COMPOST

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Compost

Composting is considered in some circles to be a form of recycling; others view it as a method of recovery. Neither opinion is wrong. In fact, composting could be considered as the recycling of nutrients, found in the Earth's soils, so the same nutrients can be recovered at a later date. By definition we will consider composting to be:

The creation of a dark soil-like material through the biological degradation or breakdown of organic material. This material is used as a soil conditioner.

Like recycling, composting is not a new discovery. Some anthropologists theorize that the practice started with ancient tribes. Rings of food scraps, fish bones and feces accumulated over time, outside of tribal settlements. Experts believe the settlers began to cultivate the accidental, yet bountiful, harvests that emerged from these rings. Through trial and error, these people began to use waste, especially manure, to raise food.

The technique of using waste to enrich the ground most likely diffused in much the same manner as writing, language or other innovations. As tribes, groups or other divisions of people came in contact with different societies, information would have been exchanged. Composting methods likely passed from one area of the planet to another in this manner.

Compost (cont.)

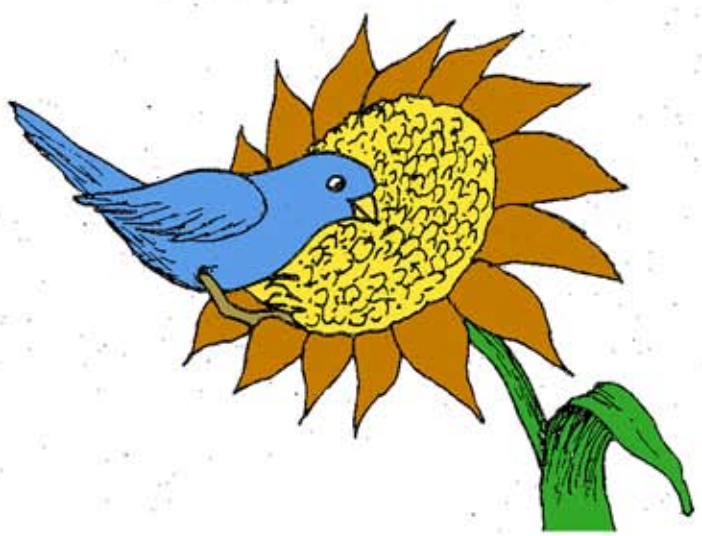
As man evolved, regular agricultural practices were established. Composting was no longer accidental when the importance of replenishing the nutrients of cultivated soils became known. The Roman scholar, Varro, wrote about composting over 100 years before the birth of Christ. Farmers systematically placed manure on their fields to help the soil's fertility. Unfortunately, the Roman Emperor began giving land to favoured officials. These land owners were concerned only with profits; thereafter maintaining the condition of the dirt was not a high priority. Slaves were used to work these large holdings. Gradually, these exploitive farming techniques reduced the soil's fertility to a point where it was suitable only for grazing. The depletion of the land around Rome was one of the factors contributing to the fall of the Empire.

In 18th century North America, a combination of muck and barnyard manure was used on farms. As pioneering farmers moved away from the east coast and into the mid-west, they found land covered in three metres of *humus*-rich topsoil. Composting was deemed no longer necessary. Poor management of the Great Plains left the land open to the ravishes of nature. In the 1930's, the *Dust Bowl* stripped away much of the fertile soils that were left.

Home composting in Canada was common until after the Second World War. European settlers brought with them the tradition of growing their own fruits and vegetables. Making compost to be used in the gardens was part of the tradition. After the war, fertilizers and the soaring economy saw people abandon these self-sufficient ways for convenience; it became easier to spray gardens or buy vegetables.

Today, composting is seen as a method of helping the Earth out of a difficult situation. Mother Nature used to compost plants, animals and their waste all by herself. Organisms would live, be consumed by other organisms or simply die, then be decomposed back into the soil. The nutrients used to create the organisms would return to the ground to help make more plants and animals. However, there are so many people on the planet that nature can no longer handle all the waste we produce. Composting is one way to help restore the natural order of things.

If Mother Nature could talk, she would tell us what almost every mother tells her children; when finished with something, put it back where you got it! Composting puts the valuables we have taken out of the soil, back where they belong.



Benefits

Canadians produce 30 million tonnes of waste per year. It would take four square kilometres or 333 hectares of land to hold this garbage. This is equivalent to a mile and one quarter section. Composting can reduce the amount of waste we generate by one third to one half. The benefits resulting from this reduction are many.

1. **Conservation of landfill space**

   It costs 2 million dollars to open, operate and close a hectare of landfill space. Finding new landfill is becoming extremely difficult and existing ones are filling up fast. Composting not only saves money today but also reduces the costs we pay to maintain landfills after they are closed. Valuable land is saved, as the amount required to hold the waste is reduced.

2. **Money saved on collecting garbage**

   Many municipalities must transport their waste to distant disposal facilities; this is costly. To counter these costs, some areas are implementing a user-pay system. A person must buy a sheet of stickers. These stickers are placed on the bags left out for collection. Workers will only take bags with these stickers attached. What this system does is distribute the cost of garbage collection fairly. If a person produces one bag per week, that person does not have to pay the same amount as someone else producing four or five bags. By composting, an individual can save money by reducing the number of bags they produce, which in turn cuts down on the number of stickers that must be purchased.

3. **Composting provides an excellent organic soil conditioner**

   It is produced free of charge and serves as an environmentally sound alternative to commercial fertilizers.

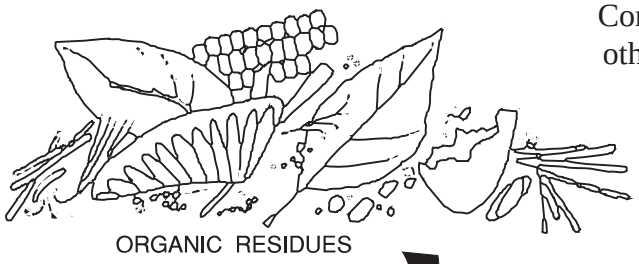
4. **People become involved in helping the earth**

   Individuals can actively participate in making positive changes to their lifestyle and their environment.

Composting saves land, keeps money where it belongs - in our pockets, and provides a sense of self sufficiency and accomplishment. There are few things in life that make the same claim.

Personal Notes

The Biology of Composting

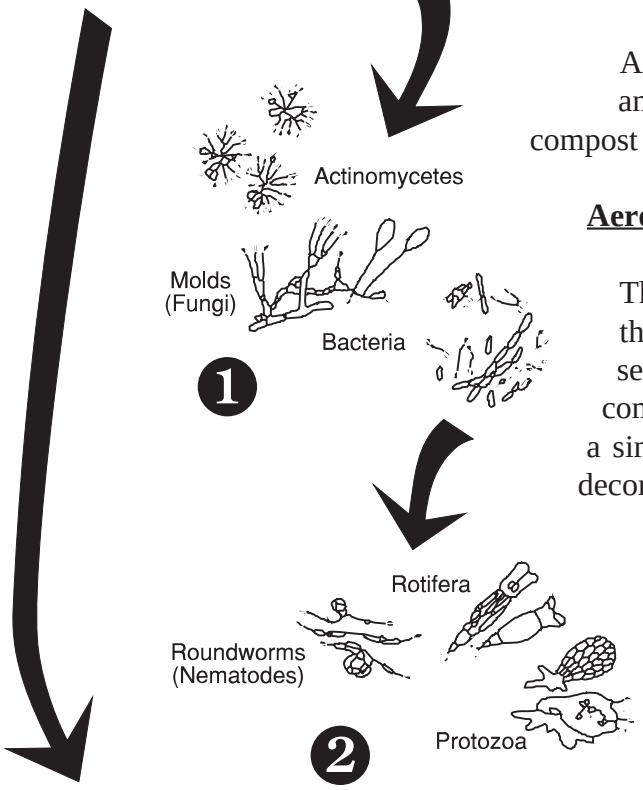


Composting, to most people, is simply the rotting of food and other organic matter. While this may be true at first glance, there are many creatures alive and active in a compost pile. The type of creatures, called "decomposers", found working in a pile are dependent upon which composting process is taking place.

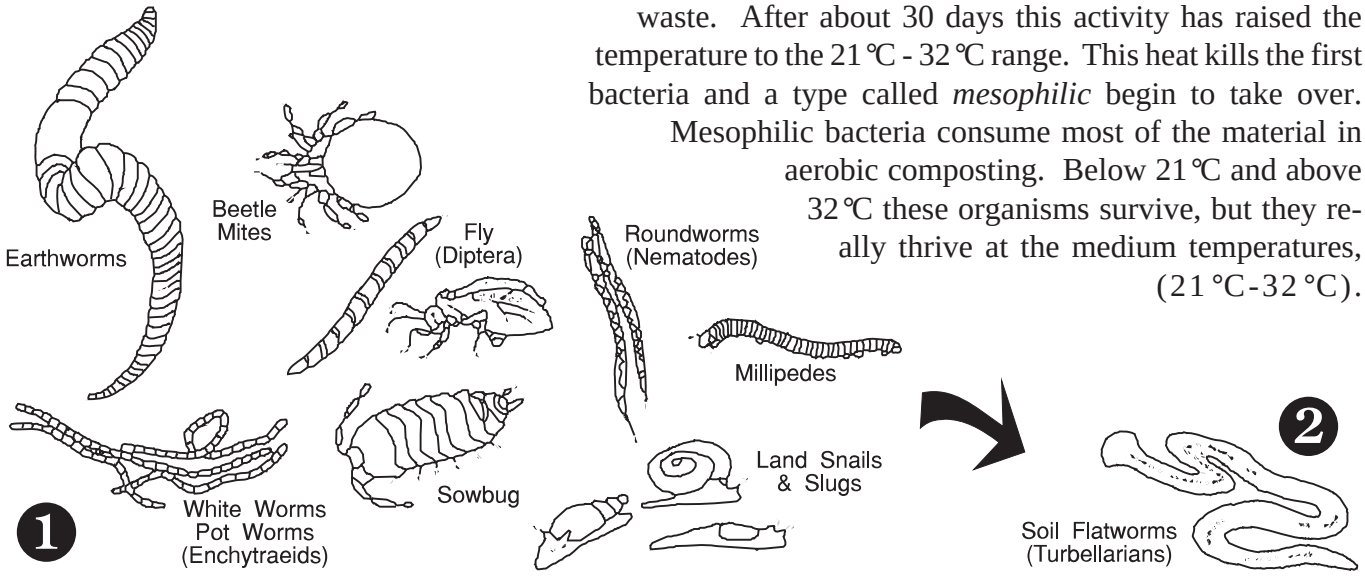
Basically, composting processes are either Aerobic or Anaerobic. Although there is a difference in the biological and chemical reactions between the two types, the finished compost each produces is exactly the same.

Aerobic:

The term aerobic is an adjective used to describe an organism that can only live in the presence of oxygen. There are several different levels of decomposers at work in aerobic composting. Each level breaks the organic matter down into a simpler form, that can be used by the next group. Many decomposer organisms become food for the next level up.



Bacteria, fungi (moulds) and *actinomycetes* are Level 1 decomposers. Through *biochemical* action they begin to break down the waste. A process called *binary fission* causes the bacteria to double their numbers (e.g. 2, 4, 8, 16, 32). The temperature of the compost pile dictates which bacteria are active. Below 21℃ *psychrophilic* bacteria begin breaking down the organic waste. After about 30 days this activity has raised the temperature to the 21℃ - 32℃ range. This heat kills the first bacteria and a type called *mesophilic* begin to take over. Mesophilic bacteria consume most of the material in aerobic composting. Below 21℃ and above 32℃ these organisms survive, but they really thrive at the medium temperatures, (21℃-32℃).



The Biology of Composting (cont.)

