ABUNDANT CALIFORNIA

RAISING RADISHES

OVERVIEW

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GRADE LEVEL: 3–5

CENTER FOR ECOLITERACY

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CALIFORNIA FOOD FOR CALIFORNIA KIDS® downloadable resource

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CALIFORNIA FOOD
FOR CALIFORNIA KIDS®

RAISING RADISHES

LESSON OVERVIEW

Behold the humble radish. This colorful orb adds a burst of flavor to food, and is also a satisfying first crop for students to grow. Starting from seed, students can harvest tasty, peppery radishes in just a few weeks.

In this lesson, students learn about composting as a way to recycle food wastes, and then conduct an experiment with radish seeds to see which type of soil is best for radishes: soil only, compost only, or a mixture of soil and compost.

There are lots of options for doing the lesson. Students may follow the suggested procedure for a controlled experiment, or plan, design, and carry out their own investigation. They may grow the radishes in containers outdoors in direct sun or indoors with grow lights, or they may conduct the experiment in the school garden.

Radishes are a cool-season vegetable, but also need plenty of sunlight. Plan this lesson either for the early fall or the spring, avoiding both the heat of summer and the darker winter.

FOOD SYSTEM EMPHASIS

Growing

GRADE LEVEL

3–5

LENGTH

One to two 50-minute periods for the taste test and to set up the investigation, plus 10-minute weekly observation periods for 4–6 weeks

LEARNING OBJECTIVES

Students will:

- Recognize some of the unique qualities of California-grown radishes.
- Conduct an investigation of radishes grown in different soils.
- Observe the growth of radishes from seed to seedling to mature plant.

STANDARDS CONNECTIONS

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices

- Planning and Carrying Out Investigations – Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- Planning and Carrying Out Investigations – Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

COMMON CORE STATE STANDARDS–ENGLISH LANGUAGE ARTS

- RI.3.7. Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

VOCABULARY

- **Compost** – a mixture of decayed plant and animal material used to fertilize soil
- **Fair test** – a science investigation that compares two or more conditions, where just one factor (the variable) is different
- **In season** – available fresh and locally at a certain time of year
- **Mature** – fully grown or ripe
- **Plant variety** – a group of plants within a species that have similar characteristics

- **Soil** – the layer of loose material on Earth in which plants grow
- **Sprout** – (verb) to begin to grow and put out shoots
- **Variable** – the factor being tested in an experiment

MATERIALS

For the Radish Taste Test

- Copies of "Taste Test" and "Fruit and Vegetable Adjectives" student handouts from *Savoring California: A Comparative Tasting of California Fruits and Vegetables* (http://www.ecoliteracy.org/sites/default/files/CEL-CA-Thursdays-Tasting-Lesson.pdf)
- Two or three different varieties of radishes (see Preparation)
- Knife
- Serving trays
- Toothpicks
- Napkins

For the Radish Growing Investigation (see Preparation for details)

- Copies of "10 Facts about Radishes" and "See How They Grow!" student handouts
- Radish seeds
- Soil
- Compost
- 3 buckets, bowls, or other vessels
- Six-pack planting containers, one per group
- Spoon, one per group
- Popsicle sticks or other markers
- Pens

- Solid trays to hold planting containers
- Measuring cups
- Rulers

PREPARATION

- Make copies of the student handouts. For the "Fruit and Vegetable Adjectives" student handout, you may make one copy for each small group or table, or project it onto a screen for the whole class to see.

For Taste Test

- Purchase two or three different varieties of California-grown radishes, or use radishes from your school garden. Possibilities include Cherry Bell, Daikon, French Breakfast, and Watermelon radishes. Depending on the size of the radishes, you will need at least two or more radishes of each variety.

- Wash the radishes. For each variety, leave one radish whole and cut the others into bite-size pieces. Place the whole radish and pieces on a serving tray. Provide toothpicks for picking up samples.

- Read over the Savoring California: A Comparative Tasting of California Fruits and Vegetables lesson (http://www.ecoliteracy.org/sites/default/files/CEL-CA-Thursdays-Tasting-Lesson.pdf).

