Germination Exploration

Overview

Old seed packets make the perfect tools for exploring seed germination.

Grade Level/Range: 2-5

Objective:
Students will learn:

- A seed contains a new plant.
- Seeds need certain conditions to grow and not all seeds need the same conditions.
- Some seeds may not germinate.

Time: 1-2 weeks

Materials:

- seed packets
- plastic sandwich bags
- paper towels
- planting containers such as small pots, paper or plastic cups
- potting soil

Background Information

The new plant (also known as the embryo) is found inside the seed and lies in a dormant state protected by a seed coat until exposed to certain conditions. The sprouting process is called germination. Most seeds just need moisture and warm temperatures for germination. When they are exposed to these two environmental factors, they begin to grow.

Some seeds need special treatment beyond moisture and warm temperatures for germination to begin. Two common treatments needed include exposure to cold temperatures (also called stratification) and exposure to conditions that cause chemical or mechanical damage to the seed coat (also known as scarification). These special treatments evolved as survival mechanisms. For example, many seeds of northern plants need a certain amount of exposure to cold temperatures before they germinate. If a seed dropped to the ground in the fall, would it be a good idea for it to begin growing and be a young seedling right before winter arrived? Of course not, which is why this built-in need for a period of cold before sprouting is so important. Other seeds germinate better in dark conditions (example is a pansy seed) and others need light exposure to germinate (example is a lettuce seed). When you purchase seeds, you will most likely find planting instructions on the seed packet. If you collect seeds from nature, you may need to research their germination requirements online.

Germination Rates: Even with the freshest seeds you will not get 100 % of them to germinate. Seeds may be damaged by environmental conditions (too dry, too wet); they may not be fully mature, or they may possess genetic defects that hamper growth. Measuring germination rates and expressing the results in charts or graphs makes an excellent math lesson.

Laying the Groundwork

Before conducting germination experiments, make sure your students understand the structure of seeds and the process of germination. You may want to first implement the Journey to the Center of a Seed https://www.kidsgardening.org/lesson-plans-journey-to-the-center-of-a-seed/ lesson.

What kind of conditions do seeds need to start growing? Why do seeds not sprout inside the packets at the store? Do they all need the same conditions?

Ask students, have you ever blown on the fuzzy seed head of a dandelion? How many seeds do you think each one has? Do you think each seed will grow into a new plant? How about acorns falling off an oak tree? What about the samaras (the seed-containing fruits) of a maple tree? What would happen if every seed ever produced sprouted into a new plant? Would that be beneficial to our environment? Ask them to list the benefits and challenges of 100% germination.

Exploration

1. Collect old and new seed packets. Each packet is stamped with a date indicating the year in which the seeds were packaged for retail sale. Before the seeds were packaged they were tested and met the required germination standards. You may have seed left from a previous garden season, or many times stores or local gardeners are willing to donate old seed packets for youth garden programs. If they were stored properly (in a dry, cool spot, out of sunlight) most seeds will still be viable after a couple of years. To make a good comparison in your experiment, try to include some of the oldest seeds you can find, along with some newer ones.

2. Next design your germination experiment. You can:

- Plant seeds from different types of plants and compare their germination rates.
- If you have both old and new seed packets of the same variety and kind of plant, you can plant seeds from both and compare the germination rates. Some kinds of seeds, such as parsley, onions, sweet corn, spinach and peppers, tend not to stay viable for more than a year or two. Including both older and fresh seeds of kinds that don't store well can help demonstrate strong results in your experiments.

3. Next plant your seeds. Since the main purpose of the experiment is to just see if the seeds will sprout, you can either use traditional pots (pots, paper cups, plastic cups, etc) and potting soil to plant your seeds or just fold up a moist paper towel in a plastic bag and place the seeds on top before sealing it. If you would like to later plant any seedlings that develop, then you will need to plant in soil.

For a further investigation, you may want to see if different seeds will sprout better given different conditions, but for this initial test, make sure all seeds are given the same treatment.

4. Check on your seeds daily for 1 to 2 weeks (most common seeds will sprout within 2 weeks; seed packet information often includes average germination time). Record information about how many seeds sprout within your time frame. Next, do the math to determine your germination rates and put data on a bar graph.

Making Connections

Once you have your germination rates displayed, ask students to consider some of the following questions:

- Did some seeds have higher germination rates than others?
- Did age of the seed seem to matter?
- Were there any characteristics of the seeds that seemed to influence the germination rate (like size or thickness of the seed coat)?
- What kind of uncontrolled variables may have influenced our results? To get the brainstorming started ask: Were the seeds previously all stored in the same place? Were their any environmental factors that could have affected them before we planted them?
- Do you think the conditions we provided may have factored into the results? What could we do to test some of these variables we have identified?

Follow up this test by planting the same seeds in the same way, but give them different conditions. Try placing them in a dark or light place, or place them in locations with different temperatures. If you are planting in soil, you can try planting the seeds at different depths. If you planted in plastic bags, you can try planting them in soil instead. Additionally, you could try treating them differently before planting. Soak the seeds in water or expose them to different conditions, such as placing them in a freezer for a certain amount of time or heating them in an oven.

Branching Out

Math: As you keep track of the number of seeds that germinate, display the germination rates in different ways. You can use fractions, percentages, or different types of charts and graphs. Have students discuss the merits of each type of data presentation.

History, Social Sciences and Geography: Throughout history, most plants were transported to new locations as seeds. For example, colonists to the Americas brought over seeds from their favorite foods and herbs to help with their survival on a new continent. Assign students to research the origins of their favorite plant. How many of their favorite plants are native to our country? If the plant is not native to North America, use maps to chart the origins and see if you can discover when and how that plant made it to North America.

Health: Explore the nutritional content of different seeds that we commonly eat (sunflower, sesame, pumpkin, peanuts, corn, etc.). Point out that many seeds are considered a protein source and explain why protein is so important to us.