



The Care & Keeping of Worms

SHEDD AQUARIUM'S HOW-TO GUIDE FOR THE NOVICE VERMICULTURIST



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Why compost? And why with *worms*?

Composting food scraps and what we call yard “waste” helps our local environment in two ways: First, composting helps stop the loss of valuable nutrients that would otherwise wind up as “garbage” in a landfill or incinerator. Second, the rich humus that results from composting can be used in your yard or garden to help restore the health and vitality of your soil without the use of expensive, polluting chemical fertilizers. By returning those nutrients to your soil,

along with the good microbes they pick up in the composting process, you’re feeding your plants, completing the cycle of soil building and preventing air and water pollution from conventional waste disposal.

As for the worms, they are nature’s best little composters.

This guide shows you how to build a simple, inexpensive worm compost bin. If you think of the bin as a compact ecosystem, you’ll begin to understand the balanced relationship of the worms, their neighbors, the food you add and the rich compost produced.



Welcome Home, Worms!

The Bin

You can build or buy just about anything that will provide darkness, warmth and shelter for your worms, but the best option is a wood or plastic container. Wood is more absorbent and a better insulator for the worms. Wood is also heavier and can be expensive. Plastic bins are affordable and can be reused. People successfully create bins from old drawers, trunks and wooden barrels, so use your imagination! At Shedd Aquarium, we use plastic containers, but we have to make sure the compost doesn't get soggy (more info under "Worm Worries"). Experiment and find out what works best for you and your worms.



How Big?

In *Worms Eat My Garbage*, Mary Appelhof suggests weighing your household food waste for one week. Based on that total amount, provide one square foot of bin per pound of food.

The container should be about 10 inches deep. Short, wide containers create better environments than tall, narrow bins. Instead of using one large heavy box, consider using several smaller containers for easier lifting and moving. Appelhof's book illustrates a variety of containers.

The bin needs a cover to conserve moisture and provide darkness for the worms. If the bin is kept indoors, a sheet of dark plastic or burlap fabric placed loosely on top of the bedding is sufficient cover.

Drill ventilation holes in the sides and top of your bin. Like people, worms need air to live so be sure to have your bin sufficiently ventilated. Some people also prefer to drill about 10 holes (1/4- to 1/2-inch each) in the bottom for aeration and drainage. A plastic bin may need more drainage—if contents get too wet, drill more holes. If you do have holes in the bottom, raise the bin on bricks or wooden blocks and place a tray underneath to capture excess liquid, which can be used to fertilize your house or garden plants. The bins at Shedd do not have holes in the bottom and work just fine.

With all these holes you may worry that the worms will crawl out. Worms prefer a dark, moist environment and will only leave in times of extreme stress. Keeping a balanced bin is easier than you think!

Which Worms Are the Right Worms?



Red Wigglers *Eisenia fetida*

Earthworms live in many different environments. Some live underground, like nightcrawlers. Others, like red wigglers, live above the soil where there are piles of leaves, animal manure, or dead plants. Red wigglers will process large amounts of organic material and are the best option in your worm bin. Don't take worms from your garden soil—they won't survive in a composting bin.



What Worms Need

You need air, water, food and warmth to live. Red wigglers need the same things!

Air

Air enters your lungs where a moist layer of tissue absorbs oxygen. Worms have lungs, too—their skin! The entire surface of a worm's body absorbs oxygen and releases carbon dioxide.

Moisture

Worms move by squeezing muscles around their water-filled bodies. They also need water to keep their skin moist for breathing.

Food

When feeding your worms, bury the food at least 3 inches deep in the bedding. Don't worry; the worms will find it. Change feeding spots each time you add food for the worms. After the first month or so, it's good to add more bedding on a weekly basis. At Shedd, we wait for the worms to process the food partially and then add more.

Temperature—Think Tropical

Worms are most comfortable and will eat the most food waste when the bedding is 70°F to 80°F. The bin slows down around 45°F, and worms can freeze at 30°F.

Who Else Lives in the Worm Bin?

Your worms need other critters for a healthy home.

