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Sampling Manures for Nutrient Analysis

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Guidelines for sampling manure for nutrient content to improve crop and soil management.

Manure and Soil Fertility Management

Animal manure has long been recognized as a source of nutrients that are normally supplied in fertilizers. Farmers need to know the amounts of nutrients supplied to crops in manure to properly adjust commercial fertilizer rates to meet crop needs while minimizing contamination of water supplies through leaching or runoff. Typical values for the nutrient content of different animal manures are available in extension publications, but actual nutrient values vary from farm to farm due to variations in manure storage and handling conditions, livestock type and age, ration formulation and other management practices. Weather conditions and variations in management practices can cause manure nutrient contents to vary from month to month and from year to year on the same farm. To determine the nutrient content of manure, submit samples for analysis to one of the laboratories serving Nebraska livestock producers (*see page 4*).

Sampling Manure for Nutrient Analysis

If the manure is tested before application, the results can be used to adjust application rates. This may not be practical, however, and feeding operations that are consistent in their feeding and manure management practices can determine application rates based on the average results of past manure analysis. Samples collected at the time of application have several advantages: the manure is mixed and similar to what is applied, and storage and handling losses do not need to be estimated. Results of tests for samples collected at application time can be used to determine if additional nitrogen will be needed and to maintain records of manure application.

The manure sample must be properly collected and handled for good results. Samples need to be composed of several subsamples to represent the available nutrients. The minimum numbers of subsamples suggested are those necessary for a reliable estimate of nitrogen content.



Figure 1. A soil probe can help provide a representative sample.

Solid and Semi-solid Manure

A solid manure is more than 20 percent dry matter and semi-solid manure is 10-20 percent dry matter. While a spade can be used to sample a manure pile, representative samples can be obtained using an auger or soil probe which can reach into a manure pile (*Figures 1 and 2*).

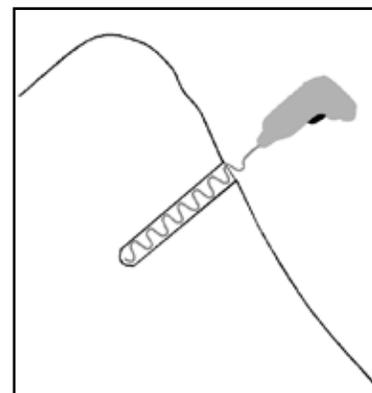


Figure 2. Using an auger bit to sample a manure pile.

Compared to sampling in open lots or from manure piles, sampling during or after loading the manure spreader is preferred because manure is mixed during loading and a more representative sample is obtained. Hand-grab samples from at least 10 spreader loads to form a composite sample.

Sample manure in open lots by scraping together manure in 20 or more parts of the feedlot and putting samples in a 5-gallon plastic bucket. The collection points should be typical for the feedlot and should exclude areas that won't be removed during yard cleanup. Wet areas near watering points may have a different analysis than manure scraped from mounds. Carefully consider where to sample in order to obtain a sample



Figure 3. Place solid manure samples in a resealable freezer bag.

Subsampling and Packaging Solid Manure Samples

During sampling, put the manure in a five-gallon bucket and break up the lumps (*Figure 3*). Mix manure well and subsample enough to fill a resealable quart-sized freezer bag. Squeeze the bag to remove excess air and seal. Put the bag into a second resealable bag to further ensure against leakage. Refrigerate if the sample cannot be sent to the laboratory immediately. Freeze the sample if delivery will be delayed by several days.

which represents the manure that will be land applied. Avoid getting hay or other feedstuffs in the sample.

Sample manure from at least 15 or more parts of a manure stack, including from the center of the stack. Recent research indicates that taking at least 30 samples minimizes error. Do not sample the surface crust; collect samples at least 6 inches below the surface.

Sample solid manure during application by spreading a plastic sheet or tarp at least 4 foot by 4 foot in the path of the applicator. (The number of pounds of manure collected on a tarp of 22 square feet — 5.5 foot by 4 foot — equals the number of tons per acre). Manure should be gathered in this way five to six times during application, mixed thoroughly and subsampled. An advantage of this method is that the manure spreader can be calibrated simultaneously.

Liquid And Slurry Manure

Liquid manure has less than four percent dry matter by weight. Slurry manures have four to ten percent dry matter.

