Manure Sampling

Proper sampling is the key to reliable manure analysis. Although lab procedures are accurate, they have little value if the sample fails to represent the manure product.

Manure samples submitted to a lab should represent the average composition of the material that will be applied to the field. Reliable samples typically consist of material collected from a number of locations. Precise sampling methods vary according to the type of manure. The lab, county extension agent, or crop consultant should have specific instructions on sampling, including proper containers to use and maximum holding or shipping times. General sampling recommendations follow.

Manure samples submitted to a lab should represent the average composition of the material that will be applied to the field.

Liquid manure

Liquid manure samples submitted for analysis should meet the following requirements:

- Place sample in a sealed, clean plastic container with about a 1-pint volume. Glass is not suitable because it is breakable and may contain contaminants.
- Leave at least 1 inch of air space in the plastic container to allow for expansion caused by the release of gas from the manure material.
- Refrigerate or freeze samples that cannot be shipped on the day they are collected, minimizing chemical reactions and pressure buildup from gases.

Ideally, liquid manure should be sampled after it is thoroughly mixed. Because this is sometimes impractical, samples can also be taken in accordance with the suggestions that follow.

Lagoon effluent. Premixing the surface liquid in the lagoon is not needed, provided it is the only component that is being pumped. Growers with multistage systems should draw samples from the lagoon they intend to pump for crop irrigation.

Samples should be collected using a clean, plastic container similar to the one shown in Figure 35-1. One pint of material should be taken from at least eight sites around the lagoon and then mixed in the larger clean, plastic container. Effluent should be collected at least 6 feet from the lagoon's edge at a depth of about a foot. Shallower samples from anaerobic lagoons may be less representative than deep samples because oxygen transfer near the surface sometimes alters the chemistry of the solution. Floating debris and scum should be avoided.

Samples should be collected using a clean, plastic container.

One pint of mixed material should be sent to the lab. Galvanized containers should never be used for collection, mixing, or storage due to the risk of contamination from metals like zinc in the container.

These recommendations are adequate for average irrigation volumes. If an entire storage structure is to be emptied by such means as furrow irrigation, more frequent sampling with many more sampling points is recommended.

Liquid slurry. Manure materials applied as a slurry from a pit or storage pond should be mixed prior to sampling. If you agitate your pit or basin prior to sampling, a sampling device pictured in Figure 35-1 can be used. If you wish to sample a storage structure without agitation, you must use a composite sampling device as shown in Figure 35-2. Manure should be collected from approximately eight areas around the pit or pond and mixed thoroughly in a

clean, plastic container. An 8- to 10-foot section of 0.5- to 0.75-inch plastic pipe can also be used: extend the pipe into the pit with ball plug open, pull up the ball plug (or press your thumb over the end to form an air lock), and remove the pipe from the manure, releasing the air lock to deposit the manure in the plastic container.

Lagoon sludge. Lagoon sludge is somewhat more difficult to obtain a representative sample. Two common methods are used. One method requires lagoon pumpdown to the sludge layers. Then, during sludge agitation, a

