Soil Sampling for Field Crops

Soil testing is done to determine pH and organic matter as well as levels of macronutrients [phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg)] and micronutrients [iron (Fe), manganese (Mn), zinc (Zn)]. When paired with data from crop response trials, chemical soil test results can be used to determine crop-specific nutrient needs for profitable and environmentally sound applications of soil amendments, including fertilizer, manure, and lime. Soil test results and the fertility management guidelines derived from them are heavily dependent on the quality and representativeness of the samples collected. As such, the main goal of a sampling program should be to obtain a reasonably representative sample of the field or sub-field that is in line with the farmer's field management objectives and yield potentials. This fact sheet provides guidance on soil sampling for field crop production.

Establish a Regular Sampling Time

It is recommended to take soil samples at least once every 2 to 3 years. Where it is desired to track nutrient fluctuations more closely, having soil test results before the next crop is planted will help refine management decisions. Soil samples are best taken in the fall after harvest of the main season crop but can also be taken in the spring or summer. Consistently sampling around the same month of the year will help reduce seasonal variation in soil tests and as a result create more reliable information on impact of crop management decisions on soil fertility and pH over time.

Use Proper Sampling Tools

Soil probes are often the best tool for the job because they collect soil in a continuous core from the surface through the entire sampling depth with minimal soil disturbance. In stony soils, an auger may work better. A spade or shovel may be used, but with care to avoid over-sampling surface soil and under-sampling at depth. All sampling tools must be clean and free of rust. Brass or galvanized tools or containers can contaminate the sample with copper and zinc, so stainless steel probes or augers are recommended. Collect samples in a clean plastic bucket.

Sample the Proper Depth

Lightly scrape the soil surface before sampling to remove surface residue. Remove all visible stones, plant and animal residues from the sample after taking the core. For field crops, under conventional tillage, sample the top 0-8 inches (Figure 1). This depth is important because fertility guidelines derived from field-based research in New York are based on soil test results of samples taken at this depth. Sampling depth is important because nutrients can be stratified in the plow layer which can impact the soil test result and the fertility guidelines. For pastures, it is recommended to sample the top 0-6 inches. For no-till or minimum-till cropping systems, take two samples: one for pH from the 0-1 inch depth and another from the 0-6 inch depth for nutrient analyses. The two samples should be clearly labeled with "0-1 inch" and "0-6 inch". The 0-1 inch sample is needed for the timely determination of a pH decline. In a no-till system, nitrogen fertilizer is often surface applied, and this reduces the pH near the soil surface, which can be masked if only taking a full-depth core. Early detection of low pH in the soil surface is important if the farmer intends to maintain a no-till system because the liming material cannot be incorporated into the soil. Without tillage, lime can take a long time to react beyond the top inch or so of soil.

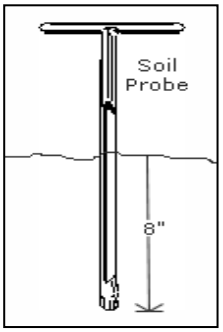

Figure 1: For field crops under tillage systems sample the top 0-8 inches.

Obtain a Representative Sample

To adequately represent the field or section of the field and to minimize sample variation, individual soil cores taken across a similar area should be composited into one sample for

analysis. Generally, each sample should represent 15 acres or less, and separate samples should be collected from areas with different crop history, fertility management, crop growth, slope, etc. Larger or smaller areas may be used depending on the soil uniformity, management history, and farm objectives. For soil pH, general soil fertility, and determination of soil nitrogen supply potential with the Illinois Soil Nitrogen Test, do not sample within 5-6 weeks of fertilizer or manure application or sod termination. This delay reduces the risk of highly variable and non-representative results. Avoid sampling in or near atypical areas within fields such as dead or back furrows, windbreaks or fence lines, old manure or lime pile areas, wet areas, boundaries between slopes and bottomland, fertilizer bands from the previous crop, manure injection slots, areas with severely eroded steep slopes, or tree stump burn piles. Also, avoid extremely wet soil conditions. As a rough guide, if soil moisture conditions are suitable for traffic or tillage, they are likely suitable for soil sampling.

The actual sampling pattern within a field can vary depending on farmer management objective, capabilities of sampling and field management equipment, field size and features, and availability of field-specific information, including yield:

- If a sample is needed to represent the entire field, and no prior information is available, take samples along a zig-zag pattern through the field. For best results, multiply the total acreage of the field by 2 to know roughly how many cores to combine across the field, with a 10-15 core minimum for smaller fields.
- Grid sampling may be used for larger fields and when zone-based management is desired. Grid cell size can vary depending on farmer management objectives, equipment capabilities, and field features (slope, elevation, soil type, drainage, etc.). Grid cell size often ranges from 0.5 to about 6 acres. Sampling intensity (number of cores to combine per grid cell) should target an average of two soil cores per acre or a full cup of soil to subsample for analysis. Grid cells can be sampled separately over time or used to develop larger management zones, which can then be sampled separately in future years. Smaller initial grid cells are more expensive but also better suited for deriving soil-test based management zones.
- Once management zones are determined, subsequent soil sampling can be targeted to these zones. Each management zone should be sampled at an intensity that targets an average of two soil cores per acre or a full cup of soil to subsample.

While grid- or zone-based sampling is encouraged, intensive sampling raises questions about converting soil test results into field averages for manure and/or fertilizer applications and managing the New York P Index. See Agronomy Factsheet #106 for more information on determining average soil test P and pH values from grid sample results.

Sample Submission

If a moist or wet sample cannot be mailed to a laboratory right away, samples should be stored in a refrigerator or air-dried as soon as possible to limit biological transformations that can affect the amounts and forms of soil nutrients. Break up any lumps or clods and mix the sample thoroughly before subsampling about 1-2 cups to submit to the laboratory.

In Summary

Soil sampling will help make the most of manure, fertilizer, and lime for crop production and protection of the environment. Sampling methods can differ, depending on management objectives, equipment, and field features.

Additional Resources

- Soil Sampling Techniques. Proceedings of the 2006 Indiana CCA Conference, Advanced Soil Fertility, Indianapolis, IN. Ron Olson, Mosaic Crop Nutrition, LLC. https://www.agry.purdue.edu/CCA/2006/PDF/Olson.pdf

Disclaimer

For more information

Cornell University Cooperative Extension

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

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