AGRONOMY
- Crops
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- Climate

Management Practices:

How to Sample Manure for Nutrient Analysis

A field-by-field nutrient management program requires that multiple practices be implemented to maintain adequate fertility for crop growth and development. The program includes soil sampling for soil test analysis, crop rotation, and giving appropriate nutrient credit to legumes in the rotation. Manure sampling and manure spreader calibration are part of a comprehensive nutrient management program so manure can be credited effectively as a nutrient source. A well-designed soil sampling plan, along with manure sampling and nutrient analysis, can reduce input costs and the potential of environmental pollution.

Animal manure has long been used as a source of nutrients for crop growth. Standard nutrient values are a guide to the amount of nutrients that animal manure will supply as a fertilizer source. Iowa State University Extension pamphlet Pm-1164, *Animal Manure: A Source of Crop Nutrients,* recommends manure nutrient credits by type of animal and handling system. That fact sheet shows nutrient values based on field losses.

This publication describes how to sample solid, semi-solid, and liquid manure. Producers sampling semi-solid manure should follow the procedure described for liquid manure. Manure with greater than 20 percent solids (by weight) is classified as dry manure and is handled as a solid, usually with box-type spreaders. Manure with 4 to 20 percent solids is classified as semi-solid manure and can be handled as a liquid. Semi-solid manure usually requires thorough agitation before pumping and the use of chopper pumps. Manure with less than 4 percent solids is classified as liquid manure and is handled with pumps, pipes, tank wagons, and irrigation equipment.

A representative sample is needed to provide an accurate reflection of manure's nutrient content. This aids producers in making decisions about taking nutrient credits.

One of the many factors affecting the nutrient content of manure is how the manure is handled and stored. Each handling system results in different types of nutrient losses—some unavoidable and others that can be controlled to a certain degree. The most important thing in collecting a manure sample is that it should be obtained in a similar way to the method used in developing standard nutrient value recommendations. The following guidelines are designed for collecting on-farm animal manure samples.

When to Sample Manure

Sample manure at the time of land application or as close as possible to application. Sampling at the time of land application will not provide manure nutrient recommendations that can be used at that time to adjust the amount of manure applied. The results, however, can be used for subsequent manure applications and to adjust commercial fertilizer application. Annual sampling is recommended so that the nutrient content can be better monitored over time and each application rate can be determined using values from the previous year. Samples should be taken when the bulk of the manure is applied. For example, sample in the spring when manure that has accumulated all winter will be used as a nutrient source.

Manure sampling should be done in the field as manure is land applied. This ensures that losses that occur during handling, storage, and application are taken into account.

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Manure Sampling from the Field

Manure accumulates in different types of livestock holding areas. These areas include barns and other similar housing—where manure is collected in gutters or in dry stacks—and open paved feedlots. It is recommended that manure from holding areas should be sampled during field application. Collect manure samples according to the following field sampling procedure.

1. Spread a sheet of plastic or tarp on the field. A 10-feet-by-10-feet sheet works well for sampling manure.

2. Drive the tractor and manure spreader over the top of the plastic to spread manure over the sheet.

3. Collect a manure sample using the hand-and-bag method described in the following section.

Dry or Solid Sample Preparations

The technique for collecting all solid manure samples is the hand-and-bag method. It is recommended a minimum of three subsamples be taken to obtain a representative sample of manure. When making nutrient recommendations, use an average of the three subsamples.

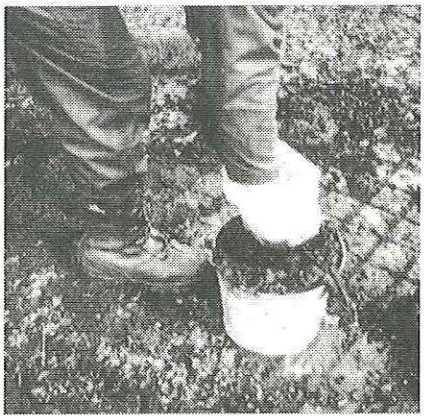

Figure 1: Manure is sampled with a plastic bag worn over the hand.

To collect samples, place a one-gallon resealable freezer bag turned inside out over one hand. Grab a handful of manure with the covered hand and turn the freezer bag right side out over the sample with the free hand (see Figure 1). Seal the bag and place it in another freezer bag to prevent leaks. Label the bag for identification and **freeze** it immediately to prevent nutrient losses and minimize odors. Manure samples should be mailed or delivered to the laboratory as soon as possible.

Liquid Manure Sampling

Every effort should be made when sampling to agitate manure in the storage facility so a representative sample is obtained for laboratory analysis.

Liquid Manure Applied with Tank Spreaders

1. Immediately after filling the tank spreader, use a clean plastic pail to collect manure from the unloading port or the opening near the bottom of the tank. Be sure the port or opening does not have a solids accumulation.

2. Ensure that the manure in the pail is well-stirred and immediately fill a one-quart plastic sample bottle to within one inch from the top. Only one sample is necessary for liquid manure.

3. Be sure to put your name, date, and storage pit identification on the bottle.

4. If the sample cannot be transported to a laboratory within a few hours, it should be frozen. Place the partially-filled container in a tightly sealed bag and store it in a freezer until it can be taken to the laboratory.

Liquid Manure Applied by Irrigation Systems

1. Place catch pans or buckets randomly in the field to collect liquid manure that is land applied by an irrigation system. Inexpensive aluminum roasting pans or plastic buckets can be used as catch pans (see Figure 2).

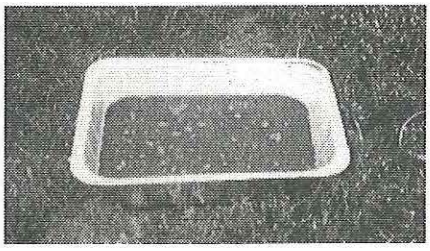

Figure 2: An aluminum baking pan used to catch manure samples from liquid tank spreaders and irrigation equipment. (Photo courtesy of University of Arkansas Cooperative Extension Service).

