PRACTICAL GUIDE

VERMICOMPOSTING

AN ECOLOGICAL WAY OF DEALING WITH ORGANIC WASTE

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For a Healthier Environment: Earthworms to the Rescue!

While we use continuously the planet's resources and millions of tonnes of our waste pile up in landfills, it becomes increasingly imperative — individually and collectively — to take responsibility for the ecological management of our waste materials.

Through recycling programs, we are able to give new life to paper and cardboard, as well as metal, glass and plastic containers. We must now intensify our efforts to reduce the amount of compostable materials that we send to the dump, which is the purpose of this practical guide.

Vermicomposting is a method that relies on the work of small earthworms "specialized" in decomposing organic matter. It requires little in terms of equipment and can transform kitchen scraps and plant cuttings into rich soil conditioner. Since this form of composting is done in a closed container that can be kept indoors, vermicomposting is perfect for those who do not have access to a garden and are unable to make their own compost outdoors.

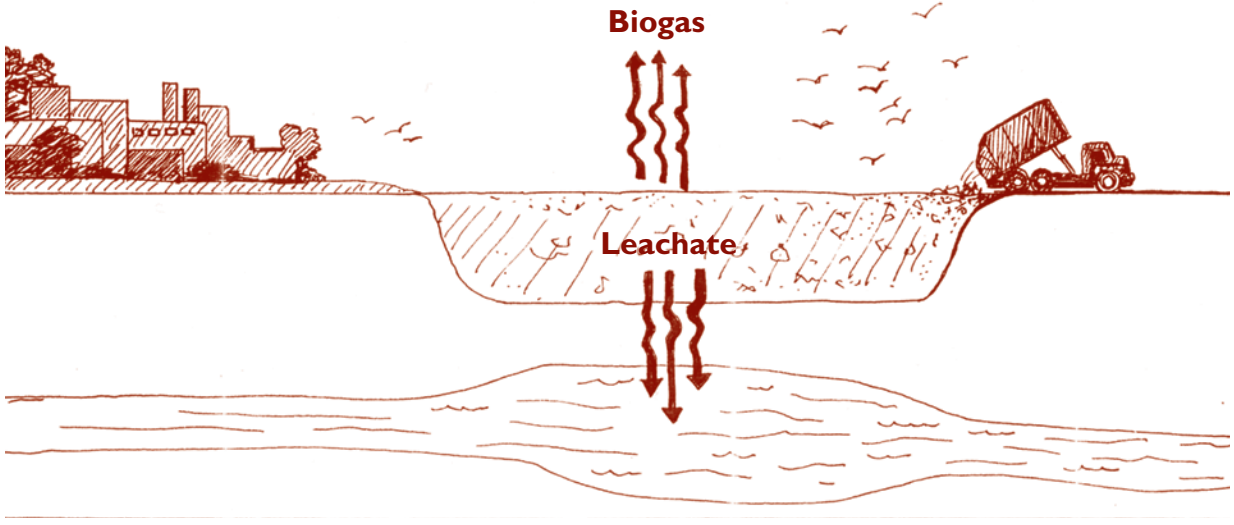
Although the technique discussed in this guide is relatively simple, it requires a certain amount of discipline. Hence for your vermicomposting experience to be worthwhile, you will have to follow a few rules and guidelines. In the end, you will have gained the satisfaction of having understood and mastered one of Nature's fundamental processes: the recycling of organic matter.

When Carrot Peels Pose an Environmental Risk...

Nearly 40% of waste produced by Montrealers are compostable materials, i.e. approximately 20% garden waste and 20% food waste. This represents for the average household nearly a half-tonne of waste per year (Chamard-CRIQ-Roche, 2000).

