Monterey Regional Waste Management District
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www.mrwmd.org
www.keepmontereycountyclean.org
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Vermicomposting Resources:

Worms & Supplies: The Monterey Regional Waste Management District carries compost bins and supplies at the Last Chance Mercantile. For those living within the MRWMD service area, the cost of the bins is subsidized.

For worm sources visit www.mrwmd.org or www.calrecycle.ca.gov/organics/worms.
Local garden and bait shops may also carry worms and compost supplies.
(Expect to pay about $20-$30 for a pound of worms.)
www.omexchange.org is a source for manure and other compostable material.

Information:
Worms Eat My Garbage, by Mary Appelhof
Complete Composting Gardening Guide, by Barbara Pleasant and Deborah L. Martin
www.wormdigest.org - General information
www.calrecycle.ca.gov - Bin plans, worm suppliers and educational materials
www.compost.css.cornell.edu - Compost topics addressed by Cornell University

Workshops: Visit **www.mrwmd.org** for schedule of compost workshops in the MRWMD service area.

"It is a marvelous reflection that the whole expanse has passed, and will again pass, every few years through the bodies of worms... It may be doubted whether there are many other animals which have played so important a part in the history of the world, as have these lowly organized creatures."

-Darwin (1881)

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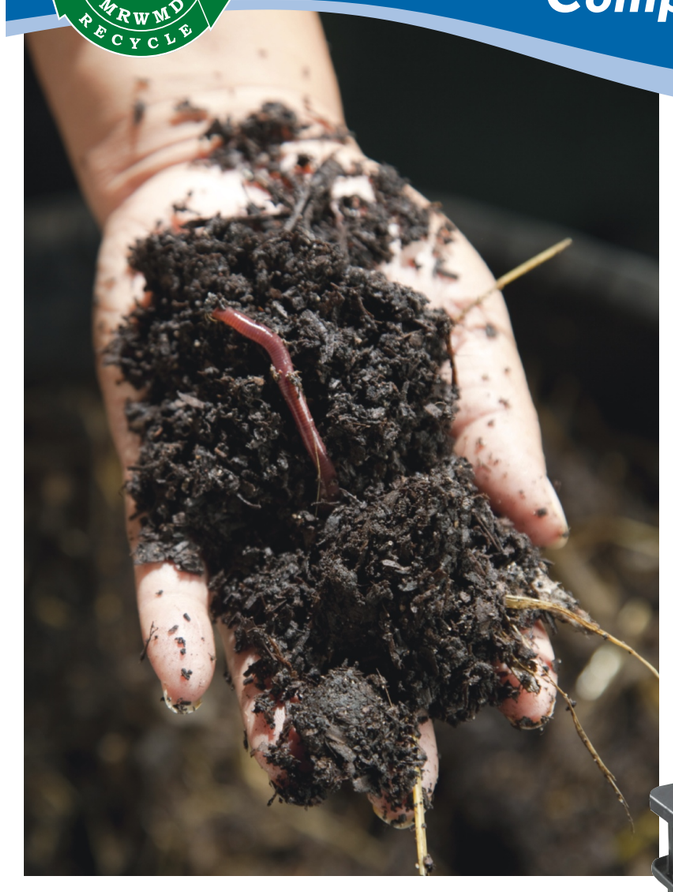
MONTEREY REGIONAL

VERMICOMPOSTING

Composting with Worms



What is Vermicomposting?

Vermicomposting is the practice of using specific species of earthworms to compost food waste and other organic materials.

With the help from associate organisms, such as bacteria and fungi the worms digest the organic material and produce vermicompost; a mixture of partially decomposed organic materials and worm castings (worm manure).

Vermicompost is considered by many to be one of the very best soil amendments available. The worm castings provide nutrients and chemical compounds that are in a form readily available to the plants, and are thought to promote plant growth and disease resistance.

Why Vermicomposting?

The benefits of vemicomposting are many.

Vermicomposting:

- Reduces organic waste going to the landfill.
- Results in a free, organic soil amendment which helps produce healthy, disease resistant plants.
- Reduces the need for synthetic, store purchased products.
- Can be done by those who have little or no yard space.
- Can be a fun and gratifying activity.

The Worms: Feeding and Maintaining

The Worm Bin:

When choosing and preparing a worm bin or environment for vermicomposting consider the following:

- Worms require a dark, moist and oxygen rich living environment. They do best at temperatures from 55 to 77 degrees Fahrenheit. They can be kept indoors or outdoors with protection from direct sun, freezing temperatures and rain.
- Bins can be made from plastic, wood and/or repurposed materials. They need to keep light out, have a lid, small aeration holes (smaller then the diameter of the worms) and drainage holes in the bottom. Short legs or small blocks and a catchment tray underneath the bin are helpful for airflow and catchment of excess moisture or leachate.
- To compost food scraps for one to four people, a small 12 to 20 gallon worm bin should be adequate.
- Small ready made bins are available at MRWMD's Last Chance Mercantile, some local nurseries and on-line. For plans to build your own visit, **www.calrecycle.gov**.

The Bedding:

Worms need a moist, organic substrate or "bedding" in the bin. All bedding should be moistened and kept wet as a "wrung out sponge."

- Bedding suitable for indoor bins include: Coconut coir, shredded newspaper or office paper, untreated wood shavings, finished compost.
- Bedding for outdoor bins include: Manure (herbivore only) and leaf mold (decaying leaves) can be used in addition to items listed above.

