

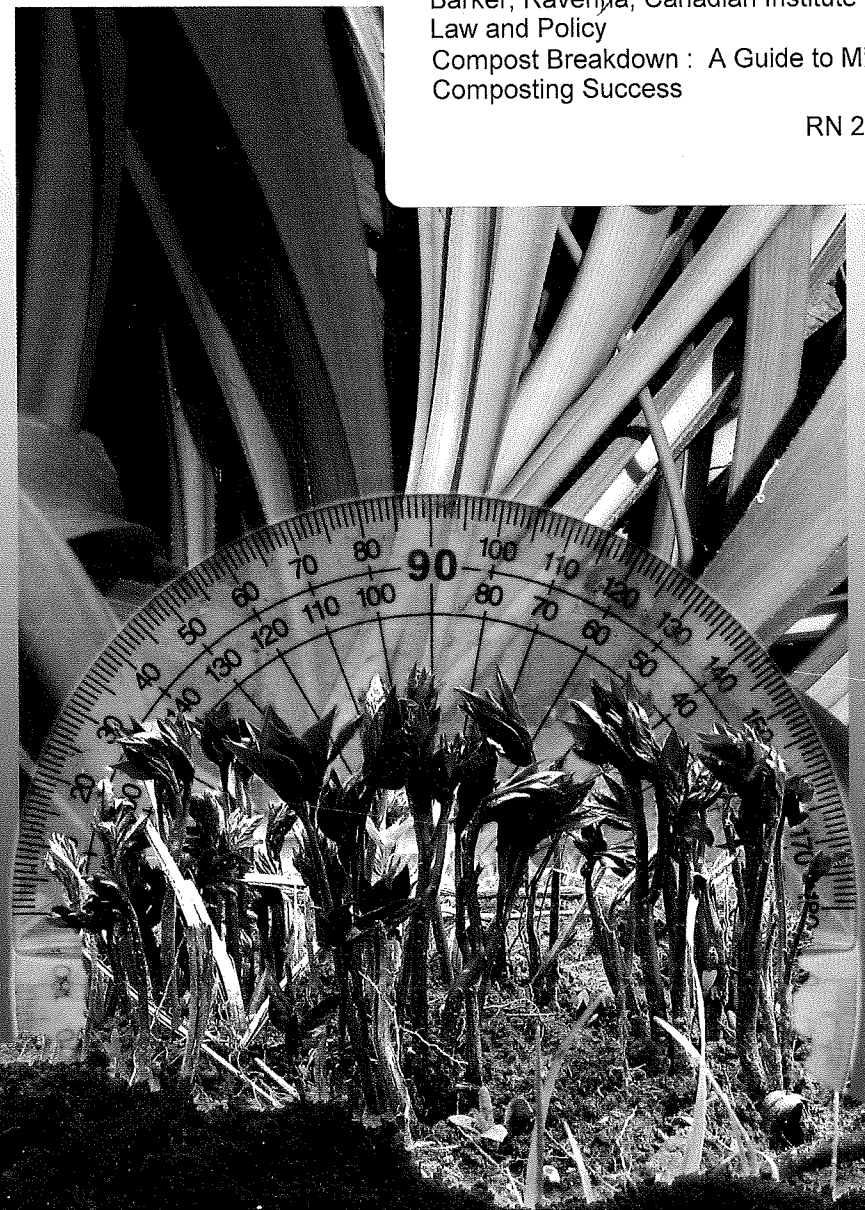
Compost Breakdown

A Guide to Mid-Sized Composting Success

Ravenna Barker

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Composting Success

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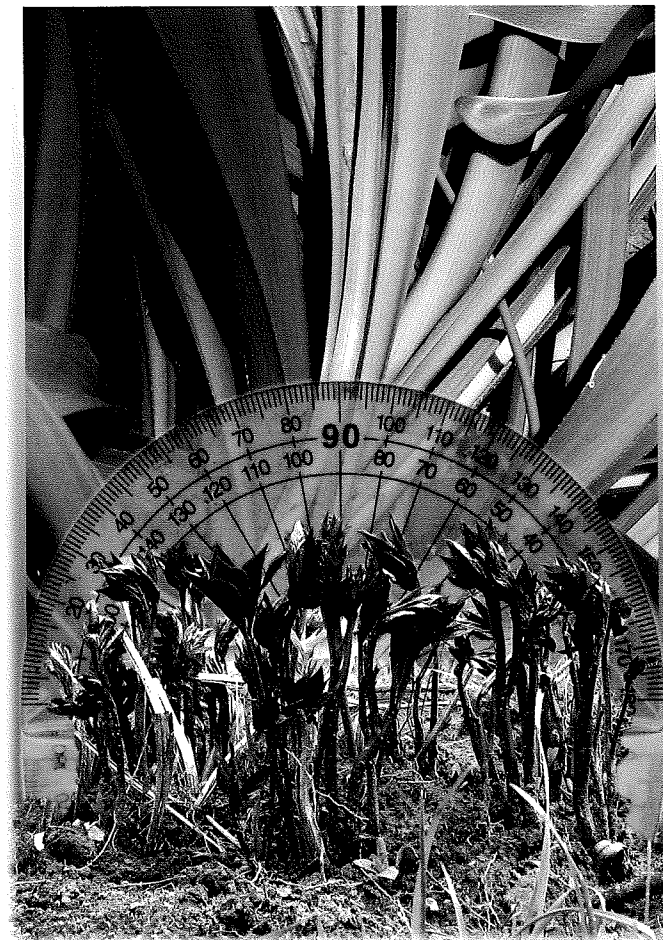
 **TORONTO** Atmospheric Fund

Food Share
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Compost Breakdown

A guide to mid-sized composting success

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Introduction to the Mid-Scale Composting Manual

FoodShare Toronto, a non-profit organization that creates community-based programs to help increase access to affordable, healthy food in the city has created this manual. It comes out of FoodShare's Urban Agriculture Program which works to:

- ☞ Demonstrate the potential for growing food in the city
- ☞ Experiment with new food production ideas and model successful techniques
- ☞ Exchange these ideas with other communities and support them in implementing their own urban agricultural projects
- ☞ Provide training and education about urban agriculture

To find out more about FoodShare Toronto please visit us at www.foodshare.org

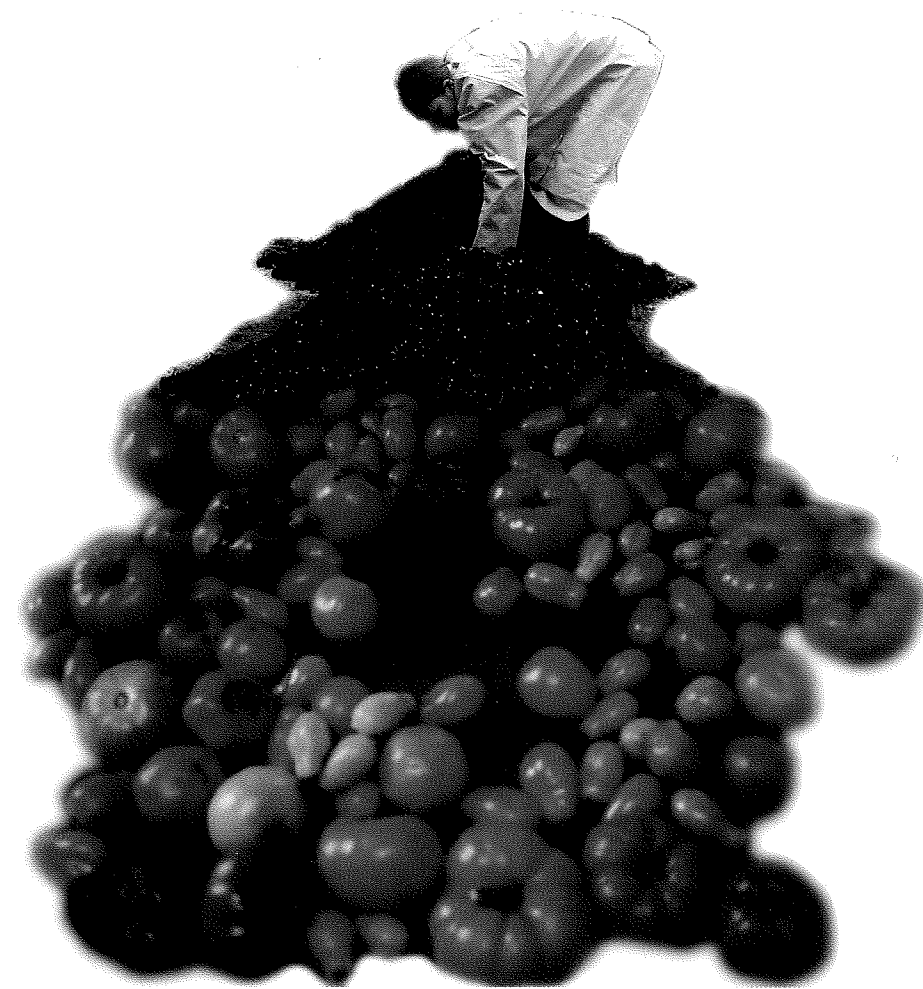


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This manual provides groups that are interested in either initiating or improving mid-sized composting operations with the tools they need. While intended for groups that will have more than one compost bin with multiple users, this manual also explains many concepts that are useful to the backyard composter or smaller group.





Chapter 1

Why Compost?

Why Compost?

This section will tell you what composting is and why you and your group should compost. You will learn that composting:

- ☞ Reduces solid waste and waste problems
- ☞ Returns nutrients to soil
- ☞ Reduces the need for polluting chemical fertilizers
- ☞ Saves landfills for waste that cannot be composted
- ☞ Creates healthy soil
- ☞ Can be profitable
- ☞ Is easy
- ☞ Is fun

Composting uses the natural processes of decay and decomposition to turn vegetable and plant waste into useful fertilizer and soil. **It's easy, and anyone can do it!**

Composting is a process that has happened naturally since plants have existed on this planet. It is the same process that happens on forest floors when trees drop their leaves. As the leaves lay on the forest floor, microorganisms break them into smaller and more accessible parts, and eventually decompose the leaves into soil, providing nutrient to new plants. Composting material in a pile takes advantage of these natural processes to break down a wider variety of plant material, and through a faster process.

Vermicomposting, or worm composting, takes advantage of the work done by worms in the decomposition process to produce soil in a controlled situation.



The soil produced by pile composting or vermicomposting is a microbe-laden humus. The microbes inoculate and activate the biological processes in the soil. Humus is the most active and nutrient laden part of soil. The benefits of humus are numerous.

- ☞ It can hold 80 to 90 per cent of its weight in water, so soil high in humus is drought-resistant.
- ☞ It is light and fluffy. This allows air to circulate easily, and makes soil easy to work.
- ☞ It has a desirable crumb structure.
- ☞ It is extremely effective at holding mineral nutrients safe from being washed away in water and in a form readily available to plants when they need them.
- ☞ It is able to moderate excessive acid or alkaline conditions in the soil.
- ☞ Many toxic heavy metals can be immobilized by humus and prevented from becoming available to plants or other soil organisms.
- ☞ It is usually dark brown or black, which helps cold soils to warm up quickly in the spring¹.

When plant and food wastes are composted not only is healthy soil created, which can replace the need for chemical fertilizers and for buying soil, but it also diverts those wastes from landfills. Solid waste has become a huge problem throughout the world.

In Ontario alone approximately 10 million tonnes (9.8 tons) of solid waste are produced every year². According to Environment Canada almost 25 per cent of this landfill waste is organic household waste³. If those wastes were kept out of landfills and composted instead, landfills would fill less quickly, and farmers and gardeners would need less fertilizer.

The benefits of composting are clear and numerous, but are there any limitations or drawbacks? The only true limitation of composting is how much effort and care you are willing to put in. If you put organic wastes in a pile you will always eventually end up with humus. If you put very little work into your compost, you will get a high quality humus in half a year to a year, but you may still have some weed seeds and small pieces of uncomposted

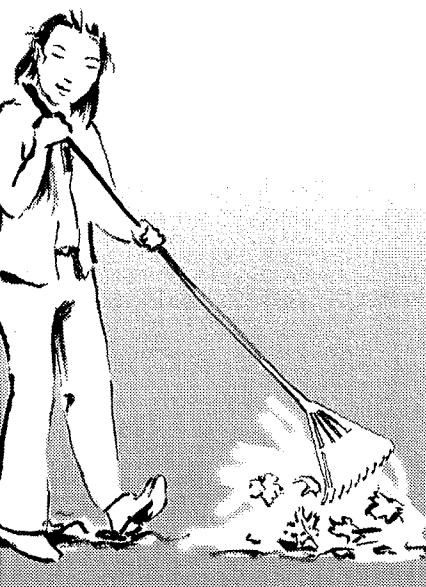
material in your pile (you will get those out by sifting). If you have the time and interest to keep a close eye on your compost and keep it well maintained, you will end up with a more homogeneous mix, in less time and one in which most weed seeds and pathogens will have been killed.

There are two potential drawbacks of composting that can be avoided by following a few basic principles. The two potential drawbacks are producing smells and attracting pests, especially rodents. Compost can produce odors if you include dairy, fish or meat or if it becomes partially anaerobic. Compost will become anaerobic when there is not enough oxygen flowing thorough the pile. This will happen if it is too wet, if there are materials in it that are matted, or if the pile is unevenly mixed. Pests will generally be attracted only if your compost produces strong odours. If you take the advice of the composters who have come before you, included in the next sections of the manual, you should be able to reap the benefits of a compost pile without any of the drawbacks. ☞

Composting:

The breaking down or decomposition of organic matter by a community of micro-organisms known as decomposer organisms, into a nutrient-rich soil conditioner.

Soil degradation costs an estimated \$500 million annually in Ontario alone.





Chapter 2

How Composting Works

How Composting Works

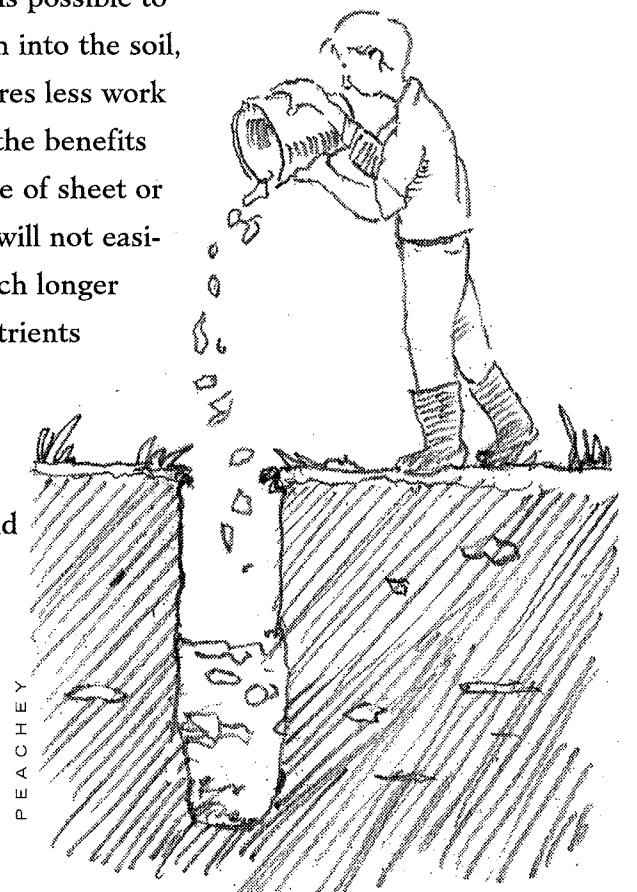
There are many ways to compost. Among them are sheet composting, post-hole or trench composting, vermicomposting, pile composting, partial or complete anaerobic composting, and compost toilets. This manual is not going to talk about anaerobic composting or digestion or composting toilets because they are more complex ways to compost. *The Rodale Book of Composting* is a good resource to find out more about anaerobic composting and digesting. The web site of *City Farmer* can lead you to more information about composting toilets. The manual will not discuss post-hole, sheet, or outdoor insulated worm composting in great depth. Most of the manual will focus on **pile composting** and **indoor vermicomposting**, which are both easy to do and have very few potential drawbacks. ♻️

Sheet and Post-Hole Composting

Sheet and post-hole composting take advantage of the fact that the process of composting happens naturally on its own. People who compost in this way have figured out that it is possible to just spread food scraps on the ground or dig them into the soil, and let them decompose on their own. This requires less work than pile or vermicomposting, but lacks some of the benefits provided by pile these methods. One disadvantage of sheet or post-hole composting is that some raw materials will not easily or quickly break down in the soil, and take much longer than they would in a compost pile. This keeps nutrients locked up and unavailable to the plants that need them. Another disadvantage is that even though the organic matter that you put on or in the soil will decompose, there is no guarantee that the end product will be humus. When those materials are composted in a pile or by earthworms they will always become humus. ♻️

Anaerobic:
The condition of being
without oxygen.

