

The Basics of Worm Composting

A Beginners Guide



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Introduction

If you're reading this booklet it is likely that you are interested in worm composting, and if you're not interested in worm composting yet, then perhaps this will *get* you interested. This booklet was put together to serve as a sort of beginners "how-to" guide, to answer the most common and a few not-so-common questions people have regarding vermicomposting.

Fancy Worm Words

Perhaps the most logical place to begin is with a language lesson, this will make your journey into the worm world a little easier to understand. Below are some of the most frequently used terms involved with worm composting.

- Vermicomposting- The process of utilizing the natural tendencies of red worms to break down your organic waste into nutrient rich natural fertilizer.
- Castings- a.k.a. vermicast or worm manure or simply, worm poop!
- Bedding- a.k.a. biomass, is the substrate or material that the worms use for their home as well as food source, consisting of decaying organic plant matter as well as carbon material such as shredded paper.
- Bin- The container used to house and retain the bedding and worms.
- Worm Tea- Not what it sounds like! This is the liquid that may drain or condense in the bottom of the worm bin when there is excess moisture present, usually containing high levels of water soluble nutrients leached from the bedding and castings in the bin.

Why Would Anyone Do This?

Anyone who has seen the news in the past few years understands that there are a number of concerns over our impact on the environment, and one simple way to reduce that impact is by vermicomposting. Approximately one third of all waste that ends up in landfills is food waste, most of which comes from plants such as fruits and vegetables. These waste products are ideal foods for worms and they are basically free!

Plant waste that is put into landfills is covered over where it has little or no access to oxygen, this causes the waste to break down more slowly and in the process create large quantities of methane, one of the most damaging greenhouse gases. If some of this waste were to be fed to worms it would be broken down more rapidly and with the access to oxygen it would not be creating any dangerous methane build up.

By feeding plant waste to worms, it is one of the few things that is virtually 100% recyclable turning it into a nutrient rich fertilizer at little or no cost. If you live where you have to pay for garbage pick up this could greatly reduce the number of pick ups that you need to pay for. If you are into gardening or lawn maintenance, the castings produced by the worms make an excellent fertilizer, as well as being helpful in other ways.

Did you know that by spreading worm castings in your lawn or garden it will not only feed the plants but also help retain moisture for plants and grasses and attract other earth worms? The earthworms will develop burrows that help maintain well draining soil, not to mention they will leave their own fertilizer.

Another nice bonus to vermicomposting is that it can be done indoors therefore done all year round. This is especially beneficial to those living in temperate climates where outdoor aerobic compost piles tend to freeze up and remain dormant most of the winter. Worms can be kept inside in the warmth of a garage, basement or even the kitchen. This helps the gardener who wants some nice fertilizer ready to go at first sight of spring thaw. In addition, vermicomposting takes about one third of the time as regular aerobic composting to reach a finished product. While you may not have space or want to create space for enough worms to eat all of your food scraps, a small bin in the house can still make a sizeable dent in your waste disposal.

What Kind of Worms and Why?

There is a common misunderstanding that worms are all alike, however, there are thousands of species of worms in the world. Even worms in the same regions can differ quite a bit.

When it comes to vermicomposting, the worms that are used are red wigglers. These are a small species of Epigeic worm, meaning that they actually live above ground rather than below it like Anecic worms such as night crawlers. Red worms primarily eat decaying organic matter, consuming about half their body weight in a day. Red worms are like sports cars in the worm world, they move quickly and burn through fuel faster than some larger species. Other benefits to using red worms is that they adapt better to captivity. Earthworms such as Night crawlers prefer to have their burrows and tunnels in the dirt and don't adapt well to being bothered by human interference. Red worms on the other hand do not build burrows and tunnels, instead they crawl their way through their habitat to find food and when there is none, they eat their habitat.

Red worms reproduce at a higher rate than earthworms. If the conditions in the worm bin are right, that is, if they have plenty of food and enough space as well as the necessary darkness, moisture and oxygen, they will double their population in about 3-5 months. A note about population, red worms will basically maintain a population for the size environment they are in, so if there is less food and space is getting tight they will not reproduce much until some die off or their environment get's bigger. You needn't worry too much about having too many worms though. If you think your clan is getting out of control, simply separate some out and give them to a friend. I don't recommend throwing them outside if you don't need them as they can really do damage to some ecosystems such as forests that rely on their build up of decaying organic matter for plant germination.

