Transpiration

Debra Smith

Columbia High School

2A

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Mr. Neddo

1. **Introduction**

Transpiration is the evaporation of water particles from plant surfaces, especially from the surface openings, or stomates, on leaves.  Stomatal transpiration accounts for most of the water loss by a plant, but some direct evaporation also takes place through the surfaces of the epidermal cells of the leaves.

The amount of water given off depends somewhat upon how much water the roots of the plant have absorbed.  It also depends upon such environmental conditions as sunlight, humidity, winds and temperature.  A plant should not be transplanted in full sunshine because it may lose too much water and wilt before the damaged roots can supply enough water.

Transpiration occurs as the sun warms the water inside the blade.  The warming changes much of the water into water vapor.  This gas can then escape through the stomata.  Transpiration helps cool the inside of the leaf because the escaping vapor has absorbed heat.

1. **Materials and Methods**

The 1000 milliliter flask fitted with a three hole rubber stopper, separatory funnel and a measuring pipet.  First, fill Erlenmeyer flask with 250 milliliters of distilled water.  Put the glass tube with a right angle bend into one hole of the three hole stopper.  Place stopper in flask making sure no air bubbles are trapped.

Take a plant shoot and cut in the sink under running water.  Remove the shoot from water and place the stem through the hole in the stopper and allow one inch of the stem to go into the water in the flask.  Place a separate funnel in third hole and fill with water to the upper mark.  Coat all joints will sealant and record the position of the meniscus at two minute intervals for 30 minutes.

Move the apparatus to the fume hood and measure every two minutes for 30 minutes.

Place a plastic bag over the leafy part of the shoot and fasten with a rubber band.  Measure this for an additional ten minutes.

1. **Results and Data**

**Table 1:  Room Conditions 25 degrees Celsius**

|  |  |  |
| --- | --- | --- |
| **Time** | **Measurement** | **Amount of Change** |
| 12:13 pm | 1.5 cm | ----- |
| 12:15 pm | 1.75 cm | 0.25 cm |
| 12:17 pm | 2.0 cm | 0.25 cm |
| 12:19 pm | 2.25 cm | 0.25 cm |
| 12:21 pm | 2.25 cm | ----- |
| 12:23 pm | 2.45 cm | 0.20 cm |
| 12:25 pm | 2.50 cm | 0.05 cm |
| 12:27 pm | 2.50 cm | ----- |
| 12:29 pm | 2.60 cm | 0.10 cm |
| 12:31 pm | 2.65 cm | 0.05 cm |
| 12:33 pm | 2.65 cm | ----- |
| 12:35 pm | 2.65 cm | ----- |
| 12:37 pm | 2.65 cm | ----- |
| 12:39 pm | 2.7 cm | 0.35 cm |
| 12:41 pm | 2.7 cm | ----- |

\* Total Transpiration - 1.5 cm

**Table 2:  Under Hood  20 degrees Celsius**

|  |  |  |
| --- | --- | --- |
| **Time** | **Measurement** | **Amount of Change** |
| 12:45 pm | 1.9 cm | ----- |
| 12:47 pm | 1.9 cm | ----- |
| 12:49 pm | 1.9 cm | ----- |
| 12:51 pm | 1.9 cm | ----- |
| 12:53 pm | 2.0 cm | 0.1 cm |
| 12:55 pm | 2.1 cm | 0.1 cm |
| 12:57 pm | 2.1 cm | ----- |
| 12:59 pm | 2.1 cm | ----- |
| 1:01 pm | 2.2 cm | 0.1 cm |
| 1:03 pm | 2.2 cm | ----- |
| 1:05 pm | 2.3 cm | 0.1 cm |
| 1:07 pm | 2.3 cm | ----- |
| 1:09 pm | 2.3 cm | ----- |
| 1:11 pm | 2.35 cm | 0.05 cm |
| 1:13 pm | 2.35 cm | ----- |

