COMPOSTING
For Your Vegetable & Herb Gardening

Our desert soils are typically low in organic matter. Our native landscape plants have evolved with these soil conditions, and *don't need* organic soil amendments. We can apply compost as a *top mulch* around these plants to help hold moisture in the soil.
If we are gardening with many of the non-native vegetables or herbs, however, they will benefit greatly from organic soil amendments. The best amendment you can incorporate into your garden is compost!

Compost is decomposed organic matter.

Composting can be very simple or quite complicated. It's your choice!

Choose a system that works for you.
Take into account:
- -the time you are willing/able to spend on your compost
- -the physical effort required by the different systems
- -the materials that are available

Choosing a pile style

Generally, a mass that is about a cubic yard (or larger) is good for successful composting. If it is too small, it won't hold heat or moisture very well (and will take longer to process). The size of your system should be compatible with the amount of space you have in your yard, as well as the amount of material available to compost.

Your system can be a simple heap or pile, or it can be some sort of bin if you are more interested in tidiness or aesthetics.
If you prefer a bin system, it is best that it be at least 3' wide and about 3' tall. 32"-36" is considered the maximum height for ease of working your system.

Also consider whether you want a stationary or a movable structure, for ease of turning your pile. If the bin is stationary, removable panels or slats, gates, or doors can make work easier.

Bins can be open-sided or enclosed (but *not airtight*).

OPEN-SIDED	**ENCLOSED**
better aeration	decreased aeration
dries out faster	retains moisture longer
loses heat faster	holds heat better
	deters animals

Some bin styles (ranging from more open to more closed designs):
- -galvanized hardware cloth, or chicken wire
  - -making a circle enclosure is very easy
- -recycled pallets
  - -pine is more rot-resistant than hardwoods
  - -choose pallets that have narrow spaces between the slats (paint)
- -wood
  - -untreated wood will decompose over time, except cedar or redwood

-treated wood or painted wood may contain heavy metals such as arsenic, copper, chromium, or other toxins, that could leach into compost over time
-straw bales
-cinder blocks
-flexible plastic enclosure
-recycled trash bin (from your city's Solid Waste Department)
-with or without lid, right-side-up or upside-down
-recycled plastic bins
standing
rolling
tumbler (rotating)

-NO PITS!!!
-pits do not allow proper aeration, and can fill with too much water = stinky mess!

1 compartment vs. 2 or more compartments
-take into consideration the space you have available, the quantity of material you have to compost, and your habits

Locating your compost system

-easy access for you
-access from your kitchen and garden areas
-enough space to maneuver as you work with the compost
-access to a water source
-placed away from walls or fences that can decay or discolor
-level, well drained surface
-not a low spot in the yard
-not too close to a tree or large shrub
-roots will grow up into the compost, and consistent moisture causes improper root growth
-sun vs. shade
-summer: sun will dry the pile out faster
-winter: sun will keep microorganisms more active
-aesthetics

The composting process

To create a finished compost product, you need to provide food, water, and air. If you provide these essentials, the workers will come.

The *food* is the material you put into the compost.

In general, the microorganisms that break the organic material down need nitrogen and oxygen to decompose the carbon. A carbon to nitrogen ratio of *at least* 3:1 will provide a suitable combination of material.

Carbon (C) is obtained from *dry* leafy and woody materials.
-dead leaves
-dried winter ryegrass clippings (safer not to include Bermuda grass)

-straw (with no Bermuda grass)
-chipped/shredded branches (good source - a tree maintenance/removal service)
-wood shavings (non-treated wood – know the source)
-coffee filters
-tea bags
-shredded newspapers
-paper bags
-cardboard egg cartons
-plates, cups, and service-ware made of plant materials (will take a long time to decompose!)

Nitrogen (N) is provided by green or *moist* material.

-kitchen fruit and veggie scraps (good source - pulp from a juice bar)
-coffee grounds (good source - coffee shops)
-fresh winter ryegrass cuttings (safer not to include Bermuda grass)
-young weeds (that have not flowered yet, and do not have seeds)
-fresh green yard/garden waste
-hair - pet or human
-manure
    -cows
    -horses
    -goats
    -sheep
    -chickens
    -*NO* cat, dog, or bird (can carry disease-causing pathogens, or parasites such as roundworms or tapeworms)

It is safest to use fully composted manure in your herb and vegetable garden. This should prevent possible pathogens, such as *Salmonella*, *Listeria*, and *E. coli* from contaminating your garden produce.
If not fully composted, the greatest risk of pathogens is with root crops or edible parts of other vegetables or herbs that come in direct contact with the soil.
Manure can contain concentrated salts.
Fresh manure can burn plant roots.

Compost food tips:

-Bury food scraps 8 – 12" below surface of pile or cover with carbon material to avoid attracting flies or creating bad odors.
-Thoroughly dry plants that spread by roots or runners before adding them to the pile, so they don't continue to grow.
-If seed germinates in the pile, chop and/or turn the seedlings under so they do not continue to grow.
-Make layers of carbon and nitrogen materials outside of the pile, and mix them as you place the material in the pile.

Do not feed your pile:

-diseased or insect-infested plant materials (aphids might be an exception)
-meat, fish, bones, or dairy products (can attract houseflies or other pests, and create odors)
-fats or oils of any kind (can become rancid and smelly, and repel water)

-weed seeds (unless you compost hot enough to kill them!)
-ashes (potassium is usually sufficient in our desert soils)
-mineral lime (our soil is alkaline!)
-eggshells (limited amounts - made of calcium, and we really don't need more in our soil)
-cat or dog feces (great risk of disease/parasites)
-magazines, colored pages of newspaper
-anything that isn't biodegradable (plastics, styrofoam, synthetic fibers, etc.)

Plant material with toxins or growth inhibitors:
The chemical toxins or growth inhibitors are broken down *if* the material is fully decomposed.
-oleander
-eucalyptus
-salt cedar
-sunflower
-palo verde

To be fully organic, avoid the following:
-wilted conventional commercial flower arrangements (use only organic bouquets)
-grass clippings from turf treated with synthetic fertilizers, insecticides, or herbicides
-pet bedding containing synthetic chemicals (for fleas, ticks, etc.)
-newspapers with regular ink (hydrocarbons present in small quantities)
    -use only soy-ink printed papers
-white (chemically bleached) coffee filters
-treated wood chips or shavings

The *water* is the moisture you provide for the compost materials.

Maintain the materials in a moist condition, damp like a wrung-out sponge. If the pile becomes too wet, an anaerobic condition is created, along with an accompanying rotten egg odor. Aeration and additional carbon materials can create an aerobic environment once again, suitable for the desired organisms.

The *air* is the aeration of the compost.

Provide proper aeration of the system by frequently turning and mixing the materials so air will be available for the hard-working microorganisms. They need both oxygen and nitrogen to decompose the carbon material.
Ideally, turn the pile once a week. Do not aerate more than three times a week.

-some handy tools for aerating your pile:
-pitchfork
-digging fork
-flat-edged or rounded shovel
-compost aerator (such as Compost Crank®)
-pvc tube with holes (or rolled hardware cloth), inserted into pile
    (*hollow*, do not fill it with compost)

The *workers* are the microorganisms (and macroorganisms).

You can add a few shovels-full of compost, soil that has been amended with compost, or some commercial compost "starter" or inoculant to provide the agents needed to decompose the organic matter.

The organic materials are broken down by fungi, bacteria, actinomycetes and other microorganisms. There are both aerobic and anaerobic bacteria. With healthy composting habits, you will encourage the preferred aerobic bacteria types.

-psychrophilic bacteria – active between 0 – 55^{o} F
-mesophilic bacteria – active between 50 – 120^{o} F
-thermophilic (heat-loving) bacteria – active between 120 – 150^{o} F

Chop, shred, or dice the debris into small pieces.

The increased surface area makes it easier for the microorganisms to do their work, so you will have finished compost faster.

Macroorganisms (larger organisms), such as earthworms, pillbugs, crickets, beetles, roaches, etc., help break down larger pieces of material, so microorganisms can take over and finish the job.

Temperatures

A temperature of 100 – 150^{o} F in the compost pile indicates that the microorganisms are hard at work. This creates the most rapidly finished compost product.

Higher temperatures of 130 – 160^{o} F will kill most weed seed and eggs of critters such as crickets or roaches (~30 days at 145 - 160^{o}F for tougher weed seed).

Stages of composting: stockpiling, hot composting, and curing

Stockpiling is hoarding or storing materials until you have enough to make a batch of compost. Holding bins can keep things tidy and keep leaves or other lightweight materials from blowing away.

Decomposition

The finished compost product will occupy only 25 - 40% of the space of the starting materials.

If the matter is fully decomposed, you can't identify any materials.

The end result, or humus, is a dark, rich looking, crumbly material that smells earthy.

Timeline

The process can take as little as 4-6 weeks, or as long as 6 months to a year. Commonly you can have a finished product in 3-4 months.

Fibrous materials (agave leaves, pine needles, corn cobs) take longer to break down.

Benefits of compost for vegetable and herb gardens

Soils

Compost enhances soil structure, allowing better root development for stronger plants.

-loosens heavy, clayey soils
-holds sandy, or gravelly soils together
-reduces soil compaction and erosion

Water

Compost provides better water-holding capacity of soil.

-creates better drainage in clayey soils
-allows salts to leach below the root zone
-holds moisture more effectively in sandy or rocky soils

-reduces leaching of nutrients below the root zone

Nutrients

Compost helps neutralize soil pH over time.

-makes nutrients more readily available for absorption from soil system

Compost returns small quantities of nutrients to the soil.

-this, combined with more friendly soil pH, *reduces* the need for additional fertilizers

The good microorganisms associated with compost create a healthy soil that can keep soil-borne pathogens (bad bacteria and fungi) in check.

Troubleshooting

Compost has a rotten egg odor

-caused by too much moisture, not enough air

-add coarse carbon materials to absorb moisture

-turn pile to aerate

-maintain moisture at a level like a squeezed-out sponge

Compost has an ammonia smell

-caused by too much nitrogen

-add carbon materials such as dried leaves

Compost is damp and sweet smelling, but is not heating up

-caused by lack of nitrogen materials

-add more nitrogen material

Compost is dry on the outside but warm and moist on the inside

-compost pile might be too small

-add more material

-turn the pile

-if the center is dry, add more moisture while turning

Have other questions?

Contact the **Master Gardener Helpdesk**

U of AZ MARICOPA COUNTY COOPERATIVE EXTENSION
4341 E. Broadway Rd.
Phoenix, AZ 85040
Master Gardener Help Desk: 520.549.1173 or maricopacountyplanthotline@gmail.com
publications: https://extension.arizona.edu/pubs

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Compost Organisms

Anette Weaver

bacteria – single-celled, shaped like a sphere, rod or spiral twist – life span of one generation is 20-30 minutes – eat nearly any living or dead organic matter
actinomycetes – a higher form of bacteria – especially important in formation of humus – liberate carbon, nitrogen and ammonia making nutrients available for higher plants – 5% or more of soil bacteria populations are actinomycetes – give the soil its earthy smell
fungi – many-celled, filamentous, or single-celled primitive plants – saprophytes lacking chlorophyll, live on dead or dying material, obtaining energy by breaking down organic matter in dead plants and animals
mites – related to ticks, spiders and horseshoe crabs having 8 leg-like jointed appendages in common – free-living or parasitic (sometimes both) – some eat plant matter, some eat nematodes, fly larvae, other mites and springtails
sowbugs – flat-bodied with distinct segments – eat decaying vegetation
snails, slugs – mollusks, muscular disks on undersides adapted for creeping – feed generally on living plant material, but will attack fresh garbage and plant debris – remove from compost before adding to garden
spiders – eight-legged creatures related to mites – feed on insects and small invertebrates – help to control garden pests
springtails – very small, rarely exceed ¼" – white to blue-grey, or metallic – distinguished by their ability to jump – feed by chewing, decomposing plants, pollen, grains and fungi
beetles, grubworms – two pairs of wings, the more forward a cover shield for back ones used for flying – most adults, like their larval grubs, feed on decaying vegetables and fruit – black rove beetles prey on snails and insects – grubworms, the larvae of June Bugs or Scarab Beetles, considered beneficial in compost but will eat plant roots if added to garden soil
ants – feed on aphid honeydew, fungi, seeds, sweets, scraps and other insects – may benefit composting process by bringing fungi and other organisms into their nests within or near compost – can make compost richer in potassium and phosphorus by moving minerals from one place to another
flies – adults feed on almost any kind of organic material – during early stages of composting flies provide ideal transportation of bacteria to the pile
worms – nematodes 1) those that live on decaying matter 2) those that are predators on other nematodes, bacteria, algae and protozoa 3) those that attack roots of plants
flatworms flattened carnivores – organisms living in films of water
rotifers small, multicellular animals, found in films of water, feed on microorganisms
earthworms – champion heavyweight decomposers – worm castings are the richest and finest quality of humus materials – high in bacteria, organic material, available nitrogen, calcium, magnesium, phosphorus, and potassium than soil itself
roaches – will inhabit a compost pile but are kept in check by whiptail lizards
lizards, geckos – inhabit compost piles feeding on roaches, crickets, and other insects

Table of Carbon to Nitrogen Ratios - Anette Weaver

material	C:N ratio
blood meal	5:1
kitchen waste	10:1
manure	15:1
fresh grass clippings	12:1
vegetables	20:1
cacti	20:1
greens	20:1
fresh leaves	25:1
fruit wastes	35:1
dry leaves	60:1
pine needles	60:1
used mulch	60:1
corn stalks	60:1
straw	80:1
paper	200:1
raw sawdust	511:1

Some References

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Harmonious Technologies, Harmonious Press

Easy Composters You Can Build
Nick Noyes, Storey Publishing

Small Scale Composting in the Low Desert of Arizona:
https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1632-2014.pdf

Compost tea: https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1739-2017.pdf

For More Compost (***not*** an endorsement by your municipality!)
-check with your local rock yard
-Singh Meadows (Singh Farms) hours vary – check their Singh Meadows/Singh Farms Facebook page
1490 East Weber Dr., Tempe 85281