

A Quick Guide to Vermicomposting

Why Worm Composting?

- It is an environmentally friendly way to recycle food wastes. Each day worms can eat half their weight in food. Just a thousand worms (approximately one pound) can consume a few pounds of food weekly.
- More beneficial micro-organisms compared to regular composting.
- The finished product is finer and not as coarse as hot compost.



- Locks nutrients and moisture into the soil, and makes nutrients more bio-available.
- Promotes disease and pathogen resistance.
- Provides various plant growth and germination hormones. Also resulting humic acid and mycorrhiza fungus helps root systems grow strong.

Various Types of Compost Worms

- Burrowing (anecic) worms. Though they come up to feed, they need to burrow deeper in the soil and don't like crowding. An example is the Canadian nightcrawler, *Lumbricus terrestris*, that is used for fishing. These are essentially earthworms, and because of their traits of burrowing, they are not suitable for composting.
- Surface (epigeic) worms. Live primarily in the top few inches, eating garbage, leaves, and all sorts of organic debris. They handle crowding well and are the most conventional composting worms. The most popular species is the red worm also known as *Eisenia Fetida*.



- Other types, such as European Crawler (*Eisenia Hortensis*) are larger, a little more darker brown, and make good fishing worms, but they are more prone to wandering if their habitat is not suitable. P. Excavatus, a.k.a. The blue worm, is a native worm to the Southeastern United States, and although it has a high reproduction rate and is a great composter, it does not tolerate low temperatures, and is prone to wandering. Blue worm picture follows:



- Another compost worm is the African nightcrawler (*Eudrilus Eugenia*) – no picture included

The Red Compost Worm (*Eisenia Fetida*)

- The Red Worm also goes by the name Red Wiggler, and is the most common composting worm. It has characteristics which make it most suitable and adaptable for worm composting.
- Maximum reproduction under ideal conditions: 3.8 cocoons per adult per week; 83.2% hatching success rate; 3.3 hatchlings per cocoon. Net reproduction of 10.4 young per adult per week. Under ideal conditions, can double in population every 90 days.
- Maximum growth rate under ideal conditions: 32-73 days to cocoon hatch; 53-76 days to sexual maturity; 85-149 days from egg to maturity
- Temperature requirements (°F): Minimum 38°, Maximum 95°, Ideal range 70-80°
- A sexually mature worm will have bands and this band or ring is referred to as the clitellum. Each worm changes sex many times, but they are not self fertile. When two worms mate, they each go off and deposit egg capsules containing up to 20 young. The

average survival rate is between three and four per capsule. The newly deposited egg will look like a small lemon, and be pale in color; as the blood supply increases, the color will deepen, and can be almost black before hatching.

Different Systems of Worm Vermicomposting

1. Stackable Tray Bins



This is the most common type. Levels are stacked and have screened bottoms which allow the passage of worms between levels. The levels can be at various ages such that once a given level is finished composting, the worms will ‘hopefully’ pass to other levels and the castings harvested. This usually requires the removal of worms via various means.

2. Flow- Through System, Reactors



There are no layers or tiers in this flow through system, but worms move upward as food is consumed, thus allowing the bottom section to mature and be harvested. Vermicompost and castings are harvested directly from the bottom via means of bars, screens, and various mechanisms (depending on design). There are some problems with messiness and drying out as the bottom remains open. The Easy Roll worm composter operates on this principle, but allows the inversion of the bin to access the bottom.

3. Outdoor Worm Beds



Outdoor worm beds range from boxes buried in the ground to pits dug in shaded areas. I have personally had great success with the latter, as native composting worms such as the blue worm, *P. Excavatus* move in for a feast.

4. Commercial Systems

Commercial systems are beyond the scope of this guide but they include outdoor windrow systems



and large flow through reactors..



Setting Up A Worm Bin

- Sources for composting worms: I am reluctant to suggest specific sources because quality may change, and it may be best to order from sources closest to you. Therefore, here are some resources to help you locate worms..

<http://www.findworms.com/>

<http://www.cityfarmer.org/wormsupl79.html>

<http://vermicomposters.ning.com/forum/topics/worm-suppliers>

<http://www.bae.ncsu.edu/topic/vermicomposting/vermiculture/resource.html>



- Provide a several-inch-thick layer of bedding

for the worms. This can be made of materials such as shredded newspaper (most common), coir, chopped leaves, pieces of cardboard, peat (can be acidic), etc. Bedding should then be moistened, but not dripping wet.

- A small amount of composted material should be added at this point so that the necessary bacteria for composting are available. Ideally, this should be from a worm bin, but it could also be matured compost from a conventional pile. Next, you can begin adding food.

