

# Nebraska Soil Science Curriculum

## Soil Organic Matter

Approximately 90 minutes

\*\*\*Content and lab derived from the USDA-NRCS Guides for Educators. Please see the Guides for additional helpful pictures and diagrams.\*\*\*

### Objectives

By the end of the lesson, students will know or be able to:

- Define: soil organic matter
- Explain the role of inherent factors affecting soil organic matter
- Explain the five soil organic matter management practices
- Explain how soil organic matter relates to soil function
- Estimate organic material needed to increase soil organic matter
- Measure soil organic matter

### Materials

- Dry Erase markers
- Soil Samples high in organic matter
- Guided notes sheet – 1 per student
- Soil Glue Lab sheet from NRCS – 1 per student
- 2 wide mouthed jars
- 2 pieces of 1/2" wire mesh
- 2 clod of soil each about the size of an egg from two different sites
- Water
- Poster making supplies
- Measuring Soil Organic Matter Lab – 1 per student
- Soil Color Chart
- Plastic Bucket
- Squirt bottle with water
- 5 Sheets of poster paper or flip charts
- Markers

### Preparatory Work

- Make necessary copies
- Obtain needed supplies
- Prepare 5 flip charts

### Enroll the Participants – Approximately 3 minutes

Write “Soil Organic Matter” on the board. As students walk into the classroom, greet them at the door with a dry erase marker. Instruct each student to write something they know about the phrase or a question they have on the board.

After all students have written on the board, review several of the responses with the class. Explain to the class that this lesson will investigate soil organic matter.

### Provide the Experience – Define soil organic matter and explain roles of inherent factors affecting soil organic matter – Approximately 5 minutes

Divide students into small groups and provide each group with a soil sample high in organic matter. Within their group, have the students collect observations for look, feel, and smell of the soil.

*Note: Consider finding a soil sample with established vegetation that may have organic matter in various stages and visible living organisms.*

After a few minutes, encourage students to share their observations with the class.

State that, in this lesson, the class will continue to explore soil organic matter.

### Label the Information – Approximately 3 minutes

Instruct students to capture the definition of soil organic matter in their guided notes.

Soil organic matter is the organic component of soil, consisting of three parts:

- Plant residues and small living soil organisms
- Actively decomposing matter
- Humus: Stable organic matter

Also, guide students through factors affecting organic matter. Encourage students to capture this information in their guided notes page.

## Factors affecting organic matter in soil

- Climate
  - Organic matter decomposes more quickly in warm and humid climates than cool dry climates
- Soil Texture
  - Soil aeration: more oxygen in the soil speeds up the decomposition process
- Vegetation
  - Prairie soils have more organic material added to the soil than forest soils because of vegetation

Demonstrate the Relevance – Approximately 5 minutes

Guide students through a short discussion on organic matter and its formation. Encourage students to describe the organic matter in the soil in your area. Use the following questions to guide your conversation:

- What type of vegetation creates organic matter in our area?
- Compared to the rest of the country, does organic matter decompose more quickly or slowly? Why?
- How do animals impact organic matter in our area?
- How is organic matter different in different soils even in our town?

Conclude this conversation by having a discussion about why they believe organic matter is important to soils.

Provide the Experience - Management practices and organic matter related to soil function – Approximately 20 minutes

Demonstrate soil organic matter's role in surface soil stability using the "Soil Glue" demonstration and have students complete the "Soil Glue – Student Exercise" with their thoughts and observations.

Label the Information – Approximately 5 minutes

While discussing management practices of soil organic matter, have students capture the following information in their guided notes

- Use of conservation cropping systems
  - No-till, solid manure, high residue crops, grasses, or perennial legumes help improve organic matter
- Reducing or eliminating tillage
  - Tillage exposes the organic matter to the air and can result in the lowering of stable organic matter
- Reduce erosion
  - When soil erodes organic matter goes with in
- Soil-test and fertilize properly
  - Proper fertilization encourages root growth for more organic matter in the soil
- Use of perennial forages
  - Provides for annual die back and regrowth of plants

Instruct student to list the benefits of organic matter as it relates to soil function:

- Nutrient Supply
  - As organisms decompose, nutrients are released in a plant usable form
- Water-Holding Capacity
  - Organic matter has the ability to hold up to 90% of its weight in water
- Soil Aggregation
  - Improved soil aggregation improves soil structure
- Erosion Prevention
  - Erosion is reduced because water infiltration and soil stability are increased

Explain how each benefit impacts soil function. Consider using the information above to help guide your instruction.

Demonstrate the Relevance – Approximately 20 minutes

Students will create an advertisement for soil organic matter. Explain to students that they have been hired by the National Soils Corporation to create a TV, radio, or magazine advertisement for the sale of organic matter. They have 10 minutes to use the materials provided to create their advertisement that will be shared with that class. Explain to students that they must include a definition or description of organic matter and at least three benefits organic matter has to soil. Divide the class in to groups of 3-4 students.

