

Transpiration Investigation.

Aim: the purpose of this investigation is to measure and investigate factors affecting rate of transpiration in a leafy shoot.

Materials:

- ❖ 4 - test tubes
- ❖ Tin foil
- ❖ 4 leafy shoot
- ❖ Test tube rack
- ❖ Sticky labels.
- ❖ Top - pan balance

Method: Select a suitable leafy plant, cut off 4 shoots from it.

- Weigh the shoots and record their weights.
- Fill the 4 test tubes with the same volume of water.
- Mark the water level on the test tube.
- Place the test tubes in a test tube rack.
- Cover the openings of the test tubes with tin foil.
- Push the shoots through the tin foil coverings and leave them in the test tubes.
NB: be careful not to break the shoot or create too big a hole in the covering.
- Using sticky labels, label the test tubes: Controlled
 - Warm
 - Dry
 - Windy
- ❖ Place all the test tubes into the environments they've been labelled with for the same length of time.
- ❖ After the chosen length of time, measure and record the difference in the water levels for each test tube.
- ❖ Re-weigh the plant shoots and record the change in weight.

Predictions: I would expect all the test tube to show a decrease in their water levels because I expect all the plant to transpire. But I expect the difference in water levels in each test tube to differ. Of all the test tubes I expect the one labelled warm to show the greatest decrease in water level followed by the one labelled dry, then the test tube labelled windy. The test tube labelled controlled should show the least decrease in water level.

Scientific knowledge: The external factor, which has the greatest effect on transpiration, is temperature. The higher the temperature, the greater the rate of evaporation of water from mesophyll cells and the greater the saturation of the leaf atmosphere with water vapour. At the same time a rise in temperature lowers the relative humidity of the air outside the leaf. Both events result in a steeper concentration gradient of water molecules from leaf atmosphere to external atmosphere. The steeper

this gradient, the faster is the rate of diffusion. Alternatively, it can be said that water potential increase inside the leaf while decreasing outside the leaf.

In still air a layer of highly saturated air builds up around the leaf, reducing the steepness of the diffusion gradient between the atmosphere inside the leaf and the external atmosphere. Any air movement will tend to sweep away this layer. Thus windy conditions result in increased transpiration rates, the increase being most profound at low wind speeds. High winds may result in closing of the stomata, stopping transpiration.

Safety: in an easy, non-complicated experiment such as this there are no major safety precautions to take to mind. Just be sensible.

Results:

	<i>Starting Water Level</i>	<i>Finishing Water Level</i>	<i>Difference</i>	<i>Starting Mass (g)</i>	<i>Finishing Mass (g)</i>	<i>Loss of Water/per unit mass (ml/g)</i>
<i>Dry</i>	80mm	75mm	5mm	1.57	1.94	2.58
<i>Warm</i>	80mm	50mm	30mm	1.25	1.19	7N25.21
<i>Windy</i>	80mm	58mm	22m	1.36	1.45	15.17
<i>Controlled</i>	80mm	55mm	25mm	1.75	2.15	11.63

Conclusions and Analysis: I predicted that the test-tube labelled warm would show the greatest decrease in water level followed by the one labelled dry. But in fact the test tube labelled controlled had the second greatest decrease in water level followed by windy, with dry having the least water loss. So it seems my predictions were not totally right after all. But looking back the results seem to correspond with what the scientific knowledge suggested should happen. In agreement with the scientific research, temperature does have a great effect on the rate of transpiration.

Evaluation.

Although this seemed an easy, non-complicated investigation I find that more could have been done in an effort to make this as fair an investigation as possible to improve the results obtained. There were good and bad points about the method used although more bad than good.

A good point being, the test tubes were covered in an attempt to reduce evaporation of the water. Evaporation would have caused wrong results to be obtained on the rate of transpiration.

One factor I feel could have been improved was the shoots that were used. The shoots were very different in that they had different number of leaves, different stem lengths and thickness. I feel that all these do affect transpiration. Remembering that leaves are the surface from which water is lost therefore the more the leaves the bigger the surface area from which the water can be lost. Some shoots had more of their stem in the water than others.

Another factor is the volume of water that was used. At the start of the experiment a measuring cylinder should have been used to measure the same exact amount of water for all the test tubes.

I feel that potometers should have been used for this experiment instead of test tubes. Four potometer should have been set up in their different environments. They would have increased the accuracy of the results obtained and would have made the investigation more fair.