Seeds to Seedlings: Seed Cleaning and Storage

Activity Overview
Students clean seed they collected in the field.

Objectives
Students will:

- Differentiate the seed from the chaff
- Discover methods for removing chaff from the seed
- Compare the seed coats of different species
- Explore the seed "timeline"
- Use observation skills and plant identification skills

Subjects Covered: Science and Math

Grades: K through 12

Activity Time: 30 minutes in the classroom

Season: Any

Materials: Trays, gloves, rolling pin, sandpaper, ziplock bags, plastic containers with lids

State Standards
Science:

Discover how organisms meet their needs (F.4.1)

Investigate how organisms respond to internal/external cues (F.4.2)

Investigate structure & function of organisms (F.8.1)

Show organism's adaptations (F.8.2)

Discover changes in technology over time (G.4.2)

Determine how science discoveries change technology (G.4.3)

Identify uses of machines (G.4.4)

Explore how machines were invented & produced (G.4.5)

Background

Seeds have adapted to their environment in different ways in order to survive and eventually germinate. There are short-lived, recalcitrant seeds that must remain moist in order to survive. Many short-lived seeds ripen in the spring and are often aquatic or nut species. Medium-lived seeds, called orthodox, can remain viable for up to two to three years in the wild. In storage, orthodox seeds such as conifers, fruit trees and grasses can remain viable for up to fifteen years. Seeds with hard seed coats that are impermeable to water are long-lived. One of the world's longest-running experiments was initiated by Professor William James Beal in 1879 to investigate how long seeds can remain dormant and still germinate. After 126 years, seeds are still viable.

Once seed has been dried, it is ready for processing. Processing includes two basic steps: threshing, which breaks the actual seed from its protective coating, and cleaning, which "seperates the wheat from the chaff," so to speak.

Threshing

There are many techniques for threshing; it takes only a little imagination. One of the simplest ways is to rub the harvested material against a coarse screen with a gloved hand. Try rubbing the plant between two ping-pong paddles. Or, alternatively, you could cut open an inner tube, tie off one end, place the material to be threshed inside, and then roll the tube underfoot on the floor. For removal of seeds from pods, a rolling pin and a wooden tray may be effective. Or gently rub the pods between two bricks. Mechanical threshing may be accompanied by employing a hammer mill. This method works particularly well on the hulled seeds of tick trefoil, bush clover, beebalm and black-eyed Susan.

Cleaning

The ideal is to get seed completely clean. While this ideal is not 100% attainable, don't worry; the seed will grow. Still, strive for the 100% clean because it will reduce the volume of material to be stored, it will make sowing of the seed easier, and it will increase the likelihood of planting viable seed. Cleaning is accomplished by shaking the threshed material through progressively tighter meshed screens. Naturally, not all undesirable material will be sifted out, but there are various methods for removal of the dirt and smaller pieces of plant material that remain. Since the desirable seed is denser than the leftover material it is a simple process to blow that material away. With this process, a little experimentation is in order. Place a fan (or perhaps a hair dryer) on a table, and winnow the chaff from the seed. The trick is to discover at what distance to place the wind source so the chaff but not the seed itself will blow away. Start at a greater distance and move closer as the seed gets cleaner—an ounce of caution is worth a pound of cure! Commercial seed producers use a fanning mill in the final stages of seed cleaning. Note: This process may be dusty so participants may want dust

Identify skills needed for a career in science or technology (G.8.1)

Illustrate impact of science & technology (G.8.3)

Design an applied science model or machine (G.8.4)

Investigate local problem & propose scientific or technological solution (G.8.5)

Analyze scientific or technological innovation (G.12.3)

Choose a problem & identify scientific or technological solution (G.12.5)

Math:

Use reasoning abilities (A.4.1, A.8.1, A.12.1)

Communicate mathematical ideas (A.4.2), logical arguments (A.8.2, A.12.2)

Connect mathematical learning with other subjects (A.4.3)

Use vocabulary, symbols, notation (A.4.4)

Explain solutions to problems (A.4.5)

Analyze non-routine problems (A.8.3)

Develop effective oral & written presentations (A.8.4)

Explain mathematical concepts, procedures, & ideas (A.8.5)

Recognize & describe measurable attributes & units (D.4.1)

Demonstrate understanding of measurement (D.4.2)

Read & interpret measuring instruments (D.4.3)

Determine measurements by using standard tools (D.4.4)

Determine measurements by using basic relationships or estimations (D.4.5)

Identify & describe attributes in situations not directly or easily measurable (D.8.1)

Demonstrate understanding of measurement facts, principles, techniques (D.8.2)

Determine measurement directly by using standard units (D.8.3)

masks.

Storage

Storing seeds in the right conditions can be very important for maintaining their viability. For medium- and long-lived seeds, removing the chaff and other plant parts can assist in drying the seeds and increase the success of storage. Dry seeds still need 3-8% moisture to remain viable. Store in sealed containers, such as ice cream pails or yogurt containers, in a refrigerator set at 41 degrees Fahrenheit.

Activity Description

Take seed you have collected (see Earth Partnership for Schools activity 7-1, "Seeds to Seedlings: Seed Collection") and place different species on different trays.

STEPS:

1. Break the seed out of its seed heads. Experiment with different threshing techniques to find the best method.
2. Remove chaff and plant parts from seeds. Use sandpaper or a gloved hand to pop the seed from the chaff and/or try other techniques to best clean the seed.
3. Observe the different plant parts to determine which is the seed. Use a microscope if available.
4. Compare different species and note the different types of seeds (recalcitrant, orthodox, and long-lived).
5. Weigh cleaned seed and note the differences in seed weight.
6. Place cleaned seed into sealed containers.
7. Store in refrigerator.
8. Note: Recalcitrant seeds need to remain moist; therefore, place in sealed container with moist sand or peat moss. Moisture level should be like a damp sponge.

Extensions

- Weigh seeds over the course of the school year. How might these seeds change? What accounts for any changes you may find? Which types of seeds change the most?
- Explore different habitats and compare the types of seeds (recalcitrant, orthodox and long-lived) within each habitat.
- Discuss how short-lived seeds take advantage of their surroundings.
- Find out why a seed would need to be impermeable to water and to wait to germinate.
- Research the progress of Professor Beal's ongoing research. Sources are listed under Additional Resources.

Additional Resources

- Milius, S. (2002). *Time Capsules: seeds sprout 120 years after going underground.* Science News, August 31, 2002, 162 (9): 132. (Beal's Research)
- Packerd, S., Mutel, C. (Ed.). (1997). *The Tallgrass Restoration Handbook: for Prairies, Savannas and Woodlands*. Island Press: Washington, D.C.
- Telewski, F.W. and J.A.D. Zeevaart. (2002). *The 120-yr Period for Dr. Beal's Seed Viability Experiment*. American Journal of Botany 89(8): 1285-1288. (Beal's Research)

Web sites

- MSU News. http://newsbilletin.msu.edu/july27/beal.html (Beal's Research)
- Telewski, F. Department of Plant Biology at Michigan State University. http://www.plantbiology.msu.edu/telewski.shtml
- Telewski, F. More Information on "Rip Van Winkle Plants". http://earthsky.com/2002/esmi021218.html

Assessments

- Students can describe the different threshing techniques, which ones work the best for them, and why.
- Students can write out detailed directions to another student on how to do this activity step by step.