Compost
Transform Trash to Treasure

Overview

Making and using compost as a soil amendment has many potential benefits for agriculture and the rest of society. Composting adds value to crop residues, manures, and other organic wastes by biologically transforming them into a valuable resource that can enhance soil fertility by improving the biological, physical, and chemical properties of the soil.

Composting is a viable way to turn potentially damaging organic byproducts into productive resources. Organic wastes can be expensive to manage and cause potential health and environmental problems. If not managed properly, unutilized agricultural materials can produce pollutants such as nitrates that end up in drinking water or methane and other gases that end up in the atmosphere. When used properly, compost enhances plant health and productivity, partly because compost contains essential plant nutrients and partly because compost increases the soil's ability to retain and store nutrients.

The goal of this activity is to introduce students to the idea of biological decomposition and engage students in the process of managing organic wastes through composting. In order to reduce waste and make quality compost one needs to be able to recognize useful composting ingredients and know how to combine materials appropriately. The following reference resources are provided to improve your familiarity with the topic.

Resource References

Cornell Composting. Cornell University Waste Management Institute
www.compost.css.cornell.edu/Composting_homepage.html

Composting Science Page. Garden Mosaics, Cornell University
www.gardenmosaics.cornell.edu/pgs/science/english/compost.htm

Let it Rot, The Gardener's Guide to Composting, by Stu Campbell, Storey Publishing, Vermont, 1990.

Family Compost Feud. French Fries and the Food System: a year-round curriculum connecting youth with farming and food, (p.30) by Sara Coblyn. Lincoln and Roxbury: A publication of the Food Project, 1991.

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Introduction

This activity is intended to introduce students to the decomposition of organic residues with a particular focus on composting. Composting is the decomposition of organic materials under controlled conditions. Students will see how compost can be made from a wide diversity of plant and animal products and learn about the value of returning the resulting compost back to the soil to improve soil fertility by participating in the following five connected activities:
1. observing common examples of "natural" decomposition of plant litter
2. identifying different compost source materials found around the farm or garden
3. building a compost pile
4. examining the results of a managed decomposition process in an aged compost pile,
5. reflecting, either by cataloging their own waste stream and estimating how much of their waste could be composted, instead of going to a landfill or other destination, or by interviewing elders in their community to research the ways in which organic matter wastes were managed in the past.

Many of us know that many things tend to rot, or decompose, but we often do not know how this process actually occurs. We also may not understand why certain materials rot while others do not, or why some rot quickly and others take a long time. Furthermore, we may not understand that composting is an effective means of managing organic wastes and that it produces a valuable resource for enhancing soil fertility. After identifying decomposable waste materials, students will learn how to make compost.

To Lead This Activity You Need to Know

Facilitators of this activity need to have basic understanding of the following concepts in order to effectively lead students through this activity:

- the basics of the biological decomposition process: what is required and what factors influence the process
- approximately how long different materials take to decompose
- what materials from the farm or garden you will put into the compost pile
- how to build a compost pile using common farm and garden materials and tools
- how to measure the pile's temperature
- the identity and some biology of some of the decomposer organisms in a compost pile

Key Concepts

- decomposition
- biodegradability
- waste management
- nutrient cycling

- soil fertility

Objectives

- Learn about the biological decomposition process
- Learn how to compost common organic materials on the farm and in the home
- Identify materials that can and can not be composted
- Learn how compost is important for soil fertility and nutrient cycling
- Compare the composting process with natural decomposition processes that occur around us all the time
- Learn about options for organic waste management in the home
- Learn the recent history of organic waste management in your area from community elders

Materials

- a farm or garden with a diversity of plant (and possibly animal) waste materials including nitrogen rich (leafy) and carbon rich (woody) materials
- a water source
- a place to build a pile
- pitchforks, shovels, wheel barrows, a garden hose and nozzle, a measuring tape
- a compost thermometer
- compost piles at different stages of decomposition
- one or more uncultivated areas to observe soil litter decomposition
- a place to wash hands
- optional: magnifying glasses, flashlights, and a dissecting microscope

Activity (45-50 minutes)

Observing waste recycling in the ecosystem (5-10 minutes)

1. Locate a part of the farm or garden that has some trees or shrubs and has not been raked or tilled for a year or so, an area with wood chips, or some other area with plant material that has been on the soil surface and has been relatively moist for over a month. Ask the students to dig and look around in the plant litter on the ground. Ask them what is happening to the leaves and other plant parts that fall on the ground? How is it breaking down? What happens to it? Can plants benefit from this at all? How?
2. Afterwards, explain that farmers (and gardeners) can mimic nature and recycle dead plant material which can then be re-used on the farm
3. Walk around the farm and identify commonly found plant (and animal, if present) wastes. Explain that farmers may choose to burn waste, throw it away, or "recycle" it - like nature does. Ask them if any of them have a farm or garden at home and what they do with their wastes at home. What do they do with their food scraps from their kitchen? Do they recycle bottles, cans or newspapers? Explain that we can recycle plants too by composting.
4. Explain what composting is. It may help to show them compost piles in different stages of the process.

