

BY THE SKINS OF OUR BANANAS

Activity #1

A Comedy about a (Possible) Tragedy

Cast of Characters:

The Banana Bunch

Beulah - strong-willed, loud voiced, a leader

Bitsy - shy, sweet, small voiced

Biggy - big but very agile & sweet tempered

Bopper - a rocker, a roller

Blanid - an artist, a dreamer

Bubba - a cut-up, a joke-teller

Bix - musical, mature, easy (has a saxophone, clarinet, fultaphone -- wind instrument of choice, real or imagined; the sounds from it are real or vocalized by Bix to sound like the instrument he plays)

They are all dressed like bananas. Being dressed like a banana is hard work, so part of the charm of each character is dealing with the "costume" while staying in character.

The Landfill

Approximately 10 students whose roles are unspoken but central to the play. They are dressed in black trash bag tunics and wear plastic mesh potato or onion sacks over their heads, with the face area cut out in a rectangle so that the audience can see their ever shifting expressions. Throughout the play they stand in a semi-circle, absolutely still; they look straight ahead at the audience, never at each other. Their faces bear unhappiness and misery; they are continuously changing, from scowl to scariness, then boredom, anything unpleasant.

The Compost Heap

Approximately 10 students who are dressed in newspaper tunics and wear hats adorned with flowers, grasses, wheat, leaves, and other natural materials. Throughout the play they stand in a semi-circle and sway gently, their faces full of happiness and pleasure, their expressions continuously changing as they look at each other and at the audience, one bright, content face after another.

The Everybody Family

Everymom

Everydad

Everybrother

Everysister

They are dressed in street clothes. They begin as environmentally disrespectful, irresponsible waste-generators and, in the course of the play, grow to become responsible stewards of Earth's resources, beginning with banana skins.

The Recycling Angel

Male or female, the Recycling Angel is dressed in recyclables from head to feet. (The challenge to props and costumes is to fashion a body suit and wings that will be both hilarious and instructive: as a suggestion, each wing tip could have a 6-pack of empty aluminum cans, for example, joined by string by their pop-tops, and hanging from a spring attached to each wing tip so that the cans sway and clank when the Recycling Angel walks, leaps, gestures.) The angel is patient and loving, but firm about getting the Everybodies to do their part.

Plot:

The Bananas all want their skins to go to a compost heap, not the landfill. They know that their skin will become part of some wonderful new plant someday. But in the landfill, nothing good will come of them. They'll just sit there and sit there for a million years, uselessly. Because the Everybody Family is not enlightened about recycling, composting, or other resource wise choices, they throw everything in the trash, and it is landfilled.

The Banana Bunch decides to call upon the Recycling Angel to help educate the Everybody Family about the virtues of recycling and composting and the vices of landfilling.

In the end, the Everybodies -- young and old -- see the light and begin to run an environmentally responsible household. One by one, the banana skins jump gleefully into the compost pile. Immediately afterward, a bright flower, a tree, etc. grows up out of the pile.

All is well. The Bananas are together in the compost and the Everybodies are model recyclers and waste reducers. The Recycling Angel flits happily through the audience passing out instructions on how to compost, recycle, etc.

Scene 1:

Takes place on a table where the Banana Bunch all sit "bunched" together, apparently joined at their heads to a common stem, then separating as each disengages to get up and present his or her perspective about wanting his/her banana skin to go the landfill after being used by one of the Everybodies on breakfast cereal.

Scene 2:

Takes place in the Everybody Family's house. All over the floor are pieces of "trash" -- paper plates, aseptic juice boxes, Styrofoam egg cartons -- very few recyclables. This is clearly a household waiting for deliverance by the Recycling Angel.

Scene 3:

The semicircle of the landfill and the semicircle of the compost heap are the two central images on stage. It is here that the play's main conflict and action take place.

(Activity reprinted from "Closing the Loop: Integrated Waste Management Activities for School and Home" with permission from Chadbourne & Chadbourne, Inc., 8554 Haskins Road, Chagrin Falls, OH 44023-1823)

Activity #2

MICRO-ORGANISMS

Concept

Micro-organisms are essential to the recycling of organic matter.

