

Get Your Kicks... at the LA County Fair



Grade Level:
Primary

Location:
The Farm

Standards:

Common Core Connections

Reading: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.R.1
- CCSS.ELA-LITERACY.CCRA.R.2
- CCSS.ELA-LITERACY.CCRA.R.4

Speaking and Listening: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.SL.1

Language: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.L.1
- CCSS.ELA-LITERACY.CCRA.L.4

Education Content Standards

Within SCIENCE

3-LS1: From Molecules to Organisms: Structures and Processes

- 3-LS1-1

4-LS1: From Molecules to Organisms: Structures and Processes

- 4-LS1-1

5-LS1: From Molecules to Organisms: Structures and Processes

- 5-LS1-1

Concepts:

- Seeds have a seed coat, embryo, and cotyledon.
- The embryo is the portion of the seed that will develop into the mature plant.
- Many plants grow from seeds, including the plants that produce the fruits, vegetables, and grain that we eat.

Supplies:

Vary according to activity.

Vocabulary:

Seed, monocot, dicot

Seeds, Miraculous Seeds

Grade Level(s)

Primary

Estimated Time

Three 30-minute sessions plus 1 week of observation

Purpose

Students will develop an appreciation and understanding of the natural development of seeds, learn the anatomy and function of each seed part through a seed dissection and classify seeds as monocots or dicots.

Materials

Activity 1:

- "Seed Dissection" activity sheet, 1 per student
- "Seeds" PowerPoint
- Seeds for dissecting (1 per student of each variety)
- Kidney or lima beans
- Corn (Make sure the corn is untreated. You may need to get this from a health food store, a feed and seed store, or a store that stocks whole grains.)
 - Pine Nuts (optional. These are typically available in the produce section of a grocery store through the fall and winter.)

- Dish of water for soaking

Activity 2:

- "Seeds" PowerPoint
- Seed Quiz

Activity 3:

- Pre-soaked pinto beans, 4 per student plus extras
- Sandwich-size Ziploc bags, 1 per student
- Stapler
- Tablespoon
- Paper towels
- Water

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- "Seed Science Experiment" activity sheet, 1 per student

Essential Files (maps, charts, pictures, or documents)

- [Seeds PowerPoint](#)
- [Seed Science Experiment Activity Sheet](#)
- [Seed Dissection Activity Sheet](#)

Vocabulary

seed: what a flower produces which provides capability of reproducing another plant

monocot: a class of plants that contains only 1 cotyledon

dicot: a class of plants that contains 2 cotyledons

Did you know? (Ag Facts)

- A coconut is the largest plant seed.
- The smallest seeds can be the size of a speck of dust.
- Seeds can sense gravity and will always grow up.

Background Agricultural Connections

What is inside of a **seed**? A new plant? Maybe a new tree? Will your students believe you? Seeds are relatively small (with the exception of coconuts) but have the potential to grow into productive plants. How can such a small package contain such potential? This lesson contains a simple yet enlightening activity you can do with your students to help them understand seeds and seed development.

Seeds have many uses. Some seeds can be eaten, like sunflower seeds, pumpkin seeds, peanuts, and coconuts. We can extract oil from some seeds and grind other seeds to make flour. Seeds are used to grow fruits and vegetables to eat, as well as flowers, trees, and other plants that we enjoy in our surroundings. Seeds are all around us.

Most seeds can be stored for a long time and kept in a dormant or no growing state. Each seed contains all of the genetic information for the plant it can grow into. Once a seed is placed in the proper environment, it will germinate or begin to grow. Proper temperature and moisture are critical for a seed to germinate.

Flowering plants and their seeds can be classified into two groups: monocots and dicots. The number of cotyledons (seed leaves) distinguishes whether a seed is a monocot or dicot. **Monocots** have one cotyledon and dicots have two. In most **dicot** seeds, the

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cotyledons store the food that the seed will use to grow until it gets its first true leaves and begins to make its own food. In many monocot seeds, the food supply for the embryo is stored separately in tissue called the endosperm. The cotyledon absorbs and transmits the food from the endosperm to the embryo.

