

# **Unit A: Basic Principles of Plant Science with a focus on Field Crops**

## **Lesson 2:**

## **Understanding Root Anatomy**

# Vocabulary

- ◆ Apical meristem
- ◆ Epidermis
- ◆ Fibrous root system
- ◆ Primary root
- ◆ Root cap
- ◆ Root hairs
- ◆ Secondary roots
- ◆ Taproot system

# What Are the Functions of a Plant's Roots?

- ◆ A plant's health is directly related to its roots

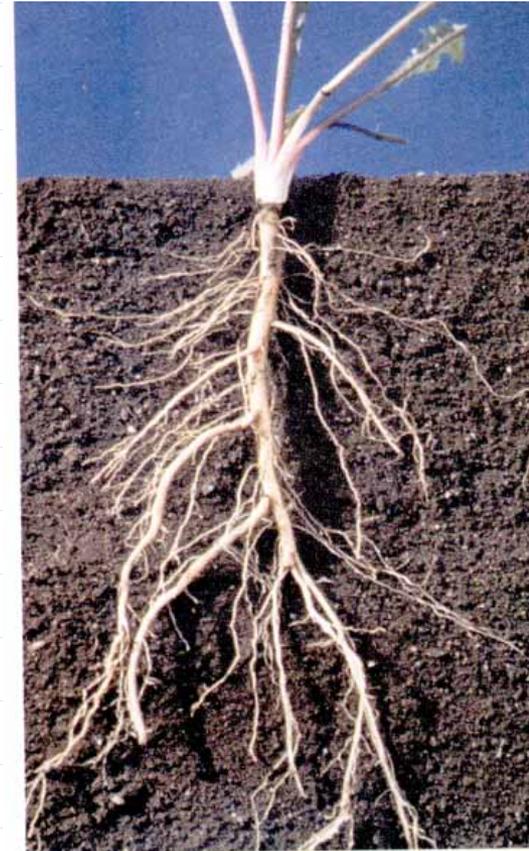


A pot bound plant in need of transplanting

- Weak and diseased roots decrease a plant's health
- Roots need to continuously grow in order to stay healthy
  - ◆ This is why plants become pot-bound: the roots start growing out of the pot because it is too small

# Functions of a Root System

- ◆ 1. Absorb water and minerals from the environment
- ◆ 2. Anchor the plant in the ground
- ◆ 3. Store food that has been made in the leaves by photosynthesis
  - Can be used later by the plant to grow and survive



