UNIT III - SOIL FERTILITY AND MANAGEMENT

Lesson 3: Soil Testing

*Competency/Objective:* Use soil test results to improve soil fertility and crop production.

*Study Questions*

1. What techniques should be used to obtain a representative soil sample?

2. Where can soil samples be tested?

3. What are the key parts of a soil test report?

4. How are soil test results interpreted?

*References*

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit III.

2. University of Missouri Outreach and Extension Publications. These are available on the Internet at <http://muextension.missouri.edu/xplor>.
   a) G9102 - *Liming Missouri Soils*
   b) G9110 - *How to Get a Good Soil Sample*
   c) G9111 - *Using Your Soil Test Results*

3. Transparency Masters
   a) TM 3.1: Field Diagram for Soil Sampling
   b) TM 3.2: Field Sampling Pattern
   c) TM 3.3: Sampling Soil for Satellite Technology
   d) TM 3.4: Results of GPS Soil Sample
   e) TM 3.5: Soil Test Report

4. Activity Sheets
   a) AS 3.1: Interpreting Soil Test Results
   b) AS 3.2: Collecting a Soil Sample
UNIT III - SOIL FERTILITY AND MANAGEMENT

Lesson 3: Soil Testing

TEACHING PROCEDURES

A. **Review**

As discussed in the last lesson, a soil test report is important basic knowledge about a producer’s field. However, a soil report is nearly useless if the producer does not know how to use it completely or does not know what it means. This lesson will further address interpreting soil reports and incorporating their information into production techniques.

B. **Motivation**

1. Obtain soil samples from several students’ farms or yards and have them tested prior to the lesson. Make multiple copies of the soil test report for all students to evaluate.

2. Arrange for students to visit a nearby soil testing laboratory.

C. **Assignment**

D. **Supervised Study**

E. **Discussion**

1. Discuss the importance of why a soil sample should be taken from several locations in the given area to be tested. Soil properties can vary even over short distances. The size of the area to be tested will depend on the uniformity of the soil. Refer to the University of Missouri Extension Guide G9110 *How to Get a Good Soil Sample*. To do AS 3.2, a copy of the Soil Sample Information form from University Outreach and Extension will be needed. This is available from a local county extension office or on the Internet at <http://www.soiltest.psu.missouri.edu/>. Also use TMs 3.1, 3.2, 3.3, and 3.4 to show the methods of soil sampling.

What techniques should be used to obtain a representative soil sample?

a) Traditional soil sampling
   1) Area to be tested should be 20 acres or less.
   2) Take samples from different soil type areas.
   3) Special areas should be tested.
      (a) Where different crops have grown
      (b) Varying soil surface texture
      (c) Eroded and wet production areas
   4) Avoid taking samples from areas that are not representative of the entire field.
      (a) Driveways
      (b) Dead furrows
      (c) Road edges
      (d) Old barn lots
      (e) Severely wet or eroded areas where production is not feasible
   5) An average of 15 to 20 samples is recommended from each soil type or special area to determine average fertility of the field.
   6) Sample from top 7 inches of top soil should be prepared and taken to testing facility.

b) Sampling soil for Global Positioning Systems (GPS)
1) Mapping software divides the field into sectors, or grids.
2) A typical sector is 2 1/2 acres.
3) One sample, which consists of 8 to 10 core samples 5 to 10 feet apart, is taken every 2 1/2 acres.
4) Track exact location of soil samples to correspond with location on mapping software.

c) Comparison of traditional sampling method with GPS method
1) Comparison of same 20-acre plot could vary tremendously.
2) Traditional soil sample would show same results throughout the plot.
3) GPS sample may show variances for each sector throughout the plot.

2. Discuss possible locations where soil samples can be evaluated. Stress that all recommendations should be made by the local University Extension Center or an independent laboratory to confirm validity.

Where can soil samples be tested?

a) University Extension Center soil testing laboratory
b) Fertilizer dealers
c) Private soil testing laboratories
d) Testing for acidity levels
   1) Salt pH measurement - used by University of Missouri Soil Testing Service
   2) Water pH measurement - 0.5 unit higher than salt pH reading

3. Discuss the importance of determining the appropriate fertilizer rates for a field, garden, or lawn. Failure to sample soils before planting could lead to over- or underfertilization, which reduces income and net returns and can have a negative impact on the environment. Discuss an actual soil test from a crop field. (Show TM 3.1.)