Generally, when monocots germinate and begin to grow, a single leaf will emerge from the soil. Monocot plants are characterized by having parallel veins and thin, strap-like leaves. Examples of monocot plants include grass, daylilies, corn, and coconuts.

Dicots generally emerge from the soil with more than one leaf. Many dicots' cotyledons emerge from the soil, turn green, and perform photosynthesis. These types of seedlings are the easiest to recognize as dicots because they have two leaves (the cotyledons) that look different from the leaves of the mature plant. Dicot plants have veins that form a net-like pattern across the leaves. Most flowers and fruit and vegetable plants are classified as dicots.

Botanists classify or categorize plants to make it easier to study and understand them. There are hundreds of thousands of different plant species, so it would be very difficult to study them all. Breaking them up into smaller groups with similar characteristics helps organize the way we study and think about plants. Not all plants are classified as monocots or dicots—this is a classification used only for the group that botanists call flowering plants. Older plants that developed earlier in the history of Earth are classified differently, although they have some similar parts. Ferns and pine trees are examples of plants that are not flowering plants and therefore are neither monocots nor dicots. It is interesting to compare pine nuts to monocot and dicot seeds because they have similar parts, but pine nuts have more than two cotyledons (the cotyledons of the pine nut look like the “leaves” of the embryo).

Three parts of a seed are discussed in this lesson: the seed coat, the food supply, and the embryo. Almost all seeds have these three parts whether they are monocots, dicots, or neither (e.g., conifers like pine and spruce trees). The seed coat is the outer covering, which provides protection for the seed. The seed coat can be thin, like on a bean seed, or thick and hard, like on a pine nut or coconut. The food supply is a large part of the seed that contains the nutrients and energy that the embryo will use to grow. In dicots, the cotyledons generally contain the food supply. In other seeds, the food supply is separate from the cotyledons and is commonly called the endosperm. The purpose of the food supply is to nourish the embryo. The embryo is the “baby” plant, or the portion of the seed that will develop into the seedling's leaves and roots. Technically, the food supply is part of the embryo, but while the embryo grows, the food supply shrinks.

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Prior to your visit have students complete a seed dissection and learn seed classifications.

Interest Approach – Engagement

1. Play a guessing game with your students. Tell them that you will give them a series of clues. As they hear the clues, they will guess the item you are thinking of. Give the following clues until the students guess, "seed."
 - It is used to make oils that we use in cooking.
 - They are usually smaller than a coin.
 - They are made inside of a flower.
 - They can be stored for a long time until they are ready to be used.
 - They can grow into a plant.
 - Some are eaten.

Procedures

Activity 1: Seed Dissection

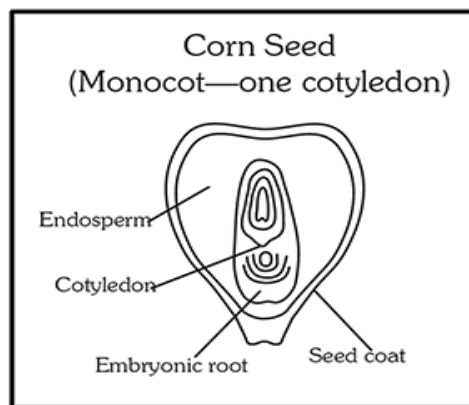
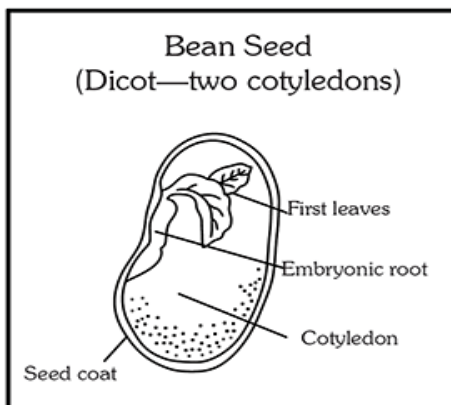
1. Pass out one copy of the “Seed Dissection” activity sheet to each student.
2. Use the first three slides of the “Seeds” PowerPoint to show students the parts of a seed. Have them label the diagram on their activity sheet and write the functions of the seed coat, food supply, and embryo.
3. Soak the seeds (except the pine nut) in water for 24 hours at room temperature. Drain the seeds and pass out a bean, corn, and pine seed to each student. Follow the instructions below to dissect each seed. Have students place each dissected seed part in the labeled box at the bottom of the activity sheet.
 - **Bean Seed:** Carefully have students remove the bean seed coat, which, before the soaking, protected the seed food source (cotyledons) and the embryo, which will become the new plant. Next, have the students gently split the bean seed—the two halves are the two cotyledons. This is where the bean seed stores the food that is used for growth until it gets its first true leaves and begins to make its own food. The students should be able to see a little lump near the edge of one cotyledon. Don’t touch it yet! Carefully study this lump (a hand lens may be useful). This is the embryo—the new plant! If students look closely, they should see the delicate, translucent leaves. Finally, instruct them to separate the embryo from the cotyledon, place it on a flat surface, and look to see not only the leaves, but also the embryonic roots.
 - **Corn Seed:** For contrast, ask the students to try to open the corn seed. You’ll probably see a lot of students squish their seeds, but if they carefully remove the

