

Worm Bin Composting 101



OREGON STATE UNIVERSITY
EXTENSION SERVICE

Master Gardener™ Program

WORM BIN COMPOSTING

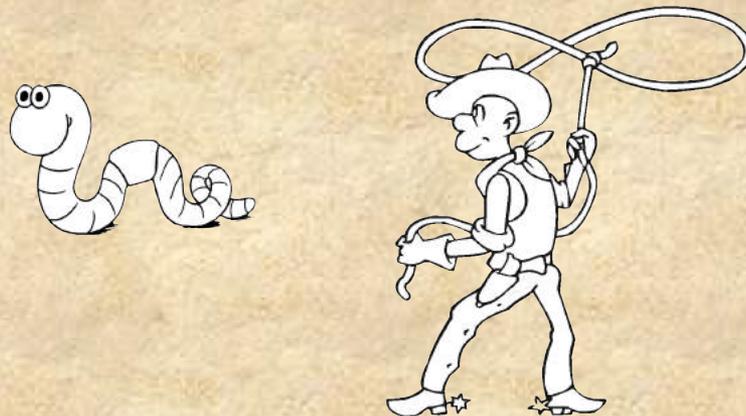
Also known as:

Vermicomposting

Vermiculture

Worm Farming or...

Worm Wrangling!



What is Vermicomposting?

Vermicomposting – (*vermi* is Latin for worms) uses Red Wiggler earthworms and other worm species to turn kitchen scraps into castings (worm manure). Castings are a nutrient-rich soil amendment ideal for most gardening needs. Castings also can be used to make *compost tea*, a concentrated fertilizer extracted in oxygenated water from castings. Worm compost has higher nutrient content than cold or hot composted materials. Nearly everything that goes through a worm is usually pathogen-free; however, some seeds may remain viable. Hot composting will kill seeds, but if too hot may harm “friendly pathogens.” Hot composting also is much more labor-intensive than vermicomposting.

Why Use Vermicomposting at Home ?

- Small bins maintained year-round in the home setting can easily turn kitchen waste into nature's fertilizer!
- Worm bins can be located in temperature-controlled areas such as under kitchen sinks, in basements or garages.
- In temperate climates, garden bins can produce castings year-round; however, in colder climates, they must be insulated or emptied in the fall to prevent worms from freezing.

Vermicomposting is an easy way for homeowners to produce a highly nutritious soil amendment for house plants or garden!

Worm Bin Placement Factors

- Whether indoors or out, place in a convenient location.
 - In climates with moderate winters, larger bins work fine outdoors year-round. Bins can be set in a corner of the garden or near the back door. Smaller bins can be located on decks and patios, or in garden sheds. Indoors, many people keep them in their garages, basements, or under the kitchen sink!
- Temperature:
 - To avoid over-heating, protect bins from excess sunlight. The hot sun will have less impact on a properly maintained large bin, while small bins must be kept out of the sun to avoid drying out or getting hot.
 - Worms tolerate a wide range of temperatures, but are most active between 65°F - 77°F (18°C – 25°C). Try to keep bins under 90°F (38°C) and above freezing, 32°F (0°C)! Worms will migrate to the interior of the bin to try to stay in their preferred temperature range. To be safe, insulate outdoor bins according to your temperature zone.

More Worm Bin Placement Factors

- **Moisture**
 - Worms breathe through their skin, so their “bedding” needs to be moist, not wet! Bedding should be covered to maintain moisture and temperature (more on bedding later). Bins must have lids to shelter from precipitation and to keep out unwanted pests. It is generally easier to hold a good level of moisture content in large bins than small bins. Small bins usually must have a way to drain off excess moisture.
- **Ventilation**
 - For proper temperature and humidity control, bins need good air circulation. Netting or screening over vent holes will keep out insects and other small pests. Small bins may require occasional stirring to add air to the materials.