Sheet or Post-Hole
Composting: Spreading or
digging raw organic mate-
rial into soil and allowing
it to decompose.



Pile Composting:
Collecting raw organic material into a pile to speed and control its decomposition.

Pile Composting

In this section you will learn why hot compost piles decompose faster than cold piles and how to make a hot pile by:

- ☞ starting your compost with a "critical mass" of material, or enough material to fill an 8 cm x 8 cm x 8 cm (3' x 3' x 3') space
- ☞ balancing your brown and green materials and avoiding meat, fish and grease
- ☞ chopping up raw materials before adding them to your compost
- ☞ aerating your compost pile maintaining the proper moisture in your compost pile
- ☞ and keeping the pile's pH near neutral

Hundreds of decomposer organisms which range from tiny bacteria to worms, beetles, and other insects come together to do the work of pile composting. When organic material is combined in a pile, microbial, or bacterial, activity begins almost immediately. The bacteria are already attached to each piece of organic matter that is added to the pile.

The bacteria that first work on the pile are called psychrophilic (cool) bacteria. These bacteria begin working when the pile is between 13° and 21° C⁴ (55° and 70° F) and although they produce very little heat they do produce enough to cause a second set of bacteria that like warmer temperatures⁵ to take over. These bacteria, called mesophilic (warm) bacteria, begin working between 21° and 32° C (70° and 90° F) and are the ones that do most of the composting work. That is why a pile that generates heat will decompose into usable soil much faster than a pile that does not. Eventually the mesophilic produce so much heat that a third type of bacteria, thermophilic (hot) bacteria, which work between 32° and 93° C (90° and 200° F), take over, and finish the bulk of the composting. These thermophiles also destroy weed seeds and disease, and release humic acid which helps plants to absorb the nutrients in the compost. Eventually the thermophiles run out of material to keep feeding on and die off, causing temperatures to drop. This allows the mesophilic and psychrophilic bacteria to decompose any remain-

Psychrophilic Bacteria:
Composting bacteria that live between 10 and 21°C (50 to 70 °F)

Mesophilic Bacteria:
Composting bacteria that live between 21 and 32 °C (70 to 90 °F)

Themophilic Bacteria:
Composting bacteria that live between 32 and 93 °C (90 to 200 °F)

ing organic material. After the bacteria have done most of their work, fungus and larger organisms such as worms and insects will move into the compost pile and will finish off the composted material, turning it into mature soil.

All compost piles will eventually turn into soil, but not all compost piles will enjoy the work of all three types of bacteria. Compost piles that do not experience thermophilic or mesophilic activity will decompose more slowly. This raises the question: how can you make a compost pile heat up? ☞

Factors that Affect Compost Temperature

There are six main qualities that determine how hot your compost pile will become:

Mass

Types of plant materials included

Surface area

Oxygen

Moisture

pH

These factors will definitely affect how quickly you get your compost and will have some effect on your final product, but there are no hard and fast rules to pile composting, only experiences and preferences. You can think of making compost like making a meal. Some people will want their food done quickly, others will want it the most convenient way possible, some people will want it to be spicy, others will want it bland, some will be interested in experimenting with different recipes while others will follow the standard. Most advice about how to compost comes from the experiences of other composters. Your group will have to choose how experimental you want to be and what your composting priorities will be. The following will help you think about how you want to run your mid-scale composting operation.





Start off with a boom!
Collect materials and add them all at once. The optimal volume to start with is 0.08 cubic meters (3 cubic feet).

Mass

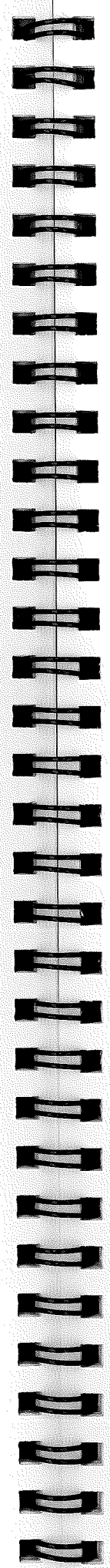
Plant and food material will break down if it is scattered about the yard or in a pile, but the fastest way to get it to decompose quickly is by collecting a large amount of material to be composted together in a pile all at once. Experienced composters generally agree that to quickly produce compost, a pile should be at least 0.08 cubic meters (3 cubic feet). When you begin a mass of material composting all at once, it causes an explosion of microbial activity and allows for the centre of the pile to act as an insulated core where thermophilic and mesophilic activity will take place. If you slowly add the material or your pile does not reach a large mass, it will certainly decompose, but the microbial, decomposing action will take place more slowly, and there will be no insulated core to encourage the development of thermophilic and mesophilic (hot) bacteria. Many composters collect raw materials outside of their compost pile until they have enough to achieve "critical mass" and then add them all at once to kick-start the decomposition process.

Type of Materials Included

One of the most important factors in determining how quickly your compost heap will turn into soil is what materials are used. Most important is the balance of brown to green or carbon rich to nitrogen-rich materials. All plant and food matter contains carbon and nitrogen in different proportions. Examples of brown or carbon rich materials are woody materials like leaves, wood chips, and hay. Green, or nitrogen rich materials include food scraps, certain types of manure, fruit wastes, and grass.

Nitrogen-rich, green materials decompose more quickly, but are more difficult to manage and will generally lead to a smelly, wet pile. Not only that, but when you compost nitrogen-rich (green) materials alone, the soil that you produce tends to be less nutrient-rich than when you mix carbon-rich (brown) and nitrogen-rich materials. This is because as the pile breaks down, if the materials are not balanced, there will be too much nitrogen in the pile. The extra nitrogen will turn into gas and escape from the pile. As a result the end product is less rich in nitrogen.

Nitrogen:
A nutrient essential to life. An essential component of all fertilizer. Materials rich in nitrogen are "green materials."



The ideal proportion of carbon-rich materials to nitrogen rich materials or C:N is between 20:1 to 30:1. This does not mean to use 30 times as much wood chips as food scraps in constructing your compost pile, since all organic materials contain both nitrogen and carbon, and generally more carbon than nitrogen.

Usually you can achieve this balance by using two parts nitrogen rich, green, materials to one part carbon rich, brown materials.

Some examples of carbon to nitrogen ratios for organic matter are as follows:⁶

C:N

7:1 Chicken manure

15:1 Food scraps

17:1 Grass clippings

60:1 Leaves

90:1 Straw, Hay

700:1 Wood chips

Beyond the C:N ratio, there are some other concerns about what should and should not be included in a compost pile. You can put any type of plant material or food waste into your compost pile, but there are certain types of food waste that will break down more slowly, attract pests, or cause odours. The debate about what you should and should not include in your compost pile is ongoing, but these are some rules that are generally followed.

- ☞ Grease, bones, dairy products and meat, with the exception of eggshells, tend to break down very slowly and to smell bad, and thus attract animals. Avoid using very many of these materials.
- ☞ Manure from grass and grain-eaters, such as cow, sheep, goats, chickens and rabbits are a wonderful addition to compost.
- ☞ Never include manure from meat-eaters, especially humans, cats and dogs in your compost. They carry disease pathogens.
- ☞ Avoid adding matter that has been treated with herbicides, pesticides or fungicides. The reason that composting happens is because a wealth of organisms interact with plant and food material to help

Carbon: The basic building block of all life. Material rich in carbon are "brown materials."

C:N: The ratio of carbon (brown material) to nitrogen in soil.



Minimize dairy, meat, fish and greasy food in your pile.

it to decay and to add nutrients and complexity. Pesticides, herbicides and fungicides can slow or stop the process. Don't worry, you can still include waste from non-organically grown vegetables and fruit. The small amount of pesticides on these products has little to no impact on the composting process.

- ☞ Avoid using weeds that have already gone to seed in your compost pile, unless you know that the pile will reach very high temperatures. If the seeds are not killed by high temperatures in the composting process they may become invasive weeds when the compost is used.
- ☞ Pure wood ash or pure wood charcoal can be good additives to compost. Never use their treated cousins, including charcoal briquettes and mixed barbecue ash. These products can contaminate your compost.

While some composters recommend not using lime, rhubarb leaves, newspaper, bones and wood chunks, others use them with great success.

Surface Area

Another factor that will affect how long it will take your compost pile to decompose is the size of the pieces of material that you add to your compost pile. The larger a piece of material is, the longer it will take to break down. This is because the bacteria can only work on decomposing the surfaces that they come into contact with, much like erosion can only happen on exposed surfaces. Because of this, many composters chop the raw material that they add to their compost into small pieces. This exposes the most surface area possible to the bacteria in the compost and speeds the process. Chopping requires a bit more effort initially, but it does noticeably speed the process.

Oxygen

The type of composting that happens in piles is aerobic, meaning that it involves oxygen. If an aerobic compost pile becomes anaerobic, the pile will produce very strong and unpleasant odours. If the bacteria working on your pile do not get enough

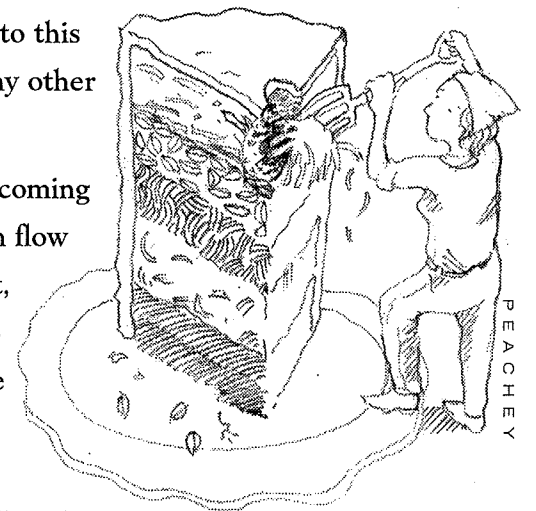
oxygen, anaerobic bacteria will take over for them. Conversely, if the bacteria working on your compost are regularly "fed" oxygen, they will work harder and faster to decompose your pile than if left on their own. You can feed your pile oxygen by aerating or turning it. Ideally, aeration should happen between every three to 10 days. Aeration can be done by poking or jabbing into the compost pile any way that you can: with a pitch fork, with specially designed compost aerating tools, or anything else that you find appropriate. While any form of adding oxygen to the pile is effective, the best way to feed your pile oxygen is to turn it, moving the materials from the inside of the pile to the outside and vice-versa. This infuses the pile with the most oxygen possible and at the same time moves the less decomposed material from the less active outside of the pile to the insulated core where most of the decomposition happens. The major drawback to this method is that it takes much more effort and time than any other aeration method.

Another important aspect of keeping your pile from becoming anaerobic (and stinky), is to structure it so that oxygen can flow through it. To do this avoid putting materials that can matt, such as dead leaves, hay, or grass clippings, in layers thicker than 10 to 15 cm (4" to 6") Also try to mix dense or fine materials with fluffy materials such as straw or thicker wood shavings or trimmings from evergreens or shrubs. If you structure your pile in this way and do not aerate, it will probably not become anaerobic, but it will take longer to produce finished compost than if it is aerated.

Moisture

Like any other living beings, the bacteria in your compost pile need water to live. Without enough moisture the decomposition process will slow down. If your compost is too wet, however, it will probably produce unpleasant smells and be difficult to work. The ideal moisture content for a pile is between 40 and 60 per cent moisture. This amount of moisture in a pile feels like a wrung-out sponge. You can test your compost by squeezing a handful of the compost until the particles stick together. If it

Aeration:
The process of exposing something to oxygen.



Chop or shred materials that you add to your compost pile.



Turn or aerate your compost pile every three to 10 days.



Keep your compost pile as damp as a wrung out sponge, just between drippy and crumbly.

Cover your compost pile with burlap or another natural, breathable material.

drips, it is too wet, if it falls apart when it is released it is too dry. Covering your compost pile with a blanket, tarp or burlap bags is a good way to keep moisture in the pile, insulate it, and keep excess moisture from rain out. If your pile becomes too dry, you can spray it with a hose after turning it, or poke holes in the pile and pour water in. If it becomes too wet you can dry it out by fluffing and turning it, adding dry materials, or leaving it exposed if it is sunny.

pH

pH: The level of acidity or alkalinity of a material.

The last component important for speeding the decomposition of the pile is the pH. Bacteria can only survive within a certain range of pH, and will thrive in a heap that is nearly neutral. Usually a heap will naturally maintain a near neutral pH, without any monitoring or work. If, however, you tend to load your pile with very acidic or basic materials, you may run into problems. To avoid problems, simply add more material of the other type. If you are experiencing major problems with acidity, you may consider adding a little bit of sulfur or lime or adding egg shells.

Activators and Accelerators

Another factor in how fast your compost heats up is whether or not you add a compost activator. Activators are not necessary for producing fast and hot compost, but they do make it easier. Activators and accelerators add microorganisms or nutrients for microorganisms to the pile. The easiest and cheapest activator to get is soil from your garden or compost saved from another pile. Both of these add microorganisms to the pile, and kick-start microbial action. Store-bought soil is often sterilized, and so it does not add microorganisms to your soil. Manure and blood meal are other organic activators. They both add nitrogen to the pile, which is food for microorganism. It is also possible to buy commercial synthetic and organic activators. If you decide to use a commercial activator, many garden stores and online compost resources sell them. 🐛



Add finished compost from old compost piles, or soil from the garden to new compost piles.

Vermicomposting

In this section you will learn how to use worms to turn plant and food material into soil. You will learn how worms produce soil and how to keep worms happy by:

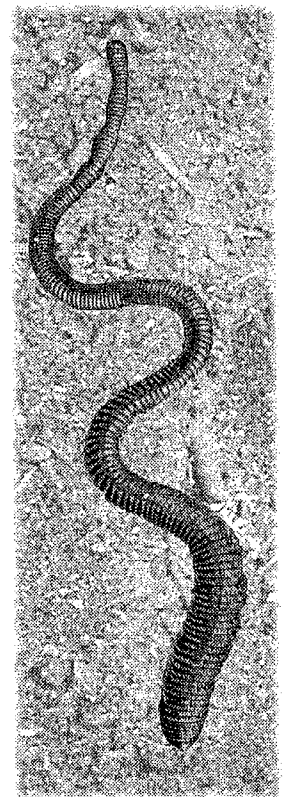
- ☞ establishing bedding for them
- ☞ maintaining the right temperature and moisture levels
- ☞ maintaining a near neutral pH
- ☞ feeding the worms what they like
- ☞ cutting up the food for the worms

Vermicomposting takes advantage of very different processes than pile composting. In vermicomposting worms do the bulk of the processing of raw plant and food materials with some help from psychrophilic (cool) bacteria and other microorganisms. In pile composting bacteria do most of the work with some help from worms and decomposer organisms. Some of the factors that affect how quickly and easily vermicomposting will happen are the same, but for very different reasons. The worms used in vermicomposting are not night crawlers or field worms, but rather red worms, also known as litter or manure worms. These worms can process their weight in organic waste daily.

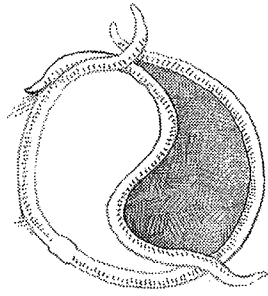
Worms consume all decomposing organic matter that they come into contact with. They eat both decaying and fresh plants, protozoans, rotifers, nematodes, bacteria, fungi, the decomposing remains of other animals and bits of soil. As they eat, the chemicals in their bodies free the nutrients of the materials that they are eating. The worms then excrete what they have eaten in the form of castings, which are more rich in nutrients than regular humus and provide most of the benefits of humus, though their texture is somewhat different.

In vermicomposting, there is very little that can be done to speed the process, only steps that can be taken to make sure that the process continues smoothly. Initially the worms will take a few days or weeks to become comfortable and well established in any sort of worm bin, and after that they can be fed regularly.

Vermicomposting: Using worms to process organic matter into rich soil.



Humus: The nutrient rich product of decomposed organic matter.