GOOD NEIGHBORS INCLUDE:

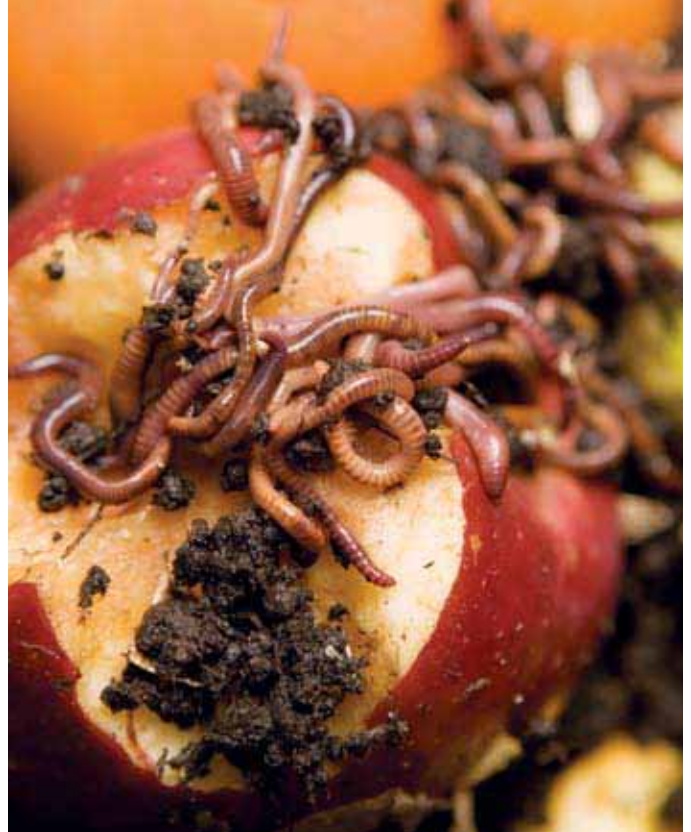
- bacteria
- fungi
- protozoa
- microarthropods
- springtails
- mites

Balancing Act: Moisture and Air

You might also see small numbers of fruit flies and sow bugs in your bin. They might be annoying, but they're harmless, and they'll come and go depending on the conditions in your bin. When conditions are good, the worms and their neighbors will be hard at work decomposing what you add. In our northern temperate climate, unfriendly neighbors are rare. Keeping a small worm bin in your home is safe and sanitary. If you suspect the worms are crowded, check out the troubleshooting tips included later. Balance will make your bin a success!

Tips

- Check for and remove excess moisture that may collect in the bottom of your bin. Excess moisture is especially common in plastic bins. Standing liquid may promote the growth of anaerobes (organisms that do not need oxygen). Their by-products can smell and are not good for plants.
- Wooden bins "breathe" and will experience more drying than plastic bins, especially in drier climates, and may require occasional rewetting.
- "Stink" is a sign that not enough oxygen is reaching part or all of the worm bin system. Very wet or compacted food waste and/or bedding will create bad odors. To solve "stink," stir the bin contents, add more dry bedding, and reduce the amount and frequency of feedings.



Bedding: Making Your Worms Comfy

Red wigglers may not sleep in beds, but we set up their bin with lots of bedding for them to live in and snack on, too!

What Kind of Bedding?

GOOD BEDDING INCLUDES:

- white paper
- newspaper (no glossy or colored ink pages)
- cardboard (without adhesives)
- toilet paper tubes
- brown leaves
- straw
- coconut husk fiber (coir)

Shred all paper and cardboard into small pieces before using. Mixing types of bedding is great. Dampen the bedding and add it to the bin. The bedding should have the dampness of a wrung-out sponge.

How Much Bedding?

Formulas exist to calculate the amount of bedding needed based on how many worms you have and the size of your bin. Generally, the more bedding the better.

- Fill your container one-half to two-thirds full of bedding when you first begin your bin.
- Add a handful of dirt or sand as well as some crushed eggshells. Worms don't have teeth to grind their food, so they need to eat this grit to help their gizzard grind. The eggshells also help keep the bedding from becoming too acidic. Add new crushed eggshells each week.
- Add your red wigglers and watch them get comfortable in their new home. They will burrow into the bedding in search of the dark, moist places.



