

Plants Grow Children Curriculum

COMPOSTING WITH WORMS

Students learn about composting and the recycling of organic wastes, especially food waste, with the assistance of earthworms. Each classroom will get their own worm compost bin to set up for composting food wastes.

Grade Level

4

Objectives

- To learn about composting with earthworms
- To learn how to construct and manage a worm composting bin
- To learn about the need for recycling our wastes
- To learn to participate in classroom questions and answer sessions

Vocabulary

annelid	bedding
castings	compost
composting	invertebrate
organic	vermiculture
respiration	

Time

45-60 minutes

Lead Time

1 - 2 weeks to develop a mold on a piece of bread.

1 - 2 days to gather materials and get worms for worm bin.

2 days or more to gather or construct posters as teaching aids.

1 week before class contact the classroom teacher and ask him/her to have class collect their food waste from lunch the day before you are

planned to arrive. Only fruit, vegetable, and grain waste. No meat and no greasy items like cheese. Store in a closed container.

Activity Materials

- 1 plastic bin with double doors on top and translucent sides
- 6-12 quarts of peat moss
- 1 cup of garden soil
- 1 garden hand trowel
- 1 garden hand claw
- 1 gallon milk jug marked in pints for water
- 1 small bucket lined with a plastic bag
- Postage or food scale for weighing food

Demonstration Materials

- Moldy bread in two sealed plastic bags
- Diagram of Organisms in a Compost Pile
- Diagram of Earthworm Anatomy
- Diagram of How Earthworms Mate

Teaching Procedure & Discussion

1. Introduce yourself. Tell the class who you are. Explain briefly about the WSU Master Gardener Program and why you are in the classroom.

2. Why do we need to recycle more of our waste? What percentage of our everyday waste is food waste? (*About 9%*) What percentage is yard waste? (*About 20%*)

Every year grass clippings make up about 20 per cent of the solid waste going into landfills. During the summer that percentage can be as high as 50 per cent. With many landfills in this country running out of space, some communities have even started banning yard waste from their landfills.

What are some things that we could do to help cut down on the amount of food and yard waste going into landfills? (*Leave grass clippings on lawn; waste less food; add grass clippings as a mulch in the garden; compost our leaves, etc. Burning is not a good answer because it causes air pollution.*)

3. Even though we can cut down on waste there will always be some food wastes, such as peelings, fruit skins, etc. What can we do with our yard and food waste so that it doesn't end up in the landfill? (*Use food wastes as livestock or animal feed; compost leaves, lawn clippings and food wastes; put food wastes in the garbage disposal; etc.*)

4. Today I'm here to talk about composting. What is composting? The technical definition of composting is "the biological decomposition of organic matter." Composting is the process by which we can biologically reduce organic or plant waste using microorganisms (fungi, molds, bacteria, and protozoa), insects, and other invertebrate animals to do the work. In the decomposition process, water, heat, and carbon dioxide are released. The material which is left is called compost. We can compost our yard and food waste to keep them from being added to the landfill.

What happens to yard and food waste in a compost pile? It decays or decomposes. Microorganisms and other "decomposers" feed on it. "Microorganisms" include bacteria, mold, fungi, actinomycetes, protozoa. "Decomposers" include small invertebrates (animals without an internal backbone) such as mites, millepedes, insects, sowbugs, earthworms, and snails. Show diagram (Organisms in a Compost Pile.) Show (Moldy Bread in Plastic Bags.) Talk about stages of

decomposition.

5. A regular compost pile in the yard can be used to recycle yard and food waste into soil building compost.

We can also use a special type of composting, composting with earthworms, for recycling our yard and food wastes. We can even use worms to compost our food wastes right inside our homes or school. Composting with earthworms is called vermicomposting, "Vermi" means worms. That's what we are going to learn about today...earthworms and composting.

6. What kind of animal is an earthworm? It's an invertebrate animal, that is one that lacks a backbone. Earthworms lack lungs and gills. Specifically, earthworms are annelids, which are segmented worms. Breathing or respiration (the exchange of carbon dioxide for oxygen) is accomplished through the moist surface of the worm's skin. So earthworms can respire or "breathe" in water but in flooded soils with oxygen poor water, the worms are forced to the top of the soil for oxygen. That's why you find them all over the sidewalks, driveway, and patio after soil saturating rainy weather.

On top of the soil they are exposed to light. Unfortunately, their skin provides them with no protection from ultraviolet rays of the sun. Thus, once on the soil surface they are killed by the UV rays of the sun, even on cloudy days. They don't drown. Show the poster of (The Anatomy of an Earthworm.)

You might be surprised to find out that there are over 1100 different species of earthworms. The giant Australian earthworm, *Megascolides australis*, can grow to ten feet long and one inch in diameter. Think of the size fish you can catch with one of these!

Our residential earthworms include the relatively large dark red or bluish "night-crawlers." These actively

burrow in the soil, improving aeration and nutrition. The smaller, gray "garden worm" tends to live in the top inch or so of soil and is valuable because it tolerates less fertile, less organic matter-rich soils.

We can't leave out the smaller reddish "little, red wigglers." They are often found in large numbers in association with rotting organic matter, such as in compost piles or manure. They breed abundantly and are excellent composters, rapidly breaking down organic matter.

Earthworms are a common inhabitant of the soil. It's not uncommon for seventeen worms to live in just one square foot of soil.

