PLANT PHYSIOLOGY Lecture 20 - Phloem Transport and Partitioning

I. Overview of transport and partitioning
- **A. Terminology of phloem movement**
  - **1. Material moved - sugar from photosynthesis (photosynthate, assimilate)**
  - **2. Direction of movement - from source to sink (often DOWN)**
  - **3. Type of movement - active, living....."symplastic"**
  - **4. Cells involved with phloem**
    - **a) Gymnosperms - sieve cells and albuminous cells (recall also xylem is primarily tracheary)**
    - **b) Angiosperms - sieve tube members and companion cells**
- **B. Transport - i.e., TRANSLOCATION**
  - **1. Movement of dissolved materials throughout the plant**
- **C. Partitioning**
  - **1. Distribution of dissolved materials**
- **D. Flow scheme - begin with the SUN ====>**

PHOTOSYNTHESIS==translocation==>UTILIZATION==partitioning==> Growth, Development, Storage, Maintenance

II. Mechanism of phloem transport [TRANSLOCATION] (pressure-flow hypothesis)
- **A. Source is high pressure; sink is low pressure**
- **B. "Source-sink" directionality (photosynthesis is source; meristem is sink)**
  - **1. Sugar (photosynthate) is actively transported into sieve tube at a source**
  - **2. Water moves into sieve tube by osmosis**
  - **3. Water uptake pushes sieve tube sap (photosynthate) towards sink**
  - **4. Sap (photosynthate) is unloaded at sink;**
  - **5. Water returns to xylem**
- **C. Simplified illustration of assimilate transport from source to sink**

III. Partitioning, yield, and harvest index
- **A. What competes for assimilate?**
  - **1. Roots, leaves, stems, and reproductive units**
- **B. Biological yield - total dry matter accumulation of plant's system**
- **C. Economic or agricultural yield**
  - **1. Volume or weight of the plant part(s) that provide economic/agricultural value**
- **D. Yield components (grain as an example)**
  YIELD = # reprod units/unit area X # of grains/reprod unit X avg wt/grain
  i.e., YIELD = heads/plot X grains/head X weight/grain
- **E. Factors affecting yield (grain)**
  - **1. Management**
  - **2. Genotype**
  - **3. Environment**
- **F. Where does yield come from (grain)**
  - **1. Pre-flowering photosynthate - remobilization (25%)**
  - **2. Current leaf & stem photosynthesis (45%)**
  - **3. Head photosynthesis (30%)**