AGRICULTURAL
GUIDE
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How to get a good soil sample

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Sampling is important

Soil sampling is the most important step in soil testing but is often the most overlooked. Fertilizer and limestone decisions hinge on results obtained from that sample. A poorly taken soil sample often results in misinformation regarding recommended rates of fertilizer and limestone. Under- or over-application of fertilizer and limestone results in lower profit potential.

Good soil sampling and analyses have drastically changed fertilizer use on one farmer's fields in southwest Missouri. The farmer normally applied 50 pounds of phosphate fertilizer per acre, along with other needed nutrients, on his corn and soybeans. Eighteen soil samples from 657 acres showed an average available phosphorus reading of 118 pounds per acre (very high), with no phosphate fertilizer recommended. Three other fields had tests showing a need for only 35 pounds of phosphate per acre. Savings on his farm just for phosphate fertilizer in one year was more than $4,000. With those very high soil tests, he won't need phosphate fertilizer for several years and should experience no loss in crop yield potential. To save that $4,000 this farmer spent only the time it took to obtain good, representative soil samples and about $125 for the soil test analyses.

Materials and containers

The best tools to sample fields are soil coring devices (see Figure 1). Soil coring tools take an equal amount of soil from the surface through the sampling depth and an equal amount at each sampling location. Research indicates our best predictor of fertilizer needs comes from samples taken with a coring tool.

Soil probes and augers are available through several agricultural supply catalogue companies. Your agricultural extension specialist can help you find a supplier of soil sampling tools. Fertilizer dealers and public and private soil testing laboratories also can tell you where to order and costs for the soil sampling tools. This small investment will more than pay for itself through accurate sampling of your farm.

You can use a shovel or spade for sampling, but these tools are inferior to the probe or auger. If using a shovel or spade, dig a hole to the proper sampling depth. Then shave a 1-inch slice from the side of the hole to the sampling depth with the shovel. Save the vertical, 1-inch wide center portion of the soil as one subsample (see Figure 2).

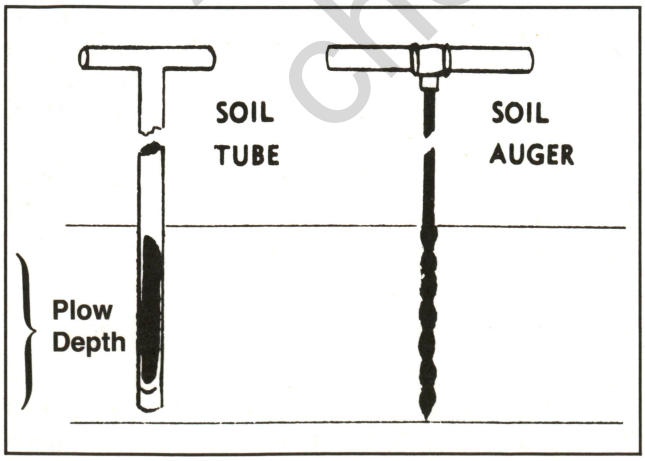


Figure 1. Soil probes and augers are best tools for soil sampling

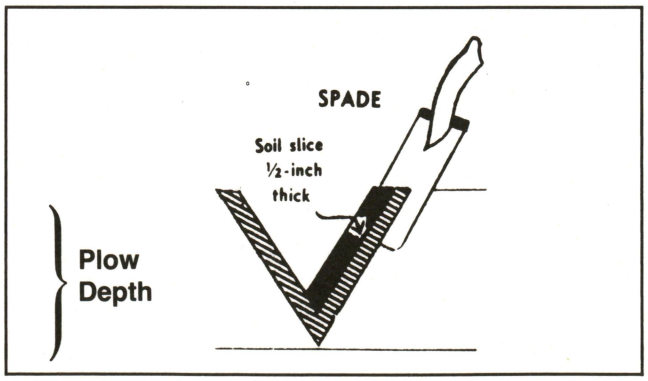


Figure 2. Sampling with a shovel. First dig out a clean hole. Then shave a thin slice to the proper depth from a side. Use the center portion of the slice, about 1 inch wide, for a subsample.