7. The great philosopher Aristotle referred to earthworms as the "intestines of the soil." Why? As earthworms tunnel through the soil, they feed on organic matter. (Remember they are one of the invertebrate "decomposers.")

They do this by feeding on food that is already partially decayed by bacteria, fungi, and protozoa. Once these organisms have softened the food, the worms draw it into their mouth along with small soil particles. In their gizzard, which is similar to that of a bird, the food is ground by the soil particles through the muscle action of the gizzard. Show diagram (Earthworm Anatomy).

The food then passes into the worm's intestine where it goes through a digestive process with enzymes. The enzymes break the food down into simple organic molecules. These molecules or nutrients are then absorbed into the worm's body. The soil particles and the undigested plant residue are then passed out of the worm. This mixed material is called "castings." They are rich in nutrients and good for the soil.

Charles Darwin estimated that if an acre of good soil contained 63,000 earthworms, they would deposit approximately 18 tons of castings per

year or about two inches of new topsoil in ten years. More recently, Researchers in Ohio found over a million earthworms per acre of bluegrass pasture. Earthworms are considered great soil builders. Just imagine how much soil building is going on with those one million worms!

8. To start a worm compost you need a worm bin and worm bedding. A variety of containers can be used or constructed. Containers should be no larger than eight to twelve inches deep. Wooden boxes, metal washtubs, or plastic utility boxes can be used. A rule of thumb to use is one square foot of surface area for each pound of garbage produced per week.

If we consider the worm bin the worm's home, then the bedding can be considered the furnishings. Bedding is the medium in which the worms work. The best bedding is made of some type of cellulose and can be kept moist while still staying loose enough to allow air exchange throughout the bin. Some materials used for bedding include shredded corrugated cardboard, shredded paper, animal manures, leave mold, or peat moss. Each material has advantages and disadvantages. Small amounts of soil are also usually added to the bedding to provide the mineral particles needed in the worm's gizzard.

The bedding needs to be moist but not too wet. Remember that the earthworms need moisture to assist their respiration but in wet conditions they don't have enough oxygen. When using dry bedding you should add water to the bedding at a ratio of 3:1 by weight, that's three pounds of water for every pound of dry bedding. How much does a pint of water weigh? Does anyone know? ("A pint's a pound, the world around.")

After getting the bin and the bedding ready, you'll need some worms. The best type of worms are red wigglers

or redworms. Other types of worms generally don't do well in worm bins. The red wiggler also has a variety of other common names including English pomace worm, stink worm, fish worm, striped worm, and tiger worm. The official Latin name is *Eisenia foetida*. Red wigglers are the worm of choice for composting in a bin because they are very efficient "recyclers," capable of processing large amounts of organic waste. They're also able to survive and reproduce quickly in confinement.

Don't make the mistake of using those big "nightcrawlers," *Lumbricus terrestris*. They don't seem to do well in worm composts since they can't take temperatures much above 50 degrees Fahrenheit and they don't like to be disturbed by digging. However, they are great recyclers of organic waste in garden soil.

If your class produces the average of one pound of food waste per day, you would need two pounds of red wigglers. How much do you think your waste from lunch weighs? Let's weigh it and see. (See references on Composting with Worms.)

What kinds of garbage can be fed to the worms? Any vegetable waste can be used, even moldy beans, stale bread, slimy lettuce, or rotten fruit. Meat waste, greasy wastes, and bones are not used because of the odor factor as they decay, the sharp edges on the bones, and the attraction

of various rodents to such materials. Dog, cat, and human manures definitely should not be used.

Should we grind up food before putting it in the bin? For most food scraps you don't need to do any grinding or chopping. However, large pieces of food do best if cut or ground up a bit first.

How do we know if the bedding is too wet or too dry? Take a handful of the bedding and squeeze it. If no water comes out, it's too dry; if several drops of water come out it's okay; and if more than three or four drops come out, it's too wet.

For more information on earthworms and composting with worms refer to *Worms Eat My Garbage* by Mary Appelhof and "As the Worm Turns" by Matthew Werner, Ph.D., *PNW Sustainable Agriculture* 6(4), December 1994.

Action Learning

1. Show working worm bin.
2. Show the materials they will use to build their own classroom bin...the plastic bin, the bedding, the soil, and the worms.
3. Explain how to start the worm bin.
4. Have class set up the worm bin.
5. Talk about how to manage the worm bin:

- a. What happens if there is too much moisture? What can you do about it?
- b. What happens if there's too much or too little food?
- c. How might too much digging cause problems?
- d. How can you schedule the distribution of wastes?
- e. What wastes should and shouldn't be put in the bin?
- f. What might be wrong if the bin starts to smell? (*Too much food for the worm. The compost is too wet.*)
- g. What can you do when the box gets full of castings and you need new bedding?

6. Give each student the take-home handout. It briefly explains what the children learned about and tells about WSU Cooperative Extension and its programs. Also distribute the WSU-MG handout on composting with worms.

7. Thank students for their attention and their questions.

Evaluation

- Jot down notes of successes and problems with the class.
- Take a camera with you if it is convenient to take pictures of the students setting up their worm bin.
- Give the teacher the evaluation form. Ask him/her to fill it out, and either give it to you then or mail it to the Extension office at the address indicated on the evaluation form.



By WSU Master Gardeners, Benton-Franklin counties and Marianne C. Ophardt, WSU Area Extension Agent, Benton-Franklin counties.

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