ACTIVITY D

COMPOSTING AND HEALTHY SOIL

Time Frame: Two 45-minute sessions plus 3–4 weeks for observation

Learning Objectives:

- Make and test hypotheses about how the pH will change over time
- Learn what pH means for soil health
- Use scientific inquiry to decide which accelerators to add and how often to rotate the soil
- Identify how farmers compost effectively and the possible difficulties of large-scale composting

Materials for activity:

- 1 medium-large compost collection bin (with a lid)
- 1 compost thermometer
- 1 compost sign (example below)
- 1 smaller bin for each small group (# depends on class size and # of groups)
- Small shovels (1 for each group, or share a few between all groups)
- Things to add/accelerators
  - Lime (increases alkalinity)
  - Coffee grounds, rabbit food pellets, grass clippings (nitrogen rich)
  - Dandelion leaves (adds phosphorus, magnesium and copper)
  - Shredded newspapers (adds carbon)
  - Water (to add if it gets too dry)
  - Earthworms (optional) as active decomposers
- Litmus paper or electronic pH test meter
- Chart of optimum pH for crops (see below)

Overview:

In this activity, students work as a class to collect and manage compost in the classroom. They then work in smaller groups to test the pH level of the compost over a period of three weeks. Note that certified organic compost takes longer.

Using the results, the groups can decide whether to add lime (or any other organic accelerators), or change the frequency of rotation to their smaller subset of compost to change or speed up the process. The groups will then "compete" to see which pile decomposes the fastest, and the ending pH values will also be compared to see which group yielded the healthiest soil.

Essential Questions:

- What does the pH of compost mean for the resulting soil quality?
  - How does the pH change over time? Does adding accelerators change the pH?
- How do natural accelerators and rotation affect the composting process? How do they work?

Preparation:

Set up a clearly labeled compost collection bin in the classroom. Include a sign (example below) to ensure that everything put into the bin is in fact compostable. Explain to the students the basics of composting and decomposition, along with pH if this has not yet been covered in class.

Alternative:

Time permitting, let students make the labels for your compost bin (and also make ones for home!). You can also have them design their own compost signs with a list of what is and is not compostable. (See Community Connection idea at the end of this lesson.)

Instructions:

1. Collect food scraps over the course of one week (or however long it takes to fill the bin). Bring back scraps from your lunch each day, and bring in things from home if they're not too smelly! Examples include coffee grounds, banana peels and newspapers.

Teachers: Proceed to step 2 after one week or however long it takes to fill the bin. Make sure there's enough compost so that it can be evenly split between small groups of students. (Note: At this point the mixture will still be fairly solid and you will be testing the pH of individual materials and not actual compost.)

2. As a class, test the pH of the compost at this point. Record this value as a baseline.

Split the compost into the smaller bins and assign one bin to each group. (Note: At this point, the split will be uneven in material distribution due to its lack of decomposition. This may affect outcomes between all groups.)

3. Work with your group to develop a hypothesis about how you think the pH will change over time and how long it will take the compost to decompose into soil. Note this in writing.
4. Now choose a specific crop (hypothetical) you would like to use the compost for and note this in writing. (Teachers: Make sure each group chooses a different crop.) Decide what you would like to add to your compost (within the available materials).
5. Test the pH of your soil every day (or every other day), and record any observations about the decomposition process. (Note: Point out that most farms use a combination of compost and other soils for planting.)
6. Along the way, compare your pH values to the chart of optimum pH values for different crops (found at the end of this lesson), to see what might grow well in your soil.
7. Once the compost is mostly decomposed (within reason), record your final pH and how long the process took from start to finish. Make a list of crops you think would grow well in your soil.

At the end, have students present and compare their results to determine which group's soil is the healthiest for the crop they've selected to focus on, and which additives helped the most.

Teacher Resources:

Composting for Teachers and Students | U.S. Composting Council
https://compostingcouncil.org/composting-for-teachers-and-students/

Learn How to Compost: Composting Basics for Beginners
http://www.sodgod.com/composting/

The Ultimate School Composting Resource Page | Life Lab
https://www.lifelab.org/composting/

Step-by-Step Guide to Lunchroom Composting | City of Cambridge, MA
https://www.cambridgema.gov/~/media/Files/publicworksdepartment/recyclingandrubbish/Schools/StepbyStepLunchroomComposting.ashx

Composting in Schools | Cornell Composting
http://compost.css.cornell.edu/schools.html

Extensions:
Expand the Experiment
You may decide to add factors like temperature and different compost ingredients to your experiment and measure these as well. Devise your own template for recording class observations based on the factors you would like to include.

Make a Classroom Compost Sign
Make a list of what's acceptable/not acceptable for your Classroom Compost. Research which items break down the fastest and make an asterisk next to those, as they are the most desirable for a short-term project. Ideas:

INCLUDE:
- Fruits & Peels
- Vegetables & Peels
- Coffee grounds & filters
- Tea bags
- Egg shells
- Cut or dried flowers
- Non-greasy food scraps (rice, pasta, bread, etc.)
- Paper napkins
- Paper bags
- Paper towels

DO NOT PUT IN:
- Meat
- Chicken
- Fish
- Greasy food scraps
- Fat or oil
- Dairy products (cheese, yogurt, milk, etc.)

Family Connections:

Learn How to Compost
Guides includes How to Compost at Home and How to Compost in An Apartment
http://www.sodgod.com/composting/

Community Connections:
Spread the Wealth: Use the compost the class generates in your school's garden, or for some plants in the classroom. (Note: It takes a lot of raw material to make enough compost to put in a garden. For example, you can compost a ton (2,000 pounds) of raw materials and gain only 20-30 gallons of finished compost. Make sure your students have realistic expectations!)

If your school does not have a garden, find a nearby farm or garden center to donate it to, and if possible, take a class field trip there! If your school is in the city, try to find a community garden or city composting initiative.

Spread the Message: Have students design their own compost signs with a creative slogan and lists of what is and is not compostable. Research information about landfills and organic materials. Include at least one sentence of text that explains the benefits of composting at home, school or in the workplace. Get permission to hang these up on community bulletin boards and at supermarkets.

Next Generation Science Standards:
NS. 5-8.1 Science as Inquiry
As a result of activities in grades 5-8, all students should develop--
- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

NS.5-8.3 Life Science
As a result of their activities in grades 5-8, all students should develop an understanding of:
- Structure and function in living systems
- Populations and ecosystems

NS.5-8.4 Earth and Space Science
As a result of their activities in grades 5-8, all students should develop an understanding of:
- Structure of the earth system