

Transpiration

Grades: K - 8

Time: 1 hour



Lesson summary:

Transpiration is the movement of water through a plant's system. The water journey starts in the roots which draws water from the soil. From there water moves up through the stems and into the leaves and flowers. Finally, water exits the plant through tiny pores on the leaves called stomata. Transpiration helps to cool the plant and the Earth; works together with respiration; and keeps plants upright.

What's the big idea? ??

- This project is a simple demonstration that plants release water vapour through their leaves.

Outcomes or purpose:

- Plants release water (in the form of vapour) from their leaves. Transpiration helps to cool the plant and the Earth; works together with respiration; and keeps plants upright.

Teacher background:

We know that all plants have basic needs. To remember plant needs we use the word: L.A.W.N.S. (light, air, water, nutrition and space). Let's look at how water moves in and out of plants in a process called transpiration.

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One reason that plants transpire water is to stay cool. When water is inside the plant, it is a liquid. Once it leaves the plant through the stomata it quickly evaporates. It's a lot like when we humans sweat on a hot day. Our skin feels damp but as the sweat evaporates (turns into a vapour) and we start to feel cooler - the same thing happens to a plant. Plants also help to regulate temperature on Earth. Think of a really tall tree. It feels cooler when you sit underneath a big tree on a hot summer's day, partly because of the shade but also because the water vapour has a cooling effect. The moisture released by plants eventually cycles into the environment and returns to the Earth as rain or snow.

Transpiration

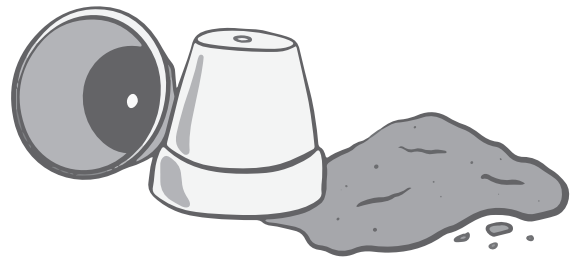
Transpiration has a buddy called respiration. Respiration is how plants breathe, which happens through the same small pores on the leaves called stomata. They breathe in carbon dioxide which they need for photosynthesis, and breathe out oxygen which we humans need. Transpiration and respiration work as a team to move water out of the plant, and move air in and out of the leaves.

Another reason plants transpire water is to stay upright! Plants don't have a skeleton like we humans do, so their cells need to be full of water for them to stay upright. (Trees stay upright on their own, but wood is made up of really tough cells. They still need water to stay alive). One way we know this is when a plant is growing in soil that has dried out. What happens to the plant? It wilts and flops over. When the soil is watered again, the plant recovers and stands straight and tall again. Transpiration is essential to keeping water moving in a plant.

Of all the water absorbed by plants through their roots, less than 5% remains in the plant for growth!

Fun facts:

- An average-size tomato plant transpires about 115 litres of water over the growing season; one corn plant transpires about 210 litres of water.
- One 16 m tall silver maple tree transpires about 220 litres of water per hour.
- A forest of deciduous trees transpires about 30,000 litres of water per acre per day.



Materials needed:

- Zippered plastic bags
- A variety of potted plants
- A sunny day



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Step by step instructions:

Prepare the containers with lids in advance for the students

1.

Find a few potted plants to use for this experiment. Houseplants are a good choice, but you can use any plant - such as vegetables or herbs - just as long as long as the plant is in a pot. Try for variety: large leaves vs small leaves; green leaves vs coloured leaves; flowering plants etc.

2.

Place a plastic bag over the entire plant or over a portion of the plant, like a branch with leaves. Zip the bag as far closed as possible without damaging the plant. Repeat this for all of the plants in your experiment.

3.

Wait for 20 - 30 minutes and observe the bag. You should see condensation starting to accumulate on the inside of the bag. If nothing has happened, wait for another 20 minutes or try putting the plant in a warmer location or closer to a window where the sun is shining.

4.

The droplets condensed inside the bag is water. Now you know that plants give off water as part of transpiration.

Discussion questions

- What happens when you breathe on a windowpane?
- Does it remind you of what is happening with your plants?

Expand the learning:

Try repeating this experiment at different times of year. Are your results the same in fall as in spring? Do you think temperature makes a difference? Does humidity, light and wind affect how much a plant transpires?

Try this experiment with two identical plants in containers of the same size. Allow the soil in one container to dry slightly but water the second container so that the soil is very wet. Now try the experiment. Compare the amount of condensation in the plastic bag: which plant transpires more - the wet plant or the dry plant? Why would that be?

What about plants that are dormant in winter? Evergreens keep their needles all year long unlike deciduous trees which lose their leaves in the fall. Do evergreens continue to transpire? Try the experiment on a living evergreen tree on a warm day in late winter and compare it to what happens to the same plant in early summer.

How is plant transpiration important to the Earth's water cycle?