

Vermicomposting



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Welcome to Vermicomposting!



Vermicomposting or vermiculture is the process of using Red Worms to transform decaying fruit and vegetable scraps into castings (worm poop).

Vermicomposting is a versatile ongoing sustainable method of composting that can be done indoors or outdoors in worm bins. Worm bins require a small amount of space and can be stacked.

To get started you'll need just a few basic items (worms, worm bin, bedding, and food waste) and you'll be able to turn your food scraps into nutrient rich compost. This book will guide you through the steps to a successful vermicomposting adventure.

Worm Species: Eisenia foetida

The Red Worm, most often called Red Wiggler, is the most common worm used for vermicomposting and is a cousin to the earthworm. Red Worms can process large amounts of organic matter and, in ideal conditions, reproduce rapidly.

Figure 1: Image of Red Worm



Red Wiggler Worm Facts



They are decomposers that eat organic material such as fruit and vegetable scraps.



They do not have eyes; they have cells called cerebral ganglion in the front part of their bodies that can detect light.



They do not have teeth; they suck decaying food into their mouth and grind the food by using the grit in their gizzard.



They are used for vermicomposting and adapt well to containers called worm bins.



They can eat half their body weight in food scraps each day!



They are both male and female (hermaphrodites), but still need another worm to reproduce.



They can produce up to two cocoons a week and each cocoon will contain 2 to 5 babies.



Have 5 “heart-like” organs called aortic arches.



They breathe through their skin; require a moist dark environment, but not sopping wet as they can drown.



They have no ears, but their bodies can sense the vibrations in the soil.



They don't have any bones. That's why they are squirmy when they move.



They can live up to one year.



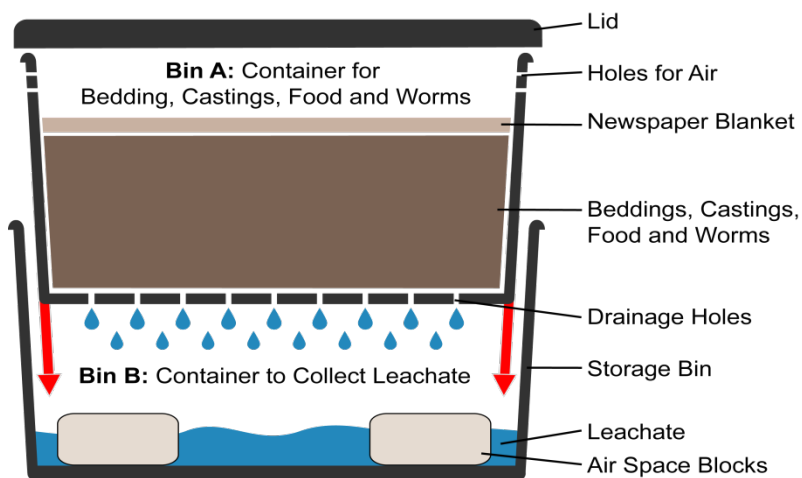
If subjected to light for a long period of time, they will secrete a yellow liquid called coelomic fluid, thought to be a defense mechanism against predators as the fluid can smell bad.

Setting Up Your Worm Bin

Worm Bin Design

The typical worm bin is designed with two bins: Bin A and Bin B. Bin A is the container for bedding, food, newspaper blanket, and worms. Bin B is the container that collects leachate (liquid produced from the digestion process) and holds Bin A. See Figure 2 for an illustration. There should always be a minimum of a half inch of liquid in the bottom of Bin B to help cool the bin system in the summer and maintain heat in the winter.

Figure 2: Cross-section of worm bin



Selecting a Worm Bin That's Right for You

The type and size of container that is best for your environment will be determined by answering the following:

- How much space do you have?
- Do you have weight limitations?
- Do you use a lot of fruits and vegetables?

If you live in an apartment or condominium with limited space, or you have weight limitations, consider using a four to five gallon container.

If you live in a house and space is not a concern, or you do not have weight limitations, you may want to consider using a 10 to 18 gallon container. Also, if you eat a lot of fruits and vegetables, you may want to build more than one bin.

The 10 to 18 gallon containers are preferred since they allow the worms more room to move around and feed in. You can make your own worm bin using the instructions provided in this booklet (see page 13), or you may purchase pre-made worm bin through various on-line retailers.

Worm Bin Bedding

Worm bin bedding serves two purposes. It gives the worms a moist environment in which to live and reproduce. It also gives them a backup food source if they consume all of the food scraps. You'll need enough bedding material to fill a bin half to three quarters full.