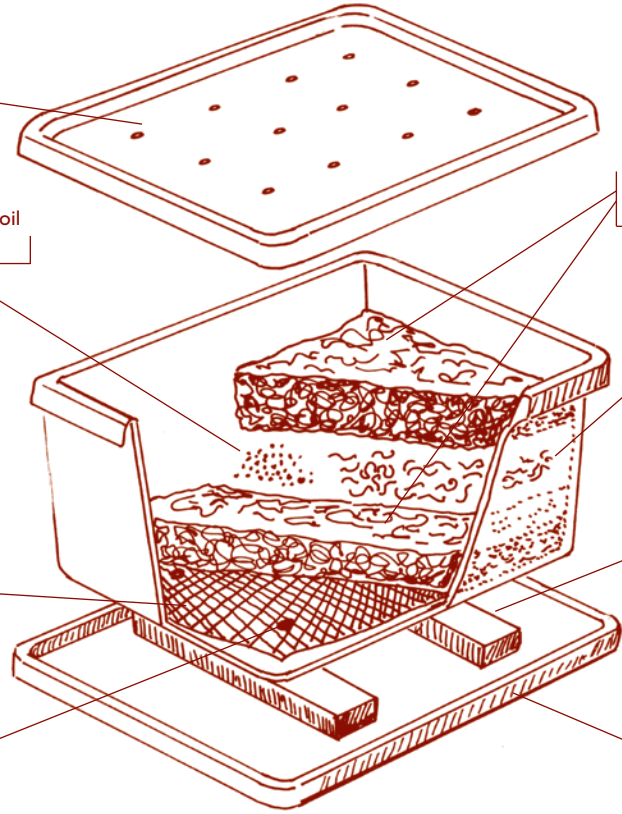
At the landfill, compostable materials are piled up with other waste. Without exposure to oxygen, their decomposition is very slow and releases acidic water. Mixed with rainwater, this acidic effluent filters through the mixed waste, carrying along the way contaminants such as bacteria, chemical pollutants and heavy metals. This phenomenon makes landfilling mixed waste a potentially major problem of ground and surface water pollution.

The anaerobic decomposition (in the absence of oxygen) of organic matter also generates large amounts of biogas, a mix that contains up to 60% of methane, a powerful greenhouse gas. Despite measures taken to trap part of this biogas, landfill sites alone account for 5% of all greenhouse-gas emissions in Quebec (CO_2 equivalent) (Ministère de l'Environnement du Québec, 2000).



Setting Up a Vermicomposting Bin

A vermicomposting bin is basically a box containing a decomposition system for organic matter. It is easy to set up and requires little in terms of tool.



Small holes in the cover will help release any excess humidity produced during decomposition.

A handful of sand or potting soil will help the worms to digest.

A piece of screen (made of fibreglass) or geotextile covers the bottom of the worm bin (optional). It can be put in place using adhesive tape (duct tape is ideal). This screen prevents bedding, earthworm compost or the earthworms themselves from escaping through the drainage holes.

A dozen holes in the bottom of the container will ensure proper drainage and aeration (approximately 1 cm in diameter).

Moist bedding made of shredded newspaper or dead leaves will provide shelter for the worms.

The *Eisenia fœtida* variety of worms will transform the organic matter with the help of millions of other decomposers.

The worm bin can be put on blocks to allow air circulation under the container.

A drainage plate collects any liquid that may run out of the bottom of the worm bin. A plastic boot mat works very well in this case.

Eisenia fœtida, The Healthy Eater

The most popular worm for vermicomposting is *Eisenia fœtida*, commonly called the red worm, red wriggler, manure worm or compost worm. It is brownish-red and no longer than 10-12 cm in length. Unlike the large earthworms that aerate and turn over the earth by digging wormholes, the red worm is rather comfortable in the upper layer of soil, when it contains plenty of decomposing organic matter. It is naturally found under piles of dead leaves, compost or manure.

