What is Plant Transpiration?

Worksheet

Transpiration is the evaporation of water from a plant's aerial parts, chiefly the leaves, through open stomata. It pulls water up through the xylem via the cohesion-tension mechanism, cooling the plant and delivering dissolved minerals as a side effect.

Questions

1. Through which structures does most water vapor leave a leaf?

A) Stomata
B) Chloroplasts
C) Root hairs
D) Xylem vessels

2. What force pulls water upward through the narrow xylem vessels?

A) Gravity alone
B) Active pumping by root cells
C) Cohesion-tension from evaporation at the leaf
D) Photosynthesis directly

3. Which condition would most increase a plant's transpiration rate?

A) High humidity, no wind, cool weather
B) Low humidity, windy, hot weather
C) Darkness, closed stomata
D) Waterlogged, cold soil

4. What is one benefit of transpiration besides moving water?

A) It produces glucose
B) It cools the leaf
C) It creates chlorophyll
D) It fixes nitrogen

5. Explain why a plant in a hot, windy, low-humidity environment transpires faster than one in a cool, still, humid one.

6. A gardener notices a plant wilting on a hot afternoon even though the soil is moist. Explain this using transpiration.

7. Why do most plants have more stomata on the underside (lower epidermis) of their leaves than on top?

8. Define: What is transpiration?

9. Define: What are stomata?

10. Define: What is the cohesion-tension theory?

Answer Key

1. A) Stomata - Stomata are the small pores, mostly on the leaf underside, through which water vapor diffuses out.

2. C) Cohesion-tension from evaporation at the leaf - Evaporation at the leaf creates tension that, combined with water's cohesion, pulls a continuous column of water upward.

3. B) Low humidity, windy, hot weather - Hot, dry, windy conditions maximize the diffusion gradient and evaporation rate, increasing transpiration.

4. B) It cools the leaf - As water evaporates from the leaf surface, it absorbs heat energy, cooling the plant - similar to sweating.

5. Heat increases the kinetic energy of water molecules, speeding evaporation from mesophyll cells. Wind removes humid air near the stomata, keeping the concentration gradient for diffusion steep. Low ambient humidity means a bigger difference between the moist air inside the leaf and the dry air outside, so water vapor diffuses out faster.

6. On a hot afternoon, transpiration from the leaves speeds up dramatically. If water loss through the stomata outpaces the rate roots can absorb and xylem can transport water, the leaf cells lose turgor pressure. The plant wilts temporarily until water uptake catches up, often recovering by evening as temperatures drop.

7. The upper surface faces direct sunlight and is hotter, so fewer stomata there reduces excessive water loss. The underside is cooler and more shaded, allowing gas exchange for photosynthesis (CO_2 in, O_2/water vapor out) with less evaporative stress. This arrangement balances the plant's need for CO_2 with the need to conserve water.

8. The evaporation of water vapor from a plant's leaves, mainly through stomata.

9. Tiny pores, usually on the leaf underside, that open and close to regulate gas and water vapor exchange.

10. It explains how water is pulled up the xylem by cohesion between water molecules and tension created by evaporation at the leaf surface.