- Torn newspaper (not shredded; don't use glossy sections)
- Leaf mold
- Coir fiber
- Finished compost
- Peat moss
- Aged manure (outdoor bins only)
- Torn cardboard or corrugated cardboard. This should be used sparingly and in combination with the above.

Prepare Bedding Material

- Place bedding material in a container (tub, sink, Bin B, etc.) that has no holes.
- Add water to cover material.
- When completely wet, wring out the material, fluff it and place in Bin A
- Repeat until you have enough bedding to fill Bin A to half or three quarters full. If using Bin B to wet your material, be sure to remove all bedding material and water from Bin B before constructing your bin system.

Newspaper Blanket

The newspaper blanket (Figure 2) covers the worm bin bedding; helps retain moisture, keeps out light, and can be used as a backup food source.

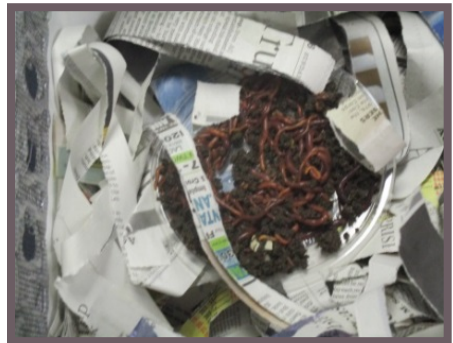
To make the blanket, take 12 full size sheets of newspaper layered on top of each other. Fold to fit inside Bin A, leaving approximately a quarter inch space around on all sides for air circulation. Soak in water until thoroughly wet. Drain excess water and lay on top of moist bedding.

Placing the Worms

You will need about one quarter (1/4) to one (1) pound of Red Worms. See Vermicomposting Resources for sources.

Place the bins in a well-lit area. Pull the blanket back and place the worms by gently laying them on top of bedding in Bin A and walk away for about 10 to 15 minutes to allow worms to burrow into bedding. Once most of the worms have burrowed, lay the prepared newspaper blanket on top of the bedding and place the lid on Bin A.

Figure 3: Placing the Worms



Worm Bin Location

Red Worms can tolerate a wide range of temperatures, but prefer temperatures between 55 - 77°F. Bins should be kept in a shady location at all times. The bins need good air circulation. Without good air circulation, the bin may become very wet. The bins should be monitored closely to ensure that it is not too dry or wet and there is enough food. Take corrective action to adjust feeding or moisture levels in the bin. Troubleshooting tips are located on page 11.

Feeding the Worms

Worms do not have teeth and can only eat food that has started or is completely decayed.

What do worms eat?

Worms primarily eat:

- Fruit and vegetable scraps
- Pasta
- Bread
- Cereal
- Coffee grounds
- Tea leaves and bags (paper)
- Egg shells
- Newspaper, paper towels and napkins
- Aged manure

Precaution and Helpful Hints

- Pasta must be cooked and relatively free of oil and sauce.
- Cereal should be drained of milk.
- Remove the filter from coffee grounds.
- Egg shells should be finely crushed.
- Use only paper towels and napkins that have been used to wipe up minor food spills.
- It is recommended that aged manure be used in outdoor bins only.

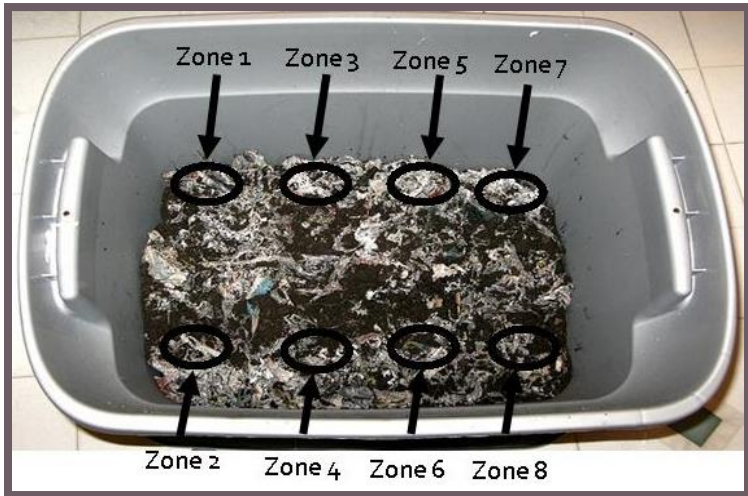
Avoid these materials

- Yard waste (leaves, grass or twigs). Mixed together they could cause the bin to heat up and kill the worms.
- Unwashed fruit and vegetable scraps.
- Citrus and citrus peels. They are too acidic for the worms to digest.
- Animal or dairy products, such as meat, bones and milk.
- Feces

Feeding Methods

- Ideally food should be buried in the bedding and then covered with a newspaper blanket.
- The feeding process needs to be monitored closely before adding more food to the bin. Check to see what is left from the prior feedings. If food has not been consumed, evaluate to see if it needs to be removed because the worms do not like it or you may be overfeeding for the amount of worms in the bin.
- The zone feeding method is recommended for 10 gallon or larger bin systems. This method promotes placing each feeding in a different zone of the bin each week, so the worms move through the bin. See Figure 4.

