

kidsGARDENING^{.ORG}

LESSONS TO GROW BY

Plant Parts

This month we are investigating important botany basics by studying plant parts. Take a look around your yard or a nearby green space and you will most likely notice a great diversity of plants. From tall trees with woody stems to the soft, creeping grass along the ground, plants can be found in a wide variety of colors, shapes, and sizes. Despite their differences in appearance, plants share a common set of parts. Learning about how the different parts function is essential to exploring plant growth and development. This foundational knowledge also contributes to our understanding how to care for the plants in our gardens and environment.

Week 1: Roots

Learning Objectives

This week kids will:

- Learn about the function and structure of roots
- Investigate the water-absorbing capabilities of roots
- Explore plant roots we eat

Materials Needed for the Week

Activity 1: Root Observation

- Root for Roots reading page
- Example of a plant with a taproot [possible examples: carrots (with leaves), beets (with leaves), dandelion, pine tree seedling]
- Example of a plant with fibrous roots (possible examples: lettuce, grass, most annual bedding plants)
- Root Observation Worksheet
- Ruler
- Magnifying glass (optional, but highly recommended)
- Ball of string (optional)

Activity 2: Watering Experiment

- Two (or more) small plants of any type in containers
- Plastic bag(s) or plastic film
- Tape
- Watering can
- Spray bottle
- Watering Experiment Observation Worksheet

Activity 3: Roots We Eat

- My Vegetable Cooking Guide Worksheet
- Recipe book or online recipe website
- Index Cards (optional)
- Root vegetables (such as carrots, beets, radishes, turnips, or sweet potatoes) (optional)

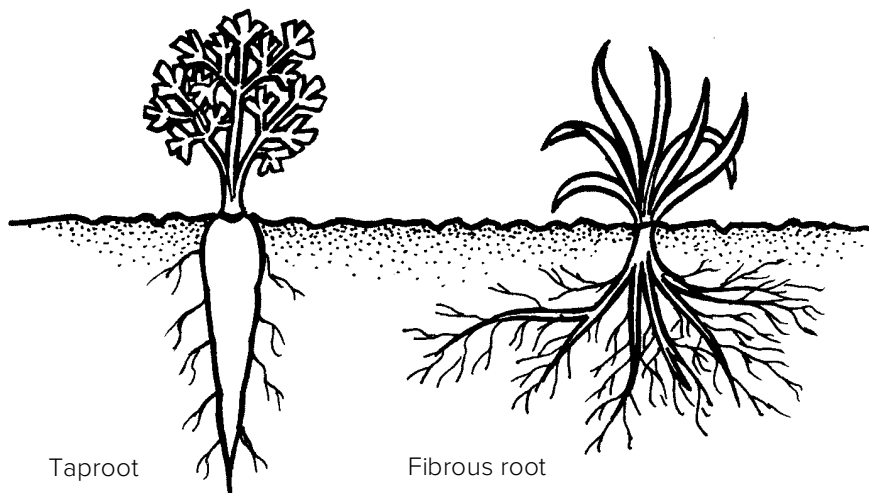
Introduction

It is the job of roots to absorb the water and nutrients a plant needs to grow and thrive. They also provide support for the plant and anchor it in the soil.

As a seed germinates, the first part to emerge is the primary root. It is the initial anchor for the plant and begins to absorb water and minerals so the shoot can develop. From that point, root development takes one of two directions depending on the plant.

Some plants have a one main root called a taproot with just a few smaller secondary roots. Reaching deep into the soil, these long, strong roots pull up nutrients from far below the surface. Dandelions are a common example of a plant with a taproot. In some plants, taproots are specialized to also be a storage site for starches and sugars. Common examples of taproots with this capability include carrots, radishes and beets.

Other types of plants have a fibrous root system — a network of small- to medium-sized roots that spread wide in the soil. Fibrous roots play an important role in soil stabilization and, even though they are not as deep as taproots, they may reach far beyond the footprint of the plant above ground. Grass plants are great examples of fibrous roots to study. One scientist measured all the roots of a single rye plant and found that if they were laid end to end in a line, their length would total 387 miles!



Both taproots and fibrous roots are covered in tiny root hairs that perform much of the water and nutrient absorption. They are very fragile, which is one of the reasons why it is important to be gentle when planting new plants and digging around established plants.

Along with their contributions to the plant, the network of roots is an important part of the soil ecosystem. Roots help break down rock to build soil and also prevent soil from eroding in the rain and wind. As plant roots grow through cracks in rocks, they break off tiny pieces of rock, which assists in the long, slow process of soil formation. Some roots even produce substances that help dissolve rocks. When living, roots aerate and loosen soil, and provide tunnels for burrowing insects and animals. When dead and decomposed, they contribute to the rich humus in the soil. The extensive network of roots and root hairs also create a strong hold on soil particles. They keep soil from eroding away in ice, water, and wind.

