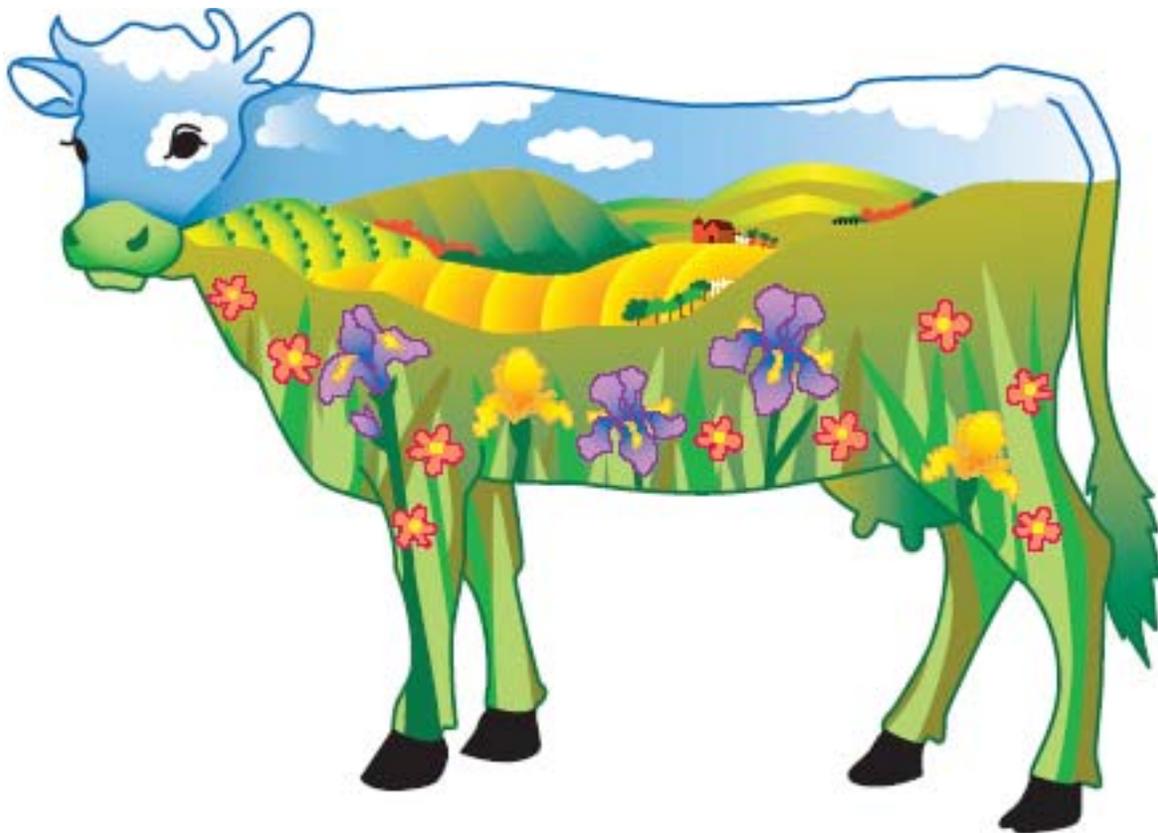


SOLE
Sciences of Life Explorations:
Through Agriculture
Grades 4 and 5



Teacher Guide
Unit: Composting for Better Soil

UNIT PLAN

UNIT TITLE

Composting for Better Soil

MONTH

January

GOAL

In this lesson, students will learn about composting: its definition, its effect on soil, how to make it, and what lives in it.

OBJECTIVES

Students will:

1. Demonstrate understanding of relationships between decision making and the attainment of goals (NYS Learning Standard 1: Career Development, Elementary 1).
2. Listen to the ideas of others and express themselves orally and in writing in planning a school composting project (NYS Learning Standard 3a: Universal Foundation Skills, Elementary 1).
3. Gather and interpret information from reference materials on composting (NYS Learning Standard 1: Language for information and Understanding, Elementary 1).
4. Use traditional structures for conveying information, such as the chronological order of the lasagna method of composting (NYS Learning Standard 1: Language for Information and Understanding, Elementary 2).
5. Explore and solve problems generated from a compost project using concrete building objects (NYS Learning Standard 1: Analysis, Inquiry, and Design: Elementary 3).
6. Understand the attributes of temperature relevant to the composting process (NYS Learning Standard 3: Mathematics: Elementary 5).
7. Collect and display data from plant germination comparisons (NYS Learning Standard 3: Mathematics: Elementary 5).
8. Identify ways in which humans change their environment, and the effects of those changes, by adding compost to the school garden (NYS Learning Standard 4: Science, Elementary 7).
9. Brainstorm ideas and plan a bin model for a compost receptacle (NYS Learning Standard 5: Technology, Elementary 5).
10. Explore and use a variety of materials to construct a compost bin (NYS Learning Standard 5: Technology, Elementary 2).
11. Describe components of an ecosystem, illustrating specific components (Food and Fiber Systems Literacy: Science, Technology, and the Environment, A. 2-3).
12. Describe renewable and non-renewable natural resources, classifying resources used in the production of food, clothing, and shelter as renewable or non-renewable (Food and Fiber Systems Literacy: Science, Technology, and the Environment, B. 2-3).
13. Discover how ecosystems regenerate, and analyze the interaction of food and fiber systems with natural cycles (Food and Fiber Systems Literacy: Science, Technology, and the Environment, A. 4-5).
14. Identify natural resource management practices that limit pollution, and cite agricultural practices used to manage and conserve soil, water, and air (Food and Fiber Systems Literacy: Science, Technology, and the Environment, C. 2-3).

TERMS

The terms are highlighted in Bold throughout the lesson pages

Compost - a nutrient-rich mixture of decaying plants and manure used to fertilize soil. This word also describes the process of making compost.

Decompose - to break down, rot, or decay

Humus - a dark soil-like material made up of broken-down vegetable and animal matter

Inorganic - composed of matter that is not plant or animal, something that is not and has never been living

Microorganism - tiny organism, such as bacteria, that breaks down organic matter and cannot be seen without magnification

Mineral - an inorganic substance found in soil that is used by plants and needed for a healthy diet

Nutrient - a material that provides nourishment (food) and gives organisms energy and helps them grow

Organic matter - something that comes from living organisms, such as plants and animals

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real world application work together to reduce pests such as insects, diseases or weeds.

- 1. Properly identify pests*
- 2. Learn the pest/ host biology*
- 3. Sample the environment for pests*
- 4. Determine an action threshold*
- 5. Choose the best tactic*
- 6. Evaluate results*

SAFETY

General school safety practices.

