# Take a Good Soil Sample to Help Make Good Decisions

One of the most important steps in soil testing is collecting the soil sample. The soil sample is the first part of the soil testing process and the foundation for information derived from laboratory analyses, soil test interpretations, and recommendations. Also, soil sampling is the largest source of errors in the soil testing process.

Remember why you are taking soil samples -- to obtain information on which you can base recommendations and decisions concerning fertilizer, manure, and limestone use.

A comprehensive soil fertility and organic matter map for each field is desirable as a basis on which to adjust fertilizer, manure, and limestone use. Over- or undertreatment may reduce profits. Best decisions can be made only if soil samples are representative of the areas sampled and accurately reflect differences in the field. You should remember that a very small amount of soil collected for samples will represent large field areas. It is essential to select uniform sampling areas and to take a representative soil sample from each sample area.

### **Materials Needed**

Plastic-lined soil sample bags, information sheets, instructions on soil sampling, information on soil tests and recommendations, and diagrams of your soil association can be obtained from your Iowa State University (ISU) Extension county office. A soil survey map of your fields may be obtained from your local Natural Resources Conservation Service (NRCS) office. You can also obtain electronic GIS-based survey maps at http://icss.agron.iastate.edu. You will also need a soil sample probe or auger, and a clean plastic pail (use only a plastic pail if a soil test for zinc (Zn) is desired).

# When to Sample

The best time to sample is when you can take the time to do a good job, when you can make visual judgments on dividing the field into uniform sampling areas, and during the times of the year for which soil tests are calibrated. Ideally, the best time would be either after harvest and before fall fertilization or before spring fertilization. Do not sample shortly after a lime, fertilizer, or manure application or when the soil is excessively wet.

Sampling at other times such as in the winter or in a growing crop is discouraged for determining pH, phosphorus (P), and potassium (K) because interpretations of results are difficult. Field research calibrations for these soil tests are based on samples collected in the fall or spring.

**Selecting Sampling Areas Within a Field Sampling Using Soil Maps and Management Zones** 

Each sample should represent a uniform soil area with similar past management. It is recommended that each sample represent 10 acres or less. The sampling area should also represent a field area that can be managed in a similar fashion (management zone) in regard to nutrient or limestone application and crop production. Choice of sample areas is determined by the soils present, past management and productivity, and goals desired for field management practices. That is, will the field be managed as whole unit or will nutrient and limestone applications be made to sub-field areas or identified management zones?

Although high fertilizer or manure application rates may mask initial soil fertility differences once due to soil properties, organic matter levels are still closely related to soil map units. This is shown in Figure 1 where organic matter levels range from 1.5 percent to 10 percent in an 80-acre tract in the Clarion-Nicollet-Webster soil association area. The soil pH of some soils is still dominated by inherent soil properties rather than management of nutrient or limestone application. Examples are certain soils in the Clarion-Nicollet-Webster soil association that contain free lime particles (calcareous).

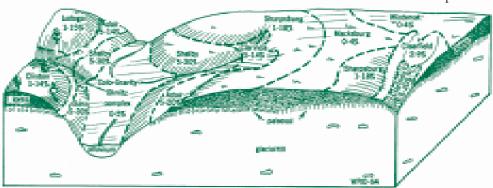
Selection of each sampling area can be based on several spatial data sources that provide information about likely variation in soil properties across fields. Soil survey maps that delineate soils, slope phase, and erosion phase are useful because organic matter, nutrient levels, and soil pH can vary following these map units. Visual observation or aerial images of bare soils or crop canopy can help distinguish areas with different soils and erosion, especially at small spatial scale. Also, maps of soil electrical conductivity and crop yield can aid in distinguishing between field areas with contrasting soil properties or crop nutrient removal.

