Effect of light intensity on photosynthesis

Plants occur around the world in a wide variety of environments. Plants are able to adapt to their surroundings because of photosynthesis. What affects the rate of photosynthesis? First, one must be able to identify what photosynthesis is. Photosynthesis is processing light. The formula for photosynthesis is 6H2O + 6CO2 ——ïƒ C6 H12O 6 + 6O 2. This ultimately means that water and carbon dioxide produce sugar as the plants energy, then the plant releases oxygen and water stays in the roots of the plant. Photosynthesis takes place in the chloroplast and chlorophyll will not absorb green light, therefore, while all the colors like violet, indigo, blue, yellow, orange, and red are being absorbed by the tree, green is being reflected that being the reason why plants are green.

Proposed Explanation

Different shades of light affect the rate of photosynthesis. The dependent variable for this hypothesis was the plants that we used. The independent variable was the different shades of light which were green, blue, and yellow. We placed each plant under each shade of light to get more accurate results. The control was just the normal experiment where we placed each plant under the light without any shade of light. We chose this experiment because plants do not absorb green light, they reflect it. So we figured different shades of light would have a direct affect on the rate of photosynthesis. Fertilizer has a direct effect on the rate of photosynthesis. The dependent variable for this hypothesis were different plants from experiment one. The independent variables were the different amounts of fertilizer we added to each plant. The control for this experiment was testing each plant without any fertilizer. After we tested the control, we added

100mL, then 105mL, then 110mL to each plant after each test. We chose to test the affects has fertilizer on photosynthesis, because fertilizer helps plants grow, therefore we believe photosynthesis would take place at a faster pace. Baking soda has an effect on the rate of photosynthesis. The dependent variable for this experiment was three different plants than the ones used in experiment two. The independent variables were the amounts of baking soda added to each plant. The control for this experiment was testing each plant without any baking soda. Then we put one pinch in each plant then tested it, then we added another pinch to each plant and tested it, then we added another pinch to each plant for a total of three pinches to complete our experiment. We chose to test the affects baking soda has on photosynthesis because if we add baking soda it will make carbon dioxide which ultimately allows the rate of photosynthesis to increase.

Predicted Results The majority of our experiments that we were going to conduct we felt we would have a pretty common sense idea of the outcomes. Here since we are testing the amount of oxygen produced in our three different hypothesis, we will first try the different shades of light, different amounts of fertilizers, and if the amount of baking soda has anything to do with the plants photosynthesis. Our first hypothesis was the different shades of light would affect the amount of oxygen produced by the plants submerged in the water. First we would do our controlled experiment of no light shade. Here we would predict that the plant would absorb some of the colors which in return would produce an average amount of oxygen. We predicted that if the shade of light shined on the plant was green then the outcome of the oxygen produced would be fairly low since plants tend to

reflect green light away from them. After we would test the green light we would move onto the yellow light. Here we predicted that the plant would produce a nice amount of oxygen since the plant absorbs multiple colors besides green and relatively absorbs yellow more since the majority of light given off the sun is yellow. Next we would try the blue light. We felt that since the light was going to be blue that the oxygen produced would be fairly low because the light absorbed from the plants tends to be higher in the yellow and orange areas.

The next set of predicted results would be if the amount of fertilizer added to the plants would affect the amount of oxygen given off. Since fertilizers are used to help plants grow and photosynthesize we felt that maybe fertilizer will also increase the amount of oxygen created. We felt that the more fertilizer that was added then the more oxygen would be produced. First we will do our control of no fertilizer added. Here again we feel that the plant would just give off a normal or average amount of oxygen off. If we added 100 ml of fertilizers to the plants we predicted that a low amount of oxygen would be given off. Only because we predicted that a higher amount of fertilizer would increase the amount of oxygen. Next we would give an extra 50 ml of fertilizer to the plants. Since more fertilizer was added again we predicted that an increase of oxygen would occur. Finally an additional 50 ml of fertilizer was added. Here since that is 200 ml we predicted that the amount of oxygen given off would at least be doubled from the 100 ml that was added earlier meaning that this should be a higher amount of oxygen produce overall.

Lastly we would predict the baking soda amounts and the oxygen produced. The reason we chose to test the baking soda is because if introduced to the water near the plant this would increase the amount of carbon dioxide absorbed from the plant. The more carbon dioxide absorbed, the more bubbles created by the plant. This would be our weakest hypothesis because we feel that the amount of carbon dioxide received would not really reflect the amount of oxygen produced because our original instinct was that it would have to do with light absorption. First we would test the controlled experiment of having no baking soda added at all. Once again our predicted result would be that an average or normal amount of oxygen would be produced. Next we would try adding a pinch of the baking soda to the water where the plant is. Here we would predict that little or no change would occur to the plant oxygen production.

