Grade 4-5 Lesson: Organics

CHAPTER 1: WHAT IS COMPOSTING & ORGANICS

[Slide 1] Compost is simply the decay (break down) of organic matter. The term organic matter has a wide-range of definitions, but for our unit we will be focusing on anything that grew from the ground. A twig can be organic matter, but so can an apple core. When you mix a bunch of these items together, they break down into a nutrient-rich fertilizer that helps gardens grow because your plants need to eat too!

[Slide 2 to 5] For the remainder of this unit, let's think about creating composting like we would baking a cake. There are four essential ingredients needed to create our mixture. If one of the ingredients is missing, our cake won't bake properly or will taste awful. The elements needed to create compost include:

1. Carbon

   Carbon is in all organic material and is essential for composting. Carbon can be found in organic materials including: leaves, dried grass, wood chips, saw dust, and peanut shells. Carbon-rich materials are also called "Browns"; we will go into more detail about browns in Chapter 4. If you have too much carbon in your compost pile, then the break down process will not start and more nitrogen is required.

2. Nitrogen

   Nitrogen or "Green" materials include our kitchen scraps, green leaves, and coffee grounds. If too much nitrogen is put in your compost pile, it will begin to give off an ammonia-like odour (similar to urine), have a slimy texture, and it won't decompose properly. Adding more carbon is the solution.

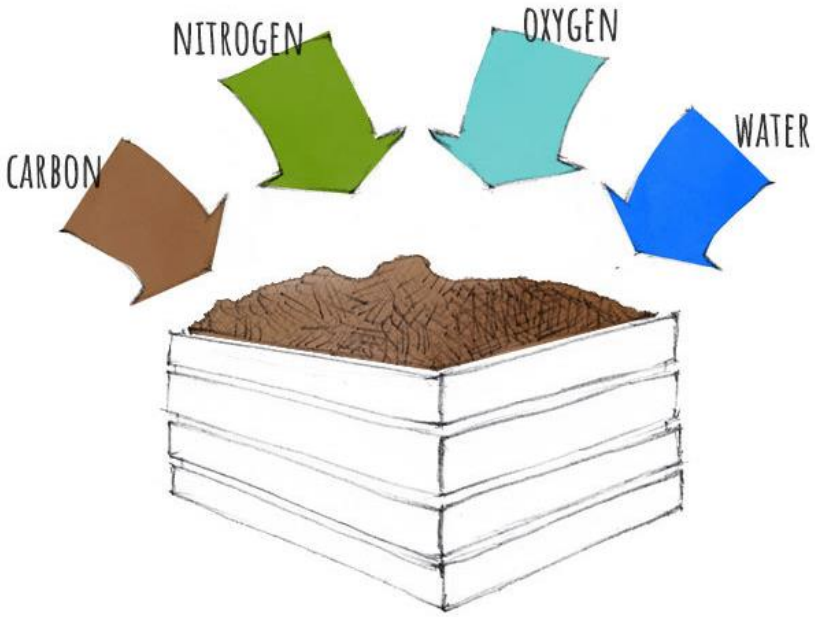
3. Water

   Water is essential to all life. If your compost pile is too dry, the microbes, bacteria, or fungus will go dormant (to sleep). If left dry for too long, other insects that do not help

with the composting process, like ants, will make the pile their home. If the compost is too wet, then nutrients from our food scraps will be washed out.

4. Oxygen

   Oxygen is also required for a compost pile to function. This is why turning a pile or adding holes to the container is so important. If oxygen can't get to the pile, it will become anaerobic (no-oxygen); creating too much nitrogen. As mentioned above, too much nitrogen will stop the decomposition process and your pile will start to smell. Compost piles with the presence of oxygen are called aerobic and without are called anaerobic.



In addition to these elements, organic matter needs a little more help to fully decompose. Critters such as microorganisms, bacteria, fungi, and/or worms or insects all use our food scraps as a source of food for themselves and turn it into compost. Find out more about composting and decomposers here: https://www.youtube.com/watch?v=Q5s4n9r-JGU.

Student Activity 1

Did you know most of foods you eat came from soil one way or another? Yup that's right! This student activity challenges the students to think about how their foods relate back to soils and food-chains. For instructions on how to complete the "Soil for Lunch" student activity, download our PDF.

