



SOYBEAN SEED CYCLE LESSON

Purpose

This lesson introduces students to how soybeans are grown by farmers, teaches seed anatomy through a seed dissection activity, and illustrates the germination of the soybean plant.

Estimated Time

45 minutes

Video Link:

Germinating seed time lapse

(www.youtube.com/watch?v=w77zPAAtVTul)

Materials Needed:

Activity 1: Seed Dissection

- Soybean plant or Soybean Commodity Card
- Soybean seeds (soaked overnight) — One per student; soybean seeds can be obtained from local farmers, or regular bean seeds from a garden center can be used.
- Soybean products (chocolate, plastic, crayons, and vegetable oil)

Activity 2: Bean Book

- Bean Book handout, one per student. The file can be found at https://cdn.agclassroom.org/media/uploads/2014/11/26/Bean_Book.pdf
- Scissors
- Glue
- Stapler
- Permanent marker

Activity 3: Bean Seed Planting

- Soybean seeds (not soaked in water), three per student
- Paper cups with drain holes punched in the bottom
- Soil
- Optional — soybean plant



Vocabulary Words

Cotyledon: the portion of a soybean seed that develops into the first leaves.

Edamame: immature green soybeans boiled or steamed in their pods and harvested before the ripening stage.

Embryo: the portion of a seed that develops into a new or “baby” plant.

Legume: a type of plant that has seeds contained in a pod such as a soybean, pea, or alfalfa plant.

Seed coat: a very thin layer on the outermost surface of the seed that offers protection to the seed.

Soybean: a cultivated plant of the pea family that produces edible seeds used in a variety of foods and animal feeds.

Did You Know? (Ag Facts)

- Each soybean pod produces three to four beans; occasionally they will produce five beans, but this is very rare.
- The soybean was first introduced to America in 1765 by a sailor named Samuel Bowen.
- One acre of soybeans (about the size of a football field) can produce 2,500 gallons of soy milk, 40,000 8-ounce (226 g) servings of tofu, and over 82,000 crayons.
- The top-producing states of soybeans in the United States include Iowa, Illinois, Minnesota, Nebraska, and Indiana.
- The elevators in the Statue of Liberty use a soybean-based hydraulic fluid.
- In Louisiana we have 2,254 soybean producers with 1.3 million acres of soybeans planted.
- Soybeans are planted in 47 of Louisiana’s 64 parishes.

Background Agricultural Connections

Soybeans are bushy green plants from the legume family. Scientifically speaking, legume plants have the ability to use soil bacteria to form a nodule on their roots by pulling nitrogen from the air and using this nutrient for growth. A simpler description of a legume is a plant that produces a seed that is contained in a pod. Examples of legumes grown in agriculture include soybeans, peas, and alfalfa. Legume crops are a natural benefit to soil quality on farms. The ability of legumes to “fix” their own nitrogen reduces the cost to farmers and gardeners for fertilizers and can be used in a crop rotation to replenish nitrogen in the soil. The fixing of nitrogen by soybeans also causes the seeds and pods to have very high protein contents.

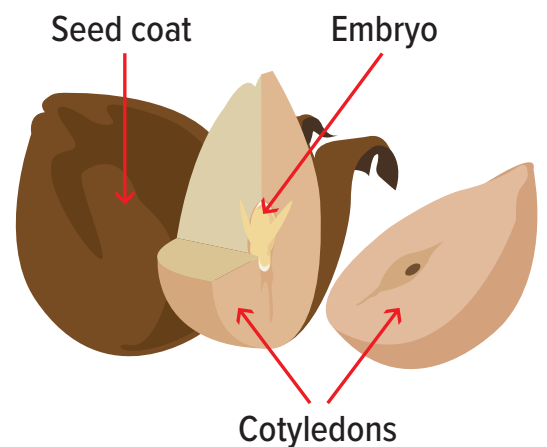
Soybeans are planted on farms in the spring after the last frost. After the seed germinates and begins to grow, it matures into a bushy, green plant that blooms in late summer. From these white or purple blossoms, a pod begins to form. During the fall season, the soybeans mature and the plant begins to turn yellow. The soybeans are harvested using a machine called a combine. The combine cuts the entire soybean plant and separates the soybeans from their pods and stems. The soybeans are then collected and trucked to facilities where they are stored and processed.

All members of the bean family (soybeans, lima beans, kidney beans, green beans, etc.) have the same seed anatomy. A seed coat is a very thin layer on the outer most surface of the seed. The seed coat offers protection to the cotyledons and the embryo. The cotyledons, or seed leaves, are the first leaves visible on a bean plant. These seed leaves are thick and contain stored glucose (food) for the new plant to grow. Before the seed is planted, the cotyledons are usually not green. When the plant sprouts, or germinates, chlorophyll is activated and the cotyledons become green. The very center of a seed contains the embryo. This embryo is the new, or “baby,” plant that will sprout out of the soil. If bean seeds are soaked in water for a few hours, they can easily be pulled apart, and these major bean seed parts will be visible.

From planting to harvest, soybeans take approximately 100 days to reach maturity. In 2018, Louisiana farmers averaged 56 bushels of soybeans per acre, which equaled almost 65 million bushels of soybeans. One bushel of soybeans weighs about 60 pounds, which means that Louisiana farmers produced 3.9 million pounds of soybeans in 2018. Louisiana soybeans are delivered by trucks to ports that are primarily located on the Mississippi River. At these ports, they are loaded onto large cargo ships headed to their final destinations across the world. Many Louisiana soybeans make their way to China, Mexico, and the European Union.

Soybeans are one of the most versatile crops in the world. When crushed and pressed, soybeans produce oil used in margarine, cooking oils, salad dressings, mayonnaise, and many prepared foods. Soybean oil contains no cholesterol and is low in saturated fat, so it is popular with health-conscious people. Soybean oil is also used to make paints, varnishes, soaps, cosmetics, plastics, and crayons. Soybean oil is even used to make ink for printing newspapers and magazines. Soy biodiesel is another product made from soybean oil. This fuel is used in cars, trucks, and buses, which reduces pollution and increases engine performance.

SOYBEAN ANATOMY



After soybean oil is removed in processing, the remaining flakes are processed into food products or protein meal for animals. Soybean meal is an important protein source for livestock and poultry.

Interest Approach - Engagement

1. Using the soybean pictures, show students the edamame and the mature soybean pod.
2. Allow the students time to look at the pictures and ask them to tell you what these two items have in common. Then ask what is different.
3. Ask the students if they know what the pictures represent. (soybeans)
4. Ask the students the following questions:
 - “Do you know where soybeans are grown?” (soybean fields mainly in the Midwestern region of the United States and the South)
 - “Who grows soybeans?” (farmers)
 - “Have you ever eaten a soybean?” (edamame, tofu, soymilk, soy sauce)
 - “Are soybeans (edamame) healthy for you to eat?” (Yes, they are high in protein, iron, and calcium and low in calories.)
 - “What are some uses of soybeans?” (cooking oils, mayonnaise, margarines, salad dressings, cosmetics, lubricants, and biodiesel)
 - “Do you remember how many soybean farmers there are in Louisiana?” (2,254)
 - “Do you know any soybean farmers?” (variable answers)

Procedures

Activity 1: Seed Dissection

1. One day before class, soak enough soybean (or any other kind of bean) seeds in water so each student can have one seed.
2. Display a soybean for the class to see.
 - Note: Soybean plants can be obtained from area farmers, or you can grow your own from a soybean seed. A picture of a soybean plant would also work. If an actual plant is not available, use the Soybean Commodity Card.
3. Tell students that soybeans are an important crop. They are commonly grown in many Midwestern states and are grown in Louisiana. If possible, bring in products that contain soybeans (chocolate, plastic, crayons, vegetable oil, etc.), and explain to the students that all of these products are made using part of the soybean seed.
4. Use the information in the Background Agricultural Connections to give a brief explanation of how soybeans are grown.
5. Give each student a water-soaked soybean seed. Explain to the students that there are three major parts to a seed: the seed coat, seed leaves (cotyledons), and an embryo.
6. Assist your students in dissecting the bean seed:
 - Peel off the seed coat. It is a very thin, almost transparent, film on the outer surface of the seed.
 - Gently split the seed in half, separating the cotyledons or seed leaves. Explain to the students that these cotyledons provide food for the plant as it is sprouting.
 - In the center of the cotyledons should be a small embryo. Explain to the students that this embryo is what will sprout and grow into a plant.

Activity 2: Bean Book

1. Before class begins, make enough copies of the Bean Book so each student has an instruction sheet, seed coat sheet, seed leaves (cotyledon sheet) and one embryo. (There are six embryos per page.) If possible use colored copies to help students visualize the seed parts or allow students to color their Bean Books. Example: Brown for seed coat sheet, yellow for seed leaves (cotyledon) sheet, and green for the embryo sheet.
2. After students have dissected their bean seed, have them throw away all seed parts. Then distribute the Bean Book handouts. Read the directions and model to the students what they should do to assemble the book. Assist students in creating their own Bean Books.
3. After the Bean Books are assembled, show students how to use them to read about the seed and illustrate the parts.

Activity 3: Bean Seed Planting

1. Give each student about three bean seeds (not soaked in water). Ask the students what is needed to help these seeds grow. (moisture, air, and the proper temperature)
 2. Pass out planting containers (paper or plastic cups with drain holes punched in the bottom work well). Assist students in writing their names on the cups with a permanent marker.
-

3. Have buckets or containers with soil available. Model the following instructions for the students:
 - a. Fill a cup about one-half to three-quarters full of soil. Have students follow your example to fill their containers.
 - b. Poke three holes, using a pencil or your finger, about 1 inch deep into the soil.
 - c. Drop one seed into each hole. Cover the seeds loosely with soil.
 - d. Use a spray bottle to moisten the soil in the container or pour water on the soil until water flows out the holes in the bottom of the container. Be sure to water over a sink or container.
4. Assist the students with planting the seeds.
5. Place the containers in a sunny window and water when the soil is dry to the touch.
6. Discuss with students what they think will happen to the seeds. (sprout, grow into plants, and produce more seeds).
7. In five to 10 days, a sprout will emerge in each container. If more than one seed sprouts or germinates, have students

References

General soybean information and activities from National Ag in the Classroom.

Louisiana information from Mark Carriere.

Modified from the National Agriculture in the Classroom Agricultural Literacy Curriculum Matrix available at <https://www.agclassroom.org/matrix/lesson/79/>.

Louisiana Standards Covered In This Lesson

1-LS1-1 Use tools and materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

2-LS2-1 Plan and conduct an investigation to determine if plants need sunlight and water to grow.

2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats.



Authors:

Mark Carriere, Justin Dufour, and Todd Fontenot

Adapted from Bean Seed Cycle by Sue Knott, Minnesota Ag In the Classroom and used with permission from National Ag In the Classroom

Visit our website: www.LSUAgCenter.com

MISC 364F (Online Only) 3/21

William B. Richardson, LSU Vice President for Agriculture

Louisiana State University Agricultural Center, Louisiana Agricultural Experiment Station, Louisiana Cooperative Extension Service, LSU College of Agriculture

The LSU AgCenter provides equal opportunities in program and employment. Louisiana 4-H is an educational program of the LSU AgCenter.
