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How to Sample Manure

This publication describes how to sample solid, semi-solid, and liquid manure. Manure with greater than 20 percent solids (by weight) is classified as dry manure and is handled as a solid. Manure with 10 to 20 percent solids is classified as semi-solid manure and can usually be handled as a liquid. Manure with less than 10 percent solids is classified as liquid manure.

A representative manure sample is needed to provide an accurate reflection of the nutrient content. Unfortunately, manure nutrient content is not uniform within storage structures, so obtaining a representative sample can be challenging. Mixing and sampling strategies should therefore insure that samples simulate as closely as possible the type of manure that will be applied.

When to Sample Manure

For best results, manure should be sampled at the time of application or as close as possible to application. Sampling during application will help ensure that samples are well-mixed and representative of the manure being applied. Because manure nutrient analysis typically takes several days at a lab, sampling at the time of application will not provide immediate manure nutrient recommendations. The results can, however, be used for subsequent manure applications and to adjust commercial fertilizer application. This is why it is important to develop a manure sampling history and use those analysis in a nutrient management plan. A manure sampling history will also help you recognize if unplanned changes have occurred to your system if management and other factors have remained constant.

Take manure samples annually for three years for new facilities, followed with samples every three to five years, unless animal management practices, feed rations, or manure handling and storage methods change drastically from present methods. If you apply manure several times a year, take samples when you plan to apply the bulk of manure. For example, it may be appropriate to sample in the spring when manure that has accumulated all winter will be applied. If storages are emptied twice a year, it may be necessary to sample in both spring and fall since the different storage temperatures in summer versus winter will affect manure nutrient levels. *NOTE: Implementation of federal regulations may require concentrated animal feeding operations (>1,000 animal units) to sample annually. Please check state and federal requirements to determine sampling frequency.*

How to Sample Semi-Solid or Liquid Manure

In liquid and semi-solid systems, settled solids can contain over 90 percent of the phosphorus (P), so complete agitation is needed to accurately sample the entire storage if all the manure in the storage structure is going to be applied. If however, solids will purposely be left on the bottom of the storage structure when the manure is pumped out, as is sometimes the case with lagoons, then

complete agitation during sampling may generate artificially high nutrient values. In this case agitation of the solids or sludge on the bottom of a lagoon is not needed for nutrient analysis.

Liquid manure is best sampled during land application, for it is potentially more difficult and dangerous to sample from liquid storage facilities than dry manure systems. When sampling manure during application is not possible, or pre-application analysis is desired for determining rates, refer to the section on sampling from a storage facility. If sampling from a liquid storage facility, use caution to prevent accidents, such as falling into the manure storage facility or being overcome with hazardous gases produced by manure. Have two people present at all times. Never enter confined manure storage spaces without appropriate safety gear such as self-contained breathing apparatus.

Ideally, liquid manure should be agitated so a representative sample can be obtained for laboratory analysis. When agitating a storage pit below a building, be sure to provide adequate ventilation for both animals and humans. When agitating outdoor unformed pits, monitor activities closely to prevent erosion of berms or destruction of pit liners.

Liquid Manure Sample Preparation

All liquid samples should be handled as follows:

- Prior to sampling, label a plastic bottle (a 3-8 oz. is adequate) with your name, date and sample identification number using a waterproof pen.
- If the sample cannot be mailed or transported to laboratory within a few hours, it should be frozen. Place the container in a tightly sealed plastic bag and keep it cold until it arrives at the laboratory.

CRL does have plastic containers available for sample collection. Do not use glass containers, as expansion of the gases in the sample can cause the container to break.