Foods and Feeding

- Plant-based kitchen scraps (fruits, veggies, etc). Chop larger pieces if possible.
- Do not let food scraps get old and foul before giving to worms. Anaerobic (without air) processes can produce ammonia and other harmful substances to the worms. Some folks chop up and preserve food scraps in the freezer. However, if you are concerned about energy costs, you might try to place your extra foods in a conventional composter (or pile) as an alternative before feeding to worms. This is my preferable practice.
- Do not add more food than what can be consumed by worms in a reasonable amount of time, as too much food can heat up the bin, cause odors and attract pests. It is best to bury or cover foods with more bedding to prevent odors and discourage fruit flies and other bugs. Let experience be your guide here.
- Use tea bags, coffee grounds and filters.
- Shredded un-glossed paper or cardboard products that don't have colored inks (unless soy based).
- Egg shells. Crush as small as possible.
- Avoid all meat and oil based foods.
- Leaves and yard maintenance items. Try and avoid oak leaves, and do not use any plant materials which have been treated with chemicals. Do not use large amounts of "greens" such as grass clippings without composting them first (as they will heat the bin up).

- Manure is one of the best foods possible. However, most “hot” manures will need to sit for a couple of weeks or be composted first. Some manures, like rabbit manure, can be added immediately.
- Strive for a good balance of “greens” and “browns.” The more nutrients go into the worm food, the more nutrients will be cycled back to the resulting vermicompost.

Ongoing maintenance and operation

1. Temperature control. Do not overfeed so as not to overheat bin. Red worms can tolerate lows into the 40’s and highs into the 90’s, but optimal growth and reproduction take place between the 70s and 80s. If bin is overheated, remove excess food, and mist bed to increase evaporative cooling (you can take top off and place damp cardboard or burlap on top). Leave outdoor bins in full shade except during colder weather. Feeding worms frozen food scraps from the freezer is a great way to cool down the bin. In cold weather, keep bin covered, move indoors, and/or move into sunlight. Adding more food in cold temps will generate more heat in bin, and this is a good method of temperature management.
2. PH – After awhile, the ph may drop due to buildup of acids from foods. A modest application of garden lime or ground egg shells can raise ph as needed. Limit the use of too many acidic foods such as tomatoes, citrus, etc. These are fine to use in moderation, but be aware of the above.
3. Bugs and pests – Most of these are more of a nuisance to humans than to the worms. Ants will occasionally build nests in outdoor bins, but can be discouraged by not allowing beds to get dry. Ants do not harm the worms. With extreme infestations, suitable insecticides can be placed around the legs of bins (avoid contact with bed!). Most insects are not dangerous to worms and in fact, can actually aid in

composting! The Black Soldier Fly Larvae ([BSFL](#)) is just one such beneficial companion composter. Picture follows...



4. If you have an overabundance of mites you are probably overfeeding and/or the bed is too wet. As mentioned, fruit flies can be discouraged by not overfeeding and by burying foods.
5. Odors – There should be very little odor in a properly operating bin. This is usually a problem of using the wrong foods, insufficient aeration, overfeeding and not covering foods.
6. Handling – Minimize the direct handling of worms because skin oils can affect their protective coating. Do not over dig or otherwise disturb the bed. This is fine in moderation, but can cause them to not eat momentarily.
7. Reproduction Rate – If it is desirable to increase numbers, then over crowding must be avoided as worms can sense the need to reduce or increase their numbers based on available space. Therefore, if more worms are desired, and the bin is getting full, it may be necessary to offload some worms to a new bin. A happy medium of density should be sought however, because worms also reproduce based on their frequency of ‘bumping’ into one another, so too much space can prevent this.

8. Overcrowding – This is a good thing and means that you need to start another bin! When the bin gets over crowded, the worms will lose their ‘clitellum’ center band. Seeing this absent on many worms, is a sign that its time to separate into a new bin.

Using Your Castings and Vermicompost

- Once finished and castings or vermicompost are collected, it is always advisable to first separate any remaining worms or cocoons. These can be removed out by hand (wear gloves) or by a variety of other methods easily researched - separation via light, etc. This can be avoided with my “Easy Roll” bin.
- If there are larger particles that have not been broken down, it is advisable to sift the castings through a screen (1/2” or 1/4” depending on the particle size you wish).
- For soil medium enhancements, pure castings should be used at around 10-20% of the mixture. A little goes a long way, and too much is less effective. Handfuls of castings and vermicompost can also be applied as needed around the base of plants, covering turf, etc.
- Compost tea. “Leachate” which is runoff from the worm bin, is non-broken down organic matter and as such, contains many anaerobic bacteria. These can produce some undesirable by products for your plants, but many swear by its effective use. Castings tea is made by adding non de-chlorinated water to “finished” castings, and it is far healthier for plants, having a good mixture of micro-organisms and nutrients. These micro-organism populations can be further enhanced by injecting air and adding sugars (like molasses) for a day or so. This however, is not necessary and the castings tea can simply be made by adding

water and applying directly to plant roots, or as a foliar spray. My own practice is to fill a bucket about 5-10% with castings and a little molasses, add about 3 ½ gallons water and then stir occasionally for a few hours to oxygenate. You can then apply this to plant roots, or strain and apply via a sprayer.

- Storing Castings – You can store castings in large zip lock bags (or smaller size for house plants etc). For larger quantities, you can store them in 5 gallons buckets, or whatever you have available, but try to keep castings from drying out and not exposed to temperature extremes so the micro-organisms survive.

**Hopefully this guide provided you with a start in learning about worm composting. There are many excellent resources and discussion boards on the internet to further your knowledge, so please take advantage of them. For more information, you can visit [Garden Web vermicomposting forum](#). Enjoy!