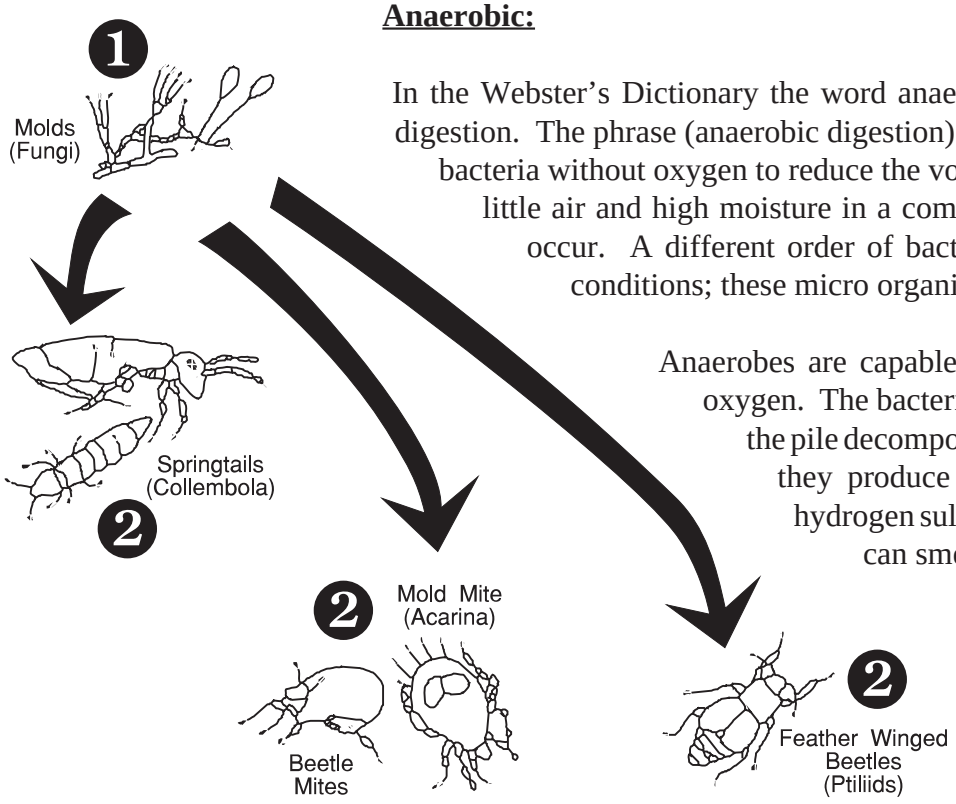
Mesophilic activities take place for about two weeks. A by-product of their work is the compost's temperature is raised to approximately 40°C. *Thermophilic* bacteria now take charge. In a week to 10 days, this bacteria turns the green, gold, and tan organic matter into a deep brown. This bacterial action can be repeated if the pile is fed more waste or turned.

Actinomycetes are a cross between bacteria and fungi. As the pile cools back to mid-range temperatures these organisms produce grayish cobweb-like growths that smells "earthy". Many actinomycetes produce vitamins and antibiotics.

At the same time beetle mites, earth worms, millipedes, land snails, slugs, round worms (nematodes), along with sow bugs and other creatures work in the waste. These creatures are a different branch of Level 1 decomposers, using physical action to turn the organic material into compost.

As the temperature in the pile drops further, Level 2 decomposers appear. Insects called spring tails, mould mites, and feather-winged beetles eat the bacteria and fungi. These bugs are then consumed by larger organisms such as centipedes, ants, pseudo-scorpions and ground beetles; they are the Level 3 decomposers.

Aerobic composting makes this complex food chain possible by providing the oxygen, food, and moisture necessary to keep the food chain active. The best way to ensure compost is conducted under aerobic conditions is to carefully choose how the material is to be contained, keep the pile at the correct moisture level and routinely turn the pile to aerate it.



Anaerobic:

In the Webster's Dictionary the word anaerobic appears next to the term digestion. The phrase (anaerobic digestion) is defined as "the utilization of bacteria without oxygen to reduce the volume of waste". When there is little air and high moisture in a compost pile, anaerobic conditions occur. A different order of bacteria are promoted under these conditions; these micro organisms are called anaerobes.

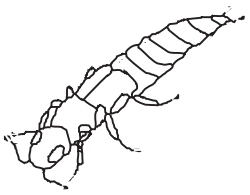
Anaerobes are capable of surviving with little or no oxygen. The bacteria is slow working but will help the pile decompose, nonetheless. Unfortunately, they produce ammonia-like substances and hydrogen sulphide. The result is the compost can smell like rotting eggs.

The Biology of Composting (cont.)

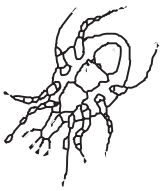
Mould mites can survive for moderate periods of time under anaerobic conditions. Their presence is a good indication of the conditions in the compost. These transparent bodied bugs feed on yeast found in fermenting organic debris.

Due to the smell associated with anaerobic composting, it is generally not used by home composters. It can, however, provide a useful source of energy. Facilities exist where organic matter is decomposed anaerobically to produce methane gas. Some landfills in the United States of America use the methane, produced by the anaerobic conditions of landfill conditions, to generate heat for homes.

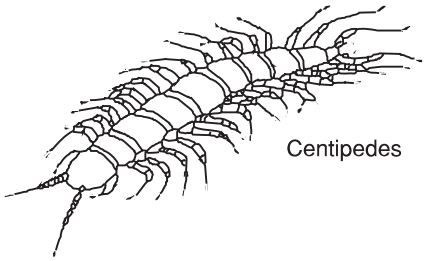
A compost pile is really a microcosm of the Earth itself. The many different creatures all go about their business trying to survive. Directly and indirectly, what one person or decomposer does, impacts on the others. Temperature, moisture, food and oxygen must all be present in the right proportions for the pile to be productive and sustain the highest population. In order to have a clean, healthy, fresh smelling pile, it must be well maintained. The Earth is no different.



Rove Beetles
(Staphylind)

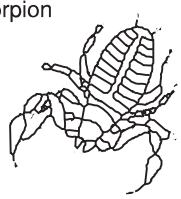


Predatory
Mite



Centipedes

Pseudoscorpion



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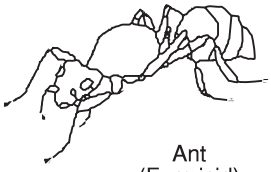
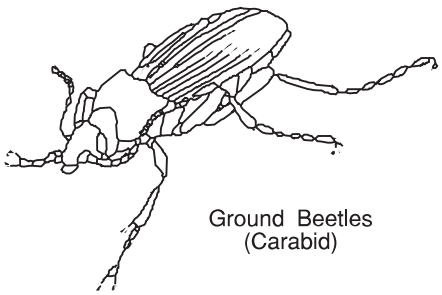


Ant
(Formicid)



Ground Beetles
(Carabid)

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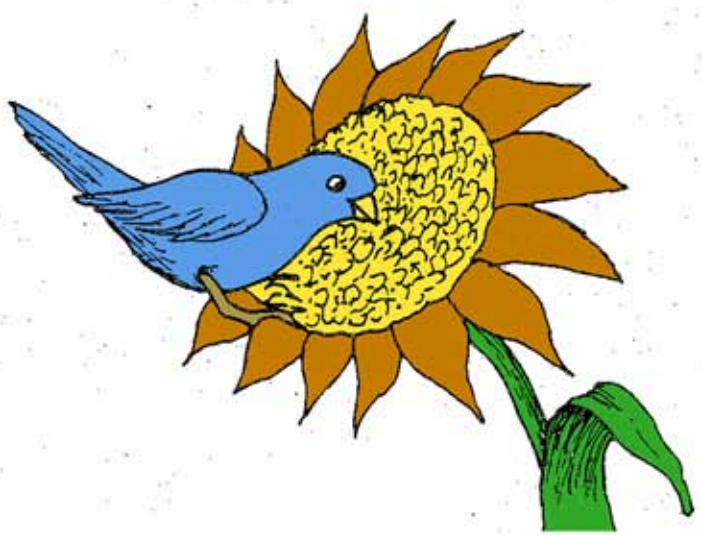


Methods (cont.)

composter has been set up and awaits waste. In order to reduce odours, each member of the household has agreed to set aside time each week to ensure the composting is done aerobically.

There are five factors that must be taken into consideration in order to achieve the ideal composting conditions the home is striving for.

The first factor is the carbon to nitrogen content of the compost pile. In a compost pile, the organisms breaking down the waste, metabolize carbon for energy and nitrogen for reproduction. The table in Figure E-1 shows typical examples of "greens" (high in nitrogen) and "browns" (high in carbon). It is a rule of thumb that a pile containing half greens and half browns will be close to the optimum ratio. Because very few items in this table are near this ideal ratio, different organic material must be mixed. If 50% by weight, brown tree leaves (40:1) were mixed with 50% fresh grass clippings (19:1) the mixture would average out to produce material with a ratio of approximately 30:1.

Average Carbon-To-Nitrogen Ratios For Organic Materials

Food scraps	15:1	**"GREENS"** (high in nitrogen)
Animal droppings	15:1	
Leguminous plants (peas, beans)	15:1	
Grass clippings	19:1	
Rotted manure	20:1	
Manure with bedding	23:1	
Alder leaves	25:1	
Ash leaves	25:1	
	25 to 30:1	IDEAL
Oak leaves	50:1	**"BROWNS"** (high in carbon)
Cornstalks	80:1	
Straw	80:1	
Paper	170:1	
Sawdust and wood chips	150-500:1	

Note: some organic materials can be both "greens" and "browns". For example, green leaves and fresh grass clippings are "greens" but dead autumn leaves and dried out grass clippings are "browns".

Figure E-1

The greens and browns are added to the compost in alternate layers (green, brown, green, brown, etc.). Each layer is five to fifteen centimetres in depth. A thin layer of soil should be added every few layers also. After two layers are put down (one green and one brown) they are mixed or turned. Too much carbon will cool the pile and slow its breakdown. Too much nitrogen will produce a smell of ammonia gas and turn the pile slimy.

Factor number two is the degree of surface area upon which bacteria can attack. This speeds up the decomposition and increases the temperature in the pile. Chopping, shredding, and splitting organic waste increases the area exposed to the decomposers.

Moisture is the third consideration that must be addressed. Like all life, a compost pile and its inhabitants

Methods (cont.)

need moisture. The moisture content in a good aerobic compost pile should be between 40% and 60%. A pile that is too dry will cause the bacteria to slow down. Too much water robs the compost of air and leads to anaerobic conditions. The pile should be moist to the touch but should not yield water when squeezed. If a pile becomes too dry, a trickling hose can be used to soak it. An overly moist pile should be turned.

For aerobic decomposition you naturally need air. This is the fourth factor. Without assistance, air can only penetrate six centimetres or so into the compost pile's sides and top. Oxygen is needed at the centre of the pile so the aerobes can live. These are four ways to aerate a pile:

1. Use a bundle of loosely tied twigs, a cylinder of wire mesh, or a perforated pipe. Place this air stack in the middle of the pile, then build around it.

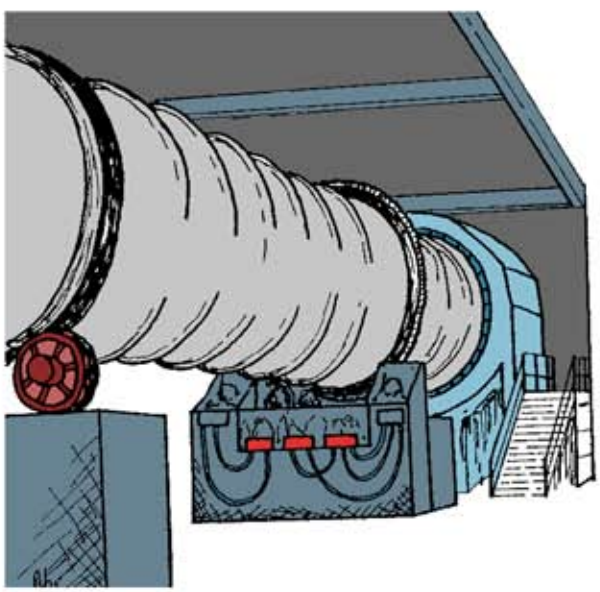
2. Using an aerator tool, provided with some composters, dig deeply into the pile, then turn as the tool is pulled out.

3. Turn the pile with a pitch fork or shovel. If the compost is too wet, it should be pulled apart and restacked. This not only puts air back into the compost but also loosens the material.

4. An old broom handle can be used to stir the pile. Simply stick the object into the centre of the compost and stir. This is an effective method for people who cannot do the work needed to turn the pile.

The fifth factor to consider when backyard composting is volume. The container or pile should be large enough to hold the heat needed in aerobic composting yet small enough to admit air. A good guideline is the pile should be one cubic metre, or three and a half cubic metres, if ventilation stacks are used.