Retail Home Worm Bins

Retail home composting bins come in two basic shapes, round and square.



Round Stacking
Worm Farm
(preferred)



Square Stacking
Worm Farm

DIY Worm Bins

DIY Bins can be made out of plastic totes, plywood, boxes, trunks, or crates



**Worm bin adapted
from Tupperware Totes**

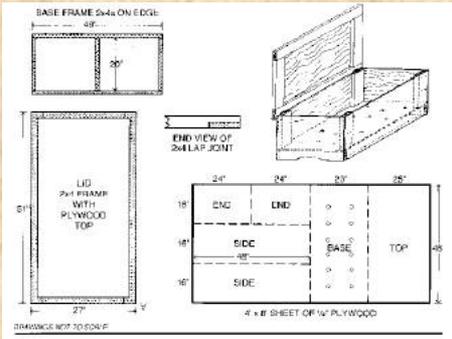


**Discovery Garden
Plywood Bins**

DIY Bins

- Plywood bins
 - Wood breathes better than plastic, but while it will still need holes for ventilation, it may not require drainage holes.
 - Wood will eventually rot, but don't use "treated" wood products because the chemicals used to prevent decay could harm the worms.
 - All bins may need additional water added to bedding during very hot, dry periods.
 - Depending on size, wood bins will become very heavy when filled with damp bedding, worms, and castings. Be sure it's where you want it!
- Plastic Tubs
 - Holes must be drilled for both aeration and drainage. Tubs can accumulate moisture, so need drain holes and dry bedding added for maintaining the correct level of dampness.
 - Drill 1/8" – 1/4" holes along the sides, a few inches below the bin's top and several smaller holes in its bottom for drainage

DIY Worm Bins (con't)



Many plans for 3' x 5' worm bins similar to those in the Discovery Garden can be found on the Internet; just Google "Plywood Worm Bin Plans."

Our bins are divided in half with wire frames using 1" x 1.5" fencing. Worms can migrate from one side to the other. Cover the floor of the bin with heavy-duty landscape cloth.



- bit.ly/1T4nGk3 - Plans for an easy-to-make, two-bin, plastic tub worm bin!

How to Choose a Bin Size

- Estimate amount of vegetable food waste your family produces weekly.
- A bin needs approximately one square foot area to process one pound of scraps each week (.1 sq M/.5k)
- A 2' x 3' bin (.6m x .9m) with 6 sq. ft. (.6 sq m) of surface area will handle about 6 pounds (3 kilos) food scraps per week, the average output of 4-6 people .

Bedding for the Worm Bin

- Worms need layers of around 2" - 4" (5 cm – 10 cm) damp bedding material spread above and below the food layers. In addition to food scraps, the worms also will eat the bedding.
- Suitable bedding materials include: shredded paper (newsprint, brown, or white office); shredded cardboard; aged compost; aged horse or cow manure; coconut coir; peat moss; straw and hay; or fall leaves. Some people like a mixture of materials.
- We currently use leaves and shredded paper in the Discovery Garden bins, both work well. Try not to use waxy leaves like magnolia or madrone, citrus leaves, or aromatic leaves such as eucalyptus, or black walnut. Although somewhat toxic, dry oak leaves can be included in a leaf mixture.

Bedding for the Worm Bin (con' t)

- Bedding is used by worms as a place to get away from the food layer to lay cocoons and where baby worms hatch out.
- Bedding regulates bin moisture and air. It provides pockets of air, and when food materials contain excess water, dry bedding materials will soak up it up.
- In bins 2' x 3' or larger, layers generally can be left undisturbed (more on this later).
- Cut a piece of moistened cardboard, damp newspapers, burlap, or a piece of foam matting to fit over the bedding. This will help keep temperature, darkness, and humidity constant.

