UNDERGROUND ROT

adapted from "How Fast Does It Rot," a Soil Biology Classroom Activity from Natural Resources Conservation Service
http://urbanext.illinois.edu/soil/sb_class/activity.pdf

WHAT'S THE BIG IDEA?

Most plant matter decomposes below ground. Underground decomposers release energy and nutrients into the soil where they become available to plants and other living things. These nutrients may then be carried above ground by the growing plants. The nature of the soil or other substrates (surfaces on which things grow), along with environmental conditions such as temperature, moisture, light levels,etc., can influence how fast things rot. This activity gives students an opportunity to compare various substrates to see how they influence decomposition.

PROCEDURE

Divide a pumpkin into several equal sized pieces. Put each piece in a separate mesh bag. Use bags made of netting, not cloth, so that small arthropods can get at the pumpkin. The bags are to be placed in various kinds of soils and this can either be done in containers or outdoors in a natural environment. Some examples: rich, soggy soil; woodland soil; leaves; sand; soil with a high clay content; gravel; a lawn; dry soil; soil of different colors; a farm field with bare soil between rows of crops;

a weedy field or meadow. Bury the bags to the same depth, a few inches below the surface. Mark the location so you can find the bags later. Once a week for a month or more, dig up the bag and check on the progress of decomposition of the pumpkin piece. Create a scale to rate how decomposed the pumpkin is from 1 for no decomposition to 10 for total liquid or mush. Note the types of decomposers seen and compare the degree of decomposition of the pumpkin chunks in the various substrates. Find ways to display the data (for example, tables or graphs).

DISCUSSION

By making and recording observations, you are doing one of the most important things scientists do. Be sure that each time you take notes, you include the date and, if possible, other conditions like temperature and weather (rainy, sunny, cloudy, etc.).

Try to think of reasons why different soils or substrates might result in different rates of decomposition. Can you think of environmental conditions that might make a difference? Can you create a hypothesis? (An example might be: “Warmer soil results in faster decomposition than cooler soil.”) Can you think of a way to test the hypothesis?

If you test a hypothesis, vary only one factor at a time. For example, if you want to know the effect of changes in temperature, you could have pumpkin pieces in soil that is identical in every way except for temperature. Don’t also change the moisture level in the same experiment or

you won’t know if any change you observed was the result of changes in the temperature or the moisture.

VARIATIONS

Try testing different physical/environmental factors by creating an experiment in which pumpkin pieces are subjected to identical conditions except for one factor.

Develop an experiment that compares different mesh sizes in the bags (larger mesh openings will allow larger animals to come in). Try different temperatures, moisture, pH, salt level or another physical or environmental factor of the soil.

Compare the results between a piece of fruit decomposing in an indoor container vs. being buried in a natural environment with the same soil outdoors.

MAKE YOUR OWN ROTTEN PUMPKIN BOOK!

adapted from "Decomposing Pumpkin Activity"
www.educationaltoyfactory.com/decomposingpumpkin.htm
and
"Hooray for Decay"
http://www.dnr.state.oh.us/Home/ExperienceWildlifeSubHomePage/kidspagesplaceholder/hoorayfordecayactivity/tabid/22132/Default.aspx

WHAT'S THE BIG IDEA?

As it decomposes, a pumpkin is utilized by a succession of visiting animals, fungi and other organisms. In general, we call them decomposers. This activity gives young scientists a chance to make and record observations about the decomposers that turn a fresh, firm fruit to mush.

PROCEURE

Put a whole or carved pumpkin outdoors in a place where you can watch it, or in an open jar (a large jar, or a slice of pumpkin in a smaller jar) indoors. Visit it once a week. Draw or photograph the pumpkin and any organisms you see visiting it or growing upon it. Try to identify them. (Don't worry if you find it difficult; even mycologists, scientists who specialize in fungi, cannot always tell what they are looking at!) Put your illustrations together into a book that chronicles the pumpkin's journey to mush.

DISCUSSION

Can you think of reasons why the decomposers change throughout the period that the pumpkin is rotting? Do you get different kinds of decomposers under different conditions?

VARIATIONS

You might want to do the experiment more than once in different environments. (Or have classmates put their pumpkins in different kinds of places with different amounts of heat, moisture, wind, exposure to animals, etc.) You might also want to do the experiment with both an uncarved pumpkin and a jack o’ lantern to see if there are differences in how they rot.

PRESERVING A PUMPKIN

adapted from "Rotting Apples"
http://www.science-sparks.com/2012/03/05/rotting-apples/

WHAT'S THE BIG IDEA?