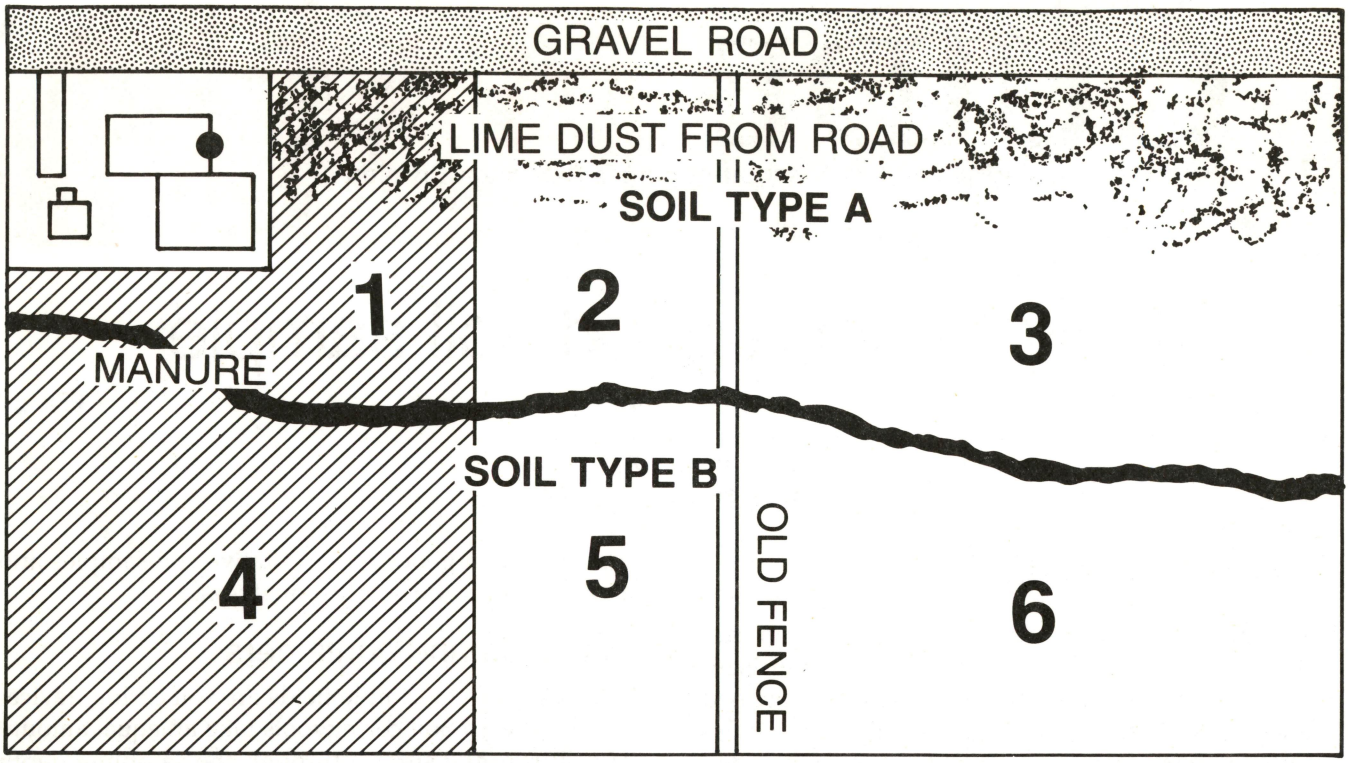


Figure 3. Field diagram for soil sampling. The field was originally two 20-acre tracts with a fence and tree row between. Separate samples for changes in soil type, crop history, and manure applications will help provide an intensive soil fertility map for the field. Fertilizer requirements will be different for the areas.

Always use a clean plastic pail for mixing subsamples to obtain one composite sample. Metal pails contaminate the soil with micronutrients.

Your University of Missouri Extension Center has soil sample boxes available for use at no charge to you. One box of soil is all a laboratory needs for analyses. Many centers also lend soil sampling tools to help you obtain the best possible samples and soil test results. Ask for these items at your local extension center.

When to sample

Nutrient levels usually vary only slightly from season to season. Soil sampling just after harvest of a high-yielding corn or soybean crop usually results in a slight depression of exchangeable potassium compared to later fall, winter or spring sampling. The best time to sample is when the acreage is lying idle; for example, summer for winter wheat, or late fall and winter for spring-planted crops.