How Do You Do It?

This is really the meat and potatoes serving of this booklet, answering the where and how questions for vermicomposting. I have divided this section into three main points that cover the primary concerns for how to go about keeping both you and your worms happy. Keep in mind that while it may occasionally sound technical and scientific, vermicomposting is really an art. These guidelines are just a reference to get you started but you may need to make minor adjustments along the way since different places may offer different challenges such as climate, pests and foods.

1) Determining your needs- The first thing you'll need to do before you get your heart set on a particular bin and definitely before ordering any worms, is to figure out how much stuff you have to feed your worms. A person who eats out three nights a week and lives off boxed or canned food the rest of the week will produce significantly less worm food than the home cook or gardener.

The best method to determine the amount of food waste your household produces is to save your scraps in a bucket for a week and then weigh the bucket at the end of the week. Divide that number by seven to find out how much food waste you create each day. I should point out here that you do NOT want to include meats (including fish and poultry), egg shells can be included but not the actual egg (more on that later), no dairy products such as cheese, yogurt and butter, or heavy oils such as left over frying oil or bacon drippings. Worms will eat about half their body weight in a day so this helps you figure out how many worms you need to buy, just by using a simple ratio of 1:2, that means for every 1 part of waste you need 2 parts of worms. Here's an example: for one week there are 14 pounds of food scraps, which averages out to 2 pounds of food per day. So we double that in pounds of worms giving us 4 pounds of worms.

From this point you can decide whether you want to feed all of your food scraps to your worms or just some because let's be honest, not everyone who has 2 pounds of food scraps wants to spend about \$100.00 on 4 pounds of worms. (Truthfully, you probably don't need to since you will produce less scrap on some days and possibly even no scraps on other days plus the fact that the worms will reproduce, but now I'm rambling.) My most common recommendation for most people is to start with a pound of worms and a worm bin that is big enough to expand, that way you can always add more worms if you need to, which brings us to our next point.

2) Boxes and Bins and Bags- Now that you have determined the amount of scraps you produce and the amount of worms you will need, you can use this information to determine the size bin you'll need remembering that a family of worms will maintain a population relative to the size home they have. That means that they will not reproduce to the point of overflowing the container they are kept in. If there is too little food, the younger will beat out the older for it forcing them to die off.

There are a plethora of containers to choose from. Some are as simple as a square box, others look like a hanging bag, and some have multiple layers of various depths. Some bins are plastic, some are wood or fabric and there's even a method using no

container at all. There are a few main things to look for when buying a container or making one yourself.

Worms prefer darkness, too much sunlight can dry them out and they will tend to avoid any light source so an open top will force them downwards and away from any food source in the top layer of the container.

Anyone who's ever seen or especially held a worm knows that they are slimy and they need moisture to keep that protective slime layer on their skin. If the container becomes too dry they will begin to slow their eating and may die causing you to lose a small investment. Like pretty much every living thing on this planet, worms need oxygen to survive so a container needs to have good ventilation that will allow air to flow through their bedding. This will also keep the food scraps that you bury from smelling bad and attracting unwanted pests. The oxygen flow allows microorganisms (that's right your worms are not alone) to survive and begin to break down the organic matter. This enables the worms to eat the food as well as some of the microorganisms. If you've ever taken a bite of raw broccoli stalks you can understand why toothless worms need a little help in breaking this stuff down.

When trying to determine your bin material preference, it is important to consider what each one has to offer as well as your personal caretaking style. When the food scraps begin to break down they release moisture into the bin, which can condense on the sides and top of the bin. In wooden bins this excess moisture typically is absorbed into the wood but in plastic bins it collects in the bottom, usually in a tray designed to collect this "worm tea" as it is referred. Usually there is some sort of spigot so this tea can be drained off and used as a liquid fertilizer, however, if there is enough build up that does not get drained it can cause worms to either escape to safety or to drown. Wooden bins rarely, if ever, have this sort of moisture build up but they also don't produce the tea, so this dilemma comes down to how often you can remember to check for tea build up. If you are like me and prefer to feed and leave, you may want to go with a wooden bin, but if you are a more disciplined caretaker you may want to try plastic.

Some bins are more decorative than others so I recommend shopping around to find the one that you like best for the space you are going to put it in and I always recommend a bin with room to grow or one that can be added to such as some of the layered designs that allow you to add more layers if needed.