For Radish Growing Investigation

- Plan whether students will plan and design the investigation, or whether you will have them follow the suggested procedure. In either case, you will want to help students understand the importance of a fair test. That means keeping all variables the same, except for the one thing being tested—in this case, the soil. The size of container, the amount of water and sunlight, and the number of plants in each condition must be the same.

- To follow the suggested procedure, prepare three different planting soil mixes in three different buckets or other vessels and moisten with water:

- Soil Only – the soil should be dug up from the school grounds or other location (not potting soil). Remove any pebbles and break up any lumps.
- Compost Only – the compost may be collected from a home or school composting bin or a municipal facility, or purchased from a garden or hardware store. It should be a rich brown, with few recognizable plant parts.
- Mixture of Soil and Compost – a mixture of two parts of the soil with one part of the compost.

- Obtain radish seeds. Choose a small, round radish variety that takes 20–30 days to produce mature radishes. Possible varieties include:
  - Cherry Bell (the standard table radish)
  - Perfecto (a red, round radish)
  - Ping Pong (a white, round radish)
  - Sparkler (a round radish that is scarlet on top and white on the bottom)

- For the suggested procedure, you will need 18 seeds for each group of students, three for each cell in a six-pack planting container. (There are approximately 90–140 radish seeds per one-gram package.)

SAFETY NOTES

- Have students wash their hands thoroughly before doing the taste test.
- Know the source of the soil you use in the lesson and avoid soil that may contain lead or other contaminants.
- Be soil safe. Make sure that students wash hands thoroughly with soap and water after handling soil. Keep desks and tabletops clean and soil-free by sponging with soap and water. Do not allow snacks or other food to be consumed or placed near soil.

DIRECTIONS

1 Ask students whether they have ever eaten radishes. Ask, "What part of the plant do we eat? How do you think radishes grow?" Discuss students' responses, encouraging them to provide evidence for their views.

2 Direct students to read "10 Facts about Radishes" student handout. Ask them to summarize what they learned from the reading. Using information from the Background, lead a discussion about what compost is and how it is made. Invite students to share any additional facts they know about radishes or about compost.

3 Show students the radishes you have prepared for the taste test. Conduct a comparison tasting of the radishes, following the suggestions in the Savoring California: A Comparative Tasting of California Fruits and Vegetables lesson (http://www.ecoliteracy.org/sites/default/files/CEL-CA-Thursdays-Tasting-Lesson.pdf). Encourage students to use descriptive terms to describe the radishes' appearance and taste, with the "Fruit and Vegetable Adjectives" student handout as a guide.

4 Ask students how they might be able to test whether compost really does help radishes grow, as claimed in "10 Facts about Radishes" student handout. How might they design the experiment? How would they make sure it is a fair test?

5 Use their suggestions to plan an investigation, or set up an experiment as follows:

- Give each group of students a six-pack planting container.
- Help students use spoons to fill the cells with the soils you have prepared (see Preparation), two cells for each soil.
- Have students plant three radish seeds in each cell by making a small hole with their finger, placing the seeds in the hole, and then covering the seeds with soil. (The extra seeds ensure that at least one seedling will germinate in each cell.)
- Provide popsicle sticks for students to label each cell. Labels should include a cell number and the type of soil it contains (Soil Only, Compost Only, or Mixture).

- Put all the six-pack containers onto trays and place them in a sunny spot outside, or under a grow light indoors.
- Have one pair of students water all the cells, measuring the same amount of water into each cell.

6 In a few days, check to see whether the seeds have germinated. When they do germinate, students should carefully thin any extra plants so that there is one plant in each cell. (You may want to help with this.)

7 Follow the growth of the plants for four to six weeks. Water as needed so that the soil stays moist, but not wet. When watering, the same quantity of water should be added to each cell.

8 Once a week, have students measure and record the height of the plant in each cell, count the number of leaves on each plant, and measure the width of the stem. They should also note whether any plants die.

9 When the radishes look ready, students may harvest them. Invite students to note any differences or similarities they observe among those grown in different soil types.

