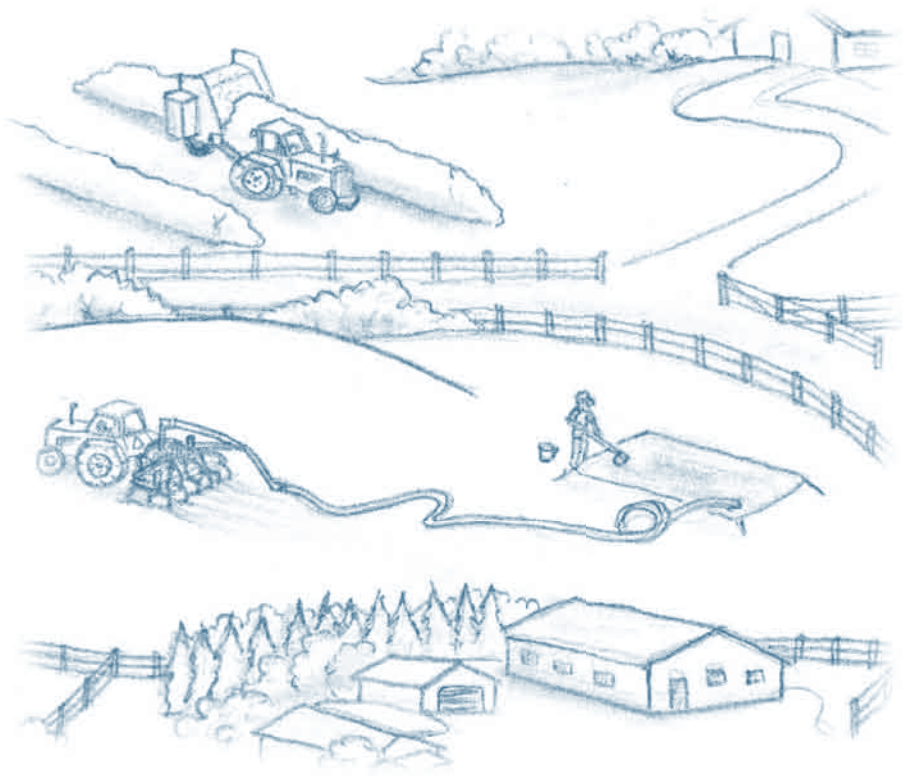
Chapter 4.2
Manure Sampling



learning objectives

- Briefly explain why sampling is preferred over book values for manure nutrient content.
- Develop a manure sampling strategy that addresses sources of variability in manure nutrient content.
- Take representative samples of liquid and solid manure.
- Properly handle and ship manure samples to a lab for analysis.
- List the recommended lab analyses for all manure samples.

more info

The commonly used standard values for manure nutrient content in Alberta appear in the AOPA Manure Characteristics and Land Base Code published by AF. This publication can be obtained from the publications office of AF by calling toll free 1-800-292-5697 or searching Ropin' the Web.

Important Terms

Table 4.2.1 Key Terms and Definitions

Term	Definition
Dilution	The process of making weaker or less concentrated, by the addition of water.
Re-suspend	To mix or agitate a solution (liquid manure) so as to mix the solid material back into suspension.
Spatial Variation	The variation in properties (i.e., nutrient content and manure consistency) laterally across the manure pile or storage, or vertically downward through the manure pile or storage.
Stratification	The formation of layers of sediment and nutrients in a liquid manure storage. The various materials separated out because of differences in size and density.
Temporal Variation	The variation in properties (i.e., nutrient content and manure consistency) that occurs with time in the manure pile or storage.
Total Kjeldahl Nitrogen	This is the amount of total nitrogen contained in an organic material (i.e., manure or soil) as determined by the 'Kjeldahl' digestion method.

To determine an appropriate manure application rate, it is critical to know the nutrient content of manure. This will help meet crop requirements, maximize yields, minimize environmental impact and optimize economic benefit.

Manure Sampling Versus Book Values

Nutrient content of manure is determined from book values or lab analysis. Manure nutrient composition varies widely between farms due to a host of factors such as: differences in animal species, bedding and feeding practices and type of manure (solid or liquid). Book values may not reflect the nutrient composition of individual farms. Therefore, the only way to get reliable, farm specific estimates of manure nutrient content is by sampling and lab analysis (Table 4.2.2).

Table 4.2.2 Variability in Analysed Nutrient Content of Manures Compared with Book Values.