Grade Level

9 - 12

Objective

Students will relate the importance of healthy micro-organisms actively to composting.

Method

Students will view slide samples under the microscope and sketch observations.

Materials

Two trays, soil, 12 slides, water, containers, violet, or methyl blue, eosine, microscopes, wax pencil

Subjects

Science, biology

Time

Three weeks

Sources

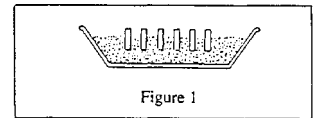
"Oscar's Options;" Daniel J. Dindal, S.U.N.Y. College of Environmental Science & Forestry

Leading Question

Can you identify micro-organisms responsible for the composting process?

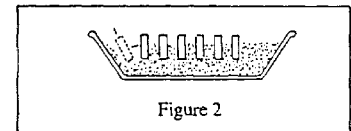
Procedure

1. Fill a tray with dry soil. Fill another with soil plus 5-10% organic matter, well mixed.



- Insert six slides vertically into each container, as in Figure 1.
2. Six slides in each container will permit observation of each sample at the end of one, two and three weeks. Each observation requires two slides, one stained dark and one stained light. Adjust the moisture content to about 20% water by adding a volume of water corresponding to about 1/5 of the volume of soil. Keep moisture content as constant as possible by adding water as needed.

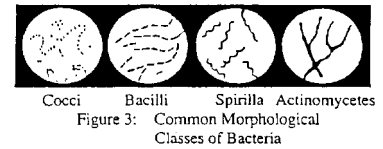
3. After one week, two slides from each container will be studied according to



- the following procedure. Dig soil away from one side of the slide, then tilt the same slide toward the hole and lift it out as in Figure 2.
4. The slide will now have a film of soil and micro-organisms on one side. Clean the other side with a cloth. Label the slide with a wax pencil and prepare a second slide in the same way.

5. The preparation of the slide is "fixed" by passing the slide over a flame - one or two passes should be sufficient. Stain one slide dark, using gentian violet or methylene blue. Stain the other slide light, with eosine.

6. Examine each slide for the presence of bacteria with the low and high powers of a microscope. If present, spirilla will probably not be seen unless the field is darker. Sketch the observations and have students compare them to Figure 3 in order to identify the morphological class of the bacteria.



7. Have students determine whether there are differences in the number of the types of micro-organisms in the two samples.
8. At the end of the second week, repeat the procedures with another pair of slides from each sample. Have students determine if the number and types of bacteria in the samples have changed significantly and help them to account for the changes.
9. At the end of the third week, repeat the procedures and make further observations. Have students relate their observations and conclusions to composting.

Evaluation

Number of samples found.

Extensions

- A. Share the food web of compost pile with students. Discuss its ramifications on composting and, if possible, assemble some of the consumers for direct observation.
- B. Culture samples on nutrient agar in petri dishes. Observe what grows.
- C. Grow a mold garden.

(Activity reprinted from the "AVR Teacher's Resource Guide: For Solid Waste and Recycling Education" with permission from the Association of Vermont Recyclers, PO Box 1244, Montpelier, VT 05602-1244)

Would you like to observe some of the animals that live in your compost pile in person? You can do so by making an insect trap called a Berlese funnel.

What You Need

small piece of window screen

large diameter funnel

small jar with soapy water

container to hold funnel (a small plastic bucket will work)

compost sample

light source

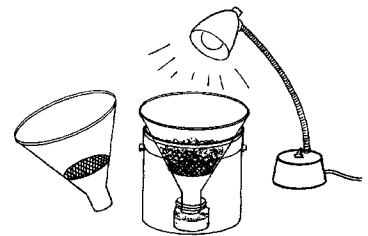
hand lens for dissecting

record sheet

pencil

What to Do

1. Cut the screen to the diameter of the funnel about two-thirds of the way down from the top of the funnel. Place the screen into the funnel.
2. Fill the jar half full with soapy water. Put the jar in the bottom of the container.
3. Put the funnel with screen into the container so that the bottom of the funnel is suspended above the jar with soapy water.
4. Put the compost sample into the funnel.
5. Place the light source over the top of the funnel. Leave for several hours or overnight. The soil animals will crawl away from the light source to the bottom of the compost in the funnel. Then they will fall into the soapy water and die.
6. Pour the excess soapy water out of the jar. Observe the soil animals with the naked eye, under a hand lens, or with a dissecting microscope. Do you recognize any of the animals from the diagram of the compost food web? Record your observations.



