







# Compost as a Soil Amendment and Worm Castings as a Fertilizer

## Overview:


Students will learn how to make (1) compost to add to the garden as soil amendment and (2) worm castings (“worm poo”) to be used as an organic plant fertilizer. They will learn that these are examples of recycling “waste” in order to grow healthy food. They will create a mini compost pile and a worm bin.

## Objectives:

At the end of the lesson, students will be able to:

-  **Identify** what kinds of materials do and do not go into a compost bin and why, and in what order they should be added.
-  **Understand** the ideal soil ratio put into the bin should be 30:1 (carbon:nitrogen), which will eventually decompose, breakdown, to 2:1 (carbon: nitrogen) by volume.
-  **Describe** the basic chemistry of these processes.
-  **Explain** why it is important for our gardens and for the planet to use compost and worm tea.

## Preparation:

-  If you do not already have one in your garden you can purchase or make a worm bin, using the link in “Other Resources.”

## Materials:

- γ Container of kitchen scraps (no meat, dairy, fish, or animal fat) and cut-up paper products for the compost pile
- γ A second container of these items for the worm bin
- γ From a plant store: a jar of “red wiggly” worms
- γ Clear plastic storage box
- γ Jar of “worm tea”
- γ Worm Bin: a small box with holes in its sides and bottom, inside a larger plastic box with a lid

## On the Board:

- γ Vocabulary
- γ Student Reflection Questions




## Other Resources:


- γ Making a worm bin: <http://whatcom.wsu.edu/ag/compost/Easywormbin.htm>



## Suggested Snack:

- γ A smoothie made from overripe fruit: [http://www.huffingtonpost.com/hannah-helsabeck/5-healthy-smoothie-recipes-for-overripe-bananas\\_b\\_7155010.html](http://www.huffingtonpost.com/hannah-helsabeck/5-healthy-smoothie-recipes-for-overripe-bananas_b_7155010.html)

## Vocabulary:

 compost  
 worm tea  
 worm bin

 nitrogen  
 carbon  
 decompose

 red wiggly  
worms  
 organic fertilizer

## Learning Activities:

- I. Presentation: Compost and Worm Bins (10 min.)
  - A. Tell students that in today's lesson they will learn how to make compost.
  - B. Ask students if they can explain how compost is useful in our garden. Have students pair off to think, pair, share their answers to this question.
    - It is dug into the soil each year before we plant. It adds nutrients to the soil and makes it healthy for plants to grow.
  - C. Ask students: What do you think causes this compost to break down so that it becomes soil?
    - Students should remember from the Introductory Lesson "Compost, Recycling, and Trash," that microbes (fungi, bacteria, and invertebrates) are decomposers.
    - Ask students to recall the definition of invertebrates. (Animals without spines—in this case, "red wiggly" worms.)
  - D. Pass around the small container of kitchen scraps. Have students draw and label an illustration of some of the scraps. Students can take notes in their garden journals.
    - Ask students: What remains of food do you see here?
    - Tell students that compost is made up of kitchen scraps (vegetables and fruit only) and/or dead plants.
    - It is "green" material, combined with "brown" material.
    - Green material can be: kitchen scraps or other items rich in the element *nitrogen*.
    - Brown material can be: crushed or torn up dead leaves, dead grass, coffee grounds, clean scrap paper, or other items rich in the element *carbon*.
    - The brown and green materials are added in layers (a little water is sprayed in between the layers to allow the decomposers [worms and insects] to live). However, the brown material should always be the very bottom and top layers to keep flies and odor to a minimum.
    - Tell students that today they will build a compost pile in a bin so they can see the layers more clearly, and usually the bin should sit on soil (so that worms can move from the soil into the pile).
    - Tell students that these insects and worms eat the "green" material and this process heats up the bin. The heat kills bad bacteria, but also breaks down/decomposes the plant materials in the bin and turns them into organic soil.

2. Garden Activity: Building a Compost Pile (10 min.)
  - A. Create a small compost bin using a clear plastic storage box, so that students can clearly see the layers of items added to it.
  - B. From the container of kitchen scraps, hold up each item and ask students to identify if they are green or brown items.
    - Banana peel
    - Pulp from a juicer
    - Coffee grounds
    - Cardboard pieces (cut into small pieces)
    - Junk mail (cut into small pieces)
    - Cotton items (cut into small pieces)
    - Paper (cut into small pieces or crumpled into balls)
    - Dead leaves
    - Dead grass
  - C. Ask students: Do you know what kinds of items DO NOT go into a compost pile? (Meat, dairy, and items with grease/oil.)
    - Why? (These will attract squirrels, mice, rats and other predators.)
  - D. Tell students that they must “turn-over” the compost with a tool every couple of weeks so that it is well mixed and the entire pile is exposed to oxygen and the added water.
  
3. Garden Activity: Creating a Worm Bin for Organic Fertilizer (10 min.)
  - A. If time allows, create (or show an already existing) *worm bin*: a small plastic box with holes in its sides and a bottom that rests inside a larger plastic box with a lid.
  - B. Pass around a jar of “*worm tea*” for students to examine. Tell students that this is what eventually comes out of the worm bin.
  - C. Explain that as worms eat through the kitchen scraps and dead plants they produce waste, or excrement. Then, it is diluted with water to make worm tea (ratio should be at least 20:1, water vs. worm waste, because the worm waste is very strong and could “burn” a plant if it is poured directly onto it without being diluted).
    - It will take 3-6 months for the “worm tea” to be ready for the garden.
  - D. Worm tea, when diluted with a lot of water, can be used as organic fertilizer on unhealthy plants to make them healthy again.
    - Define *organic fertilizer*: natural fertilizer that doesn’t use toxic chemicals.
  
4. Snack (5 min.)
  - A. Bring students inside and serve a snack that teaches a strategy for minimizing food waste. For example, smoothies made from overripe or disfigured fruit.

- B. Have the students taste the smoothie first, then explain what it is and how it can help minimize waste.
  - C. Tell students that minimizing waste is important for the health of the environment, but if they still have waste left over after a meal, they can put it in their compost pile or worm bin!
5. Have students answer the Reflection Questions in their garden journals. (5 min.)

### Student Reflection Questions:

1. Do you think its important to recycle food “waste” in compost or some other way? Why or why not?
2. Why do you think a compost pile is “hot”?
3. What do you do with your kitchen waste at home? Can you start composting it? Why or why not?
4. What are three ideas you have for campaigns on how to get more people to compost?
5. Extra Credit: Work alone or with partners to design a campaign to educate others about how composting is good for the earth and about how they can easily start composting.

### Assessment Questions:

1. Give at least two reasons it is good to make and use compost in the garden.
  - **sustainability, recycling of food scraps**
2. Do the composter and worm bin need oxygen/air for the materials to decompose? Explain why or why not.
  - **Yes, that is why we need to turn over the compost every couple of weeks with a shovel and the worm bin with a trowel.**
3. What are the two main elements in compost?
  - **carbon and nitrogen**
4. Explain what it means for something to decompose.
  - **to break down**

### Standards:

#### Common Core State Standards

#### Comprehension and Collaboration:

- CCSS.ELA-LITERACY.SL.8.1

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

**Next Generation Science Standards****DCI-Disciplinary Core Idea****- ESS3.C: Human Impacts on Earth Systems**

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)