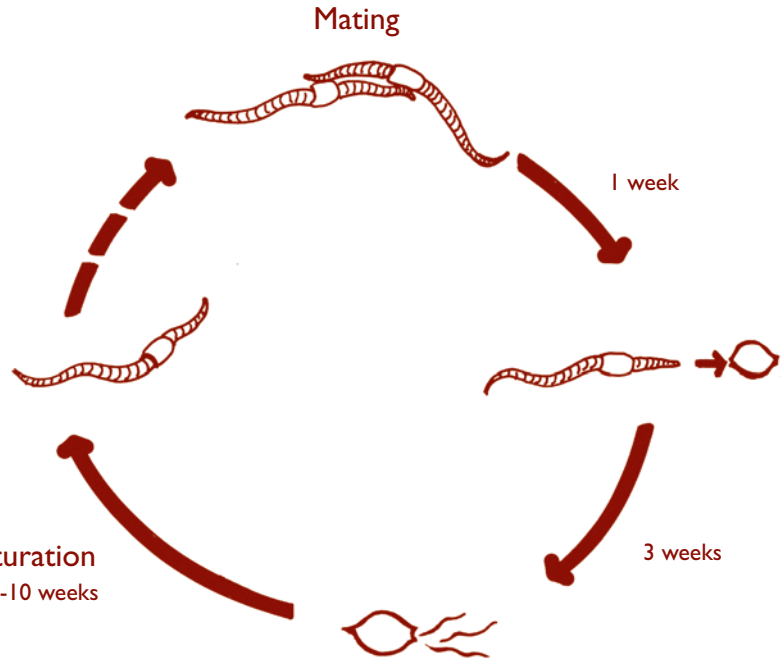
Eisenia fœtida is ideal for vermicomposting:

- **Prolific breeder:** Its population can double every three or four months.
- **Healthy eater:** Every day, it can take in an amount of organic matter equivalent to half its weight (e.g.: 500 g of worms can eat 250 g in organic matter per day).
- **Resistant:** It doesn't mind living in captivity and tolerates different temperatures, humidity and acidity.

To ensure that your worm bin works effectively right from the start, you should begin with a large number of worms (500 grammes, for example). Otherwise, you can always start off with fewer worms and just let their population grow. If you do so, you will have to be careful not to put too much food into the worm bin.

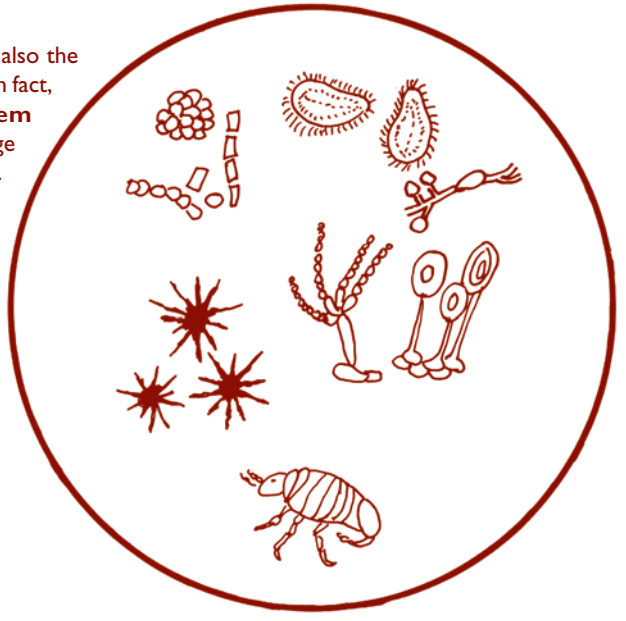
There are a few breeders in Montreal from where you can purchase compost worms. The other simpler solution would be to obtain worms from people or groups who already have worm bins.

E. fœtida is a hermaphrodite, which means that it is both female and male. In spite of this fact, two individual worms are still needed for reproduction. If you look closely at the worm bin content, you can see the worms in the different stages of their life cycle.



Team Work

Although worms are the most visible players in this process, vermicomposting is also the work of bacteria, microscopic fungi, protozoa and a host of other busy "workers". In fact, when you set up a vermicomposting system, you are creating an **ecosystem** involving millions of living organisms. Maintaining optimal conditions for this large community in the worm bin is essential for a successful decomposition process. Accordingly, you don't have to worry about the worm bin inhabitants leaving their home for yours… they see the outside world as a hostile and unwelcoming place!