Record

1. Draw a picture of the animals that you see in your compost sample.
2. Can you name any of the animals?
3. What role do these animals play in the food web?

(Activity reprinted from "Composting Wastes to Resources" with permission from the Cornell Waste Management Institute, 468 Hollister Hall, Ithaca, NY 14853-3501.)

Activity #4

GARBAGE BAG RECIPE

Concept

Solid waste is everything we find useless and throw away

Grade Level

K-3

Objective

Students will define solid waste, identify major components of the waste stream, and begin to question their throw-away habits.

Method

Students will create a classroom trash bag.

Materials

Waste basket, typical trash items from the attached trash bag recipe

Subjects

Language Arts, Science, Social Studies

Skills

Reasoning, logical thinking, sorting and classifying

Time

One class period

Background

Composition studies at Vermont landfills have indicated that almost 60 percent of what we throw away still has value and could be reused, recycled, or composted. Diverting these resources from the waste stream begins with recognizing the resource potential of what we throw away each day. This activity sets the stage for many more by creating a classroom prop you can use over and over for different reasons.

Leading Question

What kinds of things do we throw away?

Procedure

1. Begin by examining the objects in the classroom trash can. Discuss the differences between trash in different places. What kinds of trash would be found in the cafeteria or in different rooms at home?
2. Cut up the attached list so that each child has only one or two items. Ask them to bring either the item itself or a drawing of the item pasted on cardboard to class the next day.
3. When all the components have been assembled, the garbage bag can be used for different lessons. The contents can be sorted and classified by different packaging types, objects with different resource bases, biodegradable or nonbiodegradable, made from renewable or nonrenewable resources, recyclable or reusable, etc. What can they be recycled into? How could they be reused?

Evaluation

What is waste? (things we don't use or want anymore) What are resources? (things that we don't use or need or value) Name one thing that is waste or one thing that is a resource. Name one thing you throw away which could be a resource instead of a waste.

