

# HOME COMPOSTING

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1

## AGENDA

- About Composting
- Composting Methods
  - Cold Composting
  - Hot Composting
  - Vermicomposting

2

2

## WHAT IS COMPOSTING?

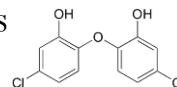
- Composting is the controlled decomposition of organic matter, such as food and yard wastes, by bacteria and other microorganisms, in the presence of air and water
- The resulting organic material may be used as a source of soil nutrients, soil structure improvements, or mulch

3

3

## HOW COMPOSTING WORKS

- Composting is a series of biochemical reactions
- Compost creates smaller, simpler molecules from larger, complex molecules
  - Organic forms of nitrogen must be broken down to inorganic, water-soluble forms ( $\text{NH}_4^+$  and  $\text{NO}_3^-$ ) to be available to plants
- Macro- and microorganisms perform this transformation



**COMPOSTING IS CHEMISTRY!**

4

4

## COMPOSTING BENEFITS

- Adds organic nutrients to soil, which become available to plant roots over time
- Improves soil structure, aeration and drainage when used as a soil amendment
- Makes plants more able to resist disease
- Decreases garden and kitchen waste going to the landfill or waste stream
- Provides a source of mulch

5

5

## COMPOSTING NECESSITIES

- **Carbon**-containing material (Carbon=C)
- **Nitrogen**-containing material (Nitrogen=N)
- Macro and microorganisms to break down C and N
- Air
- Moisture
- Warm temperatures
- Venue

6

6

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## SOURCES OF C AND N

- Dry, brown matter is normally high in **carbon**
  - Sawdust
  - Fallen leaves
  - Woodchips
- Fresh, green matter is normally high in **nitrogen**
  - Grass clippings
  - Vegetative kitchen waste
  - Manure

7

7

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## C:N RATIO (ESTIMATED)

Browns (High Carbon)	C:N
Wood chips	400:1
Leaves	60:1
Newspaper, shredded	175:1
Sawdust	325:1
Greens (High Nitrogen)	C:N
Vegetable scraps	25:1
Grass clippings	20:1
Garden waste	30:1
Manures	15:1

<https://www.planetnatural.com/composting-101/making/c-n-ratio/>

8

8

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## COMPOSTING METHODS

- Cold (mouldering)
- Hot (thermophilic)
  - Aerobic
  - Anaerobic
- Vermicomposting

9

9

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## MATERIALS **NOT** TO COMPOST

- Meat
- Fish
- Dairy
- Bones
- Pet food or waste

These items have the potential to draw mice, rats and other vermin to the pile, and pet waste can contain diseases and parasites that can be transmitted to humans

10

10

### COLD COMPOSTING

- Mouldering: “benign neglect”; processes over winter
  - Sheet mulch or “lasagna” method: layer on top of newspaper or cardboard, beginning with “green”, topped by “brown”, continuing until about 12” tall, with “brown” layer on top
  - In-place method: Bury organic material 12” deep in the soil
  - Trench method: Dig a trench 12-18” deep by 12-18” wide and pack the trench solidly with leaves, straw or chopped garden debris up to the surface level
- Compost available in spring but seeds and pathogens survive

11

11

### AEROBIC THERMOPHILIC DECOMPOSITION USING MICROBES

- Initial C:N Ratio of 25-30:1 is ideal for decomposition by microbes
- Compost calculators exist to fine tune the ratio in your compost pile (online, app, or spreadsheet):
  - <https://morningchores.com/compost-calculator/>
  - <https://puyallup.wsu.edu/soils/compost-mix-calculator/>
  - <http://compost.css.cornell.edu/download.html>

12

12

## THERMOPHILIC DECOMPOSITION USING MICROBES

- Bacteria and other microorganisms (e.g., fungi, molds) naturally occurring in organic matter break down C and N into inorganic forms
- To ensure presence of microbes, add a shovelful of soil or finished compost

13

13

## STRUCTURES FOR COMPOSTING

- Piles
- Bins
- Cans
- Pits
- Bags



14

14

## COMPOSTING HINTS

- Shred or chop organic materials:
  - Thinner layers increase the surface area so the microbes have quicker access to the materials
- Turn pile every 3-4 days
  - Allow air and water to enter pile
- Keep compost moist
- Use compost thermometer to test center of pile
  - 104°F for at least 5 days will kill pathogens and seeds
  - Temperatures > 140°F will kill microbes

15

15

## HARVESTING COMPOST



Photo from University of Vermont

16

16



## TROUBLESHOOTING

SYMPTOM	DIAGNOSIS	TREATMENT
Unpleasant odor	Deficiency of air, water, carbon, or nitrogen materials	Add carbon for ammonia odor Add nitrogen for rotten egg odor Ensure proper drainage and air
Slow decomposition	In warmer temperatures, compost should form within 4-6 weeks	Address any odors Ensure appropriate moisture and air movement Turn pile if compacted
Insect, disease, and weed pests	Insect pests and disease, weed seeds survive composting process	Don't compost weeds/invasives Don't compost infected vegetative materials Ensure pile gets hot enough
Mammal pests	Rodents, deer, dogs, bears, raccoons, and so on	Put a secured lid on your compost pile Use small aeration holes Use hardware cloth beneath and on sides of composter Bury fresh food scraps

17

17

## ANAEROBIC THERMOPHILIC DECOMPOSITION USING MICROBES

- Decomposition in a closed system, a digester, with little oxygen, including fermentation
- Generally an industrial, not a backyard, solution
  - Large scale composting of manures
- Source of bad odors
  - Methane ( $\text{CH}_4$ )
  - Hydrogen sulfide ( $\text{H}_2\text{S}$ )

18

18

## COMPOSTING USING WORMS

- Worms
- Container
- Bedding Materials
- Moisture
- Ventilation
- Warm temperatures
- Appropriate pH
- FOOD!!

