



Livestock Waste Sampling and Testing

Monroe Rasnake, Agronomy; Doug Overhults, Agricultural Engineering; Vern Case, Regulatory Services

It is estimated that about 25 million tons of animal manure are currently produced on Kentucky farms each year. Most of this is deposited by grazing animals on pastures where the nutrients are recycled. However, an increasing percentage is accumulated in feed lots, barns, poultry houses, lagoons, and other facilities until it can be spread on the land.

Nutrient Value

The nutrient content of manure depends on the animal, the ration, how it is handled and stored,

moisture content, and other factors. Data from several studies show there is much variability within and between sources of animal manure. The data in Table 1 illustrate average values for different sources of poultry and dairy manure.

Data from USDA Publication No. URR6. 1979 also show average nutrient contents of fresh manure from other types of animals (calculated as lb N - P₂O₅ - K₂O per ton) as follows: beef (9.1 - 14.2 - 8.4), swine (13.4 - 16.3 - 6.6), sheep (21.9 - 26.8 - 21.8), and turkeys (29.7 - 43.1 - 13.9). Obviously, animal type and source of the manure influence nutrient content. The variability of nutrient content of manures within the same animal type is shown in Table 2. These data illustrate the need for accurate sampling and analysis to determine the nutrient content of each type of manure. Other data in the literature often show differences of two to six times or more for the same nutrient in different samples of the same animal type manure.

Table 1. Average Nutrient Content of Samples as Received in Lab*

Type Manure	Source of Data	Number Samples	Water %	N -----	P ₂ O ₅ lb/ton	K ₂ O
POULTRY						
Broiler	Kentucky	47	20.5	48.2	66.8	47.0
Broiler	Alabama	147	19.7	62.6	59.4	40.2
Broiler	USDA	—	—	29.8	44.0	13.7
Layer	Kentucky	15	38.0	36.8	80.2	39.6
Pullet	Kentucky	9	27.8	29.4	45.0	28.0
DAIRY						
Stack pad	Kentucky	14	79.0	9.0	8.2	10.0
Fresh	USDA	—	—	8.2	7.3	9.4
Liquid**	Kentucky	13	—	2.8	1.6	1.8

*Kentucky samples were analyzed by UK Regulatory Services Lab. Alabama data are calculated from AGR-146, Table 1. Fresh data from "Animal Waste Utilization on Cropland and Pastureland," USDA No. URR6. 1979.

**The nutrient content of the Dairy Liquid converts to 158 lb N, 90 lb P₂O₅, and 102 lb K₂O per acre half inch of irrigation (13,577 gallons).

Table 2. Variability of Selected Animal Manure as Received and Analyzed by UK Regulatory Services

Type Manure	Number Samples	Approximate Range in Content			
		Water %	N -----	P ₂ O ₅ -----	K ₂ O -----
Broiler	47	<10* - 60	19 - 73	13 - 90	18 - 73
Dairy, solid	14	72 - 85	6 - 13	5 - 10	5 - 20
Dairy, liquid	13	—	0.2 - 7.6	0.2 - 5.4	0.2 - 3.4

*Moisture content was not measured on very dry samples.

When to Sample

To allow time for the analyses to be completed and a decision made on application rates, livestock waste should be sampled about a month before it is to be applied. There are some disadvantages with early sampling. The nutrient content of the manure may change during storage as additional accumulation takes place, such as in beef feeding floors, broiler houses, or stack pads. In the case of lagoons, it is very difficult to take a good sample except when it is being pumped out.

Samples can be taken just before or while spreading the manure. The disadvantage is in not having the analysis to use in determining rates of application. However, nutrient estimates can be used to determine an application rate that is not likely to provide excessive amounts of nutrients. Successive sampling of the same type of manure on one's farm each year can improve these estimates. Additional nutrients can be applied later if the test results show they are needed.

How to Sample

A good sample is one that represents the particular batch of animal waste being tested. This may be one poultry house, a stack of solid manure, a storage tank, or a lagoon. Effective sampling methods will be different for each one.

Solid Wastes:

Poultry (floor grown) — Take 10 to 12 subsamples of about one pint each from different areas of the house to the full depth of accumulation. Take samples under waterers and feeders in proportion to the area they occupy.

Poultry (caged layers) — Take 10 to 12 subsamples of about one pint each from random areas under the cages to the full depth of accumulation.

Stacked manures — Take 10 to 12 subsamples of about one pint each from random areas over the entire stack. Sampling should extend as deep as possible into the stack. Do not limit your testing just to samples from the surface.

Livestock feeding areas (covered or uncovered) — Take 10 to 12 subsamples of about one pint each from random locations over the whole area. Sampling should extend to the full depth of manure accumulation.

Liquid Wastes:

Holding tanks — These need to be agitated, or stirred, to thoroughly mix the solids with the liquid to get a good sample. The sample can be taken by dipping from the tank or collecting wastes as they are pumped out. *Be careful* to avoid exposure to *toxic gases* while sampling holding tanks. Take special precautions with covered tanks or areas where ventilation is limited.

Holding ponds or lagoons — It is difficult to take representative samples from ponds or lagoons until they have been agitated and thoroughly mixed. Good samples can be taken if special sampling devices are available. These allow subsamples to be taken from different depths and various locations to collect a sample that is representative of the whole pond.

Handling Samples

Solids:

Place subsamples in a clean plastic bucket and mix thoroughly. Take a one-pint sample and put it in a clean, one-quart, self-sealing plastic bag. *Do not* fill the bag. Compress the air from the bag, seal it, and tape over the seal. Using a permanent ink marker,

label the outside of the bag with the owner's name, sample identification number, type of manure, and county.

Liquids:

Place subsamples in a clean plastic bucket and mix thoroughly. Fill a clean, wide-mouth plastic bottle one-half full of the mixture. Tighten the lid and check to see that it does not leak. Using a permanent ink marker, label the bottle with the owner's name, sample identification number, type of waste, and county. Plastic bottles can be obtained from the laboratory in Regulatory Services for shipping test samples to the University of Kentucky. *Do not use glass containers for any livestock waste samples.*

Where to Send Samples

Manure samples for analysis can be sent to commercial laboratories or to the University of Kentucky, Regulatory Services Soil Lab through your county extension office.

Send samples by UPS or mail them early in the week (Monday through Wednesday) to avoid weekends. Also, avoid holidays, which could delay delivery. The accuracy of the test depends on taking a good sample and getting it to the laboratory quickly. Include an information sheet that lists the sample identification number shown on the sample bag or bottle and the owner's address and phone number.

Values are reported for moisture, nitrogen (N), phosphorus (P), potassium (K), and micronutrients. Reports are sent electronically to the County Extension Office from which the manure sample is received. The P and K will be reported as P_2O_5 and K_2O , which is the common terminology for fertilizer materials. Extension agriculture agents can advise farmers on taking samples and interpreting results.

Related Publications

AGR-146	Using Poultry Litter on Agricultural Land
AGR-146A	Calculating Rates of Poultry Litter for Crop Production
ASC-80	Fertilizer Value of Swine Manure
ID-19	Farm Manure: Production-Value-Use
AGR-165	The Agronomics of Manure Use for Crop Production