Manure Type	Data Source	Total Solids (%)	Total N (%)	Total P (%)
Dairy	MWPS[1] (book value)	8.0	0.39	0.19
	Source 1	6.7	0.31	0.11
	Source 2	8.3	0.36	0.15
	Source 3	10.3	0.50	0.21
	Source 4	5.6	0.34	0.13
Swine	MWPS (book value)	1.0	0.06	0.04
	Samples	0.61	0.17	0.03
Poultry	MWPS (book value)	75.0	2.35	2.40
	Samples	66.5	3.02	2.69

[1] Midwest Plan Service 1993

Adapted from Dou et al. (2001)

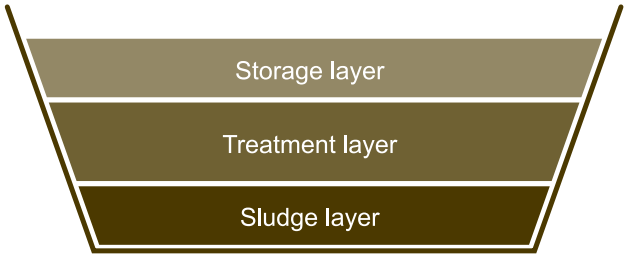
Sampling Strategies and Manure Variability

Proper manure sampling will ensure the most accurate manure analysis. Manure samples must represent the average nutrient composition of the manure being applied. Two factors influence this:

- Changes in manure composition through time (i.e., temporal variation) as a result of volatilization, precipitation, drying and other natural processes.
- Variation within a pile or storage facility (i.e., spatial variation).

Changes in manure composition through time can be addressed by sampling as close to the time of application as possible (i.e., prior to or during application). This is particularly true for uncovered lagoons and pits, which are subject to seasonal variations in temperature and precipitation. In contrast, manure from under-barn concrete pits or covered aboveground tanks receive limited exposure to environmental influences and vary little between applications.

The nutrient content of solid manure can vary from one part of the pile to another. This variation depends on the distribution of bedding materials and the depth of the dried surface layer. The nutrient content of liquid manure can be variable due to solids settling with time, referred to as nutrient stratification (Figure 4.2.1). If variability is not addressed, manure analyses will not be representative of the nutrient content of the manure being applied. This could result in management decisions that lead to over or under nutrient application for crops, and potential loss of revenue.



Adapted from Zhang et al. (not dated)

Figure 4.2.1 Stratification of Nutrients in a Liquid Manure Storage Facility

Differences in nutrient content throughout a manure pile can be addressed by using proper sampling procedures. To select an appropriate sampling strategy, it is important to consider the advantages and disadvantages of sampling before and during manure application (Table 4.2.3).

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Changes in nutrient content of stored manure occur slowly. A delay of 30 to 60 days between sampling and application will result in minor changes in nutrient content of the manure; therefore, there may be no need to resample.

sidebar

Sampling during application can account for changes in manure composition due to nutrient conversions, evaporation, and dilution.

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Generally, total N and P concentration increases with depth, whereas K concentration decreases.

Table 4.2.3 Advantages and Disadvantages of Sampling Manure Before or During Application

Parameter	Sampling Strategy	
	Sampling Prior to Application	Sampling During Application
Timeliness of Test Results	☑ Manure test results can be used to calculate this year's application rates.	☒ Cannot use analysis of samples collected during spreading to calculate this year's application rate.
Accuracy of Analysis	☒ Manure tests may not be accurate or representative because manure is not thoroughly mixed.	☑ Manure tests will be more reliable because sub-samples can be collected as the manure is being applied, getting a more representative sample.
Difficulty in Collection	☒ Large equipment or agitation may be required to get a representative sample from manure storage.	☑ Minimal time required to sample during application.
Safety	☒ Sampling from storage facilities, especially lagoons or tanks, can be dangerous due to the risk of falling in or being overcome by gases (H_2S and NH_3).	☑ Sampling from application equipment reduces risk of falling in or being overcome by gases (H_2S and NH_3).

Sampling Strategy in Relation to Planning Application

Manure nutrient content and fertility recommendations are used to calculate manure application rates and additional fertilizer requirements. The benefit of manure sampling before application is the availability of test results to calculate application rates prior to application. The limitation is that the analysis may not be representative because the manure is not well mixed. An accurate analysis of manure nutrient content will yield a more reliable manure application rate.

When samples are collected during application, test results will not be available to calculate application rates for the current application. Rather, historical analyses (if available) or book values can be used to calculate the rate for the current application (Figure 4.2.2). When sampling during application, the current year's analysis has two purposes:

- Used to verify nutrient application rate and determine if additional fertilizer inputs are needed.
- Used to calculate manure application rates in subsequent years.

Three to five years of manure analyses should provide enough information to develop reliable estimates of average manure nutrient content for an operation. Historical analyses will provide a more representative manure nutrient profile to calculate manure application rates for a specific operation compared to book values. Once historical averages have been developed, there is less of a need for annual manure sampling. However, if any component of the animal management, manure storage or handling system substantially changes, new historical averages will need to be developed.

