

PLANT ANATOMY Lecture 16 - Root Systems

- I. True vs. adventitious roots
  - A. True roots - gymnosperms, most dicots, some monocots (often have secondary growth)
    - 1. Tap root: Radicle elongates and becomes a main root - can be referred to as a taproot although the root system should still be called fibrous
    - 2. Fibrous root: arise and hang down from certain area (NOTE: all root systems are fibrous)
  - B. Adventitious roots - most monocots, some dicots
    - 1. Refers to roots arising not at their usual sites
    - 2. Often occurs as repeating patterns on ground-level stems (stolens) or roots (rhizomes)
  - C. Why adventitious root systems?
    - 1. Water pipe analogy - Plants without secondary growth need more water pressure to get enough water into the plant. They do this by forming numerous water "inlets" as part of the adventitious roots system.
    - 2. Even with adventitious roots, monocots are still restricted in size
- II. Other facts about roots
  - A. Most roots do NOT grow down - the majority are horizontal roots arising from vertical roots
  - B. Most of the roots of a perennial plant are annual roots
  - C. Annual roots grow for one season and then die
  - D. Prop roots are adventitious roots
    - 1. Hold plant up and enable it to become almost as big as a tree (or a REAL tree)
    - 2. Give extra water - they bypass the congestion of the central vascular system
  - E. What are tubers?
    - 1. Modified underground stem - stolon - regular potato
    - 2. Root tissue - rhizome - sweet potato
- III. Dicot vs monocot root systems
  - A. Dicots - large, positively geotropic root systems
    - 1. Primary roots are connected to secondary laterals
    - 2. Presence of vascular cambium enables secondary growth
    - 3. Lots of variation in root system depending on the tap root
  - B. Monocots - fine, fibrous roots lacking a vascular cambium
    - 1. First phase of growth: seminal roots from seed
    - 2. Second phase of growth: adventitious roots (from basal node)
      - a) adventitious roots also referred to as nodal or crown roots
- IV. Root efficiency and factors affecting root growth
  - A. Most absorption takes place in younger roots (especially the hairs)
  - B. Older roots are vital to the plant but absorption is severely reduced
    - 1. Older roots have fewer hairs
    - 2. Older roots have phenolics & suberin
    - 3. Older roots occupy exploited areas
  - C. Factors affecting roots growth and distribution (Genotype X Environment)
    - 1. Genotype - genetic makeup & preparedness for efficiency
    - 2. Competition - light (above); nutrients & water (below); allelopathy (secretion of toxic or inhibitory substances that gives roots competitive ability)
    - 3. Defoliation - prune shoots = same as prune roots
    - 4. Soil atmosphere & water content - oxygen content (aerenchyma)
    - 5. Soil pH and fertility
    - 6. Soil temperature