UNIT III - SOIL FERTILITY AND MANAGEMENT

Lesson 2: Soil Types and Limitations

*Competency/Objective:* Identify how soil morphology affects cropping options.

*Study Questions*

1. Using a county soil survey book, how are local soil types identified?
2. What are the limiting factors for crop selection and growth?

*References*

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit III.
2. *Soil Survey of (your county), Missouri.* U.S. Department of Agriculture Soil Conservation Service, Missouri Agricultural Experiment Station.
3. Transparency Master
   a) TM 2.1: Sample Survey Map and Soil Legend
4. Activity Sheet
   a) AS 2.1: Identify Soil Types by Using Soil Survey
UNIT III - SOIL FERTILITY AND MANAGEMENT

Lesson 2: Soil Types and Limitations

TEACHING PROCEDURES

A. **Review**

A county soil survey book is an important guide for determining soil types and limitations. Information provided in these books can help producers make decisions on site acquisitions, cropping options, location of land and building structures, and land improvements.

B. **Motivation**

Have students use the local county soil survey book to identify the soil type(s) of their family farm, a relative’s or friend’s farm, or that of another county resident’s farm. Use TM 2.1 to show an example of a soil survey map and how the soil legend details the types of soils found in that particular area.

C. **Assignment**

D. **Supervised Study**

E. **Discussion**

1. Explain the term soil morphology. Discuss the history and importance of using soil surveys. Soil survey books contain important information applicable in managing farms, ranches, and woodlands. Information includes recommendations for selecting sites for roads, ponds, buildings, and other structures, as well as procedures for determining the suitability of land tracts for farming, industry, and recreation. Explain how to interpret a soil survey book. Refer to TM 2.1 for an example of a survey map and corresponding soil legend.

Using a county soil survey book, how are local soil types identified?

a) County soil survey books to classify, map, and interpret Missouri soils
   1) Chemical and physical properties of county soil types
   2) Listed by national classification system
   3) Interpreted for agricultural, engineering, recreational, and urban uses
b) Surveys to be made by soil scientists
   1) Examine aerial photographs.
      (a) Determine relationships among soil colors, native vegetation, and topography.
      (b) Characteristics of soils help predict locations of different soils.
   2) Walk the landscape to gather additional specific data.
c) Contents of survey maps
   1) Road boundaries, water features, township sections, and cultural features (schools and farmsteads)
   2) Information about each soil - interpretations for best use and management practices
   3) Free to state residents from local soil and water conservation district offices or the state NRCS office
d) Procedure to determine soil type
   1) Select a field, farm, or a homestead to research.
   2) Identify the township section number where the field, farm, or homestead is located.
      (a) Use the Index to Map Sheets found in the center of the book.
(b) Sectioned and numbered townships correspond to soil survey sheets (aerial view of each township).

3) Identify the soil type symbol(s) on soil survey sheet for the selected location.
   (a) Symbol explanations are in the Index to Map Units found in the front of the survey book.
   (b) Symbols may also be on the back of the Index to Map Sheets page.

4) Information on general soil associations for the county is in the color-coded General Soil Map adjacent to the Index to Map Sheets page.
   (a) Soil association groups have distinctive pattern of soils, drainage, and relief.
   (b) Descriptions of each group are found in General Soil Map Units section.
      (1) Provides information useful in planning the use and management of large areas
      (2) Explains soil classification of each soil type in the association group

5) Refer to Detailed Soil Map Units section for descriptions of each county soil type and to determine the suitability and potential use of a soil.

6) Tables section shows data on specific land use for each soil type.

7) Remaining information in the book reviews general and historical information on the county.

2. Limiting factors are soil properties that limit a soil from producing productive crops. Review the limiting factors found on Table 2.1 in the Student Reference for crop selection and growth. Additional limiting factors may be associated with specific soils. (For a more extensive explanation of soil erosion, see Lesson 6 of this unit.)

What are the limiting factors for crop selection and growth?

a) Slope
   1) Incline of the land
   2) Percentage of slope - vertical distance ÷ horizontal distance x 100
      (a) Less than 3% is considered an asset.
      (b) Over 3% is considered a liability.
   3) Characteristics
      (a) Gradient - steepness of the land surface (operation of farm equipment and irrigation more difficult on steeper slopes)
      (b) Length - affects erosion (Long slope allows runoff water to gather more volume as it flows over the surface increasing erosion.)
      (c) Shape - affects erosion (classified as linear, concave, or convex)
      (d) Aspect - refers to the effects of temperature and sun exposure on the soil; depends on compass direction

b) Erosion
   1) Wearing away of the land surface by water, wind, ice, or other geological agents
   2) Types of water erosion
      (a) Sheet - the detachment of soil particles by flowing water; usually caused when rain hits wet soil
         (1) Particles are detached and can float into rills and gullies.
         (2) Particles are transported into low places or off fields.
      (b) Rill - small steep-sided channels where runoff water concentrates
      (c) Gully - miniature valleys where water usually runs
         (1) Only after rainfall
         (2) An obstacle to farm machinery