Extensions

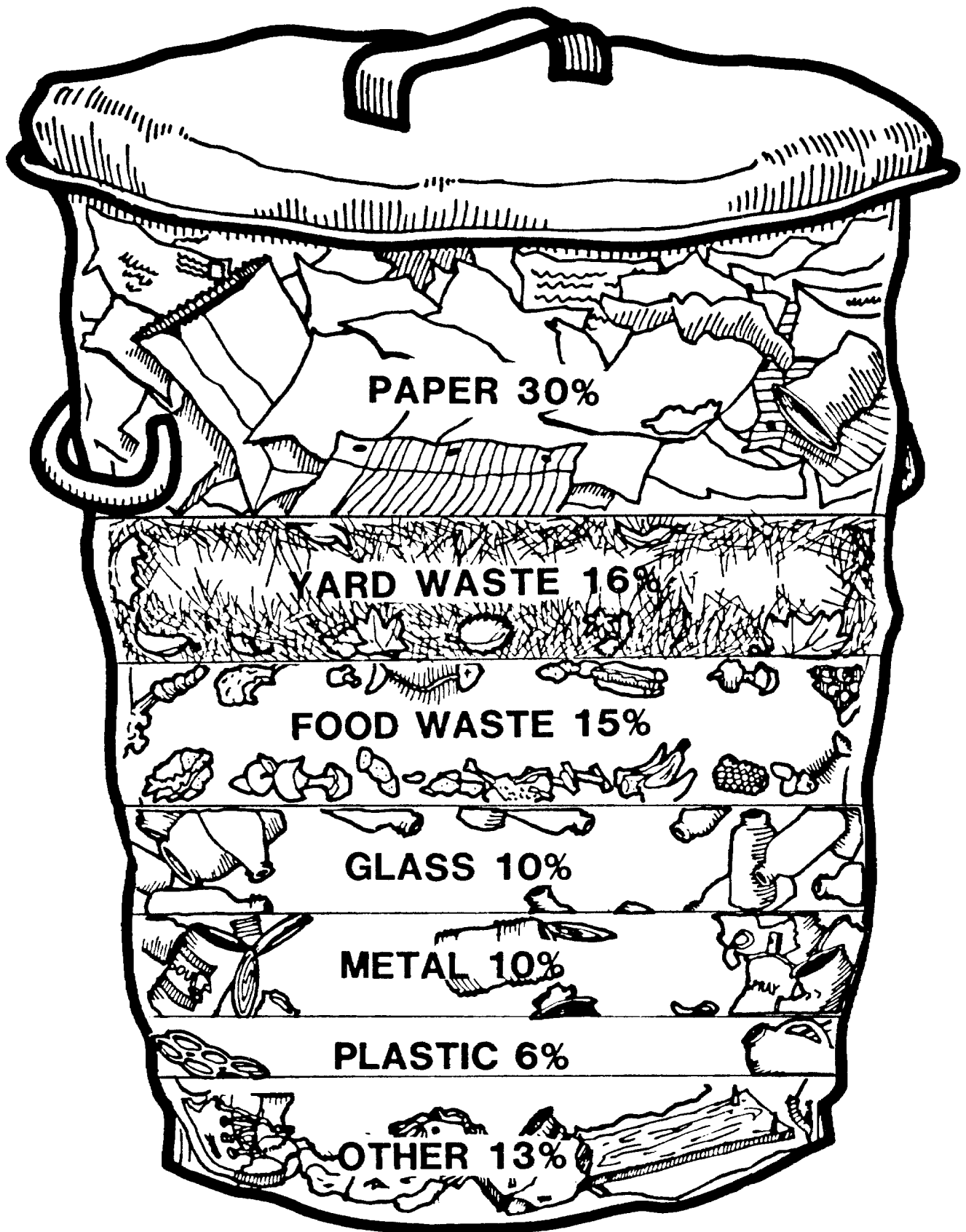
- A. WHO WANTS TO GO TO THE DUMP? Hand one trash object to each student, and have all the students stand together in a group representing one large trash bag. The teacher can be the trash collector who will take it away. Describe what happens at a sanitary landfill and ask if anyone really wants to go to the dump. If not, they can be rescued by thinking of a way they can be reused or recycled. Try to save all the items of the trash bag by thinking up alternatives. Discuss ways to redesign products that cannot be recycled or reused. Continue until all the students have been rescued.
- B. Make a trash can display showing the typical breakdown of different types of trash, as in the attached illustration. Use magazine cutouts for a collage. Also bring in the real things.
- C. Find magazine pictures of things that get thrown out after one use and things that last a long time. Make posters or a display of the two types. Compare each throw away object to the same object fifty or one hundred years ago. (razors, paper napkins, paper grocery bags, ballpoint pens, etc.)

(Activity reprinted from the "AVR Teacher's Resource Guide: For Solid Waste and Recycling Education" with permission from the Association of Vermont Recyclers, PO Box 1244, Montpelier, VT 05602-1244)

INGREDIENTS OF GARBAGE BAGS

This list represents the contents of a typical three-pound residential trash bag, as determined by the Vermont solid waste composition studies done in 1986.

one paper plate	fast-food restaurant packaging
one glass jar	one brown paper bag
an old rag	one aluminum can
some junk mail	a disposable diaper
plastic fresh produce bags	corrugated packing box
styrofoam cup	six-pack ring
newspaper	plastic film
one plastic detergent bottle	plastic margarine tub
one apple core	one banana peel
dead branches and/or leaves	some dead flowers
cardboard cereal box	cardboard egg carton
brick pack juice container	chicken bones
plastic-coated cardboard milk carton	plastic cider jug
styrofoam egg carton	coffee grounds



