Lesson 9: Soil Sampling and Interpreting Soil Test Results

Soil samples are taken from crop fields or gardens to determine the percentage of the organic matter, the pH, and the amount of available nutrients in the soil. The balance of plant nutrients needs to be adequate for the kind of crop desired. Each crop requires a particular balance of nutrients for optimal yields. For example, corn requires large amounts of additional nitrogen while soybeans require none, because soybeans have nitrogen-producing nodules on their roots. Recommendations based on soil test data are needed so adequate plant nutrients can be applied to produce healthy, high-yielding plants at a minimal cost.

Factors that Influence Sampling

A soil sample should be representative of the field, or an area within a field, but it should never represent more than 20 acres. A field should be divided if it includes different soil types, if different kinds of crops were grown in some parts of the field, or if the natural surface texture varies within the field. Also, eroded and wet areas should be sampled separately.

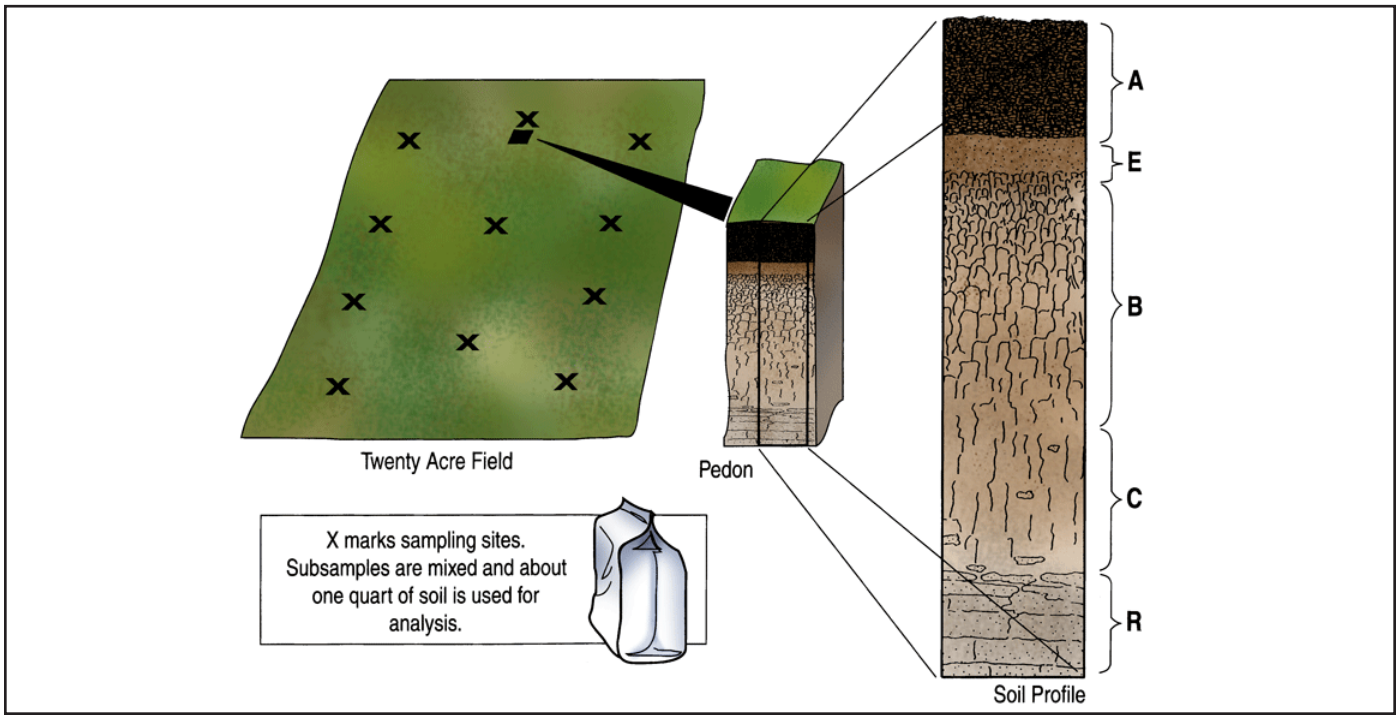
When to Sample

Samples can be taken at any time of the year. Samples can generally be obtained when the soil is dry enough to till. If the soil is slightly wet, it can be dried slowly and crumbled up by stirring or mashing with a mallet. Samples should not be taken when the soil is muddy. Generally, fields should be retested every 3 to 4 years to determine if any changes have occurred in the fertility level.