Bedding Amendments

- Worm gizzards need grit to help break down food. Pulverized egg shells can be sprinkled over each food layer to provide grit.
- Save eggshells in an open container so they dry thoroughly. As they dry, crush them down into the container until about a pint (.5 liter) has been collected. Make sure they're completely dry by placing in hot sun for a few hours or microwaving on high for a minute or so. Use a coffee mill or food processor to grind them into a relatively fine consistency. Avoid breathing the dust by grinding outside or under the stove hood.



Collect.....crush.....grind.....pulverize!

Bedding Cover

- Bedding must be covered to keep it at the right temperature, and to keep it moist and dark. In the summer it will prevent excess evaporation and will maintain a worm-friendly temperature when it's particularly hot. In the winter it will keep the bed from getting too cold.
- At the Discovery Garden, we have experimented with a number of bio-degradable covers: thick, wet, newsprint; burlap; cardboard, or wet newspapers inside a burlap bag. We finally realized these solutions just made more work and the worms ate them!
- Now we use a piece of closed-cell matting to cover each side. The mat is actually from an inexpensive yoga mat cut in half, and works great: the worms won't eat it, it rolls up nicely, is lightweight, and brightens up the bins!



Wet Newsprint.....Burlap & Newsprint.....Foam Mat

The Worms

- Thousands of worms and night crawlers burrow into soils around the world. Most have specific diets, and most are not very efficient composters.
- Several species, however, prefer food scraps and garden debris and are highly proficient composters. These worms are mostly surface feeders.
- The most popular species for home composting is the “red wiggler,” *Eisenia fetida*
- Small bins can be started with fewer than 500 worms, less than a pound, more for larger bins (worms reproduce quickly).
- Composting worms retail Online for \$20 -- \$40 per thousand.

Eisenia fetida

Pronounced <i SAY knee a fay TEE da>!

Kingdom: Animalia

Class: Clitellata

Order: Haplotaxida

Family: Lumbricidae

Genus: Eisenia

Species: E. fetida

Binomial name: Eisenia fetida

Common names: Tiger worms, Redworms, Brandling worms, Red wrigglers, Compost worms



Eisenia fetida, (con't)



Red wiggler worms in vermicompost and food scraps in the Discovery Garden Compost Area

Worm Castings

Castings are an organic fertilizer:

- Disease pathogens are reliably killed through worm digestion.
- Safe at most concentrations.
- Used for making compost tea.

An excellent soil amendment:

- Add structure and texture to soils.
- Help soils hold moisture.
- Consistent in size and content.
- Neutral ph.



Worm Cocoons



Red Worm Emerging from Cocoon



ACTUAL SIZE OF COCOON IS ABOUT 2MM: 

