Calculating Residual Nitrogen

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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

Crop	% 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 Crimson Clover	>50	Good (>3 T/A)	80
	25-49	Fair (2-3 T/A)	60
	<25	Poor (<2 T/A)	40
Hairy Vetch (cover crop)	80-100	Good	100
	50-79	Fair	75
	<50	Poor	50
Peanuts	-	-	45
Soybeans	1/2 lb. N per bushel of yield, if previous yield unknown, 20 lbs.		

Standards & Criteria, p. 108

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 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

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

Manure Residual

Manure Residual Factors for Previous Applications*

Historical Frequency of Manure Application on the Field	Residual Factor
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

* 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 - **P**lant **A**vailable **N**itrogen (**PAN**)

21.43 TKN/unit			
- 9.87 NH_4-N/unit			
11.56 Organic N/unit	.65 x availability coefficient	=	6.42 #/unit
	.35 x availability coefficient	=	4.05 #/unit
		TOTAL PAN	10.5 #/unit

Availability Coefficients from Standards and Criteria

Manure	**Biosolids**
Table 8-2	Table 9-2
Table 8-2	Table 9-1

_____ #/unit x _____ units/ac. = _____ # PAN/ac.

Unit = Ton or 1,000 Gallons

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 <u>continuously</u>

11.56	X	0.20	=	
Organic N/ 1,000 G	X	availability coefficient	=	lbs./ k gal. residual Nitrogen

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Assume the field has received manure applications <u>continuously</u>

11.56X		0.20	=	**2.31 lbs/ k gal.**
Organic N/ 1,000 G	X	availability coefficient	=	lbs./ k gal. residual Nitrogen

Another Example

Assume field has received manure frequently

11.56	X	0.10	=	**1.16 lbs. organic N/ k gal.**
Organic N/ k gal.	X	availability coefficient	=	lbs./ k gal. residual Nitrogen

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

Residual - Plant Available Nitrogen (for following year)

11.56	X	.20	=	2.31
Organic N/unit	x	availability coefficient		_____ #/unit

Manure	Biosolids
Table 8-3	Table 9-1

_____ #/unit x _____ units/ac. = _____ # Residual Nitrogen/ac.

Field 3B: Frequently Received Manure

Residual - Plant Available Nitrogen (for following year)

11.56	X	.10	=	1.16
Organic N/unit	x	availability coefficient		_____ #/unit

Manure	Biosolids
Table 8-3	Table 9-1

_____ #/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)

11.56	X	.20	=	2.31
Organic N/unit	x	availability coefficient		____ #/unit

Manure	Biosolids
Table 8-3	Table 9-1

2.31 #/unit x 6 units/ac. = 14 # Residual Nitrogen/ac.

Field 3B: Frequently Received Manure

Residual - Plant Available Nitrogen (for following year)

11.56	X	.10	=	1.16
Organic N/unit	x	availability coefficient		____ #/unit

Manure	Biosolids
Table 8-3	Table 9-1

1.16 #/unit x 6 units/ac. = 7 # Residual Nitrogen/ac.

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_2O_5-K_2O	Nitrogen Residual (leg./ organic)	Days before Incorp	Organic Material Applied (1000 gal. or tons/ac)	Org. Nut. Applied N-P_2O_5-K_2O	N-P_2O_5-K_2O Need or (Surplus)	N-P_2O_5-K_2O (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.	X	0.20	=	_____
Organic N/ Ton	X	availability coefficient	=	lbs./ Ton residual Nitrogen

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

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

For 2 Tons litter applied per acre:

10.1 lbs. N/ Ton	X	2 Tons/ Acre	=	**20.2 lbs. N/ acre**

Questions ?