Figure 4: Zone Feeding Method



Harvesting the Worm Bin

The purpose of harvesting the worm bin is to collect the worm castings for use as a natural fertilizer.

How often and when the bin should be harvested depends on the type of worm bin bedding used, size of the bin, and amount of worms in the bin. You'll want to harvest your bin when you notice that the material inside is starting to pack down, which reduces the amount of available oxygen in the bedding.

The bin can be harvested before all of the worm bin bedding and food scraps have been converted to castings. Most bins are ready to harvest in four to eight months. It usually takes about two to three hours to harvest a bin.

When you harvest your bin, you'll notice that there are many more worms than what you started with. You'll need to decide what to do with the additional worms.

If you plan on starting additional bins, have the bins ready before harvesting. You can also place the worms back in your original bin after harvesting and the population will self-regulate for the size of bin you have. Do not place extra worms in the garden because there is not enough food to support red wigglers and most of them will die.

Figure 5: Worm Cocoons



Separating Worms from Castings

Smaller bins can be harvested at one time.

10 gallon or larger bins will be harvested one side at a time. You'll feed the worms for two to four weeks on the side you are NOT going to harvest, and then harvest the other side where food has been withheld. This will attract the worms to the feeding side of the bin and allow you to more easily harvest the castings from the remaining side.

- Place worms and castings being harvested onto a table covered with plastic or newspaper.
- Make several small piles of worms and castings. See Figure 6.
- Using a stick or your fingers, begin pulling castings from the pile until worms are exposed.
- Allow worms to migrate to the center and bottom of the small pile.
- Continue doing this until all that is left is a pile of worms in the center and a ring of castings.

Castings can be used immediately or stored for later use.

Figure 6: Separating the Worms and Cocoons from the Castings



Using the Castings and Leachate

Using the Castings

Castings can provide natural micronutrients. They are too fine-grained and dense to be used by themselves as a growing medium and need to be mixed with planting mix or soil. Worm castings can be used in several ways.

- Use as a top dressing on your lawn or soil by spreading a thin layer and watering them in.
- Add to planting mix or turn into the soil by mixing one part castings to five parts of soil or planting mix.
- Use on container plants by sprinkling castings lightly on the surface of the container and water.
- Make worm tea. Place a scoop of castings in an old pillow case or a bag with tiny holes and soak in a 5-gallon bucket of water for about a day. Remove the castings and use immediately or place in a container to use later. If the tea is real dark, dilute it to look like weak iced tea.

Using the Leachate

Pour the leachate collected in Bin B into a separate bucket. Leave a half inch of leachate in the bottom of Bin B. The liquid helps cool the bin system in the summer and maintain heat in the winter. If you pour all of the leachate out, you can add water to the bottom of Bin B.

Dilute the leachate by mixing one part of leachate to four or five parts of water or until it looks like weak iced tea. The diluted leachate can be used in several ways.

- Spray on foliage. Be sure to filter the liquid so it does not clog the sprayer.
- Drench the soil, thereby providing nutrients and water for your plants.

Troubleshooting

Worms are Dying

Cause	Solution
Not enough food scraps	Add more food scraps to the bin.
Bin is in direct sun light	Move to where the bin is in the shade.
Bin is too dry	Moisten contents until slightly damp.
Bin is wet	Add dry bedding.
Large amount of moisture collecting on the lid	Increase or add ventilation by cutting a hole in the lid and covering the hole by hot gluing a piece of screen that is slightly larger than the hole to the inside of the lid (Figure 7) For smaller bins – the hole should be approximately 4 to 5 inches in diameter For 10 gallon and larger bins – the hole should be approximately 6 inches by 8 inches.
Bedding is eaten, too many castings	Harvest castings, clean bin and add fresh bedding.

Figure 7: Lid ventilation



Ant Infestation

Cause	Solution
Food is accessible	If bin is on a platform or table with legs, place legs in cans of mineral oil. If bin is located on ground, find a pan that is 2 inches longer and 2 inches wider and about 4 inches deep. Place mineral oil in the bottom of the pan and place the worm bin inside the pan. Ants will be deterred by the mineral oil.

Fly Infestation

Cause	Solution
Food is exposed	Bury food scraps in bedding. Secure lid/ cover. If screen has come loose, apply new glue as required. Place a minimum of 12 sheets of moist newspaper on top of the bedding.

