Brassica Rapa

Monitoring the activity of a living organism.

Aim:

To monitor the activity of a living organism in different colors of lights and different conditions.

Prediction:

My prediction is that the white light would help the plant photosynthesize better so the plant will grow better than the green and the red. This is because white light has all the natural colors (blue, red, orange, yellow, green, indigo, and violet).
My prediction for the red light is that it will not perform as well as the white light, the red plant will grow well because, it absorbs red and violet. So the plant might grow well.
The one in green will not grow good, I think this because plants reflect green light so the plant will not grow that well.
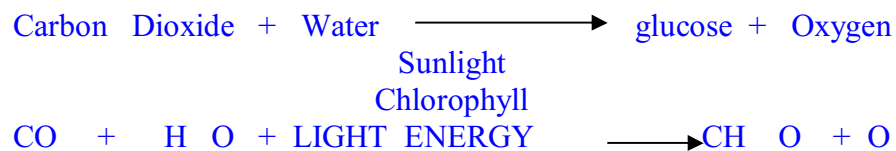
Background information.

Photosynthesis occurs only in the presence of light, and takes place in the chloroplasts of green plant cells. Photosynthesis can be defined as the production of simple sugars from carbon dioxide and water causing the release of sugar and oxygen. The chemical equation for photosynthesis can be expressed as:

$$\text{(light)}$$
$$6CO_2 + 6H_2O = C_6H_{12}O_6 + 6O_2 \text{ (in the presence of chlorophyll)}$$
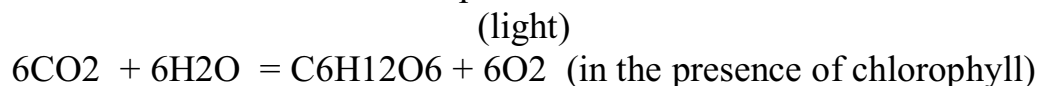
The fact that all plants need light in order to photosynthesize has been proven many times in experiments, and so it is possible to say that without light, the plant would die. The reason that light intensity does affect the rate of photosynthesis is because as light, and therefore energy, falls on the

chloroplasts in a leaf, it is trapped by the chlorophyll, which then makes the energy available for chemical reactions in the plant. Thus, as the amount of sunlight, or in this case light from a bulb, falls on the plant, more energy is absorbed, so more energy is available for the chemical reactions, and so more photosynthesis takes place in a given time. There are many factors, which affect the rate of photosynthesis, including light intensity, temperature and carbon dioxide concentration. The maximum rate of photosynthesis will be constrained by a limiting factor. Embedded in the membranes of the thylakoids are hundreds of molecules of chlorophyll, a light-trapping pigment required for photosynthesis. Additional light-trapping pigments, enzymes (organic substances that speed up chemical reactions), and other molecules needed for photosynthesis are also located within the thylakoid membranes. A chemical in plants called chlorophyll uses sunlight to convert carbon dioxide and water into carbohydrates and oxygen. Chlorophyll is the substance that makes plants green, chlorophyll is found in chloroplasts, tiny bodies in plant cells. The green pigment chlorophyll is essential for plants to be able to make food. Chlorophyll contains magnesium compounds, which help capture the energy in sunlight. The energy is used in food making process called photosynthesis. All living organisms depend on air for its survival. We use the oxygen in the air to convert food into energy, and we breathe out carbon dioxide. Plants use photosynthesis to convert the carbon dioxide from the air into foods, such as sugars, which they need to grow.

$$\text{Carbon Dioxide} + \text{Water} \xrightarrow{\text{Sunlight, Chlorophyll}} \text{glucose} + \text{Oxygen}$$

$$CO_2 + H_2O + \text{LIGHT ENERGY} \longrightarrow CH_2O + O_2$$

Apparatus;

Minipots = 3
Wicks = 12
Seed (Brassica Rapa) = 12
Growing mix = a beaker 100g soil from a grow bag
NPK Fertilizer = 6 pellets in each minipot
Ruler
Pens, pencils.

Rubber

A 100g beaker = for adding the soil and to measure the water I put in the minipots

Three light chambers = (red, green and white coloured chambers)

Method:

I am going to investigate how different conditions can affect four types of the same plant. First I am going to do a table in my book to record my results in. Then I will get four Minipots, I will insert four wicks to the bottom of each miniport so the seeds / plants get water. I then used a 100g beaker to get the soil and then inserted the soil half way in the minipots, then I placed four seeds in each hole of the minipots. Then I add the NPK fertilizer pellets. After the fertilizer I added some more growing mixture to totally cover the seeds. I decided to make it a fair test by adding the same amount of growing mixture and NPK fertilizer in all the pots. Also I will use the same measuring equipment every time I measure the growth.

I will measure the quantity of water given to the plant by using a beaker to measure the water before giving it to the seeds / plant, to make it fair I will give them all the same amount. I will be recording the colors of the leaves, how many leaves, the height of the stem, and the health of the plant. I will measure the plants every day until the brassica rapa plants are dead or when the experiment is finished. The three different conditions that I will keep my plants in will be colors of light (white, red, green.). I will put one of the minipots under the white light, one under the red light and then one under the green. Then every day I will measure there growth and water with the beaker with the measured amount of water. I will record everything In my plan or results table below.

This is my plan on how I recorded my results

Results of red light:

The seeds where planted before the weekend so I expected some stems to show.

Plant 1	Red Light	Water	Leaves	Color	Height (cm)	Health
Day 1						

A	50g	4	Green	1	Good
B	50g	4	Green	5	Good
C	50g	4	Green	7	Good
D	50g	4	Green	6	Good
Day 2					
A	50g	4	Green	1.2	Good
B	50g	4	Green	6	Good
C	50g	4	Green	7.4	Good
D	50g	4	Green	6.3	Good
Day 3					
A	50g	4	Green	1.2	Good
B	50g	4	Green	6.1	Good
C	50g	4	Green	7.4	Good
D	50g	4	Green	6.4	Good
Day 4					
A	50g	4	Green	1.2	Good
B	50g	3	Green/Yellow	6.1	O.K.
C	50g	4	Green	7.8	Good
D	50g	4	Green	6.7	Good
Day 5	50g				
A	50g	1	Yellow	1.2	Bad
B	None	0	None		DEAD
C	50g	1	Yellow	7.8	Bad
D	50g	2	Yellow	6.7	Bad
Day 6	50g				
A	50g	1	Yellow	1.2	Bad
B	None	0	None		DEAD
C	50g	1	Yellow	7.9	Bad
D	50g	2	Yellow	6.7	Bad
Day7					
A	50g	1	Yellow	1.2	Bad
B	None	0	None		DEAD
C	50g	1	Yellow	7.9	Bad
D	50g	2	Yellow	6.7	Bad
Day8					
A	50g	1	Yellow	1.2	Bad
B	None	0	None		DEAD
C	50g	1	Yellow	7.9	Bad
D	50g	1	Brown	6.7	Bad
Day9					
A	None	0	None	0	DEAD
B	None	0	None		DEAD
C	None	0	None	0	DEAD
D	None	0	None	0	DEAD

The brassica rapa plant lasted 8 days with the red light. I thought it would of done better because ''Certain red and blue wavelengths of light are the most effective in photosynthesis because they have exactly the right amount of energy to energize, or excite, chlorophyll electrons and boost them out of their orbits to a higher energy level. Other pigments, called accessory pigments, enhance the light-absorption capacity of the leaf by capturing a broader spectrum of blue and red wavelengths, along with yellow and orange wavelengths. None of the photosynthetic pigments absorb green light; as a result, green wavelengths are reflected, which is why plants appear green.''

Plant 2	White light	Water	Leaves	Color	Height (cm)	Health
Day 1						
A		50g	2	Green	To Small	Good
B		50g	2	Green	To Small	Good
C		50g	2	Green	To Small	Good
D		50g	2	Green	To Small	Good
Day 2		50g				
A		50g	2	Green	To Small	Good
B		50g	2	Green	To Small	Good
C		50g	2	Green	To Small	Good
D		50g	2	Green	To Small	Good
Day 3		50g				
A		50g	2	Green	3.8	Good
B		50g	2	Green	2.9	Good
C		50g	2	Green	3.7	Good
D		50g	2	Green	1.8	Good
Day 4		50g				
A		50g	2	Green	4	Good
B		50g	2	Green	3.2	Good
C		50g	2	Green	4	Good
D		50g	2	Green	1.8	Good
Day 5		50g				
A		50g	4	Green/Yellow	4.2	Good
B		50g	4	Green/Yellow	3.7	Good
C		50g	4	Green/Yellow	5.3	Good
D		50g	4	Green/Yellow	1.9	Good
Day 6		50g				
A		50g	4	Green/Yellow	5.5	O.K.
B		50g	4	Green/Yellow	3.8	O.K.
C		50g	4	Green/Yellow	5.6	O.K.
D		50g	4	Green/Yellow	1	O.K.
Day 7		50g				
A		50g	3	Green/Yellow	4.2	Better
B		50g	3	Green/Yellow	3.7	Better
C		50g	3	Green/Yellow	5.3	Better
D		50g	2	Green/Yellow	1.9	Better
Day8						
A		50g	3	Green/Yellow	5.6	O.K.
B		50g	3	Green/Yellow	3.9	Bad
C		50g	4	Green/Yellow	5.8	Bad
D		50g	2	Green/Yellow	2	Bad
Day 9		50g				
A		50g	3	Yellow	5.6	O.K.
B		None	0			DEAD
C		None	0			DEAD
D		None	0			DEAD

Results for white light in my experiment.

The plant in white light lasted longer than the red light plant. (as shown in the results)This is because this plant had both red and violet light to absorb which makes it healthier than the rest.

Result for green light in my experiment:

Plant 3	Green light	Water	Leaves	Color	Height	Health
Day 1		50g				
A		50g	0	None	0	
B		50g	0	None	0	
C		50g	0	None	0	
D		50g	0	None	0	
Day 2		50g				
A		50g	4	Green	6.1	O.K.
B		50g	4	Green	4	O.K.
C		50g	4	Green	3.9	O.K.
D		50g	4	D Green	3.4	O.K.
Day 3		50g				
A		50g	4	Green	7	O.K.
B		50g	4	Green	4.1	O.K.
C		50g	4	Green	4.3	O.K.
D		50g	5	Green	4	O.K.
Day 4		50g				
A		50g	5	Green	5	O.K.
B		50g	4	Green	4	O.K.
C		None	0			DEAD
D		50g	5	Green	5	O.K.
Day 5		50g				
A		None	0			DEAD
B		50g	2	Yellow	4.7	BAD
C		None	0			DEAD
D		50g	2	Yellow	4.9	BAD

The brassica plant in the green light started off well but then died quickly on day 6. This is because plants reflect green light so the plant was not getting any light. "None of the photosynthetic pigments absorb green light; as a result, green wavelengths are reflected, which is why plants appear green.''

Results:

Through my results I have found out that Brassica Rapa grows best in white and red light. This is because it needs red and violet light to

grow healthier. The red light provided the one color was not enough. The green light did not give the plant either of the colors, plus the plant reflects green light. The white light gave both of the colors so that grow the best. Even though I have found out the best light conditions the plants still died quickly. And my prediction was correct, there is evidence of photosynthesis happening because they grow and survived about nine days and the leaves where bright green and where getting quite large

Conclusion:

There are several things which need to be taken into account which can cause the rate of photosynthesis to change.

A) light concentration

B) temperature

C) chlorophyll concentration

D) carbon dioxide availability

The rate of photosynthesis decreases with decreasing light intensities, and so the more light there is, the greater the rate of photosynthesis. Temperature is an important factor in photosynthesis, and it helps to regulate the smooth functioning of enzymes and such, within plants. The enzymes work best at approximately 37 degrees.

Most suitable conditions for a plant:

The most suitable conditions for a plant is to be in sunlight, plants can tolerate prolonged temperatures above 45 C, and every 10 C rise in temperature roughly doubles the rate of photosynthesis. Soil is a big factor and the pH of the soil need to be accountable because the pH needs to be about 7.0 for a fairly neutral soil which plants like brassica rapa grow well in. A good supply of water is needed to maintain a healthy plant because plants needed water during photosynthesis. To replace the water used. And then the plant needs to be surrounded by carbon dioxide and nitrogen to grow. Also give it lots of space so its

roots can grow. It also needs lots of nutrition and fertilizer to be healthy.

Improvements :

The improvement I would make in this experiment will be that I will try to measure it over the weekend so the plants get water every day. The second will be to use different amounts of water to see if that affects growth or life span of the plant.

Evaluation:

The experiment was very fair because every thing was measured even the water was measured
A different method I would use is to change the length of time it is in light, and will try different lengths of time in light to see if that affects the growth of the plant.
I will also try to give the plant more carbon dioxide during the time the lights are on so it can produces photosynthesis more.

Any error's:

Industry improving plant productivity:

One answer for further increasing productivity is to improve crop varieties by ''selective breeding,'' and aided by genetic engineering. To achieve and produce plants that grow faster, look and taste better and are more resistant to stress and disease.
First the breeders select the best individual plants. Secondly they cross breed individuals containing at least some of the characters thought desirable, hoping to produce offspring that combine these characters.

By

William Docherty

This unit is fine- go ahead and print it.