

Day of Workshop

“The Science of Composting”

Workshops last 45 minutes, 4 workshops in the day, 12-15 girls (ages 9 - 12) per workshop + ~3 group leaders

Objectives:

- Understand what composting is, why we compost, what can be composted, and uses of compost
- Learn how microorganisms break down organic matter
- Learn how different conditions influence the effectiveness of composting
- Take qualitative and quantitative measurements

Prepping:

- Set up laptop with audio/visual working for video
- Arrange tables and chairs for 4-5 groups
- Have materials set up at tables for each group (measurement materials, compost building materials)
- Mix compost and water in glass jars
- Check that pH meter is working properly
- Draw data table on whiteboard/chalkboard

Things to do while girls are arriving:

- Hand each girl an index card with a different picture/color; these cards will determine which groups the girls are in
- Encourage girls to look at the display board and answer the questions

Introduction: (7 min)

1. Ask questions:

- What do you do with your food waste?
 - *Food waste is the part of food that we don't eat, like banana peels and orange peels*
 - (girls give various answers)
- Do you know what composting is?
 - (leader, point to photos on display: *Composting is when people manage the*

breakdown of food wastes and yard wastes, such as grass clippings after mowing the lawn. The things that break these wastes down are bacteria, bugs, and worms. We'll see soon that the conditions have to be right for composting to occur, though)

- Do you know how much food waste is produced in the United States every year?
 - *33 million tons, that weighs as much as 190,000 blue whales!*
- Given that humans produce so much food waste, why do you think composting is important?
 - *It reduces the amount of waste that we send to landfills, which is helpful because landfills take up space in the environment and we can't reuse the waste that goes there. Composting can also create fertilizer that we use to return nutrients to the soil and help it grow food.*
- Explain differences between home composting and large-scale composting. *In large compost piles, when bacteria break down waste they produce heat, which can make the inside of a compost pile get very hot.*
- How hot do you think the inside of a compost pile can get?
 - *Almost 160 °F, which is hot enough to kill pathogens (bad bacteria) that might be in the compost. The temperature will go back down once the waste has been degraded.*
- How many bacteria do you think are in this one tablespoon of compost? (hold up tablespoon)
 - *(leader: 1- 100 billion, or about 50 billion, that's more than the number of people on the planet)*

2. Time-lapse video: we explain what is happening (or video with dialogue)

- e.g., <http://www.youtube.com/watch?v=g2vGISNbPYQ> (8 weeks in wormery)

Hands-On Activities

Done in groups of ~3 (depending on number of girls)

At least one adult volunteer leading each group through the measurements, explaining importance, assisting

1. Have groups make an example compost following compost “recipe” (13 min)

- Hand out “Compost Recipe” worksheets (print-outs of recipe for girls to follow and take

home with them- tell their parents what they learned about composting!)

- Pre-activity discussion led by workshop leaders: *Compost needs certain conditions for the waste to break down. There has to be just the right proportion of carbon and nitrogen in the waste.*
 - *browns are materials with a high fraction of carbon, greens are materials that provide nitrogen*
 - *you need to achieve the right carbon to nitrogen ratio to make good compost, which is why we add more browns than greens*
- *What are things that we need to survive? Just like us, these bacteria need water and oxygen to survive and be able to eat the waste. We can allow oxygen to get to them more easily by having the correct-sized waste chunks, mixing the compost, and by not letting it get soaking wet.*
 - on the board, draw different circles to represent waste, to show that the larger the particles are, the more space there is in between them to allow air to get in; but you don't want chunks that are TOO big or else it will take a long time for them to break down
- Fake compost materials (e.g. paper cut-outs of green and brown materials, and water droplets) provided to make their artificial compost pile
- Go through the recipe together (leader says each step aloud & states its importance as girls follow along and build their compost)
 - Step 1 of the recipe is to make a compost bin; we'll provide small Tupperware containers, but will show photos of different types of home composting bins so girls know what they look like

2. Measuring compost (different compost samples for each group) (20 min)

- Pass out gloves for girls to wear
- Each group gets a compost sample in a container (ideally from different sources)
- Hand out data collection sheets and pencils
- Ask girls if they know the difference between qualitative and quantitative measurements (explain and give examples: *qualitative data are based on observations and are descriptions, e.g. color, texture, smell; quantitative data are based on measurements and are numbers with units, e.g. the room is 65 degrees F, you are 4 ft 2 inches tall*)
- Pre-activity discussion: *like we discussed before, compost needs certain conditions for it to work well. Here you'll take measurements of compost to see if it's working well.*

- *Smell: if compost doesn't have enough air it gets smelly because the bacteria use sulfur instead of oxygen, and the gas they emit smells like rotten eggs*
- *Water content: compost needs to be moist but not saturated in water. See if your compost makes a newspaper wet by placing some on top of a newspaper*
- *Nitrate and phosphate: these are nutrients that are in plants and that make compost a good fertilizer. We'll measure nitrate today with test strips from water that we mixed with the compost earlier today*
- Measuring nitrate: http://www.paceturf.org/index.php/public/quick_test_for_soil_nitrate/
 - this method is for Hach nitrate test strips
- Measure pH with soil pH meter one group at a time
 - *pH measures how acidic or basic something is. For example, lemon juice is acidic and has a pH of 2, and milk is basic and has a pH of 10.*
- Temperature with meat thermometer
 - *when the bacteria are breaking down the waste, the inside of a compost pile heats up, it can get as high as 160 °F; since this compost is only a sample, it'll be at room temperature though*
- When done taking measurements, have them all fill in a data table on a blackboard/whiteboard so they can see results from all the groups

Wrap-up/Discussion: (5 min)

- Make inferences about what the compost is made of and what stage it's at
- Have girls discuss what they found and what they think is special about the compost they were given
- Ask girls to explain if they think the person who made their compost followed the right recipe

List of needed materials

- Containers for girls to look at compost in
- pH, temp measuring instrument
- Color strips for nitrate (other nutrients too)
- Small gloves
- observation worksheets & writing utensils
- spoons for playing with the compost
- sample materials/cut-outs to build a "compost"

- laptop for playing video
- resources/print-outs of what makes a good compost, or compost troubleshooting guides (for references when girls are measuring their composts)
- newspaper or plastic sheets for them to spread compost out on
- display board for workshop/composting facts
- If measuring compost density: Mass balance & beaker/graduated cylinder
- Glass jars for mixing compost and water
- Sandwich-sized tupperware containers for fake compost pile
- index cards

Useful Websites

<http://compost.css.cornell.edu/science.html>

<http://cwmi.css.cornell.edu/factsheets.htm>

<http://compost.css.cornell.edu/physics.html>

<https://www.bae.ncsu.edu/topic/composting/>

<https://www.bae.ncsu.edu/topic/composting/pubs/compost-pile-troubleshooting.pdf>

<https://www.bae.ncsu.edu/topic/composting/pubs/composting-microorganisms.pdf>

<http://www.thewormfarm.net/> Durham's has a compost/worm farm

<http://ccetompkins.org/garden/composting/how-fact-sheets>

<http://www.brookscontractor.com/> where Duke's food waste goes