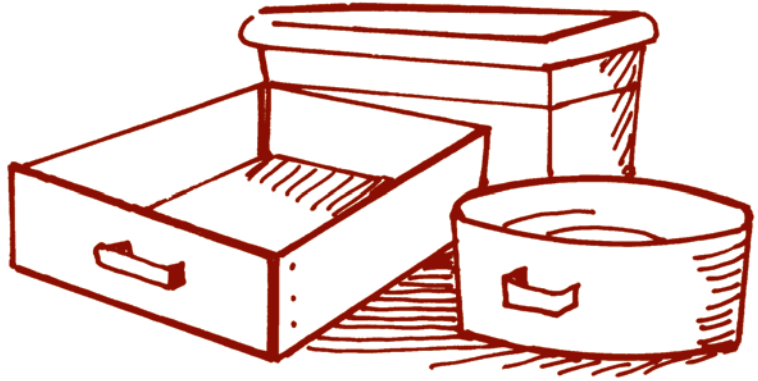
Choosing the Right Container

Worms and other decomposers need plenty of oxygen to carry out their work. Therefore, it is recommended that you use a shallow container that provides a large surface area (length x width).

The larger the surface area of the worm bin, the more space the worms have for transforming the compostable materials. As a rule of thumb, you can consider that each square foot of surface area (30 cm x 30 cm) will permit the transformation of 450 grammes (one pound) of organic matter per week. Of course, this is not written in stone: practice and experience will be your best guides for determining the "digestion" capacity of your worm bin. Households that produce large quantities of organic waste should use large containers or set up more than one bin.

In most cases, the worm bins are made from plastic storage boxes with lids. These boxes are inexpensive, long-lasting and come in a wide variety of formats. Alternatively, you can make your own vermicomposting bin out of wood, with its volume and appearance meeting the needs of the household. Think of recycling what you already have… old drawers, wood wine crates, etc.

Regardless of the type of container selected, it must be opaque since worms do not like light. Furthermore, keep in mind that, since the inside of the bin will constantly be moist, a wooden container will not last as long as a plastic one.



A Comfortable Environment: Bedding

To help worms carry out effectively their work, you must set up an adequate living environment for them. This environment is the bedding. It must have the ability to **retain moisture** while being light enough to allow **good aeration** throughout its depth. Since most food scraps added to the bin are fresh and high in nitrogen, the decomposition process must be balanced with **carbon-rich compostable materials**: the bedding will also serve this purpose. Thus for worms and other decomposers, the bedding is both a comfortable home and a source of food.

In the city, the best bedding material is shredded newspaper. It is inexpensive and easy to find. The finer you shred the paper, the better the bedding will be.

You don't have to worry about black ink, since it is generally soy oil based with carbon black (both biodegradable). Coloured inks used to contain toxic metals, such as lead, but this is now prohibited. Therefore, you can use any newsprint without worrying about poisoning the worms or yourself by using the compost for food production. However, the use of paper that is glossy or heavily printed (e.g. advertising flyers) should be avoided.

Depending on availability, other bedding materials can be used, such as corrugated cardboard (it's easy to tear up when wet), straw, dead leaves or sawdust (from hardwood—avoid using cedar).

Add a handful of sand (or potting soil, which contains sand) to the bedding. The abrasiveness of the grains of sand promotes the degradation of food in the worm's gut.

A 20-25 cm layer of bedding must be placed in the bottom of the vermicomposting bin. The bedding must be moist, but not drenched, somewhat like a wrung-out sponge. At the outset, water must be added to the dry material to obtain the desired level of moisture. However, as the composting process goes on, organic matter added to the bin usually provides the necessary moisture.

Bedding materials should be added on a regular basis. It absorbs odours and moisture, provides a source of carbon to balance out decomposition and makes the food unavailable to fruit flies. Add dry or moist bedding based on the moisture level in the vermicomposting bin.