Organic material like fruit will decay over time, but treating it in certain ways will preserve it. Cold temperatures, for example, will slow down the growth and reproduction of some microorganisms. Freezing will virtually prevent decomposition. That is why putting fruit in the refrigerator will make it last longer and putting it in the freezer will make it last a very long time. There are other ways to preserve food, including placing it in certain liquids. This experiment compares several liquids that the pumpkin can be immersed in.

PROCEDURE

Cut the pumpkin into four equal-sized pieces and put each one in an empty jar or other container. Pour one of the liquids below into each jar until it covers the fruit. Close the jar.

water
salt solution (one tablespoon of salt per cup of hot water)
sugar solution (ditto above)
vinegar

Leave the containers in a cool place for a week. Compare the appearance of each pumpkin piece. Look to see which one(s) are best preserved and least preserved.

DISCUSSION

Before people had electricity and refrigerators, they preserved fruit to make it last through the winter. One way to preserve is to use vinegar. When cucumbers are soaked in vinegar, we call it "pickling" and the preserved cukes are called "pickles." The acidity of the vinegar helps to prevent decomposers from growing. Another very effective method of preserving food is to use salt. Salt can be applied to dry food or it can be dissolved in water and the food can be soaked in the salt solution. This is sometimes called "brining." Most microorganisms cannot grow well in a salty environment. The problem with preserving food with salt is that people then have to eat the salt (although sometimes some of it can later be washed off) and too much salt tastes… salty! (Too much salt is also unhealthy.) To preserve food with salt, it is necessary to carefully control the amount of salt that is used — enough to prevent decay but not so much that it will ruin the food. This experiment gives some clues about techniques that might or might not be used to preserve a pumpkin.

Heat is also used when preserving fruit to kill any bacteria, fungi or other microorganisms that may be present at the start. These pieces of experimental pumpkin will not be eaten, and no heat is being applied but that could be done.

VARIATIONS

Try other solutions, such as milk, lemon juice or baking soda. Try different concentrations of salt and sugar. Do the same experiment without soaking the pumpkin pieces. Let one sit untouched in the air; Sprinkle the others with sugar, salt, bread crumbs or anything else you can think of. Do you get the same results if you boil the pumpkin before beginning the experiment?

A ROTTEN YEAR

adapted from classroom projects developed by Mark Hughes, Tashkent International School, Uzbekistan

WHAT'S THE BIG IDEA

This is a long-term journaling project to see what happens over the entire course of decomposition of a whole, carved pumpkin in a sealed, moist environment.

PROCEDURE

After carving a Jack O'Lantern and all associated activities (such as guessing, estimating and counting the number of seeds, and then roasting them), allow it to sit out for a few days. Then place it in a glass aquarium on a few inches of moist soil and close the aquarium with a sheet of glass. Seal it with tape and place it in a sunny window. Make observations on a regular basis and record them in a journal. In writing about the pumpkin, you can include speculations or opinions about what is happening, but be sure to distinguish them from actual observations and facts based on research. You can also include predictions. (A good time to make predictions is before a school vacation when students will not be able to observe the pumpkin for an extended period of time). Follow the pumpkin until it has completely decomposed and become part of the soil. At that point (but not before), open the tank. Predict what you will find. Use your senses of smell and touch as well as sight to observe the soil in the tank. You may want to open the tank outside or in a well-

ventilated room since there will be mold spores which can cause allergic reactions. In any case, don't stick your face too close to the tank!

DISCUSSION

You have created a closed system in the aquarium. Everything that is acting upon the pumpkin was already present when the pumpkin was placed in the tank. If something grows on the pumpkin, it had to have been present in some form before you sealed the tank. No animals will be able to visit the pumpkin unless they are already inside the tank but many other kinds of decomposers will act on the pumpkin. In the life cycle of many fungi, microscopic spores are produced. These spores can be carried by air or water to land on a nutritious surface. When you set the pumpkin in the tank, you included spores.

Not all of the decomposing organisms appear at the same time. Different kinds of decomposers require different conditions to grow. Conditions change in the course of the pumpkin’s demise. In addition, as decomposers grow they also change the conditions of their immediate surroundings. Some organisms that grow on the surface of the pumpkin can make it softer and more suitable for other organisms. Some decomposers release chemicals that make their immediate surroundings less hospitable for competitors to grow.

The physical conditions inside the aquarium also change in the course of the pumpkin’s decomposition as moisture is released, and as what happens outside the tank (such

as changes in temperature or light) can affect the inside of the tank. Note changes inside the tank as conditions change outside. Is anything different on a sunny day compared with a cloudy day?

VARIATIONS

If you have more than one pumpkin and more than aquarium tank, you can put them in different places under different conditions. Or keeping them in the same environment, you can put a carved pumpkin in one and an uncarved pumpkin in the other. For a huge change in