Worm Bin Smells Bad

Cause	Solution
Bin is too wet	Drainage holes may be plugged. Harvest and clean drainage screen. Add additional ventilation. See Figure 7
Improper food scraps	Remove improper food scraps.
Too much food	Remove excess food and feed the worms less.

Make Your Own Worm Bin

Attributes

- Low Cost
- Readily available
- Stackable
- Portable
- Long life span

Selecting a Container

The following plastic containers are all appropriate:

Figure 8: Types of containers



10 to 18 gallon plastic storage tote containers



4 or 5 gallon kitty litter pail



4 or 5 gallon white bucket

Plastic storage tote containers can be found at home improvement centers and variety stores. Do not use bins that are over 18 gallons because they will be too difficult to handle when harvesting the castings and leachate. White buckets are made of a high-density polyethylene (HDPE) plastic. These can be found at restaurants, bakeries, or donut shops.

- The minimum depth of the bin should be between 8 to 12 inches.
- They should be made of a material that is opaque.
- They must have a lid.
- The size dependent on amount of fruit and vegetable scraps to be processed. Typically 5 – 18 gallons.

Material Required and Tools

Figure 9: Drill Bit Types



Step drill bit



Spade drill bit

- Two (2) plastic bins with lids. See Figure 8 for examples.
- Safety goggles
- Electric or battery powered drill
- One (1) - 3/4 inch step drill bit (preferred) **OR** one (1) - 1/2 or 3/4 inch spade drill bit Figure 9
- Dual heat hot glue gun (heats to a hotter temperature than a hobby glue gun)
- Three (3) - large all-purpose glue sticks that fit your particular glue gun (not hobby glue sticks). Hobby glue does not hold as well as the all-purpose glue.
- Two (2) craft sticks or twigs, to spread hot glue and hold screen
- Scissors
- Either fiberglass or aluminum window screen that is three (3) feet wide and two (2) feet long. (Note: can be new or used).

Optional Material

The air space blocks (Figure 10) will create an air gap to prevent the two bins from becoming air tight. They also help to prevent the leachate that collects in Bin B from reaching the bottom of Bin A. They can be made of Styrofoam or wood.

Figure 10: Air space blocks



The size and amount will be determined by the type of container used.

- For kitty litter pails and white buckets: one block that is 4" x 4" x 6" OR two blocks that 4" x 4" x 2"
- For 10 to 18 gallon plastic storage tote containers: two blocks that are 8" x 4" x 2"

Constructing the Bin

Label the Containers

- See Figure 2 for bin configuration.
- Bin A is the container for bedding, castings, food, newspaper blanket, and worms.
- Bin B is the container that collects leachate and holds Bin A.

Drill Drainage Holes in Bottom of Bin A

Turn the container over so the bottom is facing up. Use either a step or spade bit and drill $\frac{3}{4}$ inch holes for drainage on the bottom as illustrated in Figure 11. The number of holes will be determined by the type and size of container used.

Figure 11: Drainage hole layout



For kitty litter pail



For white bucket



For plastic storage tote

Drill Air/Ventilation Holes on Sides of Bin A

Use either a step or spade bit and drill either ½ or ¾ inch air/ventilation holes as illustrated in Figure 12. For kitty litter pails and white buckets, the size of holes and the location will be determined by where the handle is located.

Figure 12: Ventilation hole layout



For kitty litter pail



For white bucket



For plastic storage tote

Cut Screen for Air/Ventilation Holes

Cut 2 to 4 strips of screen using scissors. The width and length will be determined by the size of the holes drilled and circumference of the container used.

Glue Screen on Air/Ventilation Holes

Determine the number of holes your screen sections will cover. Working in sections based on the length of your screen pieces, place hot glue on the top and bottom edges of one screen strip and around the holes on the inside of the bin for that segment. Repeat until all ventilation holes are covered.

It is recommended that you do not use one continuous piece of screen to because the glue will cool off before you place your screen.

Cut Screen for Drainage holes

Using Bin A as a template, place Bin A on top of a piece of screen and use scissors to cut around the bin to make a sheet of screen to fit the bottom of Bin A. Place the screen on the bottom of Bin A (do not glue it).

Congratulations!

You've constructed your worm bin! You can now set-up your worm bin following the instructions beginning on Page 3.

Vermicomposting Resources

Plans to build bins:

<https://www2.calrecycle.ca.gov/Publications/Download/1015>

Worm Suppliers and Pre-made Worm Bins:

<https://www.calrecycle.ca.gov/organics/worms/wormsupply#Southern>

Worms Eat My Garbage, by Mary Applehof (Flower Press, 1997)



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