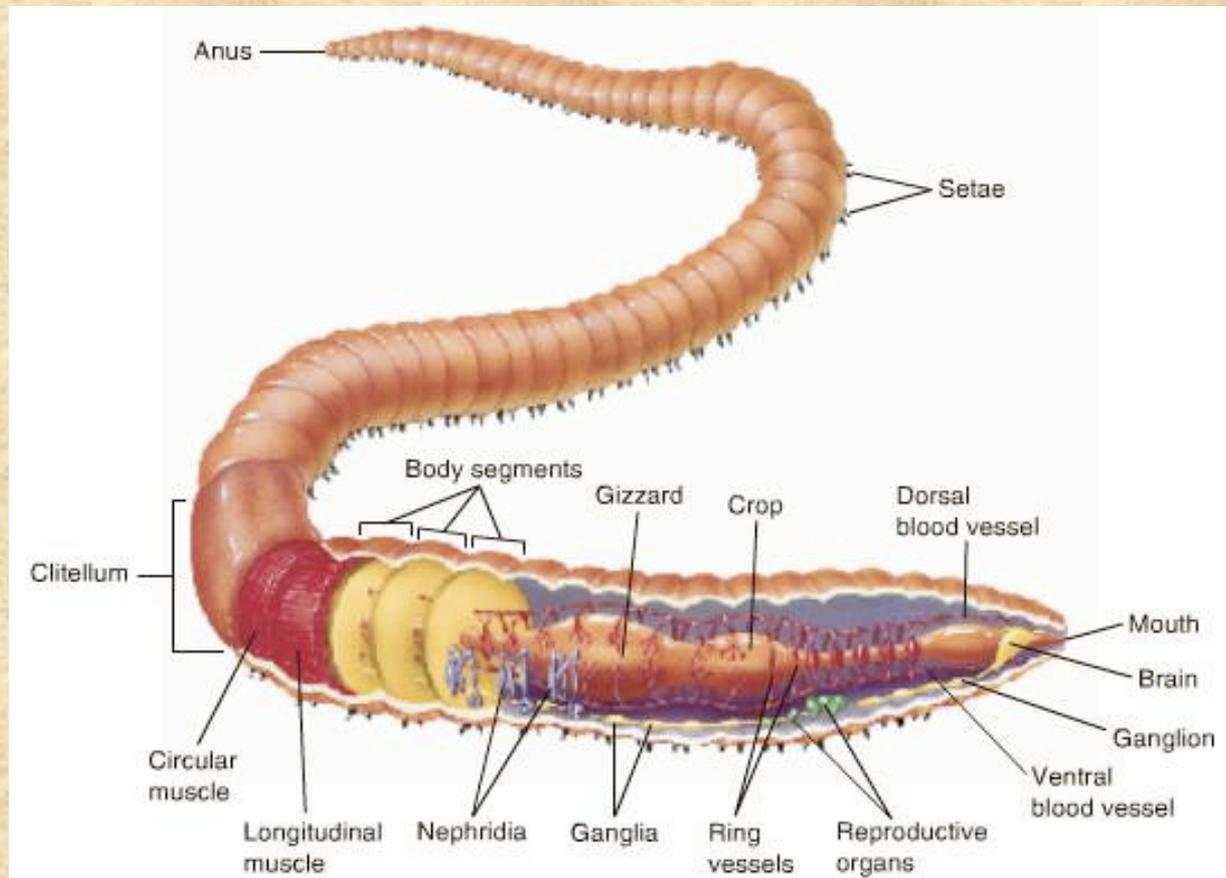
Worms mate and lay cocoons. One-to-four baby worms will hatch from each oblong, rice-sized cocoon. Cocoons hold an abundance of micro-organisms for the little worms to eat! Worms in a good bin environment will double their numbers in 3 – 4 months! Each worm can produce nearly 200 cocoons per year.

Worm Life Cycle



In their natural habitats, worms live about a year; in well-maintained bins, they can live up to four years.

Anatomy of a Worm



A worm's anatomy is as complex as other organisms. This diagram shows its most important parts.

How to Ready the Bin

- Place a 3" - 4" layer of damp (not wet) bedding on the bottom of the bin.
- Spread a layer of food scraps on to the bedding. Sprinkle a small amount of pulverized egg shells on scraps (if available).
- Spread another layer of damp bedding on top of the food layer.
- Place worms on top of bedding, gently spreading them out. Leave bin open to the light for an hour to force the worms to burrow down into the bedding.
- Cover bedding and close lid.
- Leave alone for several days, but monitor the bin to make sure it's not over-heating or gets too wet, especially when using a plastic tub for a bin. Ensure it can drain excess leachate.

Feeding Worms – Saving Scraps

- Food scraps can be stored in a closed compost container on the kitchen counter or under the sink. Some people just use plastic bags, others recycle plastic containers like 32-ounce (1 liter) yogurt containers. When filled, set aside until enough are accumulated to add to the family's worm farm.
- Food scraps chopped into smaller pieces will decompose more quickly and the worms will be able to consume them sooner.
- Don't worry if food scraps get moldy or smelly in the containers, that just means they are becoming perfect worm food! Microorganisms are breaking down the scraps so the worms can eat them.

