INSTITUTE FOR Local Self-Reliance

Vermicomposting 101

A Guide to Worm Composting

What is vermicomposting?

Vermicomposting is a process that relies on earthworms and microorganisms to break down organic materials and convert them into vermicompost, a valuable soil amendment and source of plant nutrients that consists largely of worm castings (worm poop).

This guide was developed by the Composting for Community Initiative at the Institute for Local Self-Reliance. Learn more about our resources here →

Vermicomposting vs. Hot composting

	Vermicomposting	Hot composting
Organism types	Worms and meso-philic microbes	Mesophilic and thermophilic microbes
Ideal temperature	55 - 85°F	68 - 167°F
Ideal moisture content	70 - 90%	50 - 65%
Length of process	30 days	2 - 6 months
Management needs	Passive aeration and no turning	Aeration and turning
Key factor	Surface area	Pile volume

Mesophilic microorganisms thrive at temperatures below 113°F

Thermophilic microorganisms thrive in a temperature range between 113–167°F

What are the benefits of vermicomposting?

Reduces waste

Wasted food is the largest single component of everyday garbage. Vermicomposting food scraps keeps material out of polluting landfills and incinerators.

Empowers people

Home composting encourages people to become aware of their wasting habits and to take an active role in reducing wasted food.

Protects the climate

Landfills and incinerators emit potent greenhouse gases. But vermicompost added to soils helps sequester carbon (pull carbon from the atmosphere) while reducing the need for fertilizers made with fossil fuels.

Enhances soil

Applied to soil, vermicompost adds soil organic matter and enhances soil structure, fertility, microbial activity, water holding capacity, and ability to resist plant diseases.

Earthworm facts

Earthworms are:

- Cold-blooded animals, not insects.
- Cutaneous respirators: they breathe through their skin.
- Hermaphroditic: they have both male and female sex organs.
- Sensitive to moisture: they die if their skin dries out.
- Sensitive to light: light can paralyze them in 1 hour.

Babies hatch from cocoons smaller than a grain of rice!

Photo: ECO City Farms by Chris Cano.

Use the right type of earthworm!

- Only 7 of more than 9,000 species of earthworms can be used for vermicomposting. *Eisenia fetida,* commonly called red wigglers, can live in a wide range of conditions and are best suited.
- Do **not** take worms from your yard (wrong species) or buy them from a bait shop (expensive).
- Do buy worms from a reputable worm grower using the scientific name *Eisenia fetida*, not "red wigglers." Prices vary roughly between $40 to 60 per pound.
- Add 1 to 2 pounds of worms per square foot of bin surface area. 1 pound is roughly 1,000 *Eisenia fetida*.

Acceptable materials

- Fruit and vegetable scraps (no stickers)
- Coffee grounds and paper filters
- Egg shells (pulverized with a rolling pin)
- Loose tea (paper bags okay, no staples)

Materials to avoid

- Meat, grease, or bones
- Dairy products
- Cat or dog feces
- Hot peppers, onions, or garlic
- Citrus fruits or rinds
- Very salty or sugary foods
- Fruit pits or stems
- Fresh grass
- Fats, oils, or grease

HOW TO VERMICOMPOST IN 10 STEPS

1 Buy a worm bin or build your own

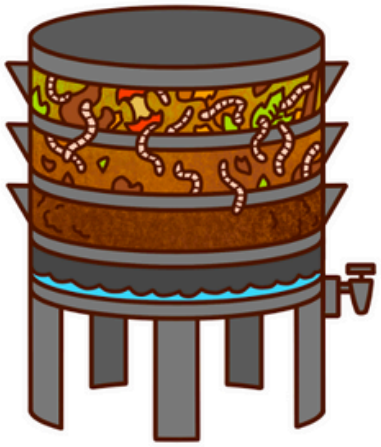
Off-the-shelf vermicomposting systems can be purchased online, or you can build one yourself using a simple plastic bin with a tight fitting lid and a drill. More bins of the same size can be stacked on top for a tiered tray system. Better yet, make it out of untreated wood. Do not use transparent material – earthworms do not like light!

For DIY bins:

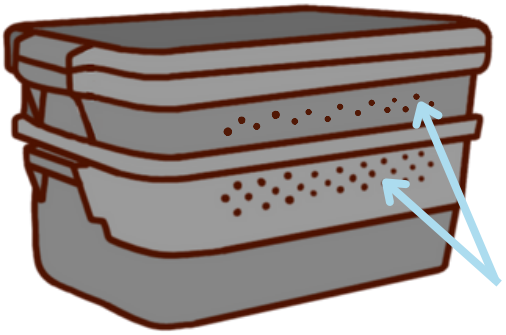
- Drill a row of ⅛-inch aeration holes along the upper sides of the bin(s) just under the lid.
- For stacked bins (excluding the bottom bin): add equally spaced ¼-inch drainage holes on the bottom. These holes will also allow worms to move between bins for tiered systems.

While bins can be as small as you like, **you will need roughly one square foot of surface area for each pound of food scraps you want to vermicompost per week**.

Purchased tray system



DIY tray system made with plastic storage bins



2 Choose a location for your system

Worms need stable conditions in order to thrive. Your worm bin should be placed in a location that is convenient for you to keep an eye on and protected from extreme weather conditions, especially if being stored outside.

- Keep bins out of direct sun
- Find a location that stays between 55 - 85˚F
- Insulate bins during colder months (such as with straw bales)

3 Add bedding

In nature, *Eisenia fetida* live in moist leaf litter on the forest floor. In a worm bin, we try to replicate that environment with moist bedding.

