Lesson Two: How does healthy soil relate to food?

“Get the Scoop on Soil” from GROWING IN THE GARDEN, Iowa State University Extension and Outreach
“Composting” from GARDEN MOSAICS, Cornell University Cooperative Extension

Students will get the scoop on soil from a mole’s or a worm’s perspective; or, they can become soil particles themselves. They will examine the soil near where they live and discover how to make it healthier by composting. The books *Dirt* by Steve Tomecek and *Diary of a Worm* by Doreen Cronin enhance the language arts component of this lesson.

Content objectives:
- Describe sand, silt and clay;
- Explain why loam is a good mixture of soil to grow plants;
- Define composting and describe what compost organisms need to grow and multiply;
- Explain how to build and care for a compost pile

Life skill objectives:
- Learning to learn, Critical thinking, Problem solving, Decision making,
- Communication, Citizenship, Leadership, Healthy living

Core and STEM concepts and skills:

Science
- Earth and space, Life science, Science in personal and social perspectives, Science as inquiry

Math
- Operations and algebraic thinking, Number and operations – fractions, Measurement and data, Geometry, Mathematical practices

Language Arts
- Reading for informational text, Writing, Speaking, Listening, Viewing,
- Inferring, Interpreting, Sequencing

Social studies
- People, places and environments; Individual development and identity, Global connections, Maps

Healthy snack: Melon Salad or Perfect Parfait

Additional and Supporting Resources: GARDEN MOSAICS, Science pages, Soil and Soil test activities
http://communitygardennews.org/gardenmosaics/pgs/science/english/mainscience.htm
BEFORE THE LESSON

1. **Lesson 2**: This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the [www.peoplesgarden.wsu.edu](http://www.peoplesgarden.wsu.edu) Educational Toolkit.

2. Assemble necessary ingredients and materials for the selected recipe(s).

3. Check your library for copies of Dirt by Steve Tomecek and Diary of a Worm by Doreen Cronin.

THE LESSON

1. **Getting the Scoop on Soil** and **Composting** are meant to be taught over two or more days.

AFTER THE LESSON

Optional Activities include 1) assessing soil types; 2) soil percolation test and 3) soil testing (see the GARDEN MOSAICS, Science pages, Soil and Soil test activities) [http://communitygardennews.org/gardenmosaics/pgs/science/english/mainscience.htm](http://communitygardennews.org/gardenmosaics/pgs/science/english/mainscience.htm)
Melon Salad

INGREDIENTS
1/2 cup cantaloupe
1/2 cup honeydew melon
1/2 cup nonfat vanilla yogurt
1/2 graham cracker sheet

PREPARATION
2. Mix both melons and yogurt together.
3. Crush graham cracker over the top.

Makes 2 servings.

NUTRITIONAL INFORMATION PER SERVING
Makes 2 servings.
One serving (1/2 cup) contains:
70 calories
0.5 grams of fat
1 gram of fiber
8% of Daily Value of Calcium
30% of Daily Value of Vitamin A
40% of Daily Value of Vitamin C

For more free healthy recipes, log on to www.idph.state.ia.us/pickabettersnack
### A Perfect Parfait

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Directions</th>
<th>Nutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yogurt</td>
<td>Measure 2 spoonfuls of yogurt and add to your serving dish</td>
<td>Calcium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gives us strong bones!</td>
</tr>
<tr>
<td>Fruit</td>
<td>Measure 1 spoonful of fruit and add to the layer of yogurt</td>
<td>Vitamin C</td>
</tr>
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<td></td>
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<td>Heals our cuts!</td>
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<tr>
<td>Granola</td>
<td>Measure 1 spoonful of granola and add to the layer of fruit</td>
<td>Carbohydrates</td>
</tr>
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<td></td>
<td></td>
<td>Gives us energy!</td>
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</tbody>
</table>

Calcium: Gives us strong bones!

Vitamin C: Heals our cuts!

Carbohydrates: Gives us energy!

