Soggy Seeds

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LEVEL: Grades 4-6

SUBJECTS: Science and Social Studies

AZ ACADEMIC STANDARDS: 5M-E1, LS-E1, LS-E2, SC04-S1C1, SC04-S1C2, SC04-S1C3, SC04-S1C4, SC05-S1C1, SC05-S1C2, SC05-S1C3, SC05-S1C4, SC06-S1C2, SC06-S1C3, SC06-S1C4

MATERIALS
For a group of 2 students you will need 7 lima beans, magnifying glass, Vaseline, scientific experiment "Soggy Seed" record sheet, a graph paper, observation paper and a small container of water.

VOCABULARY
Embryo- an organism in its earliest stages of growth, just after its development from an egg cell. An early or beginning stage.
Microphyle- a tiny hole along a seam on a seed.
Seam- the line formed by abutting edges.
Germination- to begin or cause to grow or develop; sprout.
Nutrients- providing nourishment or nutriment- something that nourishes, as food.

RELATED LESSONS
If it Smells Good, is Edible and Attracts Wildlife, Then it's a Practical Garden!
Where do They Go?
Don't Wait, Just Propagate!
Let's Make Stew
How do Plants Make Food?
Survival of the Fittest
Getting to the Root of the Matter
This Can't be a Plant
Plant Seedling
Plants, Plants and More Plants

SUPPORTING INFORMATION
A seed contains an embryo, (which has all of the necessary genetic information to create a new plant), An endosperm (the food required to sustain new growth), and a seed coat (which protects the seed from disease). A tiny hole, called the microphyle, found along the seam of the seed, allows water to enter the seed, softening it so the embryo can break through the covering and begin to germinate.

PROCEDURES
Session 1:
-Lead discussion to determine what students know about seeds.
"What is a seed?" (A seed is the reproductive part of a plant.)
"Where do seeds come from?" (Plants grow seeds to reproduce more of the same kind of plant.)
"Are all seeds the same?" (no)
"How are they alike? How are they different?" (Some are large, some are very small, rounder, flat)
"What do we use seeds for?" (to grow new plants)
"Where do new plants come from? How does this happen?" (Acknowledge all answers for now)
"Have you ever seen seeds flying in the air?" (dandelion fluff)
"Have you ever seen seeds floating on water?" (coconuts)
"Have you ever seen seeds being carried by a dog?" (burrs, foxtails)
-Distribute a lima bean, a sheet of

BRIEF DESCRIPTION
Students will learn that water is taken into a seed through a tiny hole. Students will explore conditions affected by clogging the growth hole and measure the growth of the unclogged seeds. Students will discover what conditions favor or hamper seed germination and record the results.

OBJECTIVES
Students will conduct experiments to discover seed germination.
Students will write a HYPOTHESIS about the experiment, write out the PROCEDURES and record the RESULTS.
Students will measure, using metric measurement, shoots and roots, and note appearance of the seed over the course of the experiment. (unclogged seeds)
Students will graph the data obtained from the experiment.

ESTIMATED TEACHING TIME
Session I, 45-50 min.
Session II, 45-50 min.
Session III, IV, and V, 30 minutes.

PROCEDURES (cont'd)
paper, and a magnifying glass to each student or group. Have the students examine the seed. Tell them to look closely at the seed and then draw what they see on their paper.
-Soak the seeds in water overnight.

Session II.
-Distribute the soaked seeds to the students and have them examine the seeds again closely. Instruct them to look for any changes. Discuss the changes they observe and have the students sketch how the seed appears to them now.
-Have the students gently open the seed along its natural opening, the **seam**. Stress how gently this has to be done.
-Have the students observe what they see inside. They should be able to see a tiny plant, or **embryo**.
-Discuss the findings
"What did you find?"
"What do you think happens to this tiny plant when the seed is planted?"
"What do you think all the material inside the seed is needed for?" (food, or **nutrients)**
"Why is the outside of the seed so hard?" (Protection)
-Have the students make sketches of the inside of their seed.

Session III:
-Review the concepts developed in Sessions I and II.
-Distribute six lima beans to each group.
-Have the students examine their seeds with and without a magnifying glass.
"How could water get inside the seed to soften it?" (Accept all answers)
"Can you find a spot where water can get into the seed? **(Microphyle)**
"How could we determine whether this spot allows water to enter the seed?"
-Have students formulate a test to determine whether their hypothesis is correct. Pass out Scientific Experiment "Soggy Seed" record sheet at this time. Students should come to the conclusion that if the hole is clogged, the seed will have difficulty absorbing water.
"How could we clog up this hole?"
-Have students place a small amount of Vaseline over the hole on three of the six lima beans.
Have them mark these three with a water resistant pen.
-Have students place all six lima beans in a container of water to soak overnight.
-Have students complete Scientific Experiment "Soggy Seed" record sheet, all but results section.
Session IV:
-Examine the soaked seeds and discuss the findings.
"How have the seeds changed?"
"Did all the seeds change?"
"Which seeds did change and which seeds did not change?" (The seeds that were waterproofed would not have expanded and cracked as much as the seeds that were not waterproofed)
"What do your results tell you about seeds?" (The microphyle allows water to enter the seed)
"Why is it important for water to enter a seed?" (To soften it to allow the plant to emerge, **(germination)**
-Have students complete results section on record sheet.

EVALUATION OPTIONS
-Scientific Experiment "Soggy "Seed" record sheet
-Define vocabulary words for this lesson
-Summarize how water gets into a seed and what does this allow.

EXTENSIONS AND VARIATIONS
-Have students try the same experiment using other vegetable seeds.
-Have students soak two seeds in water, one clogged and one unclogged, and plant them along with two unsoaked seeds, one clogged, one unclogged. Ask students to predict which seeds will germinate. Growth patterns can be charted and recorded.
-Ask students to try to open seeds without soaking them in water. This will lead to Sessions III and IV.

RESOURCES
The Next Move View Experiment http://www.learner.org/channel/workshops/nextmove/beanview/graphit.php3
Abruscato, Joseph, Fossaceda, Joan. Hassard, Jack. Peck, Donald. Holt Science 1986.
Project Food Land and People. Resources for Learning 2000.

EDUCATORS' NOTES

CURRICULUM DESIGN
Annette Cribbs and Abbie Weien
6th Grade
Sechrist Elementary
Flagstaff Unified School District

Scientific Experiment "Soggy Seed"

PURPOSE:

HYPOTHESIS:

PROCEDURES:

RESULTS:

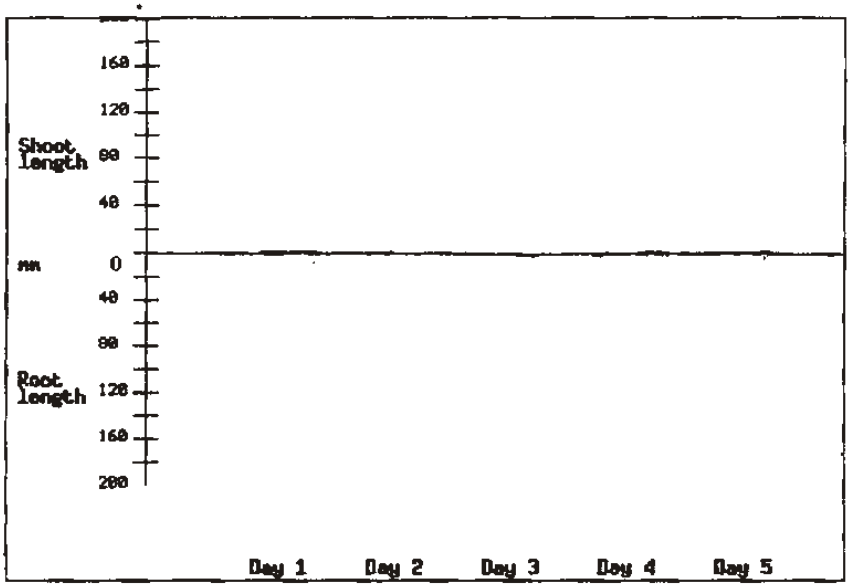
This Arizona Grown Specialty Crop Lesson Plan was paid for by a grant from the Arizona Department of Agriculture's Office of Marketing and Outreach.

Condition: Lima bean

		Observation 1	Observation 2	Observation 3	Observation 4	Observation 5
Seed A	shoot (mm)					
	root (mm)					
	appearance					
Seed B	shoot (mm)					
	root (mm)					
	appearance					
Seed C	shoot (mm)					
	root (mm)					
	appearance					

Graph Data for an Experiment

Experiment Title: Do all seeds in water sprout and grow the same?
Condition: Lima bean (across days)



SEEDS

After double fertilization, **each ovule develops into a seed,** which consists of

- **a plumule,** made up of
  - o two embryonic leaves, which will become the first true leaves of the seedling, and
  - o a terminal (apical) bud. The terminal bud contains the meristemat which later growth of the stem takes place.
- One or two **cotyledons** which store food that will be used by the germinating seedling.
  - o Angiosperms that produce seeds with two cotyledons are called **dicots.Examples:** beans, squashes, Arabidopsis
  - o Angiosperms whose seeds contain only a single cotyledon **are monocots.Examples:** corn and other grasses.
- The **hypocotyl and radicle,** which will grow into the part of the stem below the first node ("hypocotyl" = below the cotyledons) and primary root respectively.
- A pair of protective seed coats derived from the walls of the ovule.

The food in the cotyledons is derived from the endosperm which, in turn, received it from the parent sporophyto. In many angiosperms (e.g., beans), when the seeds are mature, the endosperm has been totally consumed and its food transferred to the cotyledons. In others (some dicots and all monocots), the endosperm persists in the mature seed.
The seed is thus a dormant embryo sporophyte with stored food and protective coats. Its two functions are -

- dispersal of the species to new locations (aided in angiosperms by the **fruit)**
- survival of the species during unfavorable climatic periods (e.g., winter). "Annual" plants (e.g., beans, cereal grains, many weeds) can survive freezing only as seeds.When the parents die in the fall, the seeds remain alive - though dormant - over the winter. When conditions are once more favorable, **germination** occurs and a new generation of plants develops.