General soil association diagrams, such as in Figure 2, together with other sources of spatial information, can be used to help differentiate soils based on position on the landscape, original parent material, and original vegetation. If you do not have a recent soil survey map to aid in selecting sampling areas, use the map in Figure 3 to find your general soil association area and obtain from your ISU Extension county office a general diagram of soils for that soil association area. Figure 2 is an example diagram of the Shelby-Sharpsburg-Macksburg soil association area in south-central Iowa. It shows the relationships that affect the present soil fertility and organic matter status. Also, in certain soil associations, these diagrams are helpful in locating high-lime soils that can have major differences in fertilizer and lime requirements, herbicide requirements, and potential triazine herbicide carryover when compared with adjacent acid soils.

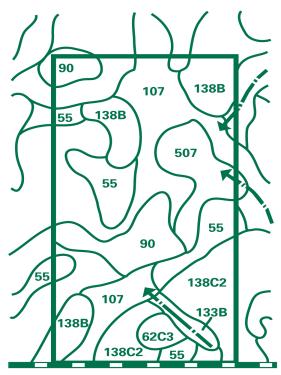
**Basic Sampling Guidelines** 

Avoid, or sample separately, odd or dissimilarly treated areas not representative of the uniform soil or management zone area. As a general rule, soils of distinctly different colors should not be mixed. Odd areas would be: dead furrows, back furrows, old livestock lots and lanes, old fence lines, fertilizer spills, and small field depressions. Dissimilarly treated areas would be, for example: a strip approximately 100 feet wide along limerock roads, recent fertilizer or manure bands (injected manure, deep banded fertilizer, and anhydrous ammonia); and areas of the same soil where only a portion had been treated with lime, fertilizer, or manure. In the latter case, take separate samples even though only one uniform soil is involved.

Figure 4 shows an example of dividing a field into uniform sampling areas using the above guidelines. If you don't take your own soil samples, it may be beneficial for you to accompany the person who does so you can call dissimilar areas to their attention. After all, no one knows your fields the way you do.



**Figure 2.** Relationship of slope, vegetation and parent material to soils of the Shelby-Sharpsburg-Macksburg soil association area.



**Figure 1.** Outline of a soil map showing varation in soils within an 80-acre field in in the Clarion-Nicollet-Webster soil association area.

Map Symbol	A Soil Map Unit	pprox. Organic Matter, %
507	Canisteo silty clay loam	6.0
138B	Clarion loam, 2 to 5% slop	es 4.0
138C2	Clarion loam, 5 to 9% slop	es,
	moderately eroded	2.4
133B	Colo silty clay loam,	
	2 to 5% slopes	7.0
55	Nicollet loam	6.0
90	Okoboji silt loam	10.0
62C3	Storden loam, 5 to 9% slopes,	
	severely eroded	1.5
107	Webster silty clay loam	6.5

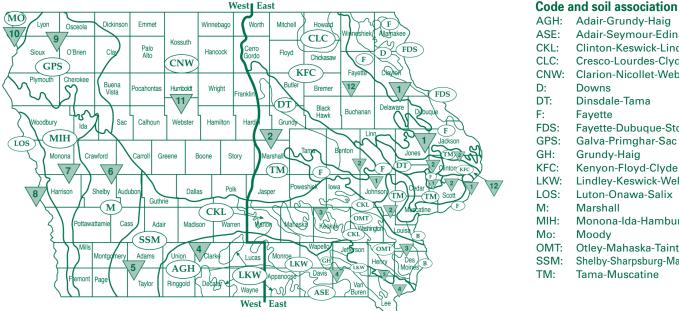
Sampling Using a Grid Pattern

Samples can be collected using a systematic grid sampling approach. Grid sampling is useful when little is known about soils or past management in a field, for precise location of collected samples, and for computer mapping of soil test results. A disadvantage of a grid sampling pattern is that non-representative field areas may be sampled. Also, sampling costs can be high with small grid sizes. Size of the grid depends upon the level of spatial information desired, complexity of the

soils/terrain, and available economic resources. No one grid size best fits all fields, but a suggested minimum size is one sample per 2.5 acres. Samples can be collected by taking cores from the entire area of each grid cell or by taking samples from a small area, usually at the center of the cell (grid-point sampling).