EXTENDED LEARNING

- Make a simple snack with student-grown radishes. Layer thin radish slices on top of butter or ricotta cheese on toast. You may drizzle with olive oil and add salt and pepper, as desired.
- Use Harvest of the Month materials to explore other aspects of radishes (see Resources).
- Start a worm composting project at your school. (See Resources for an article about one school's program.)
- Visit a local farm or farmers market to learn about other radish varieties grown in your area. (See Resources to locate a farmer's market near you.)

RESOURCES

- *Harvest of the Month—Root Vegetables*. http://harvestofthemonth.cdph.ca.gov/documents/Fall/21712/Ed_News_Roots_Tubers.pdf.
- "How Worms Saved a School District Over $6,000 in Dumpster Fees" by Binet Payne. https://www.ecoliteracy.org/article/how-worms-saved-school-district-over-6000-dumpster-fees.
- *National Farmers Market Directory. https://www.ams.usda.gov/local-food-directories/farmersmarkets.*

ASSESSMENT

Have students create graphs of their findings and, using evidence from the investigation, write a paragraph answering the question of which type of soil is best for growing radishes.

BACKGROUND

The radish is a fast-growing crop that germinates well in cool temperatures, making it ideal for spring and fall plantings. As a member of the Brassicacea (brass-ih-KAY-see-ee) or mustard family, radishes are related to arugula, broccoli, cabbage, cauliflower, collards, horseradish, kale, and turnips.

All parts of the radish are edible, including the root, leaves, flowers, seeds, and seedpods. Radish seeds were an important source of oil in ancient Egypt, and certain varieties of radish are still grown for oil production today.

You can add radishes to salads, make a quick pickle using rice wine vinegar, eat them with fresh cheese, or cook them in a curry or stir-fry.

THE HISTORY OF RADISHES

Scientists believe that the radish originated in the eastern Mediterranean region, but do not know its exact history. It was an important food crop in Egypt by

2000 BCE, and spread to China by about 500 BCE and to Japan around 700 CE. It reached Britain in the mid-16th century and was one of the earliest crops brought to North American by colonists. It is now grown throughout the world, with different varieties suited to different environmental conditions.

RADISH VARIETIES

There are many different varieties of radishes. Some common ones include:

- Black Radish – a round radish, with a dull, black skin encasing a crisp, white flesh
- Daikon – a carrot-shaped radish that grows up to 18 inches long, with a smooth, white skin
- Easter Egg Radish – a globe-shaped radish that comes in multiple colors
- French Breakfast Radish – an elongated radish, with rose-colored shoulders and a white root end
- Cherry Bell Radish – a red, round radish, with a translucent white flesh
- Watermelon Radish – a round radish with a pale green skin that surrounds a pinkish-red flesh
- White Icicle Radish – a long and tapered radish with a crispy, white flesh

CALIFORNIA RADISH CROP

Due to its generally mild climate, California produces radishes year-round and is a leading producer of radishes in the United States. Each year, more than 20,000 tons of radishes are grown in California.

HEALTH BENEFITS OF RADISHES

Radishes are rich in vitamin C, folic acid, and potassium. They are also high in fiber and low in calories.

SELECTING RADISHES

When selecting radishes for this lesson, take advantage of the wide array available at farmers markets, home gardens, or your local grocer. Look for radishes that are brightly colored and free from cracks and nicks. Give them a squeeze to make sure there's no hollow or soft center. Their tops should be bright green and not wilted. Store radishes in a plastic bag in the refrigerator.

GROWING RADISHES

Radishes are one of the easiest vegetables to grow. As a cool-season crop, they grow best when the seeds are started in either late summer to early fall or in the spring.

Whether growing radishes in containers or in the garden, choose a location for the plants where they will get at least six hours of direct sunlight and will be protected from high winds. When growing in containers, make sure that they have good drainage holes.

Sow the radish seeds by digging a shallow hole in the soil, placing seeds in the hole, and covering with about 1/4 inch of soil. Keep the soil evenly moist. If using containers, make sure that they are not constantly sitting in water and remove any standing water that may collect in the trays.

