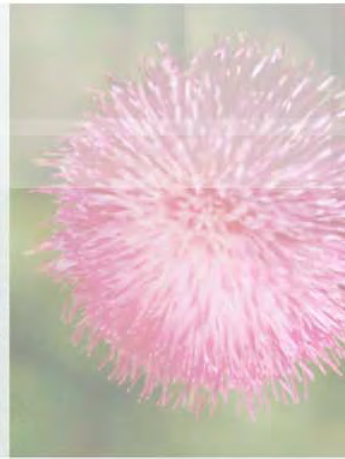




Plant Growth

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Plant Growth and development



Photosynthesis, respiration, and transpiration are the three major functions that drive plant growth and development

All three are essential to a plant's survival.

How well a plant is able to regulate these functions greatly affects its ability to compete and reproduce.

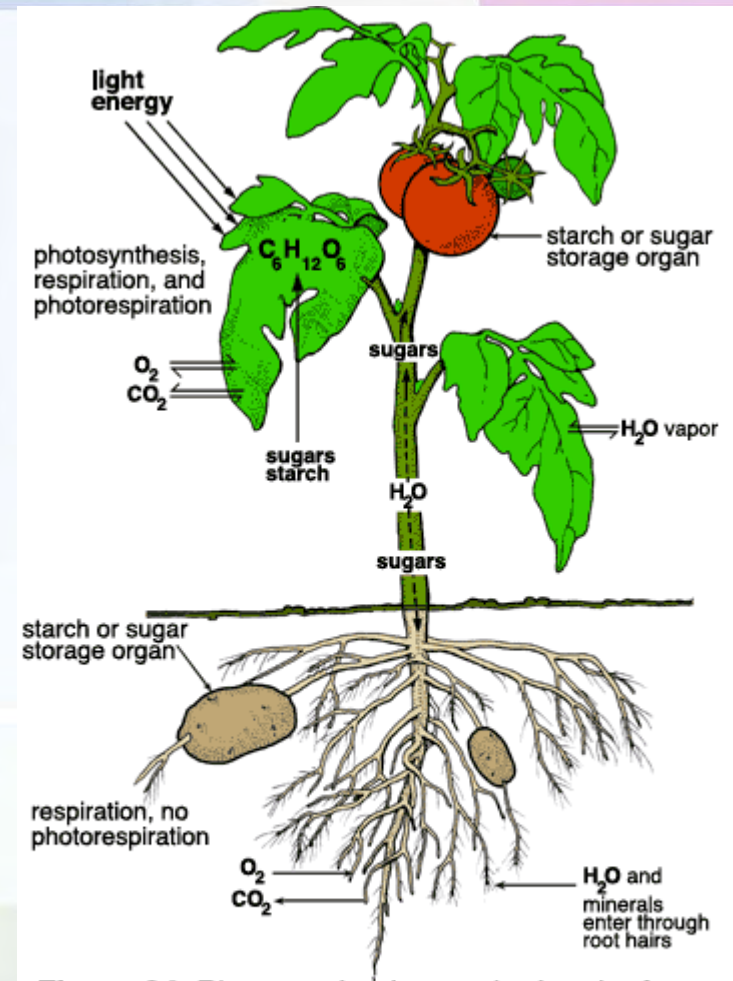

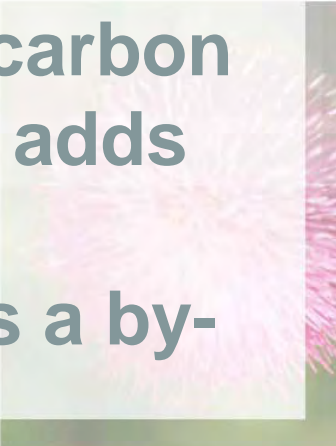


Figure 24. Photosynthesis, respiration, leaf water exchange, and translocation of sugar (photosynthate) in a plant.