Sampling Procedure

A soil auger, probe, or spade can be used to take soil samples. Each subsample should include the top 7 inches of soil. Soil samples should be taken from different areas of the field and mixed thoroughly. Then, an adequate amount (about one quart) of sample material should be placed in a small box or bag. Special sample bags can be obtained from many fertilizer dealers or from the local university extension center. The sample should be identified by field number and field map. The container should be left open in a clean, dust-free area to air-dry. The sample should be taken to the local university extension center for analysis. Figure 9.1 shows the relationship among a 20-acre field, a

Figure 9.1 – Field, Pedon, Profile, Soil Sample



pedon (with a surface area of 1–10 sq meters), a profile, and typical soil sampling points.

Soil Sampling Procedure for a Cultivated Field

In a 20-acre cultivated field, 10–20 subsamples are needed. The soil in a freshly cultivated field may need to be pressed down slightly (with the foot) to obtain a natural depth.

Soil Sampling Procedure for a No-Till Field

Most no-till fertilizers are applied to the surface, so only the top 3 inches of soil may be affected. Therefore, when taking soil samples from a no-till field, two samples are needed: one sample from the top 3 inches, and another sample from the next 4 inches. In a 20-acre field, 10–20 subsamples are needed from the top 3 inches, and another 10–20 subsamples from the next 4 inches are needed.

Sampling Procedure for a Garden

Four to 10 subsamples (from the top 7 inches of soil) should be taken from a garden or yard, even though the garden area is very small.

Pitfalls of Soil Sampling

It is important that a soil sample be representative of the field or area within a field. Samples should not be taken just inside the field boundary, near a limestone gravel road, or from a severely eroded area. The test results from samples such as these are worthless. In the first example above, the area may have had a low pH if sampled correctly, but this sample would probably show a high pH because of the lime dust from the road. In the second example, taken from a severely eroded area, the sample probably would show a high cation exchange capacity, and would be low in available calcium. The test results would indicate a large lime requirement, which really would not be necessary for the entire field.

Taking samples that are not representative of the area can be costly in two ways. First, it may indicate much more fertilizer than is actually needed. Second, it may indicate less fertilizer than is actually needed, which would greatly reduce the crop yield desired. Either example above could prevent the landowner from obtaining a reasonable profit. Therefore, avoid sampling areas near a field boundary, a limestone gravel road, dead furrows, end rows, eroded spots, wet spots, and old barn lots. Above all, do not dry samples in an oven or microwave, as this may distort the test results.

Available Soil Testing Services

Some fertilizer companies will pay for soil tests if their fertilizer is purchased. Some companies do their own testing. However, others send soil samples to a laboratory. Recommendations should be made by an independent laboratory or the local university extension center.

