Manure Sampling, Analysis & Interpretation

Accurate manure analyses are essential for proper nutrient management planning but manure analyses are only as good as the sample taken. Most manure testing laboratories request a pound or quart of sample and a very small amount of this sample is analyzed to determine the nitrogen (N), phosphorus (P) and potassium (K) content. Yet, the results are used to determine the nutrients applied across the whole farm for the spreading season. This fact sheet was developed as a guide for getting the most accurate N, P, and K quantities from your manure testing program.

When to Sample

Sampling from the manure spreader immediately after loading gives the most accurate representation of what is actually applied to the field. Sampling from the spreader also avoids the dangers of personal injury associated with sampling manure storages.

Figure 1: Manure samples taken from the spreader will lead to the most accurate estimates of the total amount of manure nutrients applied to the field (Photograph courtesy of University of Minnesota Extension).

How to Sample

Daily spread operations can sample by scooping manure out of the spreader with a pitchfork, shovel or plastic container. It is recommended to avoid large pieces or chunks of bedding and to select 5-10 sub-samples from different places in the spreader.

Stored solids in piles or bedded packs are highly variable and should either be mixed before spreading or have multiple samples submitted, each representing different sections of the pile or pack. For well-mixed piles one sample should be sufficient.

Liquid and slurry manure can be sampled from the manure loading or unloading port (see Figure 1). To avoid separation of solids, samples should be taken as soon as possible after loading (unless the spreader has an agitator).

Liquid manure (<4% solids) and well-agitated slurry (4 to 10% solids) can be sampled from one load during spreading events. It might require a minimum of 2 to 4 hours of agitation, often from multiple locations, to obtain uniform consistency in a slurry storage.

If a slurry storage is not well-agitated prior to spreading, separate samples should be taken at times when manure is pulled from the top, middle and bottom portions of the storage, or when the manure visibly changes in solids content (refer to Table 1). In these situations logs should be kept that can show to which fields manure from each section of the storage was applied.

Table 1: Manure sampling guidelines for different manure types and handling systems.

Manure type	When to sample	Minimum # of samples to submit
Daily spread solid	Once per year or more often as diet and bedding change	1
Daily spread slurry		1
Stored solid	Each major spreading event	1-3 or more
Stored agitated liquid or slurry	Each major spreading event	1
Stored non-agitated liquid or slurry	Each major spreading event	3 (top, middle, bottom)

Sludge that accumulates on the bottom of storages should always be tested and spread as a separate manure source.

For each collection method described, thoroughly mix 5 to 10 sub-samples in a 5 gallon plastic bucket, fill the sample container provided by the lab 2/3^{rds} full (to allow for gas expansion) and freeze (to slow down microbial activity). After the sample is frozen, send it to the laboratory. It is best to send samples early in the week to avoid weekend thawing in the post office.

How Often to Sample

If there are no previous sample records, samples should be taken at least twice during the first year and then every time the bulk of the manure is being spread. Sampling frequency can be reduced if results show low seasonal and yearly variability. However, New York Concentrate Animal Feeding Operation (CAFO) regulations require sampling at least once per year and corresponding to major spreading events.

Laboratory Manure Analysis Report

A manure sample should at a minimum be analyzed for:

- Total Kjeldahl nitrogen (TKN)
- Ammonium nitrogen
- Organic nitrogen
- Total phosphorus
- Total potassium
- Percent solids
- Bulk density

Most manure test results are reported "as is" or on a wet basis. If reported on a dry basis, multiply test results by the percent solids and divide by 100 to obtain nutrient content "as is". To determine manure N credits, both the ammonium N and the organic N content of the manure should be known (see Agronomy Fact Sheet #4). To determine fertilizer equivalents of manure P and K values should be reported in P_2O_5 and K_2O. To convert:

$P_2O_5 = P \times 2.27$ and $K_2O = K \times 1.2$

Interpreting the Analysis

Manure analyses can be reported in many different ways. Useful conversion factors from test results reported "as is" are:

- Lbs/ton = % * 20
- Lbs/ton = ppm * 0.002
- Lbs/1000 gallons = % * 83.4
- Lbs/1000 gallons = ppm * 0.00834
- Lbs/1000 gallons = 0.24 lbs/ton
- Lbs/ton = 4.17 lbs/1000 gallons

The laboratory may make these conversions or you can request that these conversions are included in the report. The Cornell Nutrient Analysis Laboratory offers manure testing with results reported on a wet basis in nutrients per 1000 gallons and per ton.

Using the Results

A running average of test results for each manure source should be used for nutrient management planning. If the solids content of a manure source varies widely, keep a running average of test results for each percent solid range: 1-2%, 3-4%, 5-7%, 8-10% 12-15% and >15%. A visual inspection of the solids content of manure at the time of spreading will let you know which average analysis to use to represent the manure being spread. If the nutrient needs of the crop are known and the spreader is calibrated (see Agronomy Fact Sheet #18), manure N, P and K can be applied with sufficient accuracy to meet crop needs.

Testing and recording yearly manure analysis can increase your understanding of the nutrient content of the manure. When coupled with calibrated manure spreaders, manure can reduce the need for fertilizers.

Additional Resources

- Nutrient Management Spear Program Agronomy Fact Sheet Series. http://nmsp.css.cornell.edu.
- Cornell Nutrient Analysis Laboratory. http://www.css.cornell.edu/soiltest/newindex.asp.

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information

Cornell University Cooperative Extension

Nutrient Management Spear Program
http://nmsp.css.cornell.edu

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