c) Available water capacity (AWC)
   1) Soil's capacity to hold water
   2) Commonly expressed as inches of water per inch of soil
   3) Soils with low or very low available water-liability
d) Surface drainage
1) Runoff, or surface flow of water from an area
2) Needed on all poorly drained soils regardless of their classification
   (a) Soils that are nearly level in slope with depressional areas
   (b) Soils on sloping areas below seepy areas

e) Internal drainage (depth to high water table)
1) This is the rate at which internal free water leaves the soil to allow aeration.
2) Gravitational water must move out of the profile quickly so the roots can obtain
   adequate aeration.
3) Classified on seven levels
   (a) Excessive
   (b) Somewhat excessive
   (c) Well
   (d) Moderately well
   (e) Somewhat poorly
   (f) Poorly
   (g) Very poorly

f) Rock fragments
1) Rock or mineral fragments with a diameter of 2 mm or more such as gravel, cobbles,
   or boulders
2) Affect amount of irrigation water the soil can absorb

g) Stoniness
1) Soil in which rock fragments 10 to 24 inches (25 – 60 cm) in diameter are exposed
   at the surface
2) Evaluated according to the percentage of the soil surface covered by detached stones
3) Interferes or even inhibits tillage
4) Five general classes
   (a) Not stony
   (b) Stony
   (c) Very stony
   (d) Extremely stony
   (e) Rubbly

(Refer to IML’s Soil Science Guide, Chapter 11, for a review of these classes.)

F. Other Activity

Assess the overall capability of the land in your area. Get an aerial photograph from the local U.S.
Department of Agriculture office. Determine the slope, surface texture, depth, and other features of fields
identified on the map. Occasionally, the office may have a soil scientist or conservationist who can help
with this project. Prepare a bulletin board that shows what you have found.

G. Conclusion

Students with an accurate understanding and comprehension of the various soil types may find
themselves competing in soil judging contests. Other than winning prizes and securing titles, however,
knowing the various soil types and classifications can be useful in making land use decisions.

H. Answers to Activity Sheet

The answers will vary depending on the specific location of the area to be researched.

I. Answers to Evaluation

1. b
2. d
3. a
4. c
5. c
6. g
7. f
8. a
9. d
10. b
11. e
12. Gradient, length, shape, aspect
13. Sheet, rill, gully
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EVALUATION

Circle the letter that corresponds to the best answer.

1. Which section in the soil survey book is color coded and divided into groups of soil associations in the survey area?
   a. Index to Map Sheets
   b. General Soil Map
   c. Detailed Soil Map
   d. Tables

2. Which section in the soil survey book gives data regarding specific land uses for each detailed soil map unit?
   a. Index to Map Sheets
   b. General Soil Map
   c. Detailed Soil Map
   d. Tables

3. Which section in the soil survey book shows the townships sectioned and numbered?
   a. Index to Map Sheets
   b. General Soil Map
   c. Detailed Soil Map
   d. Tables

4. Which section of the soil survey book contains soil descriptions for the soil associations and explains the soil classification of each soil type?
   a. Index to Map Sheets
   b. General Soil Map
   c. Detailed Soil Map
   d. Tables

Match the definition in the left column with the term in the right column.

5. _____ Soils capacity to hold water
6. _____ 25 - 60 cm in diameter
7. _____ 2 mm in diameter
8. _____ Inclination of the land surface
9. _____ Runoff from an area
10. _____ Wearing away of land surface
11. _____ Depth to high water table

a. Slope
b. Erosion
c. Available water capacity
d. Surface drainage
e. Internal drainage
f. Rock fragments
g. Stoniness

Complete the following short answer questions.

12. What are four slope characteristics?
   a.
   b.
   c.
   d.

13. What are the three main types of erosion?
   a.
   b.
   c.
Sample Survey Map and Soil Legend

26 = Haynie-Waldron complex
86 = Waldron silty clay
40 = Leta silty clay
24 = Haynie silt loam
70A = Sarpy loamy fine sand
0 to 4 percent slope
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Interpreting Soil Survey Books

Objective: Students will become familiar with understanding and interpreting soil survey maps and guides.

Directions: Using a soil survey book provided by your instructor, answer the following questions. This activity may be completed individually or as a group.

Procedures:

1. Locate the area being researched on the Index to Map Sheets page. What is the township section number for the area to be researched?

2. Find the location of the researched area on the survey map that corresponds to the township number above. Write down the symbols and codes located for this area. Refer to the Index to Map Units in the front of the survey book and list what each symbol or code means and on what page detailed information can be located.

3. Turn to the Detailed Soil Map Units section of the soil survey book and use this information to determine what crop or crops will be productive in this area. Summarize the information in paragraph form listing any limitations.