"From Washington State University Extension Food Sense Program"
Get the Scoop on Soil

**CONTENT OBJECTIVES**
Describe sand, silt and clay; Explain why loam is a good mixture of soil to grow plants

**LIFE SKILL OBJECTIVES**
Learning to learn using senses to sort or classify, Decision making, Problem solving, Critical thinking, Communicating in small and large groups, Citizenship by taking care of the earth

**INDICATORS**
Playing their part as a soil particle throughout the “human soil” activity, Responding verbally to discussion questions, Writing about soil particles from the perspective of a worm

**EVALUATIONS**

**SUBJECT STANDARDS**
Science: Earth (properties of earth materials), Life (organisms and environments)

Language Arts: Reading, Factual understanding, Inferring, Interpreting, Summarizing, Vocabulary, Writing, Character development, Listening, Speaking, Asking and answering questions

**LEARNER TYPES**
Linguistic-words, Bodily-kinesthetic, Interpersonal, Natural

**MATERIALS**
Clear quart-sized jar with tight-fitting lid
1½ to 2 cups garden soil (*you can bring it or dig it from the playground*)
1 cup water
*Dirt by Steve Tomecek*
3” x 5” index cards (*one per student*)
3 or 4 basketballs in a large, clear plastic dry cleaner’s bag
12 golf balls in a large, clear bag or bowl
Several pebbles in a clear cup or bag (*approximately ⅛-inch diameter, small playground rocks work well*)
Magnifying glass (*optional*)
Paper and pencils (*one per student*)
*Diary of a Worm* by Doreen Cronin
**INTRODUCTION**

**ENGAGE**

SET THE STAGE

5 MINUTES

Earth Science: Properties of earth materials

*Life Science: Organisms and environments*

Language Arts: Reading, Inferring, Vocabulary, Factual understanding, Summarizing, Listening

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**GET THE SCOOP by reading and imagining**

Are soil and dirt the same thing?

No.

What is the difference?

Dirt is what you get on your clothes, track into the house or school, or the stuff under your fingernails. Soil is something that is important to life on Earth.


Is it dirt or is it soil?

Soil

Why did the author name the book *Dirt* instead of *Soil*?

Which book would you pick up to read first, one that is titled *Dirt* or one that is titled *Soil*?

You may want them to vote by raising their hands. Many times book, newspaper, magazine, television, radio, and music lyric writers use the word dirt instead of soil because it catches people’s attention and sounds more fun.

Why is the story about the soil written by a mole?

Moles live in the soil.

Has anyone seen a mole or evidence of a mole? Describe what you saw.

A mole is a small, dark gray animal with tiny eyes and a strange looking nose that leaves raised areas on the ground where tunnels are. Maybe you have heard funny stories about family members or friends who tried to get rid of moles in their yard by standing guard with a shovel or digging in the tunnels and leaving the moles a special present! Moles can damage yards and gardens when they move the soil and roots of plants.

Start reading and showing the pictures in the book *Dirt* by Steve Tomecek. Stop at the end of page 7.
What are some examples of living things that would die without soil and why would they die? Many plants would die because they wouldn’t have anything to grow in. Many animals, including insects, and people might die because they wouldn’t have plants to eat.

Start reading again from page 8. Take time to look and talk about the illustrations on each page. Stop reading after page 12.

We learned that soil is made up of different sizes of sediment.

What is sediment?
Small pieces of rock worn down by rain, ice and wind into different-sized particles (page 8)

To get an idea of the size difference of these sediments or soil particles, let’s pretend that we shrunk and are now the size of a tiny, itsy-bitsy organism found in the soil.

What do you think the soil would look like to you at that size?
First of all, we would see that there are many different things in the soil. It has many different-sized particles that look like rocks or boulders. Those rocks are the mineral particles.

The answers to the following questions are on page 9 of the book Dirt.

According to the book Dirt, what are the four different-sized mineral particles in the soil?
Gravel, sand, silt, clay

Which particle is the largest?
Gravel

In the “soil texture triangle” used by people who study plants and the soil, there are three sediment sizes. What do you think those three sizes are?
Sand, silt, clay

According to the “soil texture triangle,” which particle is the largest?
Sand

In the book, what is the next largest mineral particle in the soil?
Sand

Although farmers dig up many small and large rocks in the soil in their fields, we’re going to concentrate on the remaining three mineral particles that we find near the surface of the soil where we live.

Write “sand” on the board and hold up the bag of basketballs. This is what a sand particle looks like to a tiny organism.

Which of these objects would represent the smallest particles in the soil? What are these particles called?
Hold up the pebbles or small rocks and write “clay” on the board.

