

Layer Away

Grade Level: 4-6

Approximate Length of Activity: Two class periods (one per day)

Objectives

Teacher

1. Help students understand the importance of soil.
2. Teach students the components of soil and the characteristics of the components.
3. Explain why it is important for farmers to test their soil.

Students

1. Learn why soil is important and why we should take care of it.
2. Understand there are many components of soil.
3. Be able to explain the different characteristics of each component.
4. Understand why farmers need to test their soil.

Michigan Content Standards: (Science) S.IP.E.1: S.IP.04.11; S.IP.04.12; S.IP.04.14; **S.IA.E.1:** S.IA.04.11; S.IA.04.12; S.IA.04.14; **S.RS.E.1:** S.RS.04.11; S.RS.04.15; S.RS.04.16; S.RS.04.17; S.RS.04.18; **L.OL.E.1:** L.OL.04.15; **S.IP.M.1:** S.IP.05.11; S.IP.05.12; S.IP.05.13; S.IP.06.11; S.IP.06.13; **S.IA.M.1:** S.IA.05.11; S.IA.05.12; S.IA.06.11; S.IA.06.12; **S.RS.M.1:** S.RS.05.15; S.RS.05.16; S.RS.06.15; S.RS.06.17; S.RS.06.18; **L.EC.M.1:** L.EC.06.11; **E.SE.M.1:** E.SE.06.11; E.SE.06.12; E.SE.06.13; E.SE.06.14

Introduction

One of the most important natural resources that cover much of the earth's land surface is soil. Most life on earth depends upon the soil as a direct or indirect source of food. Plants are rooted in the soil and obtain nutrients (nourishing substances) from it. Animals also get nutrients from eating the plants in the soil. Soil is home to many organisms such as seeds, spores, insects and worms. The contents of soil change constantly and there are many different kinds of soil. It forms very slowly and is destroyed easily, so it must be conserved in order to continue to support life.

Soil consists of four parts: air, water, minerals and organic material. Air and water provide nutrients to plants so they can make food for themselves. Organic matter, also known as humus, is made of plant and animal remains in various stages of decay. Minerals are the clay, sand and silt particles. The mineral content determines the soil type. Sandy soil has mostly sand and no organic matter. Sand is the largest of the soil particles, feels gritty, is the heaviest, and allows water and air to move easily through it. Clay soil has mostly clay, a little organic matter and sand. Clay particles are very fine and the smallest of the three soil particles. Clay is sticky when wet and hard and brick-like when dry. Silt is the soil particle that falls between sand and clay in texture. It is considered a medium-sized soil particle. It feels like flour and is very smooth when you rub it in your hands. Silt particles keep the soil rich and loose.

Farmers have very important jobs growing food and fiber for the world. If we did not have farmers, we would have to grow our own food and materials for clothing. A farmer's job consists of many more responsibilities than growing food or fiber. Farmers must also take good care of our soil so we can continue to grow enough food to feed everyone. Soil testing must be done so

farmers know the type of soil he or she has and make sure the proper nutrients and amounts of these nutrients are present. If proper nutrients aren't present, the levels of these nutrients need to be adjusted so the farmer can grow a healthy crop. By adding fertilizers and rotating crops, farmers replace nutrients that leaching and growing plants have removed. Farmers also make certain there is a high level of organic matter in cultivated soils.

Materials Needed

- "Soil Texture Triangle" handout
- "Soil Composition" worksheet
- "Soil Triangle" worksheet
- Soil sample (1 per group)
- Ruler (1 per group)
- Water
- Containers for water (1 per group)
- Paper
- Tape
- Chalkboard and chalk
- Clear quart size or gallon size jar with lid (1 per group)

Activity Outline

Prior to this lesson, have the students form into groups of three or four. Have one of the students bring a soil sample in a jar with a lid or a resealable plastic bag. The soil sample should be big enough to fill a quart size jar or gallon size jar (whichever you choose) about half way. Make sure the students understand their soil sample needs to come from their yard or garden. They should not bring in a container of potting soil.

Day One

1. Write the four components of soil on the chalkboard for the class to see. Discuss each component with the class. When discussing minerals, write sand, silt and clay on the board. Discuss the characteristics of each type and write the characteristics on the board.
2. Explain to the students that the farmers have many job responsibilities. One responsibility is to maintain the quality of their farmland. Farmers test their soil to determine what type of soil they have and what nutrients are in the soil. The soil test also tells farmers if any nutrients need to be added.
3. Divide the class into groups of three or four students (if not done previously). Give each group a quart or gallon sized jar with a lid.
4. Instruct the groups to pour their soil sample into their clear jar until the jar is half full. Then have each group fill their jar three-fourths full of water. Place the lid tightly on the jar.
5. Have students in each group take turns shaking their jar for one minute.
6. When done shaking, have the groups put their names on a piece of paper and tape it to the jar. Set all the jars out of the way where they will not be disturbed.