Activity #5

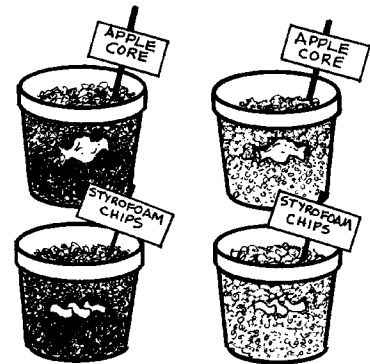
WATCHING WASTES ROT I

Some wastes break down faster than others in a compost pile. Some materials never break down in a compost pile.

Micro-organisms and soil animals do most of the work of breaking down wastes in compost. Do you think wastes will break down if these organisms are not present? How long will it take?

What You Need

flower pots
compost sample
sterile potting soil, perlite or vermiculite (sterile mix)
organic wastes, such as orange peels and apple cores
paper wastes, such as paper napkins and paper bags
plastic wastes, such as styrofoam chips and plastic bags
labels that stick on the posts
record sheet
pencil



What to Do

1. Fill half the flower pots half full with compost. Fill the other half of the pots half full with sterile mix.
2. Gather your organic, paper, and plastic wastes. Place one-half of each waste in a pot with compost and the other half in a pot with sterile mix. For example, place one apple core in a compost pot and one apple core in a sterile pot. Place three styrofoam chips in another sterile pot. Label the pots with the names of the wastes.
3. Cover the wastes with compost or sterile mix, filling the pots. Add water to all the pots so that the compost and sterile mix are damp but not wet to the touch. Check your pots every few days to be sure they are still moist.
4. After one week, examine the wastes in each pot. Which wastes are decomposing? Cover the wastes again, and continue to check them once a week for as long as you want. Record your observations.

Record

1. Record the name of the item that you buried in the pot.
2. Describe the condition of the item buried in compost each time you check it, i.e., how decomposed the item looks, what color it is, and whether or not you see fungi on it.
3. Describe in the same way the condition of the item buried in sterile mix.
4. Which items decomposed most quickly?
5. Which items didn't decompose at all?
6. In general, did items decompose more quickly in compost or sterile mix? Why do you think this is true?

(Activity reprinted from "Composting Wastes to Resources" with permission from the Cornell Waste Management Institute, 468 Hollister Hall, Ithaca, NY 14853-3501.)

Activity #6

WATCHING WASTES ROT II

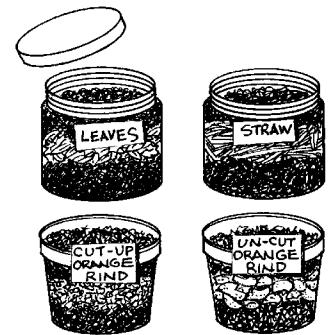
The organisms in a compost pile need air. When there is not enough air, the organisms die. New organisms that can survive without air come into the compost pile. These new organisms produce a gas that has a nasty smell.

The organisms in a compost pile also need to be able to get at the wastes to break them down. Is it easier for the organisms to get at large pieces of waste or small pieces?

Let's investigate how long it takes to break down wastes in the presence and absence of air. Let's also see how long it takes to break down wastes of different sizes.

What You Need

- wide-mouth jars
- compost sample
- organic wastes (you may use one of several kinds of wastes)
- flower pots
- labels for jars and pots
- record sheet
- pencil



What to Do

1. Fill two wide-mouth jars half full with compost. Place equal amounts of a particular waste in each jar. Then fill the rest of both jars with compost, burying the waste. Fill the first jar with water and place a lid on the jar. Add just enough water to the second jar so the compost is damp but not wet to the touch. Leave the second jar exposed to air. (Check on the second jar every few days to make sure the compost is still moist, but do not over water.)
2. Repeat the procedure with other wastes. Label each jar with the name of the waste placed in it.
3. Take two more equal portions of a particular waste. Cut the first portion into small pieces. Leave the second portion uncut. Fill two flower pots half full with compost. Place the cut-up waste in the first pot and the uncut waste in the second pot. Cover the wastes with compost, filling the pots. Add water to the pots so that the

compost is damp but not wet to the touch. Check your pots every few days to be sure they are still moist, but do not over water.