There are a number of different designs to choose from as well, some are easier for feeding, others easier for harvesting castings. Although each has its own pros and cons what you choose should be based on what you find to be most important. Just remember to include the three main needs: darkness, moisture and air flow.

A final option may be to use what are referred to as "windrows". These are shallow trenches or elongated mounds of bedding where food scraps are buried and the worms move through the mound, eating as they go. Typically these are used for larger operations such as farms or companies raising worms. They offer the benefit of no cost housing but the drawback of less protection for your worms from the

elements and from pests. This is a method I have no personal experience with so I unfortunately can't offer any more advice on it.

“Can I put my worms into my outdoor compost pile or my raised beds?” The answer is “maybe”. Typical aerobic composting involves regularly turning the pile to aerate it which increases microorganism activity and causes the pile to heat up, the internal temperature can become so hot that it may literally cook the worms or more likely, cause them to look elsewhere for food. Although worms do feed on the microorganisms the bacteria in a compost heap may use up all the available oxygen thus suffocating the worms, but if you are somewhat lax in your compost maintenance and tend to “pile it and wait”, then worms will probably do fine in your outdoor heap. As for raised beds, you are probably better off attracting earthworms such as night crawlers to the beds. Although raised beds may contain a fair amount of compost or other decomposing matter they may not offer enough food to keep red worms interested and if you live where winters get cold, red worms will likely retreat to warmer places and may not return in the numbers you would like. If you are trying lasagna gardening which adds layers of rotting food scraps as well as other decomposing organic matter, red worms may do great since there is typically more food for them.

3) Food and Bedding- First I'll cover bedding which is the material in which the worms live and where the food scraps are buried. The worms will eat the food scraps and they will also eat the bedding, especially in the absence of food scraps.

Bedding serves as a substrate for the worms to live in but also serves to help maintain an acceptable moisture level and airflow. In much the same manner as you add carbon material to an aerobic compost pile, in the worm bin it helps suppress any bad odors that the food scraps may produce while decomposing. So long as the bedding is not too wet, it will also help insulate the worms from extreme temperatures of heat or cold.

Bedding may consist of any number of carbon type materials. Some of the most common materials to use are shredded paper or newsprint, coconut coir fiber, and peat. You could also use items such as straw or dry leaves but these are items that are best left outdoors since they may contain unwanted insects or the eggs of unwanted insects which could quickly wreak havoc on your home comfort. The first year we began working with worms we decided to use dry leaves as bedding since we had plenty and it was free, plus leaves contain a great deal of micronutrients. As the weather grew much too cold for the worms in our uninsulated garage, we moved them into our basement. It didn't take long for us to discover we had a problem, I went to feed the worms and when I opened the box a cloud of tiny moth flies hit me in the face, Yummy! It took quite a bit of time and some creative fly traps to get rid of them especially since we could not spray anything in the box for fear of killing the worms.

Leaves and straw would be good items to use for outdoor bins or in windrows where you needn't worry so much about the uninvited guests. Shredded paper and coconut coir are probably the best bet for indoor use as they are virtually sterile from any

visitors. Another benefit is that these are materials that are easy to find and cost almost nothing. Shredded paper can be sourced from your work or a local business, or shredded at home when you finish reading the paper. Coconut coir is readily available online or if you have a local hydroponic gardening store, they usually have it for really cheap.

Bridging the gap between bedding and food is what is referred to as “grit”. Grit is used by worms much the same way birds use small pieces of gravel, they eat the grit and store some in their gizzard to help them grind their food since they have no teeth.

Some common forms of grit are very fine gravel dust such as limestone, another option is sand such as playground sand that you can buy from the hardware store, or simply throw in a couple handfuls of topsoil or potting soil, they should have some fine material that can be used.

Food is probably where a majority of the questions come up when talking about worms but it is really simpler than it seems. There are only a few rules to follow when feeding your worms; **1)** Do not feed them any meats including poultry or fish. These items are not part of a red worm’s regular diet and they will simply begin to putrefy or rot which will begin to smell and attract unwanted visitors such as cockroaches and rats. **2)** Do not feed them dairy products such as cheese and yogurt. This goes the same way as meats, while the worms may feed on the molds that grow on dairy products, the food will begin to rot and smell terrible which again attracts unwanted guests.

