Activity: Yo Seeds, Wake Up!

Grades K-4

Time:

Groundwork: 30 minutes

Exploration: 40 minutes set up (for each of 3 weeks)

Making connections: Ongoing

Materials:

- **Seeds [cold season: radish (will be small, but can plant afterwards), sunflower (can plant, but may be damaged in a frost), warm season: bean]**
- **Plastic bags**
- **Paper towels**
- **Refrigerator**
- **Worksheet**
- **Book: *Frog and Toad Together***

Standards At-A-Glance

Next Generation Sunshine Standards Met:

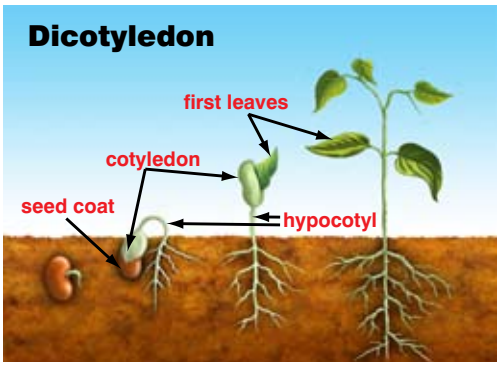
SC.K.L.14.3, SC.K.P.8.1, MA.K.G.2.1, MA.K.G.3.1, LA.K.5.2.1, LA.K.5.2.2, LA.K.5.1.5, SC.1.N.1.1, SC.2.N.1.1, SC.3.N.1.1, SC.4.N.1.1, SC.1.N.1.2, SC.1.N.1.3, SC.3.N.1.3, SC.1.N.1.4, SC.1.L.14.1, SC.1.L.14.3, SC.2.N.1.5, SC.2.L.16.1, SC.2.L.17.1, MA.2.G.5.4, SC.3.N.1.3, SC.3.N.1.6, SC.3.N.1.7, SC.3.P.8.3, SC.3.L.14.1, SC.3.L.14.2, MA.3.A.4.1, MA.3.A.6.2, MA.3.S.7.1, SC.4.N.1.2, SC.4.N.1.3, SC.4.N.1.4, SC.4.N.1.5, SC.4.N.1.6, SC.4.N.1.7, SC.4.P.8.1, SC.4.L.16.1, SC.5.N.1.1, SC.5.N.1.2, SC.5.N.1.5, SC.5.N.1.6, SC.6.N.1.3, SC.6.N.1.4, SC.6.N.1.5, SC.6.L.15.1, SC.7.N.1.3

Standard Reinforced or Skill Utilized:

SC.K.N.1.2, SC.K.N.1.3, SC.K.N.1.4, SC.K.N.1.5, SC.1.L.14.2, SC.2.L.17.2, SC.4.L.16.2,SC.5.P.9.1, SC.7.L.15.2

Background

You can hold 100 radishes in one hand, 1,000 carrots in the other, and a wildflower garden in your front pocket — for within every seed lives a tiny plant, or embryo, complete with a leaf, stem, and root parts. The seed coat protects the embryo while a temporary food source nourishes it, either as an endosperm packed around the young plant or stored in special leaves called cotyledons. Most seeds are either monocots, having one cotyledon, or dicots, with two. Seeds remain inactive until conditions are right for them to begin to grow, or germinate.



All seeds require oxygen, water, and the proper temperature range in order to germinate. Some seeds require light; others require darkness. Oxygen and moisture, initially taken through the seed coat and later by the root, help the seed get energy from its food supply. Different types of seeds have specific temperature requirements and preferences for germination. Some require warmer temperatures — 70-to-75 degrees Fahrenheit is ideal for tomatoes — and others germinate better in cool temperatures — 40-to-65 degrees Fahrenheit is ideal for lettuce. Many seeds also require the proper light conditions to germinate. Some require light to germinate and others are inhibited from germinating by light.

When a seed is exposed to proper conditions for germination, water is taken in through the seed coat. The embryo's cells begin to enlarge and the seed coat breaks open. The root emerges first, followed by the shoot, which contains the stem and leaves.

The way we plant seeds is very important. If seeds are planted too deeply, the young plants can use up their food resources before they ever reach light and begin to make their own food. If planted in soil that's too dry, seeds may not obtain the necessary moisture to germinate. Soaking-wet soil, on the other hand, may prevent seeds from getting oxygen, or may cause them to rot.

Discussion

Objective: To predict what factors will affect seeds' sprouting.

1. Pass some seeds around the classroom. Ask: Do you think these seeds are alive? Why or why not? How could we find out if they're alive? If they are alive, or could be, what do you think will make them start to grow? Explain that when seeds begin to grow, we call it 'sprouting' or 'germinating'.
   a. As a class, brainstorm a list of factors students think seeds need to sprout.
   b. List these on a class chart.
2. Read the story called "The Garden" in *Frog and Toad Together*. After reading the story, add to the class chart Toad's ideas about how to "wake up" seeds. Discuss some of Toad's ideas. Ask: "Do you think yelling might wake seeds up? Were Toad's ideas the same as or different from yours?"

Exploration

Objective: To understand that certain factors affect seeds' sprouting.

1. Have the class test some of the ideas from the chart to find out what helps seeds sprout.
2. Using large seeds is helpful for younger grades, such as sunflowers (if doing this activity August through November) or beans (if doing this activity February through April). Radish seeds can also be used and planted afterwards, in the cold season, and are edible as sprouts, as well.