4. Repeat the procedure with other wastes. Label each pot with the name of the waste placed in it and whether the waste is cut or uncut.
5. Check your wastes after two weeks. Which wastes are decomposing? Record your observations.

Record

1. Record the name of the item that you buried in the jar or pot and whether or not it was exposed to air. Describe the condition of the item buried in the compost. Include such things as how decomposed the item looks, what color it is, and whether or not you see fungi on it. Make the same observations noting whether or not the item was cut or uncut.
2. Did items decompose faster in the jar with air or the jar with water?
3. Was there a smell coming from either jar? If yes, what caused the smell?
4. Were items more decomposed when they were cut or uncut? Why?

(Activity reprinted from "Composting Wastes to Resources" with permission from the Cornell Waste Management Institute, 468 Hollister Hall, Ithaca, NY 14853-3501.)

Activity #7

MINICOMPOST

Concept

Organic waste can be recycled to enrich soil for growing more organic matter.

Objective

Students will learn about recycling organic matter.

Method

Students will build a model compost pile in a classroom terrarium.

Materials

Aquarium, organic wastes, soil (not potting soil), thermometer, trowel or large spoon, 1-2 dozen red earthworms

Subject

Science

Skills

Sorting and classifying, inferring, predicting, observing

Time

One class period to a full year.

Background

"When we mention recycling, we often think of recycling glass bottles, aluminum cans and newspapers. But another 50% of the household garbage we throw out also can be recycled. These recyclables are food scraps, leaves, grass clippings and other biodegradable organic wastes. Organic wastes can be recycled by composting. Simply stated, composting creates optimal conditions for decomposition to occur. Decomposition is the biochemical process by which bacteria, fungi and other microscopic organisms break organic wastes into nutrients that can be used by plants and animals. Decomposition occurs in nature whenever a leaf falls to the ground or an animal dies. It is essential for the continuation of life on earth. The result of decomposition in a compost pile is a nutrient-rich humus that is excellent for improving soil quality and plant growth."

Recycling Study Guide

Leading Question

What do you do with food scraps?

Procedure

1. Assemble a variety of organic wastes including the following: manure and green grass clippings, sawdust, hair, wood ash, leaves, kitchen food scraps, etc. Avoid meat scraps, dairy products, fats and oils which inhibit decomposition, cause odors, and can attract pests. Chop the organic wastes into small pieces. You can leave some large pieces of the same materials to compare

rates of decomposition between large and small items. Why might there be a difference?

2. Alternate layers of the materials as follows (amounts are approximate): one inch of soil, two inches of organic waste, sprinkle of manure or green grass clippings, sprinkle of water, repeat.
3. Cover with an inch of soil. Water the pile enough to make it moist but not soggy. It should feel like a damp sponge (it feels moist, but you can't squeeze water out of it).
4. Add the earthworms and observe their behavior.
5. Place your compost pile where it will be at room temperature (not in direct sun). Gently mix the compost once a week to aerate it. Use a thermometer to test the temperature of the pile (for consistency, do it at the same location and depth at the same time each day). Make a graph of the results.
6. Discuss composting. How does it reduce the amount of waste you would have thrown out? What do you think happens to organic wastes that end up in the landfill? Is the landfill a gigantic natural compost pile, or are there problems with placing large amounts of organic materials in landfills?

Evaluation

Students will identify the ingredients of a compost pile.

Extensions

- A. Construct a compost pile at home to use for the family garden.
- B. Begin a school garden. Use the soil you've made to plant some flowers or vegetables.

