651.1360 Appendix 13B—Manure, Soil, and Plant Testing

Appendix 13B Manure, Soil, and Plant Testing

Manure testing

(Source—Adapted from Manure Testing, Fact Sheet 430, Cooperative Extension Service, University of Maryland System, H.L. Brodia, extension agricultural engineer, Department of Agricultural Engineering, and V. Allan Bandel, extension soil specialist, Department of Agronomy, University of Maryland at College Park, published 1986-87, revised 1986-87, reprinted 1990, 1991.)

Manure analysis is a vital part of nutrient management planning for farms, which can save producers money and protect water quality.

Benefits

Agricultural waste must not be viewed as merely a disposal problem, but as a valuable resource. Applied at proper rates to cropland, manure improves the physical condition of the soil and reduces the need for commercial fertilizers.

Agricultural wastes, such as manure, are rich in plant nutrients. A recent report by Cornell University showed that approximately 75 percent of the nitrogen, 60 percent of the phosphorus, and 80 percent of the potassium fed to dairy cattle is excreted in manure (poultry and swine have higher values for phosphorus and potassium). In addition, manure supplies calcium, manganese, magnesium, zinc, copper, sulfur and other micronutrients.

Manure produced

Livestock produce valuable amounts of fertilizer. Chapter 4, Waste Characteristics, shows just how much fertilizer beef and dairy cows and broilers produce daily. Actual nutrient content of manure varies with type of animal, feed, manure storage system, and method of manure application.

The bottom line

Assuming no nutrient loss during handling and a value of $0.22 per pound for nitrogen, $0.20 per pound for phosphoric acid (P_2O_5), and $0.10 per pound for potash (K_2O) (based on 1991 pricing data):

- A 100-head beef herd produces $4,410 worth of fertilizer per year.
- A 100-head dairy herd produces $4,810 worth of fertilizer per year.
- A 100,000-bird broiler operation produces $3,485 worth of fertilizer per year.

Costs of not testing

Without manure analysis, farmers may be buying more commercial fertilizer than is needed or spreading too much manure on their fields. Either practice can result in overfertilization, which, in turn, may depress crop yields and cut profits. Improper spreading of manure also can pollute surface and ground water. Additionally, contamination of wells by nitrates and bacteria may increase health risks.

Manure analysis

To get an analysis of manure, take the following steps:

1. Contact the county Extension agent or your local testing laboratory for a Nutrient Management Kit. The kit may contain a manure sampling jar, soil test bags, record sheets and instructions. A fee may be charged with each soil sample.
2. Collect a *representative* manure sample. For daily spreading, take many small samples over a representative period. In a manure pack, collect samples from a variety of locations in the pile. Be sure to collect both manure and bedding materials. Agitate liquid manure systems before you collect samples.
3. Follow the specific instructions included in the kit for collecting samples from your liquid, solid or semisolid system with a minimum of mess and effort. The small samples collected should be mixed together in a clean bucket. Place a portion of the mixture in the sample jar.
4. Keep samples cool and deliver them to the county Extension agent early in the week to avoid storage over weekends or holidays.

Collect samples well in advance of the date manure is plan to be spread so the test results can be used to calibrate the manure spreader. With liquid waste systems it may be easiest to collect samples when the manure is pumped into the spreader. Use these test results to calibrate the spreader for future applications of manure, or to determine if additional chemical fertilizer is needed.

The manure sample should be analyzed for nitrogen, phosphorus, potassium, moisture content, calcium, manganese, magnesium, sulfur, zinc and copper. A copy of the results will be sent directly to the applicant and the county Extension agent. The agent will be able to answer questions and help plan fertilization and nutrient management programs.

Soil testing

Soil testing is an important agronomic tool for determining crop nutrient needs. Soil testing evaluates the fertility of the soil to determine the basic amounts of fertilizer and lime to apply. The following sections describe how to use soil testing to evaluate crop nutrient needs.

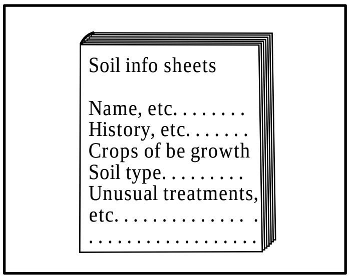
Sampling instructions

Collecting the sample is one of the most important steps in the soil testing program. When one considers that the 2-pound soil sample must adequately represent 10 million or more pounds of soil in the area being sampled, the importance of doing a good job of sampling becomes apparent. Instructions for collecting a good representative soil sample follow.

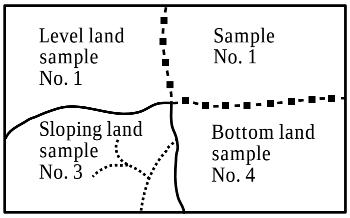
Using the soil test report

The soil test report generally contains the laboratory test results plus fertilizer and lime recommendations for the next two crops in the rotation. Additional information regarding time and method of fertilizer an slime application will also be provided in the form of a soil test note which will accompany the report. When several samples have been collected from the same field, the Soil Test Reports should be compared to determine the best rates of fertilizer and lime to use for the field. Large differences in the reports may call for fertilizer and/or lime at two or more different rates.