Safe handling of tools for compost bin construction.

Standards Matrix for this Lesson:

Standards:									
Month	Unit	Math/Science/and Technology	English Language Arts	Social Studies	HEALTH	ARTS	Food & Fiber Literacy	CDOS	Other Languages
1	Composting For Better Soil	1: 7,e3	1: 1,e1				III A 2-3		
		3: 9,e5	3a: 2,e1				III B 2-3		
		4: 10,e7	1: 3,e1				III A 4-5		
		5: 11,e5	1: 3,e2				III C 2-3		
		5: 11,e2							

Matrix Key:

NYS Learning Standards arranged by Standard: Category, Level (e=elementary, i=intermediate)

Categories:

- | | |
|---|--------------------------------------|
| 1 Career Development | 11 Technology |
| 2 Universal Foundation Skills | 12 Interconnectedness: Common Themes |
| 3 Language for Information and Understanding | 13 Interdisciplinary Problem Solving |
| 4 Language for Literary Response and Expression | 14 History of the U.S. and New York |
| 5 Language for Social Interaction | 15 World History |
| 6 Communication Skills | 16 Geography |
| 7 Analysis, Inquiry, and Design | 17 Economics |
| 8 Information Systems | |
| 9 Mathematics | |
| 10 Science | |

ADDITIONAL RESOURCES

Compost *Critters* by Bianca Lavies ISBN: 0-525-44763-6

www.sustainable.tamu.edu/slidesets/kidscompost/cover.html (an online slide show)

www.compost.css.cornell.edu/composting_Homepage.html (go to “composting in schools”)

www.kidsrecycle.org/composting.php (for teachers)

SUPPLIES AND EQUIPMENT

Students will need access to the Internet, reference books, or other sources.

Materials for compost bin construction (to be determined by class)

BACKGROUND FOR TEACHERS

Composting is a method of recycling as old as time. The Earth composts as a matter of course. Compost releases its nutrients slowly, over several months or years. As students complete the activities, they should begin to understand more about the relationship of healthy soil to healthy plants. For instance, the nutrients humans get from vegetables are a result of the fact that plants need many of the same minerals, and derive them from the soil.

Composting is also a way to reduce the amount of trash going to the landfill. It is amazing to think of the amount of food waste that goes into trash bags; it is free fertilizer when used properly. Soil retains fertilizers better when enriched with compost. Less fertilizer runs off to pollute waterways. Students will be taught how to compost food scraps and garden waste, producing a product they can use to enhance garden and potting soil. Compost balances both acid and alkaline soils, bringing pH levels into the optimum range for nutrient availability. Compost is also a natural topdressing for lawns.

Tiny organisms, especially microorganisms, do much of the work of composting. Time and weather are factors, but good microorganism activity speeds up the process. Students will learn about these organisms.

Compost helps bind clusters of soil particles (aggregates). Soil rich in aggregates is full of tiny channels and pores that hold air, moisture, and nutrients like a sponge. Compost helps sandy soil retain water and nutrients that would normally wash right out. Compost particles attract and hold nutrients strongly enough to prevent them from washing out, but loosely enough so that plant roots can take them up as needed. Compost also breaks up tightly bound particles in clay or silt soil, allowing roots to spread, water to drain, and air to penetrate. It alters the texture and structure of all soils, increasing their resistance to erosion and making them easier to work with and cultivate (“A Green Guide to Yard Care,” Texas Natural Resource Conservation Commission).

The key to composting is adding a balance of materials. An easy way to do that is to include “greens,” or food and yard wastes such as fruit skins, rotting vegetables, and grass clippings. This adds active nitrogen. To avoid animal pests and odors, do not add meats, bones, dairy products, or fats. For best results, add an equal portion of “browns” to provide carbon. Browns are similar kitchen and yard wastes that have dried out such as dead flower stalks, dried leaves, and shredded paper. Adding paper from your shredder is an excellent way to balance out the amount of kitchen scraps you use.

Keep the compost moist and always add some garden soil when you begin. Soil contains the organisms you will want to help the composting process.

Some classrooms may be able to start a composting project at their schools, especially if they are including an outdoor garden in the year's activities. Some people have concerns that composting will attract pests and produce odors. An overabundance of decomposing fruits and vegetables can cause odor. But when the compost has a good balance of wet to dry, and is turned so that it is not compacted (greens to browns), odors do not occur or are minimal. For that reason, it is best to locate a compost pile close enough to your building or home to be usable, but far enough away to not cause concerns about odors and pests.

Many classrooms that cannot use an outdoor compost pile will try indoor composting, called vermiposting. Our unit includes a vermiposting lesson. Many Cooperative Extensions and nurseries offer composting classes or directions. We hope both students and teachers will consider the benefits of this ancient method of recycling for themselves.

QUESTIONS FOR STUDENTS

What do you know about composting?

What is going on in the compost pile or bin?

What are microorganisms?

What does healthy soil have to do with me?

Why is compost good for plants?

How can I make compost?

What lives in a compost pile?

INTEREST APPROACH ACTIVITIES

Beginning a Composting Program

A. Preliminary Step:

Discuss with your principal the objectives of a school-wide compost program. State that teacher involvement will be optional. At an appropriate staff meeting, let teachers know about the composting unit you will be completing, and that their participation could be as limited or as involved as each decides.

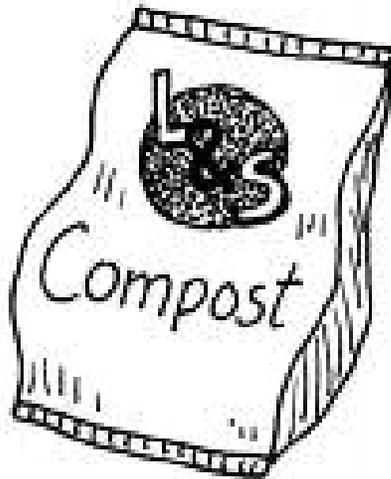
Read the poem, "Sara Sylvia Cynthia Stout" from Shel Silverstein's *Where the Sidewalk Ends*. This humorous poem is about a little girl who lived with her father and would do anything except throw the garbage out. As a result, it piled as high as the sky. Your class will love it, and it can be a springboard for discussion on what else she might have done with the garbage. In the poem, there is a long litany of items Sara piled high. Students can decide which items would be appropriate for composting.

B. Beginning a Composting Program:

Guide your students in beginning a school compost program by making posters to educate the rest of the school.