Day Two

1. Start the second process of this lesson by asking students why they think you had them put water in the jar with the soil and shake it up. Let students make some guesses.
2. When they are done guessing, explain that all the soil samples put into the jars were soil that was all mixed up. Each sample has different amounts of minerals (sand, silt, and clay) in

it, but we did not know the amounts by simply looking at the soil. By putting water in with the soil, shaking the jar, and letting the soil settle, we are able to see the different types of minerals in the soil. This occurs because the heaviest particles (sand) settle first on the bottom of the jar. The next layer of soil is the silt because it has medium size particles. Silt is not as heavy as sand but is heavier than clay. The last layer to settle on the top is clay. Clay particles are the lightest of all.

3. Instruct the students to get their jar of soil and return to their groups. Remind them to carefully carry their jar so the particles will not be disturbed. Hand out "Soil Composition" worksheets and "Soil Triangle" worksheets to each student. The "Soil Texture Triangle" handout can also be distributed to each group or made into an overhead for all to see.
4. The groups should conduct the measurement of their "Soil Composition" worksheet. Have them use their rulers to measure the total height of the soil in their jar. Record this number in centimeters on the worksheet.
5. Then have the students measure the heights of the sand, the silt, and then the clay. Record these numbers on the worksheet.
6. Next students will change their measurements into percentages. They should then compute what percentage of sand is in the sample, what percentage of silt is present, and what percentage of clay is present.
7. When students complete this worksheet, have them follow the directions on the "Soil Triangle" worksheet. They will need to use their percentages figured on the "Soil Composition" worksheet to complete the "Soil Triangle" worksheet.
8. The "Soil Triangle" worksheet will tell what type of soil their group has.