Feeding Worms – Do's and Don'ts

- Pesticides have the potential to harm or kill worms. Organic produce, or food grown without chemical pesticides, probably will have no harmful residues. Don't overwhelm worms with too much food or with a lot of one kind of food.
- Worms eat all fruits and vegetables, coffee/tea grounds and filters, bread/pasta. Citrus fruits take longer to decompose and have oils that are used in cleaning and pesticides; however, the worms won't eat them until they're OK. You can speed things up by "zesting" the peels, or letting the citrus scraps sit in a closed container and get moldy. As with other food types, though, don't put too many of them in the worm bin, throw them on the compost pile.
- **DO NOT** feed meats, fats, oils, dog or cat poop, or dairy products to worms!

When and How to Feed Worms

- Worms can go a long time between feedings, but with a good environment and enough food they will reproduce better. Worms should be fed when there are enough scraps to make a 1" - 2" layer in the bin.
- Spread the scraps on top of the last layer of bedding, sprinkle a little egg shell dust, then spread another layer of bedding, and cover. Close the lid.
- If the worms in the bin cannot keep up with the food stream, the scraps can be frozen, used in the compost pile, buried in the garden, given to someone else, or brought to the Discovery Garden. Freezing also helps break down plant cells so when thawed they will decompose faster.
- **Remember: Reduce, Reuse, Recycle**

Harvesting Castings 1

- Separating worms from their castings is easy in large bins separated by wire fencing.
- At the Discovery Garden, our wood bins are divided into two halves with wire fencing to let the worms migrate from side to side.
- For example, when Side A fills up, we stop feeding on that side and begin putting down layers in Side B.
- In six to nine months, most of the worms will migrate through the holes in the wire fencing from Side A to Side B, leaving their castings behind.
- We then bag up the castings on that side, stop feeding on Side B, and go through the process again.
- Beginning at the end of March, we start making weekly batches of compost tea using the accumulated bags of castings.



Bin dividers made
by sandwiching
1" x 1.5"
galvanized wire
fencing between
plywood frames



Harvesting Castings 2

- In retail worm farms like the Can-O-Worms™, the worms migrate up to the next layer of food, leaving castings behind.
- DIY plastic tub bins can be stacked the same way, one on top of the other.
- After the main bin fills about half-way, another bin of the same size, with 1/4" – 1/2" holes drilled in the bottom, can be placed inside the first bin, making contact with the top of the last layer of bedding.
- When food is added to the second bin, the worms migrate up through the holes.
- More bins can be added as needed.

Harvesting Castings – the Hard Ways

- Divide and Sacrifice
 - Harvest 2/3 of the bin's castings leaving the other 1/3 of the bin to propagate in fresh bedding
- Use a bright light to make the worms move away from the castings.
- Window screen division
 - Place bedding on screen and shake out compost. Then... pick out worms one-by-one.
- Black plastic over top of bedding:
 - Over time, worms will congregate under the black plastic, then... pick out worms one-by-one.
- Cut 1/2 melon, place cut side down in bin:
 - Wait 24 hrs. and... pick out worms one-by-one.

Harvesting Castings – Alternate Easy Method



- Flower pots and flats also can be used to make worms migrate down from their castings into food scraps below.
- Fill flats and pots with compost and worms, then place them on fresh bedding covering some “ripe” scraps.
- Leave exposed to light for a few hours to encourage downward migration.
- The worms eventually will follow the food scent, “migrate” down, and leave castings in the flats and pots.

Troubleshooting - Odors

- Unpleasant Odors – foul smell
 - Anaerobic environment
 - ✓ Too much food for worms to process
 - ✓ Too wet – add dry bedding and/or stir (last resort)
- Remember:
 - Add only amount of food worms can handle
 - Maintain air ventilation
 - Keep bedding moist, not wet, with plenty of loft (air pockets)
 - Use only vegetable food scraps
- Drain “leachate” if/as it accumulates in the bottom
 - Leachate has not gone through the worms’ guts so can contain phytotoxins. It is NOT “compost tea” and should not be used like compost tea. Instead, it can be sprinkled around bushes and the like, but not used on house plants or as a foliar spray.