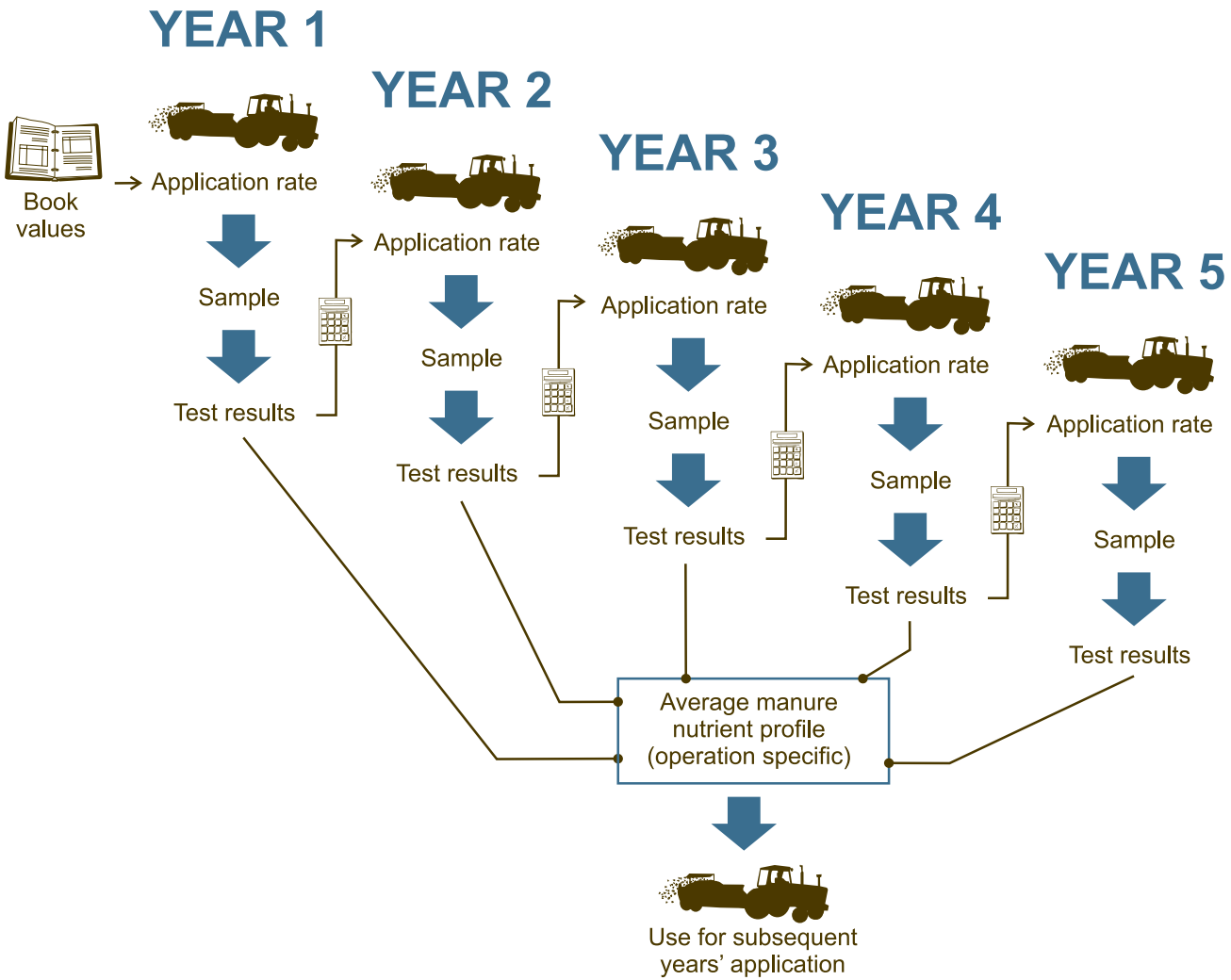


Figure 4.2.2 Sampling During Application and Nutrient Management Planning

more info

For more information on air quality in barns and managing hazardous gases found in liquid manure storage facilities, check out these factsheets, which can be obtained from the publications office of AF by calling toll free at 1-800-292-5697 or search by Agdex number or title on Ropin' the Web.

- **AF. 2004. Air Quality Resources for Alberta Livestock.**
- **AF. 2004. Hydrogen Sulfide Emissions and Safety. Agdex 086-2**
- **Ontario Ministry of Agriculture, Food and Rural Affairs. 2004. Hazardous Gases. Agdex 721. (www.omafra.gov.on.ca/english/engineer/facts/04-087.htm)**

tip

Use only plastic buckets for collection and mixing of manure samples. Galvanized steel buckets can affect the results of the lab analysis for micronutrients. Do not use glass containers for sampling or shipping sub-samples due to the risk of breakage and personal injury.

tip

Avoid sampling un-agitated liquid storage facilities. It is extremely difficult to get a representative sample of the lagoon sludge layer without agitation.

Sampling Techniques for Liquid Manure

Before sampling, consult the manure-testing laboratory on lab-specific requirements for sample size, packaging and shipping, turn-around times, analytical options, and costs. Some labs provide containers, labels and submission forms for manure samples, and may cover the shipping costs depending on the number of samples submitted. A list of labs that analyze soil and manure samples is presented in Appendix 3.

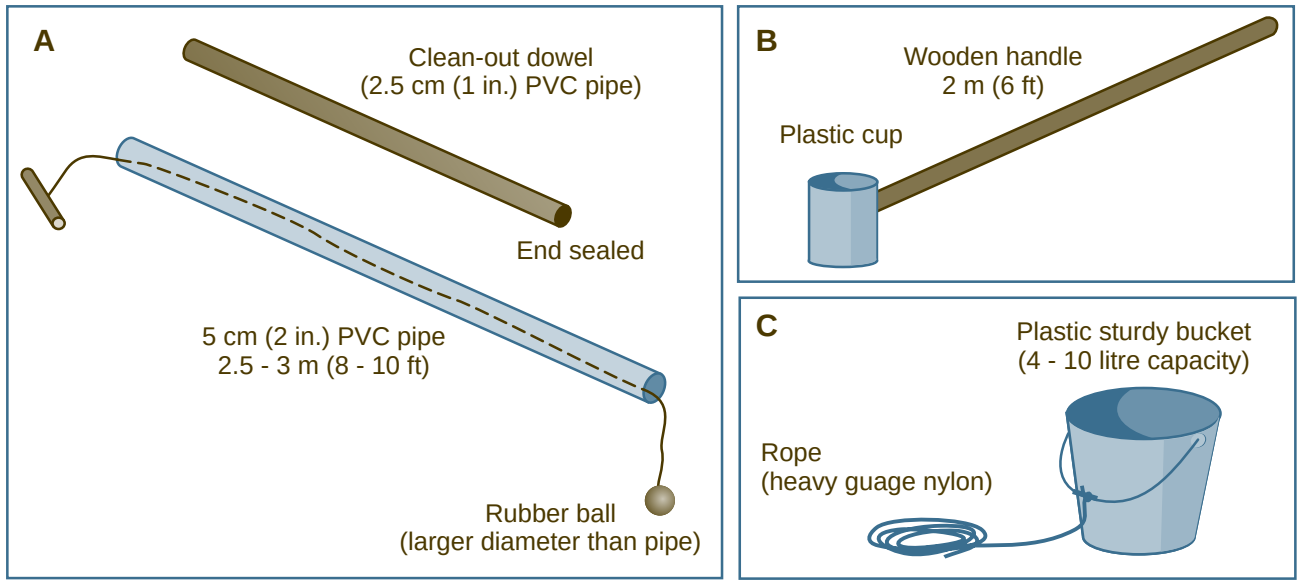
Sampling During Application

Assemble the following equipment:

- 20 L (5 gal) plastic pail
- small collection can, pole and cup device (Figure 4.2.3), small bucket, or pan
- clean, plastic bottle with a screw-on lid

Hazards Associated with Liquid Manure Storage Facilities

Liquid manure storage facilities present several hazards to personal safety. Gases such as hydrogen sulphide (H_2S) and ammonia (NH_3) can cause symptoms ranging from headaches and eye irritation to death depending on length of exposure and gas concentration.



Adapted from Coffey et al. 2000

Figure 4.2.3 Liquid Manure Sampling Devices: (a) Composite Sampling Device, (b) Pole-and-Cup Sampling Device, (c) Bucket with Rope

Follow the steps below to get a representative sample during application.

Sampling Liquid Manure During Application

1. If sampling from the flow of manure as it is being pumped from storage into the applicator, take several samples from the pump outlet.

   If sampling from a drag hose system or tank spreader in the field, collect samples from the injectors as they are lifted from the ground or from a tap near the pump.

   If sampling from broadcast spreaders or irrigation applicators, use buckets or catch pans randomly placed in the field. This method of collection provides a good picture of N loss through volatilization during surface application.

2. Combine all samples into one composite sample, in a 20 L (5 gal) pail or other plastic container, and mix thoroughly.

3. Withdraw a sub-sample from the pail and put it into the plastic bottle. Ensure the bottle is no more than two thirds full to allow for expansion from manure gas or if the contents are frozen (if freezing is required prior to shipping for analysis). Secure the lid to prevent leakage.

4. Label the plastic bottle with the date, time, farm name, and manure type, and seal in a plastic bag in case of leakage. Keep sub-samples cool and transport immediately to the lab for processing. If samples cannot be transported on the day of collection, freeze them until transport is possible to stop nutrient transformation reactions and the buildup of gases.

Sampling from Storage

If sampling from a multi-stage storage system, only sample the lagoon to be emptied. When taking a sample directly from a liquid storage facility, make sure the material is thoroughly agitated for two to four hours using an agitation pump or other equipment designed for this purpose. Agitation mixes the different layers and re-suspends the nutrient-rich sludge layer.