Before you begin to vermicompost you need to get your worms established. The first step is to create a comfortable environment, or bedding, for them. Bedding holds moisture and allows air to circulate. Bedding should be a natural material because the worms will eat it and it will become part of their castings. Good bedding materials include shredded newspapers, coconut husk fibre (cocofibre) and shredded corrugated cardboard. Leaves can be used but tend to bring in undesirable organisms or insects from outdoors. Moisten any type of paper or bedding material before you use it. It is a good idea to use more than one type of bedding material in order to create a moist, but fluffy environment for the worms. When you are starting your worm bin put a layer of 10 to 15 cm (4" to 6") of bedding in the bottom. Make sure that the bedding is moist, but not dripping. Small additions of soil should be mixed with the bedding, just enough to coat it. This provides grit for the worms' digestion. Soil should not be used as a bedding, as red worms are not soil-dwelling worms and it will be too heavy for them. Peat moss is also not desirable as it is too acidic for the worms and is not sustainable.

Once the bedding is established, give the worms a couple of handfuls of food scraps to begin with. Do not give them more food until they have finished eating what you have given them. Once you do this a couple of times you can begin giving them more food. You should add 1 kg (2.2 lbs) of food waste to your bin for every 2 kg (4.4 lbs) of worms that you have. Keep food scraps completely buried under the bedding. You can feed the worms every day or as infrequently as every two weeks. Whenever you feed the worms add a small amount of food material at a time. If you try to over-feed the worms, they will not be able to eat the food before it starts to rot or smell bad.

Harvest your worm compost when the original bedding material is no longer identifiable and most of the food scraps are gone. Take out any undigested food scraps and try to keep as many worms out of the harvest as possible. One way to do this is to take a



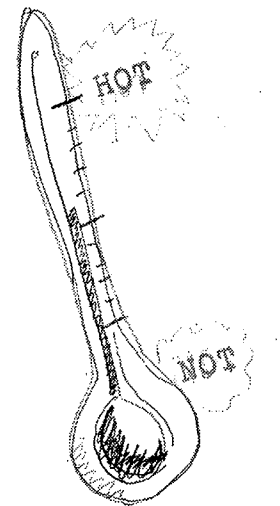
thin layer of digested material from the top about 2.5 cm (1") at a time. Wait between layers. Worms hate light, so they will escape deeper into the bin as you take each layer off. This process can be accelerated by shining an extra light source on the bin during harvesting. When you are done harvesting establish new bedding.

The factors that need to be considered in vermicomposting all concern keeping the worms happy, much as the factors to be considered in pile composting generally have to do with keeping the bacteria happy. The factors are:

Temperature: Redworms can only survive between 20 and 25°C (65 and 77° F). Because of this they must be kept either in an inside space or a well insulated place in cold temperatures. This also means that you never want your vermi-composting operation to heat up very much, which is the opposite of what you want in a pile composting operation. To prevent heating from happening, add only small amounts of material at a time, or large amounts spread thinly over a large surface area and do not use compost activators. Do not pile materials for vermicomposting. If your worm bin gets too hot, the worms will try to escape from the hot area to cooler areas. If most of your raw material is in a hot area, this will slow the composting process, and could inhibit the worms from reproducing.

Materials: It is a good idea to maintain a good carbon to nitrogen ratio in vermicomposting, but the ratio is not as important as in pile composting. What is more important is that the moisture level of the vermicomposting operation is maintained at a good level, that the pH is maintained near neutral, and that all food scraps are covered with some sort of brown material to prevent fruit flies. Avoid salty foods, as salt tends to dry out the worms. Similarly, greasy foods will slow the worms down, and can create a slight smell.

pH: Red worms need a near neutral pH (7) to survive. If the pH becomes very acidic (below 5.5) they may die off. Unlike in pile composting, the pH of vermicomposting operations does not





Chapter 3

Examples of Mid-Sized Composting Operations

Examples of Mid-Sized Composting Operations

The following case studies illustrate some of the different ways that mid-sized composting operations can work based on a variety of factors. They show that every group and situation is different and there is no one system that will work in every situation. Your group will have to look at what resources are available to you and how much work you want to put into your compost operation. You can use the case studies as examples that you may want to copy, and draw from their experience. The section following the case studies will help you to decide how want to set up your mid-sized composting operation.

In a Mid-Sized Organization

The composting system at FoodShare Toronto is an example of a mid-sized composting system associated with a mid-sized business or organization. FoodShare's programs are run from two sites, the Research and Education Centre and the Field to Table Centre (FTT). The compost operation is located at the Field to Table Centre.

The programs run out of FTT produce almost all of the food and plant material composted at FoodShare. Many programs at FTT either produce food scraps, garden scraps, or bring in and distribute large quantities of produce. As a result, FTT produces between 90 and 225 kg (200 and 500 lbs) of food and garden waste weekly. Untreated wood shavings from a wood-working shop, siftings from matured compost piles, twigs, mulch material, and leaves collected from the grounds of FTT are the brown, or carbon rich component of FoodShare's compost raw materials. FoodShare also includes small portions of greasy foods, dairy products and fish and meat. They add these materials in very small portions relative to the other materials in each bin (0.5 kg to 2.25 kg per 115 to 225 kg or 1 to 5 lbs per 250-500 lbs). Occasionally FoodShare also experiments with including other materials in the piles, like manure.

Mike is a part-time staff member at FoodShare whose sole responsibility is to oversee the composting operation. Mike is aided by volunteers who collectively contribute at least one day a week to the composting operation, though often more, and by the staff and program participants of FoodShare. Mike tends to the compost several times a week and makes decisions about what should and should not be put into the compost.



The FoodShare site is often used as a facility for educating the public about composting. Mike demonstrates the process to some school children.

Mike generally mixes half food waste and half woody, carbonaceous material, by volume. By weight this is approximately $\frac{2}{3}$ food waste to $\frac{1}{3}$ woody, carbonaceous material. Mike has found that this proportion works well to minimize smell, and to speed the decomposition process.

Participants in FoodShare programs and FoodShare employees all contribute to the compost. As they eat and snack throughout the day everyone at FoodShare puts their food waste into open buckets which are located next to garbage cans all around FTT. These buckets already have some wood shavings in them. At the end of each day FoodShare employees empty the open buckets into garbage can containers that can be easily closed. People that run the catering programs and the Good Food Box program also put unused, or decaying produce into the garbage can containers. Mike usually empties the garbage containers once a week, though sometimes he does it twice during the hottest times of the summer, when they would become stinky.

Mike empties the garbage can containers into the first of 18 wood and wire mesh cells.

The cells are constructed in groups of three. Each cell has a capacity of approximately 0.85 cubic meters (30 cubic feet) which means they can hold between 225 and 315 kg (500 and 700 lbs) of raw material. Each cell in the set has a bottom and four walls all constructed of spaced wooden planks which allow air to move freely into the compost pile and are all lined with a 6 mm (0.25") metal mesh. Each cell has a hinged door at the top, which is solid and is not lined with mesh, but has the capacity to allow the cells to be locked. The front wall of each cell is made of four panels which can be easily removed to enhance access to the materials inside.

Before he empties the garbage containers into the cells, Mike combines the food and plant waste with wood shavings and chops the mixture. FoodShare program participants help Mike chop the material. They chop the mixture into pieces approximately 2.5 cm (1") square using straight edged shovels. Mike then layers the chopped mixture is with woody material and siftings of uncomposted material from former compost piles. Mike leaves this new compost pile uncovered for a week, and within a couple of days it is generating heat.

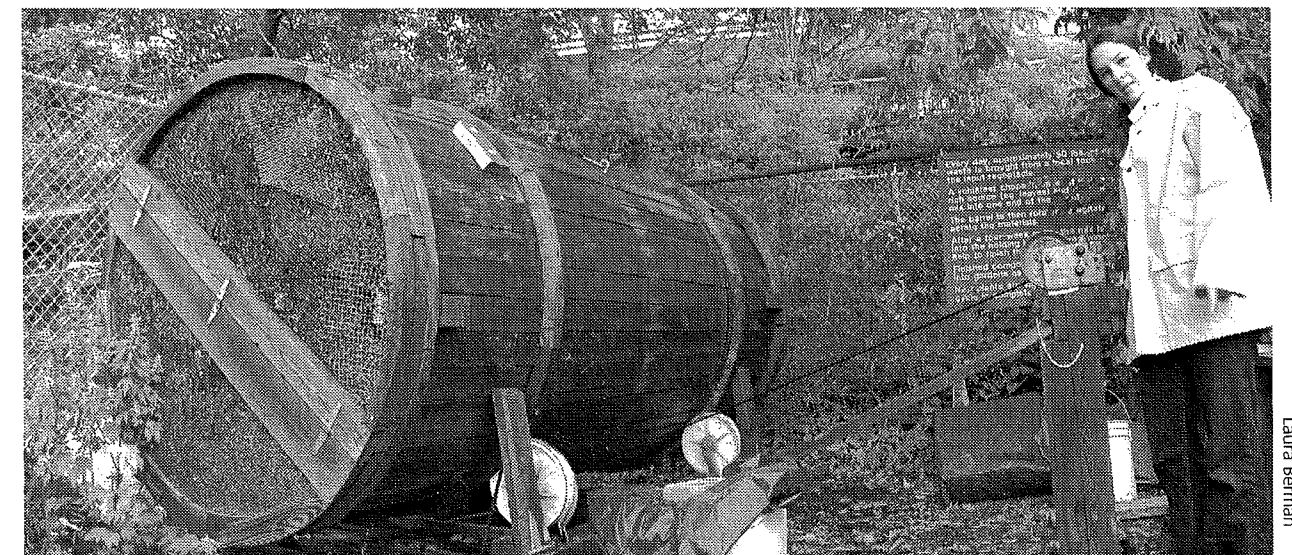
Sometimes instead of using the wood and wire mesh cells, Mike uses a large cedar composting barrel. The barrel is 1.2 m (4') in diameter and 2.4 m (8') long and has an interior

capacity of 2.8 cubic meters (100 cubic feet). A 1,225 kg (2,700 lb) winch allows the large barrel to be turned with minimal effort. The interior of the barrel is split into two separate cells. The barrel was initially constructed for \$3,000 (Canadian) as a prototype⁸. The barrel can safely and easily hold at least 550 kg (1,200 lbs) of material.

Using the barrel to turn the compost pile is much easier and faster than in the wood and wire mesh cells. However, because it is not anchored to the ground and is very large and heavy and because of the strength of the winch, there are many safety and maintenance concerns associated with it. For example, if the barrel is not similarly weighted on both sides, it could tip or if the winch is not used properly, it could cause significant head or facial injury.

If he is using the wood and wire mesh cells, Mike moves the contents of the new pile into a second cell after about one week. If he is using the barrel, Mike simply turns the barrel using the winch. In either case this turning or movement aerates the material and puts new material into the centre of the pile, where the most decomposition activity is happening. If the pile is too dry at this point, Mike mixes in some water. If it is too wet, he leaves it exposed to the sun and adds wood shavings or straw. Usually, however, the moisture content is fine and after he turns the pile, Mike covers it with burlap bags from a fair trade coffee establishment. The burlap bags keep both rain out and moisture in, helping to maintain the proper moisture balance in the cell. The bags also insulate the pile, keeping microbial activity levels as high as possible.

During the next 13 weeks, Mike, turns the compost pile every one to two weeks and continues to monitor and maintain the moisture levels. After 13 weeks, all of the food matter is composted and very little temperature is being produced. At this point Mike and his volun-



The FoodShare barrel with Ravenna Barker.

teers roughly sift the pile with a 1.25 cm to 2.5 cm (0.5" to 1") mesh. Mike takes out all uncomposted material and sends it through the composting process once again.

After it is roughly sifted, Mike puts the finished compost into a holding bin, where it is aged, ideally for at least one month. The holding bin is constructed of wood and wire mesh. This bin is wide and low, and has no top. It is approximately 2.5 m (8') wide and 2 m (7') long with a depth of only 60 cm (2'), making its capacity approximately 3.25 cubic meters (115 cubic feet). The front of the bin can be removed, allowing the material inside to be easily extracted. After it is aged, Mike will either finely sift the compost with 6 mm (0.25") mesh so that it can be used with seedlings or send it to be used on FoodShare's gardens.

Completing the entire composting process and producing finished compost at FoodShare takes about three months. One batch of compost is produced every two to five weeks which means that between 15 and 25 batches of compost are produced each year. For every 4 kg (9lbs) of raw material put into the compost, this system produces between 2 and 3 kg (4.5 and 6.5 lbs) of finished compost. For every 6 kg (13 lbs) of finished compost that is produced, 1 kg (2.2 lbs) of compost siftings is created. The siftings are usually twigs and wood pieces.



Mike adds to a batch of rich, dark, finished compost.

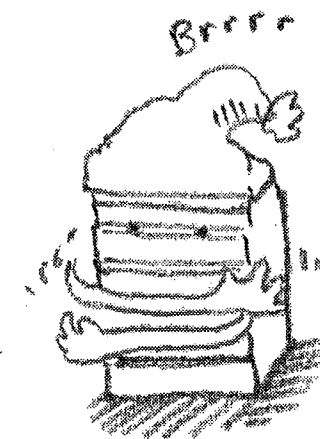
The entire composting operation is located in the large area behind the main warehouse which houses FTT's other programs. FTT has no nearby residential neighbours, and the surrounding businesses are also housed in warehouses, with very little outdoor activity. Because of this, FoodShare does not have to deal with neighbours concerns about aesthetics, pests, or odours. Other advantages of the location include that wastes do not have to be transported, and though the operation is easily accessible, it does not dominate the appearance of the FTT Centre.

Having the compost operation situated in an open space away from tall buildings means that it gets significant sun exposure, helping the cells to heat. In the winter, however, this means that the cells are exposed to significant wind, increasing the possibility that the

cells will freeze. In past years, placing straw bales outside of the cells to insulate them has combated this problem. This straw is later used in the cells as brown material. The operation is located close enough to the warehouse that its water sources are accessible, which is very useful in hot weather for keeping the cells moist. Additionally, the compost area is near to the outdoor gardens at FTT, and is easy to get to from the FTT rooftop garden. Having a composting bin on the rooftop, or closer to the front garden would make getting soil to those garden easier, but would require that some material undergo a different composting process, which would likely take more time than the process currently does.

There are a few variations and problems that Mike sometimes encounters in running FoodShare's composting operation. During the coldest times of the winter composting activity at FoodShare slows down. While most cells will continue produce some heat, despite below freezing temperatures, most will not achieve temperatures above 38° C (100° F) when the outside temperature is colder than -12° C (10° F). This limits the activity of the hot bacteria during the deepest cold of the year and slows the composting process. Deep cold also freezes older cells in which most microbial activity has stopped which makes sifting the finished cells very difficult. In a place like FoodShare that has a constant input of raw organic material, a slowdown can be very problematic if temperatures stay too cold for too long, causing a backlog of organic material, for which new spaces have to be found.

Smell from FoodShare's composting operation is not generally a problem, but it does occur. Most often new cells will have a slight ammonia odour which Mike can smell while the cell is being turned. He can only smell the cell within a meter of the cell. However, on occasional hot days after rain or at the beginning of the spring, when cells are beginning to unfreeze, some cells can produce an odour that Mike can smell from the distance of a few meters. These smells, however are only ever experienced when the cell is being turned.



There has occasionally been a rat or mouse that has tried to make a home in one of the wood and wire mesh bins at FoodShare. These creatures find their way into the bins through holes in the mesh, but often do not choose to stay for very long, as the temperatures in the cells become uncomfortable for them, and available food scraps quickly become inedible to them. When rats and mice do appear, Mike checks the bins for holes in the metal mesh, and patches them. Raccoons and opossums have not yet visited FoodShare's compost operation.