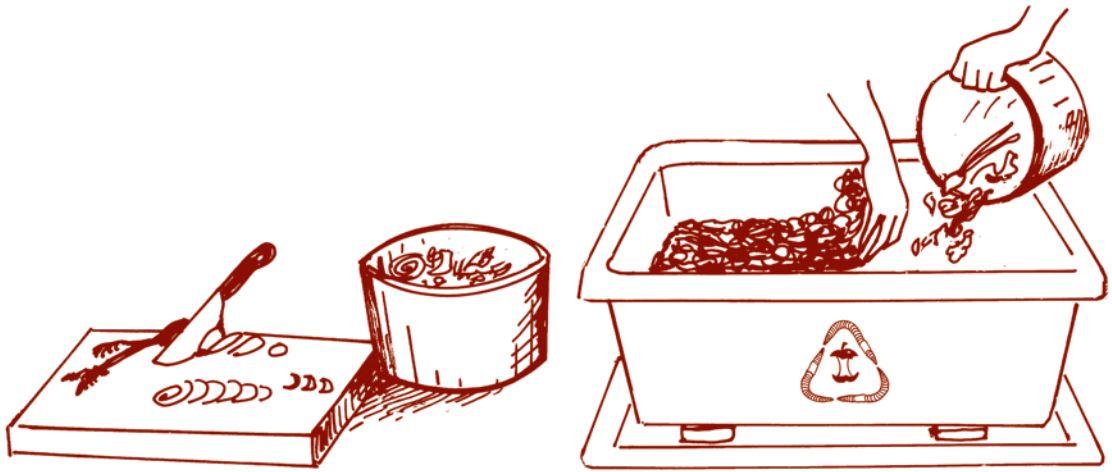
Feeding the Worms

Once the worms have been set up in their moist bedding, you should allow them a few days to adapt to their new environment before starting to feed them.

When you add food to the vermicomposting bin, you must **always bury it under a layer of bedding**. As well, organic matter that is chopped finely shows greater surface area for the decomposers to feed on and is therefore quicker to compost. As much as possible, try to bury the compostable materials in different areas of the bedding.

Organic matter waste can be kept in a closed container (e.g. a yogurt container) and added into the bin one to three times a week. The compost worms will be pleased with slightly rotting food. In fact, *E. foetida* first and foremost feeds on the micro-organisms that multiply on the surface of organic matter.

As a general rule, feeding the worms with the most diverse materials makes for a healthy ecosystem and quality compost.



On the Menu

YES

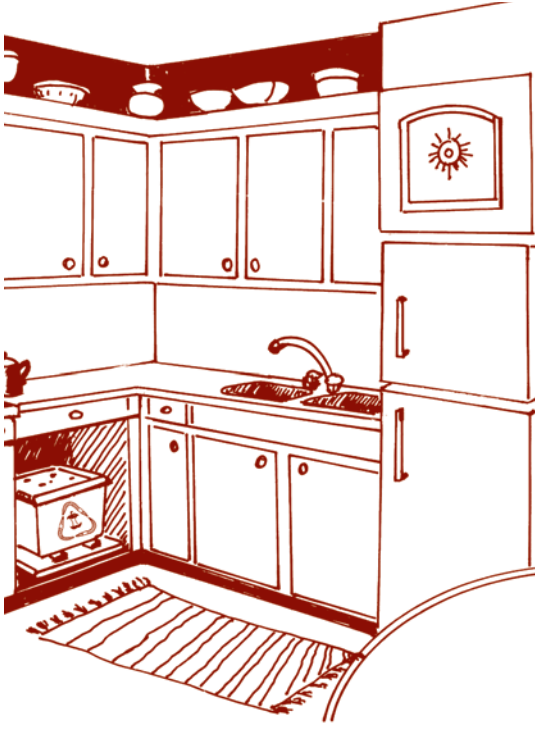
- Fruit and vegetable scraps
- Plant residues
- Coffee grounds (including the filter!)
- Teabags
- Bread and pizza crust
- Eggshells (crushed)
- Rice and pasta (with no oil or seasoning)

NO

- Meat or fish residues
- Fats (grease, oil, butter, etc.)
- Salty waste
- Vinegary waste
- Animal or bird excrement

Some special cases:

- The peel of citrus fruit can be added to the vermicomposting bin, but only in small quantities, since they are acidic.
- Potato peelings, unless they are finely cut, take long to decompose. They may even germinate!
- Milk products such as cheese can be put in the bin, especially if they are mouldy.



Tips for Locating Vermicomposting Bin

Temperature

Compost worms work best in temperatures ranging from 15°C to 25°C: outside this range, they will slow down their activities and their population may decline. Weather allowing, the bin can be left outside, but it should not be exposed to direct sunlight. Furthermore, abundant rain could drown the worms if the vermicomposting bin is not sheltered from the weather. When the fall and cooler nights start, the bin should be moved indoors.

