

# Home & Environment

## Household Composting with Worms

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Composting with earthworms, also called vermicomposting, is very similar to conventional composting, but vermicomposting lets you compost indoors year-round, requires less space, and produces lower salt levels than conventional composting.

This publication examines the benefits of vermicomposting and explains how to set up your own vermicomposting bin.

### Benefits of Vermicompost

The goal of conventional composting is to create a rich soil amendment using a specific combination of organic matter, moisture, and temperature. Vermicomposting uses earthworms to achieve the same goal. Like regular compost, vermicompost also benefits the environment because it may reduce the need for chemical fertilizers and decrease the amount of waste entering landfills.

Vermicompost is primarily earthworm excrement, called castings, which can improve a soil's biological, chemical, and physical properties. The chemical secretions in the earthworm's digestive tract help break down soil and organic matter, so the castings contain more nutrients that are immediately available to plants.

Vermicompost is similar to conventional compost and can be applied in the same way to gardens, lawns, and

potted plants (for more information, see Purdue Extension publication HENV-103-W, *Household Composting: Methods and Uses for Compost*, [www.ces.purdue.edu/extmedia/HENV/HENV-103-W.pdf](http://www.ces.purdue.edu/extmedia/HENV/HENV-103-W.pdf)).

Vermicompost is a fine peat-like material that has several soil-enhancing characteristics:

- It contains beneficial microbes.
- It has a high concentration of plant nutrients. Worm castings contain five to 11 times more plant-available nitrogen, phosphorus, and potassium than the soil the worms ingest (Martin and Gershuny, 1992). The relative amounts of these nutrients may be similar to those found in commercial potting soil (Table 1).
- It is made up of organic matter, which helps soil hold more water and nutrients.

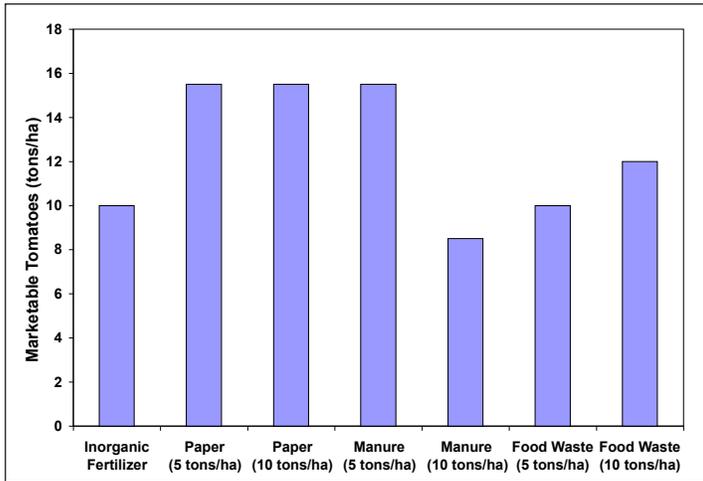
Also, studies have shown that vermicomposts may contain plant growth regulators that can enhance plant growth (Krishnamoorthy and Vajranabhaiah, 1986). One study by Arancon et al. (2003) found that adding different types of vermicompost increased tomato yields more than chemical fertilizers alone (Figure 1). Other studies have shown that vermicompost can increase yields in other crops such as sugar cane, wheat, marigolds, and peppers (Kale et al., 1992; Atiyeh et al., 2000b).

**Table 1. This table compares the nutrient composition of various vermicomposts and a commercial potting medium.**

Vermicompost Type	Nitrogen (N)	Phosphorus (P)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)
	Nutrient Content (by percent)				
Food Waste <sup>1</sup>	1.3	0.3	0.9	1.9	0.4
Cow Manure <sup>1</sup>	1.9	0.5	1.4	2.3	0.6
Paper Waste <sup>1</sup>	1.0	0.1	0.6	0.9	0.8
Pig Manure <sup>2</sup>	2.4	4.5	0.4	—	—
Commercial Potting Medium <sup>2</sup>	0.4	0.2	1.6	—	—

<sup>1</sup>From Arancon et al., 2003.

