Dig 'Em Up

Grade Levels

K - 2

Purpose

In this lesson students will investigate the functions of roots, recognize the difference between a tap and fibrous root system, and identify the roots of some plants as edible.

Estimated Time

Two 45-minute sessions and observations for two weeks

Materials Needed

Interest Approach — Engagement

- Carrot, radish, potato, rutabaga, sugar beets
- House plant such as a fern or a spider plant

Activity 1: Root Identification

- Carrots with the green tops attached, 1-2 per group
- Grass plants (weed) with roots attached, 1-2 per group
- Newspaper
- Plastic bags, 1 per group
- Hand lenses, 2-4 per group
- Rulers, 2-4 per group
- *Root Identification* activity sheets*, 1 per group*

- *Roots T-Chart,* 1 per group

Activity 2: Plant and Root Growth

- Chart paper
- 1 clear plastic cup
- 1 paper towel
- 3-5 radish seeds
- Water
- Centimeter ruler to measure root growth
- *Dig 'Em Up* observation sheet

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

- Dig 'Em Up observation sheet (https://cdn.agclassroom.org/media/uploads/2015/09/14/Dig_Em_Up.pdf)
- Root Identification Activity Sheet (https://cdn.agclassroom.org/media/uploads/2015/12/01/Root_Identification_Worksheet.pdf)
- Roots T-Chart (https://cdn.agclassroom.org/media/uploads/2015/12/01/Roots_T-chart.pdf)

Vocabulary Words

fibrous root system: formed by thin, moderately branching roots that grow from the stem found in grasses, ferns, and most flowering plants

harvest: process or period of time a farmer gathers crops such as corn, potatoes, rice, or any agriculture commodity

root hairs: tiny, microscopic outgrowths attached to the outer layer of the main roots that help absorb water and nutrients from the soil

roots: portion of a plant that anchors it in the soil and takes up water, air, and nutrients for feeding the remaining parts above ground

tap root system: a straight tapering root growing vertically downward, usually edible and found in carrots, radishes, turnips, and beets

tuber: the short, thickened, fleshy part of an underground stem, which can grow new shoots (a potato is a tuber)

Did You Know? (Ag Facts)

- A rutabaga is a natural cross between a turnip and a cabbage.[1]
- Both tuber crops, the potato and the sweet potato were listed as one of the ten most important crops in the world.[2]
- Roots contain tiny root hairs that help absorb water and nutrients from the soil.[1]
- There are two main types of root systems; tap roots and fibrous roots.[1]

Background Agricultural Connections

This lesson is part of a series called, *Edible Plant Parts.* These lessons allow students and teachers to examine the six basic plant parts—roots, stems, leaves, flowers, fruits, and seeds—in a unique way. Through hands-on activities, students will learn about the different plant parts, as well as how to include fruits and vegetables into their daily meals as part of a healthy diet. Students will also learn about **agriculture** and the people who produce our food. The remaining lessons can be found at the following links:

- Why People Need Plants (https://agclassroom.org/matrix/lesson/46/)
- *Dig 'Em Up*
- Snappy Stems (https://agclassroom.org/matrix/lesson/321/)
- Luscious Leaves (https://agclassroom.org/matrix/lesson/47/)
- Fabulous Flowers (https://agclassroom.org/matrix/lesson/93/)
- Freshest Fruits (https://agclassroom.org/matrix/lesson/322/)
- Supreme Seeds (https://agclassroom.org/matrix/lesson/323/)
- Edible Plant Game (https://agclassroom.orghttps://agclassroom.org/matrix/resource/115/)
- Eat 'Em Up (https://agclassroom.org/matrix/lesson/324/)

Students will be fascinated to learn that when eating carrots, sugar beets, potatoes, or radishes for dinner they are eating roots**. Roots** typically have four functions—anchoring the plant in the soil, absorbing nutrients such as water and minerals, transporting nutrients to other parts of the plant, and storing food. Acting as a lifeline to a plant, roots transport nutrients to the leaves for proper growth. Roots also help prevent soil erosion by keeping the soil in place. For this lesson, students' experience with eating vegetables that live and grow underground is required for helping them gain an understanding for the functions of roots and their nutritional value when eaten.

There are two types of root systems—fibrous and tap. **Fibrous roots** are normally formed by thin, moderately branching roots that grow from the stem. These types of roots are not edible and can be found in plants such as grasses, ferns, and most flowering plants. A **tap root** system is characteristic of the roots that we eat such as carrots, beets, radishes, and turnips. The tap root is a straight tapering root growing vertically downward, rather than branching out as seen in a fibrous root system. Both root systems have tiny, microscopic outgrowths from the outer layer of the roots called **root hairs** that help absorb more water and nutrients from the soil.