- Don't feed your worms right away! Let them settle in for a few days. Add small amounts of bland food scraps the first few weeks. Lettuce, apples, eggshells and banana peels are good choices. Wait a few weeks to add stronger-smelling food like broccoli and onions. You'll know they're eating when the scraps begin to disappear and you see the first signs of worm poop! In the beginning, the poop, or castings, will resemble light brown coffee grounds. In a few months, the castings will turn darker shades of brown.

What to Feed Your Worms

A Balanced Diet

Collect food scraps in a reusable pail or other container; worms like tea bags, coffee grounds and filters, vegetable and fruit scraps, and bread. Discard meat scraps, bones, dairy products and garlic or potato peelings, as these will attract insects and may cause “stink.”

When the pail is full, chop the food waste and bury it in the bin. Pull aside the bedding and bury the food waste deeply, covering it with bedding again. Start at one end of the bin and add food waste systematically to a new section each time, until you work back to the original site.

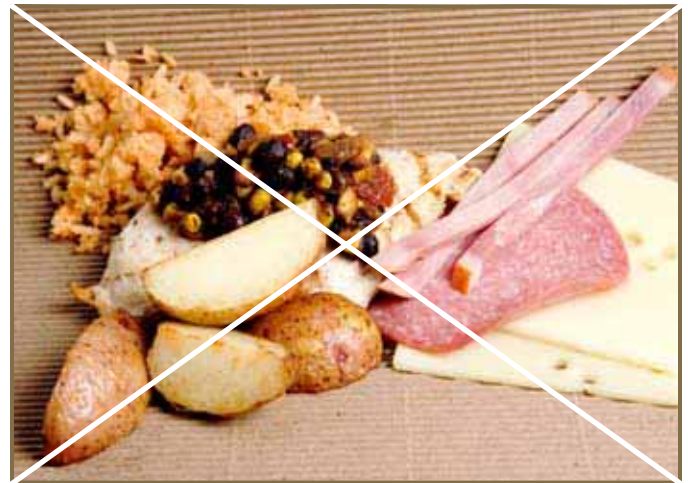
If there is still a lot of uneaten food in the first location, the worms need time to catch up. Wait a few days to add more scraps.

Your red wigglers will be a cinch to look after; they don't need to be fed on a regular schedule, they're quiet, and you don't need to look for a worm-sitter if you go on vacation!



Worms Like:

- coffee grounds and tea bags
- fruit
- vegetable peelings
- cereals (oats, barley and corn)
- annual weeds (not seed heads)
- bread
- green leaves
- cow/horse manure



Worms Don't Like:

- meat and fish
- cheese
- baked beans
- rice or pasta
- cooked potatoes
- grass in any quantity
- weed seeds
- diseased plant material
- cat or dog poop

Harvesting Your Gold...



There is no wrong way to harvest your bin; many methods and techniques exist. The technique to use is best chosen by what you want after harvesting the bin. Do you want the worms for fishing? Is your goal to have as much compost for your plants as possible?

If you want to be very hands-on with your bin and keep your worms for composting, the *Dump and Sort Method* is a good option.

If you don't mind waiting for your rewards, the *Split Harvesting Method* might be right for you.

It is important to remember that removing castings (poop) from the box will be necessary for the health of your ecosystem. Excess castings can create a toxic environment for the worms. Worms prefer bedding to poop.

* Believe it or not, all native worm species were removed from our local soil (in the Great Lakes region) during the last glacial period. None of the earthworms you might be familiar with are native to our local ecosystems, which have evolved for over 11,000 years without the presence of worms. Do not release your worms into any forested or other natural area, as they may disrupt or damage the ecosystem.

* Worms are okay in your garden, unless you live next to a forest or river. Worms don't move very quickly on their own, but humans have helped them spread to areas where they are rapidly altering and creating imbalances in forest ecosystems.

Dump and Sort Method [^]

MATERIALS NEEDED:

One small plastic sheet

Light source (sunlight or bright overhead fluorescent)

1. Prepare fresh bedding for your worms.
2. Empty the contents of your container onto the plastic sheet in one large pile or a series of smaller cone-shaped piles.
3. Add fresh bedding to the container. This is a great time to wash out your bin, but stay away from harsh chemicals. Vinegar and warm water work very well.
4. Position the light source over the casting pile. The worms will move down into the castings.
5. Carefully pick the castings from the pile(s) in layers, working toward the bottom center of the each pile. Place castings in a separate container. Keep on the lookout for cocoons (worm eggs) and very young, small worms. Make sure to add these back to the freshly bedded bin.
6. Continue sorting until there is only a small pile of castings with worms beneath it.
7. Add this pile and worms to the fresh bedding in the bin.
8. Use the harvested castings for a horticulture project.

