ALABAMA COOPERATIVE Extension SYSTEM

CIRCULAR ANR-1102

ALABAMA A&M AND AUBURN UNIVERSITIES

Sampling Animal Waste for Nutrient Management: Nitrate Field Testing

Land-applying animal waste in an intelligent manner requires knowing the nutrient content of the waste. Tables in various Extension and National Resources Conservation Service (NRCS) publications list average nutrient concentrations for various types of animal manure. However, because the nutrient content of manure varies with livestock type and age, ration fed, type of bedding, amount of water used, and method of manure storage, the values listed in these tables are sometimes misleading and inappropriate. **Research has shown that table values of manure slurry and wastewater ammonium nitrogen (NH_4-N) content can differ from laboratory-determined values by as much 40 to 60 percent.** Most table values for nonliquid animal and poultry manure nutrient content are also unreliable for land-application purposes. One exception is poultry broiler litter. In Alabama, litter from the vertically integrated poultry broiler industry is relatively uniform in nutrient content, and the published fertilizer value of 3-3-2 is reliable and well accepted. With this exception, all animal waste should be tested for nutrient content before it is used for land application. Accurate nutrient analysis begins with taking representative samples.

Collecting Samples

Collecting Semisolid Lot Manure

When scraping manure directly from the lot into a spreader, use a nonmetallic collector to collect about 2 pounds from different locations in the spreader. When spreading manure from storage, use a nonmetallic collector to collect about 2 pounds from under the surface crust, being sure to avoid bedding materials.

Collecting Liquid Manure Slurry

To collect liquid manure slurry from an under-slotted-floor pit, extend a ½-inch nonmetallic conduit that is open on both ends into the manure all the way to the pit floor. Place your thumb over the upper end of the conduit to seal it and to trap the manure that has entered the lower end. Remove the conduit from the pit, and empty the slurry into a plastic bucket or nonmetallic container. Take subsamples from five or more locations (at least 1 quart). Mix this up well, and add about ¾ pint to a nonmetallic sample container.

To collect from an outside storage basin or tank, mix the manure well, using a liquid manure chopper pump or propeller agitator. It typically takes at least 12 hours of continuous agitation for a lagoon or storage pond to be properly mixed. Take subsamples from about five pit locations, output from the agitator pump or propeller agitator, or from the manure spreader, and place the subsamples in a plastic bucket. Mix this up well, and add about ¾ pint to a nonmetallic sample container.

Collecting Lagoon Liquid

To collect lagoon liquid from the recycle system, collect about ¾ pint from the inflow pipe to the flush tanks, using a nonmetallic sample container. To collect a sample from the lagoon, place a small bottle (½ pint or less) on one end of a 10- to 15-foot pole. Extend the bottle 10 to 15 feet away from the edge of the lagoon. Brush away any floating debris, and submerge the bottle within 1 foot of the surface. Retrieve the bottle, and empty it into a plastic bucket. Repeat this process about five times around the lagoon; mix the samples, and pour about ¾ pint into a nonmetallic sample container.

Preparing and Transferring Samples

Place the sample into an expandable, sealable container. A 2-liter beverage bottle works well. Rinse residues from the bottle, using clean water, but **DO NOT USE DISINFECTANTS OR SOAPS** or treat the bottle in any way. Pack the bottle in ice or refrigerate or freeze the sample, and transfer it to the lab as soon as possible. Hand-delivering the sample is the most reliable way of getting it to the lab.

Be sure to provide the following information with the sample:

- Livestock species (dairy, swine, poultry, etc.)
- Livestock facility type (swine: nursery, finishing, farrow-to-wean; dairy: storage pond, lagoon; poultry: layer, breeder, broiler, number of flocks on litter)
- Type of waste (dairy: scraped manure, slurry, lagoon; swine: pit or pond slurry, lagoon liquid; broiler: house litter, stockpile)

The Auburn University Soils Testing Laboratory analyzes solid wastes, animal manure slurries, and animal manure wastewater samples for mineral and fertilizer content. Check with your county Extension office for the latest fee schedule for manure-sample testing.

Sending samples to a laboratory for a complete analysis is always advisable, but the typical 7- to 10-day wait for results before land-applying is impractical. One alternative is a field test to determine available nitrogen (N) during application. One field-testing device is the Nitrogen Meter, first introduced in Sweden in 1983. The Nitrogen Meter is available from Farm Home Offices, POB 840, Vinton, IA 52349 and costs between

$300.00 and $400.00. Laboratory analysis costs $25.00 to $30.00 per sample. One advantage of using the Nitrogen Meter is that you can take several samples as manure storage is being emptied to determine if there are variations in the NH_4 concentrations.

Using Nitrogen Meter for On-Farm Testing

The Nitrogen Meter has been tested by numerous U.S. researchers and has gained acceptance as an reasonably reliable field test for available N in animal manure. The meter is basically a poly-vinyl-chloride (PVC) reaction chamber with a pressure gauge. Manure is mixed with an strong oxidizing agent (calcium hypochlorite, 30 to 37 percent available chlorine) to oxidize the ammonia to N gas. The pressure gauge shows the increased pressure caused by the formation of the gas and is calibrated to give the amount of N available per unit volume of manure.

Add manure and dilution water to the meter chamber, using the filler cups provided. Measure the reagent into the tipping tray in the chamber, using the special scoop provided. Fit the pressure gauge lid tightly into place to form an airtight seal. Tip the meter chamber to mix the reagent into the manure. Continue shaking the mixture until the needle on the pressure gauge no longer moves.

The Nitrogen Meter kit contains all the apparatus needed to perform the nitrogen test. The instructions are quite clear, and the procedure for testing is fairly simple. The time to perform one test is about 3 to 6 minutes.

The Nitrogen Meter gives a direct readout of kilograms of available nitrogen (NH_4-N) per cubic meter of manure. To convert the value to pounds per 1,000 gallons, multiply by 8.35. To convert to pounds per acre-inch, multiply by 27.154. **These are estimated values of available nitrogen in the manure as sampled and do not consider the effects of the actual land-application process on the resulting available nitrogen.** To obtain the first-year nutrient-availability value, you must adjust the sampled value for the method of land application by multipying by an availability factor. **For NH_4-N nitrogen availability using irrigation (no incorporation), this factor is 0.6 for slurry and sludge and 0.7 for wastewater. The first-year availability factor for P_2O_5 and K_20 with manure slurry or wastewater irrigation with no incorporation is 0.7.**

The Nitrogen Meter can be used to test both liquid and solid waste. The procedures for taking these measurements come with the kit. The oxidizing material used with the test kit is calcium hypochlorite, which is a strong bleaching-type product; therefore, safety is a concern. Be sure to following directions carefully.

Recommendations

In order to obtain accurate land-application rates, you must take representative samples of animal waste to an analytical laboratory for analysis. Where nitrogen is the controlling nutrient, the Nitrogen Meter is a convenient field-test method for determining available nitrogen in animal wastes. Table values are no more than crude estimates.

Even if a field-test method is used, representative manure samples should still be taken and sent for laboratory analysis for N, P, K, and NH_4-N nitrogen to confirm field-tested values and for long-term nutrient management.

References

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CIRCULAR ANR-1102

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New April 1998, ANR-1102