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
  - 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

A pot bound plant in need of transplanting

Courtesy of Delmar Publishing
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

Courtesy of Wm. C. Brown Publishers
What Are the Parts of a Root?

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**

Courtesy of McGraw Hill
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.

Region of Cell Division
Region of Elongation
Region of Maturation
Root Cap
Apical meristem

Courtesy of McGraw Hill Publishers
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

Courtesy of Wm. C. Brown Publishers
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.
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?