Roots are an important part of the agricultural plant production process for farmer. A healthy root system underground grows a healthy plant above ground. Roots take in nutrients, air, and water which help crops produce higher yields during **harvest**, the time or process in which grain, vegetables, or fruit is picked. Roots also provide stability to plants during harsh weather conditions such as high winds and rainfall. If any developmental stage of the root system is compromised, the plant could suffer and produce lower crop yields.

For some plants, such as rutabagas, radishes, carrots, and sugar beets, the root is the crop. These root crops grow best in loose, well-drained soil and people eat these roots to obtain essential nutrients for a healthy diet. **Tubers**, such as potatoes and sweet potatoes, are also known as a type of root crop. A tuber is a short, thickened, fleshy part of the plant that grows an underground stem which can grow new shoots. Tuber crops are different than root crops because they contain an enlarged stem rather than a root, if cut up a tuber can grow a plant of itself, and a tuber contains more starch than a root crop. Both root and tuber crops provide a large source of carbohydrates in addition to vitamins and minerals.

Interest Approach - Engagement

1. Display a carrot, radish, potato, rutabaga, and sugar beets.
2. Ask the following questions:
   - What are the names of these vegetables? (*carrot, radish, potato, rutabaga, sugar beets*)
   - Where do these vegetables grow? *(in a garden or a farmer's field*)
   - Where can you purchase these vegetables? *(grocery store or farmer's market*)
   - Who grows these vegetables for us to eat? *(farmers or gardeners)*
   - Do these vegetables grow above ground or underground*? (underground)*
3. Record the student responses on your whiteboard or poster paper. Use the student responses to explain that the plant roots displayed are also called root crops and tubers. Root crops are produced underground, underneath the top layer of soil. They can be grown in a garden or in a field by a farmer. Root crops produce edible vegetables that provide nutrients for a healthy diet.
4. Ask the students if they have ever eaten a root.
5. Show the students the roots of a house plant such as a fern or a spider plant. Ask if they look the same or different than the root crops. Ask the students, "Are these roots edible?" Discuss the differences and help them understand that all roots provide an anchor for the plant in the soil and take up nutrients for the plant; however, some roots are edible and some are not.
6. Tell the students they will be learning about plant roots today.

Procedures

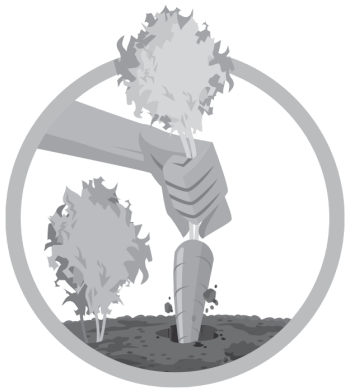
Activity 1: Root Identification

1. Place the students in groups of four. Tell them they will be going on a short walking field trip to gather a few roots. (If time is an issue, gather the examples of roots for each group before class begins).
2. Give each group of students a plastic bag for gathering their roots. Instruct each group to pull weeds (grass plant) from a school garden or another permitted section of the school grounds. Demonstrate how to pull a weed such that the roots stay intact before having the students find their own.
3. Make sure each group has at least two fibrous root system examples before taking the students back into the classroom.
4. Place newspaper down on the desks or tables and provide a hand lens and ruler for each group to examine the roots carefully.
5. Instruct each group to spread out their roots onto the newspaper and try to remove as much soil as possible so that the root hairs can be examined with a hand lens.
6. Give each group a carrot with the greens attached. Make sure to identify the difference in the root system between the grass plant (fibrous roots) and the carrot (tap root). Ask the following questions:
   - Which root can we eat*? (carrot)*
   - How are these roots different*?"(grow differently; tap root grows vertically and fibrous roots grow horizontally)*
   - How are these roots similar*? (both root systems have the same 4 functions listed in the Background Agricultural Connections)*
   - What do you see with the help of the hand lens on each root system*? (tiny root hairs)*
   - What do you think is the job of root hairs*? (help the roots absorb more water and nutrients from the soil)*
   - Why are root systems important to farmers*? (a good root system produces healthy crops and vegetables)*