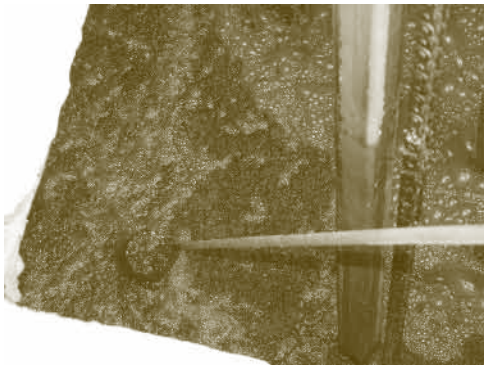
Assemble one of the sampling devices described in Figure 4.2.3. Collection from storage will also require:

- 20 L (5 gal) plastic pail or larger plastic garbage can
- clean, plastic bottle with screw-on lid

Follow the steps below to get a representative sample from a storage facility.

tip

Avoid sampling at the beginning and end of pumping, as these samples are less reflective of the storage than those taken midway through the pumping process. A good rule of thumb is to collect one sample for approximately every 1,000,000 L pumped.



Sampling Liquid Manure from a Storage Facility

1. Toss the bucket or extend the sampling device (composite or pole-and-cup) into the lagoon at least two metres (6 ft) from the edge. If using the bucket-and-toss method, begin quickly pulling the bucket back to the bank as soon as it breaks the surface of the liquid, pulling it through the top 30 cm (12 in). If possible, avoid collecting any floating debris or scum remaining on the surface after agitation.

   If using the composite sampling device, extend it far enough to collect a column of manure and then seal off the tube using either a ball plug on the bottom (attached to a handle at the top) or by covering the top of the pipe with a hand to create an air lock.

2. Empty the sample into the 20 L (5 gal) pail or garbage can. If using a composite sampling device, place the end of the pipe into the 20 L (5 gal) pail and release the airlock or ball plug to empty the pipe. Depending on the size of the bucket used (bucket-and-toss), a plastic garbage can may be required to collect and mix samples.

3. Move around the lagoon and repeat the above procedure eight to 12 times (four to six times if using bucket-and-toss method) to obtain samples from various locations around the perimeter of the lagoon. Mix collected samples thoroughly in a plastic pail.

4. Refer to steps 3 and 4 in the procedure for sampling liquid manure during application for sub-sampling and handling instructions prior to shipping.

Sampling Techniques for Solid Manure

When sampling manure, take note of visible variations in moisture and bedding. When considerable variation is observed, multiple composite samples should be taken and sent for analysis. This will ensure that test results reflect the average for the entire source. Avoid sampling from areas where moisture and bedding is considerably different from the average of the pile.

The following section outlines procedures for:

- In-barn sampling of poultry litter
- Sampling during application
- Sampling stockpiles

In-Barn Sampling of Poultry Litter

The composition of dry litter can vary throughout the barn. For instance, material under feeders and waterers is different than that material against the walls. Consider these differences when devising a strategy for collecting samples. There are two suggested methods for in-barn sampling of poultry litter: the point and trench methods.

Assemble the following equipment:

- 20 L (5 gal) plastic pail
- wheelbarrow
- narrow, square-ended spade or solid manure-sampling probe (Figure 4.2.4)
- tarp or piece of plywood
- one or more large plastic re-sealable freezer bags

Follow these steps when using the point method to sample poultry litter:

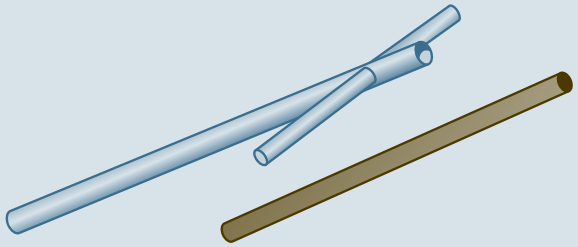
Point Method for In-Barn Sampling Poultry Litter

1. Assess the appearance of the litter pack in the barn. If there are visible differences in composition in certain areas, collect a proportionate number of samples to represent these areas. For example, if the area under feeders represents 10 percent of the barn area, ensure 10 percent of the samples are from these areas. Use the zigzag sampling pattern (Figure 4.2.5).

2. Randomly collect 15 to 20 samples of equal amount with a spade or solid manure-sampling device from the litter pack down to the depth the litter is to be removed. To collect the samples, clear a small trench the width of the spade and the depth of the litter. Take a 3 to 8 cm (1 to 3 in) slice of litter the entire depth of the trench as a sample (Figure 4.2.6). Place each sample in a plastic pail or wheelbarrow.

3. When you have collected 15 to 20 samples, thoroughly mix samples in the pail or wheelbarrow or on a tarp or piece of plywood. Collect a sub-sample from this mixture, and fill the plastic bag two thirds full to allow for gas expansion. Force the excess air from the bag, seal and double bag.

4. Label the bag with important information including date, time, farm name, manure type, and any other information requested by the testing lab.