After several months of carefully adhering to the five factors just discussed, the household has a container of ready to use compost.



Commercial Composting

Commercial and centralized composting is a relatively new idea. While individual composting has been around for centuries, the organized collection and processing of municipal solid waste, for the purpose of creating finished compost, is just beginning. The facilities and technology used for this type of composting are as varied as backyard systems.

Some municipalities or businesses process only organic material. Others take mixed waste and separate the inorganic waste from the biodegradable portion; this can be done before or after decomposition. Even sewage sludge can be commercially or centrally composted.

Methods (cont.)

A facility in Portland, Oregon can process 300 tonnes of garbage per day, with a 23% average moisture content. The material is emptied onto the floor of the receiving building. Bulky and recyclable materials are removed, before being pushed on an incline conveyor. High pressure streams of water, break the bags open. Loose garbage is conveyed to another room where workers pull out aluminium, plastic films, plastic containers, glass bottles, metals, and household hazardous waste. The remaining material is sent by ram feeder into one of two identical drums. It is inside the drums, or commercial composters, where the decomposition takes place. Each drum is 3.5 m in diameter, 245 m long, weighs 100 tonnes and rotates 360° at a rate of five revolutions per minute.

Water is added to the garbage once it is placed inside the drums, to ensure the level of the moisture in the waste increases to 55%. Metal spikes inside the commercial composter agitate the waste as the drum revolves. A series of metal bars run along the length of the machine, allowing garbage to become packed between them. This protects the sides of the drum from being abraded by the main garbage stream moving through the drum.

In eight hours, one drum can process approximately 150 tonnes. The waste has a residence time in the machinery of roughly four hours. Adjusting the turning rate and residence time, can produce compostable materials of higher quality and greater quantity.

A rotary screen at the end of the drum allows *macerated* organic material to fall through, while inorganics and other residue cannot. The rejected material is sent under a magnet before arriving at another picking line. Ten workers remove any recyclables that may be present, before the rejected material is loaded onto a trailer (bound for the landfill).

In the mean time, the macerated compost is transferred by conveyor to an aeration building. Here the organic waste is spread across a floor 46 metres wide by 107 metres long. Special slots in this floor allow air to be blown through the compost, keeping the decomposing bacteria active. After three weeks, the compost pile drops because of decomposition from two meters in height to 1.4 metres, and the moisture level decreases. Front end loaders move the material out of the aeration building and into the maturation shed. The compost is left static for another 21 days after which time the moisture level will have dropped to below 40 percent. A final screen process separates the finished compost into coarse (less than 25 mm) and fine (less than 10 mm) material.

Like all new operations, the facility has had some minor problems. At first the plant produced some noticeable odours, but these are being addressed. Likewise, the collection and transportation costs sometimes make this type of system impractical.

Another method of commercial/centralized composting is indoor windrow composting. Channels or rows of organic material are placed inside a large building. These rows are mechanically mixed, agitated, and aerated at regular intervals. The conditions in which the organic waste is stored, and manipulated are capable of producing finished compost in a very short period of time. Hensall, Ontario uses a facility of this sort to help alleviate the village's landfill problems.

Methods (cont.)

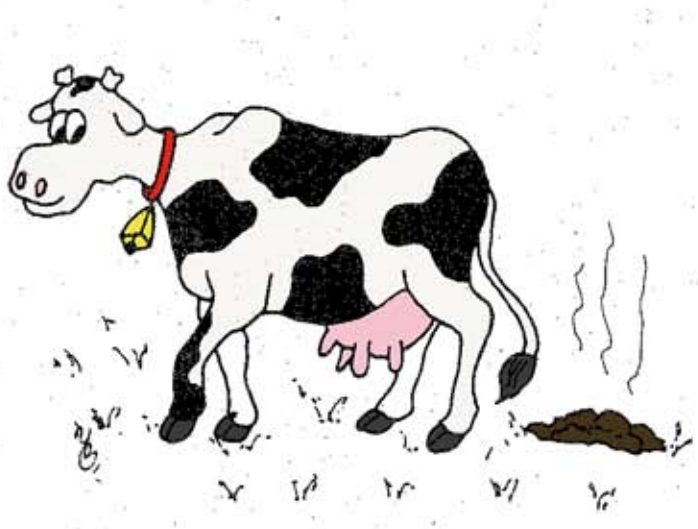
The three elevator companies operating in the municipality, make Hensall, Canada's largest inland granary. A by-product of the elevators' operations is grain screening waste. Each year, nearly 2,000 tonnes of the waste was being trucked to Hensall's landfill, causing the site to fill at an alarming rate. The village's municipal council and staff, along with representatives from the elevator companies, sought a solution.

After consultation with government and private agencies, an indoor windrow facility (Figure E-2) was deemed the answer. The grain screenings may or may not be blended with organic material. To date, the screenings alone have provided the carbon to nitrogen ratio needed for successful composting. The waste is placed into three channels, each measuring 30 meters long by 4.5 meters wide and 1.2 meters in depth. A "biomass processor", the only one of its kind in the world, takes 30 minutes to pass up and down a channel. As the processor moves it agitates, mixes, aerates, and transports the organic waste. After ten days, the grain screenings and any additives are turned into finished compost.

Figure E-2

The facility has the potential to produce 20 tonnes of compost each day. For every 33.30 tonnes of waste entering the facility, 20 tonnes of finished compost is produced. Each year the Hensall facility will divert enough waste from the landfill to cover an entire football field to a depth of 1.2 meters.

In situations where the economic factors and other considerations are favourable, commercial and centralized composting provide an excellent method of turning what was once a useless by-product, waste, into a useful end product, compost.



Animal Waste

The composting of pet waste is generally discouraged. Cat excrement and, to a lesser extent, dog manure can contain pathogens harmful to children. These bacteria and viruses are not always killed by the heat in the compost pile. Pet

Methods (cont.)

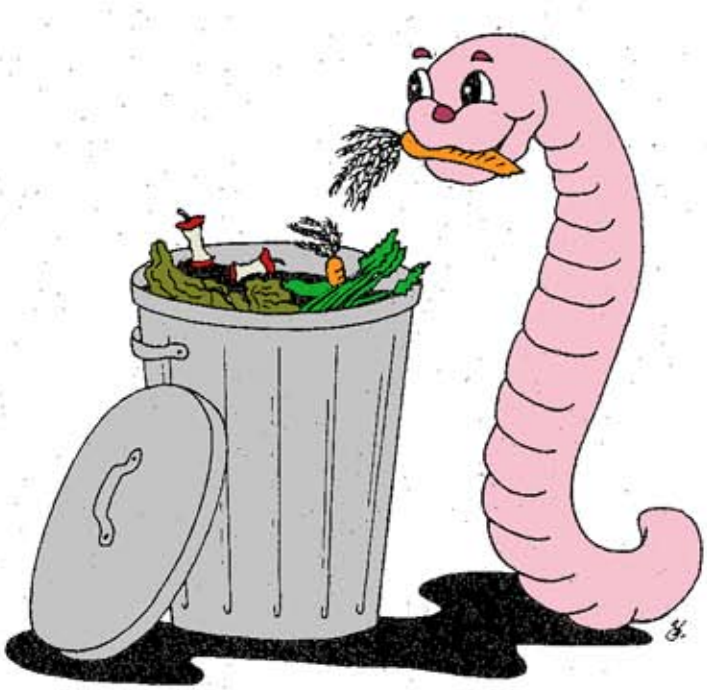
feces can also lead to pests, including neighbours complaining of the smell from your composter.

However, in a rural environment, there can be a significant amount of farm animal manure generated. This form of excrement can provide valuable nutrients to plants. Unfortunately, animal manure can also pollute surface water and groundwater. Traditionally, farm animal waste was "stacked". Stacking, where manure is simply piled up, can cause the pollution problems just mentioned.

Covering the manure, is called dry stacking, and helps stop any contamination of the soil or water, from occurring. Another option is to place the animal waste in a lagoon. Waste is placed in a large reservoir where, depending upon the bacteria, the manure is digested under aerobic or anaerobic conditions.

Some farms use anaerobic digestion, not only to turn manure into compost, but to produce methane gas. During decomposition, some of the carbon contained in the manure is converted into an odourless, colourless, inflammable hydrocarbon (CH_4); this is methane. The gas is collected in a gas holder tank and can be used for heating, refrigeration or any purpose applicable to natural gas.

Composting manure can be a beneficial ingredient in a backyard composting system. With the exclusion of cat and dog waste, excrement from horses, cows, poultry, rabbits, sheep, goats, ducks, geese, hens, pigs, gerbils, hamsters, birds, and mice can all be added to the compost pile. Because there is still a risk of health or pest/odour problems, ensure waste from only healthy animals is used and that the manure has been fully composted before being added to the compost pile.



Vermicomposting

Vermicomposting is a unique and viable alternative for situations where normal composting techniques cannot be practised. The term "vermicompost" is actually a compound word. The prefix "vermi" is a derivative of the Latin word for worm, vermis. A special kind of earthworm is used to break down the organic materials.

Called red wigglers and capable of eating their weight in organic matter each day, these worms consume waste and their bedding, then excrete castings. The castings are an excellent natural plant food, that can be richer in certain materials than topsoil. Because composting using worms requires less space than normal methods, it is ideal for offices, classrooms, apartments, and high density urban areas. It also provides a place to put food waste in the winter months.

Methods (cont.)

While an outdoor compost pile is still active during the winter, the decomposition is relatively slow. Most people are not generating yard waste after the snow falls. The only organic waste would be food and kitchen scraps. Vermicomposting allows a person to conveniently get rid of organic material without having to venture outside.

To make a vermicomposter, a person needs a container. For the following example, this container will be a plastic box that is 55 cm long by 40 cm wide by 30 cm in depth. The surface area that the container provides is more important than its depth. The box should have air holes along the top of the sides and be equipped with a tight closing lid.

Bedding for the worms to live in is added to the container. Having a total weight of 7 kg, the bedding should be 80% shredded paper and cardboard with the remaining 20% being organic peat loam (soil). Calcium carbonate can be added to the bedding to keep fruit flies to a minimum. To this, 4 litres of water are added to give the bedding a 75% moisture content. For the worms to survive, the correct moisture level is essential. The problem of too much moisture and worms drowning is prevented by cutting mesh covered holes in the bottom of the box and placing it in a raised position on a tray. Excess moisture will drip out of the container, while the worms stay safely in the box. Roughly one half kilogram of red wigglers (approximately 1000) are then placed in this, their new home. A small amount of bedding should be used to cover the worms.

Now the composter is ready for waste. The surface of the bedding should be divided, visually, into quarters. A hole is dug in quarter one. Waste is placed in the hole and completely covered with bedding. A small item, such as a bread bag clip, is placed on top of quarter one to mark where waste was last buried. One week later the next batch of food scraps is buried in quarter two. The clip or marking is moved accordingly, progressing in a clockwise manner.

By burying the waste weekly, the worms are given sufficient time to eat the freshly buried waste. Also, a weekly cycle helps reduce the chances of partially decomposed material being left on the bedding's surface. (Fruit flies can become a problem if material that has not broken down completely is left near the surface.)

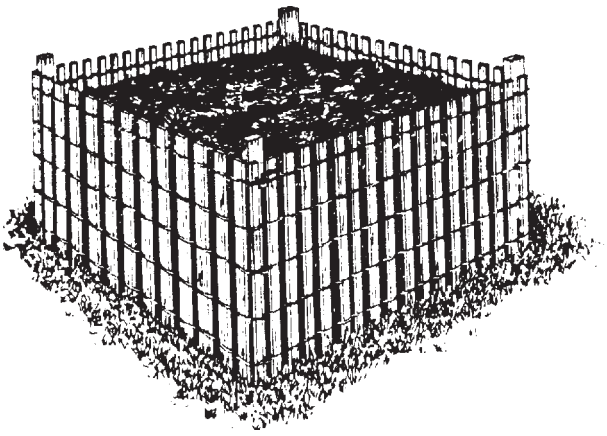
The red wigglers naturally move from one area of old waste to an area of fresh material. After three months, the worms will have eaten not only the waste they were fed but also their bedding, leaving the box full of finished compost.