Photosynthesis



Carbon dioxide + Water + Sunlight = Sugar + Oxygen

- 
- Literally means: “to put together with light”
 - To produce **food**, a plant requires **energy** from the sun, **carbon dioxide** from the air, and **water** from the soil.
 - During photosynthesis, it splits carbon dioxide into carbon and oxygen, adds water, and forms carbohydrates (starches and sugars). **Oxygen** is a by-product.
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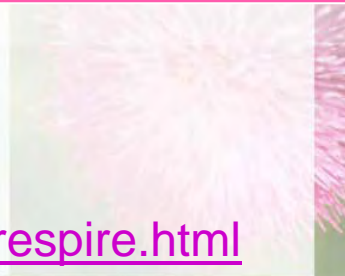
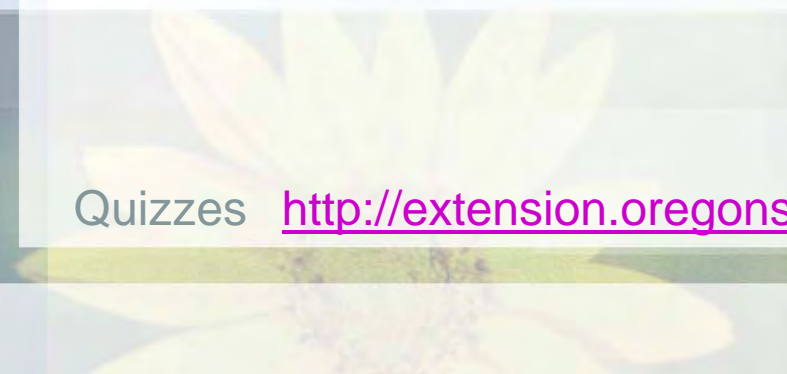
Respiration



- The process of converting sugars and starches into energy
- Energy is used for cell growth, and building new tissues



Quizzes <http://extension.oregonstate.edu/mg/botany/respire.html>



Plant Growth



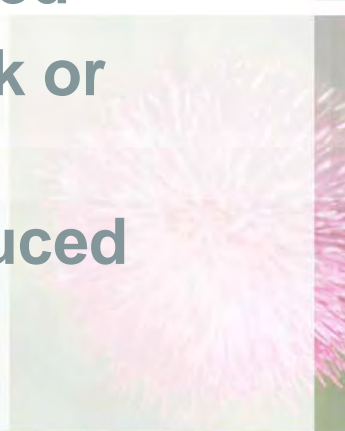
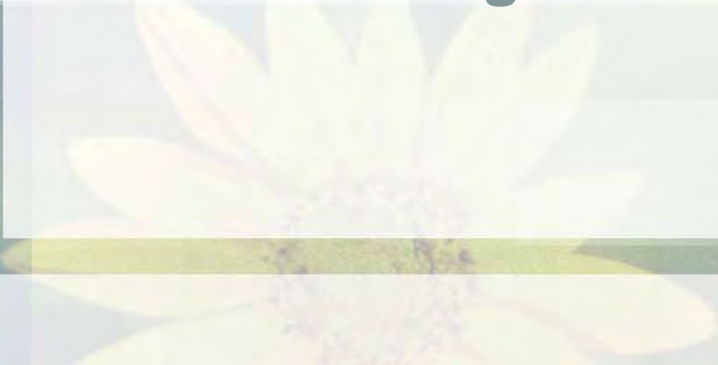
Photosynthesis is a building process, while respiration is a breaking down process

•Photosynthesis

- Produces food
- Energy is Stored
- Occurs in Cells with Chloroplasts
- Oxygen is released
- CO₂ is used
- Occurs in Sunlight

•Respiration

- Uses food for Energy
- Energy is released
- Occurs in all cells
- Oxygen is used
- CO₂ is produced
- Occurs in Dark or Light
- Water is produced



Transpiration



- Loss of water vapor usually through the stomata
- Transpiration is responsible for:
 - Transporting minerals from the soil throughout the plant
 - Cooling the plant through evaporation
 - Moving sugars and plant chemicals
 - Maintaining turgor pressure

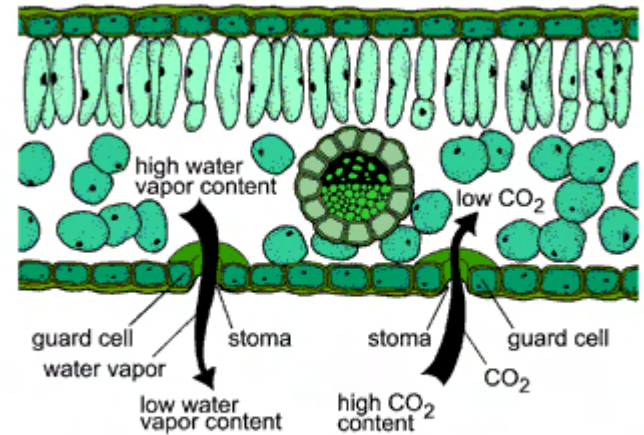
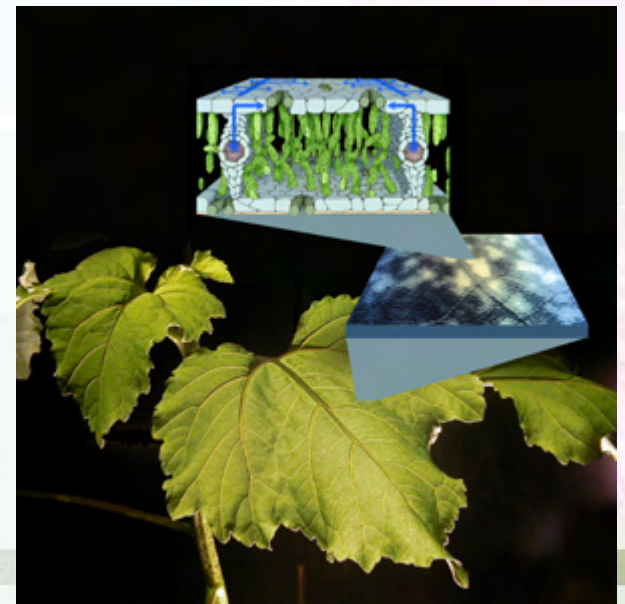


