Western Dairy News
for the West, about the West, from the West

Make manure samples count

Obtain a representative sample, preserve according to laboratory recommendations, and deliver to laboratory before hold time expires.

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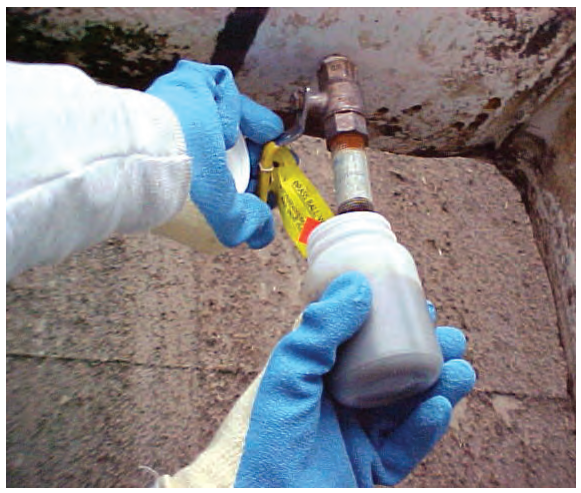

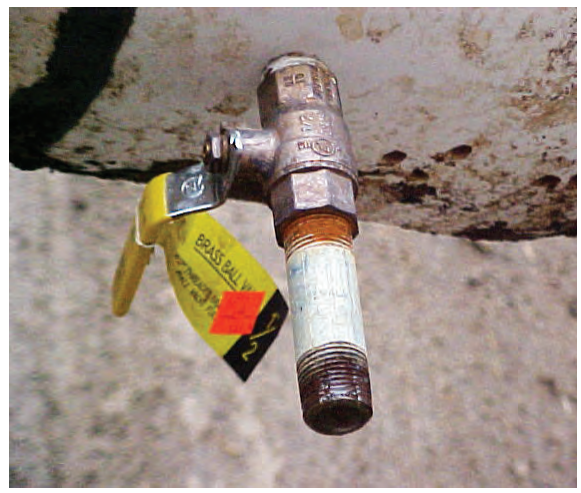

Obtaining a representative sample of liquid manure or slurry can be challenging. Most labs prefer that liquid samples fill the bottle to within an inch of the top. Installation of sampling ports with an attached hose can make sampling events much more pleasant.

Spring is in the air. Barn cleaning and planting isn't far behind. Hand in hand with these annual events is sampling manure sources for nutrients and completing paperwork needed for regulatory compliance. Each state may be different in regulatory requirements for documenting sampling and land application of manure, so it is important to understand your state's specific needs.

Following sample protocol should produce quality data. This is always money well spent and invested in the animal and farming operations. A good protocol will include some basic components:

1. How to collect a representative sample.
2. Appropriate types of container(s).
3. Sample preservation techniques.
4. Laboratory hold time.

Often protocols are written or prepared by a land grant university, the U.S. Department of Agriculture Natural Resources Conservation Service, or a regulatory agency. Sample each source of manure (heifers, cows, solids from separators, etc.) separately when previous records indicate there is a difference in the moisture or nutrient content of manures from these sources.

Be sure all the appropriate tools are available before heading out to collect the sample: sample containers, apparatus to direct collection of sample into bottle, plastic tarp, shovel, auger, chain of custody forms, field notebook for record keeping, ice and ice chest, labels for sample bottles, safety equipment (disposable gloves, safety goggles), permanent marker, appropriate lifeline and respiration gear if sampling is near a liquid manure storage structure or confined space.

Collect a representative sample

Different manure storage methods lend themselves to different sampling methods. The more variable the material is, the more difficult it is to collect a representative sample. The dry matter content of solid manure can be extremely variable, so it is important to collect many grab samples for subsampling into the composite sample.

Grab samples are collected via auger or shovel and are often placed in a large bucket. This material must be mixed in the bucket prior to removal of a composite sample. If materials cannot be mixed well in the bucket, pour the contents of the bucket onto a clean, impermeable surface (plastic tarp, concrete, etc.). Mix well. Remove a composite sample, place in a proper storage container (zip-lock type bag or sealable container), release as much air as possible, and seal the container. Refer to sampling protocol for preservation method(s).

Obtaining a representative sample of liquid or slurry manure can be challenging. Sampling liquid and slurry manures also requires following a set protocol. In storage systems where agitation is possible, be sure the liquid/slurry material is well agitated prior to sampling. This may take 30 minutes or hours depending on the volume of material being mixed and the capacity of the agitator.

Pay careful attention to worker health and safety protocols if the material is stored in an enclosed storage structure. Recommendations for Western dairies are to sample directly into the sampling container. The solids in liquid manure begin to settle immediately.

Due to the difficult nature of sample handling

It's important to break up manure before removing the composite sample.