To remove the compost, pile all the casting on one side of the box, add 3.5 kg of bedding to the now empty side of the box and bury some new waste in it. The worms will travel over to the fresh organic material allowing the individual to remove the rest of the finished compost. Adding the other 3.5 kg of bedding to the now empty side makes 100% of the bin ready to use.

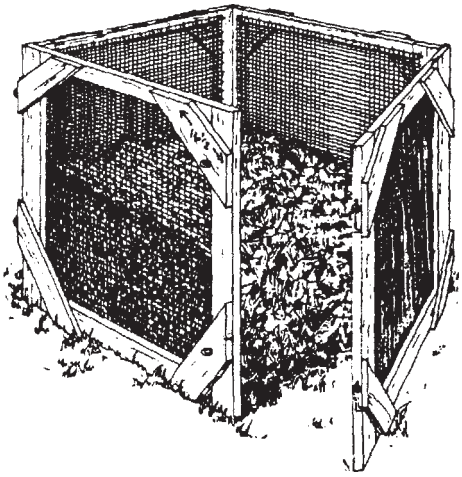
From time to time, worms will have to be removed from the box, as they do multiply. These can be sold to other people, used for fishing, or even let back into the ground.

In the end it does not matter which composting method you choose so long as you compost. The important thing is to handle your waste in such a manner that nutrients, trapped in the garbage, are fed back into the soil. Why waste the Earth's natural plant food by landfilling it, when it can be used to grow green grass, healthy houseplants and garden fresh vegetables.

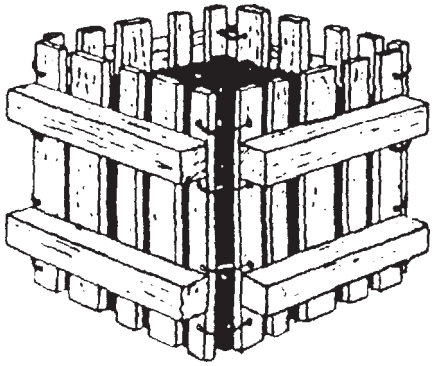
Backyard Composters



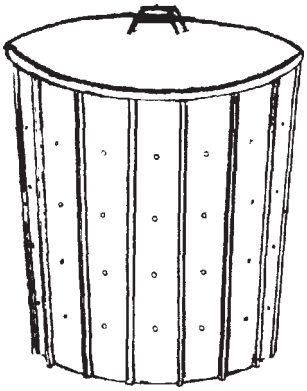
Picket Fence Bin
(Holding Unit)



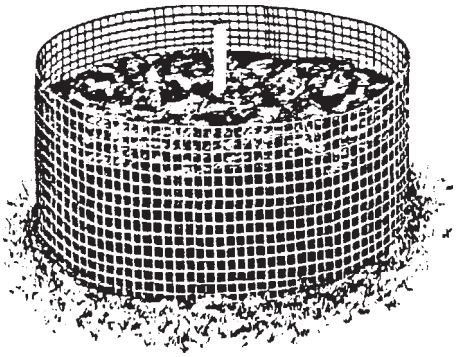
Portable Wood and Wire Bin
(Turning Unit)



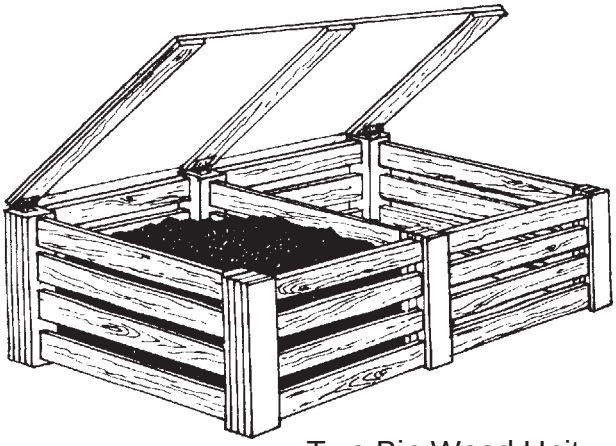
Used Pallet Bin
(Turning Unit)



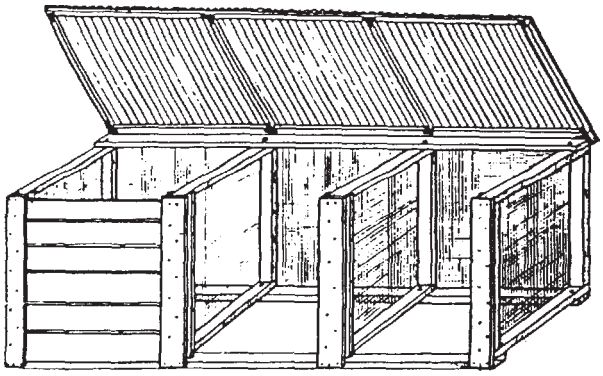
Garbage Can Bin
(Holding Unit)



Snow Fence Bin
(Holding Unit)



Two Bin Wood Unit
(Turning Unit)



Three Bin Wood & Wire Unit
(Turning Unit)

Yard Waste Reduction Tips

Grass clippings, brush, leaves and other yard refuse, can make up 20% of the total waste generated by a home. Because this material is organic, it can be used as a natural nutrient for lawns and gardens. By following these tips, you will divert waste from landfill plus have a healthier lawn and garden. Grasscycling is the process of recycling grass clippings, by leaving them on the lawn.

GRASSCYCLING

- improves lawn quality by allowing grass clippings to decay normally, releasing valuable nutrients (nitrogen, potassium, phosphorus), adds water saving mulch and encourages soil aeration by earth worms.
- saves time and work, on average 35 minutes per mowing are for raking and bagging.
- any lawnmover can grasscycle if the blade is sharp, the grass is dry, cut regularly and not more than one third its height is cut per mowing.
- improper watering and fertilizing cause thatch build up (abnormally fast growth of roots and other plants) not cut grass left on the lawn, when you grasscycle.

COMPOSTING YARD WASTE

- excess grass clippings can be composted if they are added in thin layers.
- save the leaves in the Fall to add nitrogen to the compost pile all year round.
- break up small branches and twigs to speed up break down in the compost pile.
- spread a layer of leaves on the garden in the Fall, they will decompose over the Winter to provide nutrients in the Spring.
- all the above tips will save tax dollars, landfill space, and are good for the Earth.

What To Do If...

Trouble Shooting Chart

Symptoms	Problem	Solution
The compost smells of ammonia.	Too much nitrogen in the pile.	Add brown leaves and mix them into the pile.
The compost smells like rotten eggs.	Not enough air (anaerobic).	Aerate the pile. Turn for several days until smell is gone.
The centre of the pile is dry.	Not enough water.	Moisten materials while turning the pile.
The compost is damp and warm in the middle but nowhere else.	Too small.	Collect material and mix old ingredients into a new pile.
Compost heap is attracting animals and other pests.	Meat scraps and fat have been added, or food scraps are not completely covered by soil.	Fasten lid tightly. Do not add meat or fat. Bury food wastes under layer of soil.

Compost Do's & Don'ts

This list shows the wide variety of items that can be composted. <u>All these items can be added safely to your home compost.</u>

FOOD

- Apples & apple peels
- Artichoke leaves
- Asparagus bottoms
- Bananas & peels
- Beans
- Beet tops
- Berries
- Bread
- Broccoli stalks
- Brussels sprouts
- Buckwheat hulls
- Cabbage stalks & outer leaves
- Carrot tops & scrapings
- Celery tops
- Citrus rinds
- Coffee grounds (and filter)
- Corn cobs (chopped)
- Cucumber
- Egg shells (crushed)
- Grapes
- Grapefruit
- Lettuce
- Lemon
- Melon
- Onion
- Oats
- Pears
- Pineapple
- Potato
- Pumpkin
- Squash
- Tea leaves & tea bags
- Tomato
- Turnip
- Zucchini

OTHERS

- Algae (pond weeds)
- Apple pomace
- Bird cage cleanings
- Blood meal
- Bone meal
- Corn stalks
- Cotton rags
- Feathers
- Felt waste
- Flowers
- Garden wastes (trimmings, plant remains)
- Grape plant waste
- Granite dust
- Grass
- Hair
- Hay
- Hops, spent
- Leather waste & dust
- Leaf mould
- Leaves
- Composted manure
- Muck (marsh & swamp mud)
- Peanut hulls
- Peat moss
- Pine needles
- Rope
- Sawdust
- Seaweed
- Soil
- Straw
- String
- Weeds
- Wood ash
- Wool rags

Everything of an organic nature will compost, but not everything belongs in your home compost pile. <u>These materials could create problems.</u>

MEATS, FATS, DAIRY PRODUCTS

- Butter
- Bones
- Cheese
- Chicken
- Fish scraps
- Lard
- Mayonnaise
- Meat scraps
- Milk
- Peanut butter
- Salad dressing
- Sour cream
- Vegetable oil
- Yogurt

OTHERS

- Plants with a disease or severe insect attack (e.g. aphids, tent caterpillars)
- Slowly decomposing plants (e.g. rhododendron, English Laurel leaves)
- Plants toxic to insects or other plants (e.g. walnut or rhubarb leaves
- Grasses with a rhizomatous root system (e.g. crab grass)

How to Use It

Finished compost is not a fertilizer, rather it is classified as a soil conditioner. A good range of minor plant nutrients essential for plant growth, are found in the compost, nonetheless. Unlike chemical fertilizers, compost has a built-in time-release mechanism that also promotes healthy vegetation.

The dark, soil-like material can be used in potted plants. It helps produce healthy flower and vegetable gardens. Trees and shrubs are good compost recipients. Compost can also be used as part of a seed starting mix or, when screened, as lawn top-dressing.

The best time to dig compost into a garden is when the soil bed is being prepared for planting. The compost becomes a "soil amendment". Smaller quantities of finished material can be spread under the seed furrow or placed in each transplant hole.

Compost can also be used to make tea. No, this is not a beverage for human consumption; it is used to irrigate gardens. In a barrel of water, a burlap bag of compost is inserted. After a week or two the tea is ready to use. If more nitrogen is required by a gardener, fresh manure can be substituted for compost. If the tea is too strong it can be diluted with water. When ready, the liquid is sprayed or poured onto the plants.

Using finished compost is getting the maximum return from an investment. Whether the organic materials, used to make the compost, were grown or purchased, they are still useful long after they have blossomed or been eaten. Composting makes the time and money spent on the food, lawns and gardens, go further. Not only are nutrients recovered from the waste but finished compost saves money by reducing the need for store-bought soil conditioners, while cutting waste disposal costs.

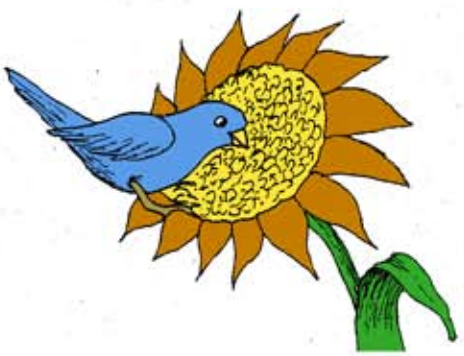
The bottom line is: compost can save a "pile" of money!

Brewster Facts

1. Vegetables, grass and other things rot when we throw them away.

2. Tiny bugs and worms help turn the rotting waste into dirt.

3. This dirt is called compost. It is good for growing more vegetables, grass and other things.



Cut & Paste Compost

OBJECTIVE: To illustrate what can and cannot be added to a compost pile.

MATERIALS: arts and crafts materials, HANDOUTS: **Composter** (E27), **This And That** (E28), **In Or Out** (E29)

VOCABULARY: compost, composting, dairy products, pile

BACKGROUND:

Composting is easy to do once a person knows what should and should not be placed in a pile. Stories about odour and pest problems fail to mention these problems occur because of incorrect materials being added to a pile. This activity will provide a simple explanation of what is right and wrong for a backyard composter or pile.

PROCEDURE:

1. Ask the children if anyone knows what composting is. Have the children who compost at home raise their hands.

2. Explain how composting turns waste into dirt. Mention that not all waste can be put in a compost pile. Some waste attracts rats and other pests, some waste is hazardous to people and some waste will not turn into dirt. Tell the class they are going to learn what can and cannot be composted.

3. Discuss with the class the items on HANDOUT: **This And That** (E28). Vegetables and fruits can go into a compost pile. Wood, twigs, paper and sawdust are good for composting too. Hair, leaves, straw along with cotton and wool rags are also acceptable.