What are the key parts of a soil test report?

a) Field information
   1) Field name
   2) Sample number
   3) Acres in the field
   4) Last crop planted
b) Soil test information
c) Rating
d) Nutrient requirements
   1) Cropping options
   2) Yield goal
   3) Pounds per acre
e) Limestone suggestions
f) Special notes

4. Explain each section of a soil test report in detail. Refer to the University of Missouri Extension Guides G9111 Using Your Soil Test Results and G9102 Liming Missouri Soils for more detailed information. Use TM 3.1 to interpret the results of the soil test or use soil test reports from local farms.

How are soil test results interpreted?

a) Field information section identifies which field was tested.
b) Soil test information gives suggested fertilizer and limestone treatments.
   1) Salt pH
2) Phosphorus
3) Potassium
4) Calcium
5) Magnesium
6) Sulfur
7) Zinc
8) Iron, manganese, and copper
9) Organic matter
10) Cation exchange capacity
c) Rating indicates probability of a yield increase from fertilizer application.
d) Nutrient requirements provide fertility management practice answers.
1) Cropping options
2) Yield goal
3) Pounds per acre
e) Limestone suggestions indicate amount of limestone needed to raise pH level to optimal level desired.
f) Special notes aid in interpreting the test results and list additional recommendations.

F. Other Activity

Organize a soil judging team. Practice judging soil near your school and at nearby schools. The local Natural Resources and Conservation Service (NRCS) office may help. In some cases, the local soil and water conservation district can help.

G. Conclusion

The information available in a soil report is worth the cost of the service. By following a soil report, a producer can make intelligent decisions about the types of plants most likely to thrive in a specific field and is able to make informed decisions on the amount and types of fertilizer to add to the field.

H. Answers to Activity Sheet

AS 3.1

1. Soybeans
2. 428 lb.
3. High
4. 6.3
5. Yes
6. Phosphorus, 86 lb.
7. 16.6 meq/100 g
8. Corn (grain), soybeans, and wheat
9. 60 bu./acre, 95 lb.
10. Phosphorus and potassium

(Note: These answers are from the example soil test report in the text. Answers will differ if local soil test reports are used.)

I. Answers to Evaluation

1.
   a) Area tested should be 20 acres or less.
   b) Take samples from different soil type areas.
c) Special areas should be tested such as different crop areas, areas with varying soil surface texture, and wet and eroded production areas.

d) Avoid taking samples from areas that are not representative of the entire field such as driveways, dead furrows, road edges, old barn lots, and severely wet and eroded areas not in production.

2. Answers should include two of the following: University Extension soil laboratory, fertilizer companies, independent soil testing laboratories.

3. 
   a) Field information
   b) Soil test information
   c) Rating
   d) Nutrient requirements
   e) Limestone suggestions
   f) Special notes

4. d
5. e
6. a
7. b
8. c
EVALUATION

Complete the following short answer questions.

1. What factors or techniques should be considered in obtaining a representative soil sample using traditional methods?
   a. 
   b. 
   c. 
   d. 

2. List two locations where soil samples can be evaluated.
   a. 
   b. 

3. List the six key components of a soil test.
   a. 
   b. 
   c. 
   d. 
   e. 
   f. 

Match the following terms in the right column with the definition in the left column.

4. _____ Indicates the level of active soil acidity.  
   a. Calcium
5. _____ Expressed in pounds of elemental P per acre.  
   b. Potassium
6. _____ Used to calculate CEC.  
   c. Organic matter
7. _____ Expressed as pounds of exchangeable K per acre.  
   d. Salt pH
8. _____ Used to estimate potential hydrogen release.  
   e. Phosphorus
Field Diagram for Soil Sampling
Field Sampling Pattern
Sampling Soil for Satellite Technology
Results of GPS Soil Sample
**Soil Test Report**

**FIELD INFORMATION**
- Field ID: AL SOIL
- Sample no: 1
- Area: 22
- Last crop: 110 SOYBEANS
- Soil sample submitted by:
  - JOHN DOL
  - RURAL ROUTE 1, BOX 1
  - CENTER TOWN, MN

