



Introduction

Manure contains ample amounts of nutrients and is considered to be an integral component of dairy farm nutrient management. Significant amounts of Nitrogen (N), Phosphorus (P), and Potassium (K) as well as small amounts of trace minerals are present in dairy manure and can be utilized as a main source of fertilizer for dairy operations, thereby potentially reducing input costs. It is important to have an understanding of the nutrient concentrations contained in the manure when planning for land application. An analysis of manure nutrients is required in order to calculate the amount of manure needed to supply enough fertility to support crop growth. Nutrient content will fluctuate depending on the diet and age of the cow, the type and amount of bedding, handling and storage, seasonal precipitation, among other management differences. For example, the nitrogen content of solid dairy manure may vary from 3 to 33 lb/ton and the phosphorus content from <1 to 35 lb/ton. In order to account for these differences, annual sampling is highly advised to track nutrient difference and maximize the economic value of manure. Separate, representative manure samples must be collected and analyzed for each form (liquid or solid) of manure applied each year. Devising an effective sampling program must take into account time, method, and frequency of sampling.

When is the Best time to Sample Manure?

Ideally, manure should be sampled during or just prior to hauling for land application. This will provide the most accurate nutrient analysis because the manure has been agitated ensuring a representative sample. However, when sampling during agitation or hauling, the results from the lab analysis will not be sent back in time to include in the current year's nutrient management plan, but analysis can be used for planning the following year's fertility plan, and to adjust additional fertilizer applications.

Take manure samples annually for three years, followed by samples every 4-5 years. Keep records on file for management references. If storage(s) are emptied twice a year, it is recommended to sample in both spring and fall since the varying storage temperatures in summer compared to winter will affect manure nutrient levels.

Methods of Sampling

In general, a composite sample, which is comprised of numerous sub-samples, is needed for every form and site where manure is contained and used as a soil amendment. The more subsamples taken, the more accurate the results will be. Based on your manure management follow these instructions for taking a precise manure sample.

Sampling Liquid Manure (less than 10% solids)

Dairy manure (about 12% solid as excreted) is often collected and stored as liquid slurry in earthen, concrete, or steel storage structures. For safety and time appropriateness, it is recommended to sample during application. However, if challenges exist where you are unable to sample at application, then sample with caution from storage facilities such as lagoons due to hazardous gases and the potential for accidents.

General Requirements for Handling a Liquid Manure Sample

1. For your final composited sample, label a clean and sealable, wide-mouth plastic container with your name, the name of the farm, date, and sample identification

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2. Agitate manure slurry storage for 2 to 4 hours before sampling taking care to prevent erosion of earthen structures or tearing of liners.
3. Follow one of the following sampling methods and take 10-20 sub-samples using an appropriate sampling devise.
4. Place all sub-samples in a larger clean plastic container, such as a 5-gallon bucket and mix contents thoroughly to suspend solids.
5. While contents are being mixed, scoop out manure and fill composite sample container three quarters full. Mixing ensures all particle sizes get into the sample.
6. Freeze sample immediately to prevent microbial activity, in particular ammonia nitrogen loss.
7. Send for analysis, by placing frozen sample in a Styrofoam or plastic cooler with ice packs to keep the temperature down. It is advised to use a rapid transit courier and avoid sending on a weekend or holiday.

Sampling Liquid Manure During Land Application

Samples should be taken from different loads, which represent the beginning, middle, and end of the application process.

By Tanker Truck

- Collect sample as soon as tank is filled since solids will immediately begin to settle unless the tanker has an agitator.
- Sample with a clean container such as a small to medium sized plastic container attached to a long pole. Dip pole into tanker and take appropriate number of sub-samples.
- Follow the above "General Handling Requirements".

By Irrigation Systems

- Place several catchment containers, such as plastic coffee cans, randomly throughout the field.
- After manure has been irrigated, immediately collect containers and compile together into one main bucket.
- Follow procedure as described above in "General Requirements for Sampling Liquid Manure".

Sampling Liquid Manure from Storage Facilities

Caution must be taken to avoid potentially fatal accidents when sampling from a liquid storage facility. Gases released from storage are highly concentrated and can be harmful. Wear a self-containing breathing mask if necessary. Never sample alone, always have at least two people to perform the procedure.

- Sample using a probe to obtain a vertical profile of manure. Construct a probe by cutting a piece of PVC piping that is a foot longer than the depth of the storage facility. Then, run a piece of string or rod that is longer than the pipe through the inside. If using a rod, make sure to bend the top end so it does not fall out. Next, securely attach a rubber stopper or ball to the end of the pipe. This will allow you to plug the pipe once your desired depth of sample is achieved.
- Place pipe with stopper open into manure storage to the full depth.
- Pull string or rod to close the pipe.
- Slowly pull up the pipe being careful not to spill contents.
- Release sample into a clean 5-gallon bucket.
- Repeat these steps till you have 10-20 sub-samples that represent all points within the manure site.
- Follow procedure as described above in "General Requirements for Sampling Liquid Manure".