Aeration

Since composting processus requires a fair amount of oxygen, there must be air circulation around the vermicomposting bin and air should easily move inside and outside the bin.

Be Aware of Acidity

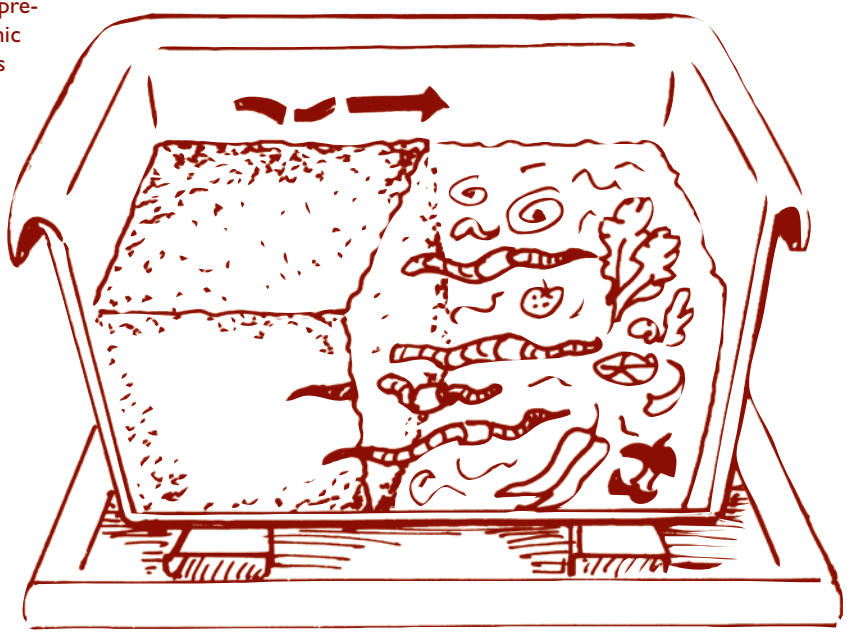
Over time, the bedding will become acidic through the composting process, which could eventually harm the worms. To offset this phenomenon, it is recommended that you regularly add crushed dry egg shells or dolomitic lime. This is all the more important if acidic food is added to the bin (e.g.: citrus fruit residues). In addition to neutralizing the acidity, adding egg shells or lime provides calcium for the worms, which will help them create their cocoons.

Harvest Time

After three to six months, most of the vermicomposting bin content will have gone through the worms' digestive system a few times and will have been turned into a dark brown gritty material. It is now time to harvest the precious compost. Compost – or vermicompost - is a mix of worm castings and partially composted organic matter. The further along the decomposition process is, the more worm castings you will find in the blend.

The Attraction of Food

So that the worms leave the vermicompost by themselves, simply move the entire contents of the bin to one side and prepare new bedding in the other half. By burying the organic matter in that fresh bedding only, you will cause the worms to migrate from one side to the other as they will go for the food. After approximately three weeks, the vermicompost will be ready for harvest, and you will just have to add moist bedding.