4. Give each child a copy of HANDOUT: **Composter** (E27). Tell the children this is their composter and they are going to fill it with waste.

5. Things that are not good for a compost pile include dairy products (cheese, milk, butter, etc.), meats, bones and fats. Chicken and fish are not good either. Mayonnaise, salad dressings, peanut butter and vegetable oil are also bad. Discuss the good and bad items with the children. Be sure to tell the class that if a good item has been fried or covered in a bad item the good item is no longer acceptable. (i.e. fried vegetables are not acceptable).

6. Have the children colour all the items on the HANDOUT: **In Or Out** (E29). After the colouring is finished, each child is to cut out the things they think are acceptable and attach them to their composter.

Cut & Paste Compost (cont.)

EXTENSION:

1. Make a bulletin board displaying the finished composters.

2. Using modelling clay, have each child make one thing that is acceptable in a composter.

3. Have the children make a list of items that are good for the composter and a list of items that are not good. This list can be put on their fridge at home.

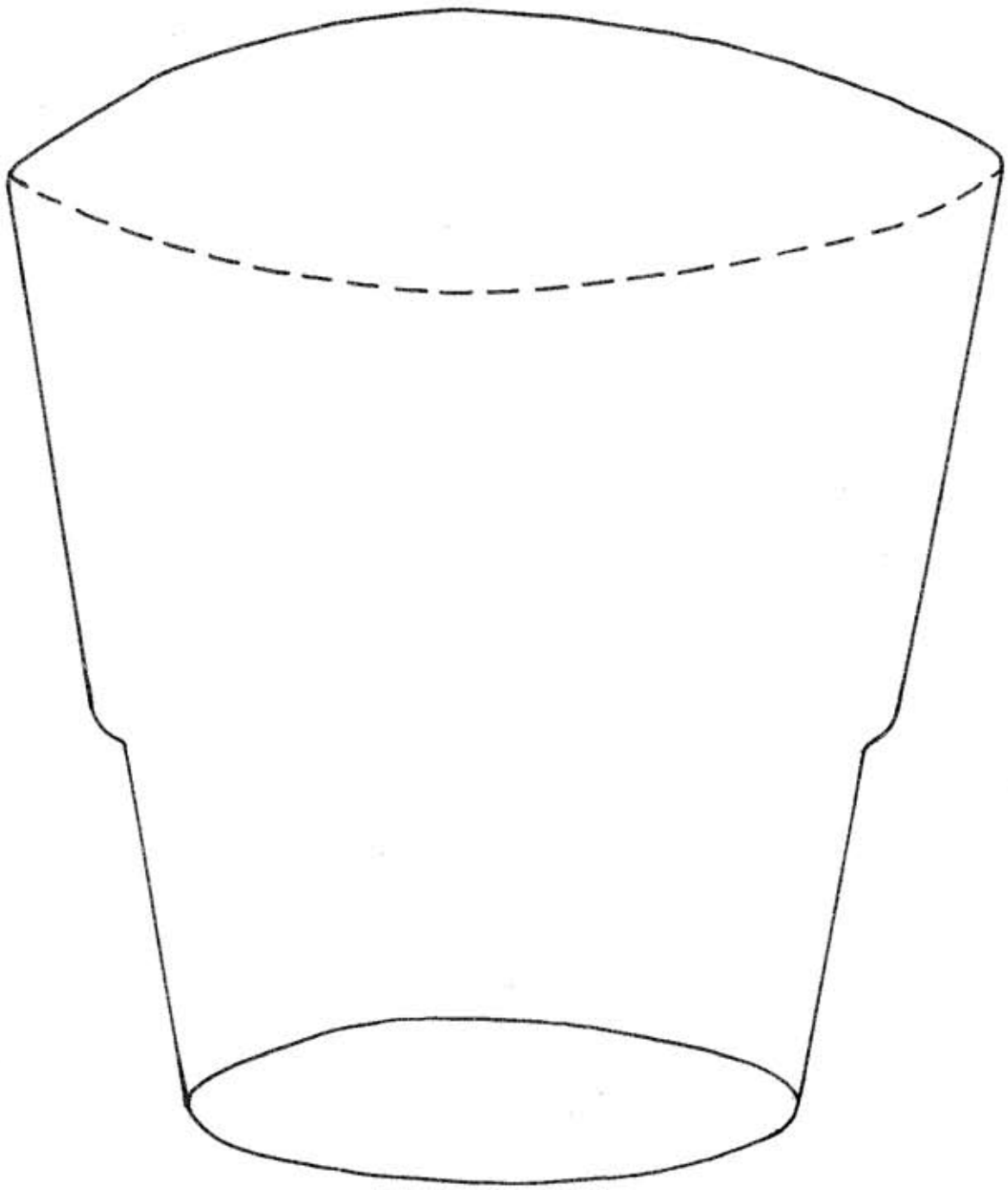
EVALUATION:

1. Ask each child to name one thing that can or cannot be placed in a composter.

2. Will the children take time to participate in home composting?

3. Ask the children to tell the class where they think the two "wrong items" from page E29 should be.

Composter



This And That

This is a list of the different things that can be composted safely in your home composter

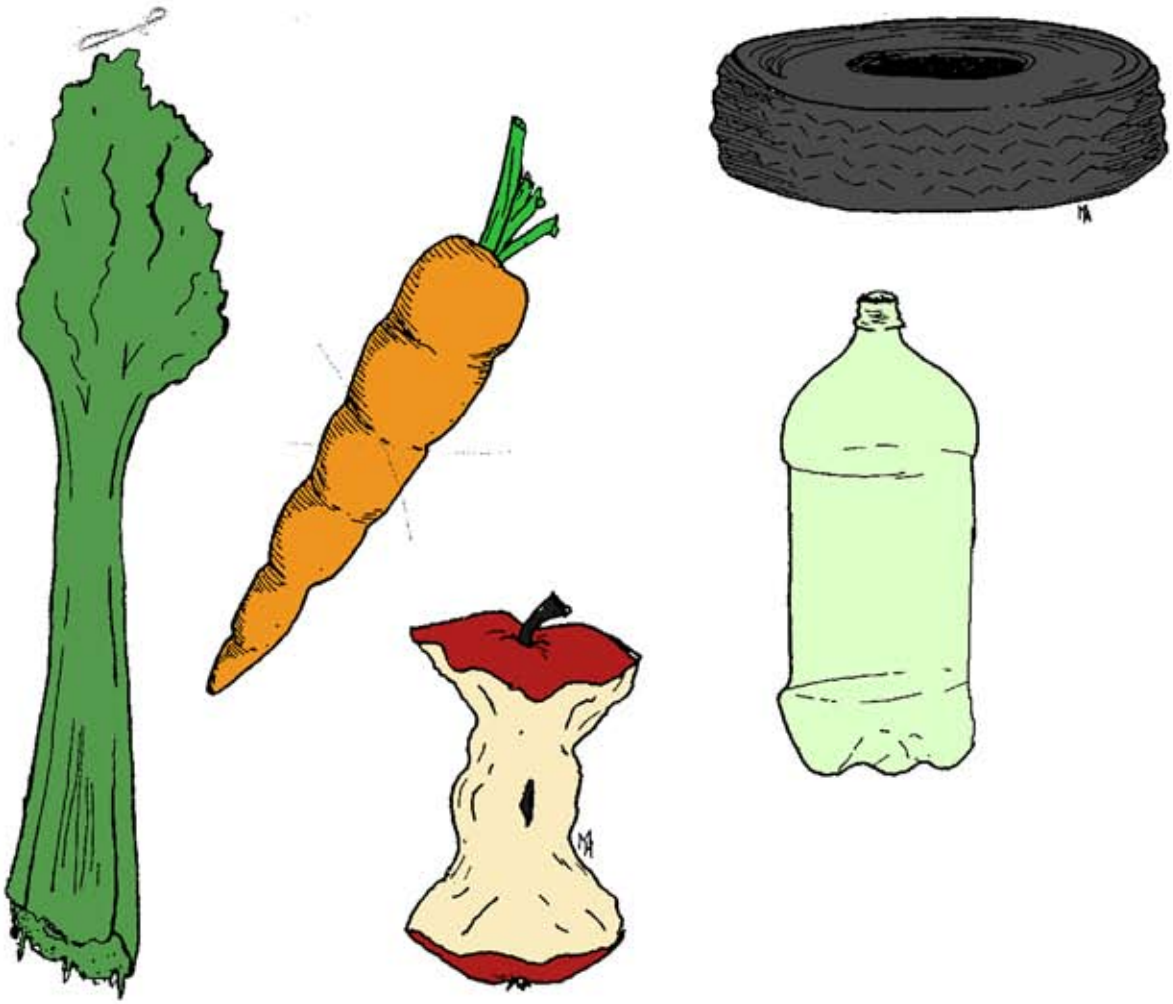
FOOD

Apples & Apple Peels
Bananas & Peels
Beans
Beets
Berries
Bread
Broccoli
Cabbage
Carrots
Celery Tops
Citrus Rinds
Coffee Grounds (and filter)
Corn Cobs (chopped)
Cucumber
Egg Shells (crushed)
Grapes
Grapefruit
Lettuce
Lemon
Melon
Onion
Oats
Pears
Pineapple
Potato
Pumpkin/Squash
Tea Leaves & Tea Bags
Tomato
Turnip
Zucchini

OTHERS

Apple Pomace
Bird Cage Cleanings
Bone Meal
Corn Stalks
Cotton Rags
Feathers
Felt
Flowers
Garden Wastes (trimmings, plant remains)
Grape Plant Waste
Grass
Hair
Hay
Leather
Leaves
Composted Manure
Muck (marsh & swamp mud)
Peanut Hulls
Peet Moss
Pine Neddles
Rope
Sawdust
Seaweed
Soil
Straw
String
Weeds
Wood Ash
Wool Rags

In Or Out



Choose the items that can be composted, colour them in and put them in the composter (E27).

Bottled Garden

OBJECTIVE: To demonstrate how compost helps plants grow.

MATERIALS: compost, sand, seeds, two 2-litre plastic bottles, HANDOUT: **The Good Gardener** (E33)

VOCABULARY: chemical fertilizers, comparison, compost, landfill, organic, overuse, seeds, soil

BACKGROUND:

Abuse and overuse of soil causes the minerals and nutrients in the soil to become depleted. Chemical fertilizers do not help soils. While they are beneficial in the short term, over time fertilizers harm soil because increasing amounts are required to achieve the same results.

Compost is a natural soil conditioner. Rather than put organic waste, and the minerals and nutrients it contains, into a landfill, composting uses waste to replenish soil.

This activity will show the children how good soil can help plants grow. The activity will also teach the students comparison skills.

PROCEDURE:

1. Distribute a copy of the HANDOUT: **The Good Gardener** (E33) to show an example of the plant holder to be created. Each child is to bring two 2-litre plastic soft drink bottles to class. The tops of the bottles should be removed so approximately the bottom 10 cm of the bottle remains.

2. Using paint, wallpaper, string, macaroni and other materials, the children should decorate their bottles.

3. Now explain to the class the benefits of composting. Tell them they are going to see how compost helps plants to grow.

4. Have each child fill one of their decorated bottles with sand and the other with compost.

5. Plant several radish seeds in each bottle. Add water on a regular basis until the seeds germinate.

6. Continue to water both bottles until a complete plant appears.

Bottled Garden (cont.)

EXTENSION:

1. Try different types of seed in the compost. Have the children guess to see which type of seed would grow best.

2. Decorate a bottle and fill with compost. Plant flowers in the bottle. After the plants have grown, allow the children to take them home for gifts.

3. Keep a pictorial diary of the plant growing.

EVALUATION:

1. Ask the children to decide which of their bottles produced a better plant.

2. Ask the class if they think composting is a good idea.

3. Ask the children how compost is made.

The Good Gardener

Brewster Facts

1. Food scraps, grass clippings and other organic waste rot. Rotting is nature's way of putting minerals and nutrients back into the soil. Minerals and nutrients help plants grow.