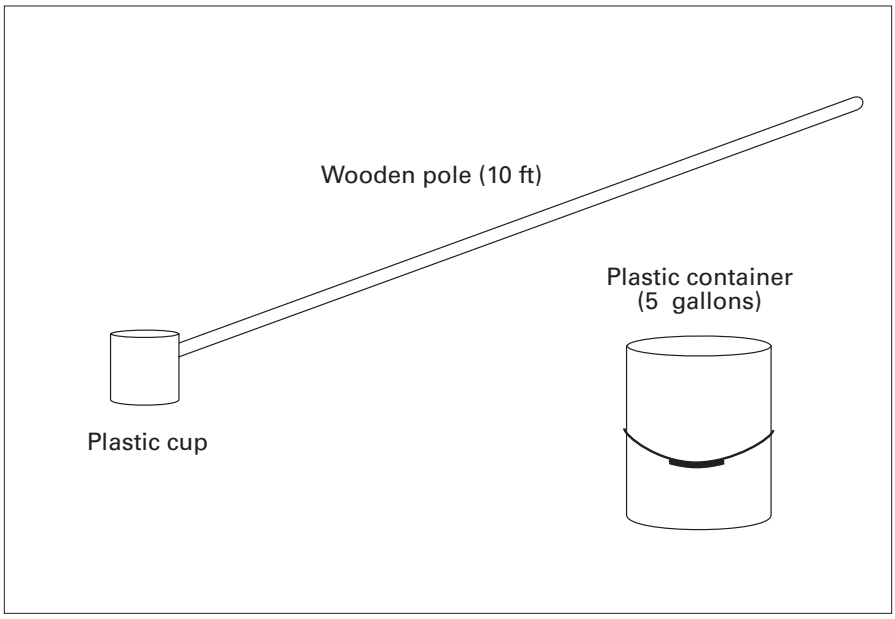

Figure 35-1. Liquid manure sampling device.

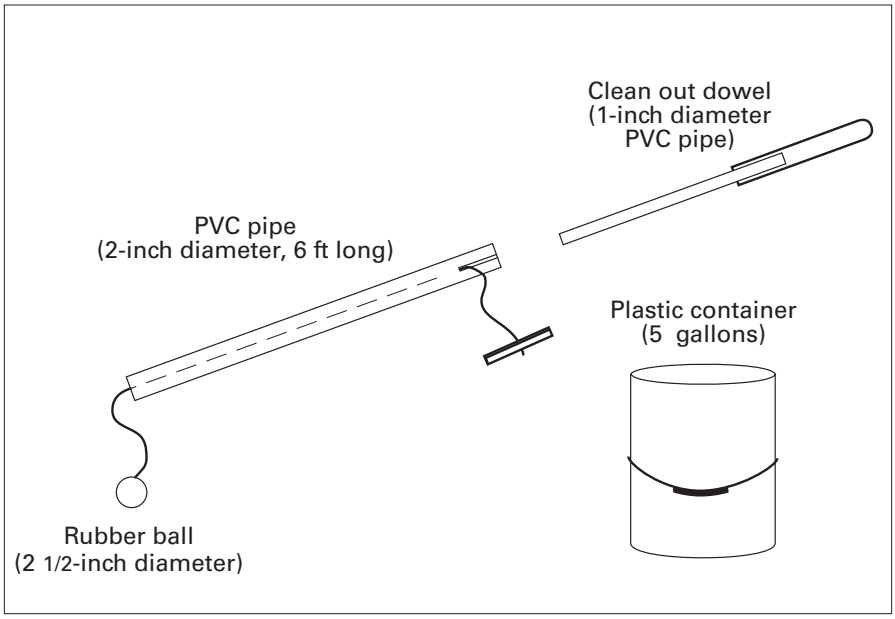

Figure 35-2. Composite sampling device.

liquid or slurry type of sample described above may be collected. The other method requires insertion of a probe to the bottom of the lagoon to obtain a column of material. A “sludge-judge” is a device commonly used for this type of sampling. The sludge component of this column is then released into a clean plastic bucket, and several (12-20) other sampling points around the lagoon are likewise collected to obtain a composite, representative sample. This procedure must be performed with a boat or mobile floating dock.

For analysis, most labs require at least 1 pint of material in a plastic container. The sample should not be rinsed into the container because doing so dilutes the mixture and distorts nutrient evaluations. However, if water is typically added to the manure prior to land application, a proportionate quantity of water should be added to the sample.

Solid Manure

Solid manure samples should represent the manure’s average moisture content. A 1-quart sample is adequate for analysis. Samples should be taken from approximately eight different areas in the manure pile, placed in a clean plastic container, and thoroughly mixed. Approximately 1 quart of the mixed sample should be placed in a plastic bag, sealed, and shipped directly to the lab. Samples stored for more than two days should be refrigerated. Figure 35-3 shows a device for sampling solid manure.