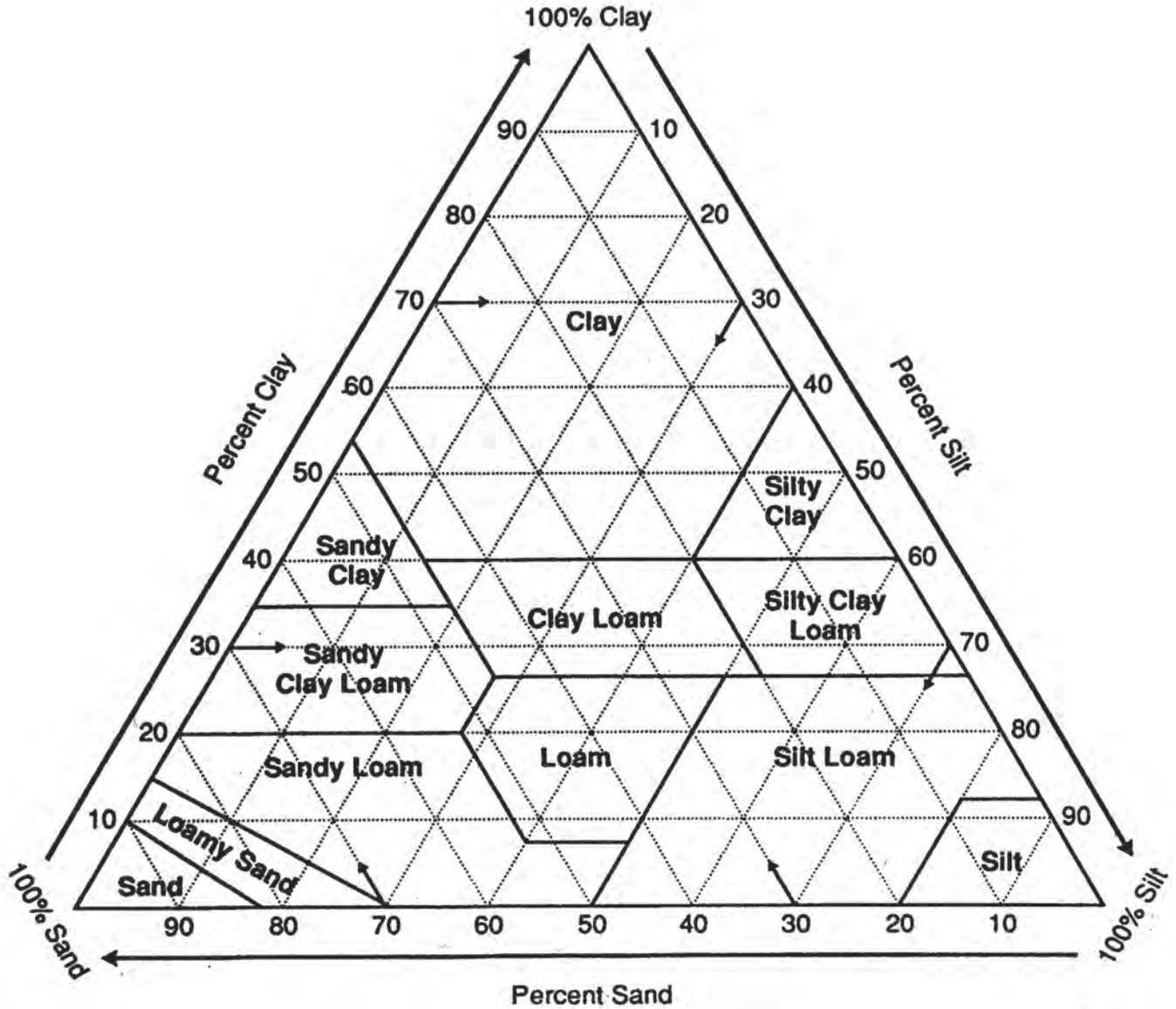
Discussion Questions

1. Why is soil important?
2. What are the components of soil?
3. What are the three types of minerals in soil?
4. How are these three minerals different?
5. Why do farmers test their soil?
6. What type of soil settled first in your jar? Second? Third?
7. What type of soil did your group have?

Related Activities

1. Have the class keep track of where each soil sample came from and compare what types of soil they are.
2. Invite a farmer into the classroom to discuss what he or she does to protect their farmland from soil erosion.
3. Have a conservationist visit the classroom to talk more about soil and its importance.
4. The lesson "Soil...It's More Than Just Dirt" located in the science section of this curriculum guide.
5. The lesson "Gardening: A Math Adventure" located in the math section of this curriculum guide.

Soil Texture Triangle



Soil Composition

Conduct the following measurements to find out what type of soil you have. Record all heights in centimeters.

1. Measure the total height (amount of soil in your jar). Total Height: _____ cm
2. Measure the amount of sand (bottom layer). Sand: _____ cm
3. Measure the amount of silt (second layer). Silt: _____ cm
4. Measure the amount of clay (the top layer). Clay: _____ cm

Take measurements for the sand, silt, and clay and turn them into percentages. The percentages will tell you how much sand, silt, or clay is present compared to the total amount of soil in the jar. To figure out the percentages of each, take your amount of sand (or silt or clay) and divide the number by the total amount of soil in the jar. Multiply this number by 100 to get the percentage of sand in your jar. Round your percentages to the nearest whole number.

Here is an example:

You have 2.5 cm of sand in your jar. The total amount of soil in your jar is 7 cm.

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|---------|---|--|
| Step 1: | Divide the amount of sand by the amount of soil. | $1.5 \text{ cm} \div 7 \text{ cm} = .357$ |
| Step 2: | Multiply the number by 100 to figure the percent. | $.357 \times 100 = 35.7$ |
| Step 3: | Round your answer | $35.7 \text{ rounded} = 36\% \text{ sand}$ |

5. Sand: _____ cm
 $\text{cm} = \underline{\hspace{2cm}} \times 100 = \underline{\hspace{2cm}} \% \text{ Sand} = \underline{\hspace{2cm}} \%$
6. Silt: _____ cm
 $\text{cm} = \underline{\hspace{2cm}} \times 100 = \underline{\hspace{2cm}} \% \text{ Silt} = \underline{\hspace{2cm}} \%$
7. Clay: _____ cm
 $\text{cm} = \underline{\hspace{2cm}} \times 100 = \underline{\hspace{2cm}} \% \text{ Clay} = \underline{\hspace{2cm}} \%$
8. Add the three percentages together. They should equal 100%.
 $\underline{\hspace{2cm}} \% \text{ Sand} + \underline{\hspace{2cm}} \% \text{ Silt} + \underline{\hspace{2cm}} \% \text{ Clay} = \underline{\hspace{2cm}} \%$

Soil Triangle

Use the **Soil Texture Triangle** to determine what type of soil your group has. Look over the soil triangle to familiarize yourself with it. The bottom line represents the percentages for sand. The slanting left line represents the percentages for clay and the right slanting line represents the percentages for silt.

1. Transfer your percentages of sand, silt, and clay from the "Soil Composition" worksheet.

Sand: _____ % Silt: _____ % Clay: _____ %

2. Take your percentage for sand and find it on the sand line (bottom line). From this point, draw a line upwards and to the left through the triangle. (This line should be parallel to the right slanting line. This line marks your percentage amount for sand.)
3. Next, take your percentage amount for silt and find it on the silt line (the right slanting line). From your percentage on the line, draw a line slanting downward and to the left, through the triangle. This represents your percentage amount for silt. (The sand line and the silt line should cross over one another.)
4. Take your percentage for clay and find it on the clay line (the left slanting line). Draw a line from your percentage point directly across the triangle (horizontally). Once you have drawn this line, all three lines should intersect at the same point.
5. Draw a circle around the intersection of the three lines. It will fall within one of the soil types on the grid. This is the type of soil that your group has.

The type of soil we have is: _____