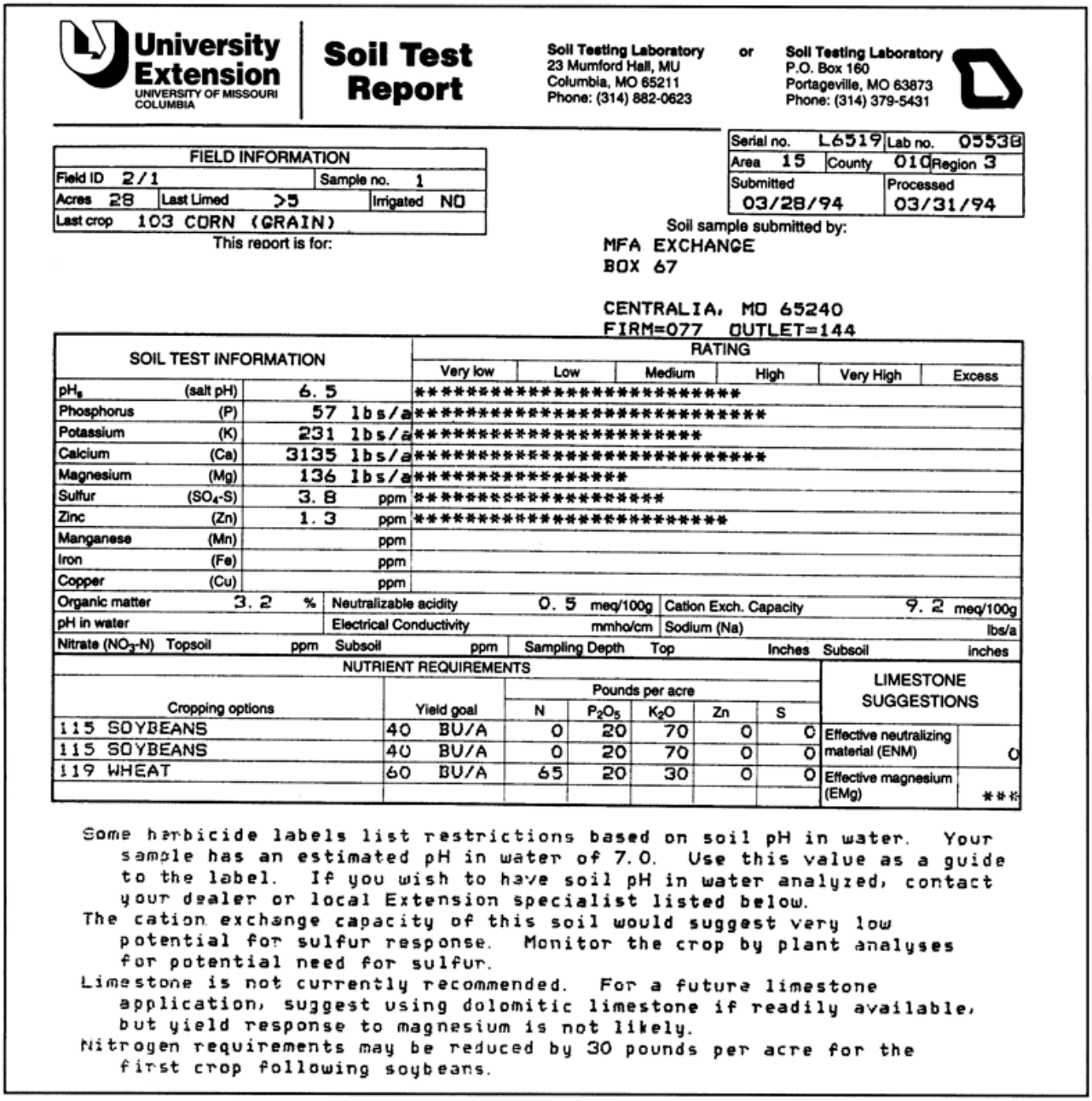
Crop History

The crop history (list of crops grown in the previous 3 or 4 years) helps to explain varying levels of nutrients found in the soil. For example, a sample showing a low nutrient level may indicate that the soil was naturally low in plant nutrients, when, in reality, an intensive cropping system without fertilizer applications had depleted the soil of available nutrients. In other words, the recent crop history usually helps to explain unusual test results and present nutrient levels. It also helps in making recommendations for future crops.

Soil Test Data

Data obtained from a complete soil test report (see Figures 9.2 and 9.3) shows the percentage of organic matter content, the pH, the CEC, and the available calcium, magnesium, phosphorus, and potassium. It will also give the neutralizable acidity (NA). Available nitrogen is not tested because it is quickly exhausted from the soil by erosion, leaching, denitrification (loss of nitrogen gas to the air), and growing crops. Therefore, nitrogen generally must be replenished as needed for each growing crop. Allowances can be made for nitrogen supplied by the organic matter and legume crops, but these amounts depend largely on how much residue is decomposed by microbes. In other words, the C:N ratio comes into effect here (see Lesson 8). To determine the actual nutrients for a particular soil, see Lesson 7.

Figure 9.2 – Soil Test Report for a Corn Field



University Extension
UNIVERSITY OF MISSOURI COLUMBIA

Soil Test Report

Soil Testing Laboratory
23 Mumford Hall, MU
Columbia, MO 65211
Phone: (314) 882-0623

or

Soil Testing Laboratory
P.O. Box 160
Portageville, MO 63873
Phone: (314) 379-5431

FIELD INFORMATION			
Field ID 2/1		Sample no. 1	
Acres 28	Last Limed >5	Irrigated NO	
Last crop 103 CORN (GRAIN)			

This report is for:

Serial no. L6519	Lab no. 05538		
Area 15	County 010	Region 3	
Submitted 03/28/94		Processed 03/31/94	

Soil sample submitted by:
MFA EXCHANGE
BOX 67

CENTRALIA, MO 65240
FIRM=077 OUTLET=144

SOIL TEST INFORMATION			RATING					
			Very low	Low	Medium	High	Very High	Excess
pH_s	(salt pH)	6.5	**********					
Phosphorus	(P)	57 lbs/a		**********				
Potassium	(K)	231 lbs/a			**********			
Calcium	(Ca)	3135 lbs/a				**********		
Magnesium	(Mg)	136 lbs/a				**********		
Sulfur	(SO_4-S)	3.8 ppm				**********		
Zinc	(Zn)	1.3 ppm				**********		
Manganese	(Mn)	ppm						
Iron	(Fe)	ppm						
Copper	(Cu)	ppm						

