California Foundation for Agriculture in the Classroom

Seed Science

Purpose

Students will dissect monocotyledon and dicotyledon seeds and identify the seed coat, embryo, and cotyledons. Students will discover each part's function in seed survival and propagation.

Time

Teacher Preparation:
30 minutes

Student Activity:
50 minutes

Materials

For the class:

- Dicot and Monocot Seed Anatomy diagram (page 31)
- Transparency film (optional)
- Document or overhead projector

For each student:

- Wet lima bean seed
- Dry lima bean seed
- Wet corn seed
- Dry corn seed
- Round toothpick
- Hand lens
- *Seed Science* handout (pages 32-34)

Background Information

Most plants naturally originate from seeds. The development of the seed completes the process of reproduction in seed plants, which began with the development of flowers followed by pollination. Flowering plants produce seeds in the ovary of the flower. The ovary helps to protect the seed from being eaten. Once the flower dies, the seeds may be encased in a shell, surrounded by a fleshy fruit, or may blow away in the breeze.

The size of the seed has no correlation to the size of the fully mature plant. Small seeds can produce giant trees like oaks, coast redwoods, and sycamores. Seeds can be big or small, but they all contain three main structures: the seed coat, cotyledon, and embryo. The seed coat is a protective covering over the entire seed to protect the embryo. The cotyledon is a "seed leaf" that usually stores food for the embryo plant. It is considered a leaf because it is often the first part of a seedling that will be able to undergo photosynthesis. The embryo is an immature plant from which a new plant will grow under proper conditions. The food surrounded by the embryo is called the endosperm.

Plants develop and disperse seeds for species survival. The number of seeds a plant produces depends on the conditions in which it grows. Unlike animals, plants are limited in their ability to seek out favorable growing conditions. Many seeds have structures that aid them in dispersal, such as the hairs of a dandelion seed, which can be carried by the wind, and the barbs of a thistle seed, which can attach to an animal's coat.

Botanists and agriculturists divide seeds into two main groups. Plants with seeds that have only one cotyledon, or seed leaf, are called **monocotyledons**. Plants with seeds that divide into two separate cotyledons are called **dicotyledons**. Here are some examples of both:

Monocotyledons	Dicotyledons
Rice	Bean
Wheat	Pea
Garlic	Almond
Corn	Peanut
Tulip	Sunflower
Lily	Apple
Barley	Peach

California Foundation for Agriculture in the Classroom

Seed Science

Content Standards

Grade 2

Science
Life Sciences 2f
Investigation & Experimentation 4c, 4d, 4f

Next Generation Science
Defining and Delimiting Engineering Problems 2-ETS1.A
Developing Possible Solutions 2-ETS1.B

English Language Arts
Reading Informational Text 4
Writing 7, 8
Language 6

Grade 3

Science
Life Sciences 3a, 3d
Investigation & Experimentation 5e

Next Generation Science
Growth and Development of Organisms 3-LS1.B

English Language Arts
Reading Informational Text 4
Writing 7
Language 6

Procedure

1. Prior to the lesson, soak half the lima beans and half the corn seeds in water, in separate containers for approximately 24 hours. Additionally, collect a variety of seeds for students to observe. Prepare an overhead transparency of the Dicot and Monocot Seed Anatomy diagram (page 31).
2. Facilitate a classroom discussion on seeds. Ask the following questions to assess what students already know:
   - What are seeds?
   - Where are they found?
   - Where do they come from?
   - Why do plants have seeds?
   - Do we eat seeds?
3. Tell students that today they will be investigating seeds. Explain that seeds can be divided into two categories: dicotyledons and monocotyledons. Practice saying the words in unison. Show students the Dicot and Monocot Seed Anatomy diagram (page 31.) Explain that plants with seeds that have only one cotyledon, or seed leaf, are called monocotyledons. Plants with seeds that divide into two separate cotyledons are called dicotyledons. Share with the class a list of dicot and monocot seeds.
4. Give each student a hand lens and a copy of the *Seed Science* handout on page 32.
5. Starting with the lima beans, give each student one dry and one wet seed. Ask them to compare the two seeds. Have students document their observations on the *Seed Science* handout.
6. Instruct students to use their fingernail or a toothpick to carefully remove the seed coat from the wet lima bean. Remind the students that the seed coat is used to protect the seed from predators, such as insects, and from infection caused by bacteria, viruses, or fungi. Have students gently separate the two cotyledons and locate the embryo. Direct students to identify the embryonic leaves. Have students document their observations on the *Seed Science* handout.
7. Distribute one dry and one wet corn seed to each student. Ask them to compare the two seeds. Have students document their observations on the *Seed Science* handout.

Seed Science

Grade 4

Science
Life Sciences 3c
Investigation & Experimentation 6f

Next Generation Science
Structure and Function
4-LS1.A

English Language Arts
Reading Informational Text 4
Language 6

8. Instruct students to use their fingernail or a toothpick to carefully remove the seed coat from the wet corn seed. Explain that the corn seed is much more fragile than the lima bean seed and the structures are smaller. Have students identify the seed parts. Have students document their observations on the *Seed Science* handout.
9. After completing both dissections, ask students to compare and contrast each seed type and answer the questions on the *Seed Science* handout.

Variations

- Provide a variety of seeds, including nuts, for students to choose for dissection. Challenge students to identify and justify whether their seed comes from a monocot or dicot plant.
- When introducing the terms "monocotyledon" and "dicotyledon," use root-word strategies to determine each word's meaning.

