

The Effect Of Different Light Intensities On Basil
Plant Growth

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Abstract:

In My project “My Plants Be-Leaf In Me”, I set up 3 growth chambers with different lumen light bulbs. The bulbs were rated at 1000 lumens, 2300 lumens, and finally 5000 lumens. Each of these lights were shining for 10 hours a day on 18 basil plant pods each. Each pod had about 5 seeds in it. The objective of the project was to determine if higher light intensity bulbs were better for basil plant growth. The experiment was performed at my school in a teacher’s classroom. The experiment was going on for 5 weeks. The plants were watered 3 times a week on Monday, Wednesday, and Friday, for the 5 weeks. The reason for this experiment was to find the most effective amount of lumens for growing plants indoors. My results suggest that the 2300 lumen light bulb was the most efficient light bulb for growing basil plants. This proves my hypothesis right.

Introduction:

Some people do not have the money to go and buy a week's worth of food at the grocery store and spend three or four hundred dollars. Because of this many people choose to grow their own food. Over 43% and still rising to this day grow their own food based on the prices of food at grocery stores (Mariotti, 2023). Since just 3 years ago in 2020 which was the first year of the Covid-19 Pandemic prices have gone up more than 20% in just three short years. The cost of fuel, food, rent, power, and lumber have skyrocketed since 2020 (Brown, 2023). Since this price change has occurred, many people across the US have started growing their own food due to the drastic rise in the cost of living. A lot of people grow plants whether it's outside in a garden or inside in a growing system. When you are growing plants inside you have to try and mimic the sunlight so that your plants can perform photosynthesis (Horticulture, 2015). When doing this there are many different methods such as an LED light or a heating light. To maximize plant growth you have to figure out exactly which light intensity is best for the types of plants you are growing. Plants use light energy from the sun and turn it into chemical energy in the form of sugars (Sapkota, 2023). There is some debate for which light intensity plants prefer the most and some studies show that plants thrive the most in very intense light areas while other studies show plants prefer moderate light intensities (Trinklein, 2023). In one study plants that are grown with very high light intensities tend to have more leaf growth resulting in more photosynthesis, which essentially means more growth overall. To maximize the performance of photosynthesis a plant should have a lot of leaves. Plants that have more leaves will grow faster and taller while plants that have less leaves will grow shorter and slower (McPhee, 2016). According to another study,

plants tended to grow faster and taller the higher the light intensity. The study revealed that as light intensity increases the rate of photosynthesis will increase as well (Benckiser, 2023).

Objective:

The objective of this experiment is to determine whether or not basil plants grow the best with higher light intensity bulbs, or if the plants grow best with lower light intensity bulbs shining on them for 12 hours a day.

Hypothesis:

If basil plants are grown with different light intensity lights such as 1000L, 2300L, And 5000L in the same environments with the same amount of water then, the basil plants with higher lumens of lights will grow faster, taller, and more efficiently than the basil plants grown with lights with lower light intensities.

Methods:

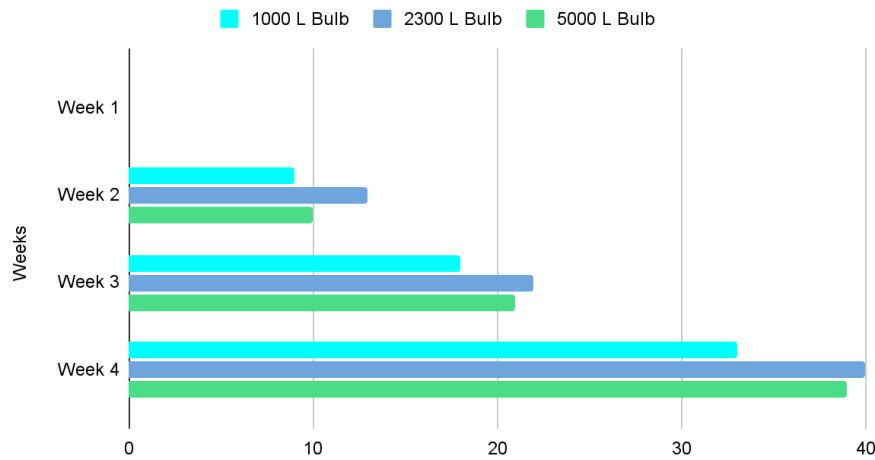
To perform this experiment I set up 18 pots of the same potting soil and the same amount of potting soil mixture (Miracle Grow), in each of my 3 growth chambers for a total of 54 pots with 4 basil seeds in each pot and each seed was buried $\frac{1}{4}$ in deep. The first growth chamber had an LED light that is measured at 1,000 lumens, the second growth chamber had an LED light that is measured at 2,300 lumens, finally the third growth chamber had an LED light that was rated at 5,000 lumens of brightness. The LED lights were only on from 8 a.m. to 3 p.m. The plants each were kept enclosed in the growth chambers so that the light from each plant only affects that plant. All of the LED lights were manufactured by the same company to ensure

validity. I watered the basil plants with 10 mL of water 3 times every week. Those days were on Monday, Wednesday, and Friday. I recorded data from the basil plant's height and the number of leaves on each plant weekly at every watering session in a data table for 1 month. After 1 month the basil leaves were picked from each plant and put in separate containers to be measured in mm. I took the three biggest basil leaves from each plant and measured the length of them in mm. After the basil was measured it was put in bags to dry for use in cooking or other needs.

Results:

Week	1000 Lumen Bulb Plant Height (Cm)	2300 Lumen Bulb Plant Height (Cm)	5000 Lumen Bulb Plant Height (Cm)
1	0mm	0mm	0mm
2	9mm	13mm	10mm
3	18mm	22mm	21mm
4	33mm	40mm	39mm

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Discussion:

My initial claim in this experiment was that the lights with the 2300 lumen lights would grow the tallest plants. After I analyzed the data I saw that my hypothesis was approved by the data. After researching I found that the reason for this was that plants don't need any more than 3000 lumens of light. The recommended light intensity for most herbs and other plants is anywhere from 2000 Lumens to 3000 Lumens of light. For plants to grow they need to perform photosynthesis which does not require very much light at all. Growing plants with 5000 Lumen light bulbs or 1000 Lumen light bulbs would not be as efficient as growing the plants with a

2300 Lumen light bulb. Therefore, by performing this experiment we can now understand very clearly that the optimal light intensity light for plant growth would be about 2300 lumens.



Conclusion:

In conclusion, at the end of the experiment, I concur that the 2300 lumen light bulb was the most efficient light in the fact that the plants under that bulb light grew the fastest and tallest.

Limitations:

Some of my limitations included the experiment not being started until the beginning of February. This affected my results because my plants did not grow as much as I would have preferred them to. Also, my original seeds did not grow at all even after almost two weeks of growing. None of the seeds sprouted even though the seeds were new.

Future Studies:

The future studies of this experiment could include growing other plants with these lights to see which light and plant interacts the best out of 10 different types of plants. I could also include different color lights with different light intensities to see which color and which light intensity would be the best for different types of plants.

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