Building a Compost Pile (20 minutes)

1. Break the students into groups of 5-6 and pass out tools needed to make compost. Ask them what makes something biodegradable. What are some non-biodegradable things? Go over a list of materials that can and cannot be composted. Include materials that should not be composted such as cat and dog feces, meat, etc.
2. Show them how to use the tools and how to build the pile in layers. As the students add layers of the different wastes to the pile, discuss these materials and their role in the compost. Discuss the importance of carbon rich and nitrogen rich materials, water, and oxygen to the compost process and how to construct and manage the pile to ensure good decomposition, heat generation and heat retention.

   Review these key points when building a compost pile:
   - the C:N ratio – or the "brown/green" ratio- is critical, although precision is not needed. About 1/2 and 1/2 of each type by bulk quantity will usually suffice.
   - Smaller pieces decompose quicker – the more surface area exposed, the faster the material decomposes
   - Sufficient moisture – materials should be wet to the touch, but not soaking
   - Sufficient air –layering and turning the pile contribute to air circulation
   - 3ft x 3ft x 3ft minimum size to maintain heat for rapid decomposition (this may be too small during cool weather)

Examining the Decomposition Process (10 minutes)

1. After building the compost pile, show the students other piles that are of varying ages. Take the thermometer and measure the temperature of different piles to show how certain biological activity generates heat. Ask the students to reach in and feel those piles with heat. Ask them what they think is causing the heat.
2. Give the students 5 minutes to dig in to different piles and survey the various living organisms in different compost piles. Explain that various microorganisms such as bacteria and fungi are the workhorses that decompose the organic materials during the very active, hot phase of composting. If possible, have the students look in the cooler, older piles for colonies of visible filamentous bacteria (Actinobacteria, formerly called Actinomycetes), fungus and insects, earthworms, centipedes, millipedes, sowbugs, earwigs, spiders, mites, etc. Have them count how many different organisms they can see living in the pile. Students can use plastic spoons to sort through the compost. Flashlights and magnifying lenses may enhance their observations. If there's time, you can examin samples under a dissecting microscope. (for a related exercise requiring more preparation time, see *Cornell Composting in the Schools* http://compost.css.cornell.edu/macroinvertebrates.html)
3. Draw attention to the shrinking effect of decomposition and how the piles get smaller as they age. Ask the students why they think this happens. Ask the students to pick up the finished compost and notice how it looks and smells like rich soil.

Discussion and Reflection (10-15 minutes)

Discussion: Once they are finished, ask the group what they learned from seeing the waste materials and compost piles. Were they surprised by how a bunch of waste could be turned into soil? Was it difficult? Gross? Fun? Ask them why a farmer, home owner, or student would want to recycle waste by composting it rather than burning it or throwing it away. Ask why the farmer would want to use compost instead of, or in addition to, buying chemical fertilizers. What is useful or valuable about compost?

Explain to them that compost:

- is a great natural fertilizer, it provides plants with important nutrients that are released slowly over time and can be made on the farm and at home
- provides food to earthworms and many other beneficial organisms which are essential for healthy soil
- helps make soil friable and easy for plants to penetrate with their roots
- holds water so well that less frequent watering will be needed
- has been shown to prevent soil borne diseases in some situations

Back in the Classroom

Reflection Option 1:
Have the students collect their household trash for one day. Ask the students to record and report back to class a categorical list of the items that they and their family throw in the trash. Based on the trash collected on this one day, estimate (by weight) the percentage of their families' average weekly waste that is compostable, recyclable or deposited in the landfill or incinerator. Use the attached "Where does my trash go" worksheet to complete this reflection exercise. Collecting and examining trash on the first day after trash pick up might be least troublesome to sort and measure.

Ask the students the following questions:
1. Where does the trash they throw away at home and school ultimately end up? Is it taken to a land fill or incinerated?
2. Estimate what percentage of their average daily waste is compostable.
3. Discuss what happens to the soil if crop residues and other organic materials are not added to the soil.

Reflection Option 2:
Ask students to interview the elders in their family or community to find out what they did with their household food, landscape, or farm wastes when they were young. Have students ask their elders to explain why these wastes were dealt with in those ways.