Adapted from Coffey et al. 2000, Shaffer and Sheffield (not dated)

Figure 4.2.4 Solid Manure-Sampling Probe

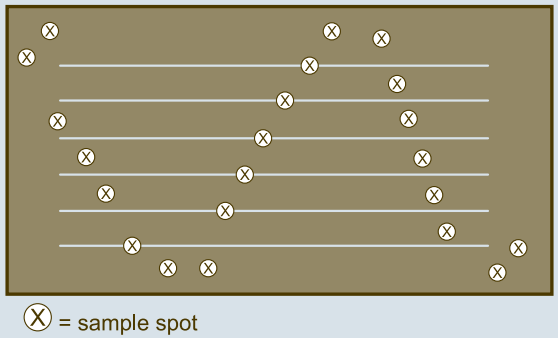


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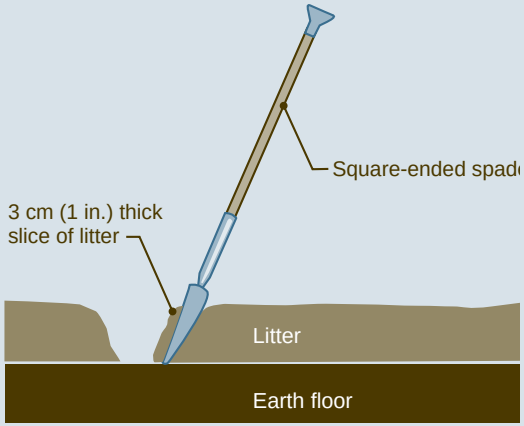
Figure 4.2.5 Zigzag Sampling Pattern (parallel feed and water supply lines run lengthwise)



Adapted from Coffey et al. 2000

Figure 4.2.6 Point Sampling Procedure

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The point and trench methods strive to collect samples that represent the litter pack throughout the entire barn.

tip

Be careful not to collect soil from beneath the litter in barns with earthen floors when sampling. The soil will skew the nutrient content reported in the manure analysis.

Follow the steps below when using the trench method to sample poultry litter.

Trench Method for In-Barn Sampling of Poultry Litter

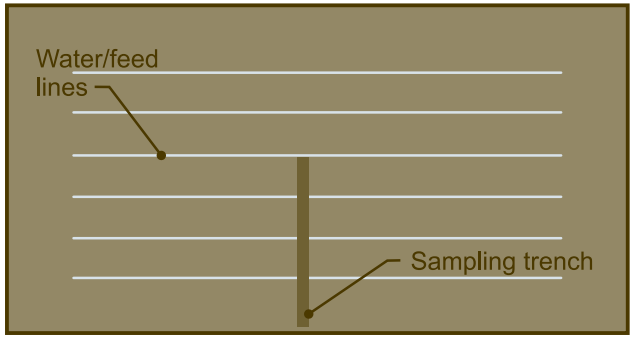
1. Starting at the centre line of the barn, dig a trench 15 cm (6 in) wide to the sidewall of the barn (Figure 4.2.7). If feed and water lines run parallel, dig the sampling trench perpendicular so that litter under these areas are adequately represented in the sample. If the barn has an earthen floor, avoid collecting soil with the sample.

2. Place all litter removed from the trench into the wheelbarrow. If the amount of litter collected exceeds the capacity of the wheelbarrow, each time the wheelbarrow is two-thirds full, thoroughly mix the material and remove one shovel full and add it to the 20 L (5 gal) pail. Empty the remaining litter from the wheelbarrow.

3. Continue collecting (and sub-sampling as necessary) until the trench reaches the opposite wall.

4. Thoroughly mix the material collected in the pail. Collect a sub-sample from this composite mixture and fill the plastic bag two thirds full to allow for gas expansion. Force excess air from the bag, seal and double bag.

5. Label the bag with the date, time, farm name, manure type and any other information requested by the testing lab.



Adapted from Coffey et al. 2000

Figure 4.2.7 Trench Sampling Method

Sampling During Application

Sampling during application is easier and safer than trying to sample from a pile.

Samples should be taken to reflect variability in the material being applied. If manure being applied comes from several sources (e.g., piles, barns, corrals) composite samples should be developed for each source. The number of composite samples required to get an accurate representation of the manure depends on the variability of the material and the volume to be applied. For volumes less than 1000 tonnes or material of consistent composition a single composite sample may be required. A minimum of three composite samples should be collected for manure volumes greater than 1000 tonnes.

Samples should be collected throughout the manure application process (i.e., beginning, middle and end). In situations where manure application can take several days (e.g., feedlots), separate composite samples can be prepared for each stage of the process or even for each day. When samples are taken over a span of several days, interim storage and handling of samples becomes important. Be sure to protect sampled material from the elements to minimize moisture and nutrient (e.g., N) changes.

It is recommended that 15 to 20 samples be collected to form each composite sample. Sub-samples from each composite sample are taken and combined to form a single composite sub-sample, which is sent for analysis. Alternatively, each of the sub-samples can be sent for separate analysis. This may allow more site-specific nutrient management planning, particularly if the field that received manure represented by a specific composite sample (particular day, source or stage of the application process) was recorded.

There are two strategies for sampling manure during application: during loading of application equipment, or as manure is being applied. In either case, the following equipment is required:

- 20 L (5 gal) plastic pail or larger plastic garbage can
- wheelbarrow
- shovel, pitchfork or solid manure-sampling probe (Figure 4.2.4)
- several tarps, plastic sheets or a piece of plywood
- one or more large plastic freezer bags

Sampling Solid Manure During Loading

1. Collect several grab samples from selected loads using a shovel, pitchfork or sampling probe. These grab samples will count as a single sample for that load. Avoid large chunks of bedding.