Figure 25. Stomata open to allow carbon dioxide (CO₂) to enter a leaf and water vapor to leave.



A Balancing Act



- Photosynthesis, Respiration, and Transpiration.
- If a plant **photosynthesizes at a high rate**, but its **respiration rate is not high enough to break down the photosynthates produced**, **photosynthesis will either slow down or stop**. On the other hand, if **respiration is much more rapid than photosynthesis**, the plant won't have adequate **photosynthates to produce energy for growth**. Hence, growth either will **slow down or stop altogether**.
- When **stomata are open**, **transpiration** occurs, sometimes at a very high rate. A corn plant may transpire 50 gallons of water per season, but a large tree may move 100 gallons per day! **Plants have problems if they lose too much water, so stomata close during hot, dry periods when transpiration is highest**. However, **CO₂**, which is **needed for photosynthesis**, also **enters the plant through open stomata**. Thus, if **stomata stay closed a long time to stop water loss**, not enough **CO₂** will enter for photosynthesis. As a result, **photosynthesis and respiration will slow down**, in turn reducing plant growth.



Environmental Factors affecting plant growth



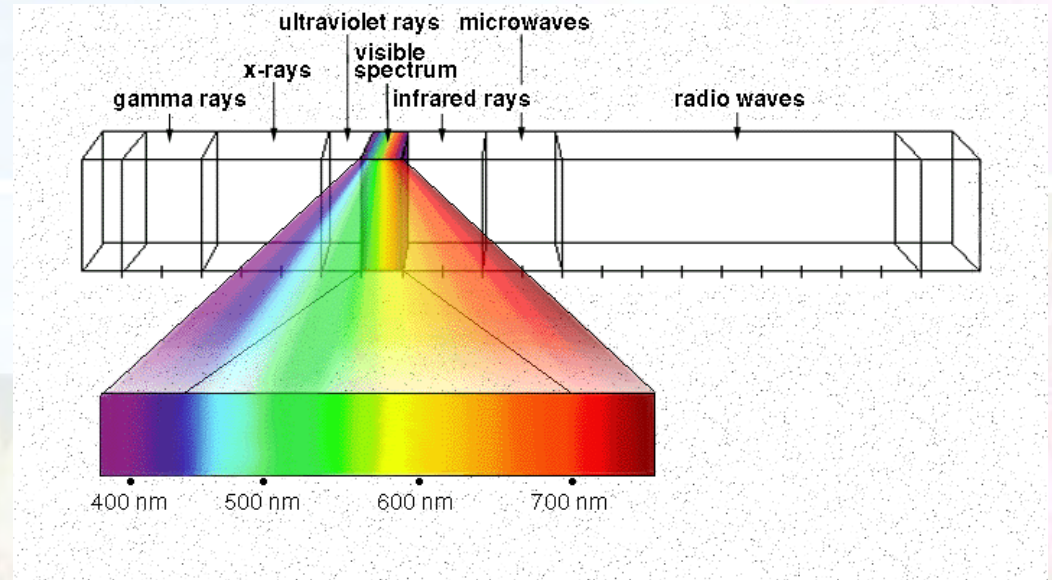
- Light
- Temperature
- Water & Humidity
- Nutrition