7. Have the students compare the carrot and grass plant by measuring and drawing each example on the *Root Identification worksheet*.
8. Instruct each group to share their drawings and measurements with the class.
9. For further understanding, use the *Roots T-Chart* to record the student answers for the following questions:
   - Which root system would give a plant the best anchoring or hold in the soil*? (Tap roots)*
   - Which root system absorbs water and nutrients from the soil*? (Tap and fibrous roots)*
   - Which root system do you think would die first because of lack of water*? (Fibrous roots)*
   - Which root system grows vertically*? (Tap roots)*
   - Which root system grows horizontally*? (Fibrous roots)*
   - Which root system transports nutrients to the plant's leaves for proper growth*? (Tap and fibrous roots)*
   - Which root system do you think corn would have if you saw the stalks laying down in a field after a thunderstorm*? (Fibrous roots)*

Activity 2: Plant and Root Growth

1. Post a large piece of chart paper in front of the room.
2. Check the students' understanding of the function of roots. Review that roots help hold the plant in place, take up water and nutrients from the soil, transport food, and store food for the plant. Write this information on the chart paper.
3. Display the selection of edible roots that you have brought in for the class to examine and assist the students in identifying them. Add any new edible roots to the list.
4. Using a clean cutting surface and knife, cut the washed roots into bite-sized pieces. Have students wash their hands and taste the vegetables.
5. Create planters for observing radish seed growth. Give each student a clear plastic cup. Have students fold up a paper towel and place it inside the side of the cup. Have students pour just enough water into the bottom of the cup so that the water wicks up the paper towel. Once the paper towel is moistened all the way to the top, have students place three to five radish seeds between the paper towel and the side of the cup, about one inch from the top of the paper towel.
6. Observe the seeds daily. Every 4-5 days, measure root growth in centimeters with a ruler and record observations on the sheet provided



Concept Elaboration and Evaluation:

At the conclusion of this activity, review and summarize the following key concepts:

- The roots of some plants are edible.
- Roots anchor plants in the ground, absorb water and nutrients from the soil, transport food, and store food for the plant.
- Farmers grow plants for us to eat.
- Roots such as carrots, radishes, turnips, rutabagas, ginger, and parsnips are healthy foods.

ELL Adaptations

- This lesson incorporates hands-on activities. Kinesthetic learning events provide an excellent learning environment for the English language learner.
- Allow students to watch you set up the experiment and any variations prior to having students set up their own experiments. ELL students will benefit from observing the procedures before they get started.
- Model the Think, Pair, Share method: After seeing edible root vegetables, have students turn to a partner and say, "_____ are roots that we eat."

We welcome your feedback (https://usu.co1.qualtrics.com/jfe/form/SV_4HhIVpN4L8IC2lT)! Please take a minute to tell us how to make this lesson better or to give us a few gold stars!

Enriching Activities

- Read aloud the book *Tops and Bottoms* by Janet Stevens. Stop and discuss which vegetables planted in Bear's garden had tap roots or fibrous roots. Have the students determine that the tap roots are edible vegetables found underground and fibrous roots produce edible vegetables found above ground. If a copy of the book is not available, you can find a read aloud (https://www.youtube.com/watch?v=Qj7_IdQTZBc) on YouTube.

Sources

Activity 2

This lesson update was funded by a grant from the Network for a Healthy California.

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Ag Facts

1. https://bonnieplants.com/library/the-importance-of-roots/ (https://bonnieplants.com/library/the-importance-of-roots/)
2. http://www.businessinsider.com/10-crops-that-feed-the-world-2011-9?op=1 (http://www.businessinsider.com/10-crops-that-feed-the-world-2011-9?op=1)

Suggested Companion Resources

- Edible Plant Game (https://agclassroom.org/matrix/resource/115/)
- What Do Plants Need to Grow? (https://agclassroom.org/matrix/resource/268/)
- Wisconsin Fast Plants® (https://agclassroom.org/matrix/resource/364/)
- A Gardener's Alphabet (https://agclassroom.org/matrix/resource/137/)
- Amazing Plant Powers: How Plants Fly, Fight, Hide, Hunt, & Change the World (https://agclassroom.org/matrix/resource/293/)
- Carrots Grow Underground (https://agclassroom.org/matrix/resource/1003/)
- Grandma Lena's Big Ol' Turnip (https://agclassroom.org/matrix/resource/1055/)
- How Food gets from Farms to Store Shelves (https://agclassroom.org/matrix/resource/360/)
- Plants Feed Me (https://agclassroom.org/matrix/resource/337/)
- The Carrot Seed (https://agclassroom.org/matrix/resource/1004/)
- The Giant Carrot (https://agclassroom.org/matrix/resource/1011/)
- Tops & Bottoms (https://agclassroom.org/matrix/resource/134/)
- Eat Happy Project video series (https://agclassroom.org/matrix/resource/822/)
- Sweetpotato Ag Mag (https://agclassroom.org/matrix/resource/1044/)
- Grow it Again (https://agclassroom.org/matrix/resource/359/)

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