Pre-Moisten Bedding:

- Soak in water for 10 minutes
- Drain or squeeze excess water out
- Fluff before putting in bin
- Fill bin halfway with bedding

Moist bedding can be made with any of the materials listed below (or a combination):

- Fall leaves
- Coir (coconut fiber)
- Shredded newspaper (aim for ½-inch or narrower strips)
- Shredded brown or kraft paper

Do **not** use glossy paper or magazines as bedding.

Soil should **not** be used as bedding, but adding a handful of soil to bedding can be beneficial for worms.

4 Add worms to bedding

Gently add the *Eisenia fetida* worms acquired from a reputable supplier to the top of pre-moistened bedding. There's no need to touch them! They will move into the bedding on their own with the lid temporarily removed (to escape the light). Touching them risks injuring them.

If using a stacked tray or bin system: add initial bedding to the bottom tray or bin. You can wait to add additional trays or bins on top as the bottom level fills with worm castings.

Worms will come shipped in peat moss or other special bedding inside of a breathable bag (left image). You may not actually see the worms until you add them to your system (right image). Photo: ILSR

5 Collect and prepare your food scraps

Chop up your fruit and vegetable scraps because worms don't have teeth!

Eisenia fetida worms have food preferences! You will not be able to feed them everything you could put in a thermophilic (hot) composting pile. Give them a variety of fresh fruit and vegetable scraps (coffee grounds in small quantities are fine too). Cut food into small pieces. Observe what your worms like and don't like.

See page 4 for more information on what to feed and what to avoid feeding your worms.

6 Feed your worms!

How much kitchen scraps can worms eat in a day?

- They eat 25 to 33% of their body weight per day!
- 1 pound of worms can consume ¼ - ⅓ pound of food scraps a day
- 2 pounds of worms can consume roughly ½ pound of food scraps a day

Eisenia fetida worms will live in the top 3 to 6 inches of the bin. As you add kitchen scraps to the system, they will move up on their own.

For stacked tray or bin systems: as worms consume food scraps and bedding, the bottom tray or bin will fill with worm castings. When it is full, begin adding food scraps to the next tray or bin up. The worms will move between the levels on their own.

How to add food scraps:

- Use a 3-prong tool, or clean or gloved hands to pull back 2 inches of bedding.
- Add food scraps.
- Cover with a minimum of 2 inches of bedding.
- Do not bury food in castings (worm poop).
- Wait until food is gone before adding more.
- If using your bare hands or gloves to move bedding around, wash them when you are done.

Food scraps being added to a vermicomposting system using a 3-pronged tool. Photo: Rhonda Sherman

7 Keep an eye on your worms

- Keep the temperature between 55-80°F. Move your system as needed.
- Keep worms and bedding moist by misting with a spray bottle. Never pour water into your system.
- Make sure food scraps are always covered with 2 inches of bedding! Add fresh bedding as needed.
- Never cover the worm bed with sheet of plastic, which cuts off oxygen.

Troubleshoot as needed.
Learn more here:

Traits of a healthy worm bin

- Bin does not have rotten odor
- Few earthworms are on sides or the lid of bin
- Bedding is fluffy and has air spaces
- Contents of bin are damp but not soggy
- Earthworms have moist, glistening skin
- Small quantities of other insects are present in bin
- Castings are accumulating on bottom of bin

Traits of an unhealthy worm bin

- Bin has rotten odor
- Puddles in bottom of bin
- Liquid dripping from bottom of bin
- Fruit flies swarming bin
- Large number of red mites
- Bedding is dry
- Food and bedding entwined in large clumps
- Worms trying to escape

8 Harvest vermicompost

Method 1: Vertical Separation

The bottom of the system will fill with worm castings as worms consume the food scraps and bedding. They will move upward to get to fresh food scraps as they are added to the system.

If using a stacked tray or bin system: eventually most of the worms will move up and out of the bottom tray or bin, making it easy to gently pick out any remaining worms and harvest the vermicompost from there.

Vermicompost is a mixture of worm castings (worm poop) and decomposed organic matter. It is never 100% worm castings!

Method 2: Light Separation

This method works because worms avoid light and requires either a sunny space outdoors or a well-lit space indoors. It is the recommended method for a system that uses a single bin, but can also be used for separating out remaining worms from tiered systems.

- **Set up space in your system** with moist bedding for the worms you will be separating out from the vermicompost.
- Using clean or gloved hands, **empty worm castings** onto a clean, protected surface. You may need to first remove the top layer of bedding and any food scraps; you want only the finished vermicompost.
- **Form little piles**, shaped like pyramids. The worms will slowly burrow into the vermicompost.
- **Harvest vermicompost** from the top of each pyramid after the worms have moved down.
- **Continue shaping and combining** the piles until all the worms remain in one pile. You do not need to pick worms out of the pile. Instead, you are harvesting the top of each pile after the worms have moved away from the light.
- **Return worms** to a system with moist bedding as soon as possible.
- **Wash your hands**, gloves, and any tools used in the process.

Make pyramid-shaped piles on a table covered with a tarp. The sunlight will drive the worms to the bottoms of the piles, allowing you to remove the worm castings from above the worms.

Photos: ILSR, Rhonda Sherman (middle)

9 Store vermicompost

Store your harvested worm castings:

- In a dark, warm place
- Inside a bag or bin with lid to retain moisture
- Add small holes for aeration

10 Use vermicompost

In nurseries and gardens:

- Add 1 part vermicompost to 4 parts potting mix for starts
- Add ½ cup to soil when transplanting small plants, or 1 to 2 cups for larger plants

For indoor and outdoor plants:

- Mix 2 tablespoons into 1 quart potting mix and add around established plants every 2 to 4 weeks

On new and established lawns:

- Add 10 pounds per 100 square feet and mix into top 1 to 2 inches of soil for new lawns, or topdress with 7 pounds per 100 square feet for established lawns

Explore ILSR's Home Composting Resources: ilsr.org/home-composting