Organic matter	3.2 %	Neutralizable acidity	0.5 meq/100g	Cation Exch. Capacity	9.2 meq/100g
pH in water		Electrical Conductivity	mmho/cm	Sodium (Na)	lbs/a
Nitrate (NO_3-N) Topsoil	ppm	Subsoil ppm	Sampling Depth Top	Inches Subsoil	inches

NUTRIENT REQUIREMENTS

Cropping options	Yield goal	Pounds per acre N	P_2O_5	K_2O	Zn	S
115 SOYBEANS	40 BU/A	0	20	70	0	0
115 SOYBEANS	40 BU/A	0	20	70	0	0
119 WHEAT	60 BU/A	65	20	30	0	0

LIMESTONE SUGGESTIONS

Effective neutralizing material (ENM)	0
Effective magnesium (EMg)	***

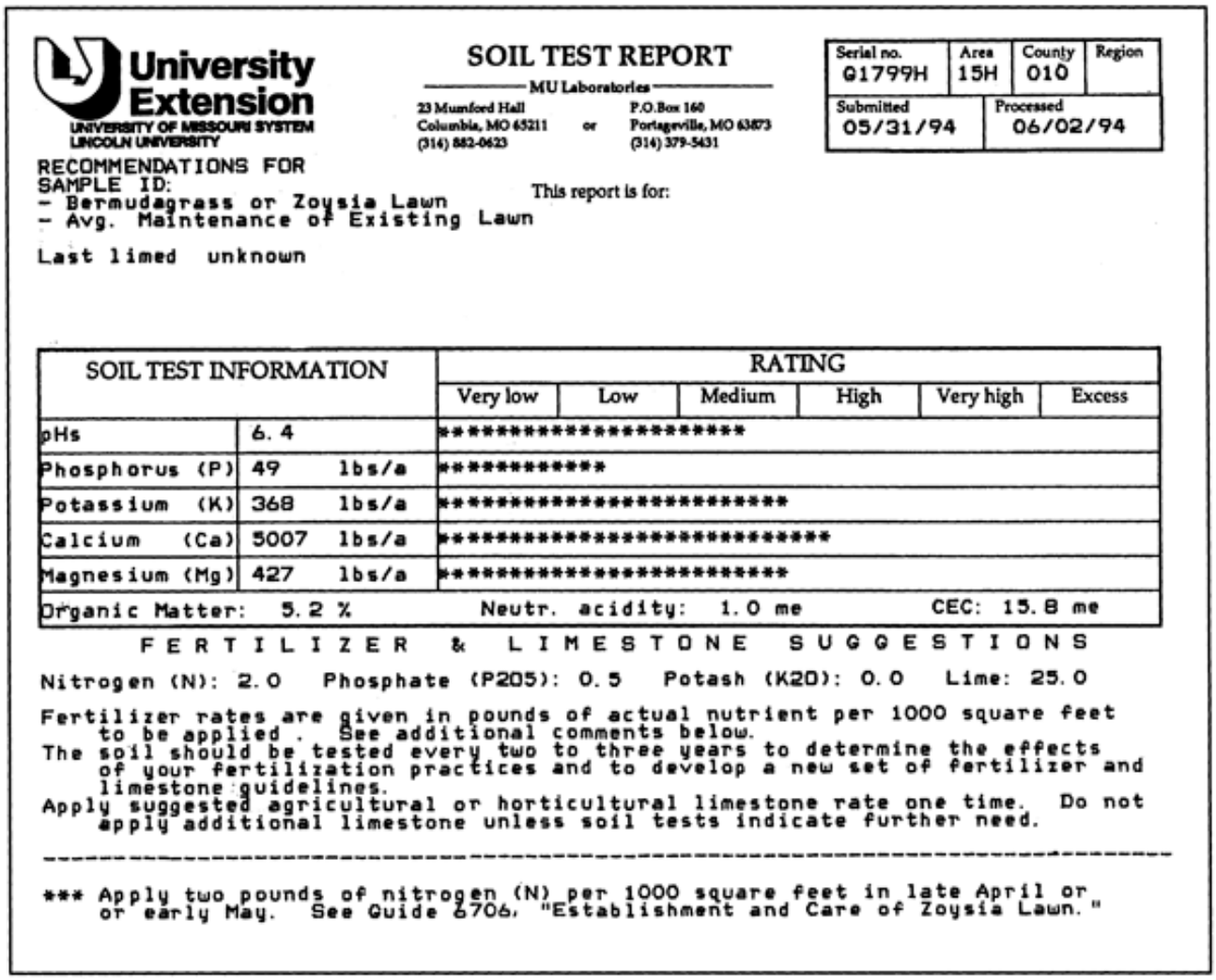
Some herbicide labels list restrictions based on soil pH in water. Your sample has an estimated pH in water of 7.0. Use this value as a guide to the label. If you wish to have soil pH in water analyzed, contact your dealer or local Extension specialist listed below.
The cation exchange capacity of this soil would suggest very low potential for sulfur response. Monitor the crop by plant analyses for potential need for sulfur.
Limestone is not currently recommended. For a future limestone application, suggest using dolomitic limestone if readily available, but yield response to magnesium is not likely.
Nitrogen requirements may be reduced by 30 pounds per acre for the first crop following soybeans.