Solid manure samples should represent the manure’s average moisture content.

Sampling within dry litter houses. Litter can be sampled in production houses prior to litter cleanouts, but care must be taken to collect a uniform sample. With a clean plastic bucket, collect 10 to 15 small samples from each house. Place the samples into the plastic bucket. Samples should be taken at the depth of cleanout, being careful not to dig into the dirt floor. Cake litter samples should be taken at the depth of cake removal. Litter samples from brooder breeder slat houses should be taken after the slat manure and litter is mixed during the cleanout process. Thoroughly mix the samples in the bucket, and place approximately 1 quart of material in a plastic freezer bag or wide mouth plastic bottle. Lastly, seal and mark the litter sample with the farm name and an identification number and/or code.

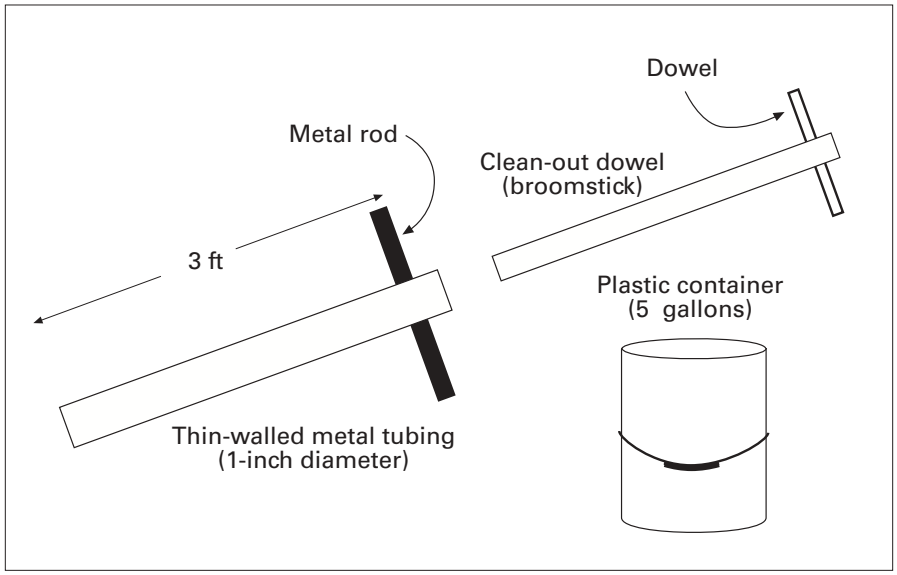

Figure 35-3. Solid manure sampling device.

Poultry below-house manure sampling. In a high-rise system, manure is deposited below the poultry house. If the system is properly managed, the manure should be fairly uniform in moisture and appearance.

Approximately eight samples should be collected throughout the storage area. If manure in certain areas differs in appearance, take samples proportionate to the size and number of these areas. For example, if 10% of the manure differs from the bulk pile, then 10% of the total sample should be taken from this area. The collected material should be combined in a plastic container and mixed thoroughly. The 1-quart lab sample should be taken from this mixture, placed in a plastic bag, sealed, and shipped to the lab for analysis. If the sample cannot be shipped within one day of sampling, it should be refrigerated.

Stockpiled manure or litter. Ideally, stockpiled manure and litter should be stored under cover on an impervious surface. The weathered exterior of uncovered waste may not accurately represent the majority of the material. Rainfall generally moves water-soluble nutrients down into the pile. If an unprotected stockpile is used over an extended period, it should be sampled before each application.

Stockpiled manure should be sampled at a depth of at least 18 inches at six or more locations. The collected material should be combined in a plastic container and mixed thoroughly. The one-quart lab sample should be taken from this mixture, placed in a plastic bag, sealed, and shipped to the lab for analysis. If the sample cannot be shipped within one day of sampling, it should be refrigerated.

