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INTERPRETING MANURE SAMPLE TEST RESULTS

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Applying the appropriate amount of manure requires correct interpretation of the manure test results. Moisture and nutrient levels on the test results need to match the crop's nutrient needs. Under-application of manure will not meet the crop's needs and over-application may allow excess nutrients to escape into ground or surface water resources. This fact sheet focuses on interpreting test results from manure samples.

Manure Test Results

Basic test results for manure samples include moisture, total nitrogen (N), ammonium N, organic N, phosphorus as P_2O_5 and potassium as K_2O . Micronutrients and additional information can also be requested for analysis. For liquid manure, nutrients are often reported in pounds per 1,000 gallon of manure. Solid manure nutrients are reported in pounds per ton of manure. If the manure is not reported in a useable unit, the lab can often convert the report to the desired reporting unit. The exception is moisture, which is only able to be reported as a percentage.

Keeping Nitrogen Available

Nitrogen is divided into two parts: organic and ammonium. Each reacts differently in the soil once the manure is applied. When manure is applied in September through June, only one-third of the organic nitrogen, expressed as organic N, is available. The remaining amount of organic N must be broken down before becoming available, which usually occurs over a three-year period.

Ammonium nitrogen, expressed as NH_4 , is stable in the soil. However, through a process called nitrification, soil microbes convert ammonium to nitrate which is readily available to the plant but can be lost easily to the environment through volatilization.

Therefore, manure applied and left on the soil surface during hot, sunny conditions may lose ammonium, and consequently nitrate N, into the atmosphere. Because of this, nitrogen availability depends heavily on when the manure is applied and how quickly it is incorporated into the soil.

Soil cover created by incorporation provides protection from the sun and runoff loss from rain. Depending on conditions associated with seasonal weather, incorporation timing may be slightly extended before significant nitrogen losses occur. Table 1 provides estimations of nitrogen availability based on timing and incorporation. Applying manure as close to planting or directly to a growing crop will increase the amount of nitrogen utilized by the crop.

Table 1. Estimated Nitrogen Availability of Manure Based on Time and Application Method.

Available Nitrogen Percent		Time of Application	Days Until Incorporated
Ammonium (NH ₄)	Organic N	Date	Days
50%	33%	Nov-Feb	Less than 5
25%	33%	Nov-Feb	More than 5
50%	33%	Mar-April	Less than 3
25%	33%	Mar-April	More than 3
75%	33%	April-June	Less than 1
25%	33%	April-June	More than 1
75%*	15%	July-Aug	Less than 1
25%	15%	July-Aug	More than 1
25%	33%	Sept-Oct	Less than 1
15%	33%	Sept-Oct	More than 1

Notes:

- The calculations are for all animal manures. It is assumed that 50 percent of the organic N in poultry manure is converted to NH₄ rapidly and is therefore included in the NH₄ column for calculating available N.
- Incorporation is the mixing of manure and soil in the tillage layer. Disking is usually enough tillage for conserving nitrogen availability.
- *The 75 percent available nitrogen (NH₄) is based on the nitrogen being used in the year it is applied. If the nitrogen is carried over to the following year, then 25 percent available nitrogen estimates should be used.

Source: Adapted from Ohio State University Extension Bulletin 604, 2006 Edition.

Phosphorus and potassium (also referred to as potash) are reported on test results as P₂O₅ and K₂O, respectively. The manure sample test reports these nutrients identical to analysis of commercial inorganic fertilizer. Crop nutrient needs can be determined from the *Tri-State Fertilizer Recommendations*, available electronically at the Ohio State University Ag Crops Team website.

Example of Interpreting Manure Sample Test Results for Crop Needs

Below is an example illustrating how to interpret a manure sample test. Having the most recent soil test results is necessary to use along with the manure sample test to accurately determine the crop's needs. The soil test will contain the current levels of nitrogen, phosphorus and potassium and other nutrients in the field. Additionally, the soil's cation exchange capacity (CEC) will be listed, which is the ability of the soil to hold and release certain nutrients.

Example: A manure application is being planned for April and will be incorporated in less than one day. The planned crop is corn with a yield goal of 180 bushels per acre and the field has a phosphorus soil test level of 20 pounds per acre or 10 ppm, and a potassium soil test level of 50 pounds per acre or 25 ppm with a CEC of 20 milliequivalents per 100 grams. A manure sample test was completed and the results are shown below:

Manure Sample Test Results (for example exercise)

Analysis	Percent	Nutrients (lbs/1000 gal)
Moisture	98.61	
Nitrogen, Total	.18	15.7
Nitrogen, Ammonium	.12	10.4
Nitrogen, Organic	.06	5.2
Phosphorus (P ₂ O ₅), Total	.11	9.6
Potassium (K ₂ O)	.15	13.0

First, calculate the amount of ammonium and organic N contained in each 1,000 gallons of manure based on the percentage listed in Table 1 (based on April application with less than one day incorporation):

Ammonium: 10.4 lbs. x 75% = 7.8 lbs.

Organic N: 5.2 lbs. x 33% = 1.7 lbs.

Add ammonium and organic N together for total N:

7.8 lbs. (ammonium) + 1.7 lbs. (organic N) = 9.5 lbs. total N (per 1,000 gallons of manure)

Because phosphorus is the limiting nutrient, we will determine the amount of manure to apply based on the phosphorus recommendation. According to the test results, the manure contains 9.6 pounds of phosphorus (P₂O₅) for each 1,000 gallons. The amount of phosphorus recommended by the *Tri-State Fertilizer Recommendations* for corn with a yield goal of 180 bushels per acre is 90 pounds per acre.

Divide the recommended amount of phosphorus (P₂O₅) per acre by the amount of phosphorus (P₂O₅) per 1,000 gallons of manure to determine the application rate:

$$\frac{90 \text{ lbs}}{\text{acre}} \div \frac{9.6 \text{ lbs}}{1,000 \text{ gal}} = \frac{90 \text{ lbs}}{\text{acre}} \times \frac{1,000 \text{ gal}}{9.6 \text{ lbs}} = 9,375 \frac{\text{gal}}{\text{acre}}$$

Rate = 9,375 gallons/acre (rounded up to 9,400 gallons/acre)

For practical application purposes, we round up the amount applied per acre to 9,400 gallons/acre. Next, we will determine how much total N will be applied with this application rate. We calculated the manure contains 9.5 pounds of total N per 1,000 gallons of manure. Multiply the amount of total N in the manure by the application rate to determine the amount of total N that will be applied:

$$\frac{9.5 \text{ lbs}}{1,000 \text{ gal}} \times \frac{9,400 \text{ gal}}{\text{acre}} = 89.3 \frac{\text{lbs}}{\text{acre}}$$

Total N = 89.3 lbs/acre

The *Tri-State Fertilizer Recommendation* for nitrogen for corn following soybeans with a yield goal of 180 bushels per acre is 190 pounds per acre. Supplemental nitrogen will need to be applied. The same formula

can be used to determine potassium levels applied. According to the manure test there is 13 pounds per 1000 gallon of K₂O in this manure. Multiply the K₂O in the manure by the application rate to determine the amount of K₂O that will be applied:

$$\frac{13 \text{ lbs}}{1,000 \text{ gal}} \times \frac{9,400 \text{ gal}}{\text{acre}} = 122.2 \frac{\text{lbs}}{\text{acre}}$$

Total K₂O = 122.2 lbs/acre

The *Tri-State Fertilizer Recommendation* for potassium for corn with a yield goal of 180 bushels per acre, 25 ppm and a 20 CEC is 220 pounds per acre. Supplemental potassium will need to be applied.

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