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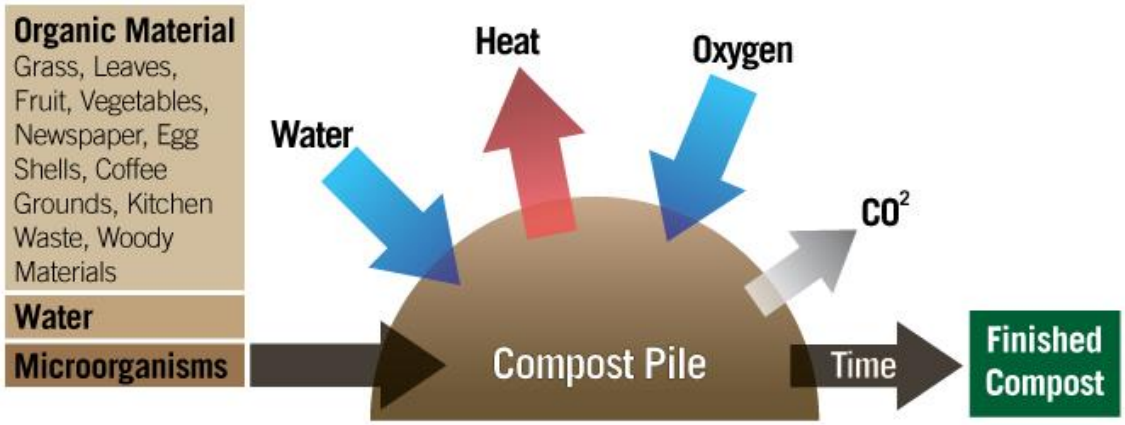
CHAPTER 2: WHY IS ORGANICS RECYCLING IMPORTANT

[Slide 6] Did you know that sending your food waste to the landfill rather than composting is bad for the environment? It's true. This is because the breakdown processes in a landfill are very different from a composting bin.

[Slide 7 & 8] Buried organic waste not only occupies valuable landfill space, it also produces a Greenhouse Gas called methane. Methane is a heavy gas that is created when organic waste is broken down. Our bodies also make methane in the form of flatulence gas (farts). The trapped methane gas begins heating up from the sun in our atmosphere; causing global warming. This is because landfills lack the two important elements required to properly break down organic materials: (1) UV rays/sunlight and (2) Oxygen. If composted correctly, our organic waste will create heat and carbon dioxide, which is the same gas humans breathe out.



Composting is a great way for you to divert materials from the landfill, while creating nutrient-rich, soil-like organic matter for gardening. When you compost, the items break down and turn into carbon dioxide and organic soil-like matter. These are important elements for our trees and plants to grow big and strong, product the fruit we eat, and provide the oxygen for us to breathe.

[Slide 9 to 11] Compost makes our soil healthy. It is valued for its ability to enhance soil structure and quality. It adds organic matter to soil, improves plant growth, increases water retention, cuts chemical fertilizer use, and stops soil erosion. Let's dig a bit deeper:

1. Adding nutrients back to soils.

   We can add it our garden or potted plants to replace nutrients that may have been previously used up by plants or washed away by the rain. Unlike store-bought fertilizers, compost releases these nutrients slowly so your plants don't use it all up at once.

2. Balancing the soils.

   Compost is like a doctor to soils. By adding compost, it can balance the pH levels within your soil creating the ideal range for plants to grow. Think about it like a tummy ache. If you eat too many acidic tomatoes, your tummy will likely begin to burn like acid. To make you feel better and balance your tummy again, your guardian likely would offer you a basic glass of milk.

3. Rebuilding soil structure.

   Compost helps bind clusters of soil particles, called aggregates, which provide good soil structure. Compost soil is full of tiny air channel pores that hold oxygen, moisture, and nutrients. Compost will help you water your plants less!

Student Activity 2

Have the students create their own soil erosion science experiment. This experiment will illustrate the importance that healthy vegetation has to our soils. Healthy soil is an important factor in protecting our waterways like rivers and ponds. Compost increases soil's ability to retain water and decreases runoff. Runoff pollutes water by carrying excess soil, fertilizers, and pesticides to nearby streams.

Click here for instructions: https://www.lifeisagarden.co.za/soil-erosion-experiment/.

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CHAPTER 3: TYPES OF COMPOSTING SYSTEMS

There are many different types of composting systems. Some are small enough to fit under your kitchen sink, while others are larger than a football field. Where ever you live and whatever you want to compost, there are systems to meet your needs. So, let's dig into different types and what makes them different!