*Taraxacum officinale* – the common dandelion

# What Are the Parts of a Root?

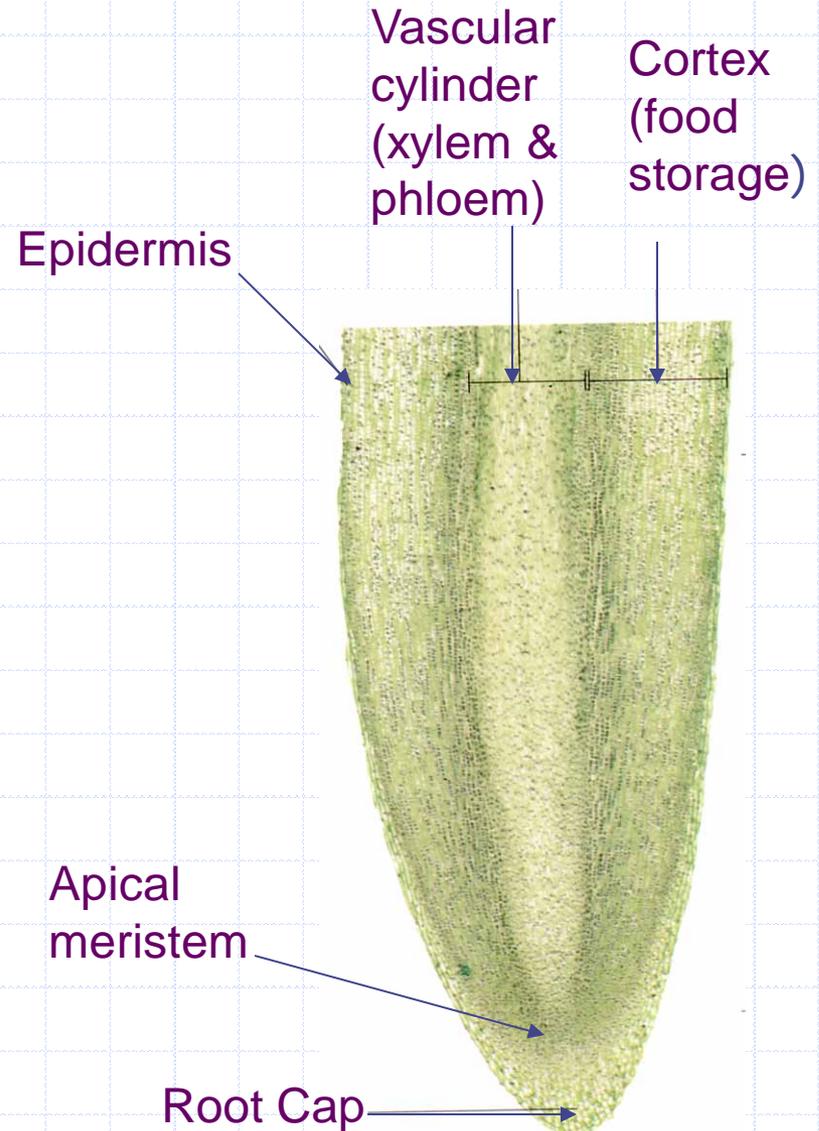


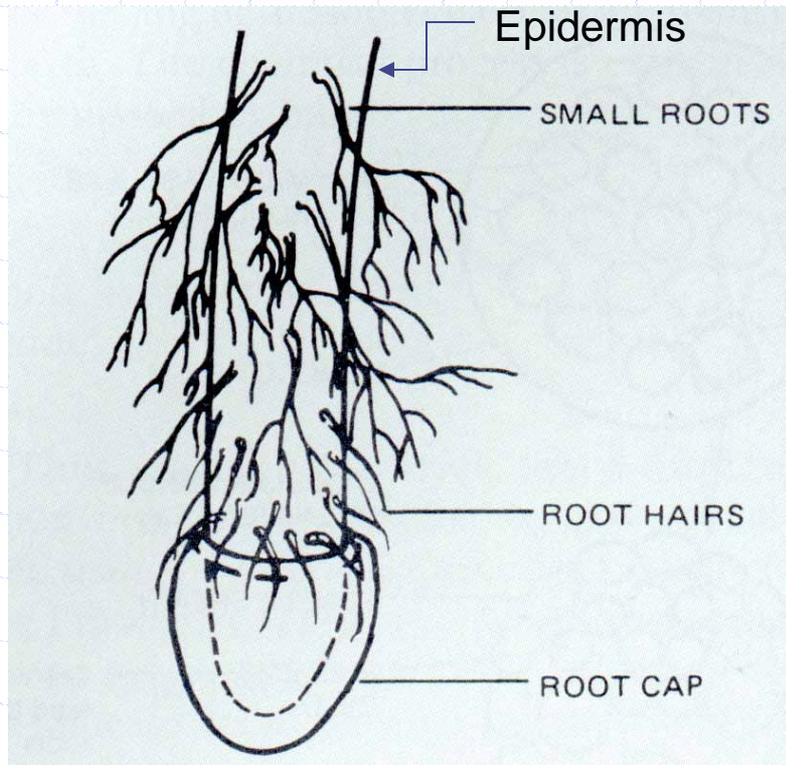
Cotyledon

Radicle = Primary root; notice all the root hairs

- ◆ When a seed germinates, the first structure to appear is the root, or radicle
  - A. It becomes the ***primary root***
    - ◆ Usually the most important root in some plants
  - B. Other roots branch out from the primary root; called ***secondary roots***

