

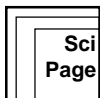
## WATER IN THE GARDEN Teaching Tips



### LEARNING OBJECTIVES

Youth will be able to:

- \* Describe the steps in the water cycle.
- \* Explain why plant roots need both water and air from the soil.
- \* Identify signs of water stress in plants.



### HOW TO USE THE WATER IN THE GARDEN SCIENCE PAGE

To demonstrate transpiration, place a small plastic bag over the leaf of a house plant or garden plant, and secure the bag around the stem with a twist tie. After about an hour, check the bag. Water from the transpiring leaf will collect on the inside of the bag.

To demonstrate evaporation, condensation, and precipitation, heat some water until it is near the boiling point. Place it in a clear, heat-proof dish. Cover the dish with an upside-down lid or aluminum foil. Put ice on top of the lid or foil. Water will evaporate from the dish, condense on the cool surface, and fall in droplets back into the dish. Tell youth to look for steam rising from warm water (clouds) and drops forming on bottom side of lid (rain). Ask: What happens to the water when it gets heated up? (Answer: It evaporates and becomes water vapor.) What effect does the ice have on the water? (Answer: It causes the water vapor in the air to condense to form water droplets.) How is this demonstration similar to or different from the water cycle that occurs in nature? (Answer: The same processes of evaporation, condensation, and precipitation occur in nature, only on a much larger scale. In nature, other processes such as transpiration are

also important.)

You may wish to review the following scientific terms, and ask youth where they occur in the natural water cycle:

**Evaporation** is the changing of water from a liquid to a gas.

**Condensation** is the changing of water from a gas to a liquid.

**Precipitation** is the process by which water condenses to form drops heavy enough to fall to the Earth's surface.

**Transpiration** is the process by which moisture is carried through plants from roots to leaves, where it changes to vapor, and is released to the atmosphere.

**Capillary action** is the climbing of liquids in narrow tubes or in tiny openings of porous material, such as soils. (This is due to forces of cohesion and adhesion.)

**Surface run-off** is the flowing of water over the land from higher to lower ground.

**Infiltration** is the process of water filling the porous spaces of soil.

Emphasize the fact that plants need a constant supply of water and oxygen. Too little water does not allow the roots to replace water lost by the plant through transpiration. Studies have shown that production is almost doubled if plants have a constant water supply. Also, plants need to take oxygen from the soil pore spaces. Without enough oxygen, plant roots suffocate and die. Plant parts above ground exhibit symptoms of lack of oxygen, including: wilting, yellowing drying foliage, and leaf drop. Constant over-watering kills most plants. These symptoms might be mistaken for the symptoms caused by lack of water. Youth may be interested in setting up a demonstration to compare the symptoms in potted plants when they are given too much or not enough water.



### PUZZLE

Answers: RUNOFF; TRANSPIRES; CAPILLARY ACTION; EVAPORATES; CLOUDS; RAIN; PLANTS; SOIL. Final message: WATER CYCLE.



### TRY THIS

Youth should discover that sandy soils drain very rapidly, and clay and compacted soils drain very slowly. Sandy loams will accept about 1.25 to 7.5 centimeters of water per hour. A clay-loam may absorb only 0.25 to 1.5 centimeters of water in the same amount of time. A very dry clay-loam soil could therefore take as long as 120 hours to become completely wet to a depth of 30 centimeters, whereas a sandy loam may take as little as 4 hours. Adding organic matter to all soil types will cause them to behave differently. Sandy soils with organic matter added will hold water longer. Adding organic matter to clay or to compacted soils allows water to penetrate more quickly. Challenge youth to set up a demonstration to show how water drainage changes when organic matter is added to different soil types.



### SPOTLIGHT ON RESEARCH

The information for this Spotlight is from: Spillman, A. "Salt-Tolerant Forages for Irrigated Areas." ARS News Service Agricultural Research Service, USDA. Washington D.C. 2002. <<http://www.ars.usda.gov/is/pr/2002/020522.htm>>