The following two charts track the life cycle of two average compost batches going through the wood and wire mesh bins at FoodShare. They illustrate what can happen under ideal composting conditions. They also show that while there is a science to composting, there are always variations and each and every compost pile is a unique experience. 🐛

Compost Batch One

Initial input: 222 kg (490 lbs) chopped food waste

45 kg (100 lbs) woody material and compost siftings

Week	Cell Temp. (°C/°F)	Outside Temp. (°C/°F)	Volume	Time Since Last Turning	Decomposition LEVEL
Wk. 1 Day 1	26°/78°	26°/78°	Full	—	All food matter and woody material clearly identifiable and separate
Wk. 1 Day 3	54°/130°	31°/88°	Full	—	Most food matter beginning to decompose
Wk. 2	67°/152°	32°/90°	7/8 Full	5 DAYS	Slight ammonia smell, lots of fungus on burlap bags, gnat activity inside and outside, food matter becoming unidentifiable
Wk. 3	70°/158°	24°/75°	7/8 Full	11 Days	Slight ammonia smell, grey webbing fungus throughout pile, most food unidentifiable except for avocado seeds and corn cobs
Wk. 4	49°/120°	16°/60°	6/8 Full	7 Days	Smell gone, webbing fungus continuing, texture very chunky and sticky, uniform dark brown colour, lots of bug and worm activity
Wk. 5	46°/115°	18°/65°	6/8 Full	4 Days	Texture becoming finer, still very sticky, webbing fungus continuing, bug and worm activity continuing
Wk. 6	46°/115°	22°/72°	5/8 Full	3 Days	Webbing fungus gone, texture and color same, bug activity subsides, no visible worm activity (likely due to weather conditions)
Wk. 7	41°/105°	32°/90°	Same	5 Days	Worm activity resumed
Wk. 8	18°/65°	22°/72°	Same	2 Days	Lots of worm activity, increased fineness in texture
Wk. 9	23°/73°	17°/62°	Same	9 Days	Same
Wk. 10	21°/70°	21°/70°	Same	7 Days	Almost finished, texture very fine, worm activity continuing
Wk. 11	32°/90°	26°/78°	Same	14 Days	Same
Wk. 12	31°/88°	32°/90°	Same	4 Days	Same
Wk. 13	27°/80°	21°/69°	Same	11 Days	Compost finished and sifted

Compost Batch Two

Initial input: 195 kg (425 lbs) chopped food waste

35 kg (75 lbs) woody material and compost siftings

Week	Cell Temp. (°C/°F)	Outside Temp. (°C/°F)	Volume	Time Since Last Turning	Decomposition LEVEL
Wk. 1 Day 1	29°/84°	29°/84°	Full	—	All food matter and woody material clearly identifiable and separate
Wk. 1 Day 4	43°/110°	27°/80°	6/8 Full	1 Day	Most food matter beginning to decompose
Wk. 2	66°/150°	26°/78°	Same	4 Days	Slight ammonia smell, lots of mold on burlap, food beginning to decompose
Wk. 3	71°/160°	32°/90°	Same	5 Days	Grey webbing, fungus throughout, texture very rough, food still visible, smell persisting
Wk. 4	66°/150°	21°/69°	5/8 Full	12 Days	Webbing and smell persist, some visible food, rough texture, mushrooms growing
Wk. 5	54°/130°	26°/78°	Same	4 Days	Smell absent, webbing absent, texture very sticky, colouring becoming homogenous, lots of bug activity, mushrooms gone
Wk. 6	47°/116°	32°/90°	Same	5 Days	Texture becoming more fine, lots of worm activity, pile full of ants
Wk. 7	38°/100°	17°/63°	Same	12 Days	Same
Wk. 8	35°/95°	17°/62°	Same	7 Days	Same
Wk. 9	33°/92°	16°/60°	Same	4 Days	Colour homogenous
Wk. 10	32°/90°	26°/78°	Half Full	11 Days	Same
Wk. 11	31°/88°	32°/90°	Same	5 Days	Texture becoming finer
Wk. 12	28°/83°	20°/68°	Same	12 Days	Same
Wk. 13	28°/82°	26°/78°	Same	7 Days	Compost finished, ready to be sifted

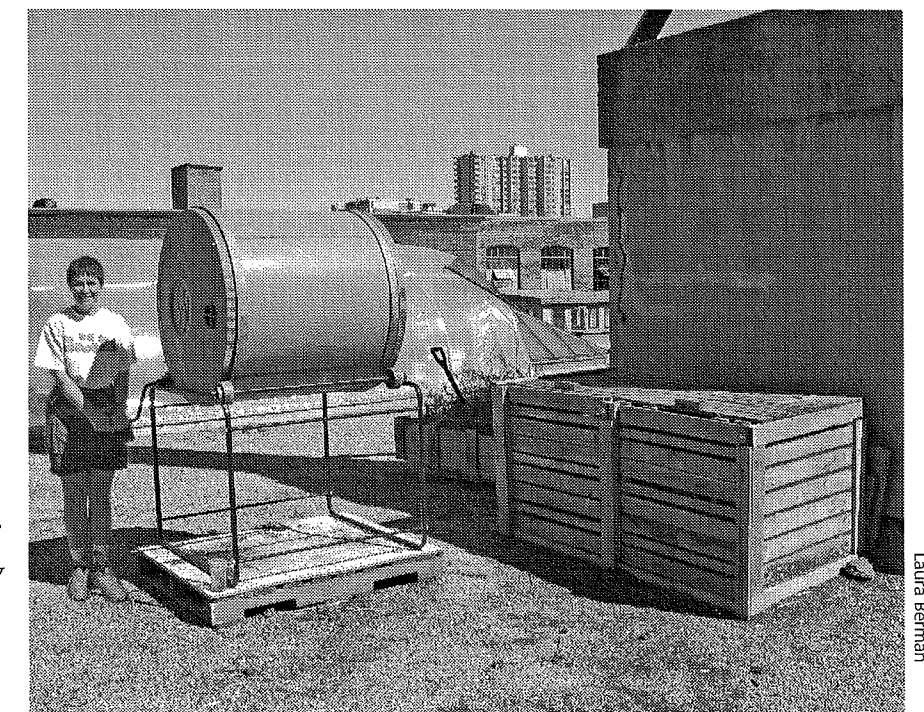
Composting Systems in Office Buildings

401 Richmond St., Toronto¹⁰

In the 1990s an environmentally conscious developer converted 401 Richmond Street West from an industrial facility into an office building. The building is now home to over 130 artists, environmental organizations and entrepreneurs¹⁰. The developer renovated the building in an environmentally friendly way, incorporating energy and resource efficient methods and technologies. During the renovation, they converted the roof of the building from empty, unused space into a vibrant garden. The garden is grown in wooden boxes filled with soil.

Beth Anne and Mike run the compost and garden at 401 Richmond. Recently, they began to produce herbs and vegetables in the garden, which are used in the restaurant on the first floor of the building. The restaurant, in exchange, provides the gardeners with scraps from food preparation to use in its roof-top compost. The restaurant collects its scraps from food preparation in a bucket, which it fills weekly and sends to the rooftop. The bucket tends to be heavy and so Beth Anne and Mike get the bucket to the compost containers using an elevator and a dolly. They also put plant trimmings and unseeded weeds from the rooftop garden into the compost pile. Finding brown material for the compost was a challenge for Beth Anne and Mike until they recently began using untreated wood shavings from a nearby carpenter's shop.

Beth Anne and Mike use a plastic compost tumbler and a three-bin wood and wire unit for their compost operation. Both units have been carefully placed over the ends of beams, so that the roof is not overstressed. Expansion of the operation might be possible, but it would be important to be sure that the roof could support the additional weight. The plastic tumbler is raised off of the ground in a frame and is easily turned with a handle. Because it has a large enough capacity, and makes turning very easy, the composting is begun in the tumbler. Beth Anne and Mike put most of the raw plant and



Beth Anne, with the compost turner and bins on the roof of 401 Richmond Street.

food materials into the tumbler first and turn it every few days. After a couple of weeks when the tumbler is full they move the material into one of the three wood and wire mesh bins, where they monitor and turn it every several days, until the compost is needed. The compost piles at 401 Richmond heat some, but they do not reach thermophilic temperatures. This is likely because a critical mass of material is not achieved in the bins.

There is a high demand for soil for the gardens at 401 Richmond and, until very recently, there was insufficient labour available to speed the composting process. Because of this, Beth Anne and Mike often use the compost unfinished. They bury compost, often in the form of large pieces of only partially processed food, underneath a top layer of soil in the garden boxes. Unfinished compost makes up one third of the total soil in almost all of the boxes. Even though unfinished compost is not as good as finished compost, the gardens at 401 Richmond flourish.

The main problem that the composting operation at 401 Richmond has to deal with is contamination of plant and food materials with uncompostable materials. Often people who contribute to the compost will add with plastic bags, rubber-bands, and food packaging to the compost buckets along with raw food and plant material. This slows the composting process and means the Beth Anne and Mike have to spend time removing the foreign material. Beth Anne and Mike are combating this problem by holding compost demonstrations that the entire building, and especially the staff of the restaurant, are invited to. These demonstrations are helping to reduce contamination of the compost in a non-confrontational way. They also increase public knowledge about composting, and it is hoped that eventually because of these demonstrations others in the building will participate in the composting operation and will know what materials are appropriate to put in the compost.

The only other problem that Beth Anne and Mike have experienced is that a few mice have been drawn to the compost pile from time to time. This is likely because the pile does not heat enough to make an inhospitable environment for the mice. ♪

Beth Anne and Mike often use their compost unfinished ... the gardens at 401 Richmond Street flourish.

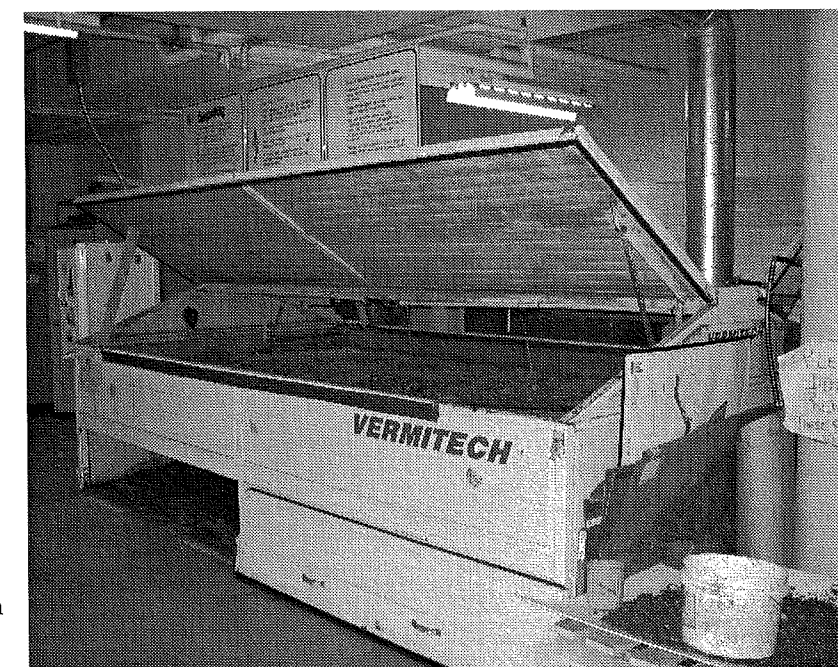
Metro Hall¹²

The composting operation at Metro Hall is an example of a mid-scale vermicomposting operation. Metro Hall is one of two buildings out of which most of the services of the city of Toronto are run. It is located in the heart of downtown and has almost 2,000 tenants as well as a cafeteria and a number of smaller food establishments. In the basement of this building is a large vermicomposting unit. The installation of this unit was an initiative of the employees' Environmental Working Group, Facilities Management, and Works Department staff.¹³

The worms in this unit can eat their own weight in plant and food material daily (about 90 kg or 200 lbs!). During 2002 they ate over two tonnes of food waste and nearly one tonne (0.98 tons) of paper towels. This produced more than 400 kg (880 lbs) of castings.

The materials composted at Metro Hall are uncooked food waste such as fruit and vegetable peels and off-cuts from the cafeteria, paper towels from staff bathrooms, and food scraps collected from staff offices. The majority of the green materials come from the building's main cafeteria. Each person who prepares food in the in the cafeterias and food concessions has a plastic bin nearby them. They put both greasy and non-greasy food materials into the bins instead of into the garbage as they are preparing food. Cafeteria staff bring the bins to the basement and maintenance staff bring the unbleached paper towels from the staff bathrooms and food scraps from the staff floors to the basement, where the worm bin is.

Bridget and Miodrag then take over the composting operation at Metro Hall. First they separate the greasy and non-greasy materials. Food waste that is greasy is sent for composting at the Dufferin anaerobic digester. Bridget and Miodrag then combine the non-greasy food materials and the unbleached paper towels in a proportion of 4 kg to 1 kg (8.8 lbs to 2.2 lbs). They put the combined materials into a grinding machine that shreds and pulverizes the materials. Then they spread the mixture over the entire surface of the worm compost in a layer that is between 1.3 cm and 2.5 cm (.5" and 1") deep.



Bridget and Miodrag con-

This is the large worm-composting bin at Metro Hall and holds 200lb of worms.

stantly observe the bin and assess its needs. They pay attention to temperature, moisture, the thickness of the pile, and worm population. What they do each day depends on the conditions of the pile on a given day.

The unit is a large, shallow steel bin which has the surface area of a parking space 4.3 m x 1.5 m (14' x 5') and is filled with 90 kg (200 lbs) of red wiggler worms. As the worms digest the organic material, they move upward and leave their castings behind on a suspended grating. A mechanical raking system loosens the lower-most portion of the castings and deposits them in a chamber from which they can be removed. Once the castings are harvested they are either used immediately on city parks and beds or are dried out for future usage. If the castings are gathered and not used or dried out, they tend to heat up, and lose their nutrient richness.

For this system to function smoothly, it is very important that the moisture and temperature be controlled. A thermostatically controlled, mechanical ventilation system takes care of this aspect of the operation. The vermicomposting unit produces almost no smell at all, and does not attract pests.

Bridget and Miodrag sometimes have problems with the worm composting unit. One problem that they sometimes have is a matting fungus which forms on the surface of new material put into the bin. This fungus stops air circulation in very local areas of the bin, causing heat to build up. Heat slows down in the worm activity, and thus composting in those areas. Bridget and Miodrag have noticed that the matting fungus occurs more often when the proportion of paper in the bin is greater than the proportion of green material.

The second problem that Bridget and Miodrag have is red mites. These tiny creatures live in the bin along with the worms and sometimes their population explodes. The red mites eat the worm eggs, slowing down the composting process. Bridget and Miodrag have discovered that the mites can be controlled by watering an area of the unit. This brings the mites to the surface. Bridget and Miodrag put a piece of food, like a slice of bread or fruit peel on the top of the unit, where it has been watered. This piece of food attracts the mites once they come to the surface, and allows Bridget and Miodrag to easily remove them from the bin.

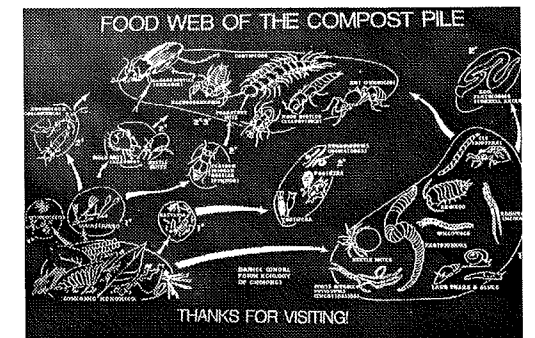
The finished worm compost produced at Metro Hall promotes itself! Small bags of the compost are distributed to staff by Facilities Management during "Compost Give-away" events for Earth Week and Environment Week. This creates awareness both of the program and the value of the compost.

Publicly Administered¹⁴ and Run Composting Systems

High Park Children's Garden

High Park is the largest public park in the downtown area of the city of Toronto and is surrounded by restaurants, stores, houses and high-rise apartments and condominiums. It spans almost 162 hectares (400 acres) and includes a small zoo, gardens, community event areas, restaurants, and open and wooded green space. The Children's Garden is located in the park and is maintained and programmed by the Children's Garden and Exploring Toronto Programs of the City of Toronto's Parks and Recreation Division. The Children's Garden hosts school groups in the spring and fall and a camp during the summer as well as community events, family drop-in programs and volunteer work parties. Children participate in planting and tending several raised beds in which they grow vegetables, herbs and flowers. A compost demonstration site is located next to this garden. Compost demonstration sites in Toronto were an initiative of the Master Composter Program, which was run by the Recycling Council of Ontario and fueled mainly by volunteers. The program and demonstration sites were funded and then taken over by the Toronto Works Department. City employees are at the site most weekdays from May to September and volunteers are often present one or two Sundays a month during the growing season. The Children's Garden and Exploring Toronto Programs also hold occasional compost demonstrations and staff training at the site to educate others about how to compost.

This compost demonstration site includes one three-cell wood and wire mesh unit, three different types of black plastic home composting units, and one leaf-holding unit that is made of a 2.5 cm (1") wire mesh in a wood frame. When the site was established, signs were put up that explain the composting process, factors that affect composting and explain how to use the composters at the site. They clearly convey how composting happens and why and how anyone should compost.