**SOIL TEST INFORMATION**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>ph</td>
<td>6.5</td>
</tr>
<tr>
<td>P</td>
<td>Low</td>
</tr>
<tr>
<td>Ca</td>
<td>High</td>
</tr>
<tr>
<td>Mg</td>
<td>High</td>
</tr>
<tr>
<td>Sulfur</td>
<td>Low</td>
</tr>
<tr>
<td>Zinc</td>
<td>Low</td>
</tr>
<tr>
<td>Iron</td>
<td>Low</td>
</tr>
<tr>
<td>Copper</td>
<td>Low</td>
</tr>
<tr>
<td>Organic Matter</td>
<td>3.9 %</td>
</tr>
</tbody>
</table>

**RATING**
- Very Low
- Low
- Medium
- High
- Very High
- Excess

**NUTRIENT REQUIREMENTS**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield goal</th>
<th>Pounds per acre</th>
<th>LIMESTONE SUGGESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>103 Corn (Grain)</td>
<td>140 BUS/A</td>
<td>155 0 70 0</td>
<td>0 Effective neutralizing material (ENM)</td>
</tr>
<tr>
<td>115 Soybeans</td>
<td>40 BUS/A</td>
<td>0 0 20 0</td>
<td>0 Effective neutralizing Limestone (EML)</td>
</tr>
<tr>
<td>127 Winter Wheat</td>
<td>60 BUS/A</td>
<td>72 0 20 0</td>
<td>0 Effective neutralizing Limestone (EML)</td>
</tr>
<tr>
<td>103 Corn (Silk)</td>
<td>140 BUS/A</td>
<td>155 0 20 0</td>
<td>0 Effective neutralizing Limestone (EML)</td>
</tr>
</tbody>
</table>

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Your sample has an estimated pH in water of 6.8. 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. Nitrogen requirements may be reduced by 30 pounds per acre for the first crop following soybeans. Not applicable for wheat. Soil testing high in P or K should be retested annually to determine when maintenance fertilizer should be applied.
Interpreting Soil Test Results

Objective: Students will be able to identify components and interpret information on the soil test report.

Directions: Using the soil sample report from the text or results from a soil sample taken locally, answer the following questions.

1. What was the last crop planted on the field from which soil samples have been taken?

2. What is the exchangeable K per acre for potassium?

3. What is the rating for probability of yield increase for potassium?

4. What is the salt pH?

5. Is the salt pH within the favorable area for Missouri soils?

6. Which component has a very high rating and what are the pounds available per acre?

7. What is the cation exchange capacity?

8. What are the cropping options to be considered for the sample location?

9. What is the yield goal for wheat and how many pounds per acre of nitrogen are recommended?

10. Which two components should be retested annually to determine when maintenance fertilizer should be applied?
Collecting a Soil Sample

Objective: Students will be able to collect a soil sample and prepare it for a testing laboratory.

Materials and Equipment:

- Soil probe, auger, or spade
- Clean, plastic bucket
- Soil sample boxes
- Soil sample information form

Procedure:

1. Scrape away any surface mat of grass or litter from the chosen soil sample site. Make sure you are taking a soil sample from a relatively uniform area of a field. Before you take the sample, look at the site surroundings. Note the slope of the land, crop rotation, limestone, fertilizer, manure, and nearby farmsteads or feedlots.

2. Remove a soil sample using a soil probe, auger, or spade. Take a sample for fertilizer and limestone recommendations to a depth of 6 to 7 inches or to tillage depth if deeper. In long-term, no-till fields, take a separate sample of the top 2 inches of soil for soil acidity measurements.

   (Note: If you use a 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.)

3. Note what the soil sample looks like including color and texture.

4. If more than one sample has been taken from the sampling area, mix all of the subsamples in a clean, plastic bucket.

5. Let the sample air-dry, then place it in a small (1-pint) box or bag, and label it for analysis.

   (Note: Record sampling depth on the information form when taking depths of less than 6 inches.)

6. Properly clean and store any equipment used.

7. Complete a soil sample information sheet for each soil sample by using the form your instructor provides you.