Conclusion:

Since there is one major technical difficulty in my experiment, which is the absence of a frequency stabilized laser, I wasn’t able to carry out my experiments. But luckily I got some help from my father. He did a short experiment for me in his lab. The experiment is similar to my project, he took wheat grass that is grown under the sunlight for about 10 days and used juice extractor to make some into liquid and measure the voltage reading using the same setup with a frequency stabilized laser. He then put the rest of the wheat grass into a dark room and took some out again after 30 hours and 50 hours and did the same thing again. The data and graph of this experiment is available in data section. This short experiment demonstrates that laser can be used to show the difference of sugar concentration in plants, which means that if I was able to get a frequency stabilized laser, I could have done my project and got some good results.

Recommendation

Since I was not able to do the experiment, I would totally recommend future AP Biology students to do it, and I have some recommendations for making the project better.

1. Get a frequency stabilized laser. This is the most important part of the experiment, because without this kind of laser, you will not be able to get a nice voltage reading. Cheap lasers will give you fluctuating voltage reading that the detector will pick up the change and give the digital voltmeter big change in readings like 5 volts. Since the sugar concentration in plants is low, if there is a change, the reading from the digital voltmeter will only have a small change like 0.1 volt. Therefore, an appropriate laser is really critical for this experiment.
2. Do NOT look into the laser beam directly! Laser beam is an intensified beam of light, although normal lasers shine on our skins will not result in any damage, it is bad for our fragile eyes.
3. Use different types of light bulbs. Different light bulbs will have lights of different spectrums. For example, incandescent lights produce a great deal of heat because it has spectrums that fall in IR level and visible light level. Plants require mostly blue and red light for photosynthesis Incandescent lights produce mostly red and some infrared light, but very little blue light. Fluorescent lights vary according to the amount of phosphorus used by the manufacturer. Cool-white fluorescent lights produce mostly blue light and are low in red light; they are cool enough to position quite close to plants. Try to use different colors of light bulbs, too. Although it is already been documented that certain wavelengths of light is best for plant growth, but maybe there is something that has not yet been discovered.
4. Use different types of plants. I was planning on using bigger plants like tomato plants and use capillary tubes to take liquid out of the phloem of the stems. But you might not be able to get enough liquid out of the plants and allow the laser to shine through the sample. But maybe if you can find a type of plants that you will be able to get enough liquid out, for example, 3 ml, it might work just fine, and you don’t have to extract juice out of the entire plant and get the sample. Try not to find a plant that’s already known to produce a lot of sugar, because you have to dilute it down to lower concentration with distilled water since the method only applies to low concentration of sugar.