Course	Agricultural Science II
Unit	Soil Science
Lesson	Soil Color
Estimated Time	50 minutes

Student Outcome

Explain the importance of soil color.

Learning Objectives

1. Explain the importance of soil color.
2. Describe how the matrix color of soil is identified.
3. Describe how organic matter affects soil color.
4. Identify other factors which affect soil color.
5. Explain soil mottling.
6. Describe what causes soil mottling to occur.
7. Describe how mottles are identified.
8. Explain what a Munsell color notation indicates.

Grade Level Expectations

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. Minor, Paul E. *Soil Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1995.
2. *Soil Science Curriculum Enhancement.* University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- ❑ Munsell color chart

Supplemental Information

1. Internet Sites
   - ❑ The Color of Soil. USDA Natural Resources Conservation Service. Accessed May 15, 2008, from http://soils.usda.gov/education/resources/k_12/lessons/color/.
   - ❑ Fletcher, Peter C., and Peter L.M. Veteman. *Soil Morphology as an Indicator of Seasonal High Water Tables.* Accessed May 15, 2008, from http://nesoil.com/properties/eshwt.htm.
   - ❑ Horizon Properties: Soil Color – Munsell Notation. Goddard Space Flight Center, NASA. Accessed May 15, 2008, from http://soil.gsfc.nasa.gov/pvg/munsell.htm.
   - ❑ Munsell Soil Color Charts, available in sets or individual pages from Forestry Suppliers, Inc. The three Munsell color charts recommended most often are the 10YR, 7.5YR, and 5YR. Three additional charts are used periodically: 5Y, 2.5Y, and 2.5YR. Accessed May 15, 2008, from http://www.forestry-suppliers.com/product_pages/View_Catalog_Page.asp?mi=3078.

2. Print
   - ❑ Ashman, Mark R., and Geeta Puri. *Essential Soil Science: A Clear and Concise Introduction to Soil Science.* Malden, MA: Blackwell Publishing, 2002.
   - ❑ Brady, Nyle C., and Ray R. Weil. *The Nature and Properties of Soils.* 14th ed. Upper Saddle River, NJ: Prentice Hall, Inc., 2007.
   - ❑ Coyne, Mark S., and James A. Thompson. *Fundamental Soil Science.* Clifton Park, NY: Delmar CENGAGE Learning, 2005.
   - ❑ Donahue, Roy L., and Roy Hunter Follett. *Our Soils and Their Management*. Danville, IL: Interstate Publishers, Inc. 1990.
   - ❑ Plaster, J. Edward. *Soil Science and Management.* 2nd ed. Albany, NY: Delmar Publishers, Inc., 1992.
   - ❑ White, Robert E. *Principles and Practice of Soil Science: The Soil as a Natural Resource.* 4th ed. Malden, MA: Blackwell Publishing, 2005.

Interest Approach

Show the Munsell color chart. Examine again the samples from home. Have the students predict what the different colors in their samples might mean.

Communicate the Learning Objectives

1. Explain the importance of soil color.
2. Describe how the matrix color of soil is identified.
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5. Explain soil mottling.
6. Describe what causes soil mottling to occur.
7. Describe how mottles are identified.
8. Explain what a Munsell color notation indicates.

Instructor Directions	Content Outline
Objective 1 *Discuss the importance of soil color. Ask the students if color affects soil or is an indicator of soil condition and composition.*	**Explain the importance of soil color.** 1. Color is one of the most noticeable properties. 2. Color gives clues about the nature of the root zone. a. Organic matter content b. Wetness c. Air-water relations
Objective 2 *Discuss how the matrix color of soil is identified. Refer to the color plates in the student reference. Remind students that soil color is identified using moist (not wet) soil and is studied in the brightest light available. Use freshly exposed samples.*	**Describe how the matrix color of soil is identified.** 1. Main body of soil 2. Dominant color of the horizon a. Moist soil b. Brightest lighting 3. Grouped in four broad classes a. Dark brown, very dark brown, black b. Light brown, brown, yellowish brown c. Red, reddish brown d. Dark gray, light gray, white
Objective 3 *Discuss the importance of organic matter. Is color an indicator we use to determine the amount of organic matter in the soil?*	**Describe how organic matter affects soil color.** 1. Humus (organic residue) coats soil particles 2. Causes dark color 3. Dark color increases as humus increases 4. Typical of A horizons 5. Breaks down slower in wet soils