Adding a couple handfuls of soil when initially preparing the bedding provides grit to aid in the breaking down of the food particles in the worm's gizzard, and introduces beneficial organisms to help with the composting process. (A handful of sand, calcium carbonate or even pulverized eggshell will also work as grit.)

For homemade bins, use a container with opening dimensions larger than depth. (Buckets do not work well.) Make aeration holes, smaller than worm diameter on lid and sides, and on bottom for drainage.

Wet enough bedding material (moist as a damp sponge) and fill container about three-quarters full.

Add worms to bin. Leave lid off approx. 10 minutes to allow for worm migration into bedding. Cover all with sheets of moistened newspaper or cardboard.

Rotate location and cover food scraps in bin. A bad odor indicates too much food added for number of worms.

The Worms

The two most common species of earthworms used for vermicomposting are ***Eisenia foetida*** and ***Lumbricus rubellis***. Both have a variety of common names, including red worms, red wigglers, tiger worms, and manure worms. These worms are natural composters; in nature they are litter dwellers, living in decaying leaves, logs and manure piles vs. the soil. The night crawler (Lumbricus terrestrius), commonly found in garden soil, is not used in vermicomposting systems, as it does not do well living in shallow depths, nor does it breed well in captivity.

How many worms will I need?

The initial amount of worms depends upon the size of bin and amount of food waste to be added. A 2:1 worms to garbage ratio can be used to calculate your starting amount. One pound of worms (approximately 1,000 adults) is recommended for bins accommodating up to one half pound of food waste per day.

Worms will reproduce quickly if their environmental conditions are adequate including space, moisture, pH, temperature, bedding material, and amount of food. Conversely, if conditions are unacceptable, the worms may leave the bin or die off.

What other organisms live with worms?

In addition to microscopic organisms like bacteria and some fungi, several other creatures, such as springtails, mites, pot worms (small white worms often mistaken as "baby" red worms), and an occasional fungus gnat can be found in the indoor bin. In an outdoor bin other creatures, such as sow bugs, millipedes even frogs may find their way in. Most organisms live in harmony with the worms and cause little problems. See "Troubleshooting" for addressing "pests."

What will worms eat?

Worms, with the help of the other associate organisms, will digest a wide variety of organic materials. Items high in moisture, soft, and in small pieces are the quickest to degrade and be consumed.

Acceptable:

- Food scraps (including fruit, vegetables and starches)
- Paper (non-glossy)
- Coffee grounds and tea bags
- Ground yard trimmings and herbivore manure (for outside bins).

Avoid:

- Meat and dairy products
- Oily, salty and acidic foods
- Citrus peel (Limonene, a chemical compound found in citrus peel is toxic to worms.)

Harvesting and Troubleshooting

Harvesting

Harvesting can begin when most of the organic material added to the bin – bedding and food scraps – has turned into a rich dark brown material with the consistency of coffee grounds. Waiting longer can result in a sludgy material that is difficult to harvest and can become anaerobic. There are several ways to harvest the castings; below are a few suggestions. Sometimes a combination of efforts is most successful. Screening or sifting harvested material may be helpful in removing any undigested pieces. The worms separated out should be enough to start your bin again.

MIGRATION: Place new bedding in one half of the bin, and feed exclusively on that side. Most of the worms will move to the side with the new bedding (this will take up to a couple of weeks) and finished compost can be harvested.

MELONS: Use two halves of a melon rind or pumpkin shell turned face down on the bedding. Within a few days to a week, the food should attract a mass of feeding worms. By turning a plastic bag inside out over your hand, you can then "reverse harvest" the worms by simply grabbing the mass of worms and turning the bag right-side out.

MOUNDS: Empty contents of the bin onto a tarp in bright light. Make small mounds, allowing the worms to burrow down to escape the light. Castings can then be separated by slowly scraping them away, pausing periodically to let the worms burrow further. After a few passes you are left with worms to start your bin again.

How to use the harvested castings

Castings can be mixed into watering solution or potting soil and used on indoor or outdoor plants. They can also be added to soil when planting seeds and transplanting seedlings, as well as used as a top dressing around plants. If they are to be stored they should be cured in an aerobic environment and dried to a 25-35% moisture content to prevent mold. For information on other preparations and uses check: *Worms Eat My Garbage,* by Mary Applehof.

Troubleshooting

Symptom	Problem(s)	Solution(s)
Worm bin smells bad	Too much food Too wet	Feed less. Check drainage. Add dry bedding.
Fruit flies	Too much food	Feed less. Take outside. Leave lid off for short periods of time. Cover with more shredded newspaper and/or moistened newspaper sheets. Sometimes "starting over" or rebuilding bin is necessary.
	Too acidic	Alter materials added to pile; bury fruit/vegetable scraps in the middle of the pile, or under 8" to 10" inches of soil.
Ants	Bedding too dry	Keeping the bin moist, stopping feeding for a week or two, covering the surface of the bedding with additional moistened shredded paper and stirring the bin every day can eliminate ants.
Worms are not eating	Too much food Too acidic	Feed less. Food should be moist, small pieces. Stop feeding acid foods such as citrus peels and onions.
Worms are not reproducing, leaving, or have gone	Too many worms Too acidic Too hot or cold Too wet	Subdivide worms. Stop feeding citrus peels. Move bin to protected area. Add additional (dry) shredded paper.