(Activity reprinted from the "AVR Teacher's Resource Guide: For Solid Waste and Recycling Education" with permission from the Association of Vermont Recyclers, PO Box 1244, Montpelier, VT 05602-1244)

Necessary Components of a Compost Pile

Soil: contains micro-organisms that help decomposition

Organic Wastes: such as leaves, food scraps, and grass clippings. Wastes should be varied, including materials with both carbon and nitrogen. By alternating layers of high-carbon and high-nitrogen materials, you can create good environmental conditions for decomposition to occur.

Nitrogen: many of the organisms responsible for decomposition need nitrogen, thus nitrogen is necessary for rapid and thorough decomposition. Nitrogen is found naturally in many organic wastes, such as manure and green grass clippings, as well as in many commercial fertilizers.

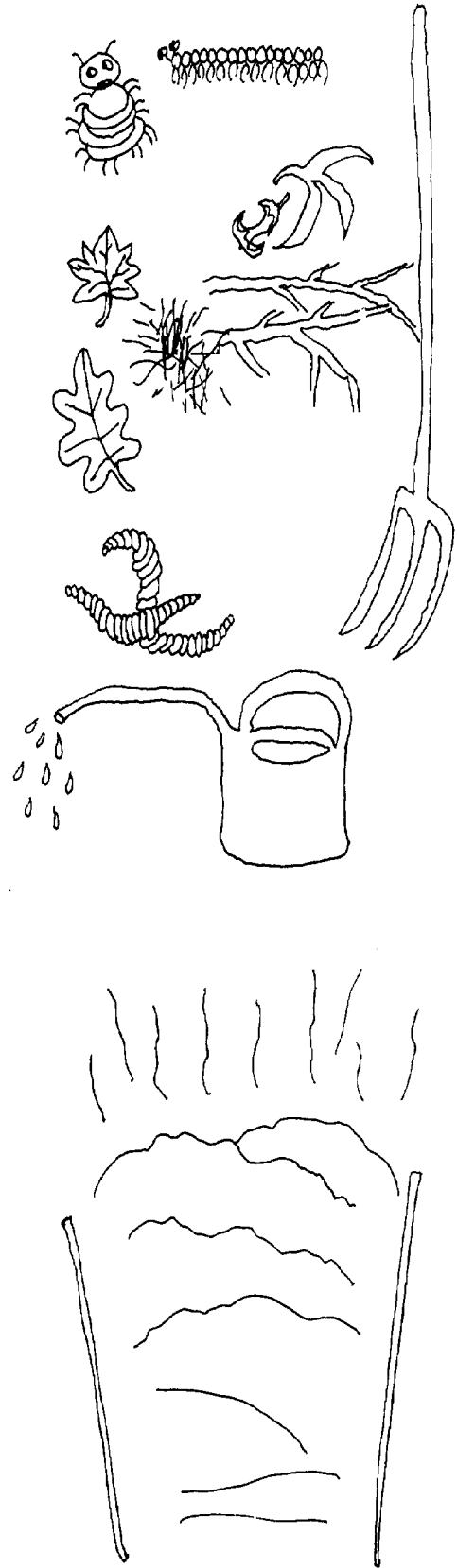
Worms: they eat the waste, helping to break it down; make droppings, which enrich the soil; tunnel through and aerate the waste, facilitate decomposition, and eventually die and become part of the compost.

Air: the biological activity of fungi, bacteria, small insects, and other organisms results in decomposition. Most biological processes require adequate amounts of oxygen.

Time: decomposition takes time. To speed up decomposition, aerate your pile every few days; otherwise just leave it and wait.

Heat: heat is produced by chemical reactions resulting from increased biological activity that occurs during decomposition. Heat helps sanitize compost by killing certain organisms (i.e., weed seeds, pathogens, harmful insect larvae).

Mass: in order to generate enough heat for optimal decomposition, the pile must contain at least one cubic meter of organic material. Thus, the temperatures generated in an aquarium compost pile may be different from those generated in one that is larger.



Activity 8

PLANTING WITH COMPOST: EXPERIMENTS WITH COMPOST MATURITY

When Can We Plant in the Compost?