2. Place grab samples in the wheelbarrow. If the amount of manure collected exceeds the capacity of the wheelbarrow, each time the wheelbarrow is two-thirds full, thoroughly mix the material and one or two shovels full to the pail or suitable mixing area (tarp, plywood or concrete pad). Collect samples from 15 to 20 wheelbarrow loads if the material is relative consistent and representative of the manure applied for a particular day, source, or stage of the application process. For more variable material, a greater number of loads may need to be sampled or more composite samples may need to be collected.

3. To sub-sample, begin by thoroughly mixing material collected in the pail or from the mixing area with a pitchfork or shovel. Break up any large clumps.

4. Divide the well-mixed manure into four portions and then discard two of the four portions. Combine the remaining two portions and mix.

5. Repeat step 4 until approximately 0.5 kg (1 lb) of material remains. This will be the composite sub-sample for analysis.

6. Place the composite sub-sample in a plastic bag filled two-thirds full to allow for gas expansion.

7. Squeeze excess air out of the bag, seal and double bag to prevent excessive odour and leaking.

8. Label bag with date, time, farm name, manure type, and any other information requested by the testing facility.

9. Keep bagged composite sub-samples cool and ship immediately to the lab. Store samples that cannot be delivered immediately in a freezer.

10. Repeat steps 1 to 3 until all manure has been applied.

tip

For severely weathered piles, it is best to sample during application rather than trying to obtain a representative sample. The weathered exterior of uncovered manure piles does not accurately represent the majority of the material in the pile. Rainfall generally moves water-soluble nutrients down into the pile while volatile compounds generally gas-off the weathered exterior.

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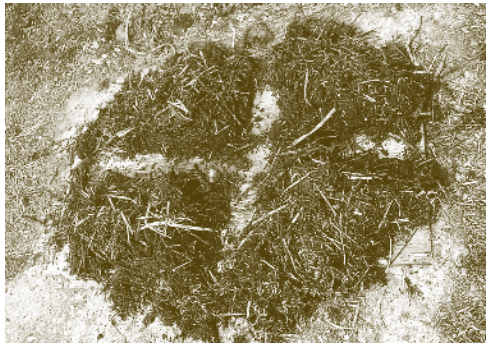
Nutrient content should stabilize within two weeks of creating a new pile or turning an existing pile.



Solid manure can also be collected during field application. Send a minimum of three or more composite sub-samples for analysis per field, depending on the size of the area. Although messy, this method has the added benefit of being more accurate because any N lost through volatilization during surface application will not be included in the samples.

Sampling Solid Manure During Application

1. Divide the area to receive manure into sample collection zones according to the planned pattern of application. Place several (five to six) tarps in each zone such that they catch the manure from several spreader passes across the field (Figure 4.2.8). Manure collected on tarps in each zone of the application area serves as the basis for building composite-sub-samples for analysis.

2. Thoroughly mix the manure sampled from each tarp. Depending on the size of the tarp, take two to three samples using the shovel or pitchfork from each tarp and place them in the wheelbarrow. Avoid larger pieces or chunks of bedding.

3. If the amount of manure collected exceeds the capacity of the wheelbarrow, each time the wheelbarrow is two-thirds full, thoroughly mix the material and remove one or two shovelfulls to the pail or suitable mixing area.

4. Collect samples from all collection zones and take this material to the designated mixing area (tarp, plywood or concrete pad). Follow the method described in “Sampling Solid Manure During Application”, steps 3 to 9, to develop a composite sub-sample of solid manure.

5. Repeat steps 1 through 4 for all sample collection zones.

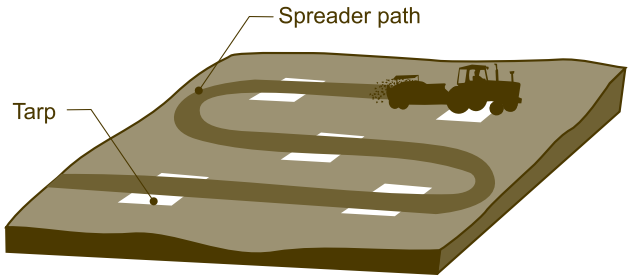


Figure 4.2.8 Tarp Placement for Collecting Solid Manure During Application

Sampling Stockpiled Manure

Stockpiles of solid manure, litter and compost are highly variable, so as a general rule, the more variable the stockpile of manure the more extensive the sampling strategy. Large, highly inconsistent piles require more extensive sampling compared to smaller, fresher or more consistent piles.

To get an accurate representation of most solid stockpiles, send away a minimum of three composite sub-samples based on samples taken from 10 to 15 points on the pile (i.e., three composite samples based on a total of 30 to 45 sampling points). If a portion of the pile is being applied, sample only that portion.

