrients on agricultural land and have talking points for "selling" the use of manure over commercial fertilizer by highlighting manure's ability to build soil health. No actual manure will be used, keeping the smell to a minimum and the fun and learning at a maximum.

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Reading a Manure Analysis

Step 1: Choose the livestock facility from the stack of AFOs that most closely matches the manure you have available. Find the Manure Analysis that corresponds with your chosen facility.

Step 2: Using the Manure Analysis, find the following information and fill in the table below and the **"As-Is" line of the facility record**.

As-Is Organic N	As-Is Ammonium N	As-Is P_2O_5	As-Is K_2O	As-Is Sulfur
_____	_____	_____	_____	_____

Step 3: As a group, discuss current fertilizer prices for the products in the table and fill in the "cost/ton" of each (column B).

Product	**% of Primary Nutrient** A	**Cost/ton** B	**Cost/lb of nutrient** (B/2000) / (A/100) = Cost/lb C
Urea	46%	$	$
32% UAN	32%	$	$
MAP	52%	$	$
Potash	60%	$	$
Sulfur	85%	$	$
Zinc	36%	$	$

Step 4: Calculate the cost of the primary nutrient using the following equation and filling in the table above (column C).

_____ / 2,000 / _____ / 100 = _____ (cost/lb of primary nutrient)

Cost per ton — Percent of nutrient (as a whole number)

Step 5: Fill in the cost per pound of nutrient in the "nutrient value" line of the Facility Record Sheet.

----------Credits Worksheet – First Year Manure Availability----------

Choose the livestock facility from the stack of AFOs that most closely matches the manure you have available. Review application and incorporation information on the facility record to help with this worksheet.

Step 1: Determine the Ammonium N Available THIS YEAR from the manure by using the below formula and Table 1.

Ammonium N Available = Availability factor x As Is Basis Ammonium N in sample (lbs/unit)

_____ (From Table 1) x _____ (From As-Is sample) (lbs/unit) = _____ **Ammonium N Available** (lbs/ton)

Table 1. Fraction of ammonium nitrogen available this year.

Sidedress Application			
Injected	0.95		
Sprinkler Irrigated	0.80 (if >0.4" applied) or 0.40 (if ≤0.4" applied)		
Preplant Application and Not Incorporated			
Surface – spring or fall	0.00		
Preplant Application and Incorporated			
	Solid	*Liquid Applied When Air Temp > 50˚F*	*Liquid Applied When Air Temp ≤50˚F*
Immediately	0.95	0.95	0.95
One day later	0.50	0.70	0.70
Two days later	0.25	0.45	0.55
Three days later	0.15	0.25	0.45
Seven or more days later	0.00	0.00	0.40

Table 2. Fraction of organic nitrogen available this year.

Beef/Dairy Manure	
Solid or Stored liquid	0.40
Composted feedlot	0.15
Poultry Manure	
Layers with no bedding	0.45
All other poultry	0.40
Swine Manure	0.40

Step 2: Determine the Organic N Available THIS YEAR from the manure by using the below formula and Table 2 above.

Organic N Available = Availability factor x As Is Basis Organic N in sample (lbs/ton)

_____ (From Table 2) x _____ (From As-Is Sample) (lbs/ton) = _____ **Organic N Available** (lbs/ton)

Step 3: Add the Ammonium N Available and the Organic N Available to get Total N Available THIS YEAR.

Total N Available this year = Ammonium N Available + Organic N available

_____ Ammonium N Available (from Step 1 above) (lbs/ton) + _____ Organic N Available (from Step 2 above) (lbs/ton) = _____ **Total N Available THIS YEAR** (lbs/ton)

Step 4: P_2O_5 is 70% available the first year. Using this and the formula below, determine the amount of P_2O_5 available THIS YEAR.

P_2O_5 Available this year = Availability factor x As Is Basis P_2O_5 in sample (lbs/unit)

0.70 x _____ (from As-Is sample) (lbs/unit) = _____ **P_2O_5 Available** (lbs/unit)

Step 5: K_2O is 80% available the first year. Using this and the formula below, determine the amount of K_2O available THIS YEAR.

