

# ***Toast to Compost***



<https://www.istockphoto.com/videos/compost>

**By Karen Gomez**

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## Background Information



<https://www.fao.org/land-water/overview/covid19/composting/en/>

Earth's natural resources are crucial for every living species, including humans. One of the most important resources is soil, which provides habitat for billions of organisms, contributes to biodiversity, and plays a critical role in natural processes such as the decomposition of organic material and the regulation of the carbon cycle.

Composting is a good alternative for making soil more fertile for growing food, for developing probiotics, and for creating a sponge underneath the soil. One of the most significant ways to keep organic waste out of landfills is to compost because it benefits soil and humans.

Composting is also a viable way to help decrease many of the environmental issues we face today. Composting can lower greenhouse emissions, regenerate the soil, revitalize water, and secure food sources for the future.

Since ancient times, cultures around the world have noticed the advantages of composting. The earliest written record of composting dates back to 2300 B.C., when the Akkadian Empire, the first ancient empire of Mesopotamia, referenced the use of manure in a series of clay tablets.

Ancient civilizations such as the Greeks, Romans, and Egyptians used composting to boost crop production and to produce summer vegetables in the winter by using the warmth of decomposing compost. They fertilized fields by spreading manure urine-soaked straw on crops and by collecting and composting waste on dung hills.



<https://pages.vassar.edu/realarchaeology/2015/11/15/sustainability-of-the-aztec-empire/>

The Aztecs, an advanced civilization that took care of the environment, also used composting. They employed a system of latrines throughout the city, and they used the feces collected as compost along with guano, the excrement of seabirds and bats.

The composting process, where nutrients from organic waste return to the earth, has been an integral part of keeping soils fertile and producing crops sustainably.





<https://www.hgtv.com/outdoors/landscaping-and-hardscaping/how-to-compost-with-worms>

The benefits of composting are vast. It not only reduces waste but makes us less dependent on landfills and decreases greenhouse emissions. Composting also reduces the need for pesticides and synthetic fertilizers. The process can also destroy pathogens in the hot and cold stages. And the worms in compost play a crucial part of the process because they eliminate detrimental bacteria such as *E. coli*.

## Challenges/Opportunities



<https://www.warrenswcd.com/composting.html>

While composting has undeniable environmental benefits, the improper handling of compost can cause problems. To get the full benefits of this natural process of recycling organic matter, it's important to address them.

Composting is especially challenging in cities, where there usually aren't open spaces for a composting system. Problems include bad odors, rodents and other wildlife, excessive waste production, and difficult neighbors.

Bad odors and pests are among the biggest difficulties. The presence of rats is typical, but some compost also attracts wildlife like raccoons, skunks, opossums, and bears.

Bad odors are usually caused by an excess of green matter, which produces significant amounts of nitrogen. To address that problem, try adding brown



matter such as dried leaves or straw, which will also help keep animals and insects out of compost bins.

## **How to Avoid the Most Common Problems**



<https://www.nrdc.org/stories/composting-101Problems>

The most common problems associated with compost are usually easy to treat, and most of the alternatives can make the composting process less inconvenient for residents and neighbors.

When addressing composting issues, keep in mind the four main components: organic matter, moisture, oxygen, and bacteria. Each one is critical for maintaining balance within the process.

### **Four Main Components of Composting**

| Organic Matter  | Moisture  | Oxygen   | Bacteria and Other Microorganisms  |
|---|---|--|--|
| <p>Green material (nitrogen)</p> <p>Lawn clippings, fruit rinds, food scraps</p>  | <p>If the pile is <b>too dry</b>, material will decompose slowly. Add water during dry periods or when adding large amounts of brown organic material.</p>  | <p>Oxygen supports the breakdown of plant material by bacteria. To supply oxygen, turn the compost pile so that materials at the edges are brought to the center of the pile</p>   | <p>By supplying organic materials, water, and oxygen, bacteria will break down the plant material into useful compost for the garden. As the bacteria decompose the materials, they release heat, which is concentrated in the center of the pile.</p>                             |
| <p>Brown material (carbon)</p> <p>Dead leaves, twigs, manure, woody materials</p> | <p>If the pile is <b>too wet</b>, turn the pile and mix the material. Another option is to add dry, brown organic materials.</p> <p>For most efficient composting, use a pile that is between 3 feet cubed and 5 feet cubed (27-125 cu. ft.).</p> | <p>* Wait at least two weeks before turning the pile, to allow the center of the pile to "heat up" and decompose.</p> <p>* Once the pile has cooled in the center, decomposition of the materials has taken place.</p> <p>* Frequent turning will help speed the composting process.</p> | <p>* Adding layers of soil or finished compost to supply more bacteria and speed the composting process.</p> <p>* In addition to bacteria, larger organisms like insects and earthworms are active composters. These organisms break down large materials in the compost pile.</p> |

<https://extension.illinois.edu/soil/composting>

To prevent problems associated with stinky piles, the idea ratio for the organic matter is 1 part green for every 1 part brown material. A bad smell is usually an indicator that the compost is unbalanced.

A compost pile or a bin with a little aeration, with too many greens, or with too much moisture usually smells bad. It doesn't take much work to add water and mix the ingredients to address the problem.

| Composting in Pile |         |          |                    |
|--------------------|---------|----------|--------------------|
| Problem            | Symptom | Solution | To Avoid in Future |



|                        |   |  |   |
|------------------------|---|--|---|
| Lack of moisture       | Feels, looks dry  | Add water  | Water pile as it's being built, after every two to four inches of new material.   |
| Lack of oxygen         | Matted ingredients; large quantities of leaves, sawdust, or grass added in clumps | Add oxygen, turn pile or fluff   | Mix ingredients well when building, esp. those that tend to mat.  |
| Lack of nitrogen       | Pile doesn't heat up; slow decay  | Add high-nitrogen material: blood meal, organic cottonseed meal, corn gluten meal. | Sprinkle high-nitrogen material over every 2 to 4 inches of new material as pile accumulates.   |
| Lack of Microorganisms | None of the other factors apply; pile still doesn't heat up.                      | Add micro-organisms directly (inoculant) or indirectly (fresh compost, soil).      | Don't build piles on plastic sheets; don't isolate piles from the ground; save some fresh compost from finished piles to incorporate into new piles; add microorganisms to new piles. |

<https://www.planetnatural.com/composting-101/making/problems/>

In addition to the options already mentioned, to avoid stench when composting in bins indoors, it's important to regularly clean and empty the bins. If necessary, avoid for short periods foods like dairy, meat, fish, and any food waste that decomposes slowly.

The next chart presents some of the most common causes of bad smells in indoor composting bins.

| Composting Inside |  |
|-------------------|--|
| Cause of Smells   |  |

|                        |  |
|------------------------|--|
| Not enough browns      | <p>Every compost heap should have a mixture of greens and browns.</p> <p>(Greens here refer to things that are high in nitrogen, such as kitchen peelings, vegetable waste, and most foods. Browns refer to things that are high in carbon, such as old newspaper.</p>   |
| Not enough air         | <p>To compost properly, the microbes in your compost heap need air. Mixing it every couple of days is ideal. And with a small compost bin, mixing is easy and quick.</p>   |
| Too much water         | <p>One cause of a lack of air in the compost bin can be too much water. The water soaks the particles and fills up those air gaps, stopping oxygen from reaching the bacteria in the compost. You then get anaerobic ("without air") bacteria, which create an unpleasant compost smell.</p> <p>You can add ingredients that will help soak up the water. Examples include shredded paper (not too much, though, as it can turn into a sludge), a little newspaper, or cardboard to soak up the water.</p> |
| The wrong type of food | <p>All foods can be composted, but foods like dairy, meat, and fish (both cooked and uncooked) are ambitious for an indoor system, unless you are using a system designed to handle it, like a Bokashi bin.</p>  |
| Large pieces of waste  | <p>The smaller the pieces in a compost bin, the easier it is for the bacteria to decompose it. That's because the surface area of the material is larger. If your bin is too smelly, try putting smaller pieces in.</p>  |
| Lack of air space      | <p>The microbes that live on bulking agent are great for odor control. If you do have an odor problem, adding a layer of sawdust on the top of your compost will quickly remove the smell.</p> <p>Ensure that any bulking agent is completely dry before adding it!</p>  |

<https://www.compostmagazine.com/stop-indoor-compost-bins-smelling/>

## Keeping Pests Out of Compost



<https://simplifygardening.com/do-compost-bins-attract-rats/>

Composting can be a relatively easy process of turning kitchen scraps and organic material into beneficial nutrients for a garden, but it can also attract unwanted animals. Controlling unpleasant visitors requires some foresight and proper compost management.

To avoid attracting pests, here are some things to consider when composting:

1. Choose a composting method that promotes the rapid decomposition of foods like meat, fish, bones, dairy products, grease, oil, and seasoning. A tumbler composter or a Bokashi compost heap are both effective ways to promote the growth of healthy microorganisms.
2. Locate your compost pile away from bird feeders, pet bowls, and natural food sources like trees with berries.
3. Always keep the brown and green matter in balance. Cover kitchen scraps or garden trimmings (green matter) with at least an eight-inch layer of leaves, straw, or organic matter that's in the process of decomposing (brown matter).
4. Use bins that inhibit wildlife access.

You should also know which species of animals and insect can help your compost and which can hurt it. Here are a few of each type:

| Beneficial Species | Problematic Species |
|--------------------|---------------------|
|--------------------|---------------------|





<https://www.hgtv.com/outdoors/landscaping-and-hardscaping/how-to-compost-with-worms>

Worms: speed up the decomposition process by breaking up debris, making it easier for other organisms in the compost food web to digest them.



<https://pela.earth/blogs/news/animals-pests-in-compost>

Rats: attracted to compost as a rich food source and a place for shelter and warmth. Rats are a nuisance because they can carry disease and damage property.



<https://www.allaboutgardening.com/pill-bugs/>

Rollie Pollies (Pill Bugs): Accelerate decomposition, turning the organic matter into soil faster, aiding plant growth. Too many might indicate excessive moisture levels.



<https://www.wesa.fm/2022-01-16/meet-meeko-the-lehigh-valley-zoos-recycling-raccoon>

Raccoons: Inquisitive animals that can get into everything. They can destroy property and can become unwanted recurrent visitors.



<https://worstroom.com/maggots-in-compost/>

Maggots, Black Soldier: Great consumers of high-nitrogen materials such as decaying kitchen food scraps and manures.



<https://littleleafy.com/are-ants-good-for-compost/>

Ants: Decrease the effectiveness of worm composters by consuming too much of the worms' food. Additionally, some types of ants eat worms.





<https://topyarddesign.com/lawn-yard/mold-in-compost/>

Fungi: Stabilize organic matter and release nutrients and elements that benefit plant growth and fertility. They help break down items such as cellulose, bark, and woody stems, which are harder for bacteria to manage.



<https://www.finegardening.com/article/critters-in-your-compost>

Centipedes & Millipedes: Millipedes feed on decaying plant matter, helping break down your compost. But centipedes feed only on living creatures (e.g., insects and insect larvae), and they may hunt in your compost.



[https://www.cleveland.com/insideout/2016/09/grubs\\_in\\_your\\_lawn\\_plus\\_compos.html](https://www.cleveland.com/insideout/2016/09/grubs_in_your_lawn_plus_compos.html)

White Grubs: Help aerate and loosen compacted parts of compost materials and break down organic matter as they feed.



<https://es.wikipedia.org/wiki/Philonthus>

Beetles: Play an important role in the compost pile, but when they start multiplying, keep an eye on them. You may have to pluck them from your compost.



<https://readytoday.com/does-compost-attract-cockroaches-0051/>

Cockroaches: You may not like seeing them in your compost bin, but there's no reason to get rid of cockroaches. They break down food and accelerate decomposition.



<https://www.bobvila.com/articles/how-to-get-rid-of-flies-outside/>

House Flies & Mosquitoes: A poorly managed compost pile may encourage infestations. Mosquitoes can carry diseases, and their presence can indicate that the pile is too wet or not turned often enough.

Most species found in compost don't represent a threat to the composting process, but they can be annoying and can cause other issues. Bees are often found around compost piles or bins because the bins are often near sources of water and offer optimal conditions for bees to nest in. Finding bees around a bin or pile is an indicator of a healthy compost system because they are attracted to warm, organic-smelling environments.

## Composting Methods



<https://www.backyardboss.net/how-often-you-should-turn-your-compost-pile/>

You can use several methods to compost, depending on your unique needs and living conditions. What might be a pro for you may be a con for someone else. Finding what works for you will allow you to make the most of your compost.

### *Hot and Cold Composting*

The two traditional composting methods are commonly known as hot and cold composting.



Hot composting, or open-air composting, involves microbial activity to optimize the process in a short period of time. It takes about 27 days for the organic matter to decompose. This method requires some special equipment, time, and attention.

Cold composing, on the other hand, takes six months to a year, but it requires almost no work. You simply add material. No turning required.

Hot and cold composting are aerobic and anaerobic composting methods, respectively. Anaerobic composting produces potent-smelling methane and nitrous oxide, which are harmful to the environment.

### *Three-Bin Composting*



<https://backyardfeast.wordpress.com/2011/02/15/how-to-build-the-ultimate-compost-bin/>

A three-bin compost system requires three bins that allow you to compost large volumes of organic waste in less time. Each bin contains compost in different stages of decomposition, and the bins are located side by side, so it's easy to move the contents from bin to bin.

This system has various advantages. First, the contents of each bin weigh considerably less than a single pile. It also reduces the amount of time and effort required to turn over a single heavy pile.

### *Vermicomposting*



<https://home.howstuffworks.com/vermicomposting.htm>

Another form of composting uses worms to recycle food scraps and other organic material. It's similar to the most traditional compost method because both use natural processes to break down organic matter.

There are three types of vermicomposting systems: bins, beds, and windrows. Vermicomposting bins are most suitable for the home. But if your goal is to produce useful waste from organic matter, then primary or secondary vermicomposting are better options.

Primary vermicomposting uses organic material to feed the worms, whereas secondary vermicomposting requires you to put the organic material through a heating cycle in a microbial composting pile before feeding it to the worms.

### *Thermophilic Composting*

Thermophilic composting uses heat in a thermophilic process carried out by “warm loving” bacteria and fungi, which can break down organic matter in short periods. This method makes large quantities of compost in less time than the traditional composting. It's typically done in meter-square piles (the smallest functional thermophilic heap) or windrows.

Thermophilic composting needs to maintain aerobic conditions to keep microorganisms alive throughout the process. One of the main advantages of this method is that the high temperatures kill diseases, and it can address a variety of solid waste management issues.

### *Tumbler Composting*

Tumbler composting has several advantages. Because compost tumblers are sealed, they can generate heat quickly and carry out the composting process in a shorter period. In addition, the tumbler can rotate, making it easier to mix the ingredients. Its design keeps pets away.

The downside of this method is that not every location is an ideal fit for a tumbler, they are generally more expensive than standard composting bins, and they have limited capacity. You also often need two tumbler systems so one can sit for a few months to fully decompose before emptying it.



<https://directcompostsolutions.com/8-methods-composting/>



<https://helpmecompost.com/home-composting/methods/how-to-start-a-compost-tumbler/>

### *Effective Microorganisms (EMO)*



This method is generally appropriate for indoor composting, and it can be combined with other composting techniques to boost the process. The EMO composting method uses effective microorganisms and molasses to improve compost.

One of the main advantages of this method is that it can handle all food wastes, even organic waste that thermophilic piles and vermicompost systems commonly cannot, including bones, meat, and dairy products.

The EMO method also barely emits noxious smells because their lids are airtight. That means that its carbon footprint is pretty small.



<https://thepotagerproject.com/bokashi-vs-compost/>

## Solar Composting

The solar composting method is one of the most efficient because it creates compost more quickly and requires less manual work than methods like the traditional compost bin.



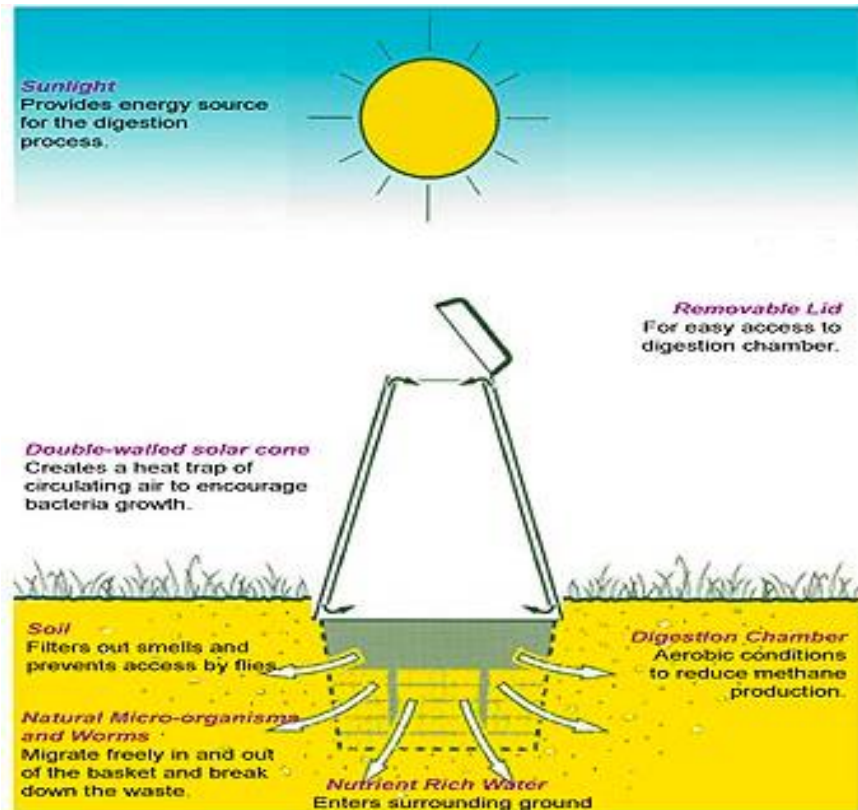
In-Vessel Composting System

<https://novid.ca/2020/04/13/the-evolution-of-waste-management/>

The solar composting system uses a cylindrical or conical container that is often made of a black plastic or metal to regulate temperature, moisture, and airflow. Solar composters use solar energy to accelerate the process by increasing the temperature inside the container and promoting bacterial growth. Some solar composting systems create usable compost in about 14 days.

There are different types of solar composting systems. Solar composting in a large-scale industrial form uses an in-vessel composting system, which involves feeding organic matter into a drum, silo, concrete-lined trench, or similar container.

At a small scale, the system involves cone-shape or tumbler composters. The cone shaped composters or solar digesters have an opaque outer shell to let sunlight in, a black inner cone to trap the heat, and a buried waste container to let the soil's microorganisms support the composting process. Tumbler composters, on the other hand, employ a cylindrical system in which heat is absorbed and a black plastic drum mounted on a stand with a hand crank. The combination of heat and rotation quickly produces ready-to-use compost.



Solar Digester

<https://www.ideaconnection.com/new-inventions/green-cone-solar-powered-composter-10825.html>

Other at-home solar systems use energy generated by solar panels. Some models mix solar with tumbler composting systems, and they can be automatically rotated to maximize efficiency.



Solar-Powered Compost Drum System

<https://www.instructables.com/Solar-Powered-Compost-Drum-System/>



## Compost vs. Mulch



<https://petersonslandscape.com/compost-and-mulch-secrets-and-tips/>

Although compost and mulch are similar, and the byproducts of both are important for a thriving garden, there are important differences. The major distinction is that **compost** is a byproduct of the decomposition of organic matter, whereas **mulch** is organic and inorganic material that can be used to cover the soil's surface.

Compost and mulch are used in different ways. Compost is great for adding nutrients to the soil and improving soil structure. Mulch is better for limiting weed growth, preventing erosion, and retaining soil moisture.

Depending on your goal, mulch or compost might be more beneficial. If your goal is to enrich soil with nutrients, the best alternative is compost. If your main concern is to limit weeds and reduce irrigation, your best option is to apply mulch.



## Best Materials for Compost

| Items for Composting  |   |  |
|---|---|--|
| Brown   | Green   | Avoid  |
| <p>Dry Leaves</p>  <p><a href="https://www.gardeningknowhow.com/composting/ingredients/composting-leaves.htm">https://www.gardeningknowhow.com/composting/ingredients/composting-leaves.htm</a></p>  | <p>Vegetable Peelings</p>  <p><a href="https://ishrecoeng.wordpress.com/2020/12/22/amaing-hacks-of-fruits-and-vegetable-peels/">https://ishrecoeng.wordpress.com/2020/12/22/amaing-hacks-of-fruits-and-vegetable-peels/</a></p>  | <p>Meat and Fish Scraps</p>  <p><a href="https://cookinginplainspeak.com/left-over-roast-meat-waste-not-want-not/">https://cookinginplainspeak.com/left-over-roast-meat-waste-not-want-not/</a></p>   |
| <p>Grasses</p>  <p><a href="https://www.evergreenseeds.com/composting-grass-clippings">https://www.evergreenseeds.com/composting-grass-clippings</a></p>  | <p>Food Waste</p>  <p><a href="https://www.kicw.com/news/shows/greeteria/organic-waste-disposal-csifina-garcia-oc/compost-food-scraps-sb-1383">https://www.kicw.com/news/shows/greeteria/organic-waste-disposal-csifina-garcia-oc/compost-food-scraps-sb-1383</a></p> | <p>Bones</p>  <p><a href="https://www.iStockphoto.com/photo/chicken-bones-gm61229772-118395923">https://www.iStockphoto.com/photo/chicken-bones-gm61229772-118395923</a></p>   |
| <p>Dead Plant Clippings</p>  <p><a href="https://www.1steofhome.com/collection/revive-almost-any-dead-plant/">https://www.1steofhome.com/collection/revive-almost-any-dead-plant/</a></p>  | <p>Tea Bags</p>  <p><a href="https://www.amedhealth.com/skin-beauty/reuse-used-tea-bags">https://www.amedhealth.com/skin-beauty/reuse-used-tea-bags</a></p>  | <p>Grease</p>  <p><a href="https://www.calgary.ca/waste/what-goes-where/cooking-oil-or-grease.html">https://www.calgary.ca/waste/what-goes-where/cooking-oil-or-grease.html</a></p>   |
| <p>Wood Branches</p>  <p><a href="https://www.theguardian.com/lifeandstyle/2016/nov/05/composting-wood-chips-gardening-diy-lowler">https://www.theguardian.com/lifeandstyle/2016/nov/05/composting-wood-chips-gardening-diy-lowler</a></p> | <p>Coffee Grounds</p>  <p><a href="https://www.thisoldhouse.com/21018057/10-uses-for-coffee-grounds">https://www.thisoldhouse.com/21018057/10-uses-for-coffee-grounds</a></p>  | <p>Dairy Products</p>  <p><a href="https://www.cnn.com/2021/08/22/health/daily-cardiovascular-disease-inf-act-wellness/index.html">https://www.cnn.com/2021/08/22/health/daily-cardiovascular-disease-inf-act-wellness/index.html</a></p> |



|   |  |  |
|---|--|--|
| <p><b>Straw or Hay</b></p>  <p><a href="https://www.alleycat.org/community-cat-care/straw-not-hay-for-outdoor-cat-shelters/">https://www.alleycat.org/community-cat-care/straw-not-hay-for-outdoor-cat-shelters/</a></p> | <p><b>Fresh Leaves</b></p>  <p><a href="https://www.conserve-energy-future.com/can-you-compost-flowers.php">https://www.conserve-energy-future.com/can-you-compost-flowers.php</a></p>  | <p><b>Citrus Foods (1)</b></p>  <p><a href="https://pharmeasy.in/blog/its-ok-about-citrus-fruits-and-their-health-benefits/">https://pharmeasy.in/blog/its-ok-about-citrus-fruits-and-their-health-benefits/</a></p>  |
| <p><b>Corn Stalks</b></p>  <p><a href="https://www.calloways.com/corn-stalks/">https://www.calloways.com/corn-stalks/</a></p>  | <p><b>Egg Shells</b></p>  <p><a href="https://www.conserve-energy-future.com/can-you-compost-eggshells.php">https://www.conserve-energy-future.com/can-you-compost-eggshells.php</a></p>  | <p><b>Whole Eggs</b></p>  <p><a href="https://www.healthline.com/nutrition/are-egg-yolks-bad">https://www.healthline.com/nutrition/are-egg-yolks-bad</a></p>  |
| <p><b>Cotton Fabric</b></p>  <p><a href="https://textilebeat.com/regenerating-clothes-into-compost/">https://textilebeat.com/regenerating-clothes-into-compost/</a></p>   | <p><b>Grass Clippings</b></p>  <p><a href="https://www.naturalivingideas.com/8-things-to-do-with-grass-clippings/">https://www.naturalivingideas.com/8-things-to-do-with-grass-clippings/</a></p>  | <p><b>Charcoal Ash</b></p>  <p><a href="https://www.bonappetit.com/test-kitchen/cooking-tips/article/everything-you-need-to-know-about-charcoal-from-briquettes-to-birchbark">https://www.bonappetit.com/test-kitchen/cooking-tips/article/everything-you-need-to-know-about-charcoal-from-briquettes-to-birchbark</a></p> |
| <p><b>Corrugated Cardboard</b></p>  <p><a href="https://whylamil.com/composting-cardboard-tips/">https://whylamil.com/composting-cardboard-tips/</a></p>   | <p><b>Seaweed</b></p>  <p><a href="https://frustratedgardener.com/2020/03/13/from-coastline-to-compost-bin-using-seaweed-as-a-garden-fertilizer-and-soil-improver/">https://frustratedgardener.com/2020/03/13/from-coastline-to-compost-bin-using-seaweed-as-a-garden-fertilizer-and-soil-improver/</a></p> | <p><b>Black Walnut Debris</b></p>  <p><a href="https://wagwalking.com/condition/black-walnut-poisoning">https://wagwalking.com/condition/black-walnut-poisoning</a></p>   |



|  |   |   |
|--|---|---|
| <p>Paper (Newspaper, Printing Paper, Paper Plates, Napkins, Coffee Filters)</p>  <p><a href="https://zerowastememories.com/a-complete-guide-to-paper-composting/">https://zerowastememories.com/a-complete-guide-to-paper-composting/</a></p> | <p>Animal Manure (Cow, Horse, Sheep, Chicken, Rabbit, <b>but not Dog or Cat</b>)</p>  <p><a href="https://www.freepik.com/free-photo/vector/cow-dung">https://www.freepik.com/free-photo/vector/cow-dung</a></p> | <p>Plants or Wood Treated with Pesticides or Preservatives</p>  <p><a href="https://www.happysprout.com/gardening/organic-pest-control-ideas/">https://www.happysprout.com/gardening/organic-pest-control-ideas/</a></p> |
|--|---|---|

Notes: (1) Add organic citrus peels to a compost bin in moderation to avoid worms and other problems.

## Composting Around the World

One of Europe's leading countries for composting is in Austria, where citizens are required to dispose of organic waste directly into an appropriate bin. Composting byproducts are used as garden trimmings and biogas plants. Austria has one of the world's highest composting rates, and around 34% of the organic waste is recycled using aerobic and anaerobic digestion at 400 facilities.



Composting Plant – Krems, Austria

<https://schwarzmann.eu/en/project/composting-plant-in-krems-austria/>

Sweden also stands out as a worldwide leader, recycling 99% of its organic waste. The country's waste management focuses on avoiding the production of trash. Everything is recycled, reused, or composted. In the case of food waste, Swedes make composting systems for fertilizers and biogases used to fuel buses.





*Jordberga Biogas Plant – Northeast of Trelleborg, Sweden*

<https://www.gasum.com/en/our-operations/biogas-production/biogas-plants/jordberga-biogas-plant/>

Japan has also demonstrated that you don't need a garden to compost. Houses and plots of land are much smaller in Japan than in Western countries, so outdoor composting bins aren't an option.

Instead, the Japanese reduce food waste and give their household food scraps and organic materials to workers, who come door to door. They use the compost to fertilize soil used to grow vegetables.

An eco-friendly organization called Food U-turn collects food waste, which is mixed with cow manure and rice husks to create a product called "Dokoyo," which translates to "soil with soul." Farmers mainly purchase this product.



*Bokashi or EFO Composting: Japanese Composting Method That's Ideal for City Living*

<https://www.forbesindia.com/article/lifes/bokashi-the-japanese-composting-method-thats-ideal-for-city-living/74929/1>

In Australia, an innovative project continually looks for new ways to convert food waste into new ecological products. Researchers on the campus of Deakin University in Waurn Ponds, Victoria, have explored the idea of producing fish feeds, nutritional supplements, medical biomaterials, textile additives, organic fertilizers, and organic cosmetics from the organic waste produced in Australian households. Deakin University is also promoting other projects, one of which is focused on converting waste from squid production into high-value nutritional fertilizer and oil.

In South Africa, the city of Cape Town created city drop-offs to divert a significant proportion of organic waste from landfills. The city hopes to divert 100% of its organic waste by 2027. They also recently implemented a food waste initiative that encourages residents to start composting at home in free home-composting containers. The city wants to create a good compost system that feeds nutrients back into the soil, which is particularly helpful in Cape Town, where some areas don't have fertile soil.



<https://lomi.com/blogs/news/benefits-of-composting>

In the U.S, San Francisco has excellent composting programs. Thanks to the San Francisco Mandatory Recycling and Composting Ordinance, the city diverts about 80% of its waste. The program requires all San Franciscans to keep recyclables, compostables, and trash separated. Due to this ordinance, San Francisco has composted 25 million tons of garbage, and it has indirectly helped save water because one of composting's upsides is that it attracts and retains water.



<https://www.sfgate.com/bayarea/article/S-F-food-scrap-collecting-to-hit-milestone-2290068.php>

The city of Seattle and the state of Vermont have also mandated composting. Twenty-four states across the U.S have laws in place banning yard waste from landfills, but the practice is permitted in most cities without a municipal program.

Toronto, meanwhile, allows residents to put diapers and pet waste in their compost bins and to use plastic bags as liners, which are removed during pre-processing. By making it easy for residents to compost, city officials have increased participation to around 90% for single-family buildings in 2021. In 2020, 140,051 metric tons of material (not including yard waste) were collected in the city's green bin program, and the material was sent to the city's anaerobic digestion facilities, where some was turned into biogas.



Toronto, Canada – Disco Road Organics Processing Facility, Anaerobic Digester  
<https://www.biocycle.net/toronto-expands-anaerobic-digestion-of-source-separated-organics/>



In South America, countries like Bolivia have developed successful programs with high economic and ecological impact. In Cochabamba, Tiquipaya, the organic waste is composted in a municipal composting plant that is mainly staffed by volunteers. The largest source of organic waste is the central market, where people have been educated to separate and deliver organic waste to authorized trucks that drop off the material to the composting plant.

In Colombia, pilot projects have been developed to compost cow dung, plant clippings, and crop waste, all mixed with rocks of low solubility to increase the availability of phosphorus during the process. Officials hope to use the byproduct as an organic fertilizer.

### Human and Animal Waste Composting

Before the creation of synthetic fertilizers, people used human waste as fertilizer. Historical records tell us that many communities have made use of human excreta as some form of fertilizer. The Aztecs were known for using a mix of mud and human waste to grow crops that could be harvested seven times a year. People in ancient Attica and Athens used sewage from latrines to increase agricultural yield. In Japan, especially before World War II, the feces of rich people were traded to farmers at high prices, presumably because the feces had more nutrients thanks to the healthy diets. Even today, some people in Japan still collect and use human waste as fertilizer.



[https://www.linkedin.com/pulse/market-manure-from-animals-human-waste-has-never-been-yutian-lu/?trk=articles\\_directory](https://www.linkedin.com/pulse/market-manure-from-animals-human-waste-has-never-been-yutian-lu/?trk=articles_directory)

In areas where the quality of native soil is poor, the use of human waste could help the land recover, but farmers must be careful when using human waste

because improperly processed human feces could spread disease-causing pathogens.

The same is true of animal excrement, and not all animal feces can be composted. Dog, cat, and pig feces carry harmful bacteria that can make humans sick. A compost system that includes animal waste must be monitored very carefully to minimize the spread of disease.

Chicken and bat dung, on the other hand, are safe to compost because they are high in urea nitrogen, which makes it warm. It's best to add it fresh to the compost pile rather than applying it directly to the plants.

Cow, horse, sheep, and goat dung are also safe for a home compost system. They can be safely used on garden beds after they have composted for about six months. This manure is a good source of nitrogen and potassium.

### *Hair, Fur, and Nail Clippings*

Human and animal hair/fur and nail clippings can be safely composted, and hair can also be used as mulch. Experimental studies have shown that hair can be a great source of slow-release nitrogen.



*Dog Fur Used as Mulch*

<https://thehomespunhydrangea.com/5-creative-ways-to-use-dog-hair-in-the-garden/>

Human hair can be a rich source of nutrients for horticultural crops. A 2008 study showed that once the mineralization of hair starts, it can provide sufficient nutrients to ensure yields similar to those obtained with commonly used fertilizers.

The study suggests that when cultivating fast-growing vegetables such as lettuce, a mix of compost or another source of easily available nutrients is needed before the hair mineralizes. One of the major impacts of hair mineralization on lettuce quality is the reduction of moisture and the promotion of soluble sugar content (SSC).



<https://www.corrays.com/es/resources/how-to-grow-lettuce>

Matter of Trust Chile conducted experimental studies that demonstrated that hair has multiple agricultural benefits. A recent study tested the use of hair mats as a water-saving system in corn farming. The results showed that not only can hair mats reduce irrigation, but also they can improve crop production by discouraging the growth of weeds and shortening the maturation period of the corn.



## Solutions



<https://www.planetnatural.com/composting-101/soil-science/myths/>

The benefits of composting are clear, which is why communities around the world have been composting since ancient times. Composting offers solutions to some of the world's greatest environmental problems. First, it reduces the amount of trash in landfills, which shrinks the amount of carbon emitted by landfills as organic material biodegrades. Compost also replenishes vital nutrients in the soil and helps it retain large volumes of water, which prevents erosion and runoff and establishes vegetation. In agricultural settings, compost and mulch can help to increase productivity and reduce the cost associated with fertilizers and pesticides.

Composting has many benefits, but there are some challenges associated with the practice, including bad odors and pests. One of the most difficult challenges is finding the balance between greens and browns and maintaining the optimal environmental conditions. But with a little hard work, we can help our composting systems thrive.



<https://www.compostmagazine.com/stop-mice-compost-bin/>

To keep odors under control, try increasing aeration and adding browns. If you hope to dispose of food wastes that decompose slowly like meat, fish, bones, grease, and dairy products, it's important to choose the appropriate method. When composting in bins indoors, it's important to empty the bin regularly to prevent bad smells.



<https://www.conserve-energy-future.com/pros-and-cons-of-compost-tumblers.php> <https://nymag.com/strategist/article/best-compost-tumblers.html>

A great option for outdoor composting is a tumbling or drum compost bin, which produces minimal odors, keeps pests under control, and reduces the amount of time required for completion.





<https://www.treehugger.com/what-is-bokashi-composting-5088917>

To create compost in the kitchen, the best options are the Effective Microorganisms (EFO) or Bokashi methods. The method is simple and requires only effective microorganisms and molasses. The full process only requires about 10 days.

Other methods like solar composting can create compost even more quickly, and they require less work than methods like the traditional compost bin. Solar composting can be used at small and large scale, and they are promising in places where solar plants are viable.

At small scale, the solar systems are cone shaped digesters that break down all food waste. Such a system requires little attention, and it keeps pests under control. This system is good for outdoor spaces like gardens. The biggest advantage of such is system is that it can feed into the soil directly by percolating compost leachates into the ground.





<https://burlington.compostersale.com/product/green-cone-solar-digester-food-waste-pet-waste-2/>

Other household solar systems incorporate solar panels, which can be combined with tumbler composters that rotate and make compost in 10 days.



Prototype of Composting Solar Unit Designed in India

<https://www.thebetterindia.com/224385/maharashtra-engineers-innovate-solar-composting-waste-management-cheap-environment-india-gop94/>

## Conclusions

Composting is a natural process that turns organic waste into usable agricultural products. The pros of composting outweigh the cons, and there are a variety of options to make the process minimally inconvenient for individuals and communities. Pests and odors can be effectively managed by choosing the right composting method and maintaining a healthy balance of greens and browns.

Composting's most significant benefit for the gardener is the nutrient-rich byproduct that helps soil, especially agricultural soil. Additionally, compost helps soil retain water, reduces or prevents erosion and runoff, establishes vegetation, and improves crop productivity.

Composting is economically competitive with other waste management methods because it cuts down the amount of trash in landfills and reduces carbon emissions required to haul and process organic materials that could be used to create an environmentally beneficial byproduct.

Large-scale composting operations are increasingly important because they save energy and space in landfills. Even so, the most cost-effective way to manage yard, kitchen, and garden waste is in our own backyards, avoiding transportation and fuel costs.

## Research

Here are some articles about the fascinating story of compost:

<http://www.texasorganicsoil.com/blog/2015/8/12/the-history-of-compost>

<https://www.compostmagazine.com/compost-history/#:~:text=Composting%20in%20Ancient%20Egypt%2C%20Greece%20and%20Rome,-The%20practise%20of&text=They%20would%20spread%20manure%20directly,land%20if%20not%20in%20compost.>

Learn the most interesting facts about compost:

<https://www.compostmagazine.com/composting-facts/>

Here are some articles about the main composting issues and how to avoid them:

<https://www.growveg.com/guides/how-to-fix-common-compost-problems/>

<https://www.compostmagazine.com/stop-indoor-compost-bins-smelling/>

<https://pela.earth/blogs/news/how-to-keep-compost-from-smelling>

<https://lomi.com/blogs/news/how-to-keep-compost-from-smelling>

Here are some articles about three-bin compost systems:

<https://helpmecompost.com/home-composting/methods/3-bin-compost-system/>

<https://envirocenter.org/three-bin-composting-tips/#:~:text=The%203%2Dbin%20system%20is,the%20first%20one%20finishes%20decomposing.>

<https://www.thedailygardener.com/3-bin-compost-system>

Read more about the presence of bees in compost:

<https://containerfags.com/bees-compost-bin/#:~:text=Second%2C%20keep%20your%20compost%20bin,will%20help%20keep%20bees%20away.>

Learn more about the pros and cons of compost tumblers:

<https://www.conserve-energy-future.com/pros-and-cons-of-compost-tumblers.php>

Read an article about hot composting and how to make compost in less time:

<https://www.thespruce.com/how-to-hot-compost-2539474>

Learn about the basics of vermicomposting and the benefits in agriculture:



<https://chloridefree.org/en/benefits-of-vermicompost-in-agriculture-and-how-it-works/>

Here's an article about thermophilic composting and its environmental considerations:

<https://seaclifforganics.nz/blogs/news/thermophilic-composting>

Here are articles about the differences between composting and mulch:

<https://www.thespruce.com/the-difference-between-compost-and-mulch-5219355>

<https://longfellowsgarden.com/compost-or-mulch-that-is-the-question/#:~:text=Compost%20and%20mulch%20are%20terms,covers%20a%20given%20soil%20surface.>

Here's an article about what to compost and what not to compost:

<https://www.thespruce.com/what-to-compost-1709069>

Learn about a solar compost dump system designed to be used at home:

<https://www.instructables.com/Solar-Powered-Compost-Drum-System/>

Read more about an innovative composting unit that runs on solar power:

<https://www.thebetterindia.com/224385/maharashtra-engineers-innovate-solar-composting-waste-management-cheap-environment-india-gop94/>