The seeds will germinate in three to four days. As the plants grow, the roots will begin to swell to form the vegetable. Keep the tops of the roots covered with soil to prevent splitting and drying. Harvest radishes as soon as they are an edible size.

WHAT IS COMPOST AND HOW IS IT MADE?

Compost is a mixture of rotted leaves, food scraps, and other plant materials that can be added to soil to make it richer. Bacteria, fungi, insects, and other tiny animals living in the soil break these materials down into fine particles.

The average American throws out four and a half pounds of trash every day, over a pound of which is kitchen and garden waste. Composting is a natural way to reduce waste and to fertilize soil.

The easiest way to make compost is to use a compost bin, which can be fashioned from an old trash can, wood pallet, or chicken wire. Place the bin in a sunny location and fill with alternate layers of "green" and "brown" materials (see below). Cover the top layer with garden soil. Keep the bin moist. In approximately 6–9 months, you will have compost.

"GREEN" COMPOST MATERIALS

- Vegetable and fruit scraps
- Grass clippings
- Coffee grounds and tea bags
- Plant trimmings
- Eggshells

"BROWN" COMPOST MATERIALS

- Dry leaves
- Wood chips
- Straw
- Cornhusks
- Newspaper

THE FOLLOWING THINGS SHOULD NEVER GO IN THE COMPOST BIN:

- Ashes
- Pet waste or cat litter
- Meat, fat, grease, oils, or bones
- Anything toxic

STUDENT HANDOUT

10 FACTS about radishes

1. Radishes

are members of the **mustard family.** They are related to cabbage, kale, broccoli, cauliflower, and horseradish.

2. Some farmers grow **carrot-shaped white radishes** to prepare the soil for other crops. The radishes make deep holes that loosen the soil.

3. Radishes' **peppery flavor** comes from sulfur compounds called isothiocyanates (eye-so-thigh-oh-SIGH-uh-nates). These compounds protect the plant from being eaten by animals.

4. People use **radish seed oil** for cooking and to make skin and hair moisturizers.

5. The radish we eat is the **swollen root** of the plant. All parts of the radish plant—including the leaves, the flowers, and the seeds—are edible.

6. To grow their best, radishes need **moist soil with plenty of nutrients.** Adding compost to soil helps it to hold water and adds nutrients.

7. There are **hundreds of varieties** of radishes. People around the world eat them for lunch, dinner, and even breakfast.

8. Radishes grown in cool weather **taste milder** than ones grown in hot weather.

9. In Mexico,

radishes have their own festival, called **Night of the Radishes.** Each December 23rd, people in the city of Oaxaca (wah-HAH-kah) carve radishes into animals, buildings, saints, or other shapes and compete for the best design.

10. The biggest radish ever recorded was 3 feet long and weighed **100 pounds.**

NAME:________________________________

SEE HOW THEY GROW!

Which type of soil is best for growing radishes—soil only, compost only, or a mixture of soil and compost? Check your radish plants once a week. Measure the height, count the number of leaves, and measure the thickness of the stem. Record your findings below.

Date	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
	Soil:	Soil:	Soil:	Soil:	Soil:	Soil:
	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:
	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:
	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:
	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:
	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:	Height: Leaves: Stem:
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CENTER FOR ECOLITERACY

ABOUT THE CENTER FOR ECOLITERACY

The Center for Ecoliteracy is an internationally recognized leader in systems change innovations in education for sustainable living. Since 1995, the Center has engaged with thousands of educators from across the United States and six continents. The Center offers publications, seminars, academic program audits, coaching for teaching and learning, in-depth curriculum development, keynote presentations, and technical assistance. Books authored or coauthored by the Center for Ecoliteracy include *Ecoliterate: How Educators Are Cultivating Emotional, Social, and Ecological Intelligence* (Jossey-Bass, 2012); *Smart by Nature: Schooling for Sustainability* (Watershed Media, 2009); and *Ecological Literacy: Educating Our Children for a Sustainable World* (Sierra Club Books, 2005).

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