Activity 1: Root Observation

1. Together or independently, read the **Root for Roots** reading page. Have your kids complete the reading comprehension questions and then discuss your answers together.
2. To build on the reading page, obtain at least one example of a taproot and one fibrous root for kids to compare. Possible taproot examples include carrots or beets from the grocery store (select ones that still have their leaves so your kids can picture what they look like when growing in the garden) and dandelions (a common weed found in lawns across the country; make sure to dig deep to get the full root). Although their root growth may change to a fibrous root system over time, many trees also start their lives with a taproot. If you can find tree seedlings in areas you do not want them (such as in flower pots or vegetable garden beds) you can pull them up for observation.

For your fibrous root example, most grass plants have fibrous roots and can be readily found in yards and greenspaces across the country. Lettuce plants also provide really nice examples of fibrous roots, as do most annual bedding plants.

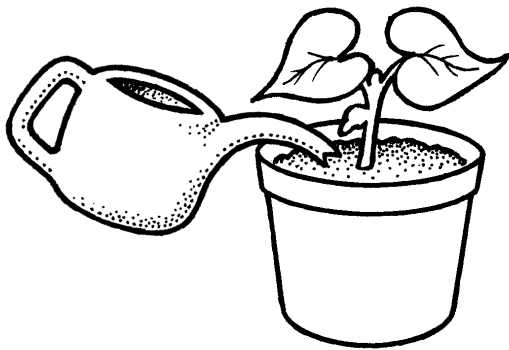
Gather a copy of the **Root Observation Worksheet**, a ruler, and, a magnifying glass (if available).

3. Very, very gently, remove the soil from the roots. If the soil is dry, you may be able to shake and/or carefully brush it off. If the soil is moist, swish the roots in a basin of water to wash away the soil, then allow to dry. Have kids measure the roots and then draw a picture of them on the **Observation Worksheet**. If you have a magnifying glass, have them look for the root hairs.
4. Talk about the differences between the two different kinds of roots. Ask kids to list some of the benefits of each kind of root. To spark discussion, ask: Are there some environments that one type of root might be better suited to than another? Do you think soil depth influences plant roots? What about space availability?
5. As an extension to this activity, share that the roots of a plant may extend much further below ground than the leaves extend above ground. A mature tree's root system may extend out two to three times farther from the trunk of the tree than the canopy. To visualize this, use a ball of string to measure the length from a trunk to the edge of the tree's canopy (a radius). Have one person stand at the trunk and hold the end of the string and then have a second person walk to the edge of the canopy in a straight line. You can measure the length if you wish. Then have the person at the edge of the canopy pivot, and have the person at the trunk walk away from the tree in the same line that same distance. Repeat again. Wow, that is a lot of roots!

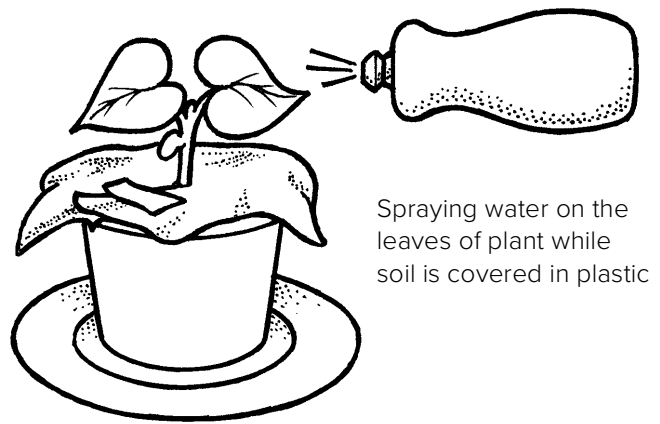
Activity 2: Watering Experiment

We have told you that taking in water for the plant is one of the most important jobs of the roots. In this activity, kids help set up a simple experiment to test if that is true.

1. Obtain at least two plants in containers. The kind of plant used can vary; houseplants or outdoor bedding/landscape plants will both work. However, you want to pick out two of the same kind of plant and also try to find two that are approximately the same size. If you do not have access to established plants, you can also start a few bean seeds (from the dry bean aisle at the grocery store) in small pots of soil or even in a cup with wet paper towels, and then perform this experiment after giving them a couple of weeks to establish roots and a few leaves.
3. Start by making sure the growing media in the containers is equally moist. Next, cover the top of one of the pots around the stem with a secure layer of plastic film so that the soil will not get wet.