Grid sampling at a small scale may allow grouping test results within sub-field or management zone areas if soil survey maps or other spatial

Figure 3. Map of lowa delineating the 21 principal soil association areas (letters) and the 12 major soil areas (numbers). B designates the Mississippi bottom-land.



Code and soil association name:

Adair-Grundy-Haig Adair-Seymour-Edina Clinton-Keswick-Lindley Cresco-Lourdes-Clyde Clarion-Nicollet-Webster

Dinsdale-Tama

Fayette-Dubuque-Stonyland

Grundy-Haig

Kenyon-Floyd-Clyde Lindley-Keswick-Weller Luton-Onawa-Salix

Monona-Ida-Hamburg

Otley-Mahaska-Taintor Shelby-Sharpsburg-Macksburg

Tama-Muscatine

information referred to earlier are available. Grid sampling also generates multiple test results that allow calculation of whole-field test average or median values. Using field soil test averages is useful only if a uniform fertilizer or limestone rate will be applied across the field, which is not always a good management practice. Enough samples are usually available with grid sampling so that areas with outlier test values can be identified for separate management or discarded when averaging for whole-field or zone management. Sampling in subsequent years can be targeted to a few identified grids to reduce testing costs and to track changes in soil-test values over time in field areas of greatest interest.

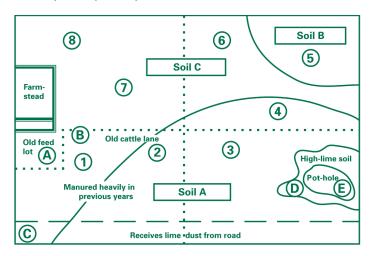
Further information about grid and zone sampling targeted for site-specific fertilization can be found in the publication Soil Sampling for Variable Rate Fertilizer and Lime Application, (NCMR 348) which is available from ISU Extension.

## Collecting a Representative Sample

As a minimum, take 10-12 cores or borings per area of interest and place all soil in a sample bag. A large number of cores is helpful to represent the sampled area because of small-scale variation typically found in fields. This number of cores per sample is recommended for both zone and grid sampling. For better representation of the average condition within an area, take 15 to 20 cores. Because this number of cores will not fit in a sample bag, place these soil cores in a clean plastic pail and mix thoroughly. After mixing, fill the sample bag one-half to two-thirds full. Take at least 20 cores if the field has recent banded fertilizer or manure. More cores will lessen the effect of a core taken from a fertilizer band or unknown dissimilar soil test area. Place these soil cores in a clean plastic pail and mix thoroughly. After mixing, fill the sample bag one-half to two-thirds full. Make certain to label sample bags with field and sample area information.

For soil map and management zone sampling approaches, or to represent the entire area of a grid cell, take separate cores in a random zigzag pattern from each sampling area. For gridpoint sampling, take the cores in a random pattern from the

Figure 4. Example of sampling map for an 80-acre tract, which is now farmed as one field. Numbers designate soil sample areas and letters designate areas either not sampled or sampled separately.



- - Old fence lines, now removed
- Present fences
- Soil type boundaries

This 80-acre field was originally farmed as four, 20-acre fields that were each managed differently. First, identify the areas that are odd or dissimilar. Areas A and B probably have very high fertility levels. Area C would be expected to have a higher soil pH than the remaining original fields. Areas D and E would be different soils and could have vastly different soil pH, organic matter and fertility levels than the adjoining soils. Old fence lines are to be avoided. The original fields should be sampled separately, unless a previous comprehensive sampling has shown no fertility differences. Samples 1 and 2 are taken because the soils differ, sample 3 would be sufficient for the original 20-acre field, samples 4 to 6 represent three different soils, and samples 7 and 8 each represent about 10 acres of uniform area.

area of the identified sample point, which should be at least 50 feet in diameter. Use equal diameter cores or borings, and collect all to the same depth.