1. Students make posters:
 - a. Hold class discussions on what goes into and what stays out of compost
 - b. Students create posters by either drawing items or cutting out magazine photos.
2. Students teach other classes about:
 - a. The benefits of composting
 - b. What goes in and what stays out of compost
 - c. Opportunities they can be involved in later
3. Place posters in school hallways and classrooms

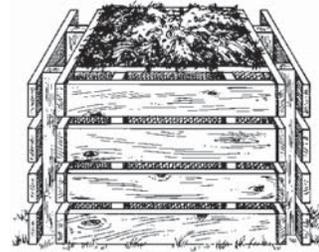
(For related activities refer to student worksheets #1 & #2)



Building a Compost Bin

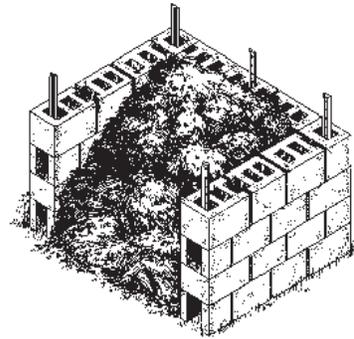
A. Background

1. Applied Science: Building a holding unit.
 - a. Use any container that will hold organic items as they break down.
 - b. Examples: pallets, cinder blocks



B. Brainstorm for ideas with the class

1. Selecting a Composting Unit
 - a. Describe compost bins you have used or seen.
 - b. What should our school compost unit look like?
 - c. What materials and tools would be needed?
 - d. Can you draw it on the board?
 - e. Explain which unit best fits our needs.
2. Locating the bin
 - a. Criteria for placement
 - i. Aesthetics
 - ii. Near a water source
 - iii. Allows for good drainage to avoid standing water
 - iv. Avoid a place with high winds that may dry out the bin.
 - b. Student discussion
 - i. What safeguards can we install to keep out unwanted pests?
 - ii. Why should we avoid location in a high wind area?
 - iii. Why is it beneficial to locate the bin near the school, but not in a high visibility zone?
 - iv. Which school personnel should we approach about location?
 - c. Prior to placement, discuss the bin with the principal and maintenance personnel to avoid possible conflicts.
 - d. Other considerations
 - i. Avoid attracting pests by not adding garbage during winter months.
 - ii. Assure the school community that the compost bin will be well-maintained so it won't be an eyesore.



C. Building the Composting Bin

1. Gather materials with help from students, parents, and school staff.
2. Have students help build the compost bin, with adult supervision and lessons on safety and tool handling.
3. Demonstrate how to put tools away.

D. Composting Maintenance

1. Collect food waste
 - a. Participating compost classes will encourage other classes to support the project by getting a plastic-lined pail with a lid (can be purchased for less than \$5).
 - b. Once or twice a week, their pail will be picked up by the Composting Class and brought to the compost pile. A layer of green weeds from the school flower or vegetable garden will be placed on top and then a layer of brown leaves from last autumn's raking. If the weather has been dry with little sign of a coming rain, students should spray it down with water.

c. Participating classes will:

- i. Need a pail with a lid
- ii.. Need plastic liners to collect garbage
- iii.. Be encouraged to eat fruit for snacks
- iv.. If classes not directly involved in composting want to be more involved, allow them the option of taking their pail to the compost bin themselves.
- v. Get the class involved in the solution of smell, for their input and ownership.

E. Additional Information

One of the most important considerations for successful composting is the moisture content of the ingredients. In general, you want to have a balance between materials with a lot of moisture such as food scraps (apple cores) and dry materials (leaves, fine wood chips). If the pile starts to smell like rotten eggs or some other objectionable odor, it may be too wet or compacted and not getting enough air. Turn the pile with a spading fork or shovel. Still have a problem? Add some sawdust or straw to provide better drainage. (p51, *Monitoring Composting*, from *Composting in the Classroom*, Trautmann and Krasny, 1998 National Science Foundation).

Composting Concepts: Moisture

A. Since moisture content is one of the key ingredients for composting, we want students to discover its importance.

B. Materials:

1. Leaves
2. Magnifying glass
3. Zippered sandwich bags
4. Spray bottle of water

C. Leaf experiment

1. Each student should bring 2 green leaves to school
2. Observe leaves with a magnifying glass
3. Insert each leaf into a plastic bag with a student name tag.
4. Seal one bag and leave the other one open
5. Twice a week, mist the leaf that was sealed in the bag, and leave the other one dry.
6. Have students predict what changes they expect to see.
7. Observe and make journal entries of changes in order to compare to initial hypothesis.



Making Compost Lasagna

- A. Definition: The “Lasagna Method” is a way of structuring a compost system so that maintenance is minimized and pests are deterred. This method can be used in any bin.
- B. Layering technique
1. Alternate green and brown layers, starting and ending with a brown layer.
 - a. Brown layers should be 2-3 times as thick as green layers. Green layers should be no more than 1-2 inches thick.
 - b. Brown layers should be shaped like saucers: lower in the center and higher around the edges. This allows the green layers to be kept to the interior of the pile with no food showing on the edges.
 2. Initial layer: The first layer in the bin should be a loose layer of twigs and branches (stalky material) that will not compress as the bin fills. The purpose of this layer is to allow air to reach the center of the pile, which helps with preventing unpleasant odors.
 3. “Brown” layers: Made of straw, dried leaves, wood chips, sawdust, or torn up paper. These are carbon-rich, supplying a critical food source for the decomposing organisms.
 - a. Helps to balance the moisture in a pile, since the brown materials are much drier than the green layers.
 - b. Creates a porous structure that allows air into the center of the pile and allows excess water to escape.
 - c. Serves as a visual and physical barrier to pests, by filtering food smells and putting food scraps out of reach of insect pests.
 4. “Green” Layers: These are nitrogen-rich materials, supplying another food source for the organisms.
 - a. Acceptable greens: food scraps from meal preparation, inedible leftovers, grass clippings that are too long to be left on the lawn, garden weeds, manure, etc.
 - b. DO NOT include meat, oily materials, dairy products, or bones. These attract pests to the compost.
 5. Investigative questions for students (answers are in the text above)
 - a. Why do twigs and other stalky materials go in the bin as the initial layer?
 - b. What are some of the materials in the carbon-rich brown layer?
 - c. What is the purpose of the brown layer?
 - d. What are some nitrogen-rich green materials?
 - e. Why is it important not to include meats, dairy, oily materials, or bones?
- C. Students begin composting using the guide above
- D. Routine maintenance
1. Spread the food scraps from the class pails on top of the pile in thin
 2. layers, keeping them away from the edges.
 3. Cover them with a generous layer of browns.
 4. Wash out the class pail and return it to its spot.
 5. NOTE: It is not *necessary* to turn the compost with this layering style, but if you want the compost finished sooner, you *may* turn it with forks or other digging tools.
- C. Information on the Lasagna Layering technique is taken from Cornell Cooperative Extension of Tompkins County: Compost Education.