K_2O Available this year = Availability factor x As Is Basis K_2O in sample (lbs/unit)

0.80 x _____ (from As-Is sample) (lbs/unit) = _____ **K_2O Available** (lbs/unit)

Step 6: Sulfur is 55% available the first year. Using this and the formula below, determine the amount of sulfur available THIS YEAR.

S Available this year = Availability factor x As Is Basis S in sample (lbs/unit)

0.55 x _____ (from As-Is sample) (lbs/unit) = _____ **S Available** (lbs/unit)

Add these numbers to the Facility Record in the "Crop Available this Year" line.

----------Credits Worksheet – Future Manure Credits ----------

Step 1: Ammonium N is not available after the first year of application, however, Organic N becomes available over time. Determine the FUTURE Organic N Available following application of manure by using the formula and Table 3 below.

Organic N Available = Availability factor x As Is Basis Organic N in sample (lbs/unit)

Table 3.

Growing Season after manure application		Availability Factor		Organic N in Original Sample		Organic N Available
2nd		0.20	x	_____	=	
3rd		0.10	x	_____	=	+
4th		0.05	x	_____	=	+
				Total Organic N Available in the Future		

Step 2: It can be assumed that the remainder of P_2O_5, K_2O, and Sulfur become available over several years following manure application. Determine the FUTURE nutrients available following application of manure by using the formula and Table 4 below.

Remainder of Nutrient Available = As Is Basis Organic N in sample (lbs/unit) - Nutrient Available FIRST YEAR

Table 4.

Nutrient		As Is Basis of Nutrient in sample (lbs/unit)		First Year Availability (from the previous worksheet)		Remainder Available
P_2O_5		_____	-	_____	=	
K_2O		_____	-	_____	=	
Sulfur		_____	-	_____	=	

Step 3: Add these numbers to the Facility Record in the "Crop Available in Future" line.

Step 4: Calculate the Potential Fertilizer Value on the Facility Record.

Potential Fertilizer Value = (Crop Available This Year + Crop Available in Future) x Nutrient Value

Nutrient	Lbs Available 1st Year		Lbs Available in Future		Total Lbs of Value		Fertilizer Value ($/lb)		Potential fertilizer value
Organic N	_____	+	_____	=	_____	x	_____	=	_____
Ammonium N	_____	+	_____	=	_____	x	_____	=	_____
P_2O_5	_____	+	_____	=	_____	x	_____	=	_____
K_2O	_____	+	_____	=	_____	x	_____	=	_____
Sulfur	_____	+	_____	=	_____	x	_____	=	_____

Add these numbers to the Facility Record in the "Potential Fertilizer Value".

---------- Credits Worksheet – Manure Application Rates ----------

Using the FIRST YEAR Manure Availability Worksheet and UNL N Fertility Recommendations

Step 1: Using the FIRST YEAR Manure Availability Worksheet and your calculated UNL N Fertility Recommendations, determine an N-based application rate by dividing your N needed by the Total N Available THIS YEAR.

N fertility recommendation ÷ Total N Available THIS YEAR = Application Rate on a Nitrogen Basis

_____ (lbs N/acre)	÷	_____ (lbs/unit)	=	_____ (unit/acre)
N needed (from Field Record)		Total N Available THIS YEAR (from Facility Record)		**Manure Application Rate**

Step 2: Determine estimated P_2O_5 to be removed within the next 4 growing seasons using Table 5.

Table 5.

Growing season after manure application	Crop to be grown	P_2O_5 Removal (from Field Record)
1st	_____	
2nd	_____	+
3rd	_____	+
4th	_____	+
Total P_2O_5 removed in next 4 growing seasons		

Step 3: Determine a P-based application rate by dividing your P removal for the next 4 years by the amount of P_2O_5 in manure.

P_2O_5 Removal ÷ P_2O_5 in Manure = Application Rate on a Phosphorus Basis

_____ (lbs/acre)	÷	_____ (lbs/unit)	=	_____ (unit/acre)
P_2O_5 Removal (from step 2)		P_2O_5 in Manure (from analysis)		**Manure Application Rate**

Add these numbers to the Facility Record in the "Proposed Application Rate" column.

for Group Discussion

Can we apply on a P-basis if it exceeds the N rate? Why or why not?