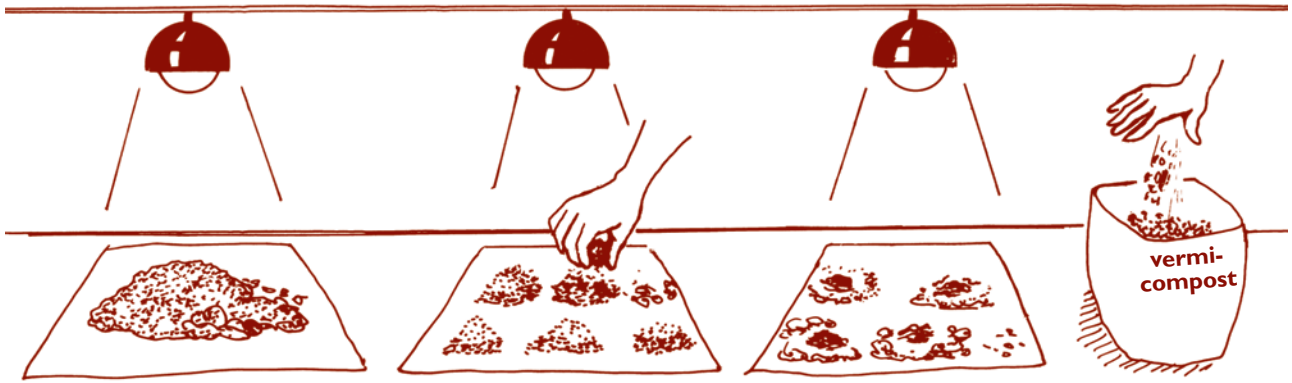


Dump and Sort

For those who don't mind getting their hands "dirty", there's another very effective harvesting method. It is based on a distinctive feature of the worms: they run away from the light when exposed to it. Here's how:

1. Stop putting food in the vermicomposting bin for one or two weeks.
2. Over a large surface and under intense light, empty the entire contents from the bin (you can work on a plastic film, for example, a cut-up garbage bag).
3. Separate the mass into several small piles.
4. Go from pile to pile, removing the upper layer of vermicompost (without removing the worms) and put it aside. *To escape the light, the worms will bury into the pile.*
5. Continue Step 4 until only small piles made primarily of worms remain.
6. Prepare fresh bedding in the bin and put the worms back in along with any undecomposed materials and some of the vermicompost (containing precious decomposers).

Using this method, you can closely follow the development of the worm population. Moreover, you can easily set aside some of the worms for someone else to start up his or her own vermicomposting bin (which, of course, is a good idea!).



Worry-Free Vermicomposting: A Question of Balance

Since vermicomposting is based on biological processes and involves living organisms, it is also a bit unpredictable. Fortunately, it's rare that a problem can't be easily fixed. Generally, you can simply bring back some balance to the system so that it will work well again.

Note: Adding too large quantities of organic matter in the bin will often bring about an imbalance, which can result in unwanted odours or fruit flies. For that reason it is important to monitor and respect the digestion capacity of your worms, even if it means having to put part of the organic matter produced by the household in the trash. In the end, you will still have contributed to reducing the amount of waste sent to the landfill site, and your vermicomposting experience will continue to be positive.

Symptom/Problem	Cause	Solution
Foul smell	• Too much food/ not enough worms	• Decrease the amount of food or obtain more worms
Ammonia smell	• Too many nitrogen-rich materials (green, fresh matter).	• Balance the system by adding carbon-rich materials (newspaper, dead leaves, dry straw, etc.).
Sulphuric smell	• The bedding is drenched and the bottom of the vermicomposting bin is not getting enough air.	• Add dry, torn-up newspaper or dead leaves to the bottom of the bin; mix some in the bedding. Open the lid of the bin and don't add as much food for a while.
Worms are climbing the walls of the bin (they never leave!)	• Bedding is too moist.	• See above.
	• Bedding is too acidic.	• Add dry powdered egg shells or dolomitic lime.
	• Conditions are no longer conducive to worm activity/the worm population is too high.	• Harvest vermicompost and restart the bin with fresh bedding and fewer worms.
Fruit flies	• Food exposed to air is attracting flies and they are laying eggs.	• Always cover organic matter with a layer of bedding. Add bedding if necessary.
	• Too much food in the vermicomposting bin.	• Decrease the amount of food for a while.

Vermicompost: The Gardener's Black Gold

More than just simple fertilizer, vermicompost is one of the richest soil conditioners there is for gardening. It improves soil structure and increases its ability to retain water. It brings beneficial microbial activity to plants and provides essential nutrients, available over a long period of time.

Plants that receive vermicompost are more productive and resistant to parasites and disease. Moreover, using vermicompost (or compost) makes chemical fertilizer—petrochemical industry products—unnecessary.

For excellent plant soil, you can mix one part vermicompost with four or five parts of all-purpose soil. While being careful not to hurt the roots, you can also replace one or two centimetres of indoor plant soil with vermicompost.

A "compost tea" can be prepared by putting vermicompost in a tissue "envelope" and immersing it in water. After a day or two, you will have a dark liquid. This solution, diluted in a few parts of water, is a good tonic for plants that need it. You can use it to water the plants or mist their leaves. You can also do the same with the liquid that may gather in the tray under the bin (collect, dilute and apply).

