NRCS	**Michigan Technical Note** **USDA-Natural Resources Conservation Service**

AGRONOMY #20
Subject: Plant Available N Calculator
Date: March 2006

INSTRUCTIONS FOR USING THE NRCS MICHIGAN PLANT AVAILABLE NITROGEN EXCEL SPREADSHEET

The Michigan NRCS Plant Available Nitrogen (PAN) Calculator is an excel spreadsheet based on Michigan State University-Extension (MSUE) Bulletin MM-2, *Manure Management, Utilization of Animal Manure for Crop Production Part II. Manure Application to Cropland* and MSUE Bulletin MM-3, *Manure Management, Utilization of Animal Manure for Crop Production Part II. Worksheet to Calculate Manure Application Rates*. The PAN Calculator is used to estimate the plant available nitrogen from manures.

It is a worksheet in excel format that uses manure test data with an analysis for total N and Ammonia N. The manure test results along with the rate, timing, and method of manure application, incorporation, and manure history can estimate the Plant Available Nitrogen for one crop year. In the Conservation Planning Process, the PAN Calculator can help a producer evaluate alternative management methods for incorporating manure and estimate the nitrogen savings by changing incorporation timing or application methods. The dollar amount per pounds of Nitrogen saved per acre of manure incorporation is useful in partial budgeting to estimate the total N saving per year and the payback period for purchasing equipment that would help capture and prevent ammonia N volatilization loss.

INSTRUCTIONS FOR USE: User must select a Manure type and have the Total N and Ammonia N results from a Manure test.

Step 1: Obtain the Nitrogen results from a recent manure test. The manure test should include an estimate of nitrogen available as Total nitrogen (TN), and ammonium-N (NH4-N). This information is usually reported as lbs. of N per 1,000 gallons or per ton.

Go to *select a manure type*: Right click on the drop down arrow in the cell to choose a manure type that is represented by the manure test results. This sets the Nitrogen Mineralization factor (M Factor) from the M factor database. The Spreadsheet then uses the equation: (**Total N - NH4-N) = Organic N x the Mineralization Factor = Available Organic N, to estimate the Plant Available Nitrogen (PAN)**, per 1,000 gallons or per ton. For a more complete explanation of this calculation, see MSUE bulletin MM-2.

Step 2: In the yellow cell under Total N, enter the Total N number from the manure test results and in the yellow cell under NH4-N, enter the Ammonium-N number from the manure test results.

Once these values are entered, the spreadsheet calculates Plant Available Nitrogen for the manure type selected based on the manure test results entered for Total N and Ammonium-N. The amount of Plant Available Nitrogen is based on two other unknown variables: Method of application and days before incorporation. The spreadsheet calculates the PAN based on factors from MM-2, Table 3, estimating losses of NH4-N by volatilization of ammonia gas when surface applying manure followed by incorporation via tillage.

An estimate for each day to incorporation is represented under PAN as PAN lbs./1,000 gallons or lbs./ton solid. Estimated PAN is the same as injected manure (no volatilization loss).

Step 3: The manure rate of application and days before incorporation determine the PAN available in the year of manure application. In the yellow cell below manure rate applied in 1,000 gallon units or tons enter the manure rate of application. The red numbers to the right of this number under columns 1-5 represent the TOTAL PAN based on the days before incorporation. From the blue cells to the right of the TOTAL PAN, the appropriate number can be selected to estimate the PAN Credit for the current crop year.

LONG TERM RESIDUAL N CALCULATOR

This calculation should only be used to estimate additional N credit from long-term manure application when the manure form, rate, placement, and timing from prior years are known. If this information is not known based on accurate records, this credit should not be estimated as there is considerable risk of under-estimating or over-estimating PAN from additional organic N mineralization.

It is suggested that a Pre-Sidedress Nitrogen or Pre-Plant Nitrogen test (if available) in your area be used in lieu of the PAN Calculator.

If the rate of manure is known and the same form was applied in prior years, then proceed as instructed below:

Step 4: In the yellow cell right of 1 year ago, 2 years ago, and 3 years ago available organic N; enter the total rate of manure applied based on farm records where the manure was applied at a uniform rate of application. Enter a rate of application in 1,000 gallon units or tons opposite each prior year that manure was applied. If no manure was applied, enter a 0. Organic N released (mineralized) during the second, third, and fourth cropping year is estimated at 50%, 25%, and 12.5% of the amount released during the first year. The 3 year total is calculated based on the number of years of prior manure applications and rates entered in the yellow cells.

LONG TERM RESIDUAL N CREDIT IS BEST ESTIMATED IF THE MANURE RATE OF APPLICATION WAS UNIFORMLY APPLIED!

N CREDIT CALCULATION

Step 5: Nitrogen credit from previous legume crop: see Table 5 from MSUE Bulletin 2904 on M factor tab. Leave as 0 if no credit.

Step 6: Enter Plant Available N from PAN Credit for current year manure application from one of the five Total PAN Blue cells above appropriate to the current year form, rate, and timing of incorporation. The number of days before incorporation of the manure determines which number to use.

Step 7: (Optional) Long-term residual N Calculation from prior year(s) manure application. Enter a manure application rate for the number of years manure was previously applied. This credit is based on the rate of application of manure for each year. If that rate is unknown, then the best way to capture the residual N is with a Pre-Sidedress Nitrate Test (PSNT) to estimate Plant Available Nitrogen (PAN). If no manure was applied then enter 0.

Step 8: (Optional) Only applies if irrigation water is applied and N analysis of water is known. Irrigation water, especially from shallow aquifers, may contain some nitrogen in the form of nitrate nitrogen. If this N contaminated water is used as the irrigation source, this nitrogen is available for crop use. To calculate the amount of nitrogen applied with irrigation water:

Determine NO3-N concentration in water (PPM or mg/L), multiply by the irrigation water volume (in acre-inches)/yr, times 0.23.

- Example: 10 PPM N x 10 acre inches applied/yr x 0.23 = 23 lb/ac/yr.

OTHER: (Optional) Latest available atmospheric deposition records from NOAA indicate that 15 lbs of N credit is available yearly from rainfall removing nitrogen from auto emissions in the Midwest region. Credit is optional. Also, Starter fertilizer Nitrogen credit is entered here if nutrient N is applied as a Sidedress application before Nitrogen estimate from manure and other sources are estimated.

Step 9: Total Nitrogen Credit. Use this number for total N credit in the NRCS MI 590 nutrient budget job sheet or deduct the N credit from the N recommended for that crop to achieve the planned yield goal.