Slip Slidin' Away

Purpose
To help students understand the importance of good soil to agricultural production

Competency
The learner will build an understanding of soil concepts.

Vocabulary
humus
organic matter

Materials Provided
“Mark, Get Set, Go” (2a), “Comparison Graph” (2b), “Adding Organic Matter” (2c), “Pick a Path” (2d)

Materials Needed
4 cups of four or five different dry soil samples (make sure one is quite sandy and another quite clayey); 5 cups of potting soil; funnel (2 liter bottles cut in half); coffee filters (cupcake shape); water; measuring cups; stopwatches or a clock with a second hand.

Teaching Strategy
Preparation:
• Gather materials, make necessary copies, and the Comparison Graph transparency.
• Prepare the 2-liter funnels as shown in the picture below. Place the bottle on a table and measuring up from the table surface, place a mark at 5-1/2 inches. This is where you should cut the bottle in half.
• Collect various soil types. Contact your county’s Soil and Water Conservation office for assistance, if needed.
1. Show students several different types of soil. Ask them which one is the best for growing plants. Explain that this lesson will help them know the answer to that question. Tell them that the first activity they will be doing will begin to give them an idea of which type is the best. Do “Mark, Get Set, Go.”
2. Do “Adding Organic Matter.”
3. Do “Pick a Path.” This is an excellent activity to coordinate with your physical education teacher.
4. Invite someone from the Soil and Water Conservation office in your county to your classroom. Ask him/her to talk with students about the various types of soil that predominate in your county. Ask him/her to bring visuals, if possible.

Adapted with permission from “Dirt: Secrets in the Soil” lesson plan developed by Utah Agriculture in the Classroom. For additional soil lessons, see http://www.ext.usu.edu/alct/pages/resource/dirt.htm.

Background Information
Soils are made of tiny pieces of rock or minerals. But not all of the particles are the same size. Gravel particles are greater than 2.00 mm, sand is classified between 2.00 and 0.05 mm, silt is a particle that is between 0.05 and 0.002 mm, and clay is any mineral particle less than 0.002 mm. To determine a type of soil, particles are analyzed. Most soils are a mixture of sand, silt, and clay and are said to be loams. If the sample has more sand it is a "sandy loam," more silt a "silty loam," more clay a "clay loam." Depending on the amounts of sand,
silt, and clay, the soil type may be further classified as a "sandy clay loam," "silty clay loam," "silty clay," etc.

Sand, silt and clay are inorganic materials. Sand is made up of larger particles which can be seen with the naked eye. It has a coarse feel and allows water to move through very quickly. Silt particles are too small to see with the naked eye. Silt is often found in places that have flooded and dried out again. Clay is made up of very tiny particles. The particles fit together so closely that it is difficult for water to flow through.

The best kind of soil for plants allows water to move through slowly enough so that some of it stays in the soil for the plants to use. Water moves too quickly through sand. It moves very slowly through clay, but clay holds the water so tightly that plants can't get to it. Soil that is good for plants has a mixture (a loam) of sand, silt, clay and organic material, or humus. Humus acts like a sponge to help the soil capture water. Humus is formed when plants and animals die.

When organic matter is used up, soil packs together in clods. A cloddy soil has fewer air spaces. A soil with more organic matter will be crumbly. Not only does a crumbly soil take in water faster than a cloddy one, it holds more. The thoroughly decomposed organic matter (humus) in a crumbly soil can absorb lots of water. On a dry weight basis, this humus has a water-holding capacity of several hundred percent and acts like a sponge. In addition to the water held by the organic matter, water held in the pores between the soil particles and between the soil granules is greater. Hundreds of very fine soil particles are glued together by the organic matter into soil granules. This increased water-holding capacity of soils high in organic matter makes a big difference in the intake of water. These well-managed soils can absorb most of the rain and snowmelt (if the soil is not frozen). This means there will be less erosion. Streams will run clear. Of course, when the soil is saturated by a long period of rainfall, any additional water then runs off. But until the soil is saturated it will store up water and let it go gradually.

Crops use lots of water. Vegetables use an average of 2 acre-feet, or 650,000 gallons an acre. Cotton takes 800,000 gallons per acre. An acre of alfalfa needs over a million gallons. To produce one ear of corn takes over a barrel of water. Organic matter helps soil store more water and helps prevent erosion and produces better crops.

*humus*: thoroughly decomposed organic matter

*organic matter*: products derived from living organisms, like plants and animals.
Mark, Get Set, Go

1. Divide the class into four or five groups, depending on how many soil samples you have.

2. Provide each group with a funnel and bottom (made from a 2 liter bottle), two coffee filters, 1 cup of one of the soil samples, a measuring cup and water.

3. Place one coffee filter into the funnel and then to measure and add 1 cup of soil into the filter. Cover the sample with another filter. This will ensure even coverage and avoid splashing.

4. One person in each group needs to be designated as the time keeper, another as the water pourer.

5. When the time keeper says go, the water pourer should pour 2 cups of water into the funnel.

![coffee filter containing soil]

Note: You will need this filter set up for a future activity.

6. Time should be kept until most of the water has gone through the soil sample. Some will go through quite quickly while other could take 30 minutes or more. So proceed with the next activity keeping an eye on the samples.

7. Compare the time it took for water to percolate through each sample. Add the data to the Comparison Graph.

8. Pour out and measure the water that percolated through the sample. Record this on the graph.
Comparison Graph

![Graph with samples S1 to S5 on the x-axis and time (minutes) on the y-axis]

1. What was the amount of water collected after percolation in each sample?
   
   S1  
   S2  
   S3  
   S4  
   S5  

2. Which sample do you think had the most sand? 

3. Which sample had the most clay? 

4. Which sample had the most organic matter? 
   
   (Hint: Compare the amount of water collected and the speed of percolation and the visual evidence.)
Adding Organic Matter

1. Duplicate steps 1 through 4 in “Mark, Get Set, Go.”

2. Add one cup of potting soil (high in organic matter) to each filter. One student should mix in the organic matter with his or her finger being careful not to puncture the filters.

3. Duplicate steps 5 through 8 in “Mark, Get Set, Go.” Be sure to record the data on the Comparison Graph.

4. Discuss the background material and ask students to identify which sample had the most sand and which had the most clay. Add this evaluation to the Comparison Graph.