19

19

## THE GOOD, THE BAD, AND THE UGLY

### Good

- Worms are low maintenance pets
- Indoor composting during colder weather
- No yard needed
- Low cost



### Bad

- Composting worms are exotic species
- Swindlers sell inappropriate worms

### Ugly

- Crazy snake worm (Amyntas spp.)



20

20

## COMPOSTING WORMS



- *Eisenia foetida*, also *Eisenia andrei* and *Lumbricus rubellis*
- Not NATIVE but not invasive
- Will NOT overwinter outdoors in New England
- Often sold as fishing bait
- If you buy composting worms, buy only from reputable sellers using the Latin, NOT common, name during ordering
- Hybrid claims of cross-varieties are marketing scams

21

21

## CONTAINER

- Specialized worm bins
- Wooden bins
- Plastic bin
- Drip tray to protect floor
- 2' x 2' x 8' bin ideal for a pound of worms
- Ensure holes in plastic for air circulation



22

22

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## BEDDING MATERIALS

- Shredded newspaper but no glossy paper
- Coconut coir fiber
- Leaves chopped up with mower
- Several handfuls of soil
- Shredded cardboard but not waxed
- Peat moss can be used, but not recommended due to pH and holding too much water

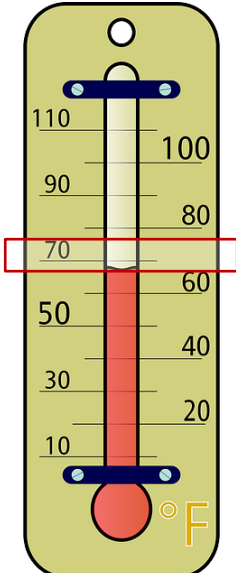
23

23

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## WARM TEMPERATURES

- 95°F and above: worm death
- Over 86° F: overheating and escapees
- 68° to 77°F: optimum
- 40° to 50°F: very slow activity



24

24

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## APPROPRIATE pH

- pH of 5 to 9 is the range acceptable to red wigglers
- Overly acidic (below pH 5) will kill the worms
- You may see escapes to alert you if the pH is too far off

Acid				Neutral				Alkali						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Battery Acid	Gastric Acid	Hydrochloric Acid	Soda	Acid Rain	Black Coffee	Urine/Saliva	*Pure Water	Sea Water	Baking Soda	Milk of Magnesium	Ammonia	Soapy Water	Bleach	Drain Cleaner

25

25

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## FOOD!

**YES**

- Fruits
- Vegetables
- Cereal and Oatmeal
- Cornmeal
- Eggshells (crushed)
- Coffee grounds and filters
- Loose tea and tea bags
- Shredded newspapers

**NO**

- Animal bones
- Animal bits
- Butter
- Salad Dressing
- Mayonnaise
- Glossy paper
- Greasy food
- Oil
- **Dairy**
- Pet waste

26

26

## HOW TO FEED THE WORMS

- Bury the food in the bedding to reduce odors
- The worms will find the food
- Food may need to soften by moisture and microbes before worms will eat it

27

27

## OTHER CRITTERS IN THE WORM BIN

- Bacteria
- Mold and Fungi – Common decay-causing organisms perfectly normal to have in the bin; may see mushrooms and white mycelium
- Mites
- Springtails
- Sowbugs
- Potworms



A, Sowbug adult. B, Immature pillbug.



28

28

## HARVESTING METHODS

- Dump and sort
- Worm self-sorting
- Alternate containers



29

29

## DUMP AND SORT

- The worms move to the food!
- Push all worms and bedding to one half of the bin
- Fill empty side with fresh bedding and new food
- Worms will migrate to cleaner, fresher side
- After two months, harvest old side



30

30

## ALTERNATE CONTAINERS

- Make a fresh worm farm by transferring handpicked worms
- After one is full of food, leave it alone and start using another one
- Dump old one directly into the garden

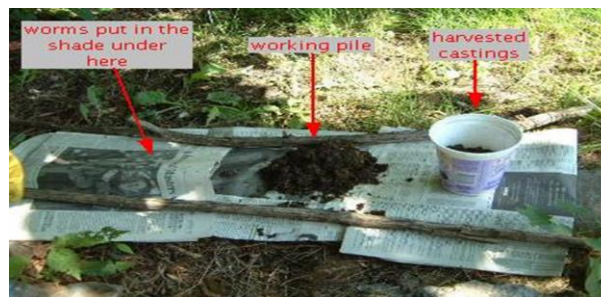


31

31

## WORM SELF-SORTING

- Dump entire box in the light on newspaper or other surface
- Scrape off castings from the top of the pile
- Worms will move to bottom of pile



32

32



## TROUBLESHOOTING

SYMPTOM	DIAGNOSIS	TREATMENT
Unpleasant odor	Too much food Not enough air Too Moist	Stop adding food Gently stir contents Ensure proper drainage Clear or add more drainage holes
Unpleasant odor	Too many acidic foods (citrus, coffee grounds)	Cut back on acidic foods. Add a little dolomitic lime or ground eggshells.
Fruit flies	Food left exposed	Always bury food. Cover surface of bin with plastic sheet, old carpet, or sacking.
Uneaten, smelly food	Don't overload the bin with too much food	As you vermicompost, you will get a feel for how much food your worms need. Remember that the bedding is also consumed as food.

33

33

## SUMMARY

There's no one way to compost!



Undercounter worm bin



Home-made composter



Leaf moldering



Industrial scale composting

## COME ON AND COMPOST!

Photos by Gail Reynolds

34

34

QUESTIONS?

35