**Sampling Depth** 

Interpretation of P, K, and Zn soil-test values and nutrient recommendations are based on soil samples collected from a 6-inch depth. Use this sample depth in all tillage systems and for pastures when sampling for P, K, Zn, organic matter, pH, and buffer pH. Samples to monitor surface pH should also be collected from the top 2 to 3 inches in no-till fields and pastures where a shallower sample represents the soil depth that is differentially affected by surface application of nitrogen (N) fertilizers, manure, and limestone. Limestone application rates are adjusted for the expected depth of incorporation because tillage systems influence the volume of soil mixed with the limestone.

For ridge tillage systems, samples should be taken from the ridge and in about equal proportions from the top and shoulders using a 6-inch depth. Collecting cores from the valleys will result in low soil-test values, which over-estimates P and K fertilization needs. When P and K fertilizers have been banded into the ridge center or shoulders for recent crops, at least 20 cores should be collected.

# **Sending Samples for Testing**

- Check that each sample bag clearly identifies the field and sample area with a unique number.
- Make certain sample bags are securely closed.
- Samples should be sent to the laboratory soon after they are taken. Keep samples out of intense heat and in a cool location if stored for any length of time.
- Laboratories will provide a field/sample information sheet to be filled out and sent together with the soil samples. The Iowa State University Soil and Plant Analysis Laboratory in Ames accepts samples for analysis, and provides information sheets for field crops and horticultural crops. These sheets can be requested free of charge from the lab or can be downloaded from ISU Extension Web site (ST-8 for field crops and ST-11 for horticultural crops). Contact your lab for the appropriate information sheet.
- Fill out the information sheet as completely as possible for all samples. Sampling depth and incorporation depth are critical for limestone recommendations.

Sample and field locations are primarily for your information. Soil information is for your use and

for the soil testing lab. Recommendations for P and K are adjusted for differences in subsoil extractable P and K for each soil series which has been determined through soil survey. Crop and proven yield is needed for the soil testing lab. Recommendations vary for different crops, and yield information is needed for determining crop removal P and K rates. Field and crop history are for your information and are used by the soil testing lab as an additional check but are not used in making recommendations.

Indicate on the information sheet which tests are desired. Soil testing labs may offer tests for many nutrients; however, Iowa State University provides soil sampling-based fertilizer and lime recommendations for available P, exchangeable K, Zn, soil pH, and buffer pH. Additionally, soils can be tested for soil organic matter, as mentioned earlier. The sampling procedures discussed in this publication should not be used for soil nitrate testing. Information for soil nitrate testing is provided in ISU Extension publication *Nitrogen Fertilizer Recommendations for Corn in Iowa* (PM 1714.)

# **How Often to Sample and Test**

Fields should be sampled every 2 to 4 years for most crops, or once in a crop rotation. Fields should be in the same crop each time when sampled to reduce variability of test results. Once you have obtained a comprehensive soil fertility map of each field, you can re-sample the entire field following the same pattern, or sample only representative portions of each field and problem areas every 2 to 4 years as a check on the fertilizer program.

# **Keep Good Records**

Important information can be obtained by monitoring changes in soil-test results over time. It is important to keep good records on sample locations and test results in order to evaluate the effectiveness of fertilizer programs. For example, if soil tests have been increasing over time, lower rates of fertilizer may be called for, or if soil-test levels are above optimum, additions of P and K could be omitted for a period of time and soil testing continued to monitor soil test changes. If soil-test levels are consistently low or are becoming more deficient even with fertilizer application, then increased fertilizer rates may be called for. Due to season variability, long-term trends in soil-test values are needed to provide this information.

ISU Extension publications can be ordered through any ISU Extension county office or by calling ISU Extension Distribution Center at (515) 294-5247 or on the Web at: http://www.extension.iastate.edu/pubs.

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