# CASE

*Curriculum for Agricultural Science Education*

## Principles of Agricultural Science – Plant

# Water Loss

Unit 6 – The Growing Environment
Lesson 6.2 All Wet

# How Water is Used

Purpose of water for plant growth:

- Translocation
- Transpiration
- Photosynthesis
- Osmotic pressure (turgor)

# Translocation

- Water and dissolved nutrients must be transported throughout the plant.
- Plants use a vascular system.
  - Phloem
  - Xylem

# Transpiration

Plant leaves have stomata, which are openings on the surface of leaves (pores).

Stomata allow:

- Gas exchange from photosynthetic activity
- Water vapor to be released to cool the plant during hot temperatures

# Transpiration Rate

The rate of transpiration can vary depending upon growing conditions.

Changes in transpiration rate can occur because of:

- Temperature
- Wind
- Humidity

# Photosynthesis

Water is needed for photosynthesis:

Chemical equation for photosynthesis:

(6) $CO_2$ + (6) $H_2O \rightarrow C_6H_{12}O_6$ + (6) $H_2O$ +(6) $O_2$

**Water is both an input and a product.**

# Osmotic Pressure

Herbaceous plants need water to keep their structure upright.

Turgor - The pressure placed on cell walls by liquid within the cell.

Osmotic pressure - The hydrostatic pressure required to stop osmosis.

# Water Losses

Water available to plants can be lost by:

- Evaporation
  - Water lost to atmosphere
- Transpiration
  - Water lost through plant leaves
- Runoff
  - Over watering causing water to be lost from targeted area of application

# Not Enough Water

If too little water is present, plants will experience stress:

- Decreased or suspension of photosynthetic and respiration processes
- Tissue damage
- Potential of stunted growth

# Signs of Water Stress

**Stage 1:**

Plants will close their stomata to try to preserve internal water reserves

**Stage 2:**

Plant leaves may curl to create a microclimate to preserve water loss through their leaves

**Stage 3:**

Plants will eventually wilt due to loss of osmotic pressure

# When to Water

- Water should be applied before physical signs are noticed to prevent water stress.
- Use of soil moisture meters are valuable to determining water needs.
- Every plant species has different water tolerances. It is important to know the water requirement of the species you are growing.

# Too Much Water

If too much water is present:

- Nutrients can be washed away from root zone.
- Plant root hairs can die because of the lack of oxygen in the soil.
- Runoff can cause erosion and waste resources.

# How do plants get water?

Plants need soil to retain moisture for when they need it. Soil water can be replenished by:

- Natural rainfall
- Irrigation

# References

Parker, R. (2010). *Plant and soil science: Fundamentals and applications*. Clifton Park, NY: Delmar.