Watering the roots of the plant



Spraying water on the leaves of plant while soil is covered in plastic

4. Over the next couple of weeks, water the soil of the plant without plastic using a traditional watering can or water bottle. Water the plant with the plastic covering the soil by spraying the leaves directly with a spray bottle. Use the **Watering Experiment Worksheet** to track your observations.
5. After a couple of weeks, compare your results. The time it will take to see a difference between the two watering techniques will vary depending on the type of plants you chose and how long it takes for the plastic-covered plant to run out of water in its existing soil. At the end of your observations ask kids, Did our experiment prove that plants take in water through their roots? Why or why not? How can we apply this information in our garden?

Activity 3: Roots We Eat

Because some roots store sugar and starches for plants, many are sweet and nutritious food sources for humans and other animals. Sweet potatoes, carrots, beets, turnips, and radishes are some of our common vegetables that are actually plant food storage roots. The root of the tropical plant cassava is used to make tapioca and although not as common in the United States, it is a food staple in many tropical countries. Another root crop of note is the sugar beet; between 55% and 60% of the sugar produced in the US comes from the roots of sugar beets.

1. Make a list of all of the common roots that we eat. Your list may include: carrots, sweet potatoes, beets, turnips, parsnips, and radishes. A couple of less common root vegetables you may brainstorm include cassava, rutabaga, and jicama. If possible, let kids join you on your next trip to the grocery store or farmer's market and see if they can spot the root vegetables.

2. Talk about and research some of the nutritional benefits of eating root crops. You can use the Nutrition Information for Raw Vegetables Chart from the USDA to get you started at:

<https://www.fda.gov/food/food-labeling-nutrition/nutrition-information-raw-vegetables>

California's Department of Public Health offers a comprehensive set of Harvest of the Month newsletters for educators and families that provides excellent resources to dig deeper into the root crops available at: <https://harvestofthemoth.cdph.ca.gov/Pages/Downloads.aspx>

3. Create your own Root Vegetable Cooking Guide featuring one or more of the vegetables you explored in Step 2. You can use the **My Vegetable Cooking Guide** worksheet or just use index cards and draw a picture of the vegetable on one side and record some of the facts you discovered about that root crop on the other side.

4. Search through recipe books and online recipe websites to find recipes to go with your root vegetable worksheets, noting which ones sound most appealing to your kids. Print out or write down recipes you would like to try on index cards or recipe cards and attach them to your cooking guide page. Here are a few cooking website you may want to explore:

ChopChop Family: <https://www.chopchopfamily.org/recipes/>

Cooking Matters: <http://cookingmatters.org/recipes>

Common Bytes: <https://www.commonbytes.org/#!/recipes>

4. If possible, sample some of fresh root crops raw or in salads and also give some of the recipes you found a try. Your kids might just discover their new favorite vegetable!

Digging Deeper

You can use the following resources to dig deeper into this week's lessons:

Books

What do Roots Do? by Kathleen Kudlinski

A beautifully illustrated book, sharing all about roots through rhymes.

Up in the Garden and Down in the Dirt by Kate Messner

A look at what happens above and below the ground in the garden.

Oliver's Vegetables by Vivian French

Journey with Oliver as he tries to find French fries in his grandfather's garden.

Videos

Bean Time Lapse from GPhase: <https://www.youtube.com/watch?v=w77zPAatVTul&t=17s>

Erosion and Soil from Funsciencedemos: <https://www.youtube.com/watch?v=im4HVXMGI68>

How to Make Roots Salad and Roots We Eat Lab Investigation Demo from Big Green's Video Library: <https://biggreen.org/edresources/video-library/>

Roots with Chris from Green Our Planet's Virtual Academy:
https://www.youtube.com/watch?v=4U_jquOzT7g

Additional Related KidsGardening Lessons and Activities to Try

Fruit and Vegetable Art: <https://kidsgardening.org/garden-activities-fruit-and-vegetable-art/>

Plant a Snack Garden: <https://kidsgardening.org/garden-activities-plant-a-snack-garden/>

Plant Parts Salad: <https://kidsgardening.org/garden-activities-plant-parts-salad/>

Kitchen Scrap Gardening: <https://kidsgardening.org/garden-activities-kitchen-scrap-gardening/>

Seed Viewer: <https://kidsgardening.org/garden-activities-seed-viewer/>

Soil Art: <https://kidsgardening.org/garden-activities-soil-art/>

Room to Grow: <https://kidsgardening.org/lesson-plan-room-to-grow/>

Exploring Oliver's Vegetables: <https://kidsgardening.org/lesson-plan-exploring-olivers-vegetables/>