<sup>2</sup>From Atiyeh et al., 2000a.



**Figure 1.** This graph shows the marketable yield of tomato plants as a result of adding different types of vermicomposts at different rates. Fertilizer was added with vermicompost to reach nitrogen rates required for tomato growth (adapted from Arancon et al., 2003).

### Constructing a Worm Bin

The four components for creating a worm bin are:

- Earthworms
- Bedding
- Food
- Containers

Each of these components are described in more detail below.

#### Earthworms

There are a number of earthworm species, but not all of them are suitable for producing compost. The large earthworms commonly found in your backyard and the local bait shop are not good vermicomposting choices. The best types for composting are red worms (*Lumbricus rubellus*), brandling worms (*Eisenia fetida*), and European nightcrawlers (*Eisenia hortensis*) (Figure 2). You can order these worms on the Internet and have them delivered to



**Figure 2.** A mix of red worms (*Lumbricus rubellus*) and European nightcrawlers (*Eisenia Hortensis*) used in vermicomposting.

your home. The “Find Out More” section at the end of this publication includes some companies that sell worms.

Earthworms are light-sensitive and prefer temperatures around 55°F to 77°F. Therefore, it is usually best to keep them indoors in lidded bins to keep the interior dark. While in a bin, worms are very active eating and reproducing: 1 pound of worms (about 1,000 worms) can eat between 1/2 and 1 pound of waste per day and can double in population in a month if they have sufficient food, water, and shelter.

To start your own bin, you will need about 1 pound of worms for a bin serving 1 or 2 people, or about 2 to 3 pounds of worms for a bin serving 4 to 6 people.

#### Bedding

Earthworms in a bin generally need bedding in addition to the waste that will be their food. The bedding helps to keep conditions inside the bin moist enough. Bedding also provides worms with something else to burrow into.

Bedding material can be anything that will absorb moisture but will not decompose rapidly (Figure 3). Some suggested bedding materials include:

- Sawdust
- Shredded leaves
- Shredded black and white newspaper (color inks may contain chemicals harmful to the worms and your plants)
- Shredded computer paper
- Shredded corrugated cardboard



**Figure 3.** An example of some of the different types of bedding materials that may be used in vermicomposting: (clockwise from bottom left) leaves, sawdust, and shredded newspaper.

Over time, earthworms will eat their bedding. In the average worm bin, bedding material will last about 2 months. The amount of bedding required for a worm bin depends on the bin’s size. A square bin with sides that are 2 feet long, 2 feet wide, and 8 inches deep (an average bin for 1 or 2 people) requires about 4 to 6 pounds of dry bedding

to create a 6-inch layer. A bin that's 2 feet long, 3 feet wide, and 8 inches deep (an average bin for 4 to 6 people) requires about 9 to 14 pounds of dry bedding to create the same 6-inch layer.

Before adding bedding to the bin, soak it for about 24 hours in 3 pints of water per pound of bedding, wring it out, then fluff it. Add the worms to the bedding in the worm bin a few days before adding kitchen wastes so the worms can acclimate to their new surroundings.

### **Earthworm food**

In general, earthworms feed on the same types of materials found in a regular compost pile. The best items for indoor compost bins, however, are kitchen wastes because they are available year-round. This includes any food scraps except bones and oily or strongly-flavored foods such as meat, garlic, and onions.

In the beginning, much of the feeding will be based on trial and error to see how much food the worms eat in a given week. Begin by feeding the earthworms carefully to prevent feeding them too much or not enough. If you add too much food before the worms have time to digest it, the wastes can begin to decompose and smell. This can attract insects that are not only a nuisance but can be harmful to the earthworms. If you find that you produce more waste than the worms can keep up with, either construct an additional bin or get a new, larger bin.

