# Investigation to find does light intensity affect the stomata density of leaves

**Aim:** To find out that does light intensity affect the stomata density of leaves.

Leaf stomata are the main means of gas exchange in vascular plants. Stomata are small pores, typically on the undersides of leaves, which open or close under the control of a pair of banana-shaped cells called guard cells. When open, stomata allow carbon dioxide to enter the leaf for synthesis of glucose, and also allow for water, and free oxygen, to escape. In addition to opening and closing the stomata, plants may exert control over their gas exchange rates by varying stomata density in new leaves when they are produced. The more stomata per unit area the more carbon dioxide can be taken up, and the more water can be released. Thus, higher stomata density can greatly amplify the potential for behavioural control over water loss rate and carbon dioxide uptake.

**Prediction:** I think that from the top section of the bush will have more stomata present. I think this is because light stimulates the stomata's to open, and at the top of the bush the leaves are receiving the most light. For photosynthesis to happen the plant needs sunlight and carbon dioxide, so there are more stomata present there to take in the carbon dioxide they need for photosynthesis. I think that at the bottom section of the bush there will be less stomata present, because there is less light reaching the leaves, so there is less photosynthesis happening so the stomata do not need to be open because they are not receiving all the light they need for photosynthesis so they don not need to open for taking in carbon dioxide, only some oxygen and water leaving. I think that in the middle section of the bush there will me a moderate amount of stomata's present, because the leaves receive an average amount of light, so some photosynthesis occurs, and some stomata are present there to take in the carbon dioxide needed. Most of the photosynthesis occurs at the top of the bush because that is where most of the light is received, so that is where more stomata will be present.

**Apparatus:**
Microscope
Slides
3 leaves from 5 different sections of the bush
Luxmeter
Measuring tape
Clear nail varnish
Eyepiece graticule
Bush - Privet

**Method:**

Using a measuring tape, measure up to the top of the bush, 250 cm from the bottom. Pick three leaves from there, which are the same size. Using a luxmeter measure

the light intensity from where the leaves were taken three times to get an average light intensity. Do the same, but at the heights of 200cm, 150cm, 100cm, and 50cm. Record the results in a neat table. I took two sets of results so I could get an average of the stomatal density. Once you have collected all your leaves, and measured the light intensity from the five different sections of the bush. Take the leaves from the first section of the bush, and turn them on to their underside, taking the clear nail varnish put some on the middle right side of the leaf. Leave it to dry. Take a graticule and place it in the eyepiece of the microscope. When the nail varnish is dry. Carefully peel it off the underside of the leaf, and place the transparent sheet on a slide. Place each one on a separate slide. Place the slide on the microscope. Focus the microscope on the imprinted varnish on the slide. Using the graticule, count the number of stomata present, which are touching the line marked across. Note down the number in the table. Repeat this for all the leaves from the different sections of the bush, and record your results in a table. To make the results more accurate, repeat the experiment again, for a second set of results.

Variables:

- Height of where the leaves were taken from
- The age of the leaves
- Light intensity
- The weather (wind, humid)
- Type of plant

I took about three leaves from five different sections of the bush, so that I get a wider range of results. The leaves I picked from the different section of the bush had to be approximately the same size. To make sure the leaves were the same age, a piece of string was used to measure around the stem of the leaves that they were all the same size. So the ages of the leaf were the same to keep it a fair test, because the age of the leaf could affect the stomatal density. I used the same bush to make it a fair test, so that all the leaves were the same type, different plants could have different stomatal densities. I measured the height from where the leaves are taken from, so that I know what the light intensity is at the different heights. I measured the light intensity using a luxmeter from the different sections of the bush, from where the leaves were taken from. So that I know how much light is received by the leaves in those sections. I did all the experiment in one day, so that it was a fair test, because then the weather would be the same, the condition for the leaves would be the same. The weather being different, more humid or windy does affect the stomatal density. I used clear nail varnish because the stomata get imprinted on it. I use the graticule in the eyepiece because it gives a measurement I could use to measure along the line to see how many stomata

were present. To ensure that I counted the number of stomata accurately, I checked several times.

**Results:** Below the table shows the results my group collected.

| Height (Cm) | Light intensity (Lux) | | | Average Light Intensity | Stomata present along line of graticule | | | Average number of Stomata present |
|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | C | |
| 50 | 36 | 37 | 37 | 37 | 6 | 7 | 6 | 6 |
| 100 | 70 | 69 | 67 | 70 | 8 | 6 | 6 | 7 |
| 150 | 185 | 184 | 186 | 185 | 6 | 5 | 5 | 5 |
| 200 | 276 | 275 | 276 | 276 | 7 | 6 | 6 | 7 |
| 250 | 851 | 850 | 849 | 850 | 8 | 9 | 8 | 8 |

These are my second set of results:

| Height (Cm) | Light intensity (Lux) | | | Average Light Intensity | Stomata present along line of graticule | | | Average number of Stomata present |
|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | C | |
| 50 | 88 | 87 | 89 | 88 | 6 | 7 | 6 | 6 |
| 100 | 250 | 251 | 250 | 250 | 6 | 6 | 6 | 6 |
| 150 | 328 | 327 | 329 | 328 | 4 | 5 | 4 | 4 |
| 200 | 389 | 388 | 390 | 389 | 7 | 6 | 6 | 6 |
| 250 | 499 | 500 | 498 | 499 | 6 | 8 | 8 | 7 |

My results show the average number of stomata present at the different heights, and the light intensity at those heights. From these tables you can see that as the height increases the light intensity increases also. The light intensities are very different at the heights, but for both sets of results the average number of stomata present are very similar. I think our quality of results was quite accurate, since our results were very similar.

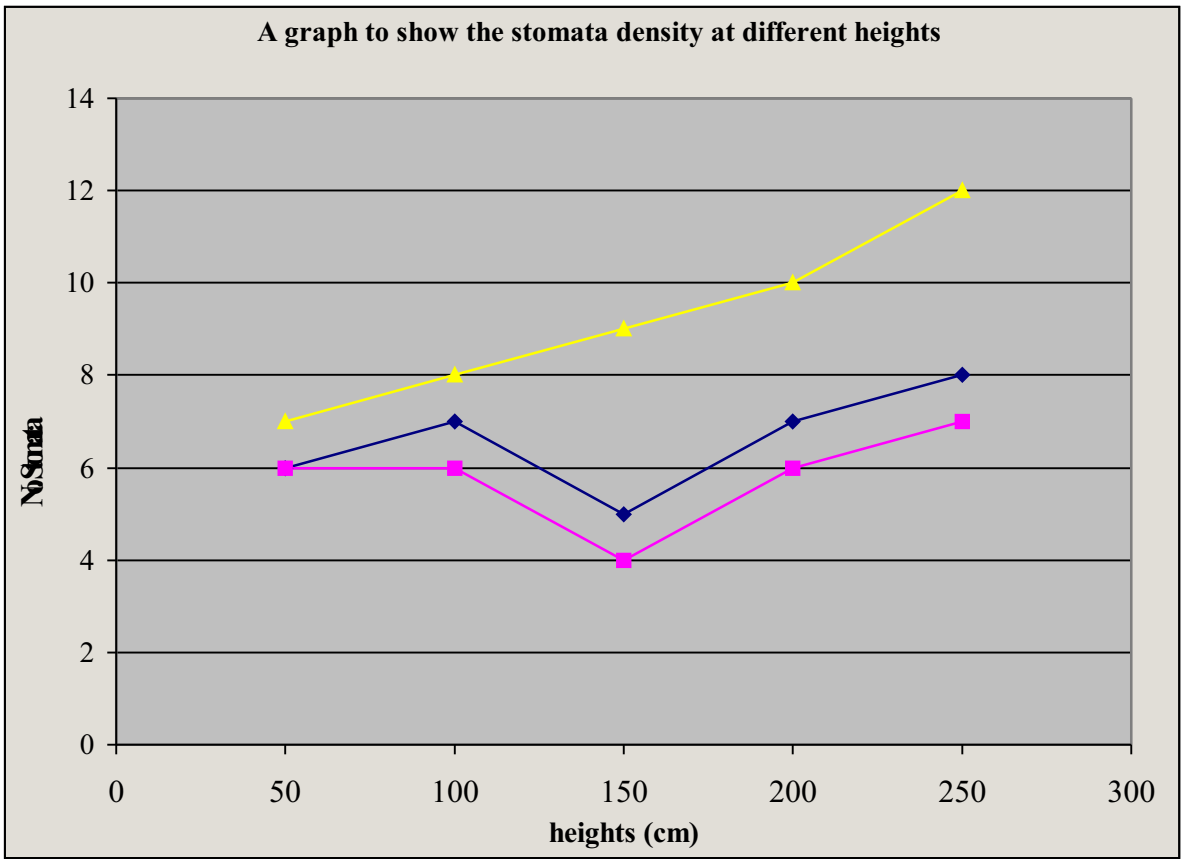
The results of my secondary source:

| Height (Cm) | Light intensity (Lux) | | | Average Light Intensity | Stomata present along line of graticule | | | Average number of Stomata present |
|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | C | |
| 50 | 60 | 59 | 60 | 60 | 7 | 8 | 7 | 7 |
| 100 | 96 | 95 | 97 | 96 | 8 | 7 | 9 | 8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 150 | 234 | 234 | 233 | 234 | 8 | 10 | 9 | 9 |
| 200 | 260 | 261 | 260 | 260 | 10 | 9 | 10 | 10 |
| 250 | 560 | 561 | 559 | 560 | 11 | 11 | 13 | 12 |

The result of my secondary source shows that as he height increases the light intensity also increases. As the light intensity increases the average number of stomata on the leaf surface also increase. This result is very different from my results. I have drawn a line graph to show all the data.

From looking at the graph you can see that more stomata were found present at the top and bottom section of the bush than in the middle section. The highest numbers of stomata were found at the top section of the bush. If you look at the graph, my two sets of results are very similar to each other; they are parallel to one another, except for the first point. If you look at the other results used from my secondary source, you can see that it is very different to my results. The result shows that the number of stomata increase as the height increases. My results are accurate to what I predicted.




**<u>Conclusion</u>:**

From looking at my results, I can say that my prediction was right. The results show that where the leaves receive the most amount of light, more stomata are found present there, because light provides energy for evaporation, the plant photosynthesis and the stomata open to allow carbon dioxide to diffuse in and water diffuse out. In the

middle section of the bush there was less stomata present because the leaves are receiving an average amount of light, so less photosynthesis is taking place so less stomata are opening to allow substances to diffuse in or out. At the bottom section of the bush there was more stomata present then the there was in the middle section. The leaves were receiving less light then the leaves in the other section, but there were still stomata present. Since there was less light reaching the leaves, there was less evaporation to take away the excess water. So the stomata were present there to remove the excess water. This was backed up by second set of results, they very similar to the first one, which shows that my prediction was quite accurate. The results of my secondary source show that as the light intensity increases, the number of stomata also increases. That as you go into the higher sections of the bush, there will be more stomata present there because those leaves were receiving more light.

**Evaluation:**

I think the experiment worked well, because I think I obtained accurate results, my results matched my prediction. I think that the quality of my method and results was quite good. I think that my method was the best way of doing the experiment, it was reliable, and gave accurate results because it was accurate to what I had predicted. I think I had enough correct results to draw a conclusion because me two sets of results were very similar. I have got enough evidence from my results to get a clear picture of how light intensity affects the stomata density. I think that my results were quite accurate and reliable, but for my secondary source of results I don not think they were that reliable. There could be various reasons for why these results were very different to mine. The method they were using could be totally different to mine. Maybe the bush might be a bit thin from where they were taking leaves. Maybe they did not count accurately using the microscope to count the number of stomata along the line of the graticule. To improve the quality of my results, I would do the experiment a couple of more times and compare and see if they are similar or not. Another experiment that could be carried out to extend this work could be to see how temperature also affects the stomata on leaves.