# A Simplified Approach to Calculating Available Nitrogen from Manure Sources

## **Purpose**:

Calculation of plant available nitrogen (N) from manure for livestock producers is an important step in a cropping system budget. However, there is some difficulty associated with sorting through the numerous tables of coefficients in order to calculate plant available N from manure. This complexity has resulted in many producers who may not be getting accurate manure N credit estimates for their manure applications. For some Ontario producers the tables in Publication 811 (Field Crop Agronomy Guide) can be used to calculate manure credits, for others the NMAN2 software is used to arrive at these available nutrient estimates for manure. The purpose of this project was to provide a simplified spreadsheet (Excel workbook) which would assist more producers in arriving at the most appropriate estimates of plant available nutrients in their manure applications.

## **Methods:**

The framework for calculation of plant available nutrients from manure is based on current assumptions and methods utilized by NMAN and official OMAFRA recommendations. The manure information input section of the calculator was designed to enable producers to provide answers to easily understandable questions regarding their manure analysis, application rate, application method, application timing and incorporation timing. Based on answers to these questions, the most appropriate information for plant available nutrient calculations is automatically selected by the Excel calculator and estimates of plant available nutrients are calculated.

Often, a manure analysis is not available which makes calculation of plant available nutrients impossible without making assumptions regarding the nutrient analysis of the manure. Whenever this occurs producers should use historic analysis if available provided that the manure analysis was obtained when the livestock enterprise was managed in a similar manner. Otherwise, the calculator can provide an estimate of nutrient analysis based on an OMAFRA database of average nutrient analysis for manure categorized by 1. livestock type (i.e. hogs, dairy cattle, beef cattle, broilers, ect) and 2. the dry matter content of the manure. The assumed average nutrient analysis for the various manure types are based on actual nutrient analyses of manure conducted by Ontario labs over the past 10 years. If there is uncertainty surrounding the dry matter content, then the most appropriate average manure analysis can be selected based on 1. type of livestock enterprise (i.e. hogs farrowing, hogs finishing, ect) and 2. type of manure storage (i.e. liquid covered, liquid open, ect). The selection of the most appropriate average manure analysis is based on dry matter estimates derived from the M-Store assumptions.

## Results:

The result of this project is the creation of the Ontario Manure Nutrients Calculator. It is a relatively simple one-page spreadsheet that can be obtained at the website www.gocorn.net. To demonstrate the operation of this calculator we will illustrate 2 examples of liquid hog application. For Scenario # 1 let's assume:

1. liquid hog manure with an analysis of 3.9% dm; 2000 ppm Ammonium (fresh weight basis); 30 lb-Total N /1000 gal; 10 lb-Total P/1000 gal; and 13 lb-Total K/1000 gal.

The manure is to be injected pre-plant in late April 2008 at 2500 us gal/ac on a field following corn with residue cover between 30-45%. The data entry and results from the Calculator are illustrated in Figure 1. The amount of plant available nutrients for the 2008 crop is 46 lb-N/ac, 8 lb-P2O5/ac and 27 lb-K2O/ac. If this same manure was injected in late November of 2007 plant available N is estimated to be 30 lb-N/ac.

**Figure 1. Display from the Ontario Manure Nutrients Calculator. Results from Scenario # 1 as described above.**

### Ontario Manure Nutrients Calculator

**Instructions:**
1. If you have a lab analysis then complete Section **1**, leaving Section **2** blank.
2. If you do not have a lab analysis then leave Section **1** blank and select from options in Section **2**. The ability to obtain estimates of nutrient availability without a lab analysis does not indicate that a lab analysis is not necessary. In fact, the best estimate of available nutrients from your manure will be obtained if you have submitted a representative sample to an accredited lab.
3. After completing either Section **1 or 2** then complete entry of Section **3**.

**Section 1: Enter Nutrient Analysis**

(No Manure Analysis, Skip to Section 2) (Click on cells to obtain other units or options)

| | |
|---|---|
| **Type of Manure** | Hog Liquid |
| **Dry Matter (%)** | 3.9 |
| **Ammonium (NH4)** | 2000.0 ppm fw |
| **Total Nitrogen (N)** | 30.0 lb (Total) / 1000 gal |
| **Phosphorous (P)** | 10.0 lb (Total) / 1000 gal |
| **Potassium (K)** | 13.0 lb (Total) / 1000 gal |

**Section 2: Select Manure Type without Nutrient Analysis**

(Select one of the two following options only if no manure analysis is available)

| | |
|---|---|
| **Type of Manure & Dry Matter Grouping** | |
| or | |
| **Type of Manure/Storage/Livestock Type** | |

**Section 3: Enter Manure Application Details**

| | |
|---|---|
| **Application Rate (fw)** | 2500 Gal (US)/ac |
| **Application Timing** | Preplant (not Fall Seeded) |
| **Year of Application** | 2008 |
| **Month of Application** | April |
| **Day of Application** | |
| or | |
| **Application Time within Month** | Late (21-31) |
| **Incorporation Timing** | Injected |
| **Residue Cover** | 30-45% |