Table 1: Target application rate tons/acre = target application rate lbs. of nutrient per acre/(2,000 lbs. per ton nutrient content on an as is basis, expressed in decimal form)

	percent N concentration as is				
	1.2	**1.4**	**1.6**	**1.8**	**2.0**
lbs. per ton	24.0	28.0	32.0	36.0	40.0
tons to achieve 250 lbs per acre	10.4	8.9	7.8	6.9	6.3

Table 2: Target application rate tons/acre = target application rate lbs. of nutrient per acre/(2,000 lbs. per ton nutrient content on an as is basis, expressed as parts per million)

	percent N concentration as is (PPM)				
	100	**250**	**500**	**750**	**1,000**
lbs. of N per 1,000 gallons	0.8	2.1	4.2	6.3	8.4
1,000s of gallons needed to achieve 250 lbs. per acre	297.6	119.0	59.5	39.7	29.8
lbs. per inch of water applied	22.7	56.7	113.4	170.1	226.8

it is not advised to create a composite sample from a subset of multiple grab samples. Instead, if a composite is needed it is recommended to collect small amounts of material over multiple sampling times, with all of the material collected in the same container. This way the composite is collected without a need to reduce the quantity of material obtained during the grab samples.

Most labs prefer that liquid samples fill the bottle to within an inch of the top. Installation of sampling ports with an attached hose can make sampling events much more pleasant. There is also a higher probability of getting the job done if it doesn't pose the risk of requiring a shower for cleanup afterward.

Sample preservation

For most samples the best and safest method of preservation is to remove as much air as possible from the container (if a ziplock), seal the container, and place the sample on ice or in a refrigerator. Discuss worker safety issues with every individual handling samples, especially if any chemical preservation is needed. It is important to remember that gases released by the manure sample can produce pressure in the sampling container, causing the sample to erupt if it is opened under the wrong conditions.

Work with your analytical laboratory to identify if it's possible to obtain the data you need without adding a chemical preservative. Manure is highly buffered and if acidification is required the individual doing the work must be well trained and wear appropriate safety equipment.

Laboratory hold time

Laboratory hold time is the time between when the sample was collected and the start of processing on the laboratory bench. Some laboratory methods may or may not include time in a non-frozen state. If a method defines laboratory hold time as the time the sample is in a non-frozen state, then more hours or days may occur between sampling and laboratory analysis.

It is important that samples arrive at the laboratory well before the expiration of the laboratory hold time. As an example, if the laboratory protocol for total nitrogen on a solid manure sample identifies a laboratory hold time of seven days (if the sample is refrigerated and sample integrity is maintained) then I need to get my sample to the laboratory well before those seven days expire.

If the protocol identifies that the sample may be frozen, then you may be able to temporarily suspend the laboratory hold time clock by freezing the sample and transporting it to the laboratory in a frozen state. Check with your analytical laboratory to be sure they will accept your samples.

Good management practices

It's always wise to check in with your laboratory before you begin sampling. Many labs will provide sample containers, chain-of-custody forms, and labels. You can also find out if they have restrictions that prevent them from running samples on certain days of the week. As an example, labs may have a 5 p.m. cutoff point for sample delivery, or they may not accept samples that require certain analytes after noon. Also keep in mind that your analytical laboratory may contract out with another laboratory for some of the analysis. If this is the situation, you need to be sure the sample arrives at your lab well before it needs to be loaded into another ice chest for transport to another lab.

Using results

There are many technicalities associated with sampling. Yet the most important item is: use the results. Once results are in hand they can be used to target nitrogen or phosphorus applications. If results are not available before application, then the data can be used to see what was applied.

Solid manure results may be reported on an as is basis or a dry matter basis. When reported as is, you can calculate tons of material to apply per acre by dividing your nutrient application target by the percent of the nutrient in the sample multiplied by 2000. If my target for N application is 250 lbs per acre and my lab N analysis is 1.2 percent as is then the equation is 250/(2000 x .012) which equals 10.4 tons per acre. (See Table 1.)

The moisture content of solid manure is very important. Proper collection and handling of the sample to minimize evaporative losses during sample collection and transport to the laboratory are important. Let's use a real life example to show how important it is to properly obtain and preserve a sample of solid manure:

Assume the actual moisture content of a sample was 55 percent (45 percent dry matter). During the collection process the sample was left open to the atmosphere and/or the sample bag was not completely sealed and moisture escaped. The lab results indicate the sample was 45 percent moisture (55 percent dry matter). The same lab results indicate the sample is 1.5 percent N on a dry basis. The application rate to target 350 lbs. of N is about 21 tons per acre at 55 percent dry matter. Since the actual manure was wetter, only 285 lbs. of N would be applied, thereby missing the targeted application rate by 65 lbs, of N (nearly 20 percent). It's very important to maintain samples in sealed containers so both the moisture and the volatile N don't escape.

For liquid or slurry manure, analyses are usually in units of parts per million. Similar calculations can be made to determine how much material should be applied.

Two common units are used in calculations. Either liquid/slurry material is applied by the 1,000-gallon unit or by the acre-in unit (27,154 gallons). If you use the 1,000-gallon unit you can determine application needs as follows: application target volume (x 1,000 gallons) = target application quantity (lbs.) of nutrient divided by (.0084 x nutrient concentration in units of parts per million).

For example, if my liquid sample has 500 ppm total nitrogen and I want to apply 250 lbs. per acre, and my units of application are 1,000 gallons, then, the calculation is 250/(.0084 x 500) = 59.5 – that means 59,500 gallons of liquid manure per acre. (See Table 2.)

For California producers, more information is available from sampling protocols found at www.cdqa.org\binder.asp (scroll down to section 5). The laboratory methods manual used with defined laboratory holding times is available at http://anlab.ucdavis.edu/docs/uc_analytical_methods.pdf.

Happy sampling!

Western Dairy News is published as a service to people interested in the health and welfare of the Western dairy industry. Archives of this publication may be found at:
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