Note: Provide a variety of props for TV commercials and poster supplies for the magazine advertisement.

Allow students to present their advertisements to the class. After all groups have presented, thank the students for their engagement and willingness to share.

Provide the Experience – Measure soil organic matter – time varies with number and location of samples

Measuring Soil Organic Matter:

Gather necessary materials and inform students you will be giving important instructions for measuring soil organic matter Ask students to follow along in their “Measuring Soil Organic Matter – Lab Sheet”

At the conclusion of the laboratory, instruct students to clean up and return materials to designated areas.

*Note: Consider reviewing the NRCS Soils Video “Soil Organic Matter” to aid in this laboratory experience.*

Label the Information – Approximately 3 minutes

Students will briefly describe the process of measuring soil organic matter using a soil color chart in their guided notes.

### Demonstrate the Relevance – Approximately 5 minutes

Instruct students to complete the questions in the “Measuring Soil Organic Matter – Lab Sheet.” After a few minutes, briefly discuss these questions as a class.

### Review the Content – Approximately - 10 minutes

Prior to class place five posters/flip charts around the room labeled with: What is Organic Matter?, Factors that Affect Organic Matter, Management of Organic Matter, Benefits of Organic Matter, and Measuring Organic Matter. Divide the class into 5 groups and assign one group to each flip chart. Give them 1 minute to write down as much as they can about that topic on their flip chart and then have them rotate and repeat at each flip chart. When they return to their original flip chart, instruct them to summarize all of the information on the chart and review the information to the class. Allow each group 2 minutes to summarize their information and 30 seconds to present to the class.

Thank each group as they finish presenting for their summarization.

### Celebrate Student Success – Approximately 2 minutes

Thank students for their contributions and congratulate them for demonstrating their understanding of soil organic matter. Take a minute to preview the next lesson.

# Guided Notes: Soil Organic Matter

Notes completed by \_\_\_\_\_

## Soil Organic Matter:

### Factors Affecting Soil Organic Matter



### Soil Organic Matter Management



## Benefits of Soil Organic Matter



The \_\_\_\_\_ chart provides an estimate of the amount of organic matter in the soil.

Steps to measure soil organic matter:

1.

2.

3.

4.

# Measuring Soil Organic Matter – Laboratory (USDA-NRCS)

Completed by \_\_\_\_\_

## Materials Needed to Measure Soil Organic Matter

- \_\_\_\_\_ Soil color chart for estimating organic matter
- \_\_\_\_\_ Plastic bucket and probe for gathering and mixing soil samples
- \_\_\_\_\_ Squirt bottle with water (to moisten soil if dry)
- \_\_\_\_\_ Pen, field notebook, sharpie, and zip lock bags (for labeling soil samples taken back to the classroom)

**Considerations** – Soil organic matter typically is measured in a lab. The University of Illinois soil color chart provides an estimate of the amount of SOM in mineral soils formed under grass, as many soils are in the Midwest and other natural grassland regions around the world. It can be used for other soils, but is not as accurate. Please read color chart instructions for details and other considerations. Other accepted methods to estimate organic matter such as color charts for other types of soils, lab testing, or tools can be used.

## In-field Estimate for Soil Organic Matter (refer to color chart for more guidance)

1. Soil Sampling: Soil organic matter is highly variable. At least 10 small samples are gathered randomly from an area that represents the soil type and management history from the surface 0-8 inch depth and placed in the small plastic bucket and mixed. You may also estimate organic matter at each sample site and average organic matter readings for the area you are assessing. Repeat for each sampling area.
2. Use moist soil. If the sample is dry moisten it.
3. Match the soil with the color that it most closely matches (Figure 3) organic matter color chart (or other method of estimating organic matter content). Record associated organic matter content in Table 3 and complete calculations in interpretations section of this document (suggest averaging several samples).

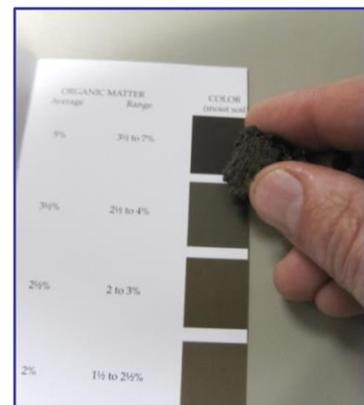


Figure 3. Soil color chart with soil at 3.5% soil organic matter (Kucera 2012).

1. What is organic matter?
2. What visible types of organic matter did you observe in your samples?
3. How does color help determine soil organic matter?
4. What predictions do you have for the future organic matter of the soil in your sampled area? Why?
5. Why is organic matter important to the soil you sampled?