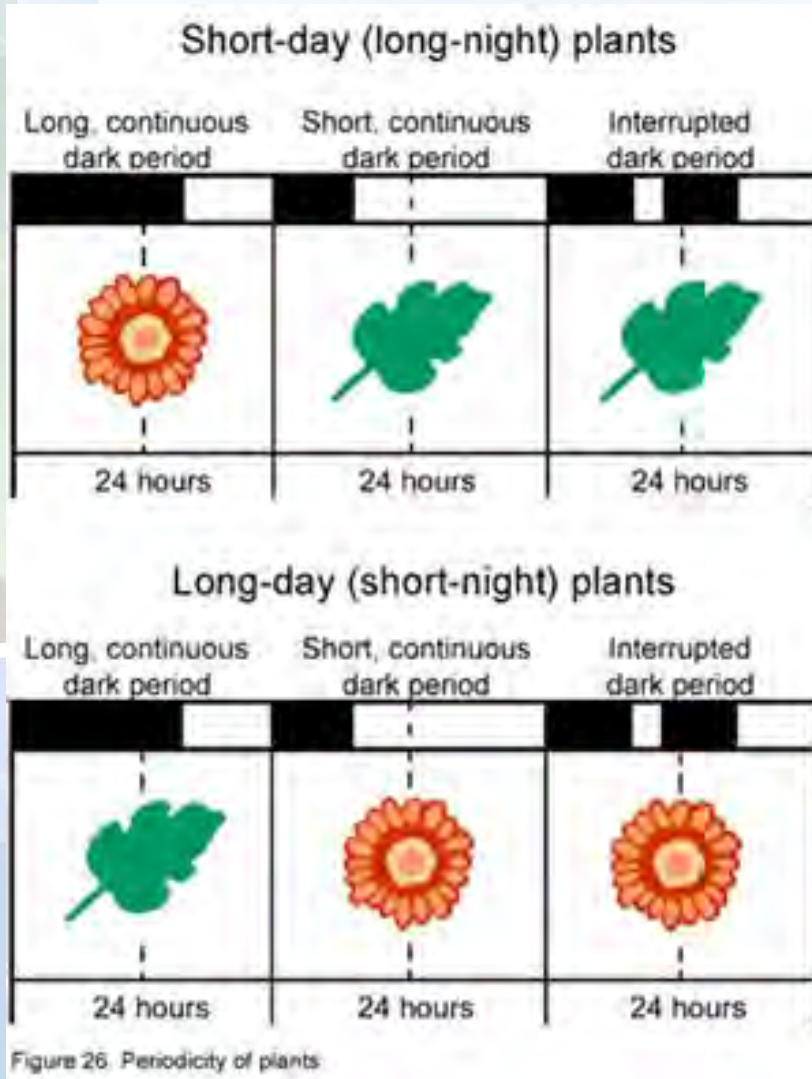
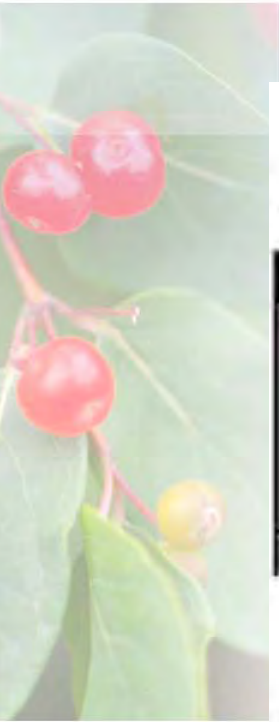
Light



- **Quantity:**
 - Intensity: varies with the seasons
- **Quality: color of light (wavelengths)**



Light – Duration (photoperiod)



- **Plant response to light duration**

- **Short day - Chrysanthemum**

- **Long day – Pentas**

- **Day neutral - Tomato**

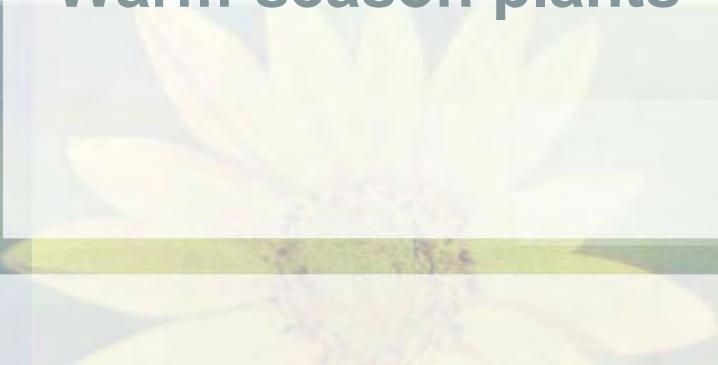


Temperature

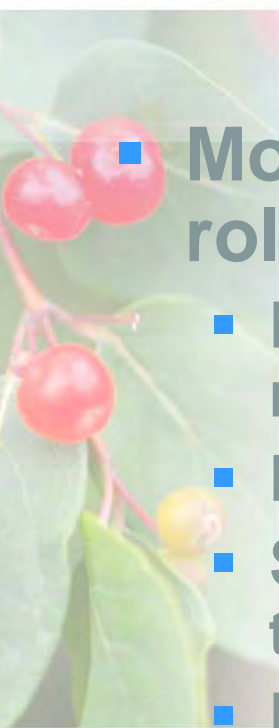


- Affects rate of plant processes: photosynthesis, transpiration, respiration, germination, and flowering