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seed coat, and then press their fingernail into the endosperm, the cotyledon and the new embryo can be removed.

- **Pine Nut:** Finally, perhaps the most interesting seed to dissect is a pine nut. Ask students to gently remove the seed coat. They may have to crack this with their teeth. Next, tell them to push their finger nail through the food source and gently open it to see the embryo—a baby tree.
4. Students should now have three seed coats, three food sources, and three seed embryos in the corresponding boxes of their activity sheets. Use glue or tape to attach them.
 5. Summarize what the students have learned. Yes! We eat seeds: peas, beans, peanuts, sunflower seeds, walnuts, cashews, wheat used in bread, poppy seeds, sesame seeds, not to mention the oil that comes from seeds. Seeds truly are a miracle with the potential for life and the ability to sustain lives—like yours and mine. Review by asking these questions: *What are seeds used for? Do we eat any seeds or are they used just to grow new plants? Which part of the seed is the outer covering that protects the inside? Which part of the seed is the largest, and what is its purpose? Which part of the seed will grow into the new plant?*



During your visit have students identify monocots and dicots as they walk through the garden. Have students plant seeds in 4” pots to take home, have them identify which are monocots and dicots as they start to germinate.

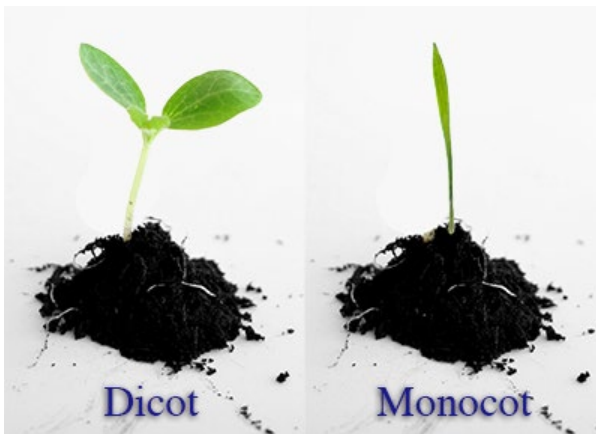
Activity 2—Monocots and Dicots

1. Tell your students that most seeds can be classified into two groups: monocots and dicots.

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2. Break the words into smaller pieces to define. Mono=one, di=two, and “cot” is short for cotyledon. Therefore, a monocot seed has one cotyledon and a dicot seed has two cotyledons. Tell students that corn is a monocot and beans are dicots. Discuss the differences they observed between the corn and bean seeds they dissected. Use the information provided in the Background section of this lesson to discuss the differences between monocots and dicots.



3. Beginning with slide four of the “Seed” PowerPoint, show students the diagrams and examples of monocot and dicot seeds and seedlings.
4. Have students apply their knowledge and identify the next eight plants on the PowerPoint as monocots or dicots. Each slide shows the seedling just after it emerges from the soil as well as the mature plant that the seedling will become. If there is one single leaf on the seedling, it is probably a monocot. You can also identify monocot plants by their long strap-like leaves that are similar to grass. If the plant is a dicot, the seedling will probably have two leaves. Use a method of formative assessment to identify the plants in the PowerPoint. For example:
 - Have all students stand in the center of the room. Instruct them to go to the far left of the room if the plant is a monocot and to the far right of the room if it is a dicot. Show students the picture, identify the correct answer, and continue to the next plant following the same procedure.
 - Use student response boards (white boards or chalk boards). Instruct students to write, monocot or dicot on their response boards and hold them up.
 - Pass out a sheet of scrap paper to each student. Have them write monocot on one side and dicot on the other. Ask students to hold up the correct answer as you show the picture of each plant.