What objects represent the medium-sized particles? What are these called?
Hold up the golf balls and write “silt” on the board. Put the basketballs, golf balls, and pebbles side-by-side on the table or desk.

As a tiny organism, you notice that there are a lot of spaces in the soil where there is nothing, only air-like windows. (Point to the empty spaces between the basketballs and golf balls. Note that the pebbles don’t have visible air spaces.) We call those windows “pore spaces.” (Write “pore spaces” on the board.) Sometimes the pore spaces are filled with
water. Because you are very tiny, you can see that there are many different-sized pore spaces in the soil. This is because good soil has particles of all sizes in it: sand, silt and clay. The amount of sand, silt and clay particles in a soil affects the way a plant grows. A soil that contains a good combination of sand, silt and clay is best for growing plants. We call this soil "loam." (Write “loam” on the board).

Now, we are going to demonstrate how water moves through soil by making a “human soil.”

**THE SOIL GAME**

You may want to observe the students to see if they understand their roles as soil particles in the following activity.

You may want to move desks aside, go in the hall, or go outside to play this game. Assign one student to be a bean seed and another student to be the water droplet. Divide the rest of the class into three groups by assigning them to be a sand, silt or clay particle, as you would numbering them off.

Have the students who are clay particles stand next to each other, shoulder to shoulder, in a line. Have the students who are silt particles stand about 3 feet in front of the clay line. Ask them to put their hands on their hips and stand next to each other touching elbows. The space between them indicates the amount of pore space between silt particles. Have the students who are sand particles stand in front of the silt particles, stretching their arms straight out and touching the next person’s shoulders to form their pore space. Place the person representing the bean seed behind the clay line and the person representing the water droplet in front of the sand line.

Ask the water droplet to try to reach the bean seed by passing through the layers of sediment – sand, silt and clay. The water droplet should get stuck in front of the layer of clay because there are no pore spaces to go through. Ask the water droplet what happened. Ask the bean seed if it got any water and what will most likely happen to it.

Ask the students how they can improve the soil so that the water can get to the seed and the bean plant can grow. Have them remember how they are standing as sand, silt or clay particles and have some people change to a different line. Each line should have some sand, silt and clay particles in it making different sizes of pore spaces in each line. For example, a silt particle will have his/her elbow touching a clay particle’s arm that is straight down from his/her side.

Ask the water droplet to try to pass through the soil now. Ask the students what happened and if their plan worked to get water to the seed. Once the water reaches the soybean, have the soybean grow through the particles of soil and out into the sunlight where it turns into a soybean plant.

Try different line-ups to see what happens. For example, what happens if all the lines representing soil are sand? The water would pass by so quickly that the seed might be washed out or not benefit from the water because it would flow right past it. What happens if all the lines representing soil are clay? The water could not penetrate the surface to reach the seed and, if somehow it did, the seed would have a hard time pushing the shoots through the clay and up to the surface.
The best soil for growing plants is a mixture of what three mineral particles or sediments? Sand, silt and clay; this mixture is called loam. Have everyone repeat the word “loam” and write it on the board when the students return to their seats.

Now, let’s go back to our seats and remember we are still itsy-bitsy organisms in the soil.

We are not alone because there are thousands of living organisms of many different kinds in the soil. Let’s learn about some of them. Finish reading the story.

**MUD PIE AND SOIL RIBBONS (optional)**

You may want to explore soil types by making mud pies and soil ribbons. This activity is found in the Optional Activity Ideas at the end of this lesson.

**SOIL SHAKE**

Refer to the book Dirt by Steve Tomecek and the human soil activity as you proceed through the following questions.

Have the students stand or sit around the soil shake. Try not to move it and don’t tip it so that the shake remains in stratified layers and the water is clear on top. Once the students have had a close look at the soil shake, proceed with the following questions.

**How many different layers do you see in the jar?**

You should see three layers of soil and water on top. There might also be little particles such as small twigs or leaves floating on the top.

**Gravel and rocks are large and heavy; where do farmers usually find them?**

Deep in the soil, deeper than the soil sample we used in the soil shake.

**What mineral particle or sediment is the largest in soil?**

Sand; it looks like tiny little rocks.

**In our soil shake, where do you think the sand settled and why?**

At the bottom – the lowest layer – because it is the heaviest and settled out first.