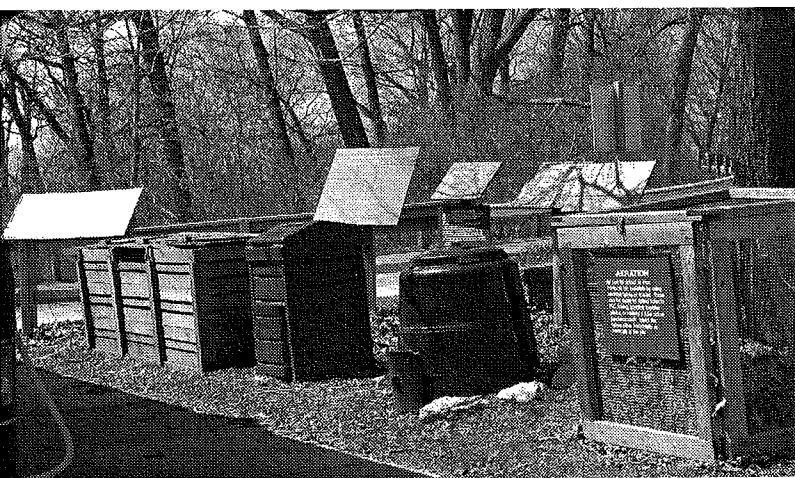


Signs like this help illustrate how composting works at the High Park site.



The compost bins at High Park.

The three bin wood and wire mesh unit is where most of the composting is done, the three plastic units are used for overflow, and the leaf unit is used to store brown materials to put into the compost, once they are partially composed. People who use the compost operation always add raw compost materials to the far left cell of the three bins. The middle cell holds partially composted material, and the right cell holds compost that is almost finished. All three bins are turned and watered about once a week by Children's Garden Program staff or volunteers. When the cell on the left fills up, the Children's Garden staff empty the right cell into the gardens or put it in a holding area. They then shift the contents of the other two bins to the right and begin filling the left bin once again. The materials are usually shifted during community events because it requires a lot of time and effort, and because involving the community creates awareness of composting, and the garden.



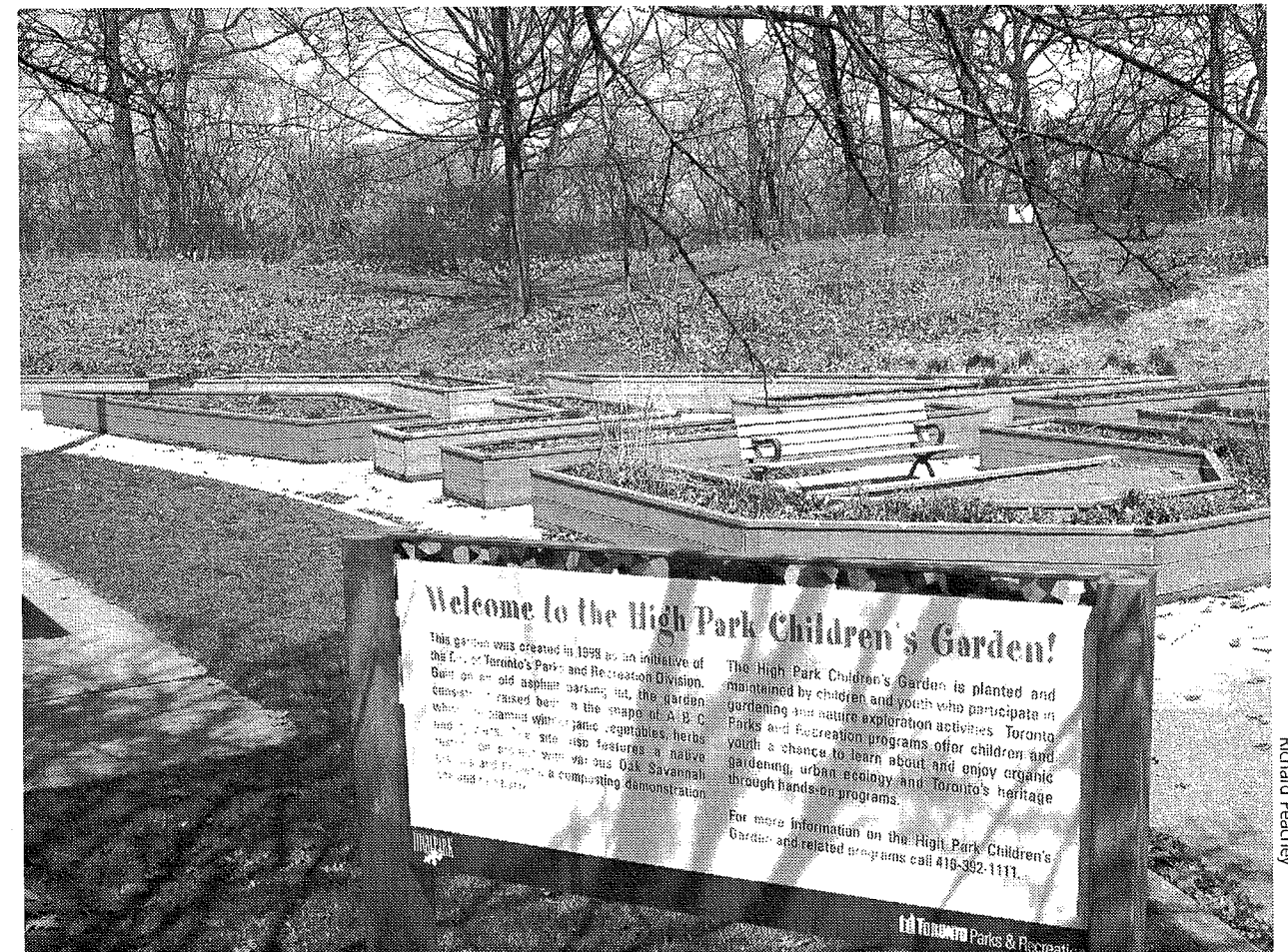
The three bin wood and mesh unit is used more than the home composting units for a number of reasons. The first is that it is easier to turn the material inside, since they have wider openings at the top and the front is removable. The second is that the capacity of the three bin unit is greater than that of the home composting units, which allows for more material to be com-

posted. The third is that because there are three bins connected and they open easily, they are ideal for demonstrating the composting process. Because only one cell is filled at a time, each of the three cells is always at a different phase of decomposition, clearly demonstrating how composting works. This is very important because the Children's Garden has an educational focus. Having the home composting units at the site is important as well, as they demonstrate different types of containers that individuals or families can use.

The raw organic material that is put into the High Park Children's Garden compost comes from both the site and from outside sources. All of the plant and vegetable waste produced from the garden and by those attending programs at the site is put into the compost. This includes weeds that have not gone to seed, plant trimmings, waste from children's lunches and waste from food consumed at community events. Leaves from the site, which are mostly oak, as well as straw that has been used as mulch are the brown material that is added to the compost. Local community members who participate in programming on site are invited to add their household plant and vegetable waste to the compost, and some do. In addition to this, coffee grounds from a local organic coffee shop and eggshells from a local restaurant are also

occasionally added. Community members very rarely add anything to the compost that should not be added, such as dairy, meat or fish products. On rare occasions non-organic waste, such as plastic bags or drink containers are found in the containers.

The High Park compost usually gets enough raw materials at once to generate some heat. For three years, the compost site was getting all of the coffee grounds from an organic coffee shop. At that time, the compost would reach temperatures around 60 °C (140 °F) and would be finished in about six weeks. Since the City of Toronto has started curbside collection of compostable waste from restaurants, coffee grounds are now only occasionally added to the pile. This has slowed the process. Temperatures of the piles are not monitored daily, but it seems that they reach 40 to 50 °C (100 to 120 °F), and they definitely maintain levels well above outdoor temperature. Between the spring and fall the site produces three to four finished bins of compost. During the winter the composting process slows considerably due to low temperatures and reduced maintenance. Two bins are left dormant and fresh material is added to one bin only. When the spring begins, new material is added to the bins that have sat dormant to jump-start microbial action, and to finish off the compost that has been sitting all winter.



Richard Peachey

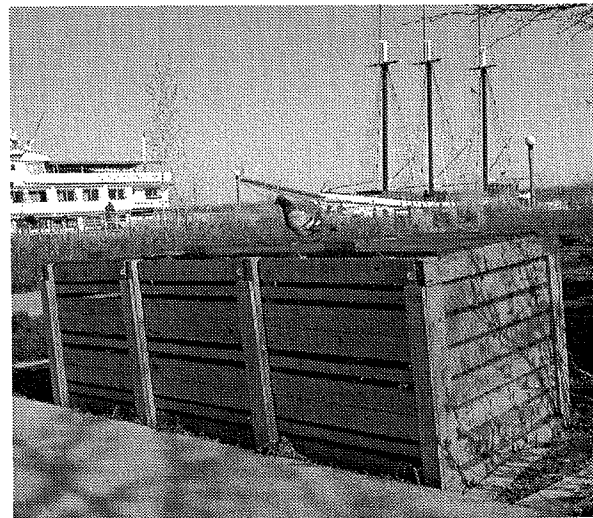
The High Park compost operation runs with very few problems. The compost piles do produce some odour when they are being turned, but the smell is only experienced within a meter (3.3") of the bins. There have seldom been rodent problems, and on the occasional times that a rodent has been sighted it has been due to a hole in the mesh and has been during a time when the raw materials bin did not have enough new materials to generate sufficient heat. The solution has been to replace the mesh when possible and to add more raw material, which speeds up the decomposition process and creates enough heat to drive the rodents out. Even so, pest problems have been minimal despite the compost's location in a park and there have been no problems with raccoons or opossums. This is partially due to the fact that all of the composters, including the various home style bins, are anchored to the ground and lined with wire mesh.

The location of the compost operation next to the Children's Garden is beneficial for several reasons:

- ☞ A broad and large population, including young children, are exposed to composting and have an easily accessible place to compost their food and plant waste
- ☞ There are no problems with neighbours who might find the operation unattractive or who would worry about smell
- ☞ Plant and food waste is produced near to the compost operation
- ☞ There is a nearby place to use the compost
- ☞ There is an easily accessible water source
- ☞ The site is easy to maintain, because those responsible for it are frequently there ☞

Waterfront Children's Garden

The composting operation at the Waterfront Children's Garden was also established by the City of Toronto and is overseen by the Children's Garden and Exploring Toronto Programs in partnership with the Harbourfront Community Centre. The garden is located near the intersection of Spadina Ave. and Queen's Quay Blvd. The Waterfront operation is similar to the demonstration site at the High Park Children's Garden, but varies in some very important ways.



Richard Peachey

The location of the Waterfront Children's Garden is somewhat different from the High Park site in that it is in a much more urban space. It was built near the Toronto Music Garden



Richard Peachey

The Waterfront Children's Garden is in an area frequented by tourists and surrounded by condominiums and apartments.

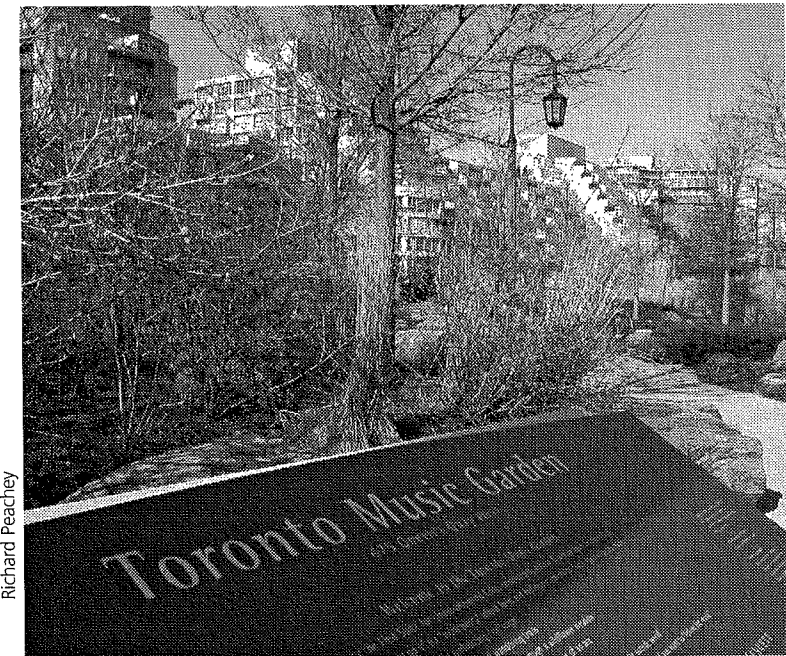
and is situated with a large open grassy space on one side of it and a wetland restoration site on the other. It is also located between Lake Ontario and Queen's Quay Blvd., a well-travelled roadway. The area is frequented by tourists and surrounded by condominiums and apartment complexes with the Harbourfront Community Centre a short distance away. The garden at this site is much smaller than in High Park and the composting operation only consists of a three-bin wood and wire mesh composter.

The sources of plant and vegetable materials for the composter include the garden, the Harbourfront Community Centre and household food scraps from the surrounding community. The composter was installed in the fall of 2000 and is not connected with a full compost demonstration site. There is currently no compost signage, though this is in the process of being created. The Children's Garden and Exploring Toronto Programs ran programming at the site from 1999 to 2001 and in 2002 began working with the Harbourfront Community Centre to increase the use of the garden and composter by children and youth in the community. The composter was not utilized much in 2001 or 2002 due to the amount of work involved in maintaining it but in 2003 it has been successfully maintained by community vol-

unteers and the children and youth participating in garden programming through the Harbourfront Community Centre.

This site has been more difficult to maintain than the High Park site for a number of reasons. First, due to the location of the garden by the waterfront, which is an area with less demand for recreational programming, there are fewer programs operated at the site. As a result, there is less maintenance of the site and fewer community members make use of the compost facilities. Additionally, this means that the staff of the Children's Garden and Exploring Toronto Program have less contact with local residents near the waterfront than with those near High Park. This has made it difficult to educate local residents about proper composting procedures. As a result, some of the community members who are using the composters seem to be uninformed about what should be composted and have put in greasy and processed food, dairy products, meat and fish, in addition to large amounts of non-compostable waste, like plastic bags and cans. The result of these factors had been that the compost was not maintained as well as it should have been and this occasionally resulted in odour and rodent problems.

The Children's Garden and Exploring Toronto Programs are now working with the Harbourfront Community Centre to address these problems. This partnership has led to a dramatic increase in community participation. As a result, there has been increased interest, usage and maintenance by community volunteers, Harbourfront Community Centre staff and program participants. Also, in 2003 the Children's Garden and Exploring Toronto Programs organized several community work parties at the site as well as more frequent volunteer clean-up days in co-operation with the Harbourfront Community Centre. These work parties generally included maintenance work on the composter. ♻️



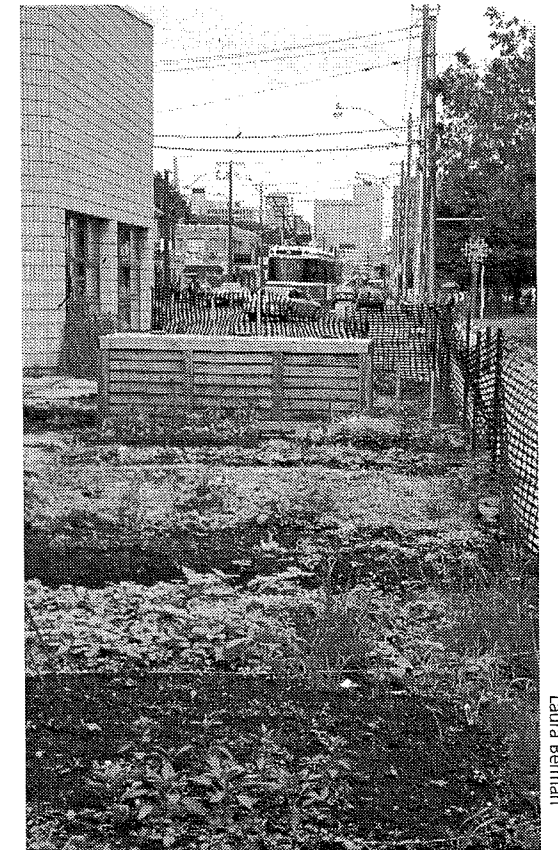
Richard Peachey

Community Organization Run Compost Systems

*Scadding Court*¹⁵ and the North Toronto Green Community's *Eglinton Park Heritage Garden*¹⁶

Scadding Court and the North Toronto Green Community are two community run organizations that have very similar outdoor composting operations. Scadding Court also does indoor vermicomposting both at the community centre and in a nearby school and daycare.