Liquid Manure Sampling During Land Application

Liquid Manure Applied with Tank Wagons

- Since settling begins as soon as agitation stops, samples should be collected as soon as possible after the manure tank wagon is filled unless the tanker has an agitator.
- Immediately after filling the tank wagon, use a clean plastic pail to collect manure from the loading or unloading port or the opening near the bottom of the tank. Be sure the port or opening does not have a solids accumulation from prior loads.
- Use a ladle to stir the sample in the bucket to get the solids spinning in suspension. While the liquid is spinning remove a ladle full and carefully pour in the sample bottle.
- Repeat this procedure and take another sample until the sample bottle is three-quarters full (Make sure the manure solids have not settled to the bottom of the bucket as each ladle is extracted; it is important to include the solids in the sample). Place the lid on tightly.

Liquid Manure Applied by Irrigation Systems

- Place catch pans or buckets randomly in the field to collect liquid manure that is applied by an irrigation system. Inexpensive aluminum roasting pans or plastic buckets can be used as catch pans. Use several pans at different distances from the sprinkler head.
- Immediately after the manure has been applied, collect manure from catch pans or buckets and combine the manure in one bucket to make a composite sample.

- Use a ladle to stir the sample in the bucket. While the liquid is spinning remove a ladle full and carefully pour into a sample bottle.
- Place the lid on tightly.

Liquid Manure Sampling from Storage Facilities

For best sampling results, samples should be taken with a sampling probe or tube. Probes can be constructed out of 1.5-inch diameter PVC pipe. Cut the PVC pipe a foot longer than the depth of the pit. Run a 1/4 –inch rod or string through the length of the pipe and attach a plug such as a rubber stopper or rubber ball. The rod or the string must be longer than the pipe. If using a rod, bend the top over to prevent it from falling out of the pipe. Another approach is to use a ball valve on the end of the tubes with a cord attached that can be used to close the valve after inserting to the bottom of the pit.

- Insert the pipe slowly into the pit or lagoon, with the stopper open, to the full depth of the pit.
- Pull the string or rod to close the bottom of the pipe and extract the vertical profile sample inside the pipe (be careful not to tip the pipe and dump the sample).
- Release the sample carefully into the bucket.
- Repeat this process at least three times around the pit or lagoon creating a composite sample in the bucket.
- Use a ladle to stir the sample in the bucket to get the solids spinning in suspension. While the liquid is spinning, take a ladle full and carefully pour into a sample bottle.
- Make sure the manure solids have not settled to the bottom of the bucket as the dipper is extracted; it is important to include the solids in the sample. Place the lid on tightly.

Pre-Sampling Nitrogen and Potassium from Liquid Manure

If the procedures described above for sampling liquid manure are impractical due to lack of sampling equipment, or the inability to agitate the manure, manure samples can be dipped off the top of store liquid manure to analyze for N and K concentrations. Research has shown that top-dipped liquid samples represent approximately 90 percent of the N concentration measure in mixed, field-collected samples. Multiply the results of the N concentration from top-dipped samples by 1.1 for a better estimate of the N concentration of the liquid storage facility. Dipping a sample from the surface of a liquid storage pit does NOT provide a good estimate of P concentration in the pit and is not recommended.

How to Sample Dry or Solid Manure

In solid manure handling systems, many of which include bedding, the proportions of fecal matter, urine, and bedding will vary from one location to another within sites, and often from season to season as well. It is necessary to take samples from various places in the manure pile, stack, or litter to obtain a representative sample for analysis. It may even be beneficial to sample several times per year based on the bedding content.

Manure sampling is best done in the field as manure is applied. This ensures that losses that occur during handling, storage, and application are taken into account and that manure is better mixed, reducing stratification found during sampling storage facilities. As with field sampling of liquid manure, results will not be available in time to adjust current application rates. However, sampling during application will still allow producers to adjust any planned future commercial fertilizer rates and manure application in subsequent years. The following method describes a procedure for collecting dry or solid manure samples from the field.

- Spread a sheet of plastic or tarp on the field. A 10-foot-by10-foot sheet works well for sampling manure.
- Fill the spreader with a load of manure.
- Drive the tractor and manure spreader over the top of the plastic to spread manure over the sheet.
- Collect subsamples as described below (Steps 1-3 Composite Sample Collection).
- Samples should be collected to represent the first, middle and last part of the storage facility or loads applied and should be correlated as to which loads are applied on certain fields to track changes in nutrient concentrations throughout the storage facility.