Surface-scraped manure. Surface-scraped and piled materials should be treated like stockpiled manure. Follow the same procedures for taking samples. Ideally, surface-scraped materials should be protected from the weather unless they are used immediately.

Composted manure. Ideally, composted manure should be stored under cover on an impervious surface. Although nutrients are somewhat stabilized in these materials, some nutrients can leach out during rains. When compost is left unprotected, samples should be submitted to the lab each time the material is applied. Sampling procedures are the same as those described for stockpiled waste.

Who can analyze my manure sample?

Both public and private labs analyze manure samples. Public labs are found either in conjunction with the land-grant university in the state or with a state agricultural or environmental agency. Private labs can be found through local Cooperative Extension Service (CES) agents, the land-grant university, state regulators, or other producers.

Deciding which lab to use depends on several factors:

- Cost to run the sample
- Response time to supply you with the results
- If the lab offers all parameters needed for your operation
- If you can get your sample to the lab in the required time

When you have selected a lab to analyze the manure, you need to follow their specific sample requirements. Many labs offer sample containers that they ask you to use. Sample collection procedures, including holding times allowed and refrigeration and shipping requirements, must be closely followed to obtain accurate results. One standard that applies to all labs and

sampling recommendations is to sample as close to the application time as possible.

Essential analyses include concentrations of essential plant nutrients, including N as ammonium (NH_4-N), nitrate (NO_3-N), and organic N; phosphorus (P); potassium (K); calcium (Ca); magnesium (Mg); sulfur (S); iron (Fe); manganese (Mn); zinc (Zn); copper (Cu); boron (B); dry matter content; pH; and electrical conductivity (for liquid samples). Check your permit or state rules for your specific sampling requirements.

Sample collection procedures, including holding times allowed and refrigeration and shipping requirements, must be closed followed to obtain accurate results.

What does my manure analysis report tell me?

Lab results may be presented in a number of ways. The easiest to use is a wet, "as-is" basis in pounds of available nutrient (N, P, or K) (1) per ton; (2) per 1,000 gallons of manure or wastewater; or (3) per acre-inch of manure or wastewater. If a lab reports results on a dry basis, you must have the moisture content of the manure to convert the results back to a wet basis. A lab may also give results as a concentration (parts per million [ppm] or milligram per liter [mg/l]), which likewise requires conversion factors to get the results into a usable form based on how you apply the manure. Finally, if a lab reports P and K as elemental P and K, you must convert them to the fertilizer basis of P_2O_5 or K_2O. This can be done with the following conversions:

$$P \times 2.29 = P_2O_5$$

$$K \times 1.20 = K_2O$$

Select a lab that reports an analysis on an "as-is" basis in the units of measure most useful to your operation. An example waste analysis is shown in Figure 35-4.

Select a lab that reports an analysis on an "as-is" basis in the units of measure most useful to your operation.

The most useful information is predicted nutrients available for the first crop. Nutrient availability is predicted based on estimates of manure breakdown and nutrient loss according to application method. If the lab does not report plant-available nutrients, use the calculations found in Lesson 30, Soil Utilization of Manure, to calculate plant-available nutrients from the lab data. Of the total nutrients predicted to be released for the first crop, 50% to 75% likely will become available during the first month. It is, therefore, important to apply manure near the time required by plants. The remaining nutrients gradually become available over the next three months. Nutrients not available for the first crop are slowly released to available forms over time. In soils that do not readily leach with heavy rainfall, nutrients may accumulate to significant quantities over time.

You should review the report to see if the analysis is within the expected ranges for your manure. It is common for manure analyses to vary between seasons, due to excess rainfall, drought, or changes in management practices. However, you should compare your results to the results from previous manure reports to ensure that they appear reasonable. If your results are significantly different from what you expected, it is advisable to resample the manure. The original sample may have been mislabeled or improperly collected, and thus not representative of the manure.

