CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
S1720

Project Title
Ozone Depletion: A Concern for More than Mankind: Year Three

Abstract

Objectives/Goals
The obvious thought after hearing phrases such as ozone depletion and intense UV is the thought of effects on humans, namely skin cancer. Since plants sustain human existence, I wanted to look into this area that is often overlooked. This experiment looks into whether or not Phaseolus vulgaris (Kentucky Wonder Bean) is able to repair damage caused by higher levels of UV.

Methods/Materials
Major Materials: Phaseolus vulgaris, Mineral Light Mild UV lamp, Olympus Fluo-view V. 5.0 Fluorescent Imaging Technology, Coors Scientific Pulverizer, Cary 50 Scan Spectrophotometer, Satorious CP 225 D Scale, ethanol.
Procedures: Label each bean plant with its illumination time and trial number. Cover 1/2 of the leaf with foil to block the UV. Illuminate for the specified interval. Record the mass of 1 square inch of surface area of the exposed side. Use a clipping of the exposed leaf for the imaging, and use the fluorescent imaging