Scadding Court is a community centre located in downtown Toronto, in the middle of an area that is made up of low and middle income housing. Programs at the centre include recreational and athletic activities for all ages and all walks of life, including swimming, basketball, literacy classes and much more. A community garden surrounds the centre. The community garden is separated into small plots that people from the neighbourhood can rent for a small fee per season. A three bin wood and wire composting unit, like those at FoodShare, is located in the community garden area.



Laura Berman

Even in the centre of the city, composting makes sense. Here, it enhances the community gardens at Scadding Court.



Laura Berman

The **North Toronto Green Community** is a community group that works to improve the environment of North Toronto. They are a non-profit association that works to promote conservation through grassroots action and the development of sustainable, self-supporting, long-term initiatives that are community based. The community has a couple of paid staff members who coordinate and oversee all of the projects, but neighbourhood volunteers do much of the work. The **Eglinton Park Heritage Community Garden** is one of their many initiatives. The community garden beautifies the area, preserves, grows and disseminates heritage species, exemplifies how organic gardening can work, and produces food within the city. Next to the Eglinton Park Heritage Community Garden, is a three-bin wood and wire composting unit.

One difference between the two composting operations is that the Heritage Community Garden has signs, installed by the Master Composter Program and the City much like those at the High Park Children's Garden. They explain how the composting system works and how members of the community can and should contribute. Scadding Court does not yet have signs, but it is hoping to have some installed soon.

Both outdoor composting operations receive their nitrogen-rich green matter from the communities around them. They invite nearby residents to deposit their food scraps (other than dairy, meat, or fish) into the bins, and to dump in leaves that are kept next to the bins. Scadding court gets leaves from the grounds of the community centre while the city of Toronto provides the North Toronto Green Community with bags of leaves. Neither composting operation has had

problems with community members putting in inappropriate material, such as inorganic material or meat. Community members also do a good job in both places of balancing brown and green material.

Both sites fill approximately one bin every two months and produce between four and six full batches of compost annually. The North Toronto Green Community would like to receive more material, but finds that getting the word out to the community that the bins are available for public use to be a challenge. Both sites are also overseen by a paid employee of the community group, but maintenance is generally done by volunteers or co-op students. The North Toronto Green Community has enough volunteer labour that the compost is turned almost

once every two weeks. Scadding Court's compost is turned every several weeks. Because of the limited amount of materials and turning available to the composting sites, they heat only enough to support psychrophilic and mesophilic activity, or between 21 and 32 °C (70 and 90 °F). In both places the compost produced by the site is used on the surrounding gardens or is given to members of the local community.

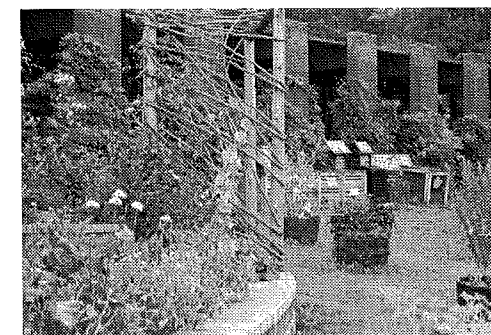
Although it has needed more raw materials for input, the Eglinton Park composting operation has had no problems with smell, pests, contamination or anything else. In contrast, Scadding Court has had to deal with occasional contamination with plastic and metal material, and a couple of rodents have visited. The difference is likely attributable to the absence of signs in Scadding Court, and that the location of its composting operation much closer to a residential area than the Eglinton Park operation. One final note is that because of awareness and capacity for composting at Scadding Court, the community centre and organizations around it were able to minimize the negative impact that Toronto's garbage strikes could have had on them. Instead of having to hire people to ship away their waste or having to deal with rotting garbage, they dug a large pit and composted all food waste during the strikes.

Krista is one of the many people at Scadding Court who does vermicomposting. Last year she and a co-op student did most of the work of overseeing the vermicomposting within Scadding court. Vermicomposting at Scadding Court is very different than at Metro Hall. It happens in plastic bins in classrooms at a nearby public school, at the centre's day care and in the centre itself. The plastic containers are very much like those used for household recycling. They are approximately 0.3 to 0.5 m (1' to 1.5') deep, 0.3 m (1') wide and 0.5 m (1.5') long and have lids. Krista drills small holes in the bottom and top of the plastic containers for aeration, and puts a thin piece of cotton, burlap, felt or other natural fibre cloth on the bottom to prevent the worms and castings from falling out. Others sometimes secure a t-shirt or large piece of material to the top of the bin instead of using just the



Laura Berman

Composting is an attractive part of the Eglinton Park Heritage Community Garden.



Laura Berman

plastic lid to further prevent fruit flies. Krista keeps the bins in places of moderate temperature, generally out of direct sun

A few of these bins are tucked away in a corner of the centre's main building, some in the daycare, and a classroom of the local public school has several. Staff of the community centre, daycare attendants, and students and teachers care for each respective bin. Having the bins in these locations makes maintenance easier, by spreading the labour and also increases the educational value of the bins, by exposing more people to them.

Food scraps from lunches and snacks consumed at the centre, in the daycare and in the school make up the majority of the green material that is put into the worm boxes. Before they are added to the worm boxes, Krista chops the food scraps into small pieces so that the worms can eat them more easily. The majority of these food scraps are from fruit, which tends to be acidic, and so Krista adds crushed eggshells to the boxes to balance the acidity. Whenever Krista adds new raw food material to the boxes, she covers it with soil, dry leaves, wood shavings, or shredded newspaper. This cover material keeps fruit flies and any other pests from being attracted to the bins, and balances the green material. All new input materials are put over established soil or bedding material. This provides the worms with a comfortable habitat. New materials are added to the box one corner at a time, and to a depth no greater than 0.3 m (1').

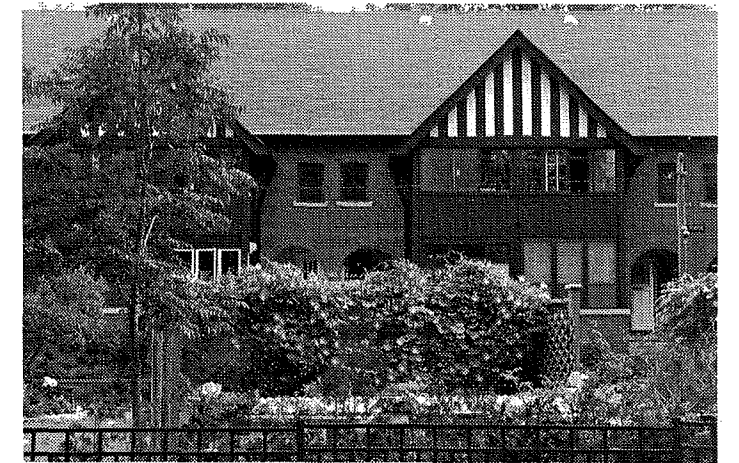
There have been problems with the bins. In one of the bins all of the worms died. No one knows exactly why, but people think that this happened because almost all of the input material was highly acidic, though heat and moisture factors could have also played a role. The bins also occasionally attract fruit flies. The flies are not a significant problem, but they are a nuisance. A better way to control the flies would be to cover the bins with solid, but very breathable fabric, rather than plastic tops with holes drilled in them.

Usually it takes a few months to produce finished soil using the bins. The castings are used on nearby house plants, sent home with the students, or given away. ♻️

Composting Systems in a Residential Setting

*Bain Co-op*¹⁷

The Bain Co-op is a 2 hectare (5 acre) residential development built in the 1920s as workers' housing. Since then it has become a housing co-op with a diverse demographic that houses somewhere between 400 and 600 people. The Co-op is organized into several courtyards, each of which has between 14 and 38 apartments with between one and four people living in each. Each courtyard makes its own decisions about many issues, including how the gardens are run and designed and how composting operations are set up and run. As a result, there are a variety of composting operations at the Bain Co-op. The Bain Co-op shows that there are many different ways that a multi-residential or mid-scale composting operation can be set up and run.



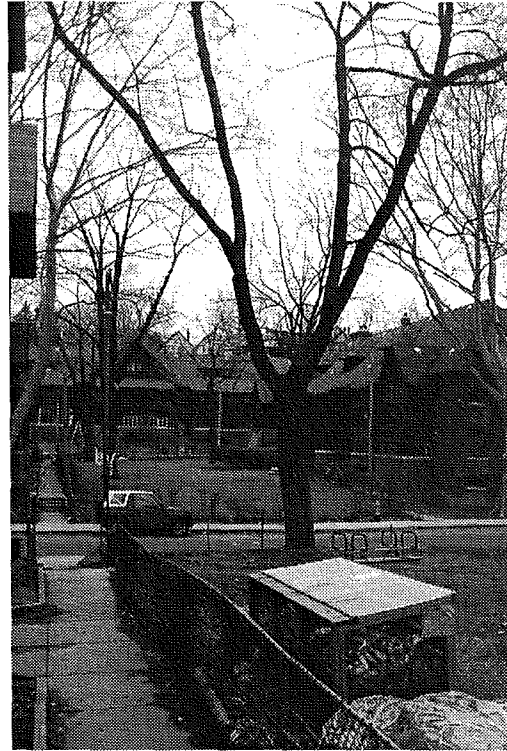
There are a few similarities between all of the compost systems at the Bain Co-op. They all use garden waste and food scraps as their main source of green, nitrogen rich material and leaves from the courtyard as brown material. They also all have the residents of the courtyard put raw materials into the compost bins themselves and they fill and use only one bin at a time.

Courtyard One Compost System

- ☞ Three wood and wire mesh bins
- ☞ At front of courtyard, as far from residences as possible
- ☞ Hidden behind a lattice screen which is both for appearance, smell, and to protect compost from wind
- ☞ Put in all types of food including processed food and dairy
- ☞ Do not chop raw material much
- ☞ Have one main caretaker who turns bins every week or two
- ☞ The other two bins are kept closed with rope
- ☞ Temperatures reach above 38 °C (100 °F)
- ☞ Piles are covered with burlap
- ☞ Compost used on courtyard gardens
- ☞ No pests or smell trouble
- ☞ No signs

Courtyard Two Compost System

- ☞ Three wood and wire mesh bins
- ☞ At front of courtyard, as far from residences as possible
- ☞ Hidden behind a lattice screen which is both for appearance, smell, and to protect compost from wind
- ☞ Meat, dairy, etc are not used
- ☞ Signs instruct how to use bins
- ☞ Have had pests. This was a significant problem. They have since improved the mesh to prevent pests
- ☞ Overseen by two people
- ☞ Compost used on courtyard gardens
- ☞ Generates some heat



Courtyard Three Compost System

- ☞ Located in a corner away from the courtyard
- ☞ No signage
- ☞ Three wood and wire mesh bins
- ☞ Generates high heat
- ☞ One cell fills every two to three months
- ☞ One batch of compost finished every few months
- ☞ Meat, dairy, etc are not used
- ☞ No signs
- ☞ Overseen by one person
- ☞ Turned every few weeks

Courtyard Four Compost System

- ☞ Four bin wood and wire mesh unit, including one leaf bin
- ☞ No screen
- ☞ At front of courtyard, as far from residences as possible
- ☞ Each cell fills within a month
- ☞ Compost finished within a month or two
- ☞ High heat
- ☞ No signs
- ☞ Uses burlap for insulation and moisture
- ☞ Tools for aerating left out, near by
- ☞ Aerated at least weekly
- ☞ Meat, dairy, etc are not used
- ☞ Overseen by a group of residents who rotate aerating responsibilities



Chapter 4

Starting Your Mid-Sized Composting Operation

Starting Your Mid-Sized Composting Operation

Now that you know about some mid-scale composting systems, and the different ways that they can be set up and can work, it's time to begin to decide how to set up your own composting system.

As you make decisions and establish your operation, it is important that you include the group that is going to be involved and make sure that everyone interested has a voice in deciding how to establish your operation. People like to know that their ideas matter and that what they say is considered as much as what anyone else says. It may be easier for one or two people to make all of the decisions about how to set up your composting operation, but this may backfire. People may feel like they are not a part of the operation or they may not understand why it is set up in the way that it is, or how it is supposed to work.

Just as important as including the entire group in decision making is having a good compost coordinator. This person should be dynamic, enthusiastic, knowledgeable, diplomatic, inspiring, and devoted. Their role should be clearly defined, and the coordinator should be selected by the entire group. The coordinator should not be expected to do everything themselves. This will lead to burn out, and may cause the operation to fail if that person decides to move, or resign. Have an organizational team support the coordinator.

There are **ten steps** that will help you to have a successful mid-scale composting operation. These steps have been adapted from American Community Garden Association and Toronto Community Garden Network:





For a Successful Mid-scale Composting Operation

- 1 Organize** a meeting of interested people:
Determine who wants to be involved in your compost operation, who it will involve, and who it will benefit
- 2 Form** a planning committee:
Choose a well-organized person as a compost coordinator. Form additional committees to tackle specific tasks, eg. funding, public education, construction, maintenance, etc.
- 3 Identify** all of your resources
- 4 Choose** your site
- 5 Decide** how you are going to set up your composting operation. Always start small.
It is much easier to expand your compost operation if it is going well than to deal with an operation that is too big for your resources
- 6 Approach** a sponsor. A sponsor is not necessary, but it can help you get the tools, financial resources, or labour that you need. Possible sponsors are schools, businesses, parks and recreation departments, community members and religious organizations
- 7 Decide** the rules and put them in writing:
Who will maintain the compost, who will get finished compost, what materials will you allow in the compost?
- 8 Set up** the composting operation:
Hold a work-bee or a community event in which you establish the operation
- 9 Keep** compost members in touch with each other:
Form a telephone tree or email list, install a rainproof bulletin board, have regular celebrations
- 10 Hold** occasional compost demonstrations.
This will keep members informed of how the operation is working and will keep the composting going smoothly

You need to decide six things before beginning your composting operation:

- ☞ Where will you locate your composting operation?
- ☞ What will you include in your compost and where you will get it from?
- ☞ What type of compost receptacle will you use?
- ☞ How and how often will you maintain your compost?
- ☞ How will you use and distribute the finished compost?
- ☞ Will you put up signs?

There are many options that you can consider for each of these aspects of a compost operation. You will want to make sure that your composting system fits your needs and your available resources. There are **three main factors** that already may be determined for you that will affect the set-up and running of your compost operation:

Why are you composting?

What labour resources are available to you?

What financial resources are available to you?

Before deciding how to set up and run your operation, it is a very good idea to answer these three questions.

(Worksheet One at the back of this manual can help you to answer these questions).

Why are you composting?

What is your main reason (or reasons) for composting? Are you composting:

- To divert waste
- To produce soil
- For profit
- For education
- For fun

What labour resources are available to you?

How much labour do you have available to maintain your compost?

- Are there a few volunteers that would like to monitor and maintain your compost operation?
- Is there one person that is willing to take the lead on your composting operation?
- Are the people available dependable?
- How much time and labour are they willing to commit?
- Do you have the financial resources to hire someone to oversee your compost operation?
- Are there any other concerns or issues that you have about labour availability?

What financial resources are available to you?

What sort of financial resources do you have available?

- Is there a budget for your composting operation?
- How much is it?
- How will you allocate the budget? To labour? Tools? Set up?
- Will you try to find new sources of funding for your compost operation?
- If there is no money available, how will you acquire a composting bin and tools for maintenance?
- Do you have access to new, donated, used, or found materials for building or fashioning bins?
- Will your compost operation save you money? Earn you money?
- How will savings or earnings be distributed?

You will likely find while answering these questions, that these factors have already been determined for you. Groups generally have a finite amount of labour and resources available to them, and there is usually a primary reason for starting a composting operation.

Where to Locate Your Composting Operation

A fourth factor that may already be determined for you is where to locate your compost operation. If you have more than one site available for you to use, you will want to choose the site that matches your needs. You will always want to choose the site that is most convenient.

(Worksheet Two will help you to decide where to locate your operation).

Some factors that you will want to consider are:

- How will you get food and plant wastes to the site?
- Is water easily accessible?
- Is the site near where the compost will be used?
- If not, how will you transport the compost?
- Is it easy to get to the site? On foot? By car? By public transit? By bike?
- If you are in a cold climate, is it possible to insulate your compost?
- Is the compost exposed to sun?
- Are there neighbours nearby that might be opposed to a compost operation?