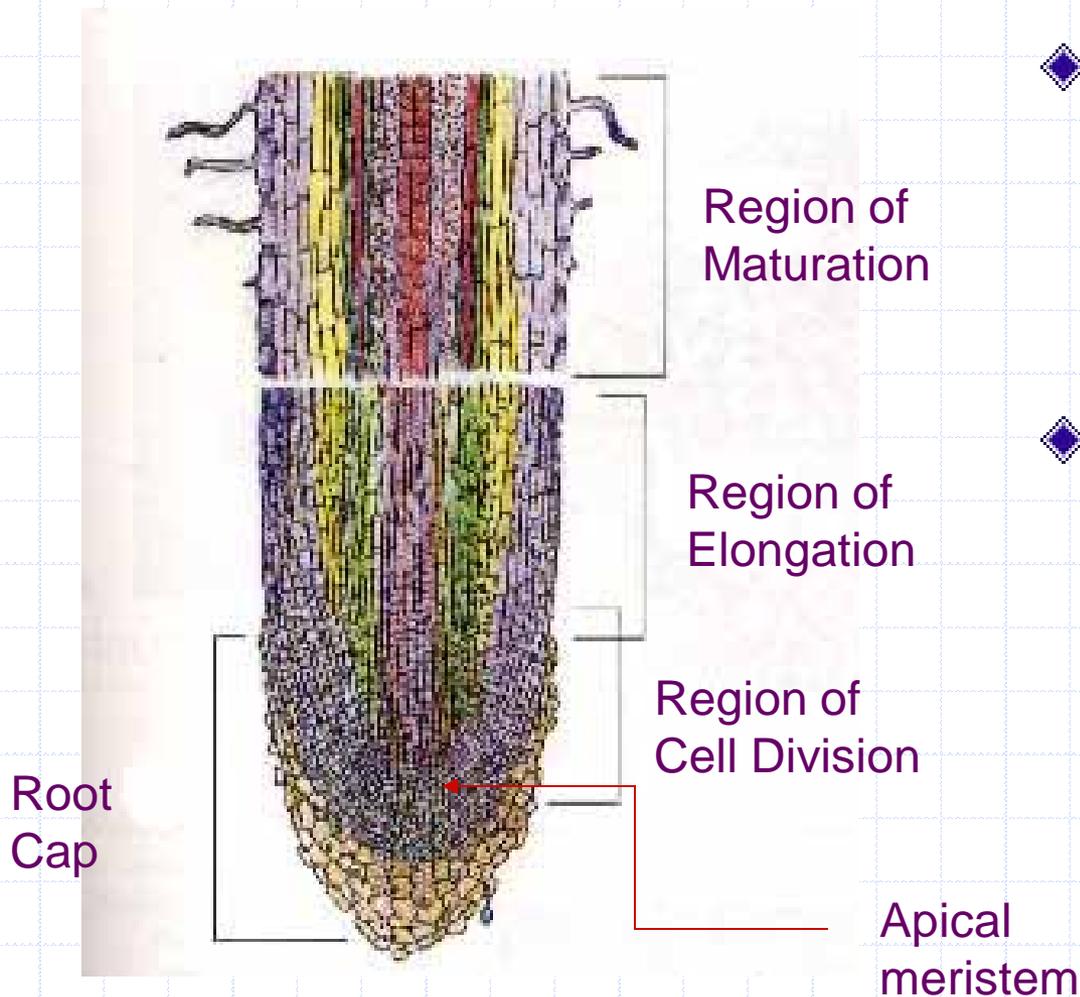
- C. The **apical meristem**, found at the root tip, is where new cells develop
  - ◆ It is covered by the **root cap** – protects it from damage as it passes through coarse soil particles