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After your visit to The Farm complete a seed science experiment by sprouting seeds and having students recall the differences between a monocot and dicot.

Activity 3—Seed Science

1. Soak a bag of pinto beans in water overnight to prepare for this activity.
2. Prepare Ziploc bags for sprouting seeds and embryos. You may choose to prepare the bags ahead of time or have students prepare their own. Fold a paper towel to fit inside the bag. Punch a row of staples two inches from the bottom of the ziploc bag. The staples will hold the paper towel in place and help with water drainage, decreasing the chance of the seeds rotting.
3. Have the students recall the differences between monocot and dicot plants. Review that monocot seeds appear to be made up of a single whole, while the dicot seed appears to be made up of pieces. Hold up a dry bean seed and ask students to identify if it is a monocot or dicot. Show them a seed that has been soaking and show them the different parts to reveal that it is a seed from a dicot plant.
4. Give each student four beans.
5. Instruct students to first place two of their bean seeds in their ziploc bag on top of the row of staples.
6. With the remaining two seeds, instruct students to carefully peel the seed coats off of the seed.
7. Next, each student should take the two seeds without seed coats and gently pull them apart to reveal the two halves—the two cotyledons. Have them look inside for the embryos. Have extra bean seeds available for this step. Some bean seeds have very small embryos, which may make it difficult for the students to remove them intact.
8. Once the embryos have been separated, carefully place them inside the ziploc bag, above the row of staples. Students should now have two bean seed embryos and two whole bean seeds in their bag.
9. Remind the students that the cotyledons are the bean seed's food supply—you can think of them as the seed's "lunch box." They feed the seed until it can grow leaves and make its own food. Tell them that they will conduct an experiment to see how well seeds grow with and without their food supply.
10. Add one tablespoon of water to each bag to wet the paper towel and moisten the seeds. Using tape, hang the bags on a window or in a well-lit area. Do not seal the bags; leaving them slightly open will help prevent the seeds from rotting.

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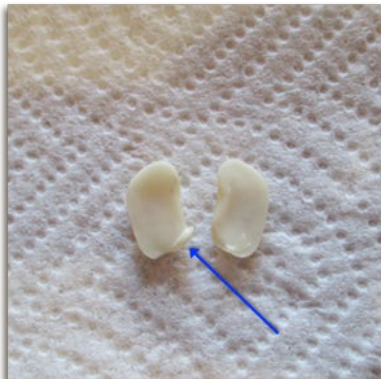
Place paper towel inside plastic bag.



Place row of staples 2" from the bottom of the bag.



Have students remove the seed coat from 2 seeds.



Separate bean seeds and remove the embryo of 2 seeds.



Place 2 seed embryos and 2 whole seeds in ziploc bag



Add 1 tablespoon of water. Tape ziploc bag to a window or in a well-lit area with bag left open.

11. Have the students complete the first section of the "Seed Science Experiment" activity sheet.
12. Observe the growth of the bean seedlings over the next week. Most seeds will sprout in three to five days.
13. Have students complete the final section of the "Seed Science Experiment" activity sheet. Discuss what factors might have affected the growth of the embryos and the whole seeds. At the completion of the experiment, students should see the growth and development of a stem, leaves, and roots of the whole bean seed. The embryos will have very limited growth without their food supply, cotyledon, or seed coat.

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Growth of embryo portion of the bean seed.



Growth of whole bean seed.

Concept Elaboration and Evaluation

After conducting these activities, review and summarize the following key concepts:

- Seeds have a seed coat, embryo, and cotyledon.
- The embryo is the portion of the seed that will develop into the mature plant.
- Many plants grow from seeds, including the plants that produce the fruits, vegetables, and grain that we eat.