Composting Concept: Effect of Compost on Plant Germination

A. Teacher Information

1. Students conduct an experiment to discover the effect of compost on plant germination.
2. Materials:
 - a. Fiber packs or plastic planting trays
 - b. Compost
 - c. Garden soil
 - d. Seeds (Marigold seeds will work well for this project.)
 - e. Light source (a window or grow lights)
3. Use the suggestions given to set up your own experiment. Use variations to fit your own needs.

B. Student Plant Germination Experiment

1. Fill fiber packs with each of 3 kinds of soil:
 - a. Natural garden soil
 - b. Compost
 - c. 50/50 mixture of compost and garden soil
2. Label the fiber packs and place them near a light source. Keep them moist.
3. Each student should make his own hypothesis to predict which treatment will have the best results and why.
4. Track results by keeping a journal.
5. Create a cluster map on the board similar to the one shown on the next page.

(For related activities refer to student worksheet #4)

Composting Concept: Macro- and Microorganisms

A. Teacher Information

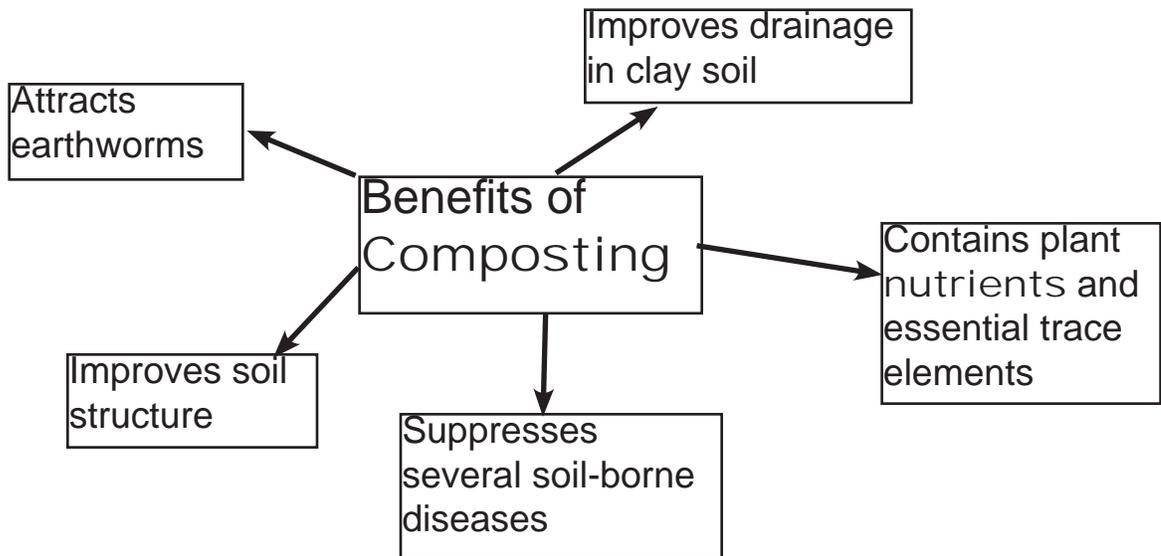
1. Expected outcome: Students will understand how microorganisms break down food particles. This is a key concept in composting.
2. Materials:
 - a. Orange
 - b. 1-quart zippered freezer bag
 - c. Magnifying glass

B. Student Experiment: Macro- and Microorganisms

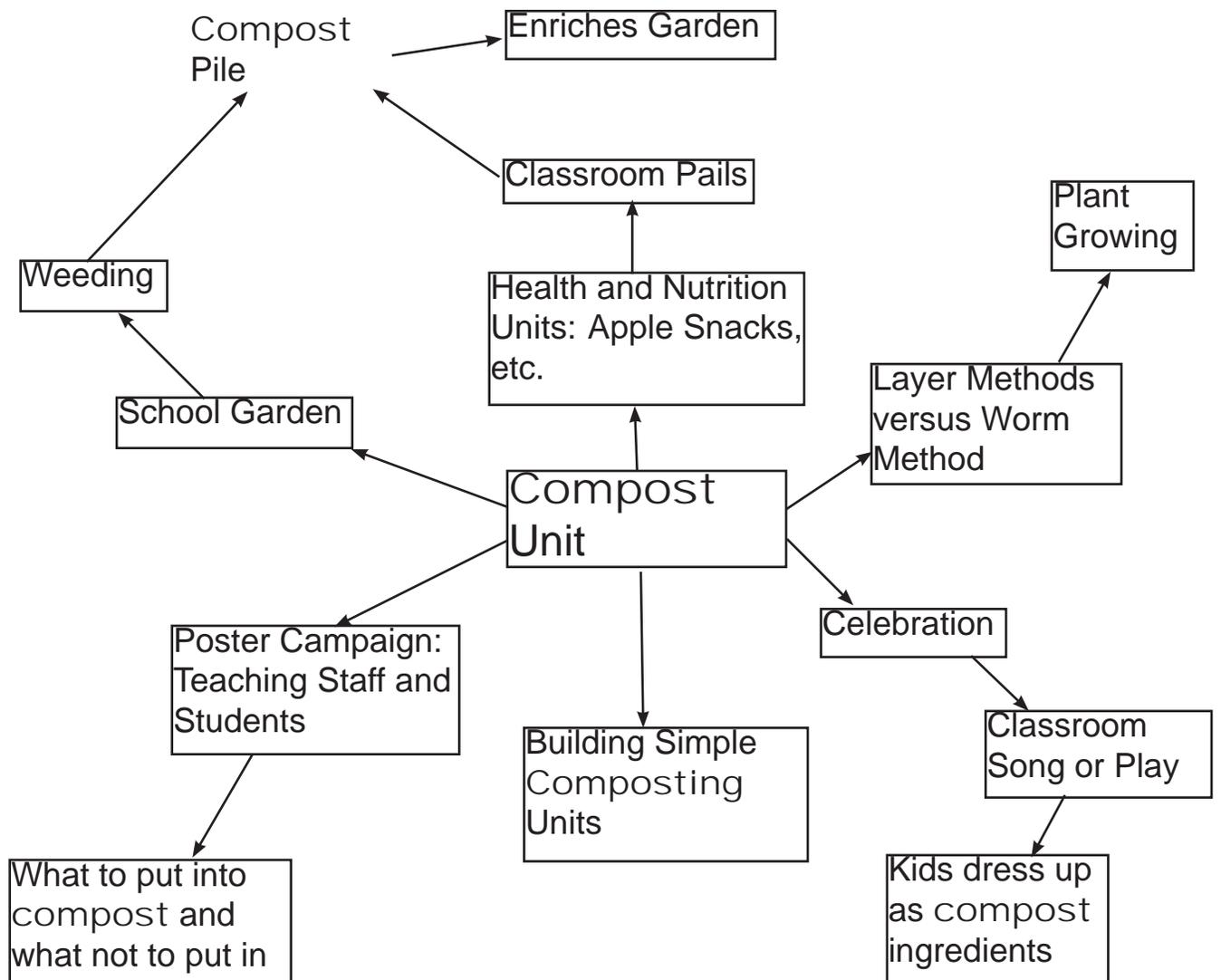
1. Using a plastic knife, cut several grooves in the peel of an orange.
2. Seal the orange in a plastic bag.
3. Place the bag in an area where it may be observed.
4. Make a hypothesis about what might happen to the orange.
5. Students will take journal notes including date, description, and when the mold begins to grow.
6. Observe the mold with a magnifying glass.
7. What is going on with the orange?
8. How is this phenomenon similar to composting?