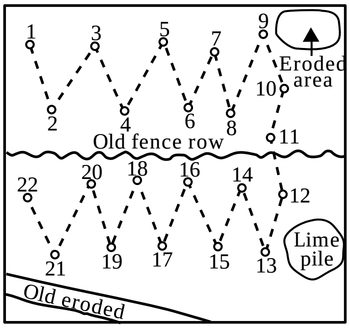
Sampling soil



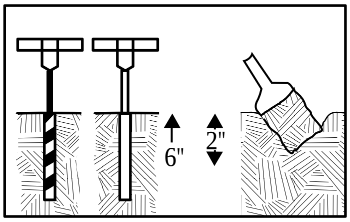
1. **Obtain soil samples information sheet and soil boxes**
   A laboratory must be located that can provide appropriate soil testing. These laboratories can often be accessed through Extension Service agents and fertilizer dealers. The laboratory will provide directions to follow for soil sampling.



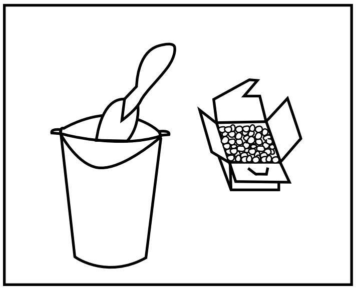
2. **Divide farm into areas or fields**
   If the field is uniform, one sample will do. But most fields will have been treated differently, or the slope, drainage, or soil type will make it desirable to divide the field into small areas of 5 to 10 acres each.



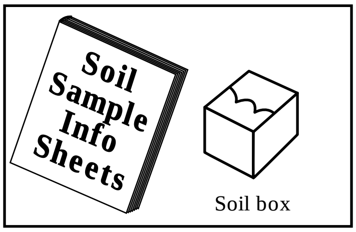
3. **Obtain a good sample of soil**
   The soil test can be no better than the sample. Take the sample from 20 or more places in the field. Zig-zag across the field or area as shown in the diagram. When taking sample, avoid unusual places such as old fence row, old roadbeds, eroded spots, where lime or manure have been piled, or in the fertilizer band of row crops.



4. **Use proper sampling tools**
   Sampling may be made with a soil auger, soil tube, or spade. The desired depth for cropland is plow depth (6 to 8 inches or more), and for pasture land, 2 to 4 inches. Place sample in clean container.



5. **Mix well in clean plastic pail**
   From the 20 or more stops you have made, you now have 1/2 gallon or more of soil. Mix it thoroughly, then send about 1/2 pint of the mixed soil for analysis.



6. Fill out sample information sheet for each sample

It is essential that your name, address, and sample number be plainly written on the sheet you send with each sample. As a guide in making recommendations for each of your numbered areas, it is important that the history of treatments and any unusual treatments be stated.

7. Mail to soil testing and plant analysis laboratory

Place completed the Soil Sample Information Sheet inside the flap of the soil sample box and mail to the laboratory. Generally, the laboratory will make a routine test of seven analyses (soil pH, phosphorus, potassium, calcium, magnesium, zinc, and manganese) on all samples. Special tests on organic matter, nitrate-nitrogen, and soluble salts can be requested if needed.

Plant testing

Plant testing is also an important agronomic tool for determining crop nutrient needs. It is used as a monitoring tool to determine if the fertilization and liming program, as determined by the soil test, is providing the nutrients at the necessary levels for top yields. Plant analysis is the ultimate test; i.e., is the plant obtaining, from the soil, ample nutrients for good growth and development. If not, nutrients can be added during the existing growing season to improve yields, or the fertilization program can be modified for next year's crop.

Plant testing procedure

1. **Submit clean sample**
   Avoid submitting sample tissue that is contaminated with dust or soil. If tissue is dusty or dirty, remove as much of it as you can by shaking, brushing, or washing the tissue in gently-flowing water.
2. **Sample healthy plant**
   Do not sample disease, insect, or mechanically damaged plant tissue.
3. **Place in clean bag**
   Place the plant tissue in a clean paper bag. Do not use plastic bags. If the sample is wet or succulent, let it air-dry in the open for one day before sending it to the laboratory. Identify each sample by number and crop name.
4. **Take two samples**
   When using tissue analysis in the diagnosis of crop production problems, take one sample from the problem area in the field and one from an area where plants appear normal.
5. **Sample proper plant part at proper time**
   When sampling, both the time (growth stage) and plant part collected are important. Be sure to sample at the recommended time and collect the proper plant part.
6. **Follow sampling instructions**
   If there are no specific sampling instructions for the crop to be analyzed, a good rule of thumb is to sample mature leaves that are representative of the current season's growth during the mid period of the growth cycle or just prior to seed set.
7. **Fill out a Plant Analysis Information Sheet**
   The plant analysis laboratory will provide the information sheet. The completed sheet should indicate where the results should be mailed and record each sample number along with crop name. Send the sample and completed information sheet to the laboratory.
8. **Analyses performed**
   Sample should be analyzed for nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), manganese (Mn), zinc (Zn), copper (Cu), iron (Fe), boron (B), and aluminum (Al). In addition, a sulfur (S) test can be run if needed.

(Source—A Handbook of Agronomy, Virginia Cooperative Extension Service, Publication 424-100, Revised December 1987.)