Extensions

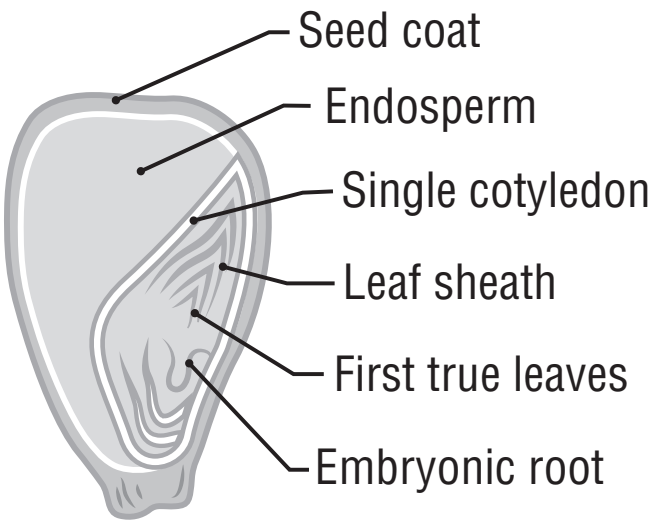
- Have students plant both the wet and dry seeds. After developing a hypothesis, have students carefully monitor each seed's germination rate. Record visual observations and theorize how soaking a seed in water may affect its germination.
- Learn how to identify whether a plant is a monocot or a dicot without dissecting the seed. Characteristics of monocots include parallel veins, stem cross-sections that feature scattered vascular bundles, and flowers in multiples of three. Characteristics of dicots include netted veins, stem cross-sections that feature vascular bundles in a ring, and flowers in multiples of four or five. Take a field trip around the school grounds and predict whether plants are monocots or dicots, then think of a way to test your prediction.

ELL Adaptations

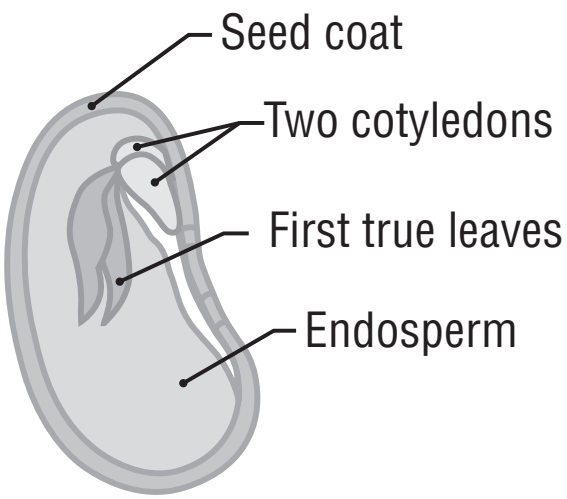
- Place ELL students in a group with other students who are proficient in English. Cooperative learning provides opportunities for students to illustrate, label, and discuss information.
- Students can define and draw illustrations of new terms like monocot and dicot in their science journal or on a classroom word wall.

Dicot and Monocot Seed Anatomy

Monocotyledon (corn)



Dicotyledon (bean)



Seed Science

Name: _____

Testable Question: Do lima bean seeds and corn seeds each have a seed coat, cotyledons, and an embryo even though the seeds are structurally different?

Hypothesis: _____

_____

_____

_____

Part I: Lima Bean Seed

Materials

- Wet lima bean seed
- Dry lima bean seed
- Wet corn seed
- Dry corn seed
- Hand lens
- Toothpick

Procedure

1. Observe the dry and wet lima bean. Compare the texture and size. Using the colored pencils draw a picture of each of the seeds in the table below. Use descriptive words to communicate your observations. We will be dissecting the wet lima bean seed.
2. Using your fingernail or a toothpick, gently remove the seed coat. It is helpful to start on the edge of the seed. The seed coat should peel away easily.
3. Look at the seed coat using the hand lens. Draw and describe the seed coat in the table below.
4. Carefully split the lima bean in half. The embryo should be attached to the top of one of the cotyledons. Use your hand lens to observe the embryo. Record your observations.

Lima Bean Results

Draw and label your findings.

Dry seed coat	Wet seed coat	Magnified seed coat

Inside the lima bean seed. Label the seed coat, cotyledon, and embryo.

Write three facts about dicot seeds:

1. _____
2. _____
3. _____

Part II: Corn Seed

Procedure

1. Observe the dry and wet corn seeds. Compare the texture and size. Using the colored pencils draw a picture of each of the seeds in the table below. Use descriptive words to communicate your observations. We will be dissecting the wet corn seed.
2. Using your fingernail or a toothpick, gently remove the seed coat. It is helpful to start on the edge of the seed. The seed coat should peel away easily.
3. Look at the seed coat using the hand lens. Draw and describe the seed coat in the table below.
4. Carefully split the corn seed in half. The embryo should be attached to the top of one of the cotyledons. Use your hand lens to observe the embryo. Record your observations.

Corn Seed Results

Draw and label your findings.

Dry seed coat	Wet seed coat	Magnified seed coat

Inside the corn seed. Label the seed coat, cotyledon, and embryo.

Write three facts about monocot seeds:

1. _____
2. _____
3. _____

Conclusion

Did you prove or disprove your hypothesis? Write a short paragraph restating your hypothesis and how you were able to prove or disprove it based on your findings.

_____

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