Studying our waste stream is a way to relate our personal relationship to organic mater to agriculture and the managing of soil organic mater, nutrient cycles, and fertility. Graph 1. below, shows the results of studying the waste stream of residents in Santa Cruz

California in 1999. After students examine their own waste stream, have them compare it with the chart number 1 below. According to the chart, "Other" represents waste materials that are not currently compostable or recyclable. A small percentage of the "Glass, Metal, Plastics and Paper" materials represented on the chart are currently not recyclable. The "Food Waste and Other Organics" materials represent those waste materials that are compostable.

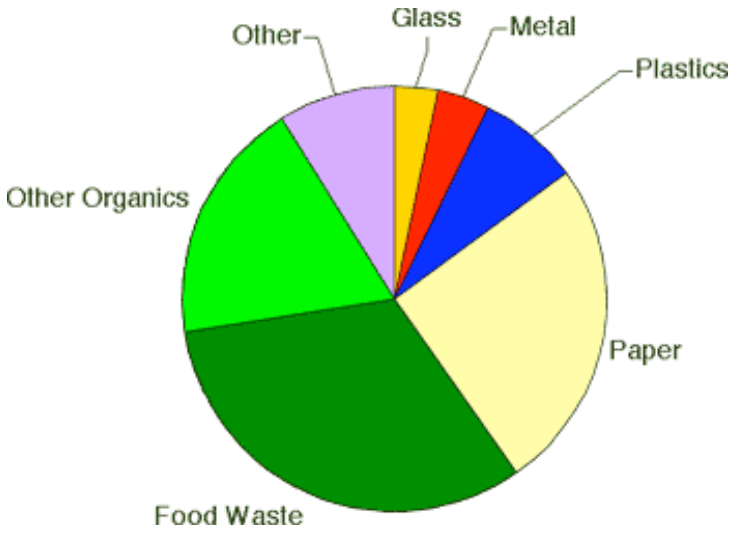


Chart 1. Component concentrations, Residential curbside collected waste,
1999 Santa Cruz County Waste Characterization
Recycling and Solid Waste Division of the Santa Cruz County Department of Public Works www.compostsantacruzcounty.org

Student Worksheet One

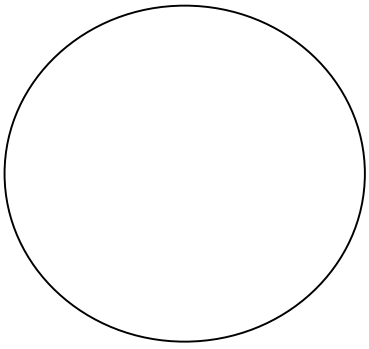
Where does my trash go?

Name:_____
Date:_____

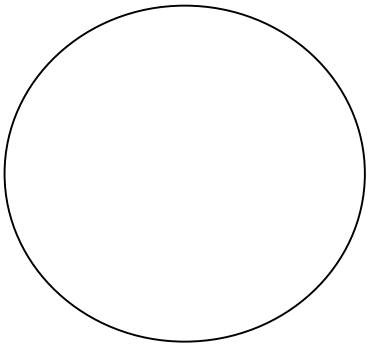
1. Of the total amount of waste material that your household generates on an average day estimate how much is currently composted, recycled and sent to the landfill or incinerator. Display these percentages in pie chart number 1 below.
2. Examine the materials currently going to the landfill or incinerator and estimate how much of that total (in weight) is actually compostable and/or recyclable.
3. Add the weights of these additional materials to the previously estimated total weight and percentage of compostable and/or recyclables. Display these percentages in pie chart number 2 below.
4. Comparing these pie charts will give you an estimate of the potential for increasing your diversion of waste from the landfill or incinerator by composting and/or recycling.

	Total Estimated Weight (lbs. or kg)	**Total Percent (%)**
What amount of material is currently composted?		
What amount of material is currently recycled in your home?		
What amount of material is currently going to a landfill or incinerator?		
Totals:		**100%**
What amount of material is currently going to a landfill or incinerator that could be composted?		
What amount of material is currently going to a landfill or incinerator that could be recycled?		
What amount of material is currently going to a landfill or incinerator that cannot be composted or recycled?		
Totals:		**100%**

Pie Chart 1



Pie Chart 2



Student Worksheet Two

Waste Management Interview

Date of Interview: _____

Interviewer's (Student's) Identification:

1. Name: _____

Interviewee's Identification:

1. Name: _____
2. Age: (approximate, if not comfortable asking): _____
3. Male/Female (circle)
4. Relationship to interviewer: _____

Questions:

5. How long have you lived in the community?
6. What did you do with your trash when you where young?

7. What did you recycle or compost when you where young?

8. Which food scraps did you feed it to animals? Which kinds, and how often?

9. Did you burn any of your household waste? If so, what did you burn and how?

10. Other questions: