

Introduction to Composting & Vermicomposting

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UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

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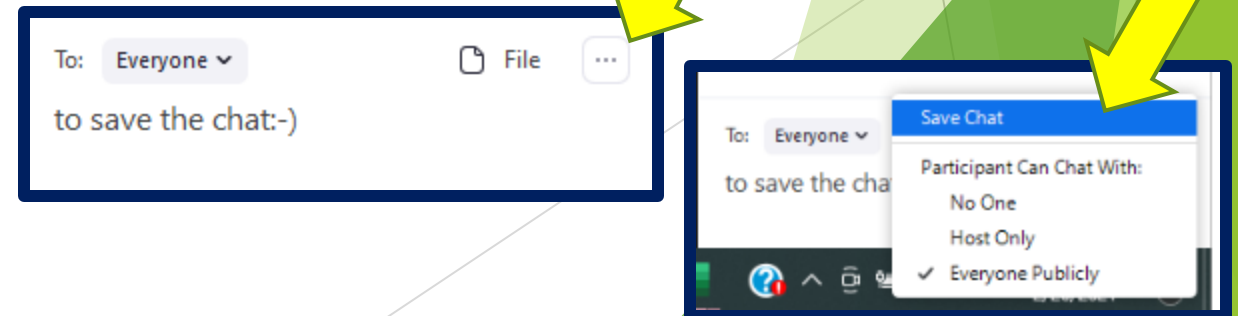


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UC Cooperative Extension Programs San Bernardino County

Expanded Food and
Nutrition Education



4-H



Master Gardeners



Master Food
Preservers



Environmental
Education



Academic Advisors (Natural Resources, Horticulture, Urban Ag, and more)



San Bernardino County Master Gardeners



- ❖ Part of University of California Agriculture and Natural Resources (UC ANR)
- ❖ Trained volunteers educating the public by sharing peer-reviewed research from University of California and other universities
- ❖ Education on a wide variety of topics including composting, sustainable landscaping, and seed saving

Environmental Education Program

- ▶ Mission: Promote environmental awareness, understanding, and sustainable practices
 - ▶ Focus areas
 - ▶ Composting
 - ▶ Waste reduction and recycling
 - ▶ Food preservation
 - ▶ Hydroponics
 - ▶ Start new composting sites (Composting Quick Start Program)
 - ▶ Loan hydroponics systems to schools
 - ▶ Perform food waste audits for schools and organizations
 - ▶ Give presentations, workshops, and classes on environmental topics



Today's Topics

- ▶ Composting
- ▶ Vermicomposting
 - ▶ What & why
 - ▶ Basic ingredients
 - ▶ Process
 - ▶ Best practices
 - ▶ Systems
- ▶ Summary
- ▶ Q&A





Question

How much composting experience do you have?

- None - want to learn
- Beginner - just starting out
- Intermediate - a year or more
- Advanced - larger-scale composting

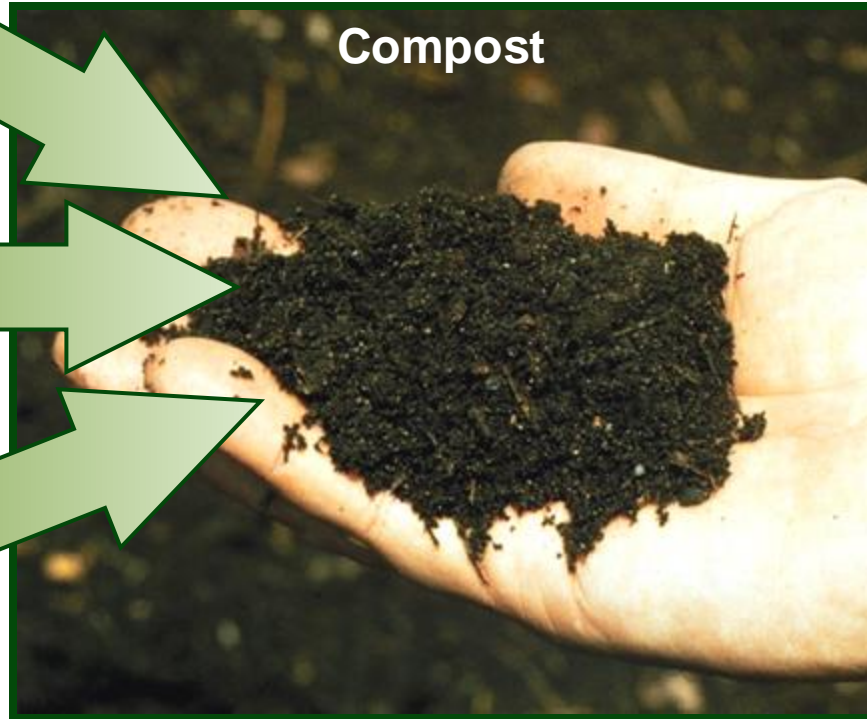




Composting at Home

What is Composting?

Using the natural process of decay to turn organic waste into a dark, crumbly, nutrient-rich material called compost



Organic waste comes from living things

Why is Composting Important?

- ▶ Reduces landfill waste and greenhouse gas emissions, especially methane
- ▶ Decreases need for chemical fertilizers
- ▶ Improves water quality by reducing fertilizer runoff
- ▶ Improves soil structure when added to soil
- ▶ Prevents weeds and retains soil moisture when used as mulch





Basic Ingredients of Composting

- ▶ Composting requires:
 - ▶ Organic materials
 - ▶ Water
 - ▶ Air (oxygen)
- ▶ Managing ingredients and temperature speeds up decomposition process
- ▶ Aerobic, hot composting

Organic Materials

Browns

High carbon materials such as:

Wood chips

Sawdust

Dry leaves

Straw

Plant stalks & twigs

Shredded newspaper



Organic Materials

Greens

High nitrogen materials such as:

Raw vegetable & fruit scraps

Coffee grounds

Crushed eggshells

Cut flowers

Grass clippings

Garden trimmings





Backyard Composting Ingredient List

Browns



Dry, high in carbon and slow to break down
50% of pile by volume

<u>Item</u>	<u>Warnings/Precautions</u>
Bark	None
Cardboard	Mix thoroughly with other ingredients to avoid matting. No waxed cardboard. (It is best to place cardboard in the recycle bin)
Coffee filters	None
Cornstalks	Very slow to decompose
Cotton fabric/string	None
Dryer lint	None
Hay and straw	Mix thoroughly with other ingredients to avoid matting
Mixed paper, junk mail, bills, paper towels napkins	Don't use envelopes with plastic windows (Paper should be shred into one inch strips)
Newspaper	Only use newspaper printed with soy-based ink. Mix thoroughly with other ingredients to avoid matting. (It is best to place newspaper in the recycle bin)
Nuts	None
Pine needles	Very slow to decompose
Pruning from trees	None
Sawdust	Don't use painted, treated or artificial lumber
Tea bags	None
Wallboards	Don't use vinyl/paper wallboard
Wood chips	None
Wood ash	Use small amounts. Don't use if it is from painted, treated or artificial lumber
Woody waste (2x4 etc.)	Slow to decompose. Don't use if it is from painted, treated or artificial lumber

Greens



Fresh, high in nitrogen, contains moisture, breaks down quickly
50% of pile by volume

<u>Item</u>	<u>Warnings/Precautions</u>
Coffee grounds	Whole coffee beans can cause odor
Egg shells	None
Feathers	None
Flowers	None
Whole fruit, vegetables	Bury food 12" deep to avoid pests
Green weeds	Use before going to seed
Grass clippings	Mix thoroughly with other ingredients to avoid matting and odor. Avoid using clippings for a month after the lawn has been treated with pesticides.
Hair: human/animal	Mix thoroughly with other ingredients to avoid matting
House Plants	Don't use if diseased or infested
Manure	Mix thoroughly with other ingredients to avoid odors
Tea leaves	None

Preparation of Ingredients

Break, chop, crumble or cut the material into pieces that are no thicker than your little finger and no longer than six inches (6") in length. This will provide the organisms more open surface area for penetration to begin decomposing material. Smaller material size makes turning and mixing the pile easier.



Compost Decomposers

- ▶ Microorganisms (microbes)
 - ▶ Bacteria and fungi
 - ▶ Break down organic materials
 - ▶ Heat up compost pile
- ▶ Macroorganisms
 - ▶ Snails, earthworms, beetles, etc.
 - ▶ Shred materials into smaller pieces
 - ▶ Feed on microbes



Materials to Avoid

- ▶ Plastic, metal, and glass
- ▶ Glossy or coated paper and cardboard
- ▶ Treated or painted wood
- ▶ Diseased, poisonous or invasive plants
- ▶ Mature weeds with seeds
- ▶ Chicken, fish, meat, and bones
- ▶ Dairy products
- ▶ Fat, grease or oil
- ▶ Pet waste



Types of Composting



- ▶ Passive or cold
 - ▶ Little management of compost pile
 - ▶ Materials break down slowly
 - ▶ Weed seeds and pathogens may survive
 - ▶ Long time to finished compost (1+ years)

Types of Composting



- ▶ Active or hot (thermophilic)
 - ▶ Management to optimize conditions
 - ▶ Temperatures over 104°F
 - ▶ More likely to kill weed seeds and pathogens
 - ▶ Shorter time to finished compost (months)

Turning

Why turn the pile?

- ▶ Expose materials to air
- ▶ Release trapped heat
- ▶ Distribute moisture, nutrients, and organisms
- ▶ Shred and break up materials

How often?

- ▶ 2 to 3 times a week when the pile is hot
- ▶ Turning less increases time to finished compost



Water



- ▶ Keep pile as moist as a wrung-out sponge
- ▶ If pile is too dry, microbial activity will slow down or stop
- ▶ If pile is too wet, lack of air will cause odors

Best Practices

- ▶ Size of materials
 - ▶ Chop materials into $\frac{1}{2}$ to $1\frac{1}{2}$ inch pieces
 - ▶ Shred or grind woody material and leaves
- ▶ Size of pile
 - ▶ At least 3 ft tall by 3 ft wide by 3 ft deep for hot composting



When is Compost Ready?

- ▶ Dark brown, crumbly, and loose
- ▶ Smells earthy
- ▶ Original materials have fully broken down
- ▶ Pile has shrunk to about a third of its initial size



Using Finished Compost



- ▶ Soil amendment - the best use!
 - ▶ Mix a 2-inch layer of compost into the top 4 to 6 inches of garden soil
 - ▶ Improves soil health and water retention/drainage
- ▶ Mulch
 - ▶ Spread a 1 to 4-inch layer of compost around plants and trees
 - ▶ Prevents weeds and retains soil moisture
 - ▶ Keep at least a foot away from tree trunks
- ▶ Potting Mixes
 - ▶ Add to soil for container plants
 - ▶ Run compost through a screen to remove large pieces

Composting Systems



High tech



Open pile



Closed plastic bin



Open plastic bin



Wire bin



Tumbler



Worm bin



Wood/wire 3-bin system



Concrete block 3-bin system





Vermi- composting



What is Vermicomposting?

- ▶ Vermicomposting is the process of using worms to transform organic food waste into compost
- ▶ Vermicompost, also known as worm castings or manure, improves soil by adding beneficial plant nutrients and microorganisms
- ▶ Vermicomposting is a convenient way to recycle kitchen scraps for use in the garden



Benefits of Vermicomposting

- ▶ Requires less labor and space than traditional backyard composting
- ▶ Can be done indoors
- ▶ Kid-friendly

Getting Started with Vermicomposting



Worms



Worm bin



Bedding



Food waste

Selecting Composting Worms



Night crawler
Lumbricus terrestris

Red wiggler
Eisenia fetida

gardeningwormcomposting.com

Red Wiggler Worms

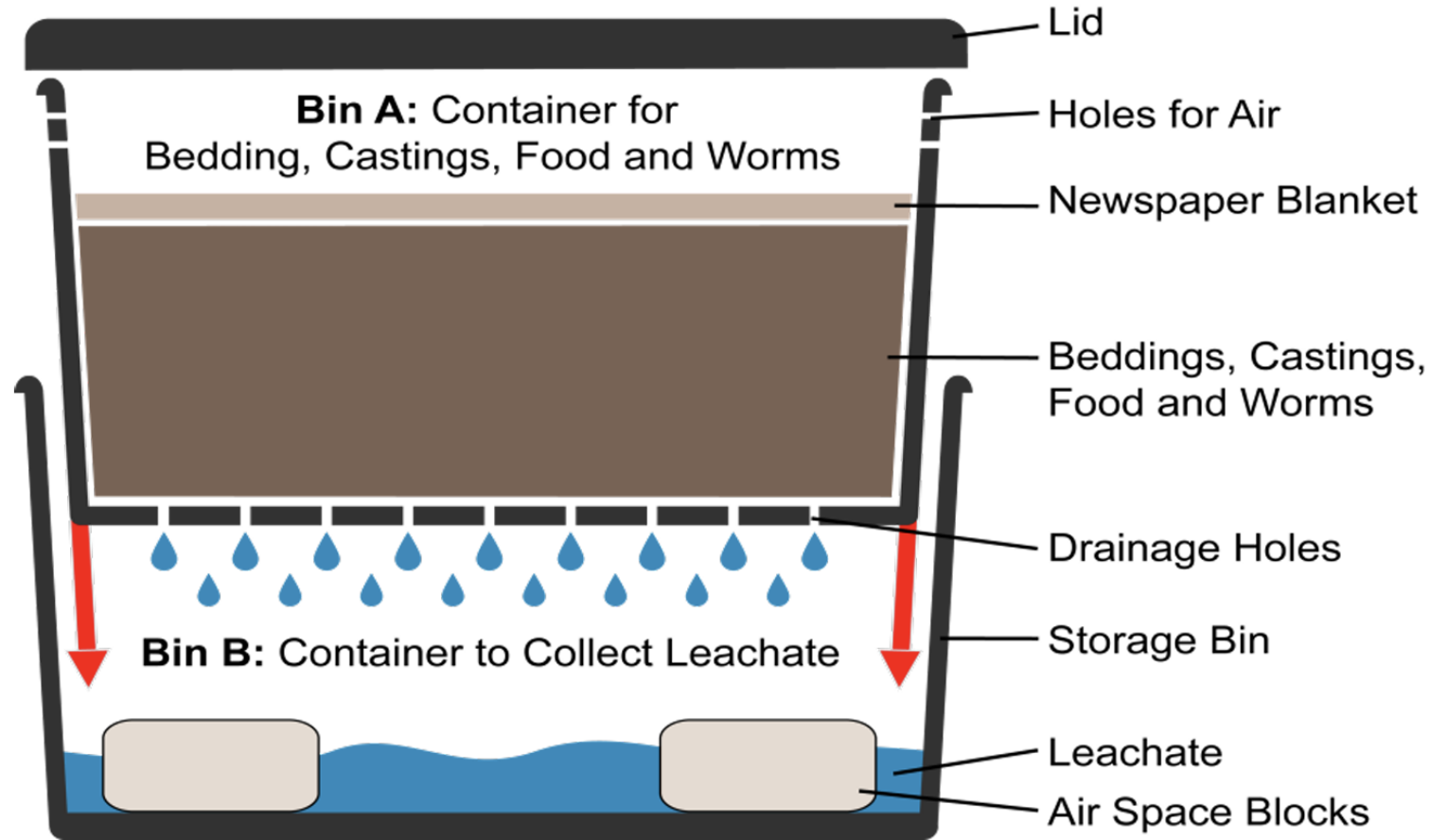
- ▶ Surface dwellers
- ▶ Adapt well to confined conditions
- ▶ Tolerate temperatures from 50 to 90 degrees F
- ▶ Eat half their weight in food scraps each day
- ▶ Reproduce rapidly
- ▶ Live up to one year
- ▶ Purchase locally or online



Worm Bins



Worm Bin Design



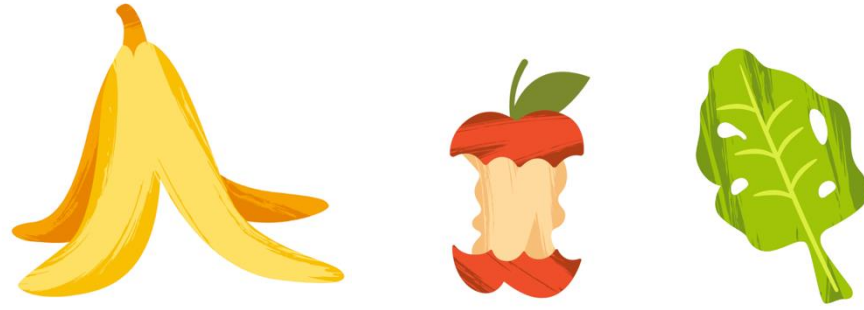
Source: Riverside County Department of Waste Resources

Worm Bin Bedding

- ▶ Provides moist environment and backup food source
- ▶ Fill bin half to three quarters full with bedding
- ▶ Bedding materials: torn newspaper, coconut coir, peat moss
 - ▶ Soak material in water
 - ▶ Wring out material and fluff before placing in bin
- ▶ Add a handful of sand, dirt or crushed eggshells for digestive grit
- ▶ Place a "newspaper blanket" on top to retain moisture and keep out light
- ▶ Spray bedding and blanket regularly with water
- ▶ Add one quarter to one pound of red worms
- ▶ Allow worms to acclimate for a week before feeding



Feeding Worms



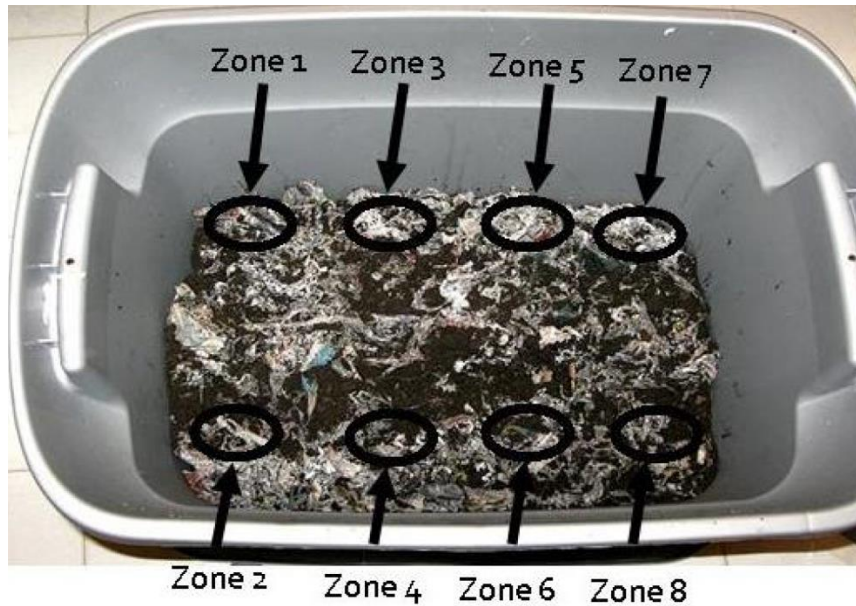
FEED

- ▶ Fruit and vegetable scraps
- ▶ Pasta, cooked without oil or sauce
- ▶ Bread
- ▶ Cereal, drained of milk
- ▶ Coffee grounds
- ▶ Tea leaves and paper tea bags
- ▶ Eggshells, finely crushed
- ▶ Newspaper
- ▶ Paper towels and napkins

AVOID

- ▶ Yard waste
- ▶ Unwashed fruits and vegetables
- ▶ Citrus fruit and peels
- ▶ Meat, fish, and bones
- ▶ Dairy products
- ▶ Fat, grease, and oil
- ▶ Salt and spices
- ▶ Processed foods

Feeding Tips



- ▶ Bury food in bedding and cover with newspaper blanket
- ▶ Monitor how much worms are eating before adding more food
- ▶ Remove food that has not been consumed
- ▶ Use zone feeding method for larger bins

Source: Riverside County Department of Waste Resources

Keys to Successful Vermicomposting

- ▶ Keep bedding damp, not wet
- ▶ Locate bin in a shady spot
- ▶ Keep worms cool, 55-75 degrees F
- ▶ Start small, add bins as worms reproduce
- ▶ Don't overfeed worms
- ▶ Avoid acidic or spicy foods
- ▶ Cut food into small pieces or blend
- ▶ Vary food placement in bin



Worm cocoon
(2-5 babies)

Harvesting Worm Castings

- ▶ Worm castings (manure) contain beneficial plant nutrients and microorganisms
- ▶ Harvest when dark brown castings accumulate and start to pack down
- ▶ Most bins are ready to harvest in 4 to 8 months
- ▶ May take several hours to harvest a bin
- ▶ Move excess worms to an additional bin if desired
- ▶ Refill bin with fresh bedding and return worms and cocoons to the bin



Harvesting Methods

- ▶ Relocation by light
- ▶ Relocation by food
- ▶ Hand sorting
- ▶ Screen sorting

Methods can be combined





Using Worm Castings

- ▶ Top dressing - spread a thin layer of castings on lawn or soil and water
- ▶ Soil amendment - mix 1 part castings with 5 parts garden soil or planting mix and work into soil
- ▶ Container plants - mix castings with potting soil or sprinkle on soil surface and water
- ▶ Seed starting mix - mix castings with seed starting mix
- ▶ Worm tea
 - ▶ Place a scoop of worm castings in a porous bag
 - ▶ Soak in a 5-gallon bucket of water for a day
 - ▶ Remove bag and use to feed plants
- ▶ Use castings after harvesting or store in a non-airtight container at moderate temperature and keep moist

Using Worm Leachate

- ▶ Worm leachate is the excess water in the worm bin that seeps to the bottom of the bin
- ▶ Worm leachate is not the same as worm tea and does not go through the worms' digestive tract
- ▶ Too much leachate indicates the worm bin is too wet
- ▶ Discard foul smelling leachate
- ▶ Mix 1 part leachate with 4-5 parts water so it looks like weak tea
- ▶ Pour on soil or spray on plant foliage



Summary

- ▶ Composting and vermicomposting help the environment by recycling organic waste and keeping it out of landfills
- ▶ Compost improves soil, decreases fertilizer use, and prevents weeds and retains moisture when used as mulch
- ▶ Hot composting (without worms) makes compost faster but requires some effort to optimize conditions
- ▶ Vermicomposting uses worms as the primary decomposers to convert food waste into compost in the form as worm castings (manure).
- ▶ The keys to successful vermicomposting are maintaining proper conditions (moisture, temperature, and ventilation) in the worm bin and feeding the appropriate type and amount of food.

Composting Resources: MG Website

<https://mgsb.ucanr.edu>

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Title
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Planting and Caring for your Native Plants (223KB)
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Thank You! Questions?

Contact Debbie Schnur, Environmental Education Coordinator, at dschnur@ucanr.edu

Contact our Master Gardener Helpline at mgsanbern@ucanr.edu