\*Total Transpiration - 0.45 cm

**Table 3:  Plant at Room Temperature 25 Degrees Celsius**   
**(Variable Plastic Bag Placed Over Plant)**

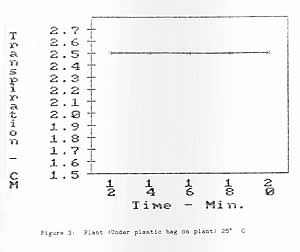
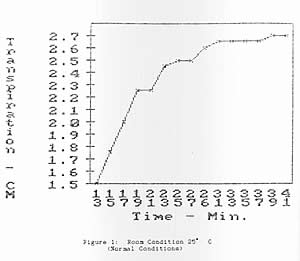
|  |  |  |
| --- | --- | --- |
| **Time** | **Measurement** | **Amount of Change** |
| 1:12 pm | 2.5 cm | ----- |
| 1:14 pm | 2.5 cm | ----- |
| 1:16 pm | 2.5 cm | ----- |
| 1:18 pm | 2.5 cm | ----- |
| 1:20 pm | 2.5 cm | ----- |

\*No Transpiration Change

**Table 4:  Control Peas (At Room Temperature 25 degrees Celsius)**

|  |  |  |
| --- | --- | --- |
| **Time** | **Measurement** | **Amount of Change** |
| 12:13 pm | 1.5 cm | ----- |
| 12:15 pm | 1.75 cm | 0.25 cm |
| 12:17 pm | 2.0 cm | 0.25 cm |
| 12:19 pm | 2.25 cm | 0.25 cm |
| 12:21 pm | 2.25 cm | ----- |
| 12:23 pm | 2.45 cm | 0.20 cm |
| 12:25 pm | 2.50 cm | 0.05 cm |
| 12:27 pm | 2.50 cm | ----- |
| 12:29 pm | 2.60 cm | 0.10 cm |
| 12:31 pm | 2.65 cm | 0.05 cm |
| 12:33 pm | 2.65 cm | ----- |
| 12:35 pm | 2.65 cm | ----- |
| 12:37 pm | 2.65 cm | ----- |
| 12:39 pm | 2.7 cm | 0.05 cm |
| 12:41 pm | 2.7 cm | ----- |

\*Transpiration Amount - 1.2 cm



1. **Discussion /Analysis**

This experiment was conducted to show how different effects such as wind or temperature affect transpiration.  The results of transpiration under normal room conditions on the plant showed the fastest rate of transpiration.  This faster rate showed that the temperature had the greatest effect on the pea plant leaves.  This also was indicated by the control group.

The next effect on transpiration comes from the wind factor present in the fume.  The rate of water loss and demand was 0.45 centimeters.  This proved that plants do lose water when outside conditions change such as in the presence of windy conditions.

When our plant was placed in the bag and the carbon dioxide and water vapor level was cut the plant had no movement of transpiration going on.  It was at this time that our plant had taken in enough water to meet the plants current water level needs.  Therefore, the stoma was closed.  The plant had no water loss to the atmosphere and so water was not taken into the plant.

A shoot was placed in the hole in the rubber stopper and inserted into colored water in the flask.  As the plant takes up water, air moves into the pipette.  Under set conditions the measurements were made on the volume and the rate at which water was transpired by following the movement of the interface between the water and air in the pipette.

Once the shoot was removed the rate of water uptake was greatly increased to 1.5 centimeters.  This was a new rate of water uptake.  The fact that the equilibrium rate of the plant freed from its roots was higher shows that the roots were unable to take up water as rapidly as the shoot was capable of transpiring it.

The rate of water uptake rose steadily during the first experiment and continued to rise at a slower rate in the fume.  Once the plant was placed under the plastic bag equilibrium had been reached ad therefore, the plant was full and turgid.

Since the roots on the plant no longer depressed the rate of movement of water into the plant, transpiration reached a new, constant equilibrium rate which was higher than that of the intact plant.