- D. The surface of the root is protected by skin cells called the ***epidermis***
  - ◆ Where water and minerals enter the root by osmosis & diffusion
  - ◆ Can grow long, hair like projections called ***root hairs***
    - They greatly increase the surface area of the root to allow more water intake

# Regions of Cell Development



- ◆ Notice that cell division occurs at the tip of the root
- ◆ Older cells are found farther away from the root tip

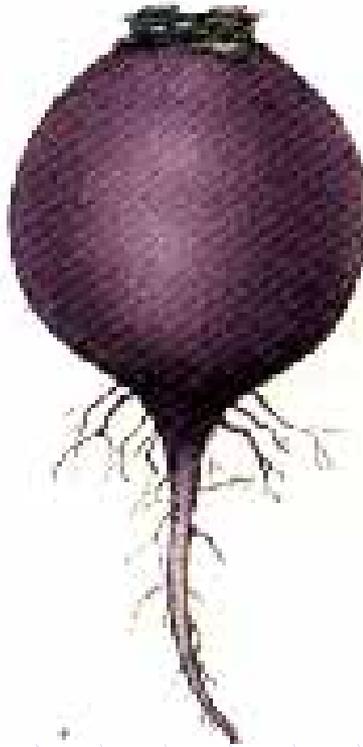
# What Are the Two Types of Root Systems?

- ◆ Plant root systems are organized in two basic ways; It has to do with primary and secondary roots
  - A. A root system comprising one main primary root and many secondary roots branching off the primary root is called a ***taproot system***
    - ◆ Their roots reach far into the ground; they can be several feet long

# Examples of Taproots



Carrot



Beet



Sweet potato

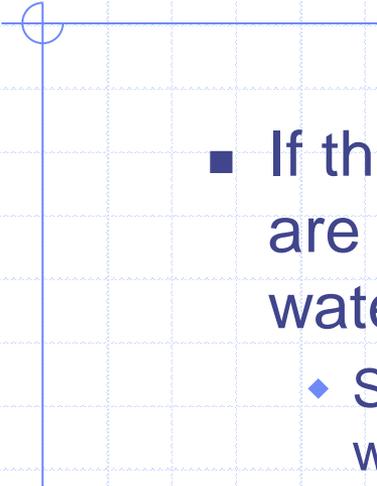


Fibrous root system of grass

- B. A system which has no dominant primary root but is made of many primary and secondary roots of similar size is called a ***fibrous root system***
  - ◆ Ex. Grasses, Magnolia, Rhododendron, Euonymus
  - ◆ The roots are smaller, shorter and more compact; They usually never grow below the first 6-12 inches of soil
    - These roots form a large network underground

# What Does a Healthy Root System Look Like?

- ◆ A healthy root system is white or nearly white in color and smells fresh, or earthy
- ◆ If roots are black, brown, or dark orange and smell rotten or sour, the root system is having some problems
- ◆ Watering a plant properly is one of the most important ways to keep the root system healthy

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- If the plants are grown in pots, be sure that there are drainage holes in the bottom to allow excess water to drain
    - ◆ Soak the pot until the growing medium is saturated and water drips out of the drainage holes
    - ◆ This encourages the roots to grow through the entire pot
  - Allow the pot to dry out slightly between watering
    - ◆ Watering too frequently is a common cause of root death
    - ◆ Medium that is kept wet has limited air exchange; the root tissues die for lack of air.

# Summary

- ◆ What are the three functions of a root?
- ◆ What is another name for a primary root?
- ◆ In the tip of the root, what kinds of cells are the only ones that divide?
- ◆ What is the epidermis and what is its function?
- ◆ Where do root hairs grow from?

# Summary

- ◆ Why does a plant have to have numerous root hairs instead of just two or three?
- ◆ Pretend you are a water molecule and you need to get into the center of the root. What are all the layers you must go through before reaching the center?
- ◆ Describe the functions of the xylem and phloem.
- ◆ Where is food stored in the root?