MOISTURE MAKERS

BACKGROUND

Transpiration of Leaves

Transpiration is the evaporation of water from plant surfaces, primarily leaves, into the air. Most plants transpire approximately 75 percent of the water taken in by their roots. Most of the water is lost through small openings on the leaf and the stem surfaces called **stomates**. The stomates can regulate transpiration by opening and closing.

Fluctuations in transpiration occur seasonally and even daily depending on environmental factors such as wind, light, moisture, and temperature. In the summer, for example, a maple tree transpires up to 200 liters per day, but in winter when its leaves are dropped, transpiration is minimal.

Plants in dry climates must retain a greater percentage of water than plants in wetter climates. Adaptations in the size, shape, and number of stomates are instrumental in reducing transpiration.

Measure the moisture released from different kinds of leaves by observing the color change of cobalt chloride paper.

MATERIALS

Cobalt chloride paper*
OR Cobalt chloride crystals*
Table salt
Water and bowl
Filter paper or some other absorbent paper like paper towels
Scotch tape
Plastic bags
Clothes pins
Twist-ties
Plastic food wrap
Paper clips
Hand lenses (optional) for looking closely at leaves
Moisture Maker Action Cards

*Cobalt chloride paper or crystals may be obtained from junior or senior high school science departments, or chemical supply companies.

PREPARATION

To prepare cobalt chloride paper: Mix two teaspoons cobalt chloride crystals, one teaspoon salt, and four teaspoons water in a bowl until all crystals are dissolved. Soak paper pieces (2 cm. by 5 cm.) in the pink solution. Dry the paper by hanging it from clothespins or matting it between paper towels. The cobalt chloride paper will turn blue when it dries. If you prefer, you may purchase commercially-prepared cobalt chloride paper.

How to use the paper:

To observe color change, place a piece of clear tape on both sides of one section of the paper. The taped area will remain blue and the uncovered area will turn pink when exposed to moisture.

Place dry cobalt chloride paper on living leaves that are attached to trees or bushes. Use paper clips to hold the paper in place. Enclose the paper and leaf in a plastic bag or plastic food wrap. Measure and compare the time it takes different leaves to turn the blue paper to pink. (Allow 5-15 minutes for the color change.)

ACTION

1. Explain the method for use of cobalt chloride paper as a moisture-measuring device. (Instructions appear on the reverse side of each Action Card.)
2. Distribute Action Cards.
    - Compare transpiration of a small leaf and a large leaf on the same plant.
    - Compare transpiration of a stem with a leaf of the same plant.
    - Compare transpiration of a pine needle with a broad leaf.
    - Compare transpiration of a dead leaf with a live leaf attache3d to the same tree.
    - Compare transpiration of a thick, juicy leaf (succulent) with a thin, flat leaf.
    - Compare transpiration of a hairy-surfaced leaf with a smooth-surfaced leaf.
    - Compare transpiration of a leaf in the shade with a leaf of the same size and shape in the sun.
    - Compare transpiration of the upper side of one leaf with the lower side of another leaf. The two leaves should be the same kind and approximately the same size. (Place the cobalt chloride paper on top of one leaf and hold in place with a paper clip. Repeat the procedure on the bottom side of another leaf.)

3. Have each participant complete the activity suggested on two or more of the Action Cards.

What Do You Think?

- Why did we put scotch tape on the filter paper?
- What type of leaf transpires the most?
  Describe its characteristics (size, shape) and location (in sun, shade).
- What type of leaf transpires the least?
  Describe its characteristics (size, shape) and location (in sun, shade).
- How might climate affect the rate of transpiration?
- What properties might you expect plant leaves to have in deserts, mountain tops, sea coasts, or lawns?

Follow Through

A. Effects of excessive watering on transpiration.
   1. Choose two plants of the same type and approximately the same size.
   2. Label plants A and B.
   3. Water plant A the day before and just before measuring the rate of transpiration. Do not water plant B.
   4. Measure the rate of transpiration and compare the results.

B. Compare the transpiration of one type of plant at different times of the day.

C. Transpiration of a potted plant:
   a. Obtain several potted plants in metal, plastic, or Styrofoam containers that have no drainage holes in the bottom.
   b. Water the plants only once.
   c. Cover the soil surface with foil, plastic food wrap, or paraffin to prevent evaporation of water from the soil. Weigh the entire set-up.
   d. As a control, set up an identical pot. Add soil and water, but replace the plant with a wooden stick. Cover the soil surface as before, and weigh the entire set-up.
   e. Continue to weigh the plants and control set-up every other day. The difference in weight loss between the control and experimental pots is the water lost through transpiration.

What To Do Next

Terrestrial Hi-Lo Hunt
Invent a Plant
Seed Dispersal

ACTION CARD
MOISTURE MAKERS

Compare transpiration of a dead leaf with a live leaf attached to the same tree.

ACTION CARD
MOISTURE MAKERS

Compare transpiration of a thick juicy leaf (succulent) with a thin, flat leaf.

ACTION CARD
MOISTURE MAKERS

Compare transpiration of a hairy-surfaced leaf with a smooth-surfaced leaf.

ACTION CARD
MOISTURE MAKERS

Compare transpiration of a leaf in the shade with a leaf of the same size and shape in the sun.

ACTION CARD
MOISTURE MAKERS

Compare transpiration of a small leaf and a large leaf on the same plant.

ACTION CARD
MOISTURE MAKERS

Compare transpiration of the upper side of one leaf with the lower side of another leaf. The two leaves should be the same kind and approximately the same size. (Place the cobalt chloride paper on top of one leaf and hole in place with a paper clip. Repeat the procedure on the bottom side of another leaf.)

ACTION CARD
MOISTURE MAKERS

Compare transpiration of a stem with a leaf of the same plant.

ACTION CARD
MOISTURE MAKERS

Compare transpiration of a pine needle with a broad leaf.

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MOISTURE MAKERS
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