To meet a specific plant nutrient requirement, nutrients listed in the report or calculated as "available for the first crop" should be used in determining the actual application rate. For the availability prediction to be reliable, you must have properly identified the type of manure and the application method on the information sheet submitted to the lab.

NCDA Agronomic Division, 4300 Reedy Creek Rd, Raleigh, NC 27607-6465 (919)733-2655 Report No: W00585 W

Waste Analysis Report

Grower: **Educational Sample-Swine Waste** *Copies to:* County Extension Director
4300 Reedy Creek Rd.
Raleigh, NC 27607

Farm: Swine Lagoon/Sludge

Sample Info. | **Laboratory Results (parts per million unless otherwise noted).**

Sample ID: 1

DM%	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb
	343	58.6	351	137	52.7	31.6	2.70	0.26	0.74	0.30	0.35			124			

Waste Code: ALS

Description: Swine Lag. Liquid

Nutrients Available for First Crop — **lbs/1000 gallons**

Application Method	*N*	*P_2O_5*	*K_2O*	*Ca*	*Mg*	*S*	*Fe*	*Mn*	*Zn*	*Cu*	*B*	*Mo*	*Cl*
Irrigation	1.3	0.78	2.8	0.80	0.31	0.18	0.02	T	T	T	T		
Soil Incorp	2.3	0.90	3.2	0.91	0.35	0.21	0.02	T	0.01	T	T		

Other Elements — *lbs/1000 gallons*

Na	*Ni*	*Cd*	*Pb*
1.0			

Recommendations:
Nutrients available for the first crop are based on estimates of mineralization rate and projected loss for the application method listed. Concentrations of zinc and other metals are not excessive. The waste product should not cause production or environmental problems if utilized according to recommended practices. Monitor nutrient buildup and soil pH with a soil test no less than every two years. I would apply the waste at rates needed to supply nitrogen for crop production.

Sample Info. | **Laboratory Results (parts per million unless otherwise noted).**

Sample ID: 2

DM%	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb
	2590	5098	366	5155	2199	1036	1071	68.4	231	223	1.53			82.8			

Waste Code: ASS

Description: Swine Lag. Sludge

Nutrients Available for First Crop — **lbs/1000 gallons**

Application Method	*N*	*P_2O_5*	*K_2O*	*Ca*	*Mg*	*S*	*Fe*	*Mn*	*Zn*	*Cu*	*B*	*Mo*	*Cl*
Broadcast	9.9	68.2	2.9	30.1	12.8	6.1	6.3	0.40	1.4	1.3	0.01		
Irrigation	13.0	77.9	3.3	34.4	14.7	6.9	7.1	0.46	1.5	1.5	0.01		

Other Elements — *lbs/1000 gallons*

Na	*Ni*	*Cd*	*Pb*
0.69			

Recommendations:
Nutrients available for the first crop are based on estimates of mineralization rate and projected loss for the application method listed. Concentrations of phosphorus, zinc, and copper are high enough to warrant an annual soil test to monitor buildup of these elements where the waste is applied. I would apply the waste at rates needed to supply a reasonable amount of phosphorus and avoid excessive buildup of phosphorus, zinc, and copper in the soil.

Figure 35-4. Example Manure Analysis Report for a lagoon liquid and a lagoon sludge.

To meet a specific plant nutrient requirement, nutrients listed in the report or calculated as "available for the first crop" should be used in determining the actual application rate.

It is important to understand that nutrient availability cannot be determined with 100% accuracy. Many variables, including the type of manure product and environmental factors (i.e., soil type, rainfall, temperature, and general soil conditions) influence the breakdown of the manure and nutrient loss.

Animal manure management regulations in some states require you to maintain your manure analysis reports for a minimum of five years, ensuring that nutrient content is consistent and justifying your application rates.