2. Composting is a special way to rot waste. By adding things together in the correct way, waste is turned into dirt.

3. A proper compost pile has two kinds of layers. The first type is called green. Vegetables, grass and plants are things found in a green layer. A green layer is high in nitrogen. This helps the tiny bugs found in the compost pile multiply. The second type of layer is called brown. Paper, twigs and saw dust could be found in a brown layer. Carbon is found in this layer. The bugs use carbon for energy.

4. After waste has completely rotted or "broken down", it can be used on gardens, lawns or potted plants.

5. Composting makes more soil and saves landfill space. Both of these things are good for the Earth.

World of Worms

OBJECTIVE: To explain how a worm composter works.

MATERIALS: calcium carbonate, foil tray, opaque plastic container with a lid (55 cm x 40 cm x 30 cm), organic peat loam, paper clip, red wigglers, sealed container, shredded paper/cardboard, something to puncture holes in container with, sheer nylon material, HANDOUT: **Worm Power** (E39)

VOCABULARY: bedding, calcium carbonate, castings, composter, opaque, organic peat loam, quarter, red wigglers, vermicomposting, waste

BACKGROUND:

Conventional home composting usually requires a backyard or other outdoor area. Offices and schools that would like to compost must overcome the issue of space. Worm composting, also called vermicomposting, allows apartment dwellers, office workers and classrooms to compost. Red wigglers are the worms used in this form of waste management. These worms can eat their weight in organic waste each day, so 1 kg of worms could handle 1 kg of waste. Waste and the bedding inside a worm composter is eaten by the red wigglers. The worms excrete castings which are an excellent natural plant food. Details of how to build a worm composter are given in the PROCEDURE section of this activity.

PROCEDURE:

1. Explain the information contained in the BACKGROUND section of the activity to the students. Be sure to express how conventional methods of composting cannot always be practiced and how worms are a viable way of handling waste.

2. Tell the class they are going to construct their own worm composters. Divide the class into groups of approximately 5 students. Each group should now use the following steps in building their composter:

   - Obtain an opaque plastic container, with a lid, approximately 55 cm long by 40 cm wide by 30 cm in depth. Drill or cut 6 holes in the base of the container and cover the bottom of the container with nylon mesh. Along the top of each side of the container drill or cut several air holes. See HANDOUT: **Worm Power** (E39)

   - Place the container in a foil tray. Be sure to raise the container so it sits just above the tray. This will allow excess moisture to drip out of the worm composter.

   - Worms need bedding in which to live. For this container 7 kg of bedding will be needed. The bedding should be 80% shredded paper and cardboard and 20% organic peat loam. Calcium carbonate could be added to this mixture to avoid fruit fly problems.

   - Now add 4 litres of water to the bedding mixture. For the worms to survive, they need bedding with a 75% moisture content.

World of Worms (cont.)

PROCEDURE (cont.)

- One half kilogram of red wigglers should now be added to the bedding. Bait and tackle shops can supply the worms or they may be found near manure piles. Use a small amount of bedding to cover the worms.

- The container is now ready to accept waste. The surface of the bedding should be divided into quarters. Waste is buried in Quarter 1. Make sure the waste is completely covered. A paper clip or similar item should be placed above the waste to mark where food was last buried.

- One week later, more waste is added this time in Quarter 2. The paper clip is moved to mark this as the latest burial.

- Students continue to bury their waste in the four quarters weekly. A pattern should be followed (i.e. 1, 2, 3, 4). By adhering to a set pattern the worms get into a rhythm and the waste has enough time to be completely eaten.

NOTE: Lunch waste and other "worm food" should be stored in an ice cream tub or other sealed container until it is time to feed the worms. After six to twelve weeks the worms will have turned all of the bedding into castings. Push the castings to one side of the container and add fresh bedding to the other side. Bury food in the new bedding, wait a day or two so the worms can migrate to the new bedding. Remove the old castings. Fill the empty side of the container with more bedding then continue to add waste as per steps 9-11. If the worms multiply to a point where there seems too many for the container use them to start another worm composter or release the worms into the ground.

EXTENSION:

1. Use the castings as plant food for a classroom or school interior garden.

2. Build a worm composter large enough for the entire school to use. Have the students maintain the composter.

3. Instead of selling cheese or chocolate bars sell worm composters to finance a class trip.

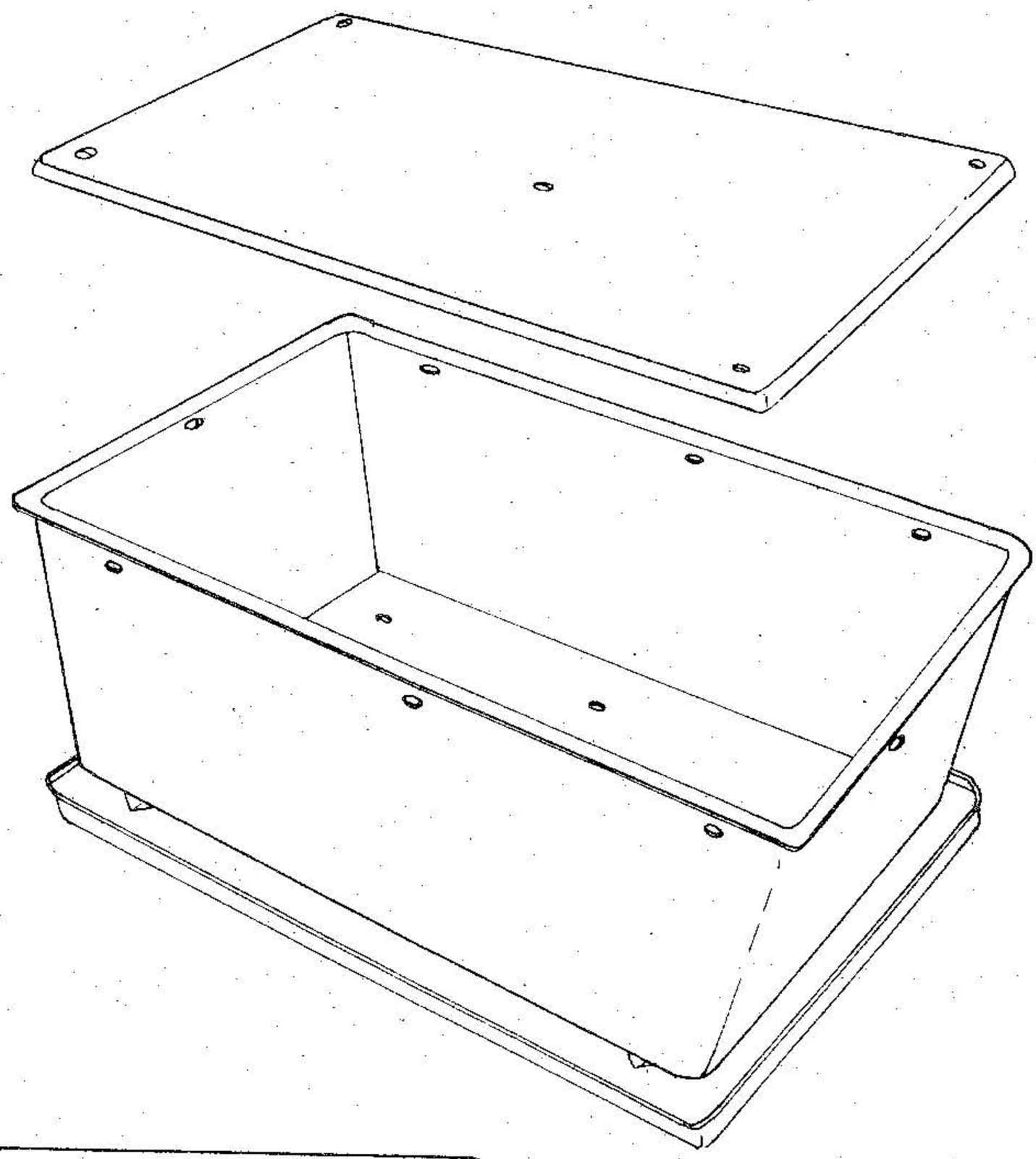
EVALUATION:

1. Have each group calculate how many kilograms (kg) of worms it would take to turn the classroom's total daily waste into castings. Assume each child produced 0.5 kg of waste per day and remember 1 kg of waste can be eaten by 1 kg of worms.

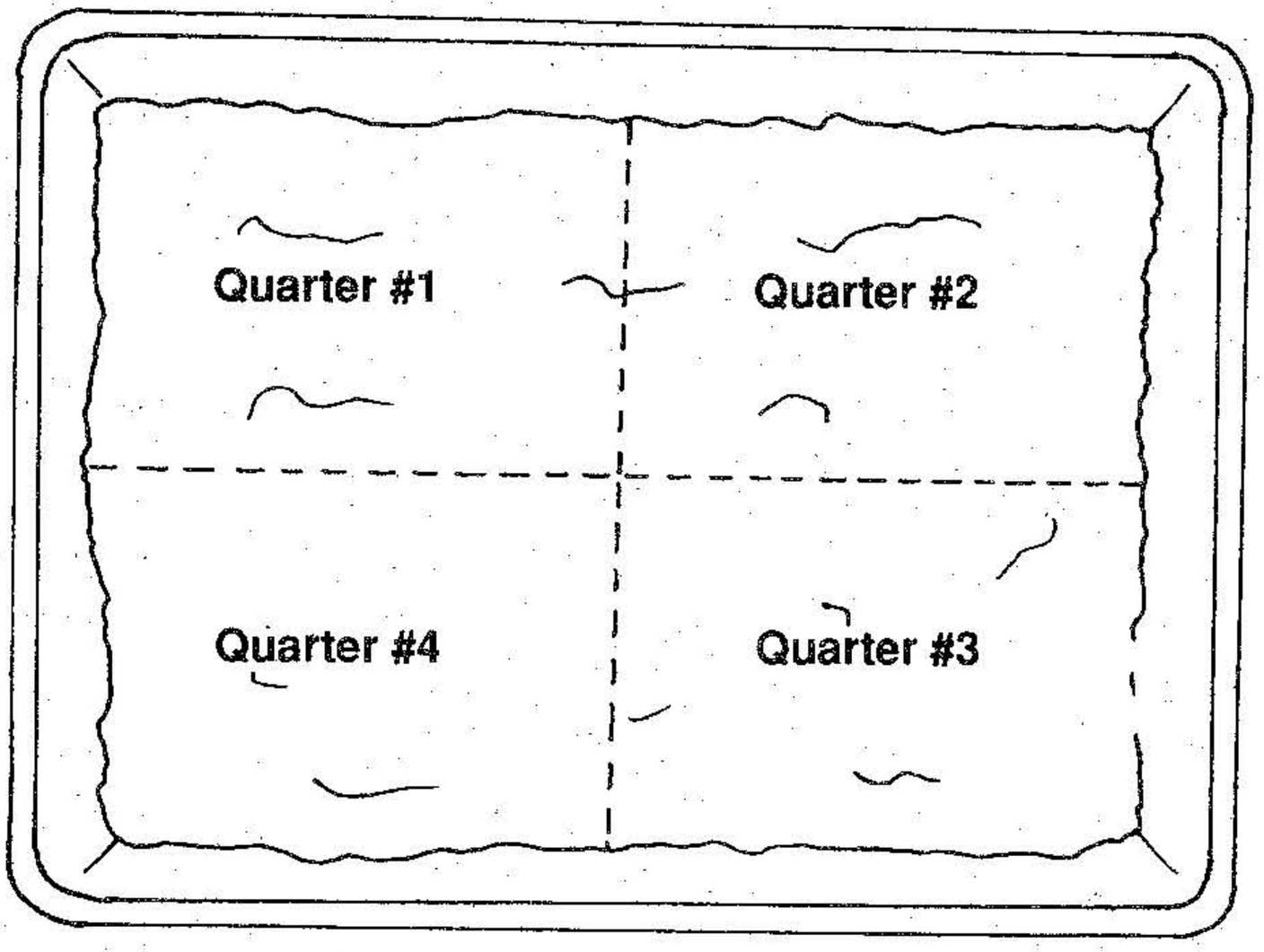
2. Have the children design a stand for their worm composters and the tub used to hold their waste.

3. Ask the students to write a list of reasons why people should use worms to compost and a list of reasons why people probably would choose not to use worms.

Worm Power



Make sure that the container you use has a lid and that the sun cannot shine through it. Also make sure that the container does not touch the surface of the tray. This can be done by placing four equal sized corks or pieces of wood under the four corners of the container.