(For related activities refer to student worksheet #6)

A. Benefits of Composting:



B. Composting Unit Overview



SUMMARY OF CONTENT

- I. What is compost?
 - A. Refer to background for teachers in this unit for additional information on compost.
- II. What do you know about composting?
 - A. This page may be read individually or as a class. Student should complete the activity individually.
- III. What is going on in the compost pile?
 - A. This page may be read individually or as a class. Student should complete the activity individually.
 - B. An optional compost-in-a-jar decomposition lesson may be included.
- IV. What does healthy soil have to do with me?
 - A. This activity helps students understand why vegetables are good for them and why healthy soil (compost) is good for plants and people.
- V. Granny's Compost Recipe
 - A. Reminds students that composting can be a fun way to recycle things that they already have into something good for the soil.
- VI. What lives in a compost pile?
 - A. In addition to earthworms, many other types of organisms live in compost. Students will find out more about an organism of their choice.
- VII. Review
 - A. Students are reminded of the four main ingredients of compost and why they should turn a compost pile.
- VIII. Quiz
- IX. Vocabulary

TEACHING-LEARNING ACTIVITIES

- I. What is compost?
 - A. Students to discuss the terms Compost and Decompose and answer questions on this page with peers.
- II. What do you know about composting?
 - A. Students will review what goes into and what stays out of compost, and complete the activity.
- III. What is going on in the compost pile?
 - A. Students will learn about the terms Microorganism, Organic matter, Humus, and Inorganic, and complete an activity to identify items that can and cannot be composted.
- IV. What does healthy soil have to do with me?
 - A. Students will learn about the terms Nutrients and Mineral, and complete an activity to identify which are needed by both plants and people.
- V. Granny's Compost Recipe
 - A. Students to read and discuss Granny's composting method. They will be reminded to use layers of greens and browns, water, and microorganisms from the soil.
- VI. What lives in a compost pile?
 - A. Students will choose an organism from the list to research and prepare a report that answers at least one of the listed questions.
- VII. Review
 - A. Students may read the page individually or it may be read aloud in class.
- VIII. Quiz
- IX. Vocabulary

Student Lesson: Composting for Better Soil: What is compost?

What do you know about composting?

What is going on in the compost pile or bin?

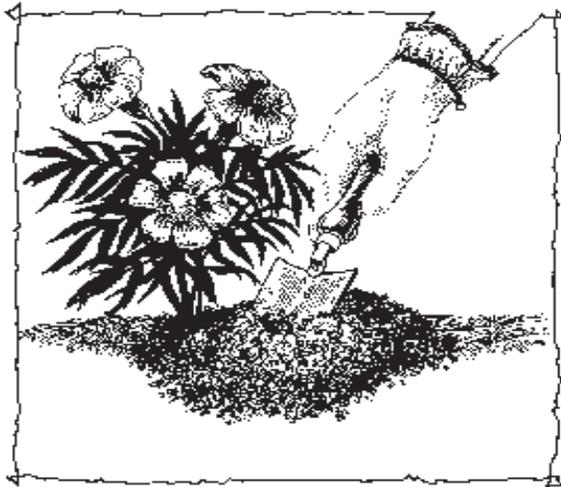
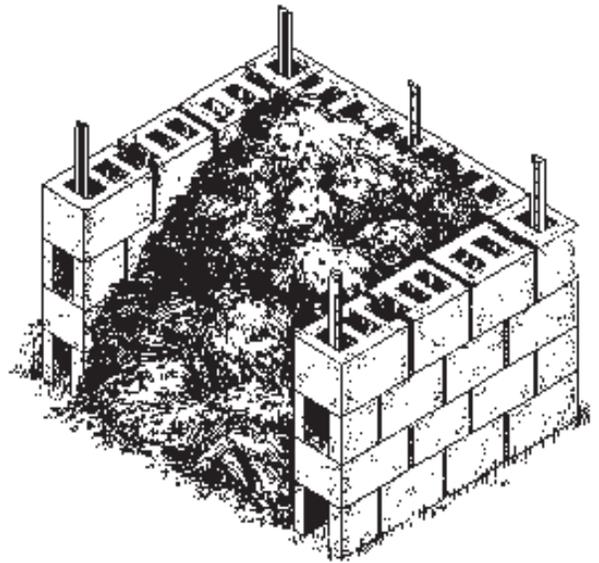
What are microorganisms?

What does healthy soil have to do with me?

Why is compost good for plants?

How can I make compost?

What lives in a compost pile?



Compost is a rich, soil-like mixture that is produced when organic matter breaks down. When compost is added to soil, it adds nutrients that plants need and improves soil texture. Composting is a way to make a usable product out of things we might just throw in the trash!

Do you see anything similar about the two words compost and decompose?

Have you ever had an apple or peach in your kitchen that started to get soft and black? It is decomposing. This means it is changing and breaking down.



