

INVESTIGATION

To investigate what causes plants to lose water.

THE PROBLEM

What do you want to find out?

I will try to find out what conditions cause plants to lose water. I will then try to prove my idea by conducting a number of experiments.

BACKGROUND KNOWLEDGE

What scientific knowledge do you have which might be useful in planning your investigation?

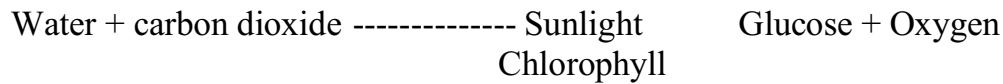
I know that Transpiration is the loss of water from the leaf surface, which helps to draw water up through the plant. The Surfaces on a cell are moist; this is because water evaporates from them into the spaces between the cells.

When transpiration takes place water vapour diffuses out of pores, these pores are called stomata. This happens between the cells at the leaf's surface. Leaf cells have to replace this lost water; they do this by replacing it with a solution inside xylem vessels, tiny tubes running through the plant from the root to the shoot.

There are a lot of different factors and conditions that affect the rate of transpiration. If the temperature increases, the water molecules evaporate from cell surfaces more quickly. If it is a windy day the moving air takes water vapour away from the leaf surface, increasing the diffusion gradient. When dry is around the leaf water from the cells evaporate faster. If the plant has more stomata transpiration happens faster. The amount of waterproof waxy cuticle the leaf has on the upper surface will prevent water moving through it.

The amount of light that shines on the leaf will also have an affect on the leaf. The amount of surface area that the leaf has, if the leaf is small and thin, that will mean that less sunlight will get to it and less transpiration takes place.

Plants also can lose water through photosynthesis.



PREDICTIONS

From what you already know what do you think will happen? Why do you think this will happen?

I think that the bigger the leaf is the more water it will lose. I think this will happen because I have a big plant with big leaves in my house and it needs more water than the smaller plants. I also have a cactus, which has little thin leaves, and it hardly ever needs watered.

VARIABLES

What factors are likely to affect your investigation? Why are these factors important?

Factors that will affect my investigation are the amount of water I use to soak the leaves in. The hair dryer I use to dry the plant will also have an effect on the plant, the distance it is from the leaf and which setting it is on (hot or cold). The time I leave the hair dryer blowing on the leaf will also bear a factor. These factors are important because it would not make the experiment a fair test and it could change the outcome of the experiment.

What will you change?

The only thing I will change is the size of the surface area on the leaf.

How are you going to control other factors?

I will control these factors using a ruler to measure the distance the hair dryer is from the leaf, I will keep it on the same setting. I will measure the amount of water I use with a measuring cylinder. I am going to use a stopwatch to make sure the hair dryers are on the leaf for the same amount of time.

What observations and measurements are you going to make and over what range? How will you make sure these are as accurate as possible?

I will record the weight of the paper with 20ml of water on it. Then I will leave the hair dryer on it for 2.30mins, and then I will weigh it after that. I will do this with a full size leaf (484cm²), three quarter size (363cm²), half size (242cm²) and a quarter size (121cm²). I will choose a volume that does not totally saturate the leaf and doesn't make the leaf drip water. I will do this more than once to get an average time.

RESULTS

What will you do with the results?

I will collect the results in a table and put them into a graph. I will also use the to try and find patterns with.

PRACTICAL PROCEDURE

What is going to be your method to test the predictions? Draw a diagram and list the materials and apparatus needed. Include any safety precautions you take.

I will simulate the conditions of the weather. I will use models as the wind and rain.

The materials I need to do this experiment are:

- Water (rain)
- Paper towel (leaf)

I will also need the following apparatus:

- Hairdryer (wind or sunlight)
- String
- Clamp Stands
- Stopwatch
- Measuring Cylinder

CARRYING OUT THE INVESTIGATION

Use your equipment to make observations and measurements as accurately as possible. Make sure you take enough results. Record all results clearly. Consider whether you should repeat any of your measurements. Describe any changes you made to your original plan. Mention any safety precautions you take.

The only safety precaution I took was to make sure I kept the hairdryer away from the water because I could get electrocuted or it can be very dangerous.

SURFACE AREA	WEIGHT (GRAMS)			
	1 st	2 nd	3 rd	Average
484cm ²	5.8	4.1	4.6	4.8
363cm ²	3.7	2.9	3.1	3.2
242cm ²	2.7	1.6	2.1	2.1
121cm ²	2.0	0.9	1.4	1.4

INTERPRETING

How can you best use and present your results?

I will best present my results in a line graph and in a table. I will also draw up a bar chart to compare the difference. *See next page*

Can you see any clear patterns?

Yes I can, it seems that the larger the surface area of the leaf the more water it loses.

What have you found out?

I have found out that when there is more surface area the more water it can absorb. I also found out that the larger the surface area the more water it loses.

How does your conclusion fit with your prediction?

My prediction matches with my conclusion. I said that the larger the surface area the more water it loses.

Try to explain what has happened as scientifically as possible.

What has happened is that water has been lost through the stomata. Water moves from cell to cell in the leaf by osmosis. What has happened is that water evaporates from cell surfaces and then diffuses out of the stomata.

This is what the lower skin of a leaf looks like under a microscope.

In most leaves, the lower skin has tiny hole in it called stomata. (One hole is called a stoma). Stomata allow carbon dioxide to pass in to the leaf and oxygen and water vapour to pass out.

This is one stoma greatly magnified. It is opened and closed by the by the guard cells.

Do you think your method was the best way of doing the investigation?

No I don't think this was the best way of doing the investigation because it wasn't entirely accurate at the start. The paper towels were dripping and that lead to water loss as well. If I did the experiment again I might try and do the experiment differently. I could leave the leaf in the sunlight over a period of time waiting for transpiration to take place. I might also try to use a lamp to shine on the leaf.

If you did it again, what improvements would you make?

If I did the experiment again I would make sure that the hair dryer was placed exactly on the leaf (paper towel), when I did it the paper towels were not always in the same place.

Do you think your results were accurate enough? Could they be improved?

Yes my results for my experiment were very accurate because I got the same results for each time I did it. First time I did the experiment I had a glitch.

Were there any results that did not fit with the main pattern? If so, can you explain why?

Yes the first time I did the experiment my results did not look very accurate. This was because instead of cutting the paper towel I just folded it in quarter and half.

Do you think your results are good enough to convince other people?

Yes I do think my results would be likely convince other people because they correspond with the hypothesis stated and are therefore in line with the expected outcome.

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12/10

Science Coursework