Week 1: Moisture

1. If water was one of the factors mentioned by students, ask: "Do you think seeds need to be moist or dry to sprout? What have you ever observed that makes you believe this?" List the headings "Moist" and "Dry" on the board, and have students suggest how they could try and sprout seeds in different conditions (e.g., by using sponges, paper towels or soil).
2. If none of the students' ideas resembles the setup below, suggest it as another option. As a class, choose several setups to test both moist and dry conditions.
3. Ask: "How will we decide when seeds have sprouted?" Tell students they must decide together what constitutes 'sprouting' in their experiments. *When they see the root or when it's two centimeters long*.
4. Using the "Yo Seeds, Wake Up!" worksheet, have students draw setups for both moist and dry conditions. Each day, students should fill in the total number of seeds that have sprouted to date.
5. At the end, have students chart on a bar graph the number of seeds sprouted in the setup. Ask: "How did seeds seem to sprout best? How did you decide when they'd sprouted? Why do you think we tried sprouting seeds in different conditions? What factors, other than the amount of water, might have affected whether seeds sprouted?" *Some may have been in a warmer spot*.
6. What to expect: Within five days, most of the moist seeds should have sprouted, but not the dry seeds. If the students' setups included submerging seeds in water, they may find that seeds fail to germinate when too wet.
7. Plant the seeds in the container or school garden once they've sprouted, and monitor their progress throughout the coming weeks.

Week 2: Temperature

1. If students mentioned temperature as a factor to help seeds sprout, ask: "Do you think seeds might sprout better in warmer or cooler temperatures? What have you ever observed that makes you believe that? How do you think we should set up a test to see whether warm or cool conditions help seeds sprout?" List student suggestions for setup under the headings "Warm Temperatures" and "Cool Temperatures."
2. Suggest the setup below as another option. As a class, use several of the suggested setups to test how temperature affects seed germination. Ask: "From what we've already learned, do you think we should keep the seeds moist or dry from this experiment? If the cool-temperature seeds are in a dark refrigerator, where should we place the warm-temperature seeds?" Remind students that they must give both sets of seeds the same conditions except for temperature, to have a fair test. Ask: "If we kept one set of seeds in cool, dark conditions and one in warm, light conditions, how would we know whether it was temperature or light that affected sprouting?" The warm-temperature seeds, therefore, should also be in a dark place.
3. Students can keep track of their investigations, as in week one, using the worksheet. Have students chart the number of seeds that sprouted after five days under both warm and cool conditions. Ask: "How did seeds seem to sprout best? What do you think would happen if we tried sprouting seeds in warm, dry conditions? In cool, moist conditions?"

The way we plant seeds is very important – if seeds are planted too deeply, the young plants can use up their food resources before they ever reach light and begin to make their own food.

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4. What to expect: Within five days, you should find that seed sprouting is generally improved with moderate warmth and inhibited with cool temperatures. Temperatures at either extreme can inhibit sprouting.

Week 3: Students' and/or Toad's ideas

1. Review the suggestions made by the class and by Toad. Have the class vote on one condition, or have small groups each choose one condition to test. Set up investigations similar to weeks one and two to determine what other conditions (e.g. light, yelling, fertilizing, singing) help seeds to sprout. Help students think about whether they're conducting fair tests (with one variable).
2. When all experiments are complete, combine results on a class graph. Ask: "What conditions seemed to be the best for sprouting seeds?"
3. Sprouts can be carefully planted in paper cups with potting mix and a hole in the bottom, and grown until roots form around the cup and it's time to transplant them in the garden.

Making Connections

- How did you decide when seeds had sprouted?
- Were you surprised by any of your findings? Which ones?
- If we knew some seeds preferred warmth, could we assume that they preferred very hot temperatures? Why or why not? How could we find out?
- Would you plant bean seeds outside in December? Why or why not?
- What other questions do you have about seed sprouting?

Enrichment

1. Play seedling Tic-Tac-Toe. Divide flat containers into nine squares; plant one type of seed in each square. The first student to have three germinated seeds in a row wins.
2. Describe, in drawings or words, how it might feel to be a sprouting seed.
3. Plant seeds in the shape of students' initials. Watch initials come to life as the seeds germinate.

Extensions for middle and high school

1. Calculate the fraction of the number of seeds that sprouted.
2. Compare germination rates and seedling growth in a variety of potting materials – potting mix with and without fertilizer, peat moss, sand, and soil from the schoolyard.
3. Determine the effects of crowding on seedling growth by comparing three containers of seedlings – one initially planted at adult plant spacing, one thinned to adult plant spacing, and one not thinned. Continue the discussion involving the availability of resources and the effects of overcrowding on plant, animal, and human health.

Additional Materials

1. The ***Keeping Florida Green*** curriculum developed by Florida Agriculture in the Classroom, has many lessons about Florida agriculture and citrus that can be used in concert with the garden. It can be obtained by attending a workshop.
2. Use the lesson "Seed Surprises" from *Project Food, Land & People's Resources for Learning*.

Seeds remain inactive until conditions are right for them to begin to grow, or germinate.

"Activity: Yo Seeds, Wake Up!"

Yo, Seeds, Wake Up! Worksheet

Name _____

Draw your Setups:

Condition:	**Condition:**

Number of seeds used: _____
How many seeds have sprouted by...

Day 2	
Day 3	
Day 4	
Day 5	

Number of seeds used: _____
How many seeds have sprouted by...

Day 2	
Day 3	
Day 4	
Day 5	

Other Observations: _____

_____

_____

_____

_____

Yo, Seeds, Wake Up!

Sample Pre-Post Assessment

1. Draw a seed that has just started to sprout, and name all the parts of the seedling:

2. What three conditions does a seed need to sprout?

   a. Fertilizer, Soil, Air
   b. Fertilizer, Soil, Water
   c. Temperature, Water, Air
   d. Temperature, Soil, Air

3. A seed can only germinate in soil. True False

4. What is the first part to emerge from a seed as it sprouts? _____

5. How can the time of year affect a seed's germination?