RESULTS

DISCUSSION

My results did not turn out as I had expected. There were no "super plants" and there did not seem to be any significant difference between the plants with 12 hours of light and the ones with 24. The measurements of the width or diameter of the plants did not show a significant change, as most of the plants, no matter what group, exhibited the same measurements.

In trial 1 it seemed as if the 16 hours group performed the best, as it grew steadily over the duration of the experiment. The 16 hours group had the tallest plants overall (see [Graph](http://docs.google.com/GRAPHS4.HTML)) and the 20 hours group had the shortest. The 12 hours group�s average height fluctuated a bit in the beginning, and then grew steadily. The 24 hours group was just under the 16 hours group and it was surprising that the 20 hours group was so far below the 24 hours group. Four hours difference of light is not very much. But according to Peer, Briggs, and Langenheim�s experiment, plants grown in the shade will undergo extension growth as a response to growing in red light depleted shade. So the difference in height of the 20 and 24 hour group was odd. Another difference I observed was the way the plants grew. The [12 hours group](http://docs.google.com/Jan13_4.jpg) was flopping everywhere and as one moved to each section, one would see less flop and more of the plants standing tall. The [24 hours group](http://docs.google.com/Jan13_5.jpg) stood straight up for the entire experiment. This suggests that because the plants never experienced darkness, the auxin concentration in the plants remained balanced and did not bend the plants in any direction. The auxin in the 12 hours group and the 16 hours group would cause the plants to bend to receive maximum exposure to light during its photoperiod. The leaves of the 24 hours group were considerably darker than the 12 hours group suggesting that there was an abundance of chlorophyll in the leaves of the 24 hours group.

After seeing the results of trial 1 I decided that the 16 hours group and the 20 hours groups were unnecessary as I was only comparing the results of 12 hours of light and 24 hours of light. The in-between groups did not show any significant difference in growth so it seemed as if 4 hours of difference in photoperiods was not long enough. Therefore, for trials 2 and 3 I only tested the 12 hours group (the control) and the 24 hours group and compared results.

In comparing the 12 hours group and the 24 hours group in trial 2, it was evident that the 24 hours group was again exhibiting the darker leaves and the straighter stem. However, my family and I left for a 3-day trip, and when I resumed the experiment I found that the 12 hours group recovered better than the 24 hours group. I had left the plants in front of an open window so that they would still have sunlight, though it was the normal day length. The [12 hours group](http://docs.google.com/Trial2Comparison_H.jpg) grew steadily taller while the 24 hours group also grew steadily, but at a slower pace. The average width of the 24 hours group also dropped a bit before returning to normal. Deciding which group had grown better depended on whether growing slowly or quickly was more advantageous. If growing quickly were better, the 12 hours group would be more adapted. And if growing slowly, the 24 hours group would be better. The 24 hours group probably grew slowly because it had an abundance of light and did not need to elongate its stems in order to receive better exposure to light, as previous studies have found. The best judge would be to allow the plants to follow their whole cycle and produce radishes. Than a comparison of the quality of the radish would show which situation would be better. But because of a lack of time and a need for more trials, this was not possible.

Trial 3 produced the best results out of all three trials and I changed my experimental subject to sunflowers because the radishes were not producing very good results. In this way I could see if other types of plants would respond in the same way. In comparing the first two [pictures](http://docs.google.com/PHOTOS3.HTML) on this page one can see that the 24 hours group is considerably a darker shade of green than the 12 hours group. The leaves of the 24 hours group are larger and broader and the stems seem more strong and stable. The 24 hours group appears to be healthier. Towards the end of the experiment almost all of the plants flopped over, with the exception of a few of the 24 hours group plants. The planting tray in which the plants were grown in was too shallow to accommodate for the extensive root system of the growing plants. I am assuming that if I had transplanted the plants into larger pots, most of the plants would be growing straight up, including the 12 hours group. But with the exception of darker leaves, the 24 hours group looks almost exactly like the 12 hours group. This means that significant effects of 24 hours of light on plants are most evident in the beginning stages of the plant, about a week after germination. Again, I would have to see the quality of the seeds the sunflowers produced in order to accurately judge the effectiveness of 24 hours of light on plants.

Both groups of sunflowers grew at approximately the same rate (see  [Graph](http://docs.google.com/Trial3Comparison_H.jpg)) and the bases of the stems were all around the same width (see [Graph](http://docs.google.com/Trial3Comparison_W.jpg)). This shows that the 24 hours group did not exhibit any "super" growth rate.

CONCLUSION

Subjecting plants to more than the normal amount of daylight was ineffective at producing more efficient plants and therefore, my hypothesis was wrong. Significant differences only appeared about a week after germination, and then all of the groups of plants exhibited the same growth pattern. This kind of growth is odd, and if I had more time, I would see if this growth affected the product of the plant at the end. I had expected very wide stems with very broad leaves, but the extra 12 hours of light did neither. Perhaps I should not jump to conclusions and say that the extra 12 hours of light was ineffective because I did not see the end product, but it was ineffective in the �short-run.� In some of the plants, it was evident that auxin played practically no role in bending the plant towards the light because they grew straight up. In others, the auxin caused it to bend completely over. I cannot tell for sure that the 24 hours groups completely avoided photorespiration because there were no significant differences between these groups and the 12 hours ones, but I am sure that if I massed the plants, I would see some differences. I had not really expected for the 24 hours groups to be exceptionally tall because other studies and my previous science projects had shown that plants with an abundance of light tend to grow in height more slowly, and this was shown in a few cases. Basically, the 24 hours group did a tiny bit better in the beginning of each experiment, though not enough to say that a full day of light is the best for a plant.

RECOMMENDATIONS

The radish plants did not grow very well, some would just wither away randomly, so if this project or any like it is repeated, I suggest trying another type of plant. The sunflowers worked very well, but the planting tray quickly grew too small to accomodate them. Also, I suggest buying more than one light and setting it up with a timer because waking up at 2a.m. in the morning to cover the plants is not fun. This project was pretty basic and spin offs of it could be like studying the effects of auxin and light, effects of shade, or testing the photoperiodic response. I also recommend trying to grow the plants outside. I had to grow them inside because I needed easy access to the light, and the plants probably did not grow as well as they would have outside. My data measurements were just of the height and width of the plants and these do not seem very accurate, especially since the width of the plants showed very little significant change. So I suggest massing the plants along with the measurement of height.