AGRONOMY 255, 270

ORGANIC SOILS AND ORGANIC MATTER

Objectives (To be able to):

1. Explain how muck and peat soils develop.
2. List the criteria which distinguishes a mineral soil from an organic soil.
3. Distinguish between a peat and a muck soil.
4. List the characteristics of sedimentary, fibrous and woody peats.
5. List two commercial uses of peats and mucks.
6. List and explain the soil order and suborder classification for organic soils.
7. List at least five management problems which occur with organic soils.
8. List and explain four economic factors which must be considered before starting to farm organic soils.
9. Explain the effects of native vegetation and drainage on organic matter accumulation.
10. Describe the method shown in the study center of extracting soil organic matter based on solubility.
11. Know the approximate C:N ratio of soil humus, soil organisms, and common residues, such as alfalfa, manure, corn stalks, wheat straw, and sawdust.
12. Explain how the addition of residues with different C:N ratios affects decomposition rate and N availability as related to mineralization and immobilization.
13. List and explain ways to compensate for wide C:N ratios in residues and avoid N deficiencies.
14. Explain the importance of organic matter to the physical and chemical properties of soils.
15. Explain in detail the ways of measuring soil organic matter content as illustrated in the Study Center.
16. Use the Munsell chart and the Illinois chart to estimate % organic matter in a soil.

Reading Assignment:

Brady and Weil, pp. 73-74, 361-394
Supplemental xerox material in booth                       Spring 2015
STUDY GUIDE

I. Organic Soils (Bench 1, computer & supplemental material)
   A. How they form (p. 353-356 of the xerox material in your booth)
      1. Topographic position
      2. Vegetation changes
      3. Climate (Factors causing accumulation of O.M.)

   B. Mineral vs. organic soils

      *All soils with greater than 30% organic matter are organic soils and all soils with less than 20% organic matter are mineral soils. The classification, of a soil with 20-30% O.M. as being organic or mineral depends on both the clay and organic matter content. SEE GRAPH!

   C. Peat vs. muck

   D. Types of Peats
      1. Sedimentary Peat
      2. Fibrous Peat
      3. Woody Peat

   E. Commercial uses of peats and mucks
      1.
      2.
      3.
F. Classification of organic soils  
(Comprehensive classification system)  
1. Soil Order - ______________________________  
2. Soil Suborders – Based on:  
   a. Fibrast  
   b. Hemist  
   c. Saprist  

G. Notes on pictures presented on the computer  

II. Management of Organic Soils (Computer)  
A. Physical and chemical properties  
   1. Subsidence  
   2. Burning  
   3. Water control  
   4. Frost damage  
   5. Wind erosion – bulk density  
   6. CEC and buffering capacity
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7. Nutrient problems
   a. Nitrogen
   b. Potassium
   c. Phosphorus
   d. Trace elements
   e. pH

III. Review of Effect of Native Vegetation and Drainage on Organic Matter (Front Bench)

A. Soil of the Week
   Why is this sand soil so high in OM?
   What is its drainage class?
   Why isn't this sand better drained?

B. What's a catena? _____________________________________________
   _____________________________________________________________
   List the 4 drainage classes
   ___________________ ___________________ ___________________ ___________________

C. Forest vs. Prairie derived soils
   How do the two catenas differ?
   Montgomery-Celina-Miami catena _____________________________
   _____________________________________________________________
   Parr-Raub-Drummer catena ________________________________
   _____________________________________________________________
   Explain Fig. 2.22, p. 50 of your text:
   _____________________________________________________________
D. Notes from magazine and bulletins on organic matter or from Jim Ahlrichs' slide set on Peats.

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IV. Soil Organic Matter

A. Humus defined

B. Plant material \[\xrightarrow{\text{time}}\] humus

C. Type structure for humic acid (bench 2 and lecture)

![Diagram of soil organic matter]

D. Characteristics of components of Organic Matter (Bench 2)

E. Read pages 372-374 in textbook: Genesis and Nature of Soil Organic Matter and Humus

RETURN TO THE COMPUTER
V. Carbon:Nitrogen Ratios (Computer, Bench 2 and p. 369-372)

A. C:N ratios in plant material

1. Age

2. Grasses vs. legumes

3. Typical C:N ratios \( C: N = C/N = \frac{C}{N} \)
   a. Humus

b. Microorganisms

c. Residues: (Bench 2, Brady and Weil, pg. 369)
   alfalfa
   manure
   corn stalks
   wheat straw
   sawdust

4. Wide C:N ratio vs. Narrow C:N ratio

B. Effect of C:N ratio on N Availability

This is not explained in your reading assignment, so if this concept is not clear to you talk to a tutor.
C. Cures for wide C:N ratios

1. Add nitrogen fertilizer

2. Burning

3. Composting (Brady and Weil, pp. 391-393)

\[
\text{Microorganisms} \quad \frac{\text{Residue}}{(\text{Wide C:N Ratio})} \rightarrow CO_2 + \text{Residue} \quad \frac{\text{Loss of C}}{(\text{Narrow C:N Ratio})}
\]

VI. Importance of Soil Organic Matter

A. Organic matter and nitrogen availability

B. Organic matter and pesticide rates

C. Influence of Soil's physical and chemical properties

1. Structure
2. Ease of tillage
3. Porosity
4. Water holding capacity
5. Nutrient holding capacity

VII. Soil Organic Matter Determination (Bench 3)

A. Determination by color

B. Determination by ashing

C. Chemical-colorimetric method