Transpiration Experiments

Introduction

Transpiration is the loss of water vapour from the leaves and stems of a plant. Loss of vapour creates a pressure gradient which draws water up from the roots via vascular tissue called the xylem. The rate of transpiration can be impacted by various conditions – such as temperature, humidity and the wind.

EXPERIMENT 1: Tissue Cross-Sections

Materials

- Celery stalk with leaves
- Large beaker ($\times 2$)
- Food colouring (blue)
- Tile / cutting board
- Dissecting microscope
- Scalpel / knife
- Carrot
- Petri dish
- Gloves

Method

1. Fill the two large beakers with water and add several drops of blue food dye to each beaker
2. With a scalpel or knife, cut off roughly 2 cm from the bottom of the stalk of celery and carrot
3. Place the celery and carrot in separate beakers and leave to stand overnight (roughly 24 hours)
4. Cut a longitudinal (lengthwise) and transverse (crosswise) section of the celery and carrot
5. Place the sections in the petri dish and observe under the dissecting microscope

Results

1. Draw a sketch of your observations of the **celery** sections in the box below

Longitudinal Section	Transverse Section

2. Draw a sketch of your observations of the **carrot** sections in the box below

Longitudinal Section	Transverse Section

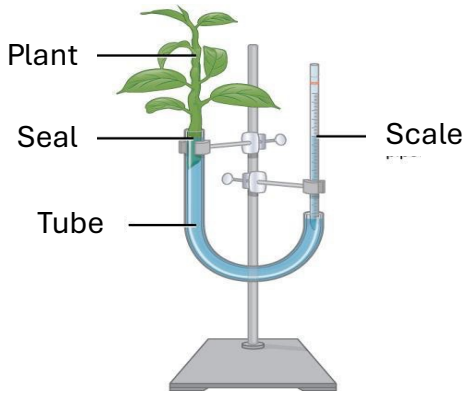
Discussion

1. Compare the differences seen in the vascular tissues of the celery and the carrot

2. Explain why the base of the stalk was removed prior to immersing the vegetables in water

EXPERIMENT 2: Potometer

A potometer is a device that is used to measure transpiration under different circumstances. A plant cutting is attached to a capillary tube via its stem. The tube is filled with water and contains a millimetre scale at the opposite end to the plant. A syringe may also be attached to the tubing via a three-way tap, to allow for adjustments to the position of the meniscus and to purge any excess air trapped within the tubing. As the plant undergoes transpiration, the water in the tubing moves. This is measured over time to determine a transpiration rate.



Aim

To determine the transpiration rate of a plant cutting under two different environmental conditions.

Method

1. Fill a large basin with water and assemble two potometers under the water (reduces air intake)
2. Once assembled, use the syringe to purge any air bubbles from within the capillary tubing
3. Cut plant samples and attach to the end of the capillary tubing (use vaseline or parafilm to seal)
4. Remove the potometers from the basin and gently dry the leaves of the plant using paper towel
5. Use the syringe to adjust the zero point on the millimetre scale (withdraw until air reaches zero)
6. Place one potometer next to a fan to demonstrate the impact of wind on transpiration rates
7. Record the time and leave both potometers overnight before recording the meniscus position

Results

Calculate the transpiration rate for each potometer (rate = distance meniscus moved ÷ time elapsed)

Potometer on open bench	Potometer next to fan (airflow)

Discussion

1. Provide a scientific explanation for the difference in the transpiration rates of the two potometers

2. Explain why a potometer only provides an *indirect* measurement of transpiration rate