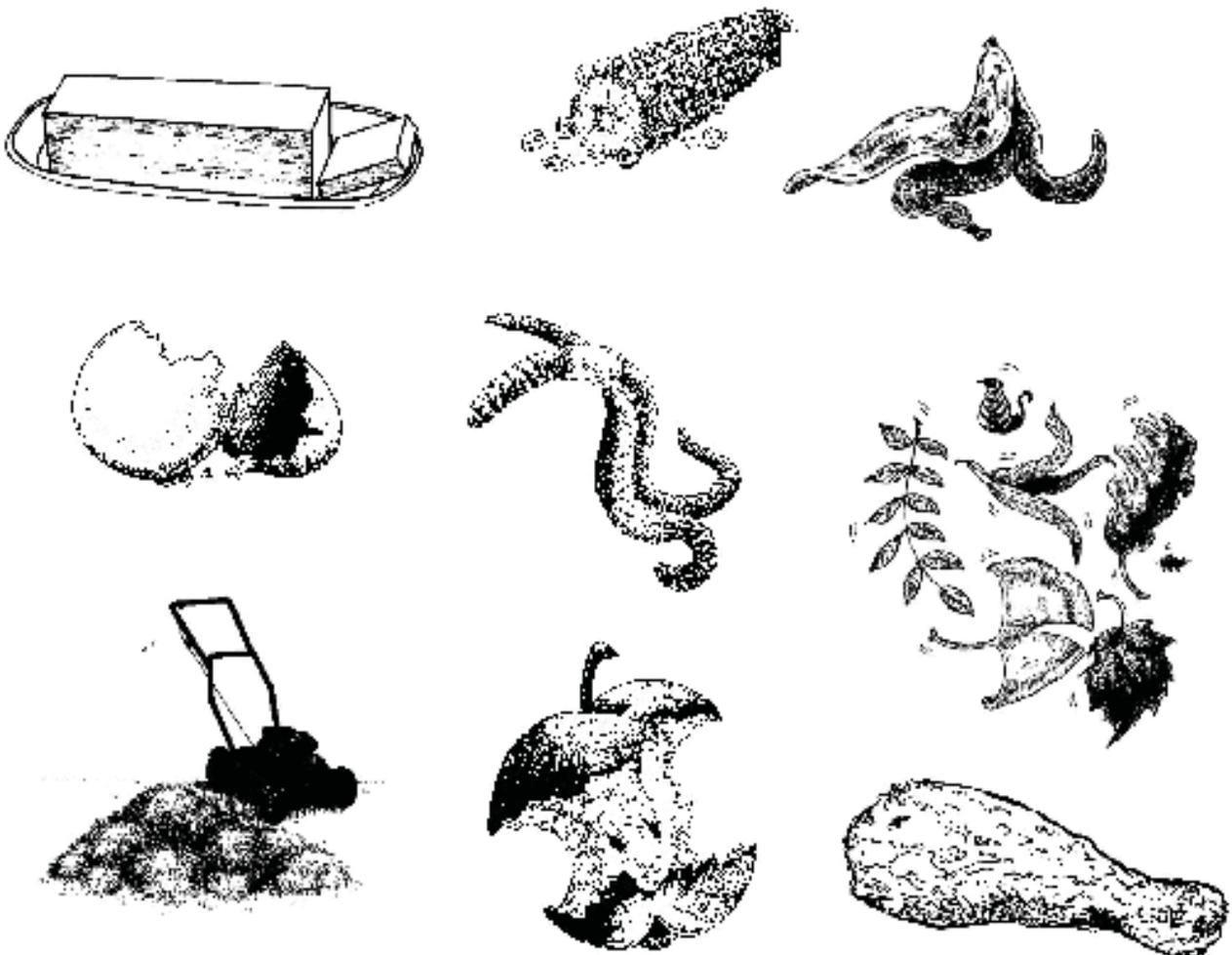
Nature wastes nothing!

Student Lesson: Composting for Better Soil: What do you know about composting?

Composting is a way to recycle things we might throw out, like apple cores, eggshells, dried leaves and wilted lettuce. We can create a compost bin or pile in our yards. Add “greens” like kitchen scraps, and “browns” like yard wastes, some water and some garden soil. This is the recipe for a compost pile! Do not add meat scraps or fats like butter or cheese. Composting is a simple way to recycle and help plants grow better.

Compost adds nutrients back into the soil; nutrients that plants need to grow and be healthy. Adding compost to our vegetable gardens means we have healthy soil and healthy plants. Nutrient rich foods are good for us!

Circle the two items which should not be put into a compost bin or pile.



Student Lesson: Composting for Better Soil:

What is going on in the compost pile?

What are microorganisms?

Microorganisms are tiny creatures that live in the soil and feed on organic matter. Organic matter are things that were once alive, or part of something alive, and will decompose (break down) over time.

Microorganisms help this process. They eat what we wouldn't! They will help change a banana peel into a rich, brown product called humus. Sometimes they are so active, they create heat. A warm or "hot" compost pile is breaking down rapidly!

Can you think of something that is inorganic - something that is not alive and was never part of something alive? (Hint: it is in the soil, it is very hard, and it doesn't drink or eat or change on its own).

Kayley wants to compost at home. Her stepmother used to have a garden and suggested she and Kayley start one of their own. Kayley is excited.

1. Circle the items they *can* add to the compost bin.
2. Cross out the items they *can't* use.

Apples

Banana Peel

Hair

Coffee grounds

Fruit

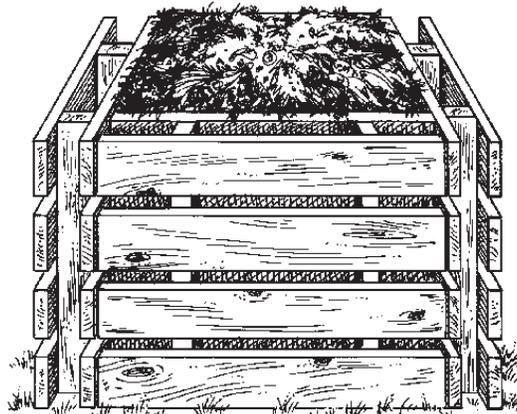
Leaves

Eggshells

Leftover Chicken

Tea bags

Torn paper



Vegetables

Onion skins

Tomatoes

Mayonnaise (an oil)

Pork Chops

Student Lesson: Composting for Better Soil:
Why is compost good for plants?

What does healthy soil have to do with me?

Compost is good for plants because it improves the soil. Plants need nutrients just like we do. If foods grow in healthy soil, they are more likely to give us the nutrients we need. How would you feel if the foods you ate had very few nutrients in them, because they grew in poor soil?