Sampling Solid Manure (greater than 20% solids by weight)

Solid manure handling systems contain much more bedding as compared to liquid manure and also typically have more storage sites such as barn gutters and dry stacks. Therefore, it is recommended that solid manure be sampled from each storage site separately as followed and possibly several time throughout the year. Stratification of nutrients occurs in manure piles, so it is advised to sample while loading or during application.

General Requirements for Handling a Solid Manure Sample

1. For your final composited sample, label a clean and sealable, wide-mouth plastic container, or zipper locked freezer plastic bag, with your name, the name of the farm, date, and sample identification number with a dark colored waterproof marker. Do not use glass or galvanized containers for gases will expand and

may break the glass while the metal interferes with analysis.

2. Collect 10-20 sub-samples and sample in a grid pattern.
3. Avoid sampling large pieces or chunks of bedding. Mix all sub-samples thoroughly in a clean 5-gallon bucket.
4. Remove a large enough sample to fill composite container half way to three-quarters full. Place composite container within another sealable plastic bag so as to avoid potential leakage. If using a plastic bag, squeeze out air.
5. Freeze sample immediately to prevent microbial activity, in particular ammonia nitrogen loss.
6. Send for analysis, by placing frozen sample in a Styrofoam or plastic cooler with ice packs to keep the temperature down. It is advised to use a rapid transit courier and avoid sending on a weekend or holiday.

Sampling During Application

Keep track of the beginning, middle, and end portions of application, so that analyses can be correlated to appropriate land application reference.

A. Tarp Method

- Spread a tarp or plastic sheet that is about 10 – feet-by 10-feet or smaller, on the field before application. Hold down securely with rocks or stakes. Have a tarp for every parcel of land or for every load that is different, such as filled from varying storages.
- Drive manure spreader over desired land ensuring to cover tarp.
- Collect sub-samples and follow procedure as described above in “General Requirements for Sampling Solid Manure”.

B. Directly from Spreader

- Using a pitchfork, shovel, or long pole with a securely attached container, extract 10-20 subsamples from the spreader as it is being filled by the storage facility.
- Collect sub-samples and follow procedure as described above in “General Requirements for Sampling Solid Manure”.

Sampling from Solid Manure Storage Facilities

The optimal time to sample manure is during application, but if time and management practices do not permit, then samples may be collected from the storage facility. Always be cautious when sampling from the storage facilities wearing personal protective equipment such as gloves and mask, possibly even a

self-contained breathing mask, if entering a confined manure space.

Sampling Dry Stacks

A dry stack of solid manure is manure that is stored outside in a facility such as a stacking shed or horizontal concrete silo above ground.

- Identify dispersed points on the stack that represent the average moisture content of the manure. Samples should be taken from a depth of at least 18 inches at various locations on the pile.
- From each point, remove the top crust layer, which is lower in nutrients, and collect 10-20 sub-samples. Once at 18 inches depth, use a shovel to take a small pile, and then take a cup full from the shovel, transferring contents into a 5-gallon bucket. Use a bucket loader to reach the center portions of the pile. Make sure to randomize sampling by performing in a zigzag pattern.
- Follow procedure as described above in “General Requirements for Sampling Solid Manure”.

Sampling from Barn Gutters

Many dairy operations collect accumulated manure from barns or housing facilities in gutters and remove from the gutter daily.

- Shovel a heap of manure from the gutter making sure to reach the bottom of gutter. The liquid, which sinks to the bottom, is a crucial component of the sample.
- Place the contents on barn floor and mix thoroughly, discarding any foreign objects and breaking up clumps of bedding. A pitchfork may be useful for breaking up clumps.
- Repeat above steps till you have taken from representative locations along the gutter. There should be numerous piles of mixed manure around the barn.
- Take subsamples from these small mixed manure piles following the above “General Guidelines” to comprise your composite sample.

Recommended Sampling Frequency

Dairy manure nutrient content is constantly changing. Therefore, to determine the best value for the nutrient content of a particular form of dairy manure, it is important to average as many analyses as possible. Remember that more subsamples will give you a better representation of manure composition.

Labs that Accept Manure Samples

University of Maine
Analytical Laboratory and Maine Soil Testing Service
5722 Deering Hall
Orono, ME 04469-5722

For further information call (207) 581-3591 or visit:
<http://anlab.umesci.maine.edu/default.htm>

Dairy One
730 Warren Road
Ithaca, NY 14850
(607) 257-1272
<http://www.dairyone.com/>

Resources

Bicudo, R. J. *Managing Liquid Dairy Manure*. AEN-91. University of Kentucky Cooperative Extension Service.
www.ca.uky.edu/agc/pubs/aen/aen91/aen91.pdf

Bush, D., R. Wagar, and M. Shmitt. 2002. *Livestock Manure Sampling*. FO-06423. University of Minnesota Extension Service.
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www.learningstore.uwex.edu/pdf/A3769.pdf

Rieck-Hinz, A., et. al. 2003. *How to Sample Manure for Nutrient Analysis*. PM 1558. Iowa State University Cooperative Extension Service.
www.extension.iastate.edu/publications/pm1558.pdf

For more information visit www.umass.edu/cdl

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