

How to Make Hard Seeds Germinate
Hokulani Science Day
April 23, 2003

Objectives

- Students investigate seed dormancy
- Students discover treatments to break dormancy
- Students have an opportunity to make observations
- Students create a hypothesis
- Students graph and interpret results
- Students draw conclusions and share with others

Skills

- Scientific method
- Seed scarification
- Experimental design
- Data collection and interpretation
- Drawing based on data conclusions
- Critical and analytical thinking

Knowledge and Values Developed

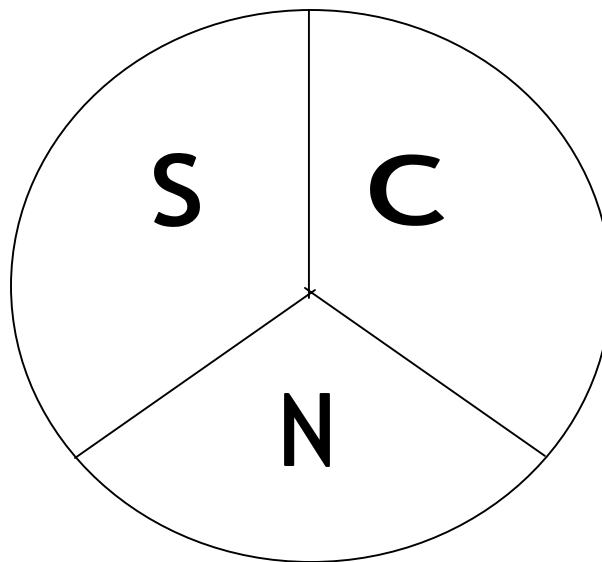
- Understanding of how some plants “spread the risk” of sprouting all at one time
- Seed can be manipulated by humans
- Interaction between seed and environment
- Structure of hard seed

Materials Needed (Based on 30 Students)

- 270 seeds with hard coat (e.g. milo, koa, haole koa, royal Poinciana)
- 30 petri dishes (or other suitable container for germination such as foam egg carton or yogurt containers)

- 30 sheets filter paper (potting soil can be used with other types of containers)
- 10 Large nail clippers
- 5 sheets 60 or 100 grit sandpaper
- Water to moisten filter paper or soil
- Exotic shaped seed with hard coats (e.g. 10 Bird of Paradise, 10 Blue Marble tree, 10 Monkeypod)
- Crayons or markers
- Poster board or flip chart

If using filter paper divide it into thirds using a pencil. Mark one space with an S to denote Sandpaper treatment. Mark the second space with a C to denote the Clipping treatment. Mark the last space with an N to denote no treatment (control). The filter paper should look like this:



Activity 1

See'd with Your Eyes

In this exercise students will practice their observation skills. Place the exotic seeds into a paper bag. Mix the seed in the bag. Allow each student to select one seed. Instruct students to use a multi-sensory approach to experience the seed (**CAUTION:** Children should avoid placing seed in their mouths. Sometimes seed can have chemicals or crystals on the seed coat that can cause irritation. Check to make sure the seeds you select do not cause irritation.) When they have finished, students are asked to illustrate and share their observations. The space below can be used for illustrations.

When the students have completed their illustrations ask them to help you make a composite list of their seed characteristics. Post the list for the class. Allow students to call out as many characteristics as they can come up with. Compare and contrast seed characteristics. Ask them if their seed were soft or hard. All the seed you provide should have a hard seed coat.

NAME_____

Activity 2

Hard Seed Coats

At this point the science partner will lead a discussion on hard seeds. The following questions will be used to prompt student interaction:

- What causes seed to be hard?
- Why is it important for seeds to have a hard seed coat?
- How do seed germinate with a hard seed coat?
- What if we did something to the seed coat?

This will be followed by a discussion and demonstration of some methods to scarify hard seeds. Below are descriptions of possible treatments to make hard seed germinate.

How to Make Hard Seed Germinate

Hard seeds are amazing. Some are so hard you can hit them with a hammer, run them over with a truck or squeeze them in pliers and they won't break. Still others can be scratched with sandpaper or placed in boiling water only to have a few seeds germinate. The reason for this toughness is a thick seed coat. For instance, the seed coat may be several cell layers thick or may be made up of only a few cell layers that are packed very tightly.

Today we will discuss some treatments you can experiment with to make hard seed germinate. These treatments damage the seed coat in some way. This is known as scarification. Seeds can be scarified many ways. For example, seeds can be dipped in concentrated acid for various lengths of time sanded with sandpaper, allowed to sit in hot water or clipped with nail clippers. The purpose of these treatments is to let water into the seed. In some cases gases may be allowed to enter or escape from the seed.

All of these treatments require adult supervision!!!!

Hot Water Treatment

- Place your seed in a mesh bag, a coffee filter will do the trick

- Close the bag or filter and tie the top with a long piece of string
- Fill a pot or beaker about half way with water
- Heat the water until it boils
- Remove the container from the heat and place your bag of seed in the water
- Allow the bag to remain in the water for different time periods
- After treating sow your seeds and observe

Mechanical Scarification

A) Sandpaper Method

- Select sandpaper of different grit
- Place seed in between two sheets of the same grit and rub
- You may also try wrapping the sandpaper around a block of wood or plastic and sanding a small amount at a time
- Try sanding for different times
- After treatment sow seeds and observe

B) Filing Method

- Select the type of file you want to use
- File seed for different times or on different places on the seed
- After treatment sow seeds and observe

C) Clipping Method

- Using a pair of large fingernail or dog nail clippers clip off pieces of seed coat
- After treatment sow seed and observe

Seeds may also be mechanically scarified using a hammer or pliers to slightly crack the seed coat. Remember if you totally smash the seed it probably won't survive.

Seeds may also be treated with concentrated acid. This treatment should only be tried in a laboratory under close supervision.

Activity 3

Seed Scarification

For this activity students will be divided into 15 groups of 2 students. Each group receives 1 petri dish, 1 piece of filter paper and 9 Milo seeds. Instruct students to moisten filter paper with water. The filter paper should be wet, but not so much that there is standing water in the petri dish. Students are instructed to scarify 3 seeds with sandpaper, 3 with nail clippers and 3 seed receive no treatment. Students should be allowed to determine what portion of the seed will receive the sanding and clipping treatments. Students may also take turns sanding and clipping their seeds. Seed should be placed in the appropriate area of the petri dish according to treatments.

Petri dishes with treated seed should be placed on a table or bench near a window but away from direct sunlight. Remember to keep the filter paper moist. The filter paper will dry out after 1-2 days. Students should keep track of the number of days it takes for seed in each treatment to sprout. The average number of days to germination for all seed in a treatment can be used as the standard measure. Students can then graph and discuss these data. A data collection sheet has been attached.

Milo Seed Germination Test
Data Collection Sheet

NAMES _____

Treatment	Number of Days for 1 st Seed to Sprout	Number of Days for 2 nd Seed to Sprout	Number of Days for 3 rd Seed to Sprout	Total Number of Days for Sprouting	Average Number of Days to Sprouting
Sanding					
Clipping					
No treatment					