Actual Results

After completing our multiple tests, we found that the majority of our predicted results were actually correct. After doing the control experiment, we realized without having anything enhance the plants that there was an average of 11 to 13 bubbles produced within a minutes span. Our first hypothesis, different shades of light, was what we really felt strong about and also was the one we felt would prevail to be the best supported. And that is was. Since plants have a higher preference to absorb yellow light we predicted that it would produce the most oxygen under the yellow film. That it did, the yellow produced the most oxygen bubbles out of all the different shades of light. The different films in general produced the most oxygen bubbles. Our third trial that we did seemed to produce an unusual amount

compared to the rest. Underneath the yellow film in one minute it produced 79 oxygen bubbles. This was inconsistent with the rest of our results. Next we did the second hypothesis which was fertilizer effected the amount of oxygen produced. Earlier explained, fertilizer is used to increase the rate at which plants photosynthesize by providing the nutrients needed. The plants really were not affected at all from the fertilizer producing an average amount equal to the control. The average was at 13 bubbles a minute and was the same throughout all three trials. Our third hypothesis, carbon dioxide effects the amount of oxygen produced was also at a low average of 11 to 13 bubbles a minute. This experiment really held no inconsistencies as well. All together we felt that the different shades of light had to do a lot with the amount of oxygen produced and now we feel this hypothesis was supported through the amount of oxygen bubbles that were produced. Here we have a graph that shows the average amount of bubbles that were produced in each trial(s).

Conclusion The first of our hypotheses we tested for was that different shades of light affect the rate of photosynthesis. Based on our experimental results our data supported our first hypothesis, because for all of the different light shades we used in our experiment each of the plants for the most part produced either more or less oxygen bubbles than the control, supporting that light shades do in fact effect the rate of photosynthesis. Our data showed that plants tend to photosynthesize at the fastest rate in yellow light than anything else as they produced the most amount of oxygen bubbles in the amount of time. The test results could easily be reproduced to produce the same results if the given materials were the same and more

trials were to be done with more plants to make sure that the experiment was not a fluke.

The first possible margin for error in these tests is the size, and condition of the plant. This causes a problem, as the plants could be larger possibly absorbing more carbon dioxide, which means more oxygen bubbles would be produced. The plant also could be less fresh possibly producing less oxygen. The second margin for error is the type of light, which in turn would affect possibly the heat of the water maybe having an effect on the photosynthesis rate. The last margin for error is miscalculating the time on either the preparation period, or the observed time allowing for more bubbles to be produced.

The addition of fertilizer effects the rate of photosynthesis was our second hypothesis, this hypothesis was not supported by our hypothesis, because the results were so varied that it was nearly impossible to tell whether the addition of fertilizer affected the rate of photosynthesis in any way. The reason that we have came to this conclusion was because though at 100ml each of the plants produced a lower oxygen amount when we tested for the 110ml the results were near identical to the control, meaning that fertilizer did not affect the rate of photosynthesis. This is a simple experiment to conduct and could easily be repeated for the same results, given that our procedure was executed as it should’ve been.

The results could also be because we added the fertilizer in a large amount then added only small 5ml amounts for the other two trials which might not have made much of a difference. A better way to conduct this would’ve been

to start by adding 50ml of the fertilizer, then 100ml then 150ml, which have a greater difference between them than 5ml intervals, so if the fertilizer was to make a difference it would become more apparent at which level the fertilizer caused the plants to demonstrate that change in photosynthesis rate. Another could be possible incorrect measurement of the fertilizer into the plants, which would provide one or more, more or less fertilizer than the other plants, corrupting the experiment. This causes a problem because it would make it so that different levels of fertilizer concentrations were in each of the plants, giving each a different level of nutrients. The plants too may not have had enough time to fully absorb the fertilizer into their roots, making it so that there would appear to be no change in the rate at which each plant photosynthesizes.

The last hypothesis we tested for was that the addition of baking soda to the plants water would affect the rate of photosynthesis. This hypothesis was supported, because the plants produced more bubbles when carbon dioxide was added to the water than the control which contained none. Our research showed that adding baking soda in fact did increase the rate of photosynthesis, because through the control all of the plants did not produce more than 3 oxygen bubbles, but when baking soda was added the plants created more oxygen, thus supporting that adding baking soda to the plants would affect their photosynthesis rate. The experiment could be recreated for the same results, given that the person recreating it has a tool that measures in pinches.

The margins for error for this experiment include: inaccurate measurements of baking soda per plant, possibly not enough time to let the baking soda

absorb into the plant, and how well the baking soda was distributed within the water. Inaccurate measurements or baking soda would have produced different amounts of carbon dioxide amongst each of the plants producing different oxygen levels. The baking soda might not have received enough time to absorb into the plant on the tests with larger amounts, thus making it appear that the amount of baking soda is for the most part irrelevant, just so long as there is some in there. The distribution of the baking soda within the water could also have been a place for error, as there is a possibility that the baking soda did not get evenly distributed throughout the plant thus making the water have different levels of concentration of carbon dioxide, because there could be clumps of baking soda sitting their preventing a quick, complete diffusion of the carbon dioxide molecules.