Manure should be sampled at the time of application, but if time and management practices prevent this, manure samples can be collected from the storage facility. Sampling from storages is not generally recommended due to difficulty in collecting a representative sample. Although solid manure storages are generally not fully enclosed and gases are somewhat diluted, always exercise caution when sampling from storage facilities. If you have to enter a confined storage facility, follow the safety recommendations described previously in the section on sampling liquid manure storages.

Manure that accumulates on paved feedlots and is scraped and hauled to the field is classified as scrap-and-haul feedlot manure. Manure is usually removed from the feedlot daily or several times a week.

- Collect manure by scraping a shovel across approximately 25 feet of the paved feedlot. This process should be repeated ten or more times, taking care to sample in a direction that slices through the large-scale variations of moisture, bedding, depth, age, etc. Avoid manure that is excessively wet (near waterers) or contains unusual amounts of feed and hay.
- Use the shovel to thoroughly mix manure by continuously scooping the outside of the pile to the center of the pile.
- Collect subsamples from this pile using the hand-in-bag method this is described below (Steps 1-3 Composite Sample Collection).
- This may need to be done several times to collect several composite samples for analysis.

Manure that accumulates in a barn or housing facility is temporarily stored in a gutter, and then removed by a barn cleaner is classified as barn gutter manure. Manure is usually removed from the barn once or twice daily.

- Shovel a vertical “slice” of manure from the gutter, making sure the shovel reaches to the bottom of the gutter.
- Remove manure from the gutter and pile it on the barn floor. Mix the manure with a shovel or pitchfork to ensure that bedding is mixed thoroughly with manure. When collecting samples from a gutter, be sure to include the liquid that accumulates in the gutter’s bottom. Discard foreign material and also take care not to add large amount of barn lime.
- Repeat steps one and two from various locations along the gutter.
- Mix each pile thoroughly and collect subsamples from each pile using the hand-and-bag method that is described below (Steps 1-3 Composite Sample Collection).

Manure that is stored outside in a solid waste storage facility, such as a stacking shed or horizontal concrete silo located above ground, is classified as a dry stack. These facilities are

usually covered to prevent the addition of extra water. Dry manure with litter should also be sampled in the following manner.

- Remove manure from 10 to 20 locations throughout the dry stack and place it in a pile using a pitchfork or shovel. Manure should be collected from the center of the stack as well as from near the outside walls, to get samples that represent all ages and moisture levels of manure in the stack. A bucket loader can cut a path into the center of the pile to provide access for sampling. Subsamples should be collected to the depth the litter will be removed for application.
- Thoroughly mix manure with the shovel by continuously scooping the outside of the pile to the center of the pile.
- Collect a composite manure sample as described below (Steps 1-3 Composite Sample Collection).

Composite Sample Collection for Dry or Solid Samples

1. Whether collecting from a plastic tarp in the field, a feedlot, a storage facility, or a barn, sample in a grid pattern so that all areas are represented. Combine 10 to 20 subsamples in a bucket or pile and mix thoroughly. More subsamples will produce more accurate results and are often required to produce a composite that best represents nutrient levels.
2. The final composite sample that will be submitted for nutrient analysis should be collected using the hand-in-bag method. To collect a composite sample from the mixed subsamples, place a one-gallon resealable freezer bag turned inside out over one hand. With the covered hand, grab a representative handful of manure and turn the freezer bag right side out over the sample with the free hand. Be careful not to get manure in the sealable tracks.
3. Squeeze excess air out of the bag, seal, and place in another plastic bag to prevent leaks. Label the bag with your name, date, and sample identification number with a waterproof marker and freeze it immediately to prevent nutrient losses and minimize odors. For manure with a high degree of variability, multiple samples may need to be analyzed.

Manure samples should be sent to CRL for chemical analysis as quickly as possible to avoid nutrient losses.