Summary

Soil samples are needed to determine the organic matter content, the pH, and the amount of available nutrients in the soil. Soil samples should be *representative* of the field or plot. If the area includes different soil types, different crops, different soil textures, or eroded and wet areas, the field should be divided and those areas should be sampled separately. Samples should be taken within uniform areas.

Samples should be taken every 3 to 4 years and at a time when the soil is dry enough to cultivate. An auger, probe, or spade can be used to take soil subsamples from the top 7 inches (except for no-till fields in which the top 3 inches and the next 4 inches are sampled separately). Ten to 20 subsamples should be taken from large fields (up to 20 acres); 4 to 10 subsamples should be taken from gardens or lawns. Subsamples should be thoroughly

Figure 9.3 – Soil Test Report for an Existing Lawn



University Extension
UNIVERSITY OF MISSOURI SYSTEM
LINCOLN UNIVERSITY

SOIL TEST REPORT

MU Laboratories

23 Mumford Hall, Columbia, MO 65211, (314) 882-0623 or P.O.Box 160, Portageville, MO 63873, (314) 379-5431

Serial no.	Area	County	Region
G1799H	15H	010	

Submitted	Processed
05/31/94	06/02/94

RECOMMENDATIONS FOR
SAMPLE ID:
- Bermudagrass or Zoysia Lawn
- Avg. Maintenance of Existing Lawn

This report is for:

Last limed unknown

SOIL TEST INFORMATION			RATING					
			Very low	Low	Medium	High	Very high	Excess
pHs	6.4		**********					
Phosphorus (P)	49	lbs/a	**********					
Potassium (K)	368	lbs/a	**********					
Calcium (Ca)	5007	lbs/a	**********					
Magnesium (Mg)	427	lbs/a	**********					
Organic Matter: 5.2 %			Neutr. acidity: 1.0 me				CEC: 15.8 me	

F E R T I L I Z E R & L I M E S T O N E S U G G E S T I O N S

Nitrogen (N): 2.0 Phosphate (P205): 0.5 Potash (K20): 0.0 Lime: 25.0

Fertilizer rates are given in pounds of actual nutrient per 1000 square feet to be applied . See additional comments below.
The soil should be tested every two to three years to determine the effects of your fertilization practices and to develop a new set of fertilizer and limestone guidelines.
Apply suggested agricultural or horticultural limestone rate one time. Do not apply additional limestone unless soil tests indicate further need.

*** Apply two pounds of nitrogen (N) per 1000 square feet in late April or or early May. See Guide 6706, "Establishment and Care of Zoysia Lawn."

mixed together, air-dried, and taken to an independent laboratory. Samples should not be taken close to roads, disturbed areas, eroded spots, dead furrows, end rows, wet spots, and old barn lots. Large eroded areas should be sampled separately.

The crop history helps to explain present nutrient levels and unusual test results. It also aids in making recommendations for future crops.

Credits

Brown, J.R., and R.R. Rodriguez. *Soil Testing: A Guide for Conducting Soil Tests in Missouri* (Guide #EC 923). Missouri Cooperative Extension Service, 1983.

Buchholz, Daryl D., James R. Brown, and Roger G. Hansen. *Using Your Soil Test Results* (Guide #9111). Columbia, MO: University Extension, 1992.