**What do you think is the second heaviest particle is in our soil sample?**

Silt

**What layer do you think is silt?**

Second from the bottom

**What is above the silt layer – the smallest or lightest particles?**

Clay

**What layer is thickest or is there the most of? The least?**

If a loam soil is a mixture of sand, silt and clay, would you call this a loam soil?
What do you think is on top of the clay or floating in the water?
The organic or dead plant material such as tiny sticks or pieces of leaves or insects

Why do you think the organic or dead material is on top?
It doesn’t weigh as much.

Let’s make a list of all the kinds of living soil organisms that we read about in the story.
(insects, snakes, moles, earthworms, and microbes)

What is a “microbe”?
Remember when you turned into a tiny organism and looked at the balls to compare them to the sizes of soil particles? You were pretending to be a microbe or a microscopic, itsy-bitsy organism that can’t be seen without a microscope.

Why are microbes so important in the soil?
Some kinds of microbes decompose or break down organic materials and make nutrients available to plants.

What important role do earthworms play in the soil?
They tunnel through the soil to create spaces for water and air. Most plants grow better in soil where water and air can reach the roots of the plant.

What are those spaces in the soil called?
Pore spaces

What are the different layers of soil called in the field if we were to dig 3 or 4 feet deep?
Horizons

What layer or horizon has the organic material in it?
The humus or top layer, also called topsoil

What soil layer or horizon do plant roots grow in?
Topsoil

Why is it important to study the different soil horizons?
Soil scientists can make suggestions on how land should be developed or what that soil should be used for.

SOIL PERCOLATION TEST (optional)
You may want to test what happens as water percolates through different soil particles. This activity is found in the Optional Activity Ideas section at the end of this lesson.
SOIL WHERE YOU LIVE

You may want to go outside to answer some of the following questions.

Are there places around our school or neighborhood where plants are not growing well or at all?
Examples include sidewalks, playgrounds and parking lots where the soil is covered by rocks, sand, concrete, and so on; where the soil is too packed down; and where the soil is mostly clay or sand. You will often find clay around new buildings, making it hard to grow things next to the building.
What kind of soil is probably there?
You may want to go look at the soil.
What could you do to make this soil better so plants can grow?
Make it into loam or make sure it has a combination of sand, silt and clay particles. If you are actually going to plant something, you may want to add some organic matter to improve drainage or the water-holding ability of the soil. Also make sure the location has enough light to grow plants and that there is good drainage so that the plants won’t sit in water.

Are there plants around your school or neighborhood that seem to be growing well?
Examples include grass in yards, weeds, flower gardens, shrubs, trees, and so on.
What kind of soil is probably there?
Loam (Go look at the soil if possible.)

What agricultural crops are grown in our state?
In Iowa, it would be field corn, soybeans, oats, sweet corn, grapes, and apples

Why are these crops grown in our state?
Different agricultural crops like different types of soil and climate conditions. Iowa has some of the richest loam on planet Earth. So, Iowa grows more agricultural crops than any other states except Texas and California. Both of those states have more land and longer growing seasons. Almost 90% of Iowa’s land is in some sort of agricultural production (growing crops or grazing animals) because of the rich soil.

What type of soil particle is is pottery made from?
Clay
Why are pots made out of clay instead of sand or silt?
The particles wouldn’t stick together and the pots would leak.

USES OF SOIL PARTICLES

Have the students take out a piece of paper and a marker; number off as sand, silt, clay and loam; write their soil particle in large letters on their paper; remember the balls and pore spaces; and then draw a group of their soil particles as they would appear microscopically in soil. Explain that you will be reading a characteristic or use of the different soil particles. Have them hold up their sign if they think their soil particle finishes your question, “What is _____?” You may want them to trade signs and play again.

Earth Science:
Properties of earth materials
Life Science:
Organisms and environments
Language Arts:
Reading, Summarizing, Factual understanding, Interpreting, Inferring, Vocabulary, Listening, Asking questions, Writing, Character development
• This is a mixture of sand, silt and clay soil particles.
  What is _____? (Loam)

• This tiny soil particle can hold water and is a good base for farm ponds.
  What is _____? (Clay)

• This large soil particle is found on beaches and in sandboxes.
  What is _____? (Sand)

• This medium-sized soil particle is found near rivers. It is particularly important to the Loess Hills in western Iowa.
  What is _____? (Silt)

• This soil particle is used under brick walks and patios to stabilize and even out the surface before laying bricks or stones.
  What is _____? (Sand)

