TECHNICAL NOTES

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WASTE MANAGEMENT TECHNICAL NOTE NO. 2

SAMPLING POULTRY MANURE AND INTERPRETING LABORATORY ANALYSIS

TEST POULTRY MANURE

One of the first steps in using poultry manure as fertilizer is to determine its nutrient content. This is done by laboratory analysis. Laboratory results are only as good as the sample collected.

SAMPLE PROPERLY

The sample must represent the entire supply of manure that will be spread. Subsamples should be collected from 10 to 12 locations throughout the house to the depth the litter or manure will be removed. Subsamples taken near waterers and feeders should be proportionate to the space these areas occupy in the house. When testing stockpiled litter, subsamples should be taken from at least six locations around the pile at depths of 18 to 24 inches.

After subsamples have been collected from a given source of poultry manure, a composite sample is removed from the thoroughly mixed material and prepared for mailing to a qualified laboratory. Approximately one pint of manure is needed for analysis.

An excellent publication on manure and soil sampling is available on the LSU Agricultural Center's website at www.lsuagcenter.com

INTERPRETING LABORATORY ANALYSIS

Laboratory results are usually reported in milligrams per kilogram (mg/kg) or milligrams per liter (mg/l), both of which are equal to parts per million (ppm). To convert ppm to percent, move the decimal point to the left four places. For example, if a laboratory report for a manure sample indicates 38,786 ppm of total nitrogen (TN) on a dry-weight basis, the material would contain 3.8786 or 3.9 percent nitrogen. One ton of the same material would contain 78 pounds of nitrogen as follows:

$$2{,}000 \text{ X } 0.039 = 78$$

To convert pounds of nitrogen to a wet-ton basis, multiply 78 pounds per dry ton by the percent dry matter in the undried sample. For example, if the sample is reported to have contained 25 percent moisture, the dry matter content would equal 59 pounds of nitrogen for one ton of material containing 25 percent moisture.

$$78 \text{ X } 0.75 = 59$$

Nitrogen is commonly reported as total N and as ammonium nitrogen (NH_4 –N). The difference between the two is the organic portion, which is approximately 75 percent of the total.

Phosphorus and potassium are sometimes reported in the elemental form. To convert pounds P to P_2O_5, multiply P by 2.29. To convert pounds K to K_20, multiply K by 1.2. Analyses from the Agricultural Chemistry Lab at LSU are reported in the fertilizer form.

USING NUTRIENT TABLES

Instead of a laboratory test, the producer may approximate the nutrient content of poultry manure by using Table 1 or similar tables. The nutrient content of poultry manure varies with the type of bird, the feed ration, the proportion of litter to droppings, the manure handling system used, and the type of litter. The values listed in Table 1 provide general guidelines for estimating the nutrient composition and value of the nutrients inherent in the waste. There can be a wide range in nutrient content.

NUTRIENT AVAILABILITY

The nutrients in poultry manure will not be 100 percent available for crop use. While 80 percent of the phosphorus and potassium is estimated to be available for use the first year, the availability of nitrogen present will be much less. Two important aspects must be considered.

First, about 75 percent of the total nitrogen present in poultry manure is in the organic form and is slowly released to crops.

Secondly, much of the remaining nitrogen is in the ammonium (NH_4) form which can readily transform into ammonia (NH_3) and evaporate if not mixed with the soil. Only about 50 percent of the organic fraction will become available during the first year of application, while one-half to nearly all of the ammonium form will be available depending upon how the material is handled and spread. (See Estimating Application Losses)

Using the above criteria, one ton of broiler litter with the analysis indicated in Table 1 would supply 34 pounds of available nitrogen, 51 pounds of available P_2O_5 (64 X 0.80 = 51) and 33 pounds of available K_2O (41 X 0.80 =33) the first year of application.

If a material with a similar analysis is applied to the same field continuously, about 42 pounds of nitrogen per ton would be available on a continuing basis (Table 2). Phosphate and potash would continue to be added at rates of 51 and 33 pounds per ton respectively. Soil phosphorus and potassium levels should be checked regularly by soil testing.

Table 1. Nutrient Content and Value of Poultry Manure [1/]

		Nitrogen				Phosphate	Potash
Manure Type	Moisture %	Total lbs/$	Ammonium lbs/$	Organic[3/] lbs/$	Available lbs/$	P_2O_5 lbs/$	K_2O lbs/$
Broilers/Pullets [2/]	25	59/24.19	15/6.15	45/18.45	34/13.94	51/16.83	33/8.58
Breeders [2/]	28	42/17.22	24/9.84	18/7.38	27/11.07	40/13.20	18/4.68

1/ Averages based on data from several sources.
2/ Based on annual accumulations.
3/ Organic N = total N – ammonium N.
4/ Available N = 50% of organic and 75% of ammonium.

Table 2. Pounds of Nitrogen Available from Broiler Litter in Year of Application and in Subsequent Years.

	Pounds of Available N/Ton Year After First Application				
Annual Applications	1	2	3	4	5
1st	34*	6**	2**	0	0
2nd		34	6	2	0
3rd			34	6	2
4th				34	6
5th					34
Total	34	40	42	42	42

* Value from Table 1

** Pounds of N available the 2nd and 3rd years following applications are 13 percent and 5 percent respectively of the original N content of the manure.

ESTIMATING APPLICATION AND OTHER LOSSES

Ammonium nitrogen (NH_4 –N) can readily transform to ammonia (NH_3) and evaporate if not incorporated into the soil. Use the following factors to calculate the amount of ammonium nitrogen loss during handling and application.

FACTOR	METHOD OF APPLICATION
0.75	Broadcast with no incorporation or incorporated after 7 days.
0.80	Incorporated within 7 days.
0.90	Incorporated within 4 days.
0.95	Incorporated within 2 days.

Additional nitrogen can be lost due to leaching and denitrification. Estimates of leaching and denitrification losses can be found in Tables 11-7 (leaching) and 11-8 (dentrification) in Chapter 11 of the Agricultural Waste Management Field Handbook (AWMFH).

APPLICATION RATES

Nitrogen or phosphorus based applications of manure and other organic sources of nutrients are based on a risk assessment for off site movement of phosphorus using the Phosphorus Index (PI). Nitrogen based application is allowable under low to medium risk. Phosphorus based application is recommended at high risk. No manure application is advised when risk is very high.

It should be noted that sustained application of manure at nitrogen rates would rapidly increase soil test phosphorus levels, which may ultimately raise risk assessment leading to a significant reduction in the amount of manure which can be safely applied at a particular location.

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REFERENCES

1. Goan, H. Charles, and John Jarred. 1990. Poultry Manure: Proper Handling and Application to Protect Our Water Resources. The University of Tennessee Agricultural Extension Service PB-1421.
2. Payne, Victor W.E. and James O. Donald. 1990. Poultry Waste Management and Environmental Protection Manual. Alabama Cooperative Extension Service Circular ANR-580.