3) Do not feed them heavy oils such as butter or meat drippings. This once again is for the same reasons as meats and dairy products. **4)** Do not feed them eggs whether cooked or raw. This one get’s tricky, because egg shells are fine to put in the bin, I’ve seen the worms eat the small amount of membrane left inside the shell but much more than that will just rot and begin to smell. The worms can not eat the shell itself if left whole but there is something you can do that is great for the worms and your finished castings. Dry the egg shells out either on a tray or in the oven on low heat then grind them in a food processor and mix into the bedding. This will give the worms some natural grit and will add more calcium to their castings which is helpful to many plants such as tomatoes. If this sounds like too much work just to feed the egg shells to your worms you could just crush them by hand and throw them in the garden wherever you have slug problems. Apparently slugs are too sensitive to crawl over the sharp edges.

There are two other food items that you can feed your worms but should avoid large quantities of. The first is Citrus fruits such as lemons, limes, oranges, grapefruit, pomelo, etc. These fruits contain a chemical called Limonene which can, in large quantities, kill worms. A rind here and there is fine but if you tend to juice a lot of oranges for breakfast or make fresh lemonade, you may just want to put the leftovers in your regular compost or the garbage to be safe. The other item you can feed in moderation is stale bread or grain products like stale cereal, crackers, corn chips, etc. The worms will eat these and they will also feed on the molds that grow on them. I’ve even thrown in a chunk of stale homemade bread that began to ferment and found it full of worms a few days later. It was like an open bar at a fraternity house! Too much of these products could begin to ferment too much and create an alcohol smell,

which will attract critters from all around, it will also decrease the oxygen level in the bin which could begin to suffocate the worms. Red worms are much like children in that they prefer the sweet stuff. Fruits will disappear much faster than vegetables. This probably has a lot to do with the fact that fruits tend to be softer and break down faster.

They also have higher sugar contents which promote fermentation which speed decomposition by microorganisms. Unlike the fermenting bread, I have not had any problems with adding too much fruit and getting that fermented smell that attracts other critters, possibly because the worms like to eat the fruit quickly so the smell doesn't build up.

Vegetables will disappear more slowly, at least the fresh scraps like broccoli stalks. Some vegetable scraps will actually live longer in a worm bin if they are not rotting when you put them in. Potatoes, carrots, beets and even cabeges and lettuces have begun to sprout new growth in a worm bin, and while it makes a fun science experiment, it defeats the purpose of feeding them to the worms. For these types of hearty vegetables I recommend grinding them up in a food processor or cooking them in the microwave for a couple of minutes to begin the breakdown process. Also like children, there are some things that they simply will not eat. I have not come across too many of these items but they do exist and it may depend on your diet and what you have left over to feed them. If you come across these items simply remove them from the bin and either put them in the outdoor compost or discard them.

House Guests

There is a common misconception that worms are the only critters in a worm bin, this however is not so. There can be a multitude of organisms living in your worm bin, and provided that things are going well, they are all good house guests. The unfortunate reality is that some unwanted guests can and sometimes do show up and even the good houseguest can occasionally get out of hand, so this section is dedicated to the "who's" and "why's" of worm bin house guests.

Probably the best place to begin is with the friendly house guests, those tiny, often benign critters that you never invited but they showed up anyway. There are actually a few culprits in this category and of course they may vary depending on where you are.

The first is the sow bug a.k.a. potato bug, rollie pollie, ball bug, etc. Every kid in the country has probably seen and played with one of these guys, they look like little armadillos with their gray segmented armor that protects them when they roll up into a little ball. These guys like to eat rotting vegetation, so if they find out you're giving it away they may show up, more likely in outside bins than indoors. We have had absolutely no sign of these guys in our garage bins, but from what I have read, they offer little or no problems.

Next up is the Pot worm, tiny quarter-to-half-inch long white worms (baby red worms begin to turn pink by this size). Pot worms offer only a small threat to your worm bin. They can compete for food and seem to have a great affection for moist or

fermented bread products. They can be thinned out by placing moist pieces of bread on top of the bedding then removing it along with any attached pot worms after a couple days. A good preemptive measure to take is feeding little or no bread products to the worms.

Next is Springtails, which look like tiny (almost too small to notice) white specks moving around in the bedding. Much like the red worms, they will tend to flee from the light when exposed. Unlike some garden varieties, these don't actually have the tail spring so under closer inspection they just look like a white mite of some sort.

These guys feed on decaying organic matter just like the red worms, however, if they begin to populate too densely they could compete for food. Keeping your bins moisture like a rung out sponge will help keep their numbers at a safe level as they tend to prefer wet conditions.

