# Calculating Residual Nitrogen

# Nick Moody Department of Conservation and Recreation



# **Residual Soil Nitrogen**

- Residual soil nitrogen is inorganic nitrogen (ammonium and nitrate) which remains in the soil at the end of the growing season.
- The majority of the inorganic N is nitrate.

# **Sources of Nitrogen**

- Previously grown legumes
  - Alfalfa
  - Clover
  - Soybeans
- \* Prior applications to field
  - Manures
  - Biosolids



# Nitrogen Credits from Legumes

Table 7-1

Estimated Nitrogen Availability to Succeeding Crops From Legumes

Сгор	% Stand	Description	Residual N (Lbs/ac)		
Alfalfa	50-75	Good (>4 T/A)	90		
	25-49	Fair (3-4 T/A)	70		
	<25	Poor (<3 T/A)	50		
Red Clover or	>50	Good (>3 T/A)	80		
Crimson Clover	25-49	Fair (2-3 T/A)	60		
	<25	Poor (<2 T/A)	40		
Hairy Vetch (cover	80-100	Good	100		
crop)	50-79	Fair	75		
	<50	Poor	50		
Peanuts	-	-	45		
Soybeans	1/2 lb. N per bushel of yield, if previous yield unknown, 20 lbs.				

#### How to Use the Information

Assume a corn crop need of 160 pounds of nitrogen per acre. The farmer tells you that he had a good stand of alfalfa growing in the field the prior year. Table 7.1 (p. 108, S&C) indicates that there are 90 is lbs. of residual nitrogen available to the next crop on a per acre basis.

CORN Need - residual N = Nitrogen to apply

**160 lbs.** N - **90 lbs.** residual N = **70 lbs.** N to be applied from another source

### A few More Examples:

#### What's the Nitrogen Residual?

Hairy vetch was used a winter cover crop and achieved a 60% stand. **75 lbs. N/ Acre** 

Peanuts were grown in a field last year; this year the farmer will plant cotton.

# 45 lbs. N/ Acre

From 200 acres of soybeans, a farmer harvested 8,600 bushels.

**21.5 lbs. N/ Acre** 

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# **Manure Residual**

**Manure Residual Factors for Previous Applications\*** 

Historical Frequency of	Residual
Manure Application on the Field	<b>Factor</b>

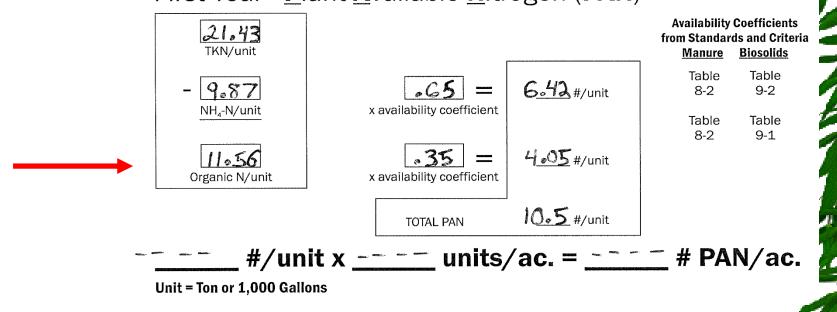
0.10 0.20

Rarely Received Manure in Past (0-1 years in last 5) Frequent Past Applications (2-3 out of 5 years) Continuously Received Manure (4-5 out of 5 years)

- \* The appropriate rate of manure to use in residual calculations is generally the average rate applied for years in which manure was land applied to the field.
- \* Multiply the initial organic N content by the appropriate manure residual factor to obtain an estimate of residual nitrogen from past manure applications.

\* If more detailed manure history information is available, a residual availability of the initial organic nitrogen content of .12, .05, .02 may be used for one, two, and three years respectively following application.

Note: Total of year 1, 2, 3 residuals approximately equals the value for "continuously received manure."



#### First Year - Plant Available Nitrogen (PAN)

A

# Nitrogen Residual for Dairy Manure Example

Manure Slurry Analysis:	(k gal. = $1,000$ gallons)				
Ammonium	9.87 lbs./ k gal.				
TKN	21.43 lbs./ k gal.				
TKN $- NH_4-N = Organic N/k gal.$					
21.43 - 9.87 = 11.56 lbs. organic N/ k gal.					