You will also have to decide whether or not to locate your compost in a public location where members of the community will have access to it or in a private place, away from the general community. One factor that will help you to decide is the reason that you are composting and the amount of labour that you have available.

- If you are composting with the purpose of educating the community or reducing the waste produced by the community, it is important to locate the operation in a place that is used by and accessible to the community.
- If you are composting for fun or to produce soil, either type of location will be appropriate.
- If you are composting to make a profit, it is important to locate your compost in a secure place, where it will not be contaminated or taken.
- If you have less than an hour or two of labour available every two weeks, it is not a good idea to locate the compost in a place where it may be contaminated by foreign material, or near to residents that may complain about an unattractive area.

Once you have chosen the location of your compost operation, these factors will be important in helping you to decide how to set up the other aspects of your composting operation:

- Is the location publicly or privately owned?
- How nearby are neighbours?
- What type of neighbours are near by?
- What type of organic matter is available at the site? Near the site?
- How accessible is the site?

Organic Matter:
All material that is or once was living.

A final decision that you may have to make about where to locate your composting operation is whether you want a centralized or decentralized system. The Bain Co-op is a very good example of why you may want to decentralize your operation. At the Co-op, each courtyard group, which is made up of several families, has responsibility for the composting system in their own courtyard. In this way all of the composting systems vary slightly, but are all well cared for, as each courtyard feels ownership over their composting system. FoodShare illustrates why you may not want to decentralize your composting operation. Because FoodShare has one person who oversees the entire operation, decentralizing it would make it more difficult for that person to manage, and would likely lead to variation in the process, as all those working on the compost would not be working in close contact with one another. Your group needs to determine if there is one person or one group of people that want to oversee the entire operation, or if it would be of greater benefit to have many smaller groups take over the operations.

When you are aware of your reason for composting, labour available, financial resources available and the qualities of the site chosen for your compost operation it will be easy to make appropriate decisions about how to set up your compost operation. You need to decide: what to include in your compost and where you will get it from, what type of compost receptacle to use, how to use and distribute compost, whether or not to put up signs, and how and how often to maintain your compost. These five issues are all interrelated, and what you decide for one will help you decide the others.

What to include in your compost

As the section on how composting works noted, the materials that you use in your compost will have a significant impact on how easily your compost operation runs and on the quality of the final product. The three rules that you should always follow in choosing materials to put into your compost are:

1. Always keep a good carbon to nitrogen, or brown to green ratio (generally about 1:2),
2. Avoid including meat, fish, or greasy food, and
3. Never include human, cat or dog feces.

Finding sources for these materials is one of the challenges that you may face in establishing your composting operation. The case studies offer examples of places that materials can be found.

Composting Operation	Sources for Green Material	Sources for Brown Material
FoodShare	food wastes from programs, garden wastes	garden wastes, straw from a farm, untreated wood shavings from a local woodworking shop, compost siftings
Metro Hall Vermiculture	restaurant and food stall food wastes, staff floor food wastes	paper towels from staff bathrooms
401 Richmond	garden wastes, food preparation scraps from restaurant	wood shavings from a local woodworking shop, leaves collected from nearby residential areas
High Park Children's Garden	garden wastes, food scraps brought by local community members, food scraps from lunches eaten on premises	leaves collected in the park
Harbourfront Centre	food scraps brought by local community members	leaves collected by the city
Scadding Court & Eglinton Park	food scraps brought by local community members, garden wastes	leaves collected by the city
Bain Co-op	food wastes from residents, garden wastes	leaves collected on premises

Depending on how much labour you have available and why you are composting you may want to either limit or increase the amount of raw material you have going into your compost. To increase the amount of raw material going into your compost you can invite the surrounding community to contribute and get local businesses to contribute their food wastes. To limit the amount of material you can invite only those that are involved in the composting project to contribute, or only add wastes produced on site. Deciding whether or not to experiment with adding different types of materials such as manure or unbleached paper to your compost should also be determined by how much labour you have. As a general rule, if there is very little labour available, you are best off limiting the amount of material in your compost, and limiting the number of people contributing to the compost. The following table offers more clear advice about what sources are a good idea to draw from based on how much labour you have available and why you are composting.

Worksheet Three will also help you to decide where to get your materials.

Options for Raw Material Inclusion and Factors Affecting Their Selection

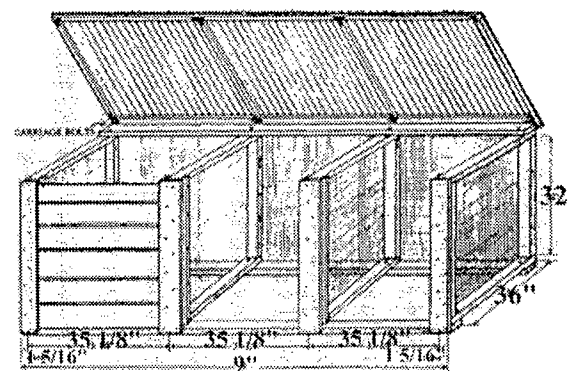
	Limit intake to organic wastes produced by those involved	Invite the community to contribute	Invite businesses to contribute	Experiment
28+ hours of labour available per week				
7-28 hours of labour available per week				
Labour available only every 2+ weeks				
Composting to produce soil to sell or for large garden				
Composting to produce soil for small garden				
Composting to educate				
Composting for fun				
Composting to reduce waste				

KEY	Important to do	A good idea	Viable	Likely to lead to problems or limit results	No effect
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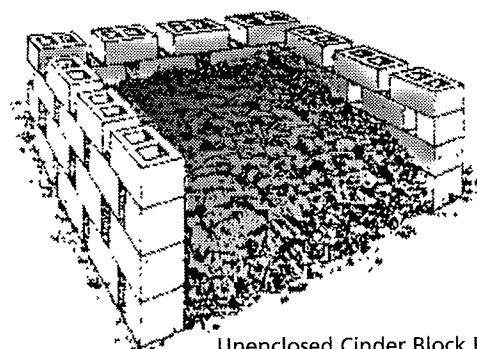
A final factor that you will want to consider when deciding what materials you will want to include and from where is how significant an issue pests will be for your composting operation. If the appearance of any pests will cause your composting operation to have to cease, then you will need to have very frequent maintenance. Otherwise you will want to limit those who contribute to the compost to individuals that can be relied upon to always avoid adding greasy foods, fish, and meat and to always add both brown and green materials at the same time.

What type of compost receptacle to use

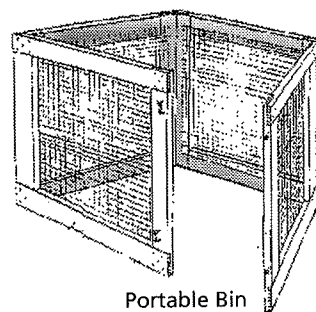
The type of receptacle that you choose to use will have a significant impact on the amount of labour you have to put into your compost operation, how easy it is to control pests, and on your financial resources. There are many types of compost containers for sale that can be found in gardening stores, on web sites and from many cities. You may also choose to make your own compost receptacles depending on the labour you have available, the amount of materials present and your enthusiasm and skill for building. If you choose to make your own bins *The Real Dirt* by Mark Cullen and Lorraine Johnson and *The Rodale Book of Composting* provide instructions on how to make many types of bins. Plans are also available from the City of Toronto Compost Helpline (416-392-9804) and the Recycling Council of Ontario ([www.http://www.rco.on.ca/factsheet/fs_e03.html](http://www.rco.on.ca/factsheet/fs_e03.html)). The following chart summarizes the types of receptacles used by the composting operations in the case studies, as well as a few other types of bins and the advantages and disadvantages of each.



Three Bin Cell Bin



Unenclosed Cinder Block Bin



Portable Bin

Type of Receptacle	Composting Operations that use it	Advantages	Disadvantages
three-celled unit constructed of wood and wire mesh	FoodShare, 401 Richmond, High Park, Scadding Court, Eglinton Park, Bain Co-op, Harbourfront	moderate pest control; easy to access material inside; can be locked; inexpensive and relatively easy to make or buy; capacity for large insulated core of pile; durable and easy to fix; very safe; good air flow; easy to view composting process in steps requires high input of	labour to turn mesh tears relatively easily
large compost barrel	FoodShare	easy to turn a large quantity of material; good pest control; capacity for large insulated core; dries out quickly; many safety concerns; expensive and difficult to make or buy	requires high maintenance discourages worms
mid-sized compost turner	401 Richmond St.	very easy to turn mid-range quantity of material; light weight; excellent pest prevention; can be locked;	expensive; small capacity; difficult to view compost process
very small compost turner	Bain Co-op,	individual home unit; easy to turn a very small quantity of material	not very durable; very small capacity; relatively expensive; cannot be locked
vermicomposting machine	Metro Hall	allows for large scale vermicomposting; able to process large amounts of material with little to no smell and no pests; safe ;	very expensive to install and run; requires a large, indoor space; potentially difficult to locate in a good place for education; labour-intensive
plastic home composting bins	High Park, Bain Co-op, Eglinton	inexpensive; easy to find;	difficult to turn material; smaller capacity; low level of pest control; cannot be locked
large open wood and wire mesh holding bin	FoodShare	ideal for aging or holding completed material; relatively easy to make;	inappropriate for composting raw material; cannot be locked
unenclosed wood, wire, or cinder block bins		inexpensive and easy to make; easy to access material	no pest control; low durability; requires high labour input; cannot be locked
no container		free; easy-to-access material; easy to view composting process; no maintenance	no pest control; often considered unattractive; requires some labour to turn; cannot be locked
small plastic worm boxes	Scadding Court	very inexpensive; excellent for education; requires very little labour input; easy to find or make	produces very small amounts of compost; can attract fruit flies

Based upon your budget, location, labour available, the amount of material you intend to compost and purpose for composting, it should be relatively easy to select the bin that will best suit your needs. Worksheet Four will help you to review what is already established for you, and then match your needs with the bin that best matches your needs for advantages and minimizes the disadvantages that are most important to you. 🍃

How and how often will you maintain your compost

The level of maintenance is fundamental in determining how quickly and smoothly your operation produces finished compost. The general rule is, the more frequently and thoroughly maintained your compost operation is, the more quickly and easily you will produce finished compost. This rule, of course, operates within limits. For example, there is no reason to turn a compost heap daily, and this might even slow the process. A compost that is frequently and thoroughly maintained can produce finished compost within six weeks. A compost pile that is just left to sit can take up to one year.

FoodShare offers a good example of all of the steps that can be taken in a compost operation to speed the decomposition process. FoodShare:

- 🍃 Collects all food wastes in a central location so that they can be added to the bin at once
- 🍃 Weighs the food wastes and adds proportionate amount of carbonaceous material
- 🍃 Chops the food wastes into 2.5 cm (1") pieces before putting them in the compost
- 🍃 Aerates the compost
- 🍃 Waters compost when it becomes dry

Within step four, aeration of compost, compost operations have many options, as explored at the beginning of the manual. Your group may choose to:









































- 🍃 Turn the compost pile, moving the material from the inside of the pile to the outside, and vice-versa
- 🍃 Use a tool manufactured specifically for compost aeration which pokes holes and forces air into the pile while moving the material around or poke holes in your pile with any sort of stick
- 🍃 Turning the pile or using the aeration tool are most effective. You may choose to aerate your pile every three to five days, weekly, bi weekly, monthly, or haphazardly. The more frequently the pile is aerated (but no more frequently than every three days), the more quickly it will decompose. If you would like your compost sooner, rather than later, and have some financial resources but very limited labour resources, it is advisable to purchase an aeration tool, as it can speed the process of turning greatly, and at a relatively low cost.

Based on how much labour you have available and what containers you have chosen, you may be able to undertake all of these tasks, and with great frequency but the likelihood is that you will have to choose to forego some of them. The most important steps that you should take to speed the process are aerating the compost and keeping it moist. If your compost is not aerated, any heat generated, and subsequently any mesophilic or thermophilic bacteria produced will die off, slowing the process. If the compost dries out (or becomes too wet) it will also kill off the most active bacteria.

The chart on the following page shows which activities you should plan to undertake and how often you should plan to turn your pile to maximize its speed, based on the amount of labour you have available and the type of compost container you have chosen. It assumes that your operation has between three and nine bins, although all of the information in the sections 28 or more hours and 14-28 hours would remain the same for up to 20 bins. "Turn" and "bin" refer to the types of containers used. "Turn" refers to any compost receptacle that can be turned relatively easily. "Bin" refers to any form of stationary compost container or pile. If you are going to aerate with a tool, the frequency of aeration in the bins can increase.

Other options for maintaining a compost operation, as illustrated by FoodShare, do not speed the process, but rather improve the quality of the final product. After steps one to five, FoodShare sifts the finished compost with a 1.25 cm (1/2") mesh, ages the compost, then sifts some of the aged compost with a 6 mm (1/4") mesh.

Once again, based on the amount of labour that your operation has available and your needs, you may choose to forgo some or all of these steps. For compost that is going to be used on gardens that need to be aesthetically pleasing, it is a good idea to do a rough sift of the compost. For saleable compost you will want to do at least a rough sift, and perhaps a fine sift as well. Rough sifting one batch of compost can take one person from one and a half hours to five hours depending on the moisture of the compost, the sifter, and the speed at which the person works.






	28+ hours/week		14-28 hours/week		7-14 hours/week		7 hours or less/week		1-2 hours bi-weekly or less	
	bin	turn	bin	turn	bin	turn	bin	turn	bin	turn
gather material together before composting										
weigh material										
chop material										
aerate material	every 3 days	every 3 days	every 7-14 days	every 3-7 days	every 7-14 days	every 3-14 days	every 10-30 days	every 7-20 days	every month	every 20 days+
keep material moist										

A final step in maintaining a compost operation is keeping the area neat and clean. If your operation is located in a public place you may want to plan to devote at least a half hour a week to this, as people often drop debris around public sites.

Beyond determining what steps to take to maintain your compost and how often, it is very important to determine who will take those steps and when. Too often, compost operations and community gardens depend on one enthusiastic person to complete all of the work. Not only does this deny the other participants in the project the experience and connection to the process, it also leads to burn out, and subsequent slow down of the operation. It is a good idea to create teams or schedules or to designate different people in charge of different aspects of the composting operation. What you decide will depend on how your group seems to work best. What is most important is that you have a plan for maintaining your operation that fits your available labour and general set up and does not depend on one unpaid person.

If you choose to use a mid scale vermicomposting system like the one at Metro Hall, there is a certain amount of labour that will be required to keep the system running smoothly. The materials that are available for the machine must be sorted through into appropriate and inappropriate (greasy or non-organic) materials. You will need to grind the materials that you put into the system. The grinding process tends to take about half an hour to two hours. The worms should be fed at least every few days, and ideally would be fed small batches of food daily. The castings must be harvested every week or so, which also takes a couple of hours. The moisture of the system needs to be monitored and adjusted every couple of days, which can take anywhere from a quarter of an hour to an hour. Addressing problems with the operation, such as matting fungus and red mites also take some labour input. Just to keep the system running smoothly requires one to two hours of labour daily. If you have less labour available, it would be unwise to compost using this method. You will want to establish a feeding schedule where individuals are designated to feed on certain days, and a maintenance schedule, that accounts for maintaining moisture levels, harvesting castings, and addressing problems.





A worm box like the one at Scadding Court needs different steps in maintenance than either pile composting or large-scale vermicomposting. There is very little that can be done to speed the process, and less maintenance than the other systems. The steps that need to be taken are:

-  Obtaining composting worms (redworms)
-  Establishing bedding in new boxes
-  Adding new material
-  Monitoring moisture levels
-  Harvesting finished material

It is important that the material added is always of a relatively neutral pH, that all food material is covered with some sort of brown material, and that no greasy foods are added. It would be wise to schedule a feeding for the worm boxes every few days and to have a clear schedule of when to check the moisture of the boxes and to harvest the finished compost.

How will you distribute your compost

You have a number of options for how to distribute and use your compost. You can:

-  Sell it
-  Use it on near-by gardens
-  Give it away
-  Distribute it according to labour or materials put in

If you are composting to produce soil for use or for sale, you probably already know how you want to distribute your compost. If, however, you are composting for fun, to educate or to reduce waste, you will have to decide what happens to the rich soil that you produce. To decide this you will want to include the opinions of all those who are working on the operation. You will need to determine if your group would prefer to keep its compost as a group or as individuals, make money off its compost, contribute to the external community, or a combination. If it is decided that the compost should be portioned, you can divide it according to the amount of labour or materials put in. This, however, will often lead to conflict or confusion as it is difficult to directly correlate how much raw material is put in and how much labour is expended to how much compost is produced. Much more reasonable is to portion the compost into equal parts by family, individual or group. In many community garden situations, it works very well for gardeners to simply take compost as they need it. It is very important that all members of your group come to a consensual agreement about how the compost will be split up, as this has the potential to be a divisive issue. 🍃

Will you put up signs?