Most people take soil samples in spring, just before applying fertilizer. That leaves little planning time for important fertilizer and limestone application decisions. Spring is also the time when soil testing laboratories are overloaded with samples. This will delay the return of results. Fall and winter sampling leaves more time for planning limestone and fertilizer programs for the coming year.

Collecting the soil sample

Sample from relatively uniform areas of a field. Map the fields or obtain field maps from your county's soil survey or ASCS office. Carefully delineate any known differences in soil nutrient composition. Common causes of nutrient differences in a field include soil color, soil texture, slope, crop rotation, limestone, fertilizer, manure, and old farmsteads or feedlots (see Figure 3). Avoid any known differences in composite samples; sample them separately.

A sample should not represent more than 20 acres. Seldom in Missouri are 20 acres homogenous in past history or soil type. Farmers looking to greatly improve fertilizer use efficiency are dividing fields into much smaller blocks and sampling accordingly. The result is an ability to map soil fertility differences in a field and adjust fertilizer application across the field.

For each composite sample, take 15 to 20 separate cores at random in a zigzag pattern across the field. Thoroughly mix these subsamples in a plastic pail and retain 1 pint (University of Missouri soil sample box full) for analyses.

Field variations and soil sampling

Fields of any size, soil type, crop management, or fertilizer or limestone history will have variations in fertility. Fertilizer application (overlaps and skips) and natural soil variations often cause large changes

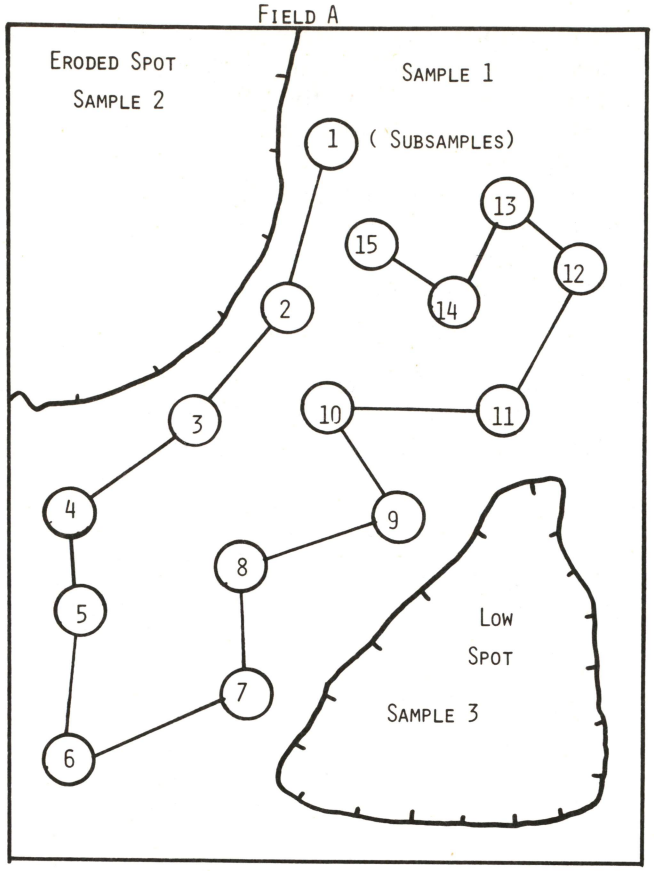
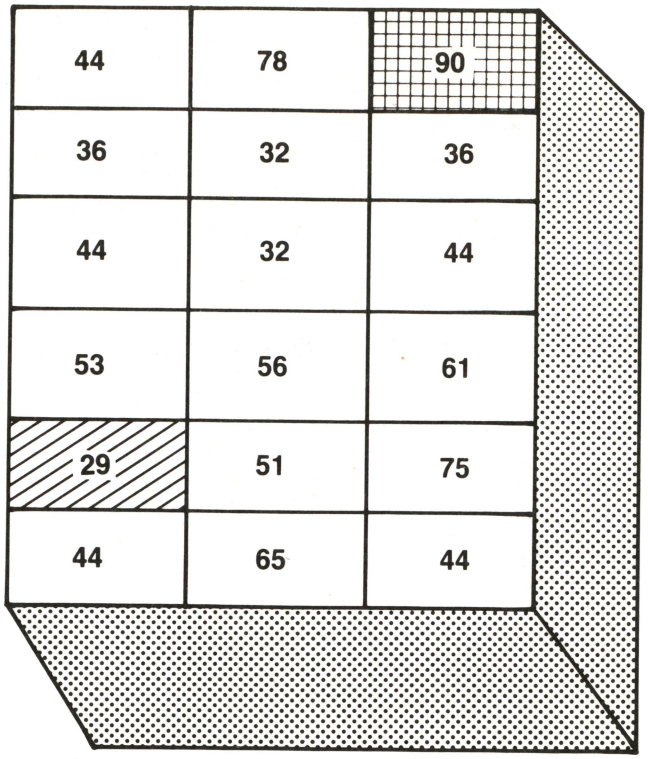