Assume the field has received manure applications continuously

11.56 X Organic N/ 1,000 G X

availability coefficient

 $\equiv$ 

0.20

lbs./ k gal. residual Nitrogen

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availability coefficient =

**2.31 lbs/ k gal.** lbs./ k gal. residual Nitrogen

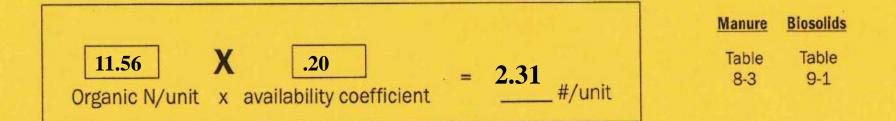
## **Another Example**

Assume field has received manure <u>frequently</u>

11.56X0.10=**1.16 lbs. organic N/ k gal.**Organic N/ k gal.Xavailability coefficient =lbs./ k gal. residual Nitrogen

# Fields 1, 2A, & 3A: Continuously Received Manure

### Residual - Plant Available Nitrogen (for following year)

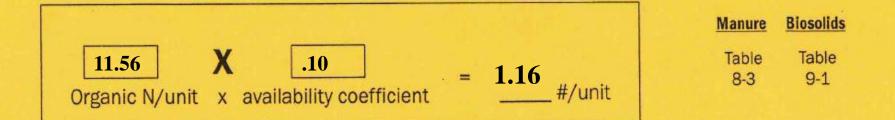


\_\_\_\_\_ #/unit x \_\_\_\_\_\_ units/ac. = \_\_\_\_\_\_ # Residual Nitrogen/ac.



# Field 3B: Frequently Received Manure

### Residual - Plant Available Nitrogen (for following year)



#/unit x \_\_\_\_\_ units/ac. = \_\_\_\_\_ # Residual Nitrogen/ac.



To calculate per acre N residual, multiply the organic N/ 1,000 gallons by the rate per thousand gallons applied to the field.

For 6,000 gallons manure/ acre:

Continuously received manure: Case Study Fields 1, 2A, 3A

2.31 lbs. N/k gal. X 6 (1,000 gal.)/ acre = 14 lbs. residual N/ acre

Frequently received manure: Case Study Field 3B

1.16 lbs. N/k gal. X 6 (1,000 gal.) / acre = 7 lbs. residual N/ acre



# Fields 1, 2A, & 3A: Continuously Received Manure

### Residual - Plant Available Nitrogen (for following year)

$$2.31$$
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# Field 3B: Frequently Received Manure

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#### **NUTRIENT MANAGEMENT Balance Sheet**

WilDaLyn Farms T-1989 Date: February 2012

Ac.	Crop Rotation	Expctd Yield (bu or tons)	Nutrient Needs (from soil test & expctd yield) N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O	Nitrogen Residual (leg./ organic)	Days before Incorp	Organic Material Applied (1000 gal. or tons/ac)	Org. Nut. Applied N-P₂O₅-K₂O	N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O Need or (Surplus)	N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O (commercial)	Notes
8	Orchard- grass Pasture	2.94 ac/au	50-40-70	0/14				36-40-70	36-40-70 br	
16	Corn (grain)	121 bu/ac	120-80-100	0/14	>7	1.45 t/ac Litter	55-80-77	51-0-23	0-0-23 br 20-0-0 ba 31-0-0 sd	1 2
12	Corn (grain)	90 bu/ac	90-0-0	0/0	>2	4.4 k/ac Dairy	46-51-87	44-(51)-(87)	20-0-0 ba 24-0-0 sd	2
9	Orchard- grass Hay (maint.)	3.3 t/ac	140-40-95	0/0	>7	3.68 t/ac Litter	140-202-196	0-(162)-(101)		3
11	Corn (grain)	100 bu/ac	100-100-80	0/14	>1	9.53 WT (2.95 DT)	86-?-?			4
11.3	Corn (silage)	22.5 t/ac	165-120-240	0/7	>2	6 k/ac Dairy	63-69-119	95-51-121	0-31-121 br 20-20-0 ba 75-0-0 sd	4



#### **Same calculation for poultry litter**

Ammonium = 15.62 lbs./ Ton

TKN = 66 lbs./Ton

Organic N = 50.38 lbs./ Ton

Rarely Received Manure in Past (0-1 years in last 5)	0
Frequent Past Applications (2-3 out of 5 years)	0.10
Continuously Received Manure (4-5 out of 5 years)	0.20

Assume <u>CONTINUOUS</u> application of litter to field

50.38 lbs.	Х	0.20 =	=	
Organic N/ Ton	Х	availability coefficient	=	lbs./ Ton residual Nitrogen



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5 years)	

Assume continuous application of litter to field

50.38 lbs.	Х	0.20	=	10.1 lbs. N/ Ton
Organic N/ Ton Nitrogen	Х	availability coefficient	=	lbs./ Ton residual

For 2 Tons litter applied per acre:

10.1 lbs. N/ Ton X 2 Tons/ Acre = \_\_\_\_\_

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For 2 Tons litter applied per acre:

10.1 lbs. N/ Ton X

2 Tons/ Acre

20.2 lbs. N/ acre