**Applied Nutrient Summary**

| | |
|---|---|
| Analysis Source: | Not Assumed. Based on Lab Analysis |
| General Manure Type | Hog Liquid |
| Best Assumed Analysis | Hog Liquid (DM: 2-4%) |
| Ammonium Entry | Acceptable |
| NMAN Application Timing | Preplant |
| NMAN Residue Group | Over 30% |
| NMAN Incorporation Timing | Injected |

**NMAN N Calculation** Method 2

| Available Nutrient Applied * | kg/ha | lb/ac |
|---|---|---|
| **Nitrogen (N)** | | |
| 2008 Crop | 51 | 46 |
| 2009 Crop | 2 | 2 |
| 2010 Crop | 1 | 1 |
| 2011 Crop | 0 | 0 |
| **Phosphorous (P2O5)** | | |
| 2008 Crop | 9 | 8 |
| **Potassium (K2O)** | | |
| 2008 Crop | 27 | 24 |

* E Means Estimate based on Assumed Analysis

For scenario 2 lets assume that a manure analysis is not available and manure was from a finishing (feeder) hog operation with covered storage. If manure analysis is not available and dry matter of manure is unknown then an estimated analysis could be obtained by selecting "Liquid Swine Covered Storage: Feeders". A finishing hog

enterprise with covered storage is assumed to have an dm range of 6-8% which results in estimated plant available nutrients for the 2008 crop of 60 lb-N/ac, 31 lb-P2O5/ac and 50 lb-K2O/ac. See results in Figure 2.

**Figure 2. Display from the Ontario Manure Nutrients Calculator. Results from Scenario # 2 as described above.**

**Ontario Manure Nutrients Calculator**

**Instructions:**
1. If you have a lab analysis then complete Section **1,** leaving Section **2** blank.
2. If you do not have a lab analysis then leave Section **1** blank and select from options in Section **2**. The ability to obtain estimates of nutrient availability without a lab analysis does not indicate that a lab analysis is not necessary. In fact, the best estimate of available nutrients from your manure will be obtained if you have submitted a representative sample to an accredited lab.
3. After completing either Section **1 or 2** then complete entry of Section **3**.

**Section 1: Enter Nutrient Analysis**

(No Manure Analysis, Skip to Section 2) (Click on cells to obtain other units or options)

| | |
|---|---|
| Type of Manure | |
| Dry Matter (%) | |
| Ammonium (NH4) | |
| Total Nitrogen (N) | |
| Phosphorous (P) | |
| Potassium (K) | |

**Section 2: Select Manure Type without Nutrient Analysis**

(Select one of the two following options only if no manure analysis is available)

| | |
|---|---|
| Type of Manure & Dry Matter Grouping | |
| or | |
| Type of Manure/Storage/Livestock Type | Liquid Swine Covered Storage: Feeders |

**Section 3: Enter Manure Application Details**

| | |
|---|---|
| Application Rate (fw) | 2500 Gal (US)/ac |
| Application Timing | Preplant (not Fall Seeded) |
| Year of Application | 2008 |
| Month of Application | April |
| Day of Application | |
| or | |
| Application Time within Month | Late (21-31) |
| Incorporation Timing | Injected |
| Residue Cover | 30-45% |

**Applied Nutrient Summary**

| | |
|---|---|
| Analysis Source: | Hog Liquid (DM: 4-6%) |
| General Manure Type | hog liquid |
| Best Assumed Analysis | #N/A |
| Ammonium Entry | Not Entered |
| NMAN Application Timing | Preplant |
| NMAN Residue Group | Over 30% |
| NMAN Incorporation Timing | Injected |
| **NMAN N Calculation** | Method 1 |

| Available Nutrient Applied | * | kg/ha | lb/ac |
|---|---|---|---|
| **Nitrogen (N)** | | | |
| 2008 Crop | E | 67 | 60 |
| 2009 Crop | E | 4 | 4 |
| 2010 Crop | E | 2 | 2 |
| 2011 Crop | E | 1 | 1 |
| **Phosphorous (P2O5)** | | | |
| 2008 Crop | E | 34 | 31 |
| **Potassium (K2O)** | | | |
| 2008 Crop | E | 55 | 50 |

* E Means Estimate based on Assumed Analysis

## Summary:

This prototype Ontario Manure Nutrients Calculator provides an easy and quick method for producers to calculate estimates of plant available nutrients for the type and conditions under which they apply manure. It should be noted that while the estimates of available nutrients will be the same as those generated by OMAFRA tables or NMAN2 software there are many uses and functions that NMAN software provides that are not captured in this spreadsheet. To obtain more information or order the NMAN software please connect to the following website:
http://www.omafra.gov.on.ca/english/nm/nman/default.htm#Nman

## Acknowledgements:

Funding for this project was obtained from the Agricultural Environmental Stewardship Initiative (AESI Project #151) administered by the Agricultural Adaptation Council.

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