...a.k.a. Worm Poop

Split Harvesting Method >

OPTION 1:

If you don't want to be hands-on with harvesting

1. Simply "split" your bin by adding two-thirds of the castings (worms and all) directly to your garden.
2. Add the remaining one-third to your fresh bedding. This will inoculate the bedding with the microscopic neighbors from your existing bin and provide some worms to get you going again, but it depletes your worm population for awhile.

OPTION 2:

If you don't want to risk losing any of your red wigglers

1. Don't feed the worms for a few days.
2. Move all the castings and worms to one side of the bin.
3. Add fresh bedding to the empty area, moisten the bedding, add eggshells and then bury food in the new bedding. The worms will start to move to the new bedding to feed.
4. In about a month, you can remove the worm castings from the older bedding and use them in your garden. When you remove them, you may need to add some more bedding.



A wise person once said,
"The best way to fertilize
is do it weakly weekly."

Using Your Castings in a Horticulture Project: Worm Poop to Feed Your Plants

OPTION 1

Sprinkle fresh castings directly on the soil or add pinches of poop when potting plants. A small amount near your newly planted seeds will help them grow.

OPTION 2

Add 1 tablespoon of fresh castings to 2 cups of warm unchlorinated water. Shake or stir mixture for one minute. Pour directly on soil to feed your plants.

Worm Worries: Troubleshooting

When you have:	What may be happening:	What you can do:
ODOR	exposed food	cover food scraps with bedding
	too much moisture	add dry bedding; reduce the amount of food placed in the bin; avoid adding food with a high percentage of water (such as melons)
	not enough oxygen	add dry bedding; mix bin contents daily; be sure bin is adequately ventilated with holes
	food in bin is naturally odorous; onion, broccoli	avoid foods that smell unpleasant when they decompose; don't add meat, bones, dairy, or oil products to the bin because these become rancid when decomposing
DISAPPEARING WORMS <i>dead worms decompose rather quickly; if you don't monitor these conditions, you can have a bin with no worms before you realize it</i>	bin is too wet; worms are drowning	don't panic; add dry bedding; avoid adding foods with high water content
	bin is too dry; worms are drying out	lightly moisten bedding; add moist foods
	not enough air; worms are suffocating	mix bin contents to aerate; be sure bin is adequately ventilated with holes
	not enough food	add food
	bin is too hot or too cold	keep bin in a location where it will be between 50°F and 80°F
	an overabundance of mites	remove any food that has a congregation of mites
FRUIT FLIES <i>if fruit flies become a problem, you can try using flypaper traps or make your own fruit fly trap*; houseflies should not be attracted to your worm bin if you cover the food scraps with bedding material</i>	exposed food	bury food under bedding material; cover the contents with a dry sheet of newspaper
	too much moisture	avoid overfeeding; add dry bedding
	fruit fly eggs in food scraps	wash all fruits and peels—even those you remove before eating, such as bananas and citrus—to remove any fruit fly eggs

* Make your own fruit fly trap by leaving out a cup of wine or beer. This will attract and drown these unwanted houseguests. Flypaper can also be used on or near your bin.

Resources

Where to Get Worms

Find a friend with extra worms.

Order Locally (if you can)

Soil Exchange Inc.

2307 Colby Dr.

McHenry, IL 60050

Dean Allen 815-483-6046

\$15 a pound for red wigglers, plus shipping

Order On Line

www.composters.com

They order from the grower closest to you.

About Worms

Recommended Book

Worms Eat My Garbage by Mary Appelhof

www.wormwoman.com

Posters and Other Materials

The Illinois Sustainable Education Project (ISTEP)

Shedd Contact

contactus@sheddaquarium.org



John G. Shedd Aquarium
Conservation Department
1200 South Lake Shore Drive
Chicago, Illinois 60605