Taking a Compost and a Solid Manure Sample

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THE IMPORTANCE OF SAMPLING COMPOST AND SOLID MANURE

Compost and solid manure are nutrient-rich resources that can be used as soil amendments. There are many benefits to utilizing compost and manure, such as converting a waste product on-farm, therefore, reducing off-farm nutrient losses, reducing fertilizer input costs by using on-farm amendments, and increasing soil health such by increasing soil organic matter leading to improved aggregate stability, water holding capacity, and cation exchange capacity.

One of the most important practices when applying compost and solid manure is taking samples for analysis. The greatest barrier to effectively using the nutrients in manure or compost is not knowing what is in the material, and compounding this is the variability of the material itself. "Book values" for nutrients in manure, calculated from the results of many lab analyses, are a place to start, but they may not match what is in your pile or your pit very well. Collecting and analyzing samples from your manure or compost will give you confidence in the nutrient credits for those materials, as analysis results will provide a more comprehensive understanding of the C:N ratio, pH, dry matter, and plant essential nutrients; however, only if the sample submitted to the laboratory represents what is actually applied to your fields. This means understanding the sources of variability in your manure. This factsheet will outline sampling strategies and techniques for compost and solid manure to ensure representative samples.

Figure 1: Aerial view of manure application

SOURCES OF VARIATION IN MANURE AND COMPOST

Before you sample, it is important to know the characteristics of your manure or compost sources because of the variability. Variability in manure and compost can come from (1) manure/material source, (2) age, and (3) handling and storage.

1. **Manure/Material Source** – The most obvious differences are between livestock species. Chickens and cows eat very different diets, so the materials excreted out is also different. Poultry and pig diets may look similar, but the way they process the feed is quite different, and so is the nature of the manure. The manure that is applied to land is not just the urine and feces excreted by the livestock but also contains spilled feed, bedding material, wash water, and if the material is stored outdoors, rainwater. The management systems in place for different species will influence the amount and type of additional materials in the manure.

Figure 2: Windrow composting system

2. **Age** – Knowing the age of your manure or compost is crucial because it indicates the state of decomposition. Younger compost will likely have a higher pH, lower available nitrogen, and a stronger odour (NSDA, 2010). Within species and management systems, the manure can change over time. Forage quality may change over the seasons or from year to year, leading to changes in nutrient excretion. There is generally more consistency in the diets of livestock or poultry fed complete rations, but the amount of dilution in storage lagoons will vary with precipitation. The amount and type of bedding material may change over time, leading to nutrient concentration and dry matter content changes.

3. **Handling and Storage** – There is also spatial variation introduced by how manure is handled and stored. Solid manure, particularly from bedded pack systems, will have uneven mixing of manure and bedding materials, and this can be either mitigated or exaggerated if the packed manure is moved to secondary storage. Stacked manure will lose nutrients and moisture from outside the pile due to exposure to the weather. Composted manure will tend to be less variable because of the mixing occurring as the windrows are turned, but even in these systems, there will be differences from the outside to the inside of the windrow.

PLANNING THE SAMPLING AND ANALYSIS PROGRAM

The goal of your sample collection is to represent the manure that will be applied to your fields, so you will need to consider both the variability of the manure or compost and the end use. On-farm composted manure, for example, will only need analysis for nutrient content if it is to be applied to your fields but may require additional testing for heavy metal or pathogen concentrations if it is intended for sale as a soil amendment. There may also be specific protocols for sample collection for soil amendments; it would be wise to consult with a nutrient management specialist for this circumstance.

To reduce variability in the sample, taking multiple subsamples combined into one composite sample is recommended. The number of subsamples needed to make up a representative composite sample will depend on the variability of the material. Compost and solid manure can be more variable than liquid manure, so a larger number of samples across various parts of the pile are recommended (Modderman, 2021).

Sampling frequency will depend on the variability of the manure and any seasonal differences. Annual or semi-annual sampling is recommended for the first 3-5 years to develop a baseline of nutrient concentrations and should be taken at the same time each year. However, it is less frequently needed (every 4-5 years) after 3-5 consecutive years of sampling because farmers can estimate the application rate using the historical average nutrient values of the manure unless there are substantial changes in the manure types and manure management practices (Wallace, 2008).

Part of planning the sampling program is understanding which parameters will be analyzed (Table 1). Most samples will be used to determine what fertilizer credits to allow for the applied manure, so the major plant nutrients (N, P, K) should be included in each analysis. The dominant mineral form of nitrogen in both liquid and solid manure is ammonium (NH_4-N), and this determines how much of the manure N is immediately available to plants as opposed to organic N (determined as Total N minus NH_4-N), which is released as the organic materials break down.

