PLANTS LOSE WATER

TOPIC:

Water Loss from Leaves

INTRODUCTION:

Plants lose water by transpiration, the evaporation of water from the leaves. As water is lost by the leaves, it is replaced by water brought by the xylem, the water transport system of the plant. In turn, more water is drawn up the stem xylem from the roots, and more water is taken into the roots from the soil. This steady movement of water through the plant is called the transpiration stream. Water evaporates from the leaves through the stomata, small pores in the leaf's surface. In this experiment you will determine from which surface of the leaf most water evaporates (which surface has more stomata) using the "washing line" method.

TIME NEEDED:

1 hour to set up the experiment
1 week to leave the experiment
30 minutes to observe the results

MATERIALS:

shrub or tree with evergreen leaves (not needles)—*e.g.*, bayberry, holly, eucalyptus
2 ring stands or other suitable fixed uprights
cotton thread
masking tape
petroleum jelly
scissors
metric ruler

Safety Precautions

Please click on above link to view our safety guidelines.

PROCEDURE:

Outdoors

1. Pick or cut four leaves of the same size and shape from your chosen tree or shrub. Make sure you remove the leaf stalk with the leaf.

Indoors

2. Position the ring stands on a table or bench approximately 45 cm apart.
3. Cut a piece of cotton thread approximately 61 cm long and tie it between the ring stands about 30.5 cm above the table top. Adjust the ring stands so that the thread is taut.
4. Cut four pieces of cotton thread each 7.5 cm long.
5. Take a leaf. Tie one end of a short piece of cotton thread to its stem and the other to the thread tied between the two ring stands.
6. Cut a piece of masking tape about 5 cm long and fold it around the cotton thread holding the leaf.
7. Mark this leaf "A" on the masking tape.
8. Take a second leaf, leaf B. Smear a thin layer of petroleum jelly on its UPPER surface.
9. Repeat steps 5 and 6 with leaf B, tying this leaf to the right of leaf A. Mark it "B" on the masking tape.
10. Take a third leaf, leaf C. Smear a thin layer of petroleum jelly on the LOWER surface of the leaf. Repeat steps 5 and 6, tying this leaf to the right of leaf B. Mark it "C" on the masking tape.

11. Take the remaining leaf, leaf D. Smear a thin layer of petroleum jelly on BOTH surfaces of the leaf. Repeat steps 5 and 6, tying this leaf to the right of leaf C. Mark it "D" on the masking tape. (See figure 1.)

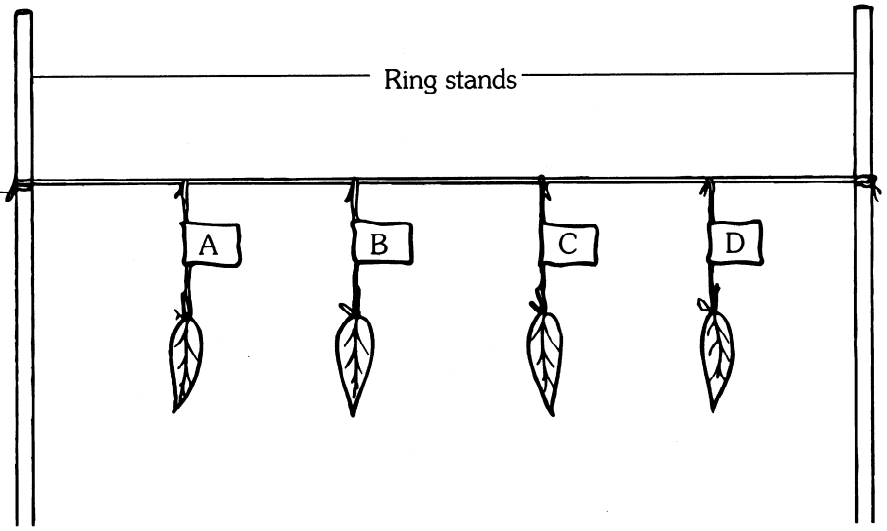

figure 1

12. Record the appearance of these leaves in the Data Table with a sketch and brief description. Leave the leaves for a week.
13. After one week, again record in the Data Table the appearance of the leaves, using a sketch and brief description.

DATA TABLE

Leaf	Appearance at beginning of experiment	Appearance after one week
A		
B		
C		
D		

ANALYSIS:

1. Describe the changes in appearance (shape and texture) that had occurred to each leaf after one week.
2. Why did these changes occur?
3. Which surface of the leaf has more stomata: upper or lower? Explain how you reached this conclusion.
4. How were the changes related to where the petroleum jelly had been smeared?
5. What happens to a plant if it loses more water from its leaves than it can take in through its roots?

OUR FINDINGS:

Click on above link to see what we found.

Our Findings

IV. PLANT PROJECTS

4.006 Plants Lose Water

1. After one week, A should be dry and wrinkled; B should be dry but not as much as A; and C and D should look quite fresh, C probably being a little drier than D.
2. Drying and wrinkling occur because of water loss from the leaf. Lost water would normally be replaced by water brought into the leaf through the xylem of the petiole (leaf stalk) from the rest of the plant, but in this experiment the leaf has been removed from the plant so there is no replacement water.
3. Most loss occurs through the stomata (pores), with a small amount also passing through the cuticle that covers the leaf's epidermis. Most stomata are found in the lower epidermis of the leaf. Leaves with the lower surface unprotected by petroleum jelly showed the most water loss.
4. Petroleum jelly prevents water loss from whichever surface it is applied to. So if it is smeared over the whole leaf, as in D, water loss is prevented; if it is smeared on the lower surface only, as in C, most water loss is prevented although a little is lost through the upper epidermis; if it is smeared on the upper surface, as in B, water is lost through the stomata; finally, if neither surface is smeared, as in A, water is lost through stomata and across the cuticle.
5. It will dry out and appear wrinkled.

SPECIAL SAFETY NOTE TO EXPERIMENTERS

Each experiment includes a short list of special safety precautions that are relevant to that particular project. However, these do not include all of the basic safety precautions that are necessary whenever you are working on a scientific experiment. For this reason, it is absolutely necessary that you read, copy, and remain mindful of the General Safety Precautions that follow this note.

Experimental science can be dangerous, and good laboratory procedure always includes carefully following basic safety rules. Things can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. There will be no time after the fact to protect yourself. Always prepare for unexpected dangers by following basic safety guidelines the *entire* time you are performing the experiment, whether or not something seems dangerous to you at a given moment.

We have been quite sparing in prescribing safety precautions for the individual experiments. We made this choice for one reason: We want you to take very seriously every safety precaution that is printed in this book. If you see it written here, you can be sure that it is here because it is absolutely critical to your safety.

One further note—The book assumes that you will read the safety precautions that follow, as well as those at the head of each experiment you are preparing to perform, and that you will *remember* them. Except in rare instances, these precautions will not be repeated in the procedure itself. It is up to you to use your good judgment and pay attention when performing potentially dangerous parts of the procedure. Just because the book does not say BE CAREFUL WITH HOT LIQUIDS or DON'T CUT YOURSELF WITH THE KNIFE does not mean that you should be careless when simmering water or stripping an electrical wire. It does mean that when you see a special note to be careful, it is extremely important that you pay attention to it.

If you ever have a question about whether a procedure or material is dangerous, wait until you find out for sure that it is safe.

GENERAL SAFETY PRECAUTIONS

Accidents caused by carelessness, haste, insufficient knowledge, or taking unnecessary risks can be avoided by practicing safety procedures and being alert while conducting experiments. Be sure to check the experiments in this book for additional safety regulations and adult supervision requirements. If you will be working in a lab, do not work alone.

PREPARE:
—Clear all surfaces before beginning experiments
—Read the instructions before you start
—Know the hazards of the experiments and anticipate dangers

PROTECT YOURSELF:
—Follow the directions step-by-step; do only one experiment at a time
—Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eye wash, and first-aid kit
—Make sure there is adequate ventilation
—Do not horseplay
—Wear an apron and goggles
—Do not wear contact lenses, open shoes, loose clothing, or loose hair
—Keep floor and work space neat, clean, and dry
—Clean up spills immediately
—Never eat, drink, or smoke in laboratory or work space
—Do not eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult

USE EQUIPMENT WITH CARE:
—Set up apparatus far from the edge of the desk
—Use knives and other sharp or pointed instruments with caution
—Pull plugs, not cords, when removing electrical plugs
—Don't use your mouth to pipette; use a suction bulb
—Clean glassware before and after use
—Check glassware for scratches, cracks, and sharp edges
—Clean up broken glassware immediately
—Do not use reflected sunlight to illuminate your microscope
—Do not touch metal conductors
—Use only low voltage and current materials such as lantern batteries
—Be careful when using stepstools, chairs, and ladders

USING CHEMICALS:
—Never taste or inhale chemicals
—Label all bottles and apparatus containing chemicals
—Read labels carefully
—Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves)
—Do not touch chemical solutions
—Wash hands before and after using solutions
—Wipe up spills thoroughly

HEATING SUBSTANCES:
—Use goggles, apron, and gloves when boiling water
—Keep your face away from test tubes and beakers
—Never leave apparatus unattended
—Use safety tongs and heat-resistant mittens
—Turn off hot plates, bunsen burners, and gas when you are done
—Keep flammable substances away from heat
—Have fire extinguisher on hand

GOING ON FIELD TRIPS:
—Do not go on a field trip by yourself
—Tell a responsible adult where you are going and maintain that route
—Know the area and its potential hazards, such as poison plants, deep water, and rapids
—Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold)
—Bring along a first-aid kit
—Do not drink water or eat plants found in the wild
—Use the buddy system; do not do outdoor experiments alone

FINISHING UP:
—Thoroughly clean your work area and glassware
—Be careful not to return chemicals or contaminated reagents to the wrong containers
—Don't dispose of materials in the sink unless instructed to do so
—Wash your hands
—Clean up all residue and put in proper containers for disposal
—Dispose of all chemicals according to all local, state, and federal laws

BE SAFETY CONSCIOUS AT ALL TIMES