1. Look at the list of minerals that people need to be healthy.
2. Look at the list of minerals that plants need to be healthy.
3. Circle the mineral nutrients which are needed by both people *and* plants.



People need:

Plants need:



Boron
 Calcium
 Chromium
 Copper
 Fluoride
 Iodine
 Iron
 Magnesium
 Manganese
 Molybdenum
 Nickel
 Phosphorus
 Potassium
 Selenium
 Vanadium
 Zinc

Boron
 Calcium
 Chloride
 Copper
 Iron
 Magnesium
 Manganese
 Molybdenum
 Nitrogen
 Phosphorus
 Potassium
 Sulfur
 Zinc

Student Lesson: Composting for Better Soil:
How can I make compost?

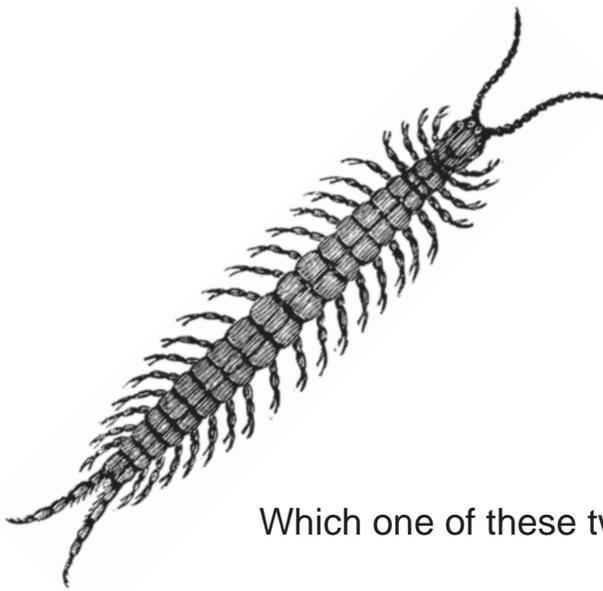


1. Fix one bucket of greens (I use grass clippings, weeds, veggie peels). Sometimes when those rascally grandchildren won't eat their broccoli, that goes in there too! I put the greens down as the first layer of my compost bin.
2. Add one bucket of browns (I put Grandpa's old crossword puzzles through the shredder and he's none the wiser). I add dry leaves and pine needles, too.
3. The browns go right on top of the greens. I pretend it's a layer cake. But don't taste it! One shovel-full of soil. Soil is the magic ingredient, because soil has all those critters in there that are going to make our layers decompose.
4. Add one bucket or less of water depending on how dry things are.
5. Then, start the layers all over again. Keep layering and adding a bit of water.
6. Now, just like a layer cake has to bake to be ready, the compost has to "cook" or heat up. But don't put it in the oven - it heats up by itself! (I wish my cakes did that.) Let it break down for six months or so before you add it to your flowerpots or garden. You might want to make two, 'cause they're so much fun! One can sit and cook while you use the second one to keep adding to during the year!
7. Don't add meats, fats, oils, diseased plants, or that stuff the dog leaves in the yard!

Healthy soil makes healthy plants; healthy plants make healthy people

Student Lesson: Composting for Better Soil:
What lives in a compost pile?

When Kayley is ready to use the compost, she will find some soil creatures in her compost pile. They have been helping the ingredients decompose.



Which one of these two is an insect?

Besides earthworms, many other types of organisms live in compost. Choose one from this list and write a paragraph about it. You will have to do some research! Answer at least one of these questions in your report:

1. What does it eat?
2. Can you see it without magnification?
3. Is it an insect? (Remember, insects have 6 jointed legs.)

Sowbug
Pill Bug
Soil Mite
Ant
Land Snail
Nematode

Millipede
Springtail
Hister Beetle
Centipede
Soil Bacteria
Soil Fungus

Student Lesson: Composting for Better Soil:
Review

Composting is great, isn't it? You can take things that might go in the trash and make something that is good for the soil, good for plants and good for yourself!

Composting works because there are many organisms in the soil that love to eat what you would throw away!

Be a Composter!
Remember these four ingredients:

greens

- kitchen and yard waste (like grass clippings)

browns

- dried leaves, garden wastes and shredded paper

moisture

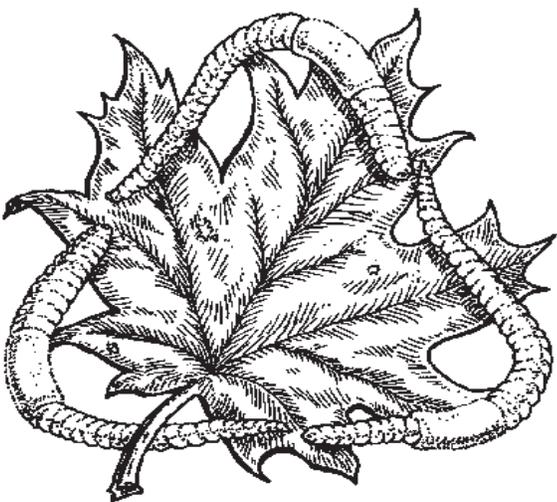
- do not let the compost dry out, but don't over-water it, either!

microorganisms

- add some garden soil; the living microorganisms in the soil will feed and multiply and break down your wastes.

Turn or stir the pile - if you can mix the ingredients, it will work better.

Active compost will heat up as microorganisms go to work. The more it heats, the sooner it will be ready to use.



Who is the biggest recycler on Earth? Who does the most composting?

The answer is *the Earth itself!* Leaves drop to the ground and decompose, adding nutrients back to the soil. This is just one example of how the Earth recycles.

Many schools have compost programs. Some are small, like adding fruit snacks and leaves to a compost bin. Some school programs involve the entire cafeteria system and may produce truckfuls of compost each year!

Student Lesson: Composting for Better Soil
Test Your Knowledge

1. Composting is (circle one):

- a. A way to recycle
- b. A way to make soil healthier
- c. A process using microorganisms to help break down organic matter.
- d. All of the above

2. Kayley's outdoor compost bin was ready to be filled. She had vegetable scraps, grass clippings, weeds from the flower garden and some soil. She had a full water bucket ready to pour. What was she missing? (circle one)

- a. Meat scraps
- b. Leaves and pine needles and shredded paper
- c. Moldy cheese
- d. Diseased plants

3. Name two organisms that live in compost piles:

4. Plants and people need many of the same mineral nutrients: True or False

5. Name two things you should not put into a compost pile or bin:

6. Organic is something that is living or once living. Name something that is inorganic:

7. Is paper an organic material? Yes or No? Why?

Student Lesson: Composting for Better Soil:

Vocabulary

Compost - a nutrient-rich mixture of decaying plants and manure used to fertilize soil. This word also describes the process of making compost.