Not a gardener you say? Someone around you would probably be pleased to receive this precious fertilizer. If not, why not return this fertile food to the Earth by spreading it at the foot of bushes or trees in your neighbourhood?

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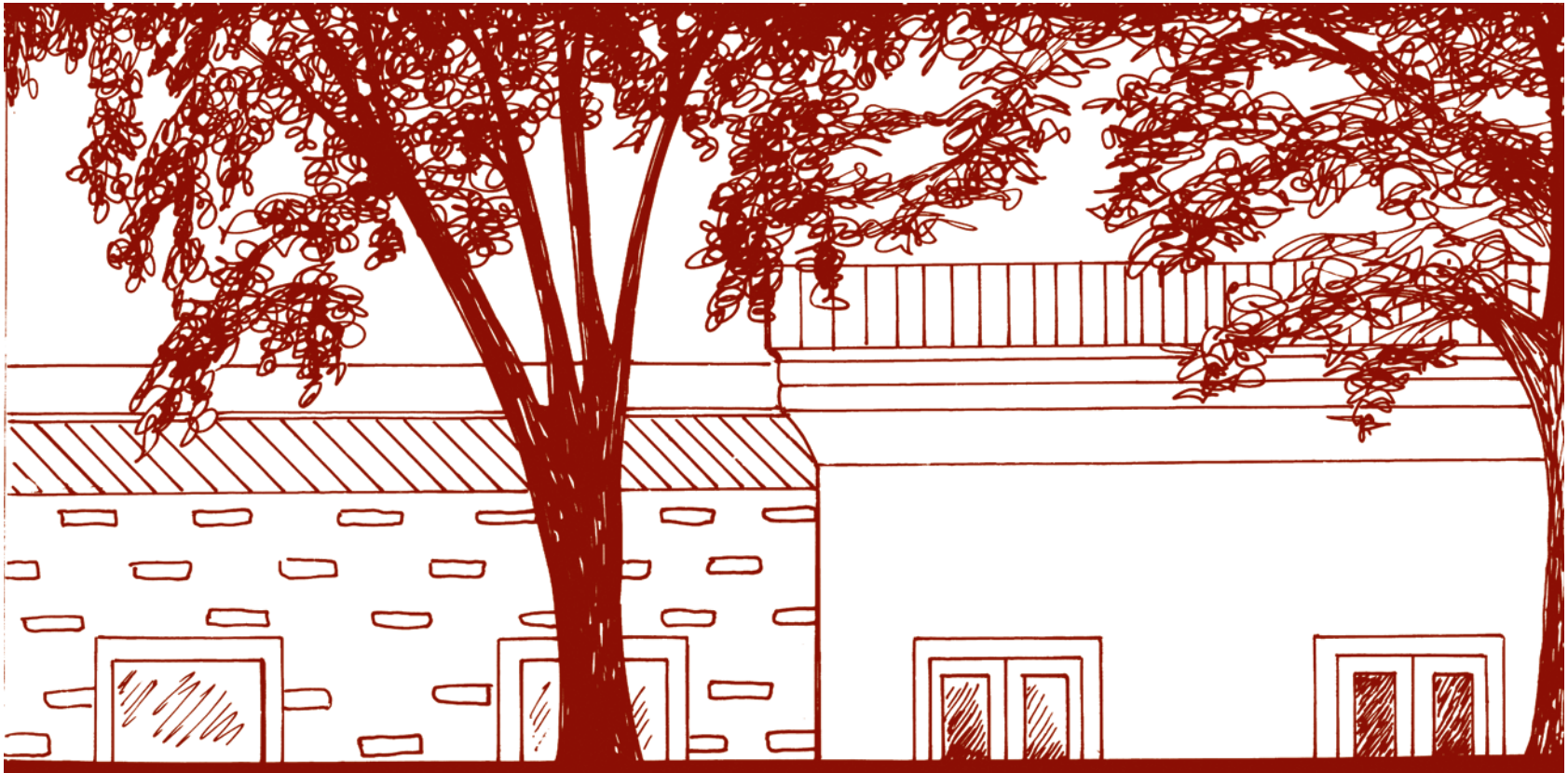

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