• This is farmers’ and gardeners’ favorite kind of soil to plant crops.
  What is _____? (Loam)

• This soil particle is found in the Loess Hills in western Iowa. It blows away easily so farmers have to practice good soil conservation techniques to keep it in place for the plants to grow.
  What is _____? (Silt)

• This soil particle is common around construction sites where there have been huge holes dug into the ground. If it rains, the water runs off these soil particles, making a slippery mess.
  What is _____? (Clay)

• This is used as a de-icer so you won’t fall on the ice. Your parents might have bags of it in the back of your vehicle for weight to give the tires traction on slippery roads.
  What is _____? (Sand)

• This medium-sized particle is used on golf courses, where growing special kinds of grass and good drainage are important.
  What is _____? (Silt)

• This soil mixture is very valuable to us because it grows a lot of our food.
  What is _____? (Loam)

• This is used to make flower pots, dishes, plates, bowls, mugs, serving bowls, and so on.
  What is _____? (Clay)

How do you benefit from loam?
Loam grows plants that we use for food, clothing and shelter. Even if the animals are the primary consumers of our popular grain crops, we benefit from the animals. In Iowa, many families and communities depend on loam to earn an income or money to spend on education, food, clothing, shelter, services, and entertainment.

FROM AN EARTHWORM’S PERSPECTIVE

Read Diary of a Worm by Doreen Cronin.

Let’s think about what it would be like to be an earthworm going through the different types of soil. Pretend that you are an earthworm. Choose one type of soil and write what it would be like to visit there. What would you see? How would you feel? Would things be growing there? Write this on the back of a 3”x5” card - postcard style. On the front, draw a picture of yourself (the worm) in the soil with a caption such as “Wish You Were Here” or “Worm Heaven,” etc.
Mud pies and soil ribbons

MATERIALS
3 soil stations that include three types of soil in plastic containers or aluminum trays (Label the stations "sand," "loam" and "clay." For sandy soil, use 2 parts sand to 1 part good garden soil. For loam soil, use good, loose garden soil. For clay soil, add 1 part clay to 1 part good garden soil.)

- Bucket of water and small paper or plastic cup
- Paint shirts
- Paper towels or something else to clean up with
- Newspapers or plastic to cover tables

This is a wonderful activity to see and feel the difference between soil particles and to observe their characteristics. It works best to set up the tests at three learning stations (sand, clay, loam) with an adult volunteer to help at each station. To facilitate cleanup, you may want to do this activity outdoors or indoors with large garbage bags or newspapers under the stations. Have the students put on their paint shirts.

Take a handful of clay soil. Add water, a little at a time with a cup, and make a slimy “mud pie.” Try to form a ball with the soil. Can you do it? Why? Because the small clay particles stick together. Now, squeeze a small amount of soil between your thumb and the side of your index or pointer finger. Keep squeezing it through to form a “ribbon” of soil. See how long you can make a ribbon before it breaks. Does it feel smooth like a satin ribbon? Put your ribbons and clay balls back in the clay pile. Brush your hands off above the clay pile.

Take a handful of sandy soil. Add water, a little at a time with a cup, so that it creates a soggy “mud pie.” Try to form a ball with the sandy soil. There should be enough sand in the soil so that this is not possible. Can you form a ball? Does the soil feel gritty? Now, try to form a ribbon with the sandy soil. It can’t be done. It always breaks off. Put the sandy soil back in the sand pile. Brush your hands off above the sand pile.

Repeat this with the loam soil. What did you find? A good loam soil will hold together at first when squeezed in your fist, but will crumble apart when lightly touched. This is an easy way to determine the texture of soil.

What were the three different textured soils or soil particles we tested?
Sand, silt, clay

What difference does the texture of a soil have on how fast water will go through it?
Pore spaces

How can you tell if a soil is sandy?
Large particles that don’t hold together, won’t form a ribbon, and feel gritty

How can you tell if a soil has a lot of clay?
Small particles that stick close together will form a ribbon.

Which kind of soil works best for growing plants? Why?
Loam because roots would have a hard time growing through clay and may not get enough water and nutrients from sand

Would you have to water gardens in sandy soil more often or less often than ones in clay soil?
More

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OPTIONAL ACTIVITY IDEAS

Why?
The water runs right through the sand particles.
Test the soil in your school garden using the “ribbon test.” What did you find?
How can you change the soil in your garden to be more like loam?