---------- Manure's Real Agronomic Value Worksheet ----------

Step 1: Answer Yes or No for individual fields and crops for N, P, and K. For nitrogen, if fertilizer-N will be reduced to match manure-N application then manure will deliver value for nitrogen. For P and K, if a soil test value is approximately equal or less than the recommended soil test threshold for supplemental P and K, then answer "Yes." If your soil test value is substantially above the recommended threshold, then you are not likely to receive value from this nutrient.

My Field	Nitrogen	Phosphorus		Potassium	
	Will fertilizer-N be reduced to match manure-N?	Soil Test Threshold for Recommending Broadcast P (Bray 1)[1]	Will value be received from manure-P?	Soil Test Threshold for Recommending Broadcast K[1]	Will value be received from manure-K?
Corn for grain or silage	Yes or No	20 ppm	Yes or No	125 ppm	Yes or No
Soybean	Yes or No	12 ppm	Yes or No	125 ppm	Yes or No
Wheat	Yes or No	30 ppm	Yes or No	125 ppm	Yes or No
Alfalfa, for hay	Yes or No	25 ppm	Yes or No	125 ppm	Yes or No

[1] *Refer to "Which Fields/Crops Best Capture Manure's Value?" Fact Sheet to assist with answers*

Step 2: If you answered "Yes" for a nutrient, look up manure's value found on the AFO Information Card. If you are completing this for your own field, estimate your manure's value by using Nebraska Manure Value Calculator found at http://water.unl.edu/manure-software.

My Manure's Value: $ _____ (for N) per ton or 1,000 gal.

\+ $ _____ (for P) per ton or 1,000 gal.

\+ $ _____ (for K) per ton or 1,000 gal.

\+ $ _____ (for S or other nutrients that you commonly apply)

= $ _____ (total) per ton or 1,000 gal.

Step 3: Refer to the proposed application rate you came up with based upon Nitrogen and Phosphorus.

N-Rate:_____tons (or 1,000 gallons)/acre

P-Rate:_____tons (or 1,000 gallons)/acre

For each application rate, estimate value per acre.

N-rate = $_____ (total) per ton or 1,000 gal. X _____ ton or 1,000 gal. / acre = $_____ per acre

P-rate = $_____ (total) per ton or 1,000 gal. X _____ ton or 1,000 gal. / acre = $_____ per acre

Step 4: Discuss amongst your group and decide whether you want to use a N-based rate or a P-based rate or something else.

Which rate do you propose to apply? *Rate cannot be more than the N rate*. _____

Add your proposed manure application rate to the field placement card on the map.

Step 5: Compare value for all fields in Land Application Map Activity with other participants.

Cost of Manure Transportation Worksheet

Step 1: Determine Transportation Distance (ONE-WAY) from map and record for each field. Slurry Manure uses only one map.

Step 2: Look up Transportation and Application Costs and add to Lines A and B, respectively. "Value Charged by AFO" (Line C) is the charge for the manure. This is optional and might be assumed as "0" for your first estimate of Total Cost.

Step 3: Sum all costs and record in Line D.

Step 4: Add application rate (Line E) and calculate total cost per acre (Line F).

Step 5: Compare total cost (Line F) with Manure Value (Line G) calculated in the Agronomic Value Worksheet.

My Field		
	One-Way Transportation Distance (miles)	_____
A.	Transportation Cost ($/1,000 gallons or ton)	_____
B.	Application Cost ($/1,000 gallons or ton)	_____
C.	Value Charged by AFO ($/1,000 gallons or ton)	_____
D.	Total Cost = A + B + C ($/1,000 gallons or ton)	_____
E.	Application Rate ($/1,000 gallons or ton from Agronomic Value Worksheet)	_____
F.	Total Cost per Acre = D x E	_____
G.	Manure Value per Acre (from Agronomic Value Worksheet)	_____
H.	Net = G – F	_____

Step 6: Compare values with other participants.
Place emoji cards on the board.