Nutrient concentrations in liquid storage facilities become stratified due to settling and crusting. The concentration of phosphorus has been found to be from two to eight times more at a 14-foot depth compared to a 2-foot depth. Nitrogen concentration can be twice as high at the 14-foot depth than near the surface. Therefore, reliability of liquid or slurry manure analysis results is best with agitation. Good mixing of manure in a storage facility may require two to four hours of agitation before manure removal and continued mixing during the emptying process.



Figure 4. Liquid out of pump.

Sampling during pumping, loading, or after loading of liquid and slurry manure is preferred. Collect a sample in a clean container from the pump during loading, or when pumping to an irrigation system or an umbilical cord applicator (*Figure 4*). Samples can be taken from the unloading port of a tank spreader immediately after loading. Do this for several loads or several times during pumping to ensure a representative sample. Be sure the sampling port does not have an accumulation of solids.

If sampling from the storage facility is the only option, a tool made with PVC pipe may be useful for vertical sampling (*Figure 5*). If a storage structure is sampled without agitation, it is especially important to obtain manure from the various depths due to stratification of the nutrients. A good estimate of manure nitrogen content of liquid manure sampled from unagitated storage requires at least 20 subsamples.

It is hazardous to sample liquid and slurry manures in storage due to the possibility of falling into the storage unit and breathing lethal gases emitted during agitation of manure in enclosed pits or tanks. Due to release of toxic gases, remove all people and animals from the building during agitation, and ventilate well with forced air movement. Take additional precautions: wear gloves and have someone else present when you are in the building. **Never enter confined manure storage areas without the appropriate safety equipment.**

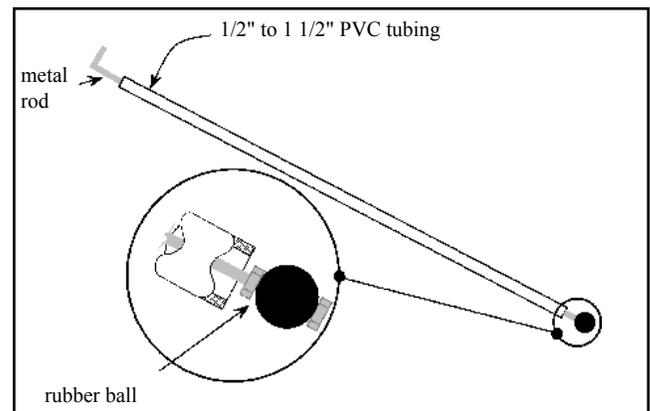


Figure 5. PVC pipe sampler.

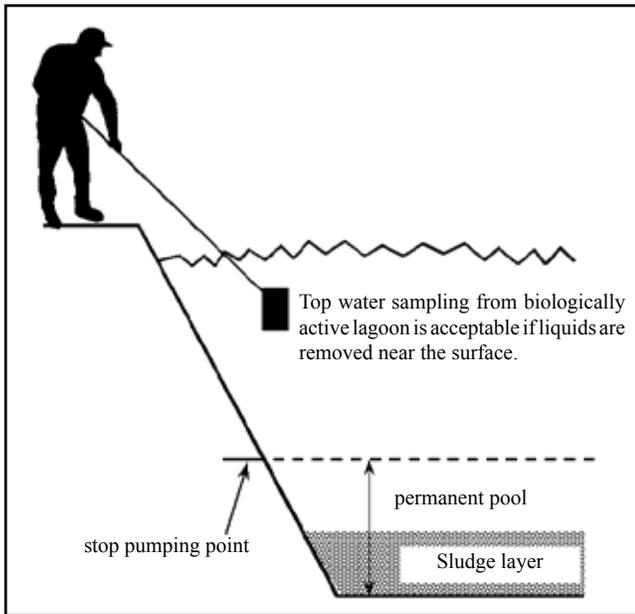


Figure 6. Sampling from a lagoon.

Anaerobic Lagoons

Anaerobic lagoons are not usually agitated before manure removal. The topwater, effluent, when sampled from May to November, is fairly uniform in nutrient concentration from the surface to the interface with the sludge layer due to biological mixing. If anaerobic lagoons are pumped from near the surface, a representative manure sample can be obtained by taking several surface samples with a small container attached to a 10-foot pole (Figure 6). Avoid samples that contain floating solids.