SOIL PERCOLATION TEST


MATERIALS 1 cup each of sand, silt and clay soil types
3 empty clear cups with small holes in the bottom
3 cups water
Tray to catch water dripping from cups
3 to 6 bean seeds (optional)

Do this activity outside or over a tray because dirty water will come out of the bottom of each cup.

1. Feel each soil type – sand, silt and clay.
2. Put equal amounts of sand, silt and clay in three separate cups.
3. Give a countdown and have the students pour 1 cup of water in each cup at the same time.
4. Note which cup or soil type has water coming out of the holes first. Sand should be first, followed by silt, and then clay.
5. You may want to plant bean seeds in each cup to see which ones grow best.

RESOURCES


WHAT IS COMPOSTING?

Composting is the controlled decay of plant and animal matter to produce compost—a dark, rich soil-like material. Compost can be added to soil to improve its structure and nutrient content.

Leaves that fall to the forest floor slowly decay to form part of the organic matter in soil.

Composters create ideal growing conditions for compost organisms. This speeds up the natural decay process.

WHAT COMPOST ORGANISMS NEED

1. A balanced diet of compost materials

“Browns” are compost materials that are brown and dry.

“Greens” are compost materials that are green and moist.

“Browns” are high in carbon, which is energy food for microbes.

“Greens” are high in nitrogen, which microbes need to make proteins.

If I add about 3 parts browns to 1 part greens, then the compost organisms will have a balanced diet.

2. Just the right amount of air and water

If there’s the right amount of oxygen and moisture, microbes can rapidly grow and multiply. Too much—or too little—water, and microbes will die.

Compost materials should have a thin film of water around them, and lots of pore spaces filled with air.

I’m mixing my compost pile so that all the compost organisms get enough air and water.

3. The right temperature

Organic materials will eventually decay, even in a cold compost pile. But the decay process is speeded up in a hot compost pile. When bacteria and fungi grow rapidly, they burn a lot of food, and give off a lot of heat. If the compost pile is big enough, the heat will build up inside the pile. Bacteria that grow well at high temperatures take over and speed up the decay process.

A compost pile that is about one cubic meter (1m x 1m x 1m) in size is big enough to hold in heat and warm up.

This compost pile is not big enough to retain heat, so it stays cool.
CROSSWORD PUZZLE

Across
2. Compost materials that are high in carbon.
4. Dark, rich, soil-like material.
6. A compost pile should be big enough so _____ builds up inside it.
7. A balanced diet for microbes is about _____ parts browns to one part greens.

Down
1. Microbes that help break down plant and animal matter.
3. Compost organisms need just the right amount of _____.
5. Compost materials that microbes use to make proteins.

TRY THIS
BUILD A COMPOST PILE
What you need
* 3-meter length of wire mesh fencing
* wire cutters
* twist ties
* compost materials
* duct tape

What to do
1. Choose a site to set up your compost bin. Try to find a shady, well-drained, level place that is convenient.
2. Snip off the fencing close to the cross wires and cover the sharp ends with duct tape to avoid getting scratched. Lap the ends of the fencing together and tie together with twist-ties to make a cylinder one meter high and one meter in diameter.
3. Put a layer of twigs in the bottom of the bin to help air to reach the center of the pile.
4. As you collect compost materials, layer them in the compost pile, as shown in the picture.
5. Stir or turn the compost every week or so to let in more air. To reach the compost, undo the twist-ties and open the fencing.
6. The length of time it takes for compost to be ready depends on many factors, such as weather conditions, the type of materials included, and the amount of turning. If you want your compost to be finished faster, keep it moist and turn it a couple of times a week. Finished compost is about one-third or less of its original size, dark brown, and has a nice, earthy odor.

Green layers should be no more than 3-5 cm thick.
Brown layers should be 2-3 times as thick as green layers.
Start with a brown layer, then a green layer, then a brown layer, and so on. Always end with a brown layer so that wastes are covered.

SPOTLIGHT ON RESEARCH
Compost Can Help Control Plant Diseases
Recent research has shown that compost not only improves soil. It can also help to control plant diseases caused by fungi. Fungi that attack plants include molds, rusts, mildews, and smuts. They over-winter in the soil and in plant debris. When the weather is warm, they produce spores, which can be splashed or blown onto wet leaves. Then the spores can germinate and infect plants.