2. Immediately after the manure has been applied, collect manure from catch pans or buckets and combine the manure in one bucket to make one composite sample.

3. Mix the manure well and fill a one-quart sample bottle to within one inch of the top. Ensure the bottle is sealed tightly and labelled. Place the sample bottle in a tightly sealed plastic bag. If immediate shipment to a laboratory is not possible, refrigerate or freeze the samples.

Sampling from Storage Facilities

Sample manure as close as possible to the time of land application and preferably at the time manure is land applied. If time and management practices prevent this, collect manure samples from the storage facility. This, however, is not recommended due to safety factors in collecting a liquid sample and the inability to collect a representative sample of both liquid and solid manure.

Dry or Solid Manure

Open Paved Lots

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

1. Collect manure by scraping a shovel across approximately 25 feet of the paved feedlot. This process is repeated six to eight times. (See Figure 3).

2. Then, use the shovel to thoroughly mix manure by continuously scooping the outside of the pile to the center of the pile.

3. Collect a sample using the hand-and-bag method that was described in the section on dry or solid sample preparation.

4. Repeat steps one through three to obtain remaining subsamples, which should be collected from various areas around the feedlot representing the bulk of the lot's manure. Avoid manure that is excessively wet (near waterers) or contains large amounts of feed and hay.

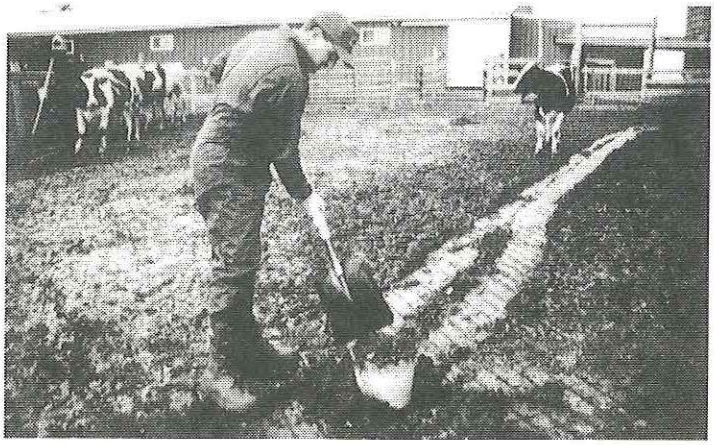

Figure 3: Collecting manure samples from a lot.

Barn Gutter

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

1. Shovel a "core" of manure from the gutter to the depth of the gutter.

2. Remove manure from the gutter and pile it on the barn floor. Mix the manure by hand (wearing freezer bags or rubber gloves) with a kneading motion. This ensures that straw is mixed thoroughly with manure. When collecting samples from a gutter, be sure to include the liquid that accumulates in the gutter's bottom.

3. Collect a sample using the hand-and-bag method that was described in the section on sample preparation.

4. Repeat steps one through three from various locations along the gutter to collect the subsamples. Discard foreign material such as disinfecting towels.

Dry Stack

Manure stored outside in a solid waste storage facility—usually a stacking shed or horizonal concrete silo located aboveground—is classified as dry stack. These facilities are usually covered to prevent the addition of extra water.

1. Remove manure from several 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 near the outside walls.

2. Thoroughly mix manure with the shovel by continuously scooping the outside of the pile to the center of the pile.

3. Collect a manure sample using the hand-and-bag method described in the section on dry or solid sample preparation.

4. Repeat steps one through three to collect the remaining subsamples.

Liquid Manure

Liquid manure is more difficult to sample than dry manure. Use caution to prevent accidents—such as falling in the manure or being overcome with hazardous gases produced by manure. For these reasons, collecting liquid manure samples from the storage facility is not recommended. Instead, follow the guidelines given earlier in this publication for sampling liquid manure during land application.

Additional Considerations

Laboratory Analysis

Manure samples should be sent to a lab for chemical analysis as quickly as possible to avoid nutrient losses. Basic manure analyses determined by the laboratory includes total Kjeldahl nitrogen (TKN), phosphate (P_2O_5), and potash (K_2O).

Results from commercial laboratories are presented as a percent of the sample weight, as pounds per ton or in pounds per 1,000 gallons of manure. In any case, manure values from commercial laboratories express nutrients as the total amount of nutrient available in the manure sample. Primary nutrients (N, P, and K) are not all available for plant growth the first year manure is applied. A portion of some nutrients is present in manure in an organic form and unavailable for plant uptake. Organic nutrients require transformation to an inorganic state to be available for plant uptake.

This transformation is dependent on temperature, moisture, chemical environment, and time. Availability of nutrients can be limited by field losses, which are affected by type of manure and by manure application methods. These losses are not accounted for in laboratory results. Refer to ISU Extension publication PM-1164 for mineralization rates and losses due to types of manure application.

Equipment Calibration

Determining manure application rate is just as important as having manure tested for nutrients or using table values for nutrient credits. Manure spreaders and irrigation equipment can be calibrated in order to determine the amount of manure applied. Experience suggests that nutrients are often over-

applied due to miscalculation of how much manure is distributed, not necessarily because the manure's nutrient content was unrecognized. It's only after spreaders are calibrated that nutrient analysis will effectively help producers manage animal wastes as a fertilizer source. Contact extension and private sector agronomists to help interpret manure analyses and to determine actual field application rates of different types of handling equipment.

References:

Killorn, R. 1984. *Animal Manure: A Source of Crop Nutrients.* Pm-1164. Iowa State University.

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