To obtain a representative sample from a solid manure storage facility, collect multiple sub-samples from throughout the pile when the nutrient content is fairly stable. Do not sample from freshly piled or turned manure unless it is going to be spread in the next few days.

Assemble the following equipment:

- 20 L (5 gal) plastic pail
- wheelbarrow
- shovel, pitchfork or solid manure-sampling probe (Figure 4.2.4)
- tarp, a piece of plywood or a concrete mixing area
- one or more large plastic re-sealable freezer bags

Repeat the procedure below for each of the three composite sub samples being sent for lab analysis.

Sampling Solid Manure or Compost from Stockpiles

1. Select 15 to 20 points on the pile uniform distances apart. Include sampling points in the centre of the pile or pack as well as near the edges. To get samples from the centre of a large pile, you may need to use a front-end loader and sample from material in the bucket of the loader.

2. At each point selected, remove the top crust layer until a fresh, moist surface is exposed. This layer may be as thick as 30 cm (1 ft) or more.

3. Use a pitchfork, spade, or manure collection probe to sample the pile to a minimum depth of 50 cm (20 in) into the pile. When sampling, avoid large chunks of bedding.

4. Deposit samples in a wheelbarrow. If the amount of manure collected exceeds the capacity of the wheelbarrow, each time the wheelbarrow is two-thirds full, thoroughly mix the material and one or two shovels full to the pail or suitable mixing area (tarp, plywood, or concrete pad).

5. Continue collecting until all 15 to 20 points selected on the pile have been sampled. Store samples in cool (e.g., shaded) location, or cover with a tarp until sampling is complete.

6. Follow the method described in “Sampling Solid Manure During Loading”, steps 3 to 9, to develop a composite sub-sample of solid manure.

7. Repeat steps 1 through 6 until the appropriate number of sub-samples has been collected.

Handling and Shipping Samples

Large, re-sealable freezer bags are generally suitable for solid manure, while one-litre plastic bottles with airtight closures are acceptable for liquid manure samples. Take measures to prevent leakage by ensuring a tight seal on the bag or container and double bagging as an extra precaution.

Take the following precautions when handling manure samples for analysis:

- Fill liquid manure containers no more than two-thirds full to provide air space in the container for manure gases and to allow for expansion if the contents are frozen.
- Keep samples cool by refrigeration or placing on ice until they are transported to the lab. Do not allow the samples to sit in a warm environment such as the dashboard of the truck or trunk for longer than a few hours.
- Transport samples within a day. If this is not possible, freeze samples until they can be shipped.
- Ensure samples spend no more than two days in transit.
- Clearly label all samples with a permanent marker. Samples should be labeled with a minimum of farm name, contact information, date and time the sample was collected and type of manure.

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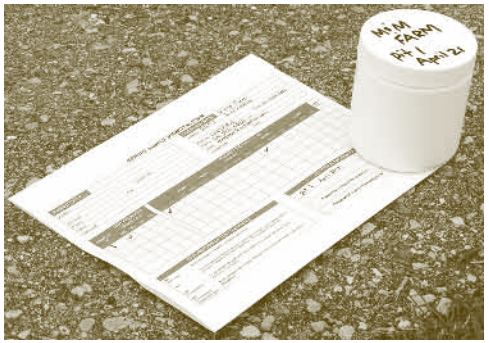
Elevated temperatures promote microbial activity and can result in nutrient conversions that alter the analyzed nutrient content of the sub-sample.



Recommended Analyses for Manure Samples

Laboratories offer a variety of tests and analyses packages for manure (costs can vary). The recommended tests for nutrient management planning purposes include:

- moisture content, dry matter content, or total solids
- total N (Total Kjeldahl Nitrogen TKN)
- ammonium N (NH_4-N)
- total P
- total K

Optional tests for manure samples include: nitrate-nitrogen (NO_3-N), pH, total carbon or carbon to nitrogen ratio (C:N), electrical conductivity, chloride (Cl), sulphur (S), sodium (Na), calcium (Ca), magnesium (Mg) and micronutrients such as copper (Cu), manganese (Mn), zinc (Zn) and iron (Fe).

It is usually not necessary to analyze manure for mineral constituents such as Ca, Mg, Zn and boron (B). Most manure contains significant quantities of these minerals and fields with a history of manure application are rarely deficient.

summary

- Manure book values may not reflect the nutrient composition of individual farms because nutrient composition varies widely. The only way to get reliable, farm specific estimates of manure nutrient content is by sampling and lab analysis.
- Changes in manure composition with time can be addressed by sampling as close to the time of application as possible. Differences in nutrient content throughout a manure pile can be addressed by using proper sampling procedures.
- To obtain a representative manure sample, collect manure from throughout the storage or throughout the application process. Sample liquid manure only after thorough agitation.
- Ensure that samples sent for analysis are handled appropriately: fill liquid manure containers only two-thirds full, keep samples cool, transport samples within a day and clearly label all samples.
- The key analyses to request from the testing facility include: moisture content (or dry matter/total solids content), total N (Total Kjeldahl Nitrogen), NH_4-N and total P.