INDOOR AT-HOME SYSTEMS

Vermicomposting

[Slide 13] They're squirmy and love to eat your leftover lunch scraps. What are they? Worms! Yup that's right, you can compost indoors using worms. This composting system is called Vermicomposting. It uses worms, oxygen, and a little bit of water to safely break down organic material with few odours. Basically, worms do most of the heavy lifting, but they sometimes get help from other bugs and bacteria too. You can feed your worms potato peelings, apple cores, and coffee grounds. Avoid foods like grains, meat, dairy products, or foods high in citrus like lemons.

For vermicomposting, you can't just pluck worms from the garden. The worm species that is used for vermicomposting are called Red Wigglers. These worms can live up to 4.5 years and will grow to a length of up to 7.5cm. Red Wriggler worms can live in a wide range of temperatures, but are the happiest from 13 to 22 Celsius. Red worms are hermaphrodites meaning they have both male and female organs. If their environment is healthy and they have plenty of good-quality organic waste to munch on, their populations can double or triple in a single year!

Bokashi

[Slide 14] Bokashi composting is one of the oldest composting systems and first originated in Japan. Farmers would compost their food waste by fermenting (pickling) it. This was done by covering the organic materials with dirt rich in microorganisms. Bokashi created high-quality compost for the Japanese famers, allowing them to grow an abundance of healthy foods to feed their families. The best part about this composting system is its ability to compost fruits and vegetables as well as bones, meat, and cheese too!

Bokashi composting is a two-step process:

1. First, food waste is added to a sealed anaerobic (oxygen-free) bucket with a mixture called Bokashi Bran for 7 to 30 days until the food ferments. Bokashi bran is made from a mix of wheat bran, molasses, and microbes including lactobacilli (the bacteria that make yogurt), yeast or fungi, and photosynthetic purple bacteria.
2. During the pickling process of your food waste, a watery substance is created and will drain to the bottom of the bucket. The liquid is removed from the bucket and can be mixed outside with regular soil. In one to two weeks, your soil will turn into rich, nutritious compost!

INDUSTRIAL SYSTEMS

Windrow - Aerated Composting

[Slide 15] The next composting system is similar to a compost pile at your house, just a lot bigger! Organic waste formed into large rows in a long piles are called windrows. Windrow piles are 8 feet tall (the height of a door) and at least 16 feet long (the length of a van).

Piles have to be big to insulate and keep heat in the middle to start break down organic, yet small enough to allow oxygen to flow to the middle of the pile. After the middle of the pile heats up and begins breaking down our organic waste, the piles are turned so that the outside can compost too. This process can take anywhere from 3 months up to 1 year depending on the temperature. Think of it like an ice cube. In the summer months the ice cube will melt down quickly into a new form, but in the winter it remains a solid ice cube. Windrow composting

accepts garden waste, grass clippings, and small twigs from trees, but can't break down meat or dairy.

Loraas Organics - Aerated Static Pile Composting Technology

[Slide 16 & 17] Loraas has a unique way to compost that is available from large grocery stores to small households. After organic waste is collected from your school or household from the green cart or bin, it is taken by a Loraas truck to an Organics Processing Facility just outside of Saskatoon, SK. Loraas uses aerated static pile composting technology. It's basically like a fully sealed containers with adjustable controls allowing Loraas to break down difficult compostable materials like grain, cheese, bones, and meat! Without high temperatures, these materials will ferment, give off putrid odours, or potentially pass along harmful bacteria to our plants as they do not fully decompose in our at-home or industrial windrow composting systems.

To see our facility in action visit: https://www.youtube.com/watch?v=fImcrZ1CoAE.

Student Activity 3

Want to start composting on your own? Have the students find out which composting system is right for their home or your classroom. Complete the short composting quiz from The Saskatchewan Waste Reduction at: http://www.saskwastereduction.ca/quiz/.

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CHAPTER 4: CREATING HEALTHY COMPOST

[Slide 18] In order to create nutritious compost for your plants, the perfect mixture of organic materials called Browns and Greens are required. Let's break down the difference between what they are and their special qualities:

Browns (Dry Organic Materials)

1. [Slide 19] Quite simply, Browns in terms of composting are organic materials that are usually the colour brown. Browns are rich in carbon and act as a bulking agent allowing oxygen pockets within your compost. As we learned in Chapter 1, oxygen is essential in keeping the composting pile aerobic and continuously breaking down our organic waste properly. Examples of browns include: Dry leaves, hay, and food-soiled cardboard.