- Cool-season plants
- Warm-season plants



Water



- **Most plants are 90% water. Water plays many roles:**
 - **Primary component in photosynthesis & respiration**
 - **Responsible for turgor pressure in cells**
 - **Solvent for minerals and carbohydrates moving through the plant**
 - **Responsible for cooling leaves**
 - **Regulator for stomatal opening and closing**
 - **Source of pressure to move roots through the soil**



Humidity

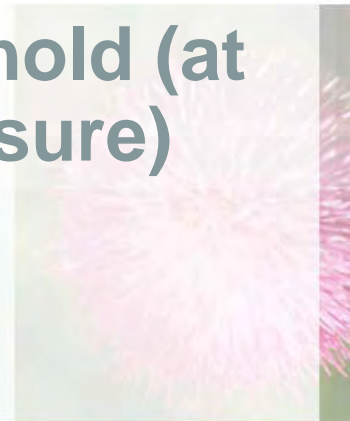
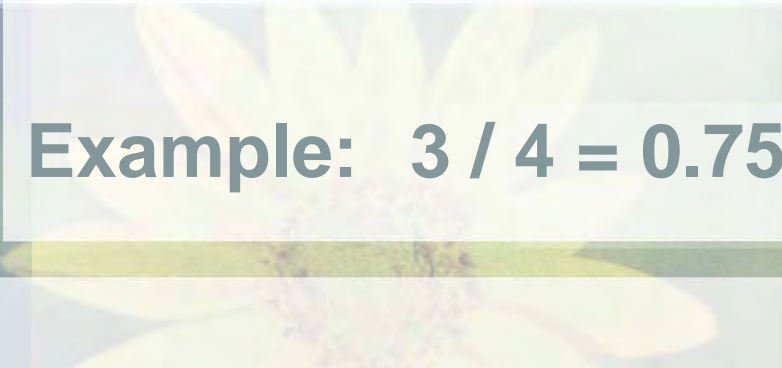


Relative Humidity: is the ratio of water vapor in the air to the amount of water the air could hold at the current temperature and pressure.

- Warm air can hold more water vapor than cold air

RH=water in the air /water could hold (at constant temperature and pressure)

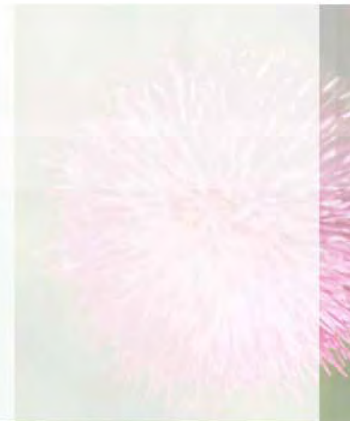
Example: $3 / 4 = 0.75 = 75\%$



Plant Nutrition



- Plant Nutrition refers to a plant's need for and use of basic chemical elements
- Fertilization is the term used when these materials are added to the environment around a plant
 - Macronutrients
 - Micronutrients

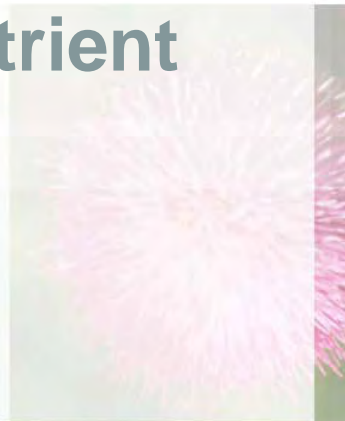


Fertilizers



- **Slow release granular fertilizers**
- **Micronutrient foliar sprays**
- **Chelated iron (EDDHA)**

- **Nutrient absorption:**
 - **Plants under stress, reduces sugar production and can lower nutrient absorption**



Acknowledgments



Botany Basics

Master Gardener Series
Online Botany Module

<http://extension.oregonstate.edu/mg/botany/index.html>