### **Container**

The size of a worm bin container depends on the amount of waste a household generates. A good rule of thumb is to have 1 square foot of surface area for every pound of kitchen waste produced each week (Apelhof, 1997). If there are 1 or 2 people in a household, this typically will require a box that is 8 to 12 inches deep and has an area of 4 square feet (for example, a square box with sides that are 2 feet long). For 4 to 6 people, the box should be about 6 square feet in area.

Plastic storage bins usually make the best worm bins (Figure 4). Below are the steps for constructing a two-tier worm bin using a bin that is 16 to 24 inches deep. Constructing a two-tier system follows the same procedure as the smaller bins explained above, but the different levels allow for easy separation of worms from the compost.

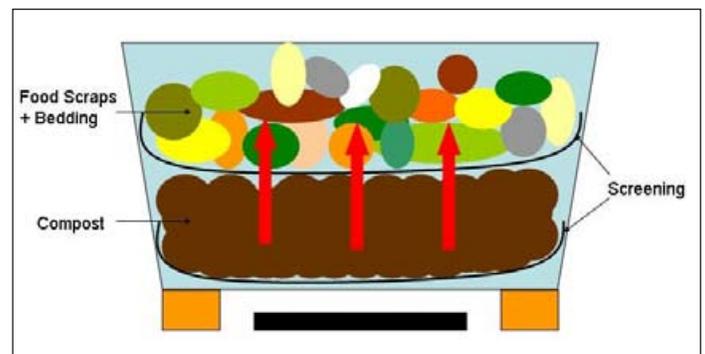
To build a two-tier vermicompost bin:

1. Drill 8 to 12 quarter-inch diameter holes in the bottom of the bin. The holes allow for aeration and the removal of excess moisture. Place the bin on blocks with a tray underneath to collect drainage (Figure 5).



**Figure 4.** A plastic storage bin with mesh screening that's ready to be converted into a vermicomposting bin.

2. Place nylon or mesh window screening on the bottom of the bin, making sure to leave excess screening along the bottom edges.
3. Add about 6 inches of bedding and a handful of soil. The soil will provide the worms some grit to aid in their digestion.
4. Add worms and allow them to acclimate to their new surroundings for about one week.
5. As you produce it, add kitchen waste to the top of the pile until the waste is about 8 inches deep.
6. Place about 1 inch of bedding on top of the waste (to keep flies out) and place another piece of screening above this (again, be sure to leave excess screening along the bottom so you can easily remove it and the layers above it). Continue to add layers of kitchen waste and bedding to the top-half of the box in the same manner. About every two weeks, you will have to “fluff up” the bedding to allow proper aeration.



**Figure 5.** Diagram of a worm compost bin showing movement of worms up into undigested material.

7. As worms run out of food in the lower-half of the bin, they will migrate toward the upper-half of the bin through the screening. These worms are very thin and can stretch to make themselves even thinner so they should be able to fit through the holes in average-size window screening.
8. When the bottom-half is ready to be used as compost (after about two months) it will be dark brown and little of the original food will be noticeable. Lift out the first screen along with the upper-half of the organic material, then remove the bottom screen and bottom-half of material. The bottom-half of the material is now ready to be used as vermicompost in your garden or flower bed.
9. Place the upper-half of the pile with screening back down into the lower-half of the bin.
10. Add screening on top of the new lower-half, then add bedding and kitchen wastes as before.
11. Repeat steps 7 to 9 as often as necessary.

### Find Out More

The resources below provide more information about vermicomposting or are outlets for ordering composting worms.

- Journey to Forever vermicomposting page  
[http://journeytoforever.org/compost\\_worm.html](http://journeytoforever.org/compost_worm.html)
- New York Worms  
[www.nyworms.com](http://www.nyworms.com)
- The Worm Farm  
<http://thewormfarm.net>
- Worms Wrangler  
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