Instructor Directions	Content Outline

Objective 4
 	
Discuss what other factors might affect the color of soil. Ask students what they believe causes the dominant soil color in your area.
	Identify other factors which affect soil color.
	
	1. Wetness
	2. Aeration: iron oxide coatings
	3. Weathering
	  a. Leached
	  b. Acidic
	4. Mineral color: naturally gray

Objective 5
 	
Discuss what soil mottling is. Discuss the color plates in the student manual.
	Explain soil mottling.
	
	1. Splotches of soil colored differently than the dominant matrix color
	2. Examples:
	  a. Reddish brown splotches in a gray matrix
	  b. Gray splotches in a brown matrix

Objective 6
 	
Discuss what causes soil mottling.
	Describe what causes soil mottling to occur.
	
	1. Seasonal high water tables in landscapes that restrict water movement (drainage mottles)
	  a. High water table
	  – Blocks air circulation
	  – Removes iron oxide coatings (gray mottle)
	  b. Low water table
	  – Allows air circulation
	  – Develops iron oxide coatings (yellowish-brown mottle)
	2. Chemical weathering
	  a. Minerals change color
	  b. Rocks fragment
	3. Coatings on soil aggregates
	  a. Not considered a soil mottle
	  b. Usually dark in color
	  – Organic coatings
	  – Clay coatings
	  – Moisture films

Objective 7
 	
Discuss how mottles are identified. Discuss the four properties of mottle patterns. Use Figure 3.1 in the student reference as a guide.
	Describe how mottles are identified.
	
	1. Abundance
	  a. Few: less than 2% of exposed surface
	  b. Common: 2 to 20% of exposed surface
	  c. Many: more than 20% of exposed surface

Instructor Directions	Content Outline
	2. Size a. Fine: diameter less than 5 mm b. Medium: diameter 5 to 15 mm c. Coarse: diameter more than 15 mm 3. Contrast a. Faint: evident only on close examination b. Distinct: readily seen though not striking c. Prominent: conspicuous 4. Color a. Dark brown, very dark brown, black b. Light brown, brown, yellowish brown (common mottle color) c. Red, reddish brown (common mottle color) d. Dark gray, light gray, white (common mottle color)
Objective 8 *Show the students a Munsell color chart in the classroom. The Munsell Color Company makes small color chips for each combination of variables. Use the example 10YR 4/6 listed in the student reference to discuss what this Munsell color notation indicates for this particular soil.*	**Explain what a Munsell color notation indicates.** 1. Hue (color) indicated by first number and letter—initials of color name 2. Value (light to dark) indicated by fraction numerator: scale of 0 (black) to 10 (white) 3. Chroma (brightness or purity) indicated by denominator: scale of 1 (dull) to 8 (bright)
Application	Other activities: 1. Using the Munsell color chips, examine your local soil for all of the color factors in this lesson.
Closure/Summary	Soil color is one of the most noticeable of soil properties. Soil matrix color also gives clues about the nature of the root zone. Soil mottling gives clues as to seasonal high water tables. To be consistent, samples should always be evaluated using moist soil in the brightest available light.
Evaluation: Quiz	Answers: 1. a 2. b 3. d 4. g 5. c 6. e 7. h

Instructor Directions	Content Outline
	8. f 9. Dark brown, very dark brown, black 10. Light brown, brown, yellowish brown 11. Red, reddish brown 12. Dark gray, light gray, white