Table 1: Parameters to analyze in a manure or compost sample

Minimum Recommended	Optional
Dry Matter (or Moisture Content) Total N NH_4-N Total P Total K	pH C:N ratio NO_3-N (compost only) Ca, Mg, S Micronutrients Heavy Metals* Pathogenic Bacteria*
*These parameters would only be measured for composted materials sold as soil amendments	

The optional parameters can provide useful information but are not as key as the macronutrient analyses. The pH of the sample can indicate the risk of ammonia volatilization from surface-applied organic materials. C:N ratio is an indicator of how much and how rapidly the organic N in the sample will mineralize. In finished composts, much of the NH_4-N has been converted to NO_3-N; this is also immediately plant available but is not included in the standard manure test. Knowing the levels of micronutrients as well as calcium, magnesium, and sulphur, is useful for targeting deficiencies and avoiding overapplication of these nutrients.

SAMPLING SOLID MANURE OR COMPOST

The best time to gather a representative sample of a pile of solids is during the spreading process when the center of the pile is exposed. While it would be desirable to have the analytical results before applying the material to land, there are few situations where it would be possible to collect a representative sample ahead of time. The exception might be for windrow composting, where samples can be collected as the windrow is turned; these samples would be reflective of the total nutrient concentration in the compost but will not reflect the changes in nitrogen forms that will occur during compost maturation (NSDA, 2010).

Step One: Gather the Required Materials

To take a proper sample, you will need the following:

- A shovel or spade for extracting and mixing,
- A clean flat surface (concrete or plywood) or a bucket (larger than one litre) where the samples can be accumulated and mixed,
- A plastic bag or container of appropriate size for shipping (one to two litres) to put the mixed sample into,
- A permanent marker to identify the sample on the container.

*Depending on where you send the sample, the ID requirements may differ, so reading the specific laboratory protocol is important

Step Two: Sample Collection

It is important that samples are well-mixed and representative of the entire pile/area. Using the shovel, take approximately 10-15 samples from different depths and locations within the pile, avoiding any extremely wet or dry areas, as well as the surface of the pile.

Combine these samples in a clean plastic bucket or on a clean flat surface and mix thoroughly. After mixing, divide this sample into quarters and discard three quarters.

Re-mix the remaining quarter thoroughly and divide and discard three quarters. Repeat this process until you are left with a sample that will fit into the shipping container. Place the sub-sample into a plastic bag or container of the volume specified by the lab (one to two litres). Be sure to tape the sample container shut and write on the container your name, the farm name, sample identifier, manure type (beef, dairy, poultry, or swine), date and time of sampling, contact information and address. It may be desirable to double bag the sample, in which case the sample information should be printed on the outer bag as well. Send the sample promptly to the lab for analysis. If this is not an option, freeze the sample to send later. Depending on what type of storage system you are sampling from, the protocol for taking a sample may vary; however, sticking to these general principles will ensure that a quality sample is being taken.

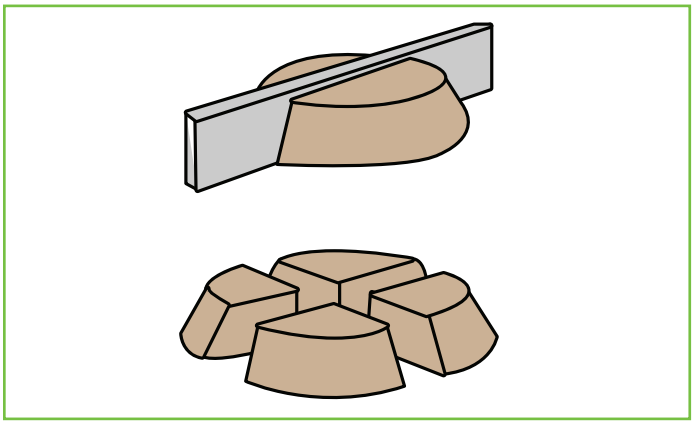

Figure 3: Conceptual diagram of manure subsample division

Sampling frequency will depend on several factors. Sampling should occur if:

- A new Nutrient Management Plan (NMP) has been done
- You are using a new source of compost or solid manure
- You don't have control over the source of compost or solid manure

Sampling timing should remain as consistent as possible:

- Ideally at the same time each year of sampling
- Ideally well before spreading to allow enough time for sample analysis

Step Three: Submitting Your Sample

You can submit your sample to Perennia Lab Services by using the correct submission form at **www.perennia.ca/analytical-lab**

It is important to be consistent in what lab is used for regular analysis. Upon receiving analysis results, producers can use these amendments to target the specific nutrients lacking in the soil and prevent overapplication of nutrients. This leads to more efficient, profitable, and sustainable nutrient management.

One the submission form, select this package:

(A1 package: DM, pH, N, C/N ratio, NH_4 -N, Ca, P, K, Mg, Fe, Mn, Cu, Zn, B, Na)
*Sample size: 2 L

CONCLUSION

Sampling compost and manure samples is an important step for better nutrient management on your farm. Upon receiving your results, it is important to know how to use the information to maximize the benefits of your compost or solid manure. The results should be used in conjunction with soil test results to identify appropriate amendment application rates. Contact your local agronomist to help calculate the available nutrients from manure and compost and the appropriate application rates.

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LAB CONTACT INFORMATION

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