Greens (Wet Organic Material)

2. [Slide 20] Green organic material is a bit misleading because they can be a variety of colours. They are rich in nitrogen and have water content within them. Examples of greens include: apple cores, rotten carrots, and fresh flower clippings. How can you tell the difference? Let them sit for 3-days, if they begin to smell they are a green.

[Slide 21] In order to create high-quality compost, we need to become similar to bakers or scientists. The perfect ratio of brown and green ingredients is needed; approximately 25 parts brown to 1 part green organic material. This will differ depending on your composting system and the size, so do your research first and complete small experiments to see what works best. Microorganisms, bacteria, fungi, and critters have basic requirements for food like us. This ratio is designed to keep the above decomposers healthy so they can continue to break down organic waste into compost, while easily preventing excess mold, odours, or unwanted bugs.

[Slide 22] In addition to keeping organic materials at a ratio, we must also mix them correctly too. Let's think of it like creating a layered lasagna. You need to add the right brown to green layers in order to create a yummy meal for the decomposers. For an at-home, backyard composting system always start a new compost pile with a fluffy layer of browns on the bottom; at least 15cm to 20cm deep. This will help to absorb moisture from the pile and keep things well-aerated.

Student Activity 4

By now we should understand the importance of compost, what elements are required, and the different types of composting systems that are right for you. Let's test out your skills! Have the student create their own composting system. For easy instructions please click the link: https://www.youtube.com/watch?v=kA3q07paNbE

STUDENT QUIZ - GRADE 4-5: ORGANICS

For a passing grade, students must achieve a grade of 50% (6 out of 12 correct).

Please circle the most correct answer by circling the letter:

1. **From the list below, which are considered "decomposers"?**
    a. Microorganisms, Bacteria, and Fungi
    b. Worms and Beetles
    c. Both A and B

2. **What 4 elements are needed to decompose/break down our organic waste?**
    a. Fire, Water, Earth, Air
    b. Carbon, Nitrogen, Water, Oxygen
    c. Methane, Worms, Soil, Fruit

3. **What composting system uses worms/red wigglers to break down our food scraps?**
    a. Bokashi Composting
    b. Windrow Composting
    c. Vermicomposting

4. **What two elements are needed for organic waste to break down properly at landfills?**
    a. Methane gas and fire
    b. UV sunlight rays and oxygen
    c. Worms and water

5. Adding compost can rebalance the pH (acid/base) of your soil.
    a. True
    b. False

6. **What Greenhouse Gas emission is created when organics break down at landfills?**
    a. Methane (Human fart gas)
    b. Carbon Dioxide (What humans breathe out)
    c. Oxygen (What humans breathe in)

7. **What is one reason composting is important?**
    a. It saves our natural resources (i.e. Trees, fossil fuels, sand)
    b. It feeds our garden worms
    c. It reduces Greenhouse Gas emissions (methane) at landfills

8. **The Bokashi composting system was first practiced in Japan.**
    a. True
    b. False

9. **What waste stream does the "green cart" represent?**
    a. Garbage
    b. Recycling
    c. Organics

10. **An example of "Brown organic material" that is carbon-rich includes which of the following:**
    a. Brown dry leaves, hay, and food-soiled cardboard
    b. Yellow grains, cheese, bones, and meat
    c. Green apple cores, coffee grounds, and fresh flower clippings

11. **A ratio of 50 parts green material to 1 part brown material is ideal for creating compost.**
    a. True
    b. False

12. **The term "compost" means the _____ of organic matter?**
    a. Smell
    b. Decay/Break down
    c. Texture

13. **BONUS Question: List 4 items you can compost.**

_____

_____

Quiz Answer Key - Grade 4-5: Organics

For a passing grade, students must achieve a grade of 50% (6 out of 12 correct).

1. A
2. B
3. C
4. B
5. A
6. A
7. C
8. A
9. C
10. A
11. B
12. B
13. Answers include:
    a. Any fruit or vegetable (banana peel, tomato, watermelon, carrot top)
    b. Coffee beans/coffee grounds, tea bags
    c. Any 100% paper or cardboard product (newsprint, pizza box, muffin liner)
    d. Yard waste (grass, leaves, twigs)