There are two main reasons to put up signs: to direct usage, and to educate. If people who are not directly maintaining the compost operation often are using the set up, or if those who are involved have very little interaction with each other it is a very good idea to have signs to direct the usage of the compost operation. This is especially true of compost operations located in public areas. The experience of the Harbourfront operation illustrates how a lack of signs can lead to misuse of a composting operation. In a situation like the one at Harbourfront, it would have been very helpful to have signs directing what should be put into the compost receptacles. Your group should ask itself, is your compost in a public place where members of the community may put their wastes? If it is, and if you have enough financial resources, it would be a good idea to put up signs directing what to put in the bins.

Many of the composting operations at the Bain Co-op also have signs directing the usage of the compost, but they are of a very different nature. The residents of the courtyards who use the compost bins know what is appropriate to put into compost, but unless they are involved in the compost maintenance, it is difficult for them to know which compost is finished, and which is still processing. Some of the operations at the co-op have made signs that can be moved to show which pile is new and which is old. If you have a similar situation you may want to consider making signs as well.

If you have established your operation with the intent of educating the community about composting, it is a very good idea to put up signs describing how composting works, and why it is a good idea. This is an easy way to get information to people who may visit the site when

there is no one to explain how it works and to people who are too shy to ask. It can also help to keep your operation running smoothly.

If your operation is not intended to educate, nor used by people not directly involved in the operation, you have very little need for signs, and might as well save yourself the hassle and money. 🍃

Regulations

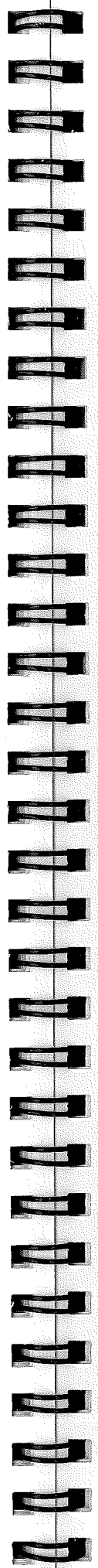
Most composting operations will not be subject to regulations, but if you intend to start a composting operation that is larger than a few bins, it would be wise to make sure that you do not need a permit or review. If you intend to sell your compost there are standards that have been developed. If you are in Canada these are the laws and standards that might apply to you. As regulations often change, it is a good idea to check to make sure that no new regulations have been established. 🍃

Compost Regulations¹⁸

Province	Contact Information	Composting Laws and Regulations	Compost Standards
British Columbia	BC Ministry of Environment, Land & Parks Prevention and Remediation Branch Tel: (205) 387-9985 Website: www.elp.gov.bc.ca	Production and Use of Compost Regulation (Jan 1/94); Organic Matter Recycling Regulation Draft 2.0 (July 1999)	Production and Use of Compost Regulation
Alberta	Alberta Environment Action on Waste Tel: (780) 422-8466 Web: www.gov.ab.ca/env/waste/aow/index.html	Code of Practice for Compost Facilities Municipal Waste Facility Operator Certification Guidelines for Landfills and Composting Operations	CCME Guidelines for Compost Quality
Saskatchewan	Saskatchewan Environment & Resource Mgmt Environmental Protection Branch Tel: (306) 787-6124 Web: www.serm.gov.sk.ca	For municipal composting, depends on permit for landfill	CCME Guidelines for Compost Quality
Manitoba	Manitoba Environment Pollution Prevention Branch Tel: (204) 945-7100 Web: www.gov.mb.ca		CCME Guidelines for Compost Quality
Ontario	Ontario Ministry of the Environment Tel: (416) 325-4440 Web: www.ene.gov.on.ca	Environmental Protection Act, Part V -Regulations 101, 347 -Draft Standardized Approval Regulation (SAR)	Interim Guidelines for the Production and Use of Aerobic Compost proposing to adopt CCME criteria
Quebec	Ministere de l'Environnement Direction des politiques de secteur municipal Tel: (418) 521-3885 Web: www.mef.gouv.qc.ca	Guidelines on Approval Procedures, Siting and Operations Criteria for Organic Composting or Inorganic Recovery Facilities (preliminary, July 1999)	Instruction Note 99-06 on Agronomic Utilization of Residuals Interim Guidelines for Landspreading
New Brunswick	NB Department of the Environment Municipal Services Section Tel: (506) 444-4599 Web: www.gov.nb.ca	Water Quality Regulation under the Clean Environment Act	Guidelines for the Site Selection, Operation and Approval of Composting Facilities in New Brunswick
Nova Scotia	Nova Scotia Department of the Environment Tel: (902) 424-5300 Web: www.gov.ns.ca/envi/wasteman	Solid Waste-Resource Management Regulations Nova Scotia Department of the Environment Composting Facility Guidelines	Nova Scotia Department of the Environment Composting Facility Guidelines
Prince Edward Island	PEI Department Technology and Environment Tel: (902) 368-5029 Web: www.gov.pei.ca	Draft Waste Resource Management Regulations	CCME Guidelines for Compost Quality
Newfoundland	NF Department of Environment and Labour Tel: (709) 729-2556		
Yukon	Yukon Territorial Government Dept of Renewable Resources: Tel: (867) 667-5934 Web: www.gov.yk.ca/govt.htm		
Northwest Territories	Gov't of Northwest Territories Environmental Protection Service: Tel (867) 873-7654 Web: www.rwed.gov.nt.ca		CCME Guidelines for Compost Quality
Nunavut	Government of Nunavut Dept of Sustainable Development: Tel: (867) 979-5119 Web: www.gov.nu.ca		CCME Guidelines for Compost Quality

If you are in the United States, there is similarly no national standard. The Environmental Protection Agency has delegated authority to the states for all composting programs, but has also published a guidance document entitled , which you may want to consult. Composting facilities may need approvals or permits from the state before they can begin operating, though many states have yet to establish any regulations concerning compost¹⁸.

If you are outside of Canada or the United States you should consult your national and local environment and waste management departments to inquire if there are any regulations that might apply to your composting operation. ☺



Chapter 5

WORKSHEETS

WORKSHEETS

The following four worksheets can help you to figure out how to set up your composting operation.

Worksheet One: What resources do you have?

If at all possible this worksheet should be filled out as a group

Part One: Why are you composting

Use the following scale of 0 to 5 to determine why you are composting and which reasons are most important to you. Circle the level of priority of each reason. You may rate as many reasons as you want with the same number

Reducing Waste	0	1	2	3	4	5
Making Soil	0	1	2	3	4	5
Educating	0	1	2	3	4	5
Profit	0	1	2	3	4	5
Fun	0	1	2	3	4	5
Other _____	0	1	2	3	4	5

What is your highest priority? _____

Part 2: How much labour do you have available to run your composting operation?

How many people in your group are interested in helping to run the compost operation?

Write their names here: _____

How many hours can each person firmly commit to contributing to the operation either weekly, every two weeks or every month? Before people specify an amount of time, have everyone think for a moment about all of their other responsibilities and make sure that they are committing to an amount of time they can realistically contribute.

Person 1 _____ Person 2 _____ Person 3 _____

Person 4 _____ Person 5 _____ Person 6 _____

What is the total number of hours available to attend to your composting operation each week?

Are there any composting jobs that anyone who is going to be helping specifically does or does not want to do?

Is there anyone who would like to be the compost co-ordinator? If so, clearly define the role that the compost coordinator will have here:

Are there others who would like to be part of an organizational team? What will their roles be?

Is there enough funding available to hire someone part-time or full-time to oversee your composting operation? If so, will you hire someone from within or from outside? If not, will you raise funds so that you can hire someone?

Part 3: Financial Resources

Is there a budget for your composting operation?

If yes, how much is it? _____

If no, how will you pay for the materials to set up your compost operation (e.g. compost containers, shovel, screens, etc.)?

If there is a budget for your operation, how might you distribute it? It may be better to answer this question after you have researched the price of tools, receptacles and signage in your area.

site _____

receptacles _____

tools _____

labour _____

education _____

signage _____

Calculate your budget here:

If your compost operation is going to earn you money, how will you distribute it?

Worksheet Two: Location

If you already know the location of your operation skip to part two.

Part One: Public or Private

- 1) Is education high on your list of composting priorities? Yes No
- 2) Are you composting to reduce waste in the area around your operation? Yes No
- 3) Is making profit one of the goals of your composting operation? Yes No
- 4) Do you have less than two hours of labour available a week? Yes No

*If you answered Yes to questions 1 or 2 and No to questions 3 or 4, then you should locate your operation **in a publicly accessible place***

*If you answered Yes to questions 3 or 4, and No to questions 1 or 2, then you should locate your operation **in a private place**.*

If there seems to be a conflict about location, work as a group to imagine a solution.

Part Two: Convenience

For each compost site that you consider use the following checklist. If any of the factors on the checklist are unimportant to your group simply ignore them. Choose the site that fulfils the criteria most important to your group.

- Is it easy to get food and plant wastes to the site?
- Is water easily accessible?
- Is the site near where the compost will be used?
- Is it easy to get to the site on foot?
- By car?
- By public transit?
- By bike?
- Are there neighbours nearby that might be opposed to a compost operation?

If you are going to do pile composting:

- Is it possible to insulate your compost?
- Can the compost be exposed to sun?

If you are going to do vermicomposting:

- Is it easy to maintain the temperature and humidity of the site?
- Is it easy to keep the worms in the dark?
- Is it easy to keep the worms safe from birds?

Part Three: Centralized or Decentralized

Will you have one person running your composting operation or will the work be evenly distributed?

Are there many locations that would be suitable for a compost operation or only one?

Is there a need for compost in many different places or in one main place?

If there is only one person to run the operation, if there is only one appropriate location or if you need compost in only one place, it would be wise to have a centralized operation. Otherwise a decentralized operation may work just as well.

Worksheet Three: What Sources of Materials Should You Use?

Will You Draw From the General Public or From Within the Group

How many hours of labour do you have available per week?

What is your top composting priority?

Do you have a secondary composting priority?

Once you have answered these three questions, use the chart on the following page to determine whether you should include materials from the wider community or only your composting group.

What sources should you include?

Should you experiment? Yes No

	Limit intake to organic wastes produced by those involved	Invite the community to contribute	Invite businesses to contribute	Experiment
28+ hours of labour available per week				
7-28 hours of labour available per week				
Labour available only every 2+ weeks				
Composting to produce soil to sell or for large garden				
Composting to produce soil for small garden				
Composting to educate				
Composting for fun				
Composting to reduce waste				

KEY	Important to do	A good idea	Viable	Likely to lead to problems or limit results	No effect
-----	-----------------	-------------	--------	---	-----------

Worksheet Four: Receptacle

List the compost receptacles that you have found that are available to you how much they cost, how much they hold, and if they are easy to turn. If you are considering making a receptacle, look at how much it costs and how much time it will take to build

Receptacle	Capacity	Price	Easy to Turn?

Are you very concerned about pests? Yes No

If your answer is yes, then it is very important that you either have a container that is completely inaccessible to them or is lined with a small-holed mesh.

Are you concerned about others taking your compost or contaminating it with inappropriate material? Yes No

If you are, choose a receptacle that locks.

How much material are you planning on composting weekly? _____
monthly? _____

How many receptacles of each type would you need to run your operation?

What is the total budget for your composting operation?

How much of the budget do you need for other uses such as labour, tools, signs, or education?

Which containers can you afford?

How much labour do you have available weekly?

How quickly do you need to produce finished compost?

If you either have more than seven hours of labour available per week, will be composting less than 23 kg (50 lbs) of material a week, or do not need your compost in under a year, any compost receptacle that meets your security and pest needs will be appropriate for you.

If you have a large amount of material or need your compost quickly any compost receptacle will meet your needs, provided you have enough labour available to turn the compost at least every two weeks. Consider that turning a pile by hand can take an hour and that you need to turn each pile. If you do not have enough labour, it is advisable to get or build a receptacle that will make turning very easy. This can reduce the time it takes to turn a pile to as much as a quarter of what it would be by hand.

If you are going to be vermicomposting, there is no need to consider turning, but rather upkeep, feedings, and harvesting. Each small worm box requires about half an hour of labour per week. Small worm boxes can handle 0.5 to 1.4 kg (1 to 3 lbs) of food a day. A large vermicomposting machine requires at least 10 hours of labour a week and can handle 70 to 90 kg (150 to 200 lbs) of food a day.

Would it make sense to use more than one type of container?



Chapter 6

Other Resources

Other Resources

Books

Let It Rot, by Stu Campbell (Garden Way Publishing, 1990).

The Rodale Book of Composting, by Deborah Martin and Grace Gershuny (Rodale, 1992).

Worms Eat My Garbage, by Mary Appelhof (Flowerfield Press, 1997).

Worms Eat Our Garbage, by Mary Appelhof (Flowerfield Press)

The Real Dirt, by Mark Cullen and Lorraine Johnson (Penguin Books, 1992).

Home Composting Made Easy, by C. Forrest McDowell and Tricia Clark-McDowell (Cortesia Press, 1998)

Composting to Reduce the Waste Stream, by Ithaca NY Cooperative Extension Service. Available from N.E. Regional Agricultural Engineering Service, 152 Riley-Robb Hall Cooperative Extension, Ithaca, NY, USA 14853-5701. E-mail: NRAES@cornell.edu Phone: 607-255-7654.

Web sites

Master Composter: www.mastercomposter.com

A membership site where all things compost are discussed and posted. A great source for books, chats, and discussion streams all about compost.

City Farmer: www.cityfarmer.org

A web site all about urban agriculture, including huge sections on compost and even composting toilets!

Government of New Brunswick Composting Guide: www.cityfarmer.org

An excellent guide to the basics of composting.

The Composting Council of Canada: www.compost.org

A guide to all things compost related.

The Recycling Council of Ontario: www.rco.on.ca/

The City of Toronto: <http://www.city.toronto.on.ca/compost/index.htm>

Info on composting, yard waste and lawns

Gardeners' Supply Company: www.gardeners.com

A good source for buying compost bins and accelerators and finding compost tips.

Footnotes

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- ⁴ Cullen, Mark and Lorraine Johnson, *The Real Dirt*, Toronto, Penguin Books, 1992. pg xvi,
- ⁵ Cullen, 4
- ⁶ McDowell, C. Forrest and Tricia-Clark-McDowell, *Home Composting Made Easy*, Eugene Oregon: Cortesia, 1998, pg 24
- ⁷ McDowell, 12
- ⁸ Cullen, 123
- ⁹ Kuellmer, James and Jayne Walker, "A Study of Urban Community-Scale On-Site Composting", *Grow T.O.gether Community Gardeners*, Toronto, 1994, pg 2
- ¹⁰ Currie, Beth Ann, personal interview, July 8, 2003 and 401 Richmond, Home Page. www.401richmond.net, last visited August 1, 2003,
- ¹¹ 401 Richmond, Home Page.
- ¹² Haworth, Bridget, personal interview, August 9, 2003.
- ¹³ City of Toronto, *Composting at Metro Hall*, Toronto: pamphlet, 2003.
- ¹⁴ Forth, Keely, personal interview, July 10, 2003.
- ¹⁵ Fry, Krista. personal interview, July 9, 2003.
- ¹⁶ North Toronto Green Community, interview, July 9, 2003
- ¹⁷ Nevin, Mike, series of personal interviews, February to August, 2003
- ¹⁸ Compost Council of Canada, *Compost Regulations and Guidelines Across Canada*, <http://www.compost.org/ccs.sw&r.legislation>, PDF, last visited July 16, 2003.
- ¹⁹ EPA, *Solid Waste Laws*, <http://www.epa.gov/region09/waste/solid/laws.html#6>, last visited July 26, 2003.
- ²⁰ Savan, Beth, ed. *Analysis of Wet Waste Producers and Potential User Sites in the ICI Sector Within a Community: A Case Study of the Broadview Avenue and Gerrard Street Area*, Toronto: 1995, Toronto Food Policy Council. pg 2-1



Laura Berman



For more copies please contact:

FoodShare

238 Queen Street West
Toronto, Ontario, M5V 1Z7

info@foodshare.net

www.foodshare.net

