

Introduction

How does a root absorb water and nutrients? Why is water and nutrients stored in the roots? How do roots anchor and support a plant? Students in this lesson will explore roots and learn about the role they play in helping a plant survive.

Objectives

- Students will learn the common types of roots.
- Students will learn the function of roots.
- Student will learn basic parts of a root system.

Materials

- Raisins or dried cranberries
- Water
- Sugar
- 2 Glass cups/bowls
- Roots Worksheet

Background

Flowering plants have four main parts: roots, stems, leaves and flowers. We are going to start at the bottom of the plant with the roots. The first thing to grow out of most seeds is the root.

Watch a Corn Seed Germinate - <https://www.youtube.com/watch?v=aJM3gb4QoJA>

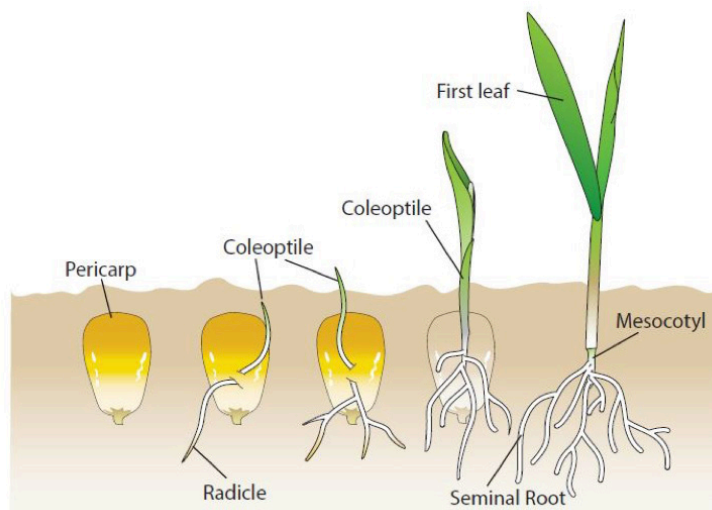


Photo provided by Dr. Ciampitti, KSUCROPS Team, K-State Agronomy and Bob Holcombe, K-State Communications

As we know, plants can come in many shapes and sizes. Roots do not vary nearly as much but there are different kinds of roots.

Even though they can look different, they all have the same three jobs:

1. Absorb water and nutrients
2. Store water and nutrients
3. Support and anchor the plant to the ground

Let's talk about each job.

How does a root absorb water and nutrients?

Nutrients needed for the plant are attached to water. The roots absorb the water through a process called osmosis. Osmosis is the movement of water from an area of high-water concentration through a membrane to an area of lower water concentration. That sounds confusing but think about this, if you put water in the sink and add dish washing soap the sink now has a high concentration of water. Let's pretend that the soap is nutrients. A dry dish cloth has a low concentration of water, if you put the dish cloth in the water, it will soak up the water and the soap. That is kind of like osmosis!

Osmosis is how water moves into roots, but it moves up to the plant using a different method. Besides water, a healthy plant needs 17 elements or nutrients. The ones they need the most are nitrogen, phosphorus and potassium.

Why is water and nutrients stored in the roots?

Plants store water and nutrients in their roots to have available if they need them later. Some plants store lots of water and nutrients. We call those tubers and we often eat them. Carrots and radishes are an example.



Some plants use these stored nutrients to survive the winter. The grass in the lawn is an example of this.



How do roots anchor and support the plant?

Most plants have hundreds of root hairs. In some plants, there can be thousands of root hairs. Each grows and wedges itself tightly among the soil. Have you ever tried to pull up a large plant? It can be very difficult! Not only do roots help keep the plant in place, it helps reduce erosion by holding the soil in place.



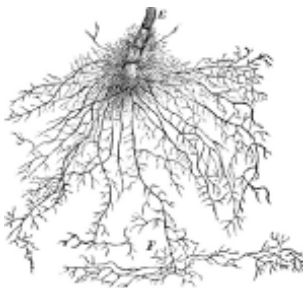
Types of roots

Remember, all roots have the same jobs but they can look different. There are three main types of roots:

1. Tap root



2. Fibrous



3. Adventitious - many times, these are called brace roots.



Parts of roots

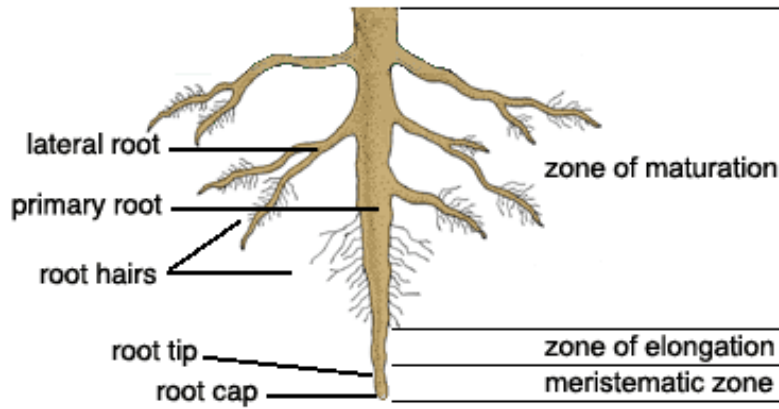
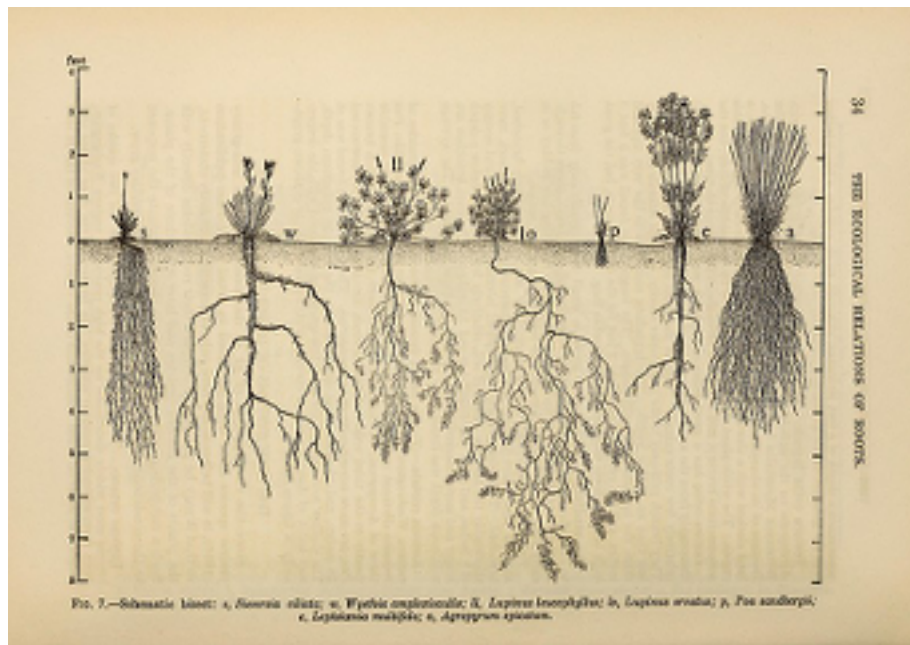


Figure 2. Root Structure

Photo: <https://extension.oregonstate.edu/gardening/techniques/vegetative-plant-parts>

Interesting facts about roots:

- The alfalfa plant grows to around 2 to 3 feet tall but, its roots can grow anywhere from 1 foot deep to 100 feet deep!
- Turnip plant roots can explore up to 100 cubic feet. That is about the size of a closet (2 feet by 6 feet by 8 feet)!
- In order to produce a full-grown ear of corn, a corn plant will absorb around 100 gallons of water!
- Roots come in many shapes and can grow at different depths.



Supplemental videos

- Osmosis provided by It's AumSum Time - <https://www.youtube.com/watch?v=KmQyVWtxeqM>
- The Root System, Different Kind Roots, Tap Root & Fibrous Roots provided by Periwinkle - <https://www.youtube.com/watch?v=-ROXGqBSxl>

Directions

This lab is designed to show you how osmosis works and teach you a few new terms.

Part 1-Create a hypotonic solution:

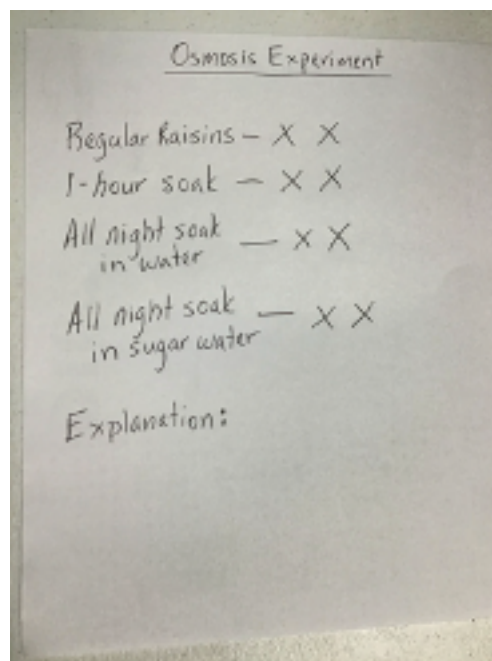
1. Place six raisins or dried cranberries in a bowl with a half cup of water.
2. Let set for at least two hours.
3. Take two of them out of the water and place on a paper towel beside two raisins or dried cranberries that were not in the water.
4. View differences.

Explanation

- When water concentration outside a cell is greater than the concentration inside the cell, it is called a hypotonic solution. Osmosis is the passing of water in high concentration through a membrane to an area of low concentration. The raisins that have been soaking should be bigger because of osmosis.

Part 2-Create a hypertonic solution:

1. Use the other glass cup or bowl.
2. Add $\frac{1}{2}$ cup of sugar and $\frac{1}{2}$ cup of water.
3. Mix thoroughly.
4. Take two raisins or dried cranberries from the first bowl and drop in the sugary water. You should now have two raisins in the first bowl of water, two raisins in the sugary water and two raisins on the paper towel with the two regular raisins.
5. Let set over night.
6. Make a set of notes similar to the one pictured.



7. Place raisins on the appropriate X.
8. View results

Explanation

- When the water concentration inside a cell is higher than the concentration outside of the cell, it is called a hypertonic solution. The raisins in the sugary water should be smaller than the ones that soaked over night. This shows how the water leaves the roots and moves up into the plant.

Test your knowledge. Complete the Roots Worksheet to see what you have learned.