Decompose - to break down, rot, or decay

Humus - a dark soil-like material made up of broken-down vegetable and animal matter

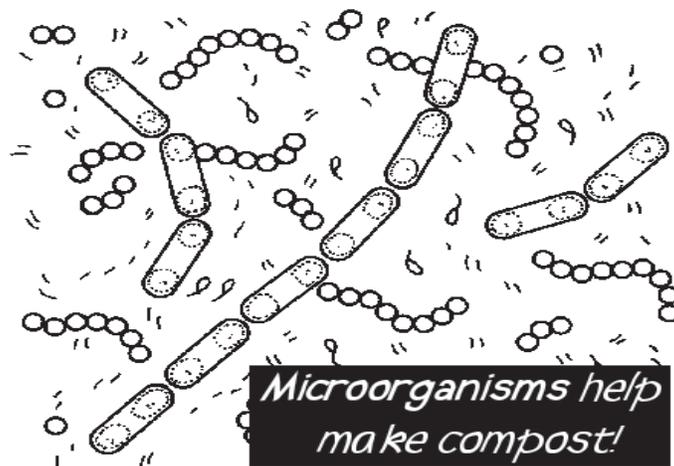
Inorganic - composed of matter that is not plant or animal, something that is not and has never been living

Microorganism - tiny organism, such as bacteria, that breaks down organic matter and cannot be seen without magnification

Mineral - an inorganic substance found in soil that is used by plants and needed for a healthy diet

Nutrient - a material that provides nourishment (food) and gives organisms energy and helps them grow

Organic matter - something that comes from living organisms, such as plants and animals



Integrated Pest Management is a specialized form of environmental management wherein scientific research and real world application work together to reduce pests such as insects, diseases or weeds.

- 1. Properly identify pests*
- 2. Learn the pest/ host biology*
- 3. Sample the environment for pests*
- 4. Determine an action threshold*
- 5. Choose the best tactic*
- 6. Evaluate results*

Celebrate Your New Knowledge of Composting!

The Composting Song

(To the tune of "I've Been Workin' on the Railroad")

I've been working on my compost
All the live-long day.
I've been working on my compost,
Where I throw my scraps away.
Greens and browns in different layers,
No bad smells for my nose.
Maybe I will put some worms in,
And watch it decompose!
Watch it decompose, watch it decompose,
Then it makes my garden grow-ow-ow!
Watch it decompose, watch it decompose,
Then it makes my garden grow!



Teacher Information for Student Worksheets

Student Worksheet 1

What is compost?

Compost is a great way to reduce trash and improve soil. Gardeners and farmers compost because it is the natural way to use what they have a lot of - plant waste - to make a product they need at no cost. Composting can be done in any size space, with a wide variety of methods and costs. Composting units can be purchased or made. It can be as easy as making a pile in the corner of a garden!

Student Worksheet 2

What do you know about composting?

Students may know about composting, depending on their experience with gardening or farming. An important lesson in composting is knowing what to add. An easy way is to think “greens” and “browns.” It’s also important to remember not to use diseased plants, meats, bones, cheese, fats, oils, or pet droppings. Compost should not smell strongly, attract pests or contain products that will spread disease into soil.

Circled items should be butter and chicken.

Student Worksheet 3

What is going on in the compost pile?

What are microorganisms?

A quick, optional decomposition lesson can be done in the classroom. Place 2” of soil, and enough water to moisten it, into a glass or clear plastic jar with a well-fitting lid. Add leaves, fruit and vegetable scraps, twigs, grass clippings and outdoor soil. Have students observe the jar daily and predict what will happen to the ingredients. Without air flow, this compost will become anaerobic and will provide both condensation and an odor when opened. Remember, compost with air circulation will NOT behave in the same manner!

Items crossed out should be: leftover chicken, mayonnaise, and pork chops.

Student Worksheet 4

Why is compost good for plants?

What does healthy soil have to do with me?

Vegetables have to take their vitamins, too! This activity helps students understand why vegetables are good for them. These nutrients have long names. Students may enjoy trying to pronounce them, but it is also a good visual exercise to compare the words in each list.

Circled items should be everything except Chloride, Chromium, Fluoride, Iodine, Nickel, Nitrogen, Selenium, Sulfur, and Vanadium.

Student Worksheet 5

How can I make compost?

Granny’s compost recipe reminds students that composting can be a fun way to recycle things that they already have into something that is good for the soil - for free! Granny reminds us to use layers of greens and browns, water and microorganisms from soil.

Student Worksheet 6

What lives in a compost pile?

Creepy-crawlies can abound in an active compost pile - you are likely to find almost any soil organism inside. Those invisible to the naked eye, like soil bacteria and fungus, are an important part of the decomposition process, also.

As students do this activity, they will need to note whether or not the organism can be seen without magnification. Those include sowbugs, pill bugs, ants, snails, millipedes, springtails, beetles, centipedes and some fungus. There are many species of nematodes and soil mites. Generally they are too small to see. Bacteria cannot be seen without magnification. Remind students that there is a huge range of bacterial and fungal species; some are helpful and some are not.

Answer: The ant (right) is the insect. The centipede (left) is not.

Student Worksheet 7

Composting review:

Composting is a simple and efficient way to improve soil health and therefore plant health, while reducing trash. We hope students will be interested in composting and encourage others to do it as well. There are many resources for more information on composting on many different levels.

If your students remember the four main ingredients to compost (greens, browns, moisture and microorganisms) they are well on their way to using the process in the future.

Student Worksheet 8

Test Your Knowledge

Students should answer the review questions individually

Answers:

1. D
2. D
3. Earthworm, Sowbug, Millipede, Pill Bug, Springtail, Soil Mite, Hister Beetle, Ant, Centipede, Land Snail, Soil Bacteria, Nematode, Soil Fungus
4. T
5. Meats, cheese, oils, fats, diseased plants, pet waste
6. Rocks. stones
7. Yes. Paper is made from trees, which are (or were) alive.

Student Worksheet 9

Vocabulary

Students may refer to this sheet for help with words in boldface.

Student Worksheet 10

The Composting Song

The sheet could be copied onto an overhead transparency or enlarged into a poster for easy class reading. If desired, guitar chords and sheet music can be found at <http://www.northern.edu/wieland/piano/tunes/rr2.htm>. A singalong MIDI file is available at <http://www.niehs.nih.gov/kids/lyrics/railroad.htm>