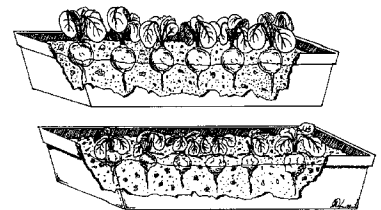
By Patrick Cushing

Background

If done aerobically, composting usually takes about 10-30 days. In the classroom, you may not be able to have optimum conditions and therefore this process could take longer. With limited space and possibly less than ideal composting conditions, you may have immature compost when you are finished with your composting.

Before compost can be used with plants, it should be mature. Immature compost may contain substances toxic to plants. Most of these toxic substances are intermediate compounds of the composting process. They may suppress seed germination, inhibit root growth, and decrease crop yields. If the compost were to continue to maturity, these compounds would be chemically converted into non-toxic substance.

In addition, immature compost has the tendency to further decompose, depleting oxygen in the soils, reducing root respiration, and leading to the production of H_2S and NO_2 - by anaerobic bacteria. These compounds cause odors and are toxic to plants.



Many methods have been proposed to determine when a compost is mature. There is a noticeable temperature change as composting occurs. After the cool down period, maturation occurs. Mature compost often is covered by a layer of gray actinomycetes, it attracts few insects, and it appears and smells like rich soil. One scientist claims that a simple taste test can be performed, as immature compost has a strong after-taste. (This method can be dangerous and is not recommended!) Other more formal tests of compost maturity include enzyme activity and nitrate and ammonia concentrations.

While these formal tests may give you a handle on one or more of the properties of your compost, the true test of a compost's worth is in the planting. If healthy plants can

grow in the compost, then you will have successfully composted organic waste into a usable material.

An easy experiment to perform is a germination experiment. Seed germination is relatively quick (depending on the type of seeds), and if time permits you can grow the plants to maturity and observe the compost's effects on plant growth as well as germination.

Materials

potting trays	compost
light source (fluorescent)	radish seeds
light timer	tomato seeds
potting soil (sterile)	

Procedure

Preparing the Compost/Soil Mixture

1. Obtain compost at various stages of maturity. If you have only one batch from your classroom work, you can purchase finished compost from a company such as Agway.
2. Determine the percent compost you want to test. Use more than one mixture. Try one which is heavy in compost (70-100%) and one that is light (perhaps 25%). This will give your students more data to observe.
3. Determine the amount of each mixture you will need. Be sure to have enough to grow twenty seeds in each mixture.

Planting Your Seeds

It is best to follow the specific planting instructions provided with your seeds. We used the following basic set-up in our radish and tomato experiments.

1. Plant your seeds $\frac{1}{2}$ to 1 inch deep in the soil. Water them so that the soil is completely damp yet drains well. Continue to water every 3 to 4 days as the soil dries.
2. Place the plants in an area of ample sunlight. If this is not possible, set up a fluorescent light source above the plants to ensure adequate light. It is helpful to hang the lights by hooks on a chain. This way as the plants grow you can raise the

lights. Start with the light about 6 inches from the plants. A timer is helpful so that the plants will receive the same amount of light each day.

Making Observations

1. Observe the plants daily, looking for germination. Record the day and time you notice that germination is beginning.
2. After the plants germinate, begin measuring the plants and record the data as average height vs. day after germination.
3. Observe the general health of the plants, making notations about differences you see with the plants.
4. Keep these plants alive for some time to see how growth occurs in the different compost mixtures. When you are finished with the growth experiments and no longer wish to grow the plants, cut the plants off at the soil level and mass them for each of the compost-soil mixtures. This will give you one final bit of data on the plants.
5. Graph the germination rate results (number of days after planting vs. number of plants germinated).

Discussion

From these experiments, your students can plan new experiments and truly become inquisitive scientists. They can continue using various ages of compost, or they can design experiments based on other factors. It may help your students to do a literature search on germination to find out what factors affect germination and how compost quality could effect germination rates.

Suggestions for Further Experiments

1. Wash the compost with water and use this water to germinate seedlings between pieces of filter paper.
2. Add vitamins to the compost/soil mixtures to see if they influence the germination rate.

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