Troubleshooting – Predators and Pests

- Sometimes we'll find the occasional frog in our worm bin. Do not know how they get in, but they are not welcome because they will eat the worms, of course. No snakes so far. Gently remove.
- Never have seen predatory worms called *planarian*. They will eat worms. Kill them.



Large centipedes will eat worms, small ones are not a problem unless there are lots of them. They generally are beneficial decomposers, but remove or kill if there are lots.



These Bugs are Not Problems

- **Gnats** – Won't hurt anything, but are annoying and will get into plants and fruit around the house. Hang sticky flypaper in the bin to help keep down their populations.



Soldier fly and larva.

Armadillo Bug

- **Flies** – most flies are just annoying, but while black soldier flies look scary, they are actually beneficial. Their larvae eat scraps and leave castings, too!
- **Armadillo Bugs** - also called roly-polly bugs, sow bugs, or pill bugs are also “decomposers” and live harmoniously with worms.

...Not Problems (Con't)

- *Enchytraeids* (en chy TRAY ids) are small, white worms often mistaken for baby red wigglers. They are harmless and produce compost castings, too. Also called "pot worms."



- Millipedes are arthropods that generally dine on decomposing debris, not worms. You are unlikely to find a millipede in your bin, but if one wanders in -- remove, but don't kill. BTW, they don't bite!



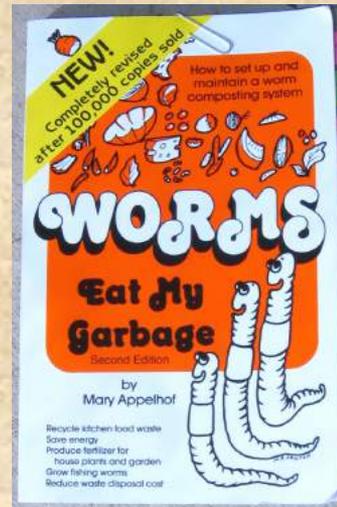
Spiders

- There are usually two or three spiders in our Discovery Garden bins, but since they keep eat flies, we leave them alone and they don't bother us.
- However, if one of these black girls shows up in your bin (rare), you might prefer to squish her!
- Most spiders are harmless; however, just to be safe - leave them alone.

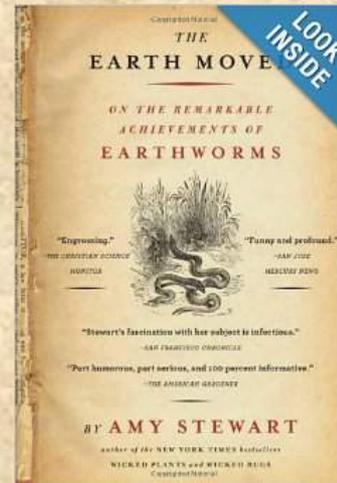


References

Worms Eat My Garbage – by
Mary Appelhof



The Earth Moved: On the Remarkable Achievements of Earthworms
– by Amy Stewart



Websites for Vermicomposting

“Google” for thousands of sites!

bit.ly/1oJU3aR - Video of baby worms being born!

bit.ly/1LKbstO – Mary Appelhof's site for Worm Composting Resources

eugenerecycles.org– Eugene, Oregon Solid Waste

ecosystems.serc.si.edu/earthworm-invaders/- History of earthworms

journeytoforever.org/compost.html -- Composting Resources

bit.ly/1TKxBeR -- Mother Earth News on how to make a worm bin

bit.ly/1T4nGk3 -- Plans for the easy-to-make, two-bin, plastic tub worm bin!

Credits:

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