When feeding the worms put the food into a different quarter each time. To remember which quarter was last used you can mark it with a paper clip or something similar.

Learning Layers

OBJECTIVE: To explain the carbon to nitrogen ratio of backyard composting.

MATERIALS: bristol board, crayons, glue, magazines, scissors and other craft materials, HANDOUTS: **Brown Or Green?** (E43), **Composter** (E27)

VOCABULARY: carbon, compost, cross section, energy, green, brown, micro-organism, nitrogen, ratio, reproduce

BACKGROUND:

Successful backyard composting depends upon many factors. The easiest to understand is the carbon to nitrogen ratio. Micro-organisms use carbon for energy. This energy allows them to turn waste into finished compost. Nitrogen helps the organisms to reproduce. The ideal compost pile has a carbon to nitrogen ratio of 30:1. By adding waste in green and brown layers this ratio can be achieved. A green layer is high in nitrogen, a brown layer high in carbon. A good compost pile will have nearly 50% green and 50% brown layers as well as a layer of dirt every few layers. These layers should alternate (green, brown, green, brown, soil and so on).

PROCEDURE:

1. Explain the information found in BACKGROUND section of this activity to the class.

2. Distribute copies of the HANDOUT: **Brown Or Green?** (E43) to the class. Explain that the items under "Green" are high in nitrogen. The items under "Brown" are high in carbon. Both materials are needed to make proper compost.

3. The students are to draw a cross section of a composter on a piece of bristol board. The composter outline on the HANDOUT: **Composter** (E27) could be enlarged and used.

4. The children now start putting waste "into" their composter. Each acceptable item on the HANDOUT (E43) should be drawn, cut out of a magazine, photocopied, etc. and attached to the cross section. Items can be used more than once, for example several pictures of bread could be put in the composter, the only stipulation is the drawings must be attached in layers. This means several green items are attached to the bristol board. Several brown items are placed above the green then more brown items and so on.

5. Have each student title their finished cross section and write a small report explaining what the cross section illustrates. Reports should mention carbon to nitrogen ratio, micro-organisms, green and brown items and layers.

Learning Layers (cont.)

EXTENSION:

1. Provide the children with photocopies of pages E5-E7 of the COMPOST BACKGROUND INFORMATION. Explain these are the micro-organisms and insects that turn the green and brown layers into finished compost. Have the children attach the pictures of the organisms and bugs to their cross sections.

2. Make a three dimensional model of a composter showing finished compost at the bottom with green and brown layers on top.

3. Have the children display their finished compost posters in the lunch room and have them answer questions for other pupils in the school.

EVALUATION:

1. Ask the children to explain what carbon and nitrogen do for a compost pile.

2. Would any of the students consider composting as a science fair project?

3. Ask the children to name, from memory, some green and some brown items.

Brown Or Green?

Greens

Apples and Apple Peels
Apple Pomace
Artichoke Leaves
Asparagus Bottoms
Bananas and Peels
Beans
Beet Tops
Berries
Bird Cage Cleanings
Broccoli Stalks
Brussel Sprouts
Cabbage Stalks and Outer Leaves
Carrot Tops and Scrapings
Celery Tops
Citrus Rinds
Coffe Grounds and Filter
Composted Manure
Cucumber
Egg Shells (crushed)
Flowers
Grapes
Grass (fresh cut)
Hair
Lettuce
Lemon
Melon
Onion
Peanut Hulls
Pears
Pineapple
Potato
Pumpkin/Squash
Seaweed
Tea Leaves and Tea Bags
Tomato
Turnip
Weeds
Zucchini

Browns

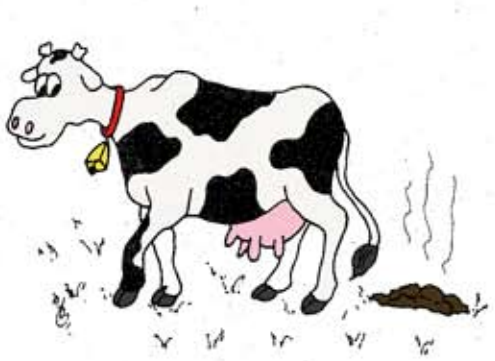
Bread
Corn Stalks
Corn Cobs
Cotton Rags
Feathers
Felt Waste
Garden Wastes (dry trimmings & plant remains)
Hay
Leather Waste and Dust
Leaves
Oats
Peat Moss
Pine Needles
Rope
Sawdust
Straw
String

Personal Notes

Brewster Facts

1. Composting is part of a natural cycle. Organic materials such as plants, vegetables and trees use nutrients and minerals found in the soil to grow. When the plant dies, it rots. This returns the nutrients and minerals to the soil.

2. When waste is placed in a landfill the cycle just mentioned is interrupted. Compost allows a person to dispose of their waste without affecting the cycle.



3. Basically, all a compost pile does is let organic waste rot in a controlled way. Composting allows food and other waste to rot or decompose without odours, health risks or pest problems. The two types of composting are aerobic and anaerobic, Aerobic uses oxygen while anaerobic does not.

4. A good compost pile is made from two alternating layers; green layers and brown layers. A green layer is high in nitrogen. The bacteria and insects in a compost pile use nitrogen to reproduce. Vegetables and wilted plants would be found in a green layer. A brown layer of straw, twigs, or paper is high in carbon. Carbon gives bacteria and insects energy to help a compost pile decompose.

5. Finished compost looks like top soil. Compost is a good conditioner for lawns, gardens, and house plants.

6. Most composting is done by individuals in their backyard. There are other methods. Some areas use central composting. Truck loads of organic waste are turned, under controlled conditions, into soil. People in apartments or classrooms do not have room to compost. Worm composters allow these people to decompose their waste.

Compost Construction

OBJECTIVE: To build, monitor and maintain a composter.

MATERIALS: material and tools to make composter, HANDOUT: **Backyard Composters** (E17)

VOCABULARY: anaerobic, brown, carbon, composting, green, landfill, nitrogen, pile, ratio, surface area, volume, waste

BACKGROUND:

Composting can reduce the amount of waste going to landfill by 40%. It is also the most natural form of waste management. There are five factors contributing to a good compost pile.

The carbon to nitrogen ratio is the first factor. Wastes high in carbon are called "brown". Wastes high in nitrogen are said to be "green". A compost pile with the correct carbon to nitrogen ratio will have alternating green and brown layers plus a thin layer of soil every so often; the pile should roughly be 50% green and 50% brown. Surface area of waste is factor number two. Chopped, shredded or split waste has a large surface area. This increases the temperature and rate of decomposition in the pile. Factor three is moisture. A good pile will have a moisture content of 40-60%. If the pile is too dry the decomposition will slow down. An overly wet pile will stink; this is called an anaerobic condition. Material in a pile should be moist to touch but should not yield water when squeezed. The fourth factor is air. Without air a pile will experience anaerobic conditions. As stated above, this causes a foul odour. Using a pitchfork to stir or mix waste in a compost pile provides sufficient air. The final factor is volume. A good guideline for a pile should be approximately one cubic metre. The five factors are necessary to encourage growth of the bacteria and insects which process the waste into compost.

PROCEDURE:

1. Explain the benefits of composting to the class. Mention, waste reduction, the landfill space this reduction saves and the nutrients compost returns to the soil.

2. Give the students the five factors of successful composting. Discuss the factors to ensure their importance is well understood.

3. Tell the students they are going to put these factors to work by composting at school. Distribute copies of the HANDOUT: **Backyard Composters** (E17) to the class. Ask the class to decide which composter they think they should construct or have them design one themselves. You may wish to avoid building a composter by purchasing a commercial unit. If the school's population or waste production is sufficient you may use several composters.

Compost Construction (cont.)

PROCEDURE (cont.)

4. The students are to collect waste from the school. Waste should be piled in green and brown layers. Students should keep a log of how much waste (by weight) is added to the pile, a description of the pile (i.e. foul odour, etc.) and describe what is happening.

5. Periodically finished compost should be removed. Its weight should be recorded.

6. At the end of the school year the class is to compare how much waste went into the composter to how much finished compost was produced.

EXTENSION:

1. Use the finished compost to grow flowers and plants in the school's foyer.

2. Write to the school board asking if a central composting operation for all schools could be established.

3. Arrange a class trip to visit a commercial or central compost facility.

EVALUATION:

1. Did the students keep an accurate record of the compost?

2. Did they seem enthused about the project?

3. Ask them to name the five factors of composting.

The "Doo Doo" Do

OBJECTIVE: To test the rates of decomposition for a homemade diaper versus a commercial disposable diaper.

MATERIALS: commercial disposable diaper, grated carrot and potato, shredded newspaper, water, blender, bowl, pantyhose, composter, note pad, pen, paper towel, cookie sheet, HANDOUT: **Diaper Diagram** (E51)

VOCABULARY: bacteria, compost, decomposition, disposable, experiment, groundwater, pile, surface area, waste

BACKGROUND:

Diapers are a touchy environmental issue; both cloth and disposable diapers claim to be environmentally superior. Cloth diapers can be reused over and over but use water, detergents and possibly bleaches when cleaned. Manufacturers of disposable diapers claim their diapers will decompose in landfills. While this may be true it can cause problems. If the waste a disposable diaper contains is not removed before the diaper is disposed, this waste is also buried in the landfill. Water can percolate through the diaper and its waste carrying diseases and other hazards into groundwater supplies.

This activity will have the students produce their own homemade diapers and test the diapers' strength and absorbency. The students will be able to see how different materials decompose at different rates.

PROCEDURE:

1. Explain the background information to the class. Tell the students they are going to conduct an experiment to test how decomposition rates vary.

2. The recipe for making a diaper is given on the HANDOUT: **Diaper Diagram** (E51), distribute it to the class.

3. When the homemade diaper is dry, compare it to the commercial diaper. Add 60 ml of water to test the absorbency of each diaper.

4. Place each diaper in separate compost piles. Make sure both diapers are buried at the same depth. If compost piles are not available place each diaper in the garden or another area. Cover both diapers with a uniform amount of soil.

5. Start a log. The first entry should include the date the diapers were buried, what the compost or soil surrounding the diapers looked like and a description of the diapers themselves.

The "Doo Doo" Do (cont.)

PROCEDURE (cont.)

6. Keep a record of the weather for the two weeks after the diapers were buried. Make daily entries into the log detailing the temperature (daily high and low), whether the sky was cloudy, sunny, etc. and any precipitation that may have occurred.

7. After the two weeks have passed uncover the diapers. Describe the state of each diaper. Be sure to mention which one appears to have decomposed the most. Again describe the compost or soil around each diaper. Enter these observations into the log.

8. Each student should now write a conclusion as to whether or not the homemade diaper decomposed faster then the commercial diaper.

9. Lead a discussion in class. Have the students debate whether it is better to use cloth diapers or disposable diapers. The students should consider the resources used in making both types of diapers, the benefits and pitfalls of both products and more environmentally friendly alternatives.

EXTENSION:

1. Continue the experiment until both the homemade and commercial diaper have completely decomposed.

2. Research what materials are used in the production of commercial diapers. Is a diaper made of natural vegetable material (potatoes or carrots) practical?

3. Do the experiment with other products such as biodegradable garbage bags, orange peels, etc.

EVALUATION:

1. Did the students keep accurate logs?

2. Are advertisers being truthful when they say disposable diapers decompose?

3. Have each student state his or her view on the cloth versus disposable diaper debate.

Diaper Directions

750 ml peeled grated potatoes	blender
250 ml grated carrots	bowl
300 ml water	cookie sheet
100 ml vinegar	paper towels
2 sheets of shredded newspaper	rolling pin

1. Grate potatoes and add vinegar to prevent discolouration. Put water in blender and potato mixture. Puree.

2. Gradually blend shredded newspaper into mixture.

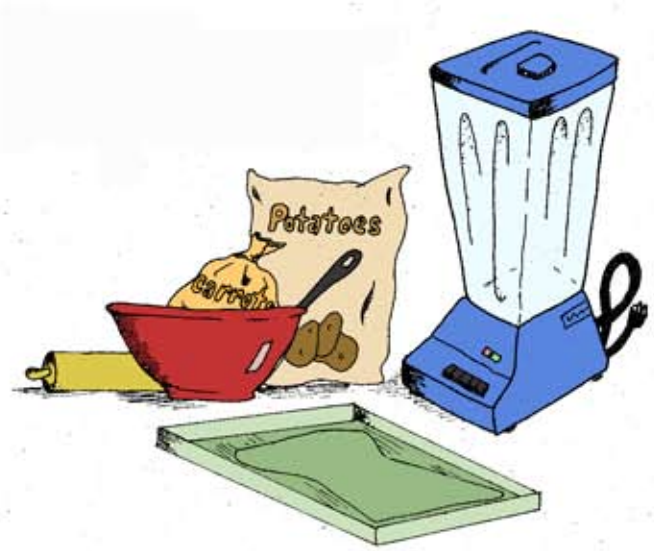
3. Stretch old pantyhose over bowl. Pour mixture into the pantyhose. Pull pantyhose around mixture to form a bag.