Moth Flies or as most people call them, Fruit Flies, due to their great love for fruits and sweet smells are on the "unwanted house guest" list. These tiny flies have a love for decaying organic matter but they do not limit themselves only to the dark regions of the worm bin, oh no!

These little buggers like to buzz around the house finding any and every little morsel they can while driving you creepy-crazy (can you tell I don't like them?). They will lay eggs in the bedding and even hang out in great numbers there until you open the lid and nearly choke on the cloud of flying vermin. You are likely to find some crawling in the bin which is fine as long as there aren't many of them, keeping a one to two inch layer of dry shredded paper on top of the bedding helps keep from attracting them.

They are very difficult to eradicate once they've established themselves in your home but here are a few methods. Sticky fly paper hung across the inside of the worm bin as well as some hung outside of it nearby, a few vinegar traps placed in or around the bin work well. Vinegar traps are a shallow dish with vinegar in it and plastic wrap stretched tightly over top then poked with a tooth pick. They climb in but can't get out, there are a few different models for this on the internet as well. After that you must separate the worms from their bedding and discard it to the outdoor compost or garbage to keep them from reestablishing a roost.

Another potential tenant is the Black Soldier Fly Larvae, which is hard to miss at about ½ to ¾ inch long, pale white to gray and covering the top layer of the bedding. At first you might mistake it for a large sow bug but the unmistakable aroma will give it away. Another name for the adult fly of these things is the Latrine Fly because they are often found in latrines (yummy!) The only time I've experienced these larvae was in a poorly kept outdoor compost bin that began to smell, well, like a latrine. The larvae are voracious eaters, devouring rotten vegetation and the adults disappear almost as soon as they develop, which together makes them sound fairly harmless but if they are in your worm bin it means there are a number of problems only one of which is nasty looking giant maggots. If you

maintain the moisture levels and airflow you'll probably never have to worry about these guys.

Troubleshooting

- **Runaway worms-** This can be caused by a few different problems, the most common of which would be a pH imbalance. Red worms prefer bedding with a pH of about 6.5, much higher and it's too alkaline, much lower and it's too acidic. This can be tested with a pH probe available at most garden stores for around \$10, simply push the probe into a few different parts of the bedding and see what it reads. If bedding is slightly acidic you can mix in crushed eggshells and test again after about an hour. Highly acidic you can buy "soil sweetener" or hydrated lime which you need to be careful with. First moisten the bedding then sprinkle a small amount on top of bedding and let set to absorb moisture, 15-30 minutes should work. Next mix the moistened lime into bedding and test again. If you mix it in dry it could burn the worms.
- If bedding is slightly alkaline try adding clean saw dust or wood chips such as pine, try to avoid cedar and black walnut as they could poison the worms. Wood chips or sawdust can be mixed right in. If it's really alkaline you can buy acid soil additive but again be careful and do a little at a time testing in between. The other likely causes are too much moisture which will be evident by pooling in the bottom of the bin and bedding that pack together easily or an over population of other critters such as Pot worms or Springtails that are competing for the same food.
- **Smelly Bin-** Most likely this will be caused by over feeding and insufficient carbon bedding. If there is too much food for the worms to consume in a reasonable time it will begin to rot and if there is not enough carbon bedding like shredded paper to control that odor it will become very noticeable. Too much moisture and/or too little air flow will also cause this. Bedding should be moist but not so moist that it easily packs together, it should stick to your hand if you mix it around but should brush off fairly easily.
- **Slow movers-** The most obvious cause of this is that the temperature inside the bin is too cold, however, this may also happen if the bin gets too hot, especially if it begins to dry out. The temperature of the surrounding air may differ quite a bit from the temperature inside the bin so it's a good idea to check the temperature often during extreme weather. You can purchase an instant read thermometer from a kitchen supply store for a small price, this can be inserted directly into the bedding to get a reading. The range to stay within is 40-90 degrees Fahrenheit, any higher and you risk cooking the worms, any lower and you risk freezing them. The other most common cause of slow worms is that the bedding is too dry causing the worms to dehydrate, if left unchecked this will kill the worms.

Quick Reference Guide

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Good Luck!

Whether your goal is to reduce your environmental impact, or to turn your garbage into fertilizer hopefully this booklet will make your vermicomposting experience easier and more enjoyable.