Scientists are testing different composts to find out what types are most effective at suppressing harmful fungi. In one study, a team of scientists tested different composts to see which one would be best for controlling fruit rot in pumpkins. Fruit rot is a serious problem that affects pumpkins, melon, squash, peppers, tomatoes, and eggplants. In greenhouse trials, scientists first screened composts made of several different materials. One product, made from brewery wastes, stood out as very effective. In the following year, the brewery waste compost was applied to two fields where fruit rot had been a big problem in the past. In one field, no disease occurred, and the growth and yield of pumpkins improved a great deal compared to untreated fields. In the other field, the brewery waste compost was not effective in suppressing fruit rot. Scientists think that perhaps there was just too much of the fruit rot fungi present. If brewery compost were added to this field for several more years, then the disease might be suppressed. Time will tell.


RIDDLE
Why did the gardener bury money in his compost pile?

Answer: Because he wanted his soil to be rich!
COMPOSTING Teaching Tips

**LEARNING OBJECTIVES**

Youth will be able to:

* Define composting.
* Describe what compost organisms need to grow and multiply.
* Explain how to build and care for a compost pile.

**HOW TO USE THE COMPOSTING SCIENCE PAGE**

Ask youth what happens to their household food scraps, yard trimmings, and fallen leaves. Explain that these organic materials make up 20-40% of the total wastes that go to landfills and incinerators in the U.S. Yet these valuable resources could be composted to produce a soil amendment that can greatly improve garden soil.

Show youth various materials, some of which can be composted (for example, leaves, newspaper, and kitchen scraps) and others (for example, metal and plastics) which cannot decompose. Have the youth separate the materials into two piles, one with items that will decay, and another with items that will not decompose.

Show youth some finished compost. Let them feel and smell the compost. Ask: How did kitchen scraps and other compost materials become this rich, dark brown, sweet-smelling compost? (Answer: Microbes and physical processes [e.g., heat] broke down the materials into compost.)

Pick up a handful of compost, and tell youth that you are holding more microbes than there are people living on the earth. Although these microbes cannot be seen, evidence of their growth can be observed. If all of their needs are met, microbes grow and multiply very quickly, and turn vegetable scraps and yard wastes into compost. Tell youth that the Science Page contains information on what compost organisms need in order to produce compost.

Emphasize that the more ideal the conditions are for microbes in a compost pile, the faster the decay process. A compost pile can take from several days to several months to finish composting. Turning the pile will help ensure that all parts of the pile have enough air and moisture, which will speed up the decay process.

Explain that brown materials are usually much drier than the food scraps and other green materials in a compost pile. So they help to balance the moisture in a compost pile as well as provide carbon-rich food for microbes. The browns are also usually coarser than the greens, so they create a porous structure that allows air into the pile, and excess water to escape. Warn youth not to include meat, oily materials, dairy products, or bones in the green layers. They may attract pests to the compost pile.


**CROSSWORD PUZZLE**


**TRY THIS**

Ask youth to keep a pail or other container in their kitchen for collecting food scraps. Line the container with newspaper to make it easier to empty and to clean. Ask: What items can you collect in your compost bucket? (Answer: Vegetable or fruit scraps, coffee grounds, tea bags, and crushed egg shells.) Ask: What items should not be put in the compost bucket? (Answer: meat, fat, dairy products, bones, or raw eggs.) Explain that cutting up the food scraps into smaller pieces will make them rot faster.

Discuss where you can find local sources of browns, such as straw, dried leaves, sawdust, or newspaper. Remind youth that they need to have three times as many browns as greens. Ask everyone to collect and bring in greens and browns to add to the compost pile.

Emphasize the importance of size of the compost pile. Ask: What would happen if the compost pile were smaller than one cubic meter? (Answer: It would lose heat, so the composting process would be slowed down.) Talk about the importance of moisture and air in the pile. Ask: How can we make sure that the compost organisms have enough air and moisture? (Answer: Make sure the pile stays as moist as a damp sponge. Turn it at least once a week so that all parts of the pile get enough moisture and air.)

Schedule times for youth to turn the pile once a week. Once the compost is finished, youth may wish to use it in a garden, or for potted plants.

**SPOTLIGHT ON RESEARCH**