Figure 4. Soil type and fertilizer overlaps or skips cause large variability in soil fertility of a field. Fifteen to 20 individual soil cores per composited soil sample will average out those differences. The goal in fertilizer application is to fertilize for the average nutrient requirements of a field area.



Average of all samples = 51 lbs/a
Properly sampled composite = 53 lbs/a

Figure 5. Variation in Bray & Kurtz #1 available phosphorus (lbs P/a) from individual soil probe samples on a 3-acre field with uniform soil type and history of even, precise fertilizer application. Average of the 18 individual cores or one properly sampled composite resulted in a very reliable soil test.

in available nutrient measurements across a field (see Figure 4).

The number of individual soil samples taken from a field to make one composite sample can cause variations in test results. In an actual 3-acre research field, all of which was of the same soil type and fertilizer history, researchers undertook a detailed soil sampling study. They took 18 individual soils cores in a grid design on the field, equal distances apart, and analyzed them separately. The phosphorus results (see Figure 5) ranged from medium to very high. Recommendations for 100-bushel corn would run from 65 pounds of phosphate per acre to none (a cost difference of about $16 per acre just for phosphate). The average of the 18 soil tests is 51 pounds of phosphorous per acre. When a soil sample was taken following the instructions in this guide, the phosphorus test was 53 pounds per acre.

When you fertilize a field, you are trying to apply the right amount of fertilizer based on the *average* fertility of that field (51 to 53 pounds of phosphorus per acre in the example) and not the 29 or 90 pound test from an individual core.

An average of 15 to 20 cores per composited sample will usually reduce the sampling variation to an acceptable level. Additional cores may be necessary in fields with greater variation caused by previous banding of fertilizers.

Sampling depth

You should take soil samples for fertilizer and limestone recommendations to a depth of 6 to 7 inches or to tillage depth if deeper.

Soil sampling to the 6 or 7 inch depth is vitally important in pasture, permanent forages, minimum tillage, and no-tillage fields. Nutrients accumulate at the surface because of fertilizer application. The surface soil is not, however, a good indicator of fertility requirements. An equal amount of soil from the surface to 6 or 7 inches depth (as obtained with a soil probe) is best for determining fertilizer needs for these situations.

In long-term, no-till fields, you should take a separate sample of the surface 2 inches of soil for soil acidity measurements. Soil pH may drop rapidly in the surface soil and reduce some herbicides' activities. A lower rate of limestone to reduce the acidity of the surface 2 inches of soil is necessary if acidity becomes a problem. Be sure to record sampling depth on the information form when you take depths of less than 6 inches.

Where to submit the samples

Soil samples are tested for acidity, phosphorus, potassium, calcium, magnesium, and organic matter to provide recommendations for limestone, N, P_2O_5, and K_2O on your crop. Tests for sulfur, zinc, iron, manganese, and copper are also available. Special tests for salt content of soils are also available for problem areas or irrigated fields.

Soil samples can be dropped off at your local extension center and at some fertilizer dealers. They will send the samples to the University of Missouri Soil Testing Laboratory for analyses. A nominal fee is charged for the analyses.

You need to complete a soil sample information sheet for each soil sample. Your extension specialist will help you fill out the form. Come prepared with the following information for each sample:

- Test desired (regular, zinc, sulfur, micronutrients),
- Last crop grown,
- Cropping plans and yield goals.

Retest fields as frequently as necessary to gain an understanding of the effects of cultural practices and crop production on the chemical properties of the soil.

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