4. Squeeze the bag to remove moisture from the mixture. Continue to squeeze until moisture no longer seeps through the pantyhose.

5. Place several layers of paper towels on a cookie sheet. Remove mixture from pantyhose and place on top of towels.

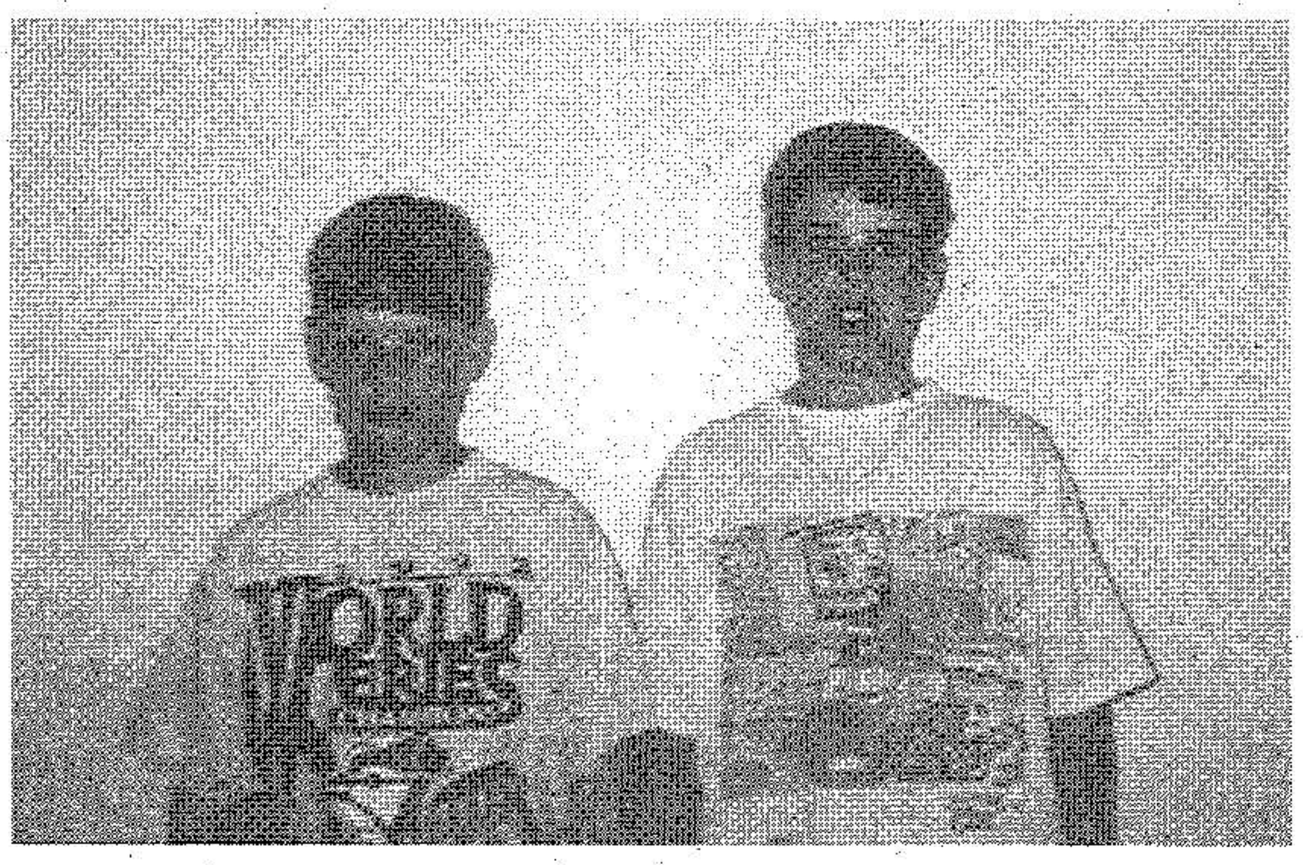
6. Hand flatten the mixture and shape like a diaper; place a layer of paper towels on top then roll the mixture flat (2 cm thick).

7. Remove top layer of towels and allow diaper to air dry for 3 to 4 days.



COMPOST - INTERMEDIATE HANDOUT

Student Participants



Jacob Bruxer and Jason Geoffrey

Jason and Jacob attend St. Boniface School in Zurich, Ontario. While in grade 7 they entered their school's Science Fair and were selected to represent their school at the Huron County Science Fair. Bluewater Recycling Association asked if the boy's project could be used as the basis for the previous activity. Jason and Jacob showed imagination in selecting this unique topic. They are to be congratulated for their contribution to this activity.

Ecotalk

ANAEROBIC - when there is no oxygen in a compost pile**.**

BACTERIA - a tiny creature. A microscope is needed to see bacteria.

BEDDING - hay, straw and other things used in animal pens, stalls, stables.

BROWN - anything that has a log of carbon is called brown.

CALCIUM CARBONATE - is also called live. It looks like flour and is used to keep odour and flies away from waste.

CARBON - found in brown items. Carbon gives energy to the bugs and insects in a compost pile.

CASTINGS - are the things worms make after eating waste. Castings made good fertilizer.

CHEMICAL FERTILIZERS - are man-made fertilizers used to help plants grow. Some chemical fertilizers are good but many are harmful to people and the environment.

COMPARISON - to judge one thing against another thing. People who buy cars do a comparison of dint price so they can get a "good deal".

COMPOST - if waste is carefully treated it will become compost. Compost looks like dirt and it helps plants to grow.

COMPOSTER - a box, barred or other container that holds waste and allows the waste to rot.

COMPOSTING - a way to turn waste into dirt.

CROSS SECTION - a view of something where part of the object is missing. Cutting a cake shows a cross section of the cake's layers.

DECOMPOSITION - happens when something rots.

ENERGY - is the power used to move vehicles, make lamps glow and heat homes. Gasoline, propane and the sun all provide energy. The food we eat gives me energy to breath, think, walk and talk.

GREEN - anything that has a lot of nitrogen is called green.

LANDFILL - is a pit or hole in the ground used to hold garbage.

Ecotalk (cont.)

MICRO-ORGANISMS - are small creatures a person cannot see with a microscope. Bacteria is a micro-organism.

NITROGEN - found in green items. Nitrogen helps to make more bugs and insects in a compost pile.

OPAQUE - something that does not let light through. A glass bottle would be clear but a green garbage bag would be opaque.

OVERUSE - to use something too much or too many times.

PILE - a group of things laying on top of each other. For example a notebook has sheets of piled paper.

QUARTER - one of four equal parts. For examples the numbers 12, 3, 6 and 9 divide a clock into quarter. The space between 12 and 3 is one quarter.

RATIO - a way to show a type of division. If a person had some mixed fruit that was five oranges and 2 apples the ratio of oranges to apples would be 5:2.

RED WIGGLERS - a type of worm. Red wigglers are used to turn waste into fertilizers.

REPRODUCE - to make more of the same thing. When people have children they reproduce. When a factory makes bolts it is also reproducing something.

SEEDS - is the beginning of a plant. With water and food a seed can grow into a plant.

SOIL - dirt found on the ground. Soil is made from tiny pieces of rocks.

SURFACE AREA - the outside of an object. A box has six sides. By measuring the sides you could find the surface area.

VERMICOMPOSTING - a way to handle waste. Worms are used to turn waste into fertilizer.

VOLUME - the amount of something an object can hold. Milk cartons come in many sizes. Some are 1 litre, some are 500 millilitres and some 250 millilitres. The size of the carton is really their volume.

WASTE - is the things left over from people's activity. Food scraps, old newspapers, grass clippings and many other things are waste. Most waste can be reduced, reused or recycled. Only a very small portion is truly useless; this is called garbage.

Glossary

AEROBIC: the utilization of bacteria with oxygen to reduce the volume of waste.

ANAEROBIC: the utilization of bacteria in the absence of oxygen to reduce the volume of waste.

ACTINOMYCETES: fine, gray-coloured cobweb like organisms. A cross between bacteria and fungi, they excrete vitamins and antibiotics as they consume the organic waste in the compost pile.

BINARY FISSION: a biological splitting of a nucleus into two nuclei; a form of simple reproduction.

BIOCHEMICAL: a chemical process of living matter.

BIODEGRADE: the breaking down of a substance through natural decomposition into harmless elements in a short period of time.

DUST BOWL: land on the Great Plains from which the eroded topsoil was blown away, in the 1930's.

HUMUS: the result of decomposition of vegetable or animal matter, taking place over hundreds or thousands of years.

MACERATED: a mechanical grinding of material, to increase its surface area, thus speeding up the composting process.

MESOPHILIC: bacteria that are active at temperatures from 21 to 40^0 C.

PATHOGEN: an organism that produces disease, a bacteria or virus.

PSYCHROPHILIC: bacteria that are active at temperatures below 21^0 C.

THERMOPHILIC: bacteria that are active at temperatures from 40 to 93^0 C.

Resources

1. Bluewater Recycling Association
   P.O. Box 1330
   Grand Bend, Ontario
   N0M 1T0
   Phone: (519) 238-8661
   Fax: (519) 238-2330

2. Recycling Council of Ontario
   489 College Street, Suite 504
   Toronto, Ontario
   M6G 1A5
   Phone: (416) 960-1025
   (800) 263-2849
   Fax: (416) 960-8053

3. Ministry of Environment and Energy
   135 St. Clair Avenue West
   Toronto, Ontario
   M4V 1P5
   Phone: (416) 323-4321
   Fax: (416) 323-4643

4. Worm Works - Bougarts and Associates
   1295 Hastings Drive
   London, Ontario
   N5X 2J1
   Phone: (519) 667-2101
   (Dr.'s Office)

Videos

Unless specified all videos listed are available for use through the Bluewater Recycling Association.

Barclay Recycling, Soil Saver Classic Composter.

Recycling Council of Ontario, The Magic of Composting.

Stinnes Enerco, Bio Container Composting.

The Earth Machine, 21st Century Home Composting.

Tier One Communications Lue, Ecolyzer Digester/Composter.

Capital Regional District, Black Gold, A Guide to Home Composting.

Hensall Compost Facility, Back to the Land, The Story of the Hensall Compost Facility.

B.C. Environment, Eddie and the Ecosaurus and the Compost Scene.

Resources (cont.)

Speakers

1. The Bluewater Recycling Association
   P.O. Box 1330
   Grand Bend, Ontario
   N0M 1T0
   Phone: (519) 238-8661
   (800) 265-9799
   Fax: (519) 238-2330

2. The Recycling Council of Ontario
   489 College Street, Suite 504
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   (800) 263-2849
   Fax: (416) 960-8053

3. Ministry of Environment and Energy
   135 St. Clair Ave West
   Toronto, Ontario
   M4V 1P5
   Phone: (416) 323-4321
   Fax: (416) 323-4643

4. Global Action Plan (G.A.P.)
   R.R.#4, 6080 Durham Road 23
   Uxbridge, Ontario
   L4P 1K4
   Phone: (416) 852-4786
   Fax: (416) 852-4786

5. Ontario Hydro
   Speakers Bureau
   700 University Avenue
   Toronto, Ontario
   M5G 1X6
   Phone: (416) 592-2322
   (800) 668-8500

6. Pollution Probe
   12 Madison Avenue
   Toronto, Ontario
   M5R 2S1
   Phone: (416) 926-1907
   Fax: (416) 926-1601

7. Greenpeace
   185 Spadina Avenue, 6th Floor
   Toronto, Ontario
   M5T 2C5
   Phone: (416) 345-8408
   Fax: (416) 345-8422

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