Understanding Photosynthesis and Carbohydrate Movement

Information adapted from "Leaf Canopy Structure and Performance" by M. Carmo Vasconcelos and Steve Cadogan AJEV Vol. 51(4): 390-396 and presentations of Kevin Ker and Dr. Wendy McFadden Smith.

Photosynthesis

- Absorption of light and retention of light energy
- Conversion of light energy into chemical potential
- Stabilization and storage of chemical potential

$\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
Cellular Respiration

- Mitochondrion breaks down CHO (developed by photosynthesis)
- Captures stored energy in ATP molecules
- ATP used for
  - Biosynthesis
  - Active transport

Factors affecting Photosynthesis

- Leaf Age
- Temperature
- Light levels
- Time of Day
- Leaf orientation
- Sunflecks
Leaf Age

- Young newly expanding leaves
- Leaves at 30 to 45 days
- Leaves at 70 days plus
- Influence of hedging/tipping

Factors Affecting Photosynthesis

- Leaf Age
  - Young leaf
    - CO₂ compensation point 300 ppm – high demand to meet its own needs
  - Mature leaf
    - 30-40 days after unfolded
    - Optimum photosynthetic activity
    - Respiration rate decreases
    - CO₂ compensation point 20-60 ppm
  - Older senescent leaves
  - Low photosynthetic rates due to low N content

Temperature

- Optimal temperature ranges
- Influenced by other factors – cv, light levels, stresses
- Typical 75 to 86 F
- 95 to 102 F rapid decline and shut down by temp alone
- Stomatal conductance
Light Intensity

- Light balance
  - 85% absorbed
  - 9% transmitted
  - 6% reflected
- Light saturation point (1/3 full sunlight)
- Light Compensation point

Direct Sunlight Interception by Leaves

First layer of leaves
- Above light saturation
- Photosynthesis maximum

Second layer of leaves
- About 1/3 light saturation
- Photosynthesis 25% of maximum

Third layer of leaves
- At compensation
  - No net Photosynthesis
  - Leaves are drain for CHO

Bud break to 4 Leaves
5 Leaves

6 to 8 Leaves
Root activity

Bloom
Root activity
Ripening

After Harvest