Liquid manure applied through sprinkler irrigation systems also can be collected during application. Place collection pans or buckets at eight or more points throughout the application area to collect the manure. This accounts for any dilution if water is added to the manure and for ammonium losses during application; however, ammonium losses from the soil surface will not be accounted for by collecting samples after sprinkler irrigation.

Labeling, Shipping, and Analysis of Samples

Label the sample container for identification, including your name and address, your sample identification, the date of sampling, manure type, and the sample location. Provide additional information with the sample as requested by the laboratory. This is often useful in interpreting the results.

If it will take more than a few hours to deliver the sample, it should be refrigerated or frozen to prevent nutrient losses and transformations. If kept at room temperature, the manure may eventually ferment or decompose, with significant breakdown of the solids.

Keep the sample chilled during shipping by packing it in an insulated container or wrapping it in layers of newspaper. Cold packs may be added. Avoid weekend delays in shipping by sending it early in the week.

Laboratory Analysis

A basic manure analysis for nutrient content should include total nitrogen, ammonium-nitrogen, phosphate, potassium, and dry matter content. Electrical conductivity is important for anaerobic lagoon management. Soluble salt content, or electrical conductivity, should be determined if liquid manure is applied to a crop through a sprinkler irrigation system. Tests for sulfur and zinc may be of interest. When manure is applied to meet nitrogen or phosphorus needs, the addition of other nutrients in manure is generally sufficient for soils in Nebraska.



Figure 7. Put liquid manure samples in plastic, screw-topped containers.



Figure 8. Seal liquid manure samples carefully.

Subsampling and Packaging Liquid or Slurry Manure Samples

During sampling, collect the manure in a five-gallon bucket. Mix well and remove a subsample while the sample is still swirling. Put the subsample in a pint-sized plastic, screw-topped container that can be tightly closed (Figure 7). Never use glass containers. Fill the bottle to 1-2 inches from the top and seal the lid with tape to ensure that it does not become unscrewed (Figure 8). Put the sample in a resealable plastic bag. Chill the sample and send or deliver to the laboratory within a few days. Freeze the sample if delivery will be delayed.

Land Application and Rate Determination

A portion of the nutrients in manure will not be available to the crop in the season following application. The laboratory report should give an estimate of nutrients available to the first crop following manure application as well as total nutrient. For example, 20 percent to 50 percent of the organic nitrogen should be available to the first crop, depending on the manure type; much of the remaining organic nitrogen becomes available in following years. The report also may provide an estimate of ammonium-nitrogen losses which will vary with application and incorporation practices.

Nutrient concentrations should be reported for the manure sample on an “as is” or “wet” basis. The results also should be reported as pounds per ton for solid manure, per 1000 gallons for slurry and liquid manure, and per acre-inch for liquid manure that will be applied through irrigation systems.

Related Resources

Livestock and Poultry Environmental Stewardship Curriculum, Chapters 31 and 33. (<http://www.lpes.org>)
Manure Characteristics, Midwest Plan Services, MWPS-18, Sec. 1 (<http://www.mwps.org/>).
Manure Matters Web site (<http://water.unl.edu/manure>).

Laboratories Providing Manure Testing Services

Agvise Laboratories
902 13th St. N, P.O. Box 187
Benson, MN 56215
(320) 843-4109
<http://www.agviselabs.com>

Midwest Laboratories
13611 “B” St.
Omaha, NE 68144
(402) 334-7770
<https://www.midwestlabs.com/>

Servi-Tech Laboratories
1602 Park Dr. West
Hastings, NE 68902
(402) 463-3522
(800) 557-7509
<http://www.servitechlabs.com>

A&L Heartland Labs, Inc.
111 Linn Street, P.O. Box 455
Atlantic, IA 50022
(800) 434-0109
(712) 243-5213
<http://allabs.com>

Olsen’s Agricultural Laboratory
21 E. 1st St., P.O. Box 370
McCook, NE 69001
(308) 345-3670
<http://www.olsenlab.com/>

Ward Laboratories
4007 Cherry Ave., P.O. Box 788
Kearney, NE 68848
(308) 234-2418
(800) 887-7645
<http://www.wardlab.com/>

Platte Valley Laboratories
P.O. Box 807, 914 Hwy. 30
Gibbon, NE 68840
(308) 468-5975
<http://www.soillab.com/>

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**Index: Waste Management
Waste—Resource Management**

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