Worm Composting

Introduction

In recent years, Americans have become increasingly concerned about solid waste management. The US still relies heavily on landfill disposal techniques. Fears about groundwater contamination, rodent populations, increased traffic, decreased property values and costs to municipalities have fueled the public's distaste for landfills.

However, Americans have also continued to increase the amount of garbage they produce, thus increasing the demand for solid waste disposal.

Many jurisdictions have "reduce-reuse-recycle" campaigns to encourage citizens to minimize their contributions to the solid waste stream. Composting is a less discussed component of this concept and has the same goal.

Composting is a process of biological decomposition of organic material. The organic matter can be consist of materials such as yard waste (leaves, grass, twigs) or food waste. When the proper ratios of organic material, nitrogen, carbon, oxygen, moisture and microorganisms are in place, the process can produce **compost**; a dark, nutrient-rich, earthy-smelling material.

Composting can reduce the solid waste stream and create a desirable substance in the process. Compost can be used to enhance soil and improve plant growth.

Worm composting (vermicomposting) is the practice of using worms to transform food waste into a nutrient-rich finished product called **vermicompost**. Earthworms are efficient food-waste-digesting machines that can eat over half their body weight in organic matter per day. The **castings** that they create are rich in nutrients.

People are becoming aware that landfilling garbage is an option with environmental consequences. While most people think about paper, plastic and yard waste when they think about garbage, food waste can be a significant percentage of the total waste stream. For segments of society (institutions such as schools) that participate in traditional recycling programs, food waste is often the single largest element remaining in their solid waste stream. Composting can be a viable option in reducing the solid waste stream by diverting some food waste to this alternative disposal technique.

In this exercise you will set up and maintain over a period of 9

weeks, a worm composting bin for the purpose of illustrating the role that composting can play in reducing food waste in the solid waste stream and producing a nutrient-rich material in the process.

Materials

- Plastic bin
- Newspaper, or white paper
- Water
- Squirt bottle
- Worms
- Potting soil
- Food waste (plant only)
- Masking tape
- Permanent marker
- Balance
- Beaker
- Plastic trash bag
- Goose neck lamp
- Containers for worms retrieved from bins at end exercise
- Plastic bags for compost retrieved at end of exercise

Procedure

Week 1

1. Work in groups of 3-5. For labs that are full, you will work by lab table. In labs that aren't full, you will need to regroup for this exercise so that the limited number of bins are being used most efficiently.
2. Select a plastic bin. Using the provided masking tape and permanent marker, label the end (shorter dimension) of the bin with your lab section # and group name.
3. Gather a small stack of newspaper (you will need to record the total weight of newspaper that you add)
   a. use the balance to weigh out a 100 gram portion
      i. tear the newspaper into 1 inch (~25mm) wide strips and add the strips to the plastic bin
   b. continue this process until the bin is filled with newspaper strips to a depth of approximately 4-5 inches (100mm-130mm) (but do not exceed the height of the ventilation holes)
   c. Record in Table 1 the total weight of newspaper added
4. Using the squirt bottle, add water to the paper in the bin until it is moist (as damp as a wrung-out sponge). Mix the paper with your hands as you add the water to ensure that it is evenly distributed.
5. Weigh out 100g of potting soil and add to the bin. Mix in the soil, using your hands. Record in Table 1 the weight of soil added to the bin.

6. Obtain and add to the bin 25 worms (or a smaller number as indicated by instructor in case the worm supply is lower than expected due to deaths during shipping). Record in Table 1 the number of worms added to the bin.
7. Obtain one apple from the provided supply. Weigh the apple and record the mass in Table 1 as the weight of food waste added in week 1. Quarter the apple, and then cut the quarters in half. Starting in one corner of the bin, create a hole 2-3 inches (50-80mm) in diameter in the bedding and bury the apple pieces. Use the permanent marker to indicate the location of the starting hole. Also sketch and label the location of this hole in the space provided on page 7. In subsequent weeks you will bury the food waste in a progression of holes.
8. Place the lid on the bin and store the bin on the shelf as indicated by your instructor.
9. **IMPORTANT NOTE**: For the next 8 weeks (the duration of the exercise) it will be the **responsibility of your group** to bring to lab the food waste that will be fed to the worms!!
   a. **suitable food waste** includes fruits, vegetables, grains (bread, pasta, etc.), coffee grounds, egg shells
   b. ABSOLUTELY DO NOT BRING MEAT OR DAIRY PRODUCTS!!!!! They will encourage odors.

Week 2

1. Retrieve your bin from the storage shelf.
2. Remove the lid and observe the condition of the bin contents without disturbing the contents. Make notes on the condition of the contents in the space provided in Table 1.
   a. if the bedding appears too dry, add water (remember, bedding should be as damp as a wrung-out sponge)
   b. if the bedding level has decreased significantly below 4-5 inches (100mm-130mm), add bedding, but be sure to determine and record the weight of any added bedding
3. Cut the food waste (brought by your group) into pieces (approximately 1" (25mm) squares). Determine and record the weight of the food waste in Table 1.
4. Working in a clockwise direction from the hole

created in the previous week, create a new hole 2-3 inches (50-80mm) in diameter in the bedding and bury the food waste. Sketch the location on page 7.

5. Return the lid to your bin and return the bin to the storage shelf.

Week 3 - Week 9

Repeat the process detailed in week 2.

Week 10

1. Retrieve your bin from the storage shelf.
2. Spread a plastic trash bag on the lab table.
3. Empty the entire contents of the bin onto the plastic trash bag.
4. Set up a goose neck lamp and position it such that it shines down on the pile of contents from the bin.
5. The worms will burrow deep into the pile to get away from the light.
   a. gently lift hands full of compost from the top of the pile and inspect for worms
      i. if no worms are present, set that compost aside into a separate pile
      ii. if worms are present, separate them from compost and place them into a container of damp potting soil, and then place the compost into the separated compost pile
   b. continue this process until all worms have been separated from the compost.
6. Count the worms in the container of potting soil and record this number in Table 1.
7. Weigh the compost and record this as the final weight of compost in Table 1.
8. Give the container of worms to your lab instructor.
9. Clean and store the plastic bin as directed by your instructor.
10. Place the compost into the plastic bags provided.

General Information

- Do not overload the bin with acidic items (such as orange peels)
- Make sure food waste is buried to minimize odors and potential for fruit flies
- Err toward underfeeding rather than overfeeding!
- DO NOT use meat or dairy products as food waste

Personal Energy Inventory LAB WRITE-UP: Submit pages 5-7

Student Name: _____ Lab Date: _____
Lab Instructor: _____ Lab Section: _____

Results (Data)

Table 1. Record of initial inputs into worm bin, weekly food waste inputs, and final weight of compost and number of worms, by group.

	Weight of food waste	Weight of paper	Weight of soil	Total weight	# worms
Week 1					
	Weight of food waste	**Observations**			
Week 2					
Week 3					
Week 4 Spring Break					
Week 5					
Week 6					
Week 7					
Week 8					
Week 9					
				Weight of Compost	**# worms**
Week 10					

Conclusions (Questions) *For full credit these questions should be answered thoroughly, in complete sentences, in legible handwriting.*

1. How effective were your worms at converting food waste to compost? Did the food waste you added one week completely disappear by the next week? What was the relationship between the total weight of food waste added and the final weight of compost obtained?

2. Do you think composting food waste (whether by vermicomposting or traditional composting) is a feasible alternative to landfill disposal of food waste? Why or why not? What are the pros and cons of composting, in general, and vermicomposting, in particular?

Sketch of bin and location of weekly holes: