Environmental Conditions On The Rate Of Photosynthesis

Introduction:

Plants are essential for us to live as they provide us with oxygen, but plants also need to make their own food. Plants have chlorophyll in their leaves and the green pigment allows plants to make their own food by a process called photosynthesis (Fernando, 2012). Photosynthesis is needed for plant growth as well. The rate of photosynthesis also depends on many factors, especially environmental conditions (Kaiser et al., 2014). Light and Carbon dioxide are the two main essential environmental conditions needed for photosynthesis. As a result, the aim was to see that whether changing these two conditions will have an effect on the plant growth or not. So, for this, a hypothesis was created. Two investigations were carried out with two different conditions and, in each condition, only one variable was changed, keeping the other same in order to see the change based on the desired variable which is changed.

In the first investigation, two leaves were taken from E. Sativa plant, and one was exposed to ambient CO2 with high light and the other one was kept in elevated CO2 with high light. This was the first condition. The hypothesis drawn from here was if the leaf is kept in ambient CO2 with high light then the plant growth will be less compared to elevated CO2 with high light.

Again, in the second investigation, two leaves were taken and this time, one was kept in ambient CO2 with high light and the other one in ambient CO2 with low light. This was the second condition. From here, the hypothesis was that if the leaf is kept in ambient CO2 with high light then the plant growth will be higher than the one kept in ambient CO2 with low light.

Results:

The environmental conditions are as follows:

- a) Ambient CO2 (400ppm)
- b) Elevated CO2 (1000ppm)
- c) Hight Light (800 ?mol m^-2 s^-1)
- d) Low Light (200 ?mol m^-2 s^-1)

Results were shown after some time. So, in the first investigation (Figure 1), it had been seen that the leaf which was kept in elevated CO2 with high light had an increased growth, in terms of leaf surface area, compared to ambient CO2 with high light (Wang et al., 2001).

On the other hand, in the second investigation (Figure 2), it had been seen that the leaf which was exposed to ambient CO2 with low light had a greater growth compared to the one kept in ambient CO2 with high light (Tian et al., 2017). As a result, the hypothesis for both the investigations were correct.

Statistics was also used to make the results of the investigations valid. Two-tail tests was conducted on both of the investigations.

- For investigation 1: t=5.503570788, df=198, p=1.14352 x 10^-07.
- For investigation 2: t=6.345072526, df=198, p=1.48201 x 10^-09.

Figure 1: Two bar graphs have been plotted with small error bars with respect to ambient CO2, high light and elevated CO2, high light. On the y-axis, the mean surface area of the leaf (cm^2) has been given which explains the change in growth of plant. The difference is clearly shown in the growth of plants between the two variables.

Figure 2: Two bar graphs have been plotted with small error bars with respect to ambient CO2, high light and elevated CO2, low light. On the y-axis, the mean surface area of the leaf (cm^2) has been given which explains the change in growth of plant. The difference is clearly shown in the growth of plants between the two variables.

Discussion:

After performing the above investigations, it clearly shows that both carbon dioxide and light are the most important components for the growth of plant as both of them, when increased, increase the rate of photosynthesis which thus increase the growth of plants. This is because both carbon dioxide and light are used in the photosynthesis reaction which spurs the growth in plants (Evans, 2013). The p-values for the two-tail tests of the two investigations are less than 0.05 which mean that the hypothesis is valid. Consequently, there is a significant difference between the two variables which resulted change in plant growth.

These studies (investigations) help us to understand the impact of the environmental conditions on the plant growth. Plants play an important role in people’s lives and as a result, plants should grow more and more in order to provide more and more oxygen in the environment.

Though the investigations were carried out in a good way, there were some limitations to it. The first limitation was the way the leaf surface area had been measured in the investigations. It had been measured using a software called ImageJ and so there can be a possibility of technical error. This problem can be minimized by using regression equation, grid count method, gravimetric method and plainmeter (Chaudhary et al., 2012). The second limitation was that only one type of plant species (E. Sativa) was used. For this to prevent, different species of plants should be used as they have different growth rates (Rapaport et al., 2014). The last, but not the least, the limitation is that no control was used in this experiment. The control group helps to minimize the effect of all variables except the independent variable (Explorable.com, 2019).