

## Manure Part III. How to determine how much to use.

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### How to calculate availability:

*Nitrogen* is the most important nutrient to figure out the availability for. You need to know the nutrient analysis for the manure being applied. For solid manure, the analysis needs to have moisture content, total N concentration, and inorganic N concentration. The results should be expressed as pounds of N per ton of manure. For liquid manures, such as swine and dairy, you need moisture content, or percent solids, total N concentration, and inorganic N concentration. The results for liquid forms of manure should be expressed as pound per 1000 gallons. The amount of organic N can be calculated by the difference between the total N and inorganic N.

With this knowledge, we can calculate the N availability from a manure application. There are two ways to do this in Minnesota. The first method can be found in the bulletin entitled "Manure Management in Minnesota" J.A. Hernandez and M.A. Schmitt Univ. Minn. Ext. Bull WW-03553 revised 2012. <http://www.extension.umn.edu/agriculture/manure-management-and-air-quality/manure-application/manure-management-in-minnesota/>

This method requires you to use a worksheet. See Appendix A at the end of this document.

Step 1. Determine the crop needs. Usually this information comes from a soil test and recommendations based on University of Minnesota guidelines.

Step 2 requires the knowledge of the total nutrient content in the manure.

Step 3, is to determine the available nutrients from manure. This information is taken from an availability factor that incorporates the type of manure and the application method used.

The final step is to calculate the rate of application needed from the amount of nutrient needed in step 1 and the availability of nutrient in step 3.

The second more universal method is adapted from the "Livestock Waste Facilities Handbook" from Midwest Planning Service.

Step 1. Determine the nutrient needs of the crop.

Step 2 Determine the total nutrient content of the manure. A chemical analysis of the actual product is strongly recommended.

Step 3. Determine the available nutrient content.  $\text{Available N} = (\text{Organic N} \times K_m) + \text{Ammonium-N}$ .  $\text{Organic N} = \text{Total N} - \text{Ammonium N}$  (lb/ton or lb/1000 gallons).  $K_m$  is the fraction of organic N released (this will depend on the type of manure). For dairy manure this value should

be in the range of 50 %. Ammonium-N = Ammonium in lb/ton or lb/1000 gallon from manure analysis. If the manure is not incorporated within 12 hours after application, the ammonium-N value will need to be reduced to account for volatilization losses. Use the full value for organic-N.

Step 4 Calculate the rates of application needed to supply the recommended amount of N ie. Divide the recommended nutrient needs from Step 1 by the amount of available nutrient in Step 3.

Both of these methods are similar but handle the availability of N a little differently. Method one combines the organic and inorganic contributions while method two separates them. The results are normally similar. Method 2 is used by the University of Wisconsin Extension. Both methods handle P and K the same.

*Other nutrients:* Phosphorus in manure is normally 80 to 90 % available to the plant after application. Potassium is 90 % available. Most micronutrients are very available.

## Appendix A.

Worksheet for determining rate of application form “Manure Management in Minnesota”

<b>Worksheet 1: Rate of Application Worksheet</b>			
	<b>N (lb./A)</b>	<b>P<sub>2</sub>O<sub>5</sub> (lb./A)</b>	<b>K<sub>2</sub>O (lb./A)</b>
<b>Step 1. Nutrient needs of the crop.</b> <i>Use soil tests and recommendations based on University of Minnesota guidelines</i>			
<b>Step 2. Determine total nutrient content of the manure</b> (lb./ton or lb./1,000 gal.)			
<b>Step 3. Determine available nutrients from manure</b> (lb./ton or lb./1,000 gal.) <i>Multiply the values from Step 2 by the availability factors from Table 2 and from the text</i>	See Table 2	80%	90%
<b>Step 4. Calculate the rates of application needed for each nutrient</b> <i>Divide the values from Step 1, amount of nutrient needed, by values from Step 3, the available nutrients per ton or thousand gallons</i>			
<b>Selected Rate: _____ ton/A or gal./A</b>			
<i>Determine amount of available nutrients being applied by multiplying the selected rate of application times the available nutrients, Step 3. This can be compared to crop needs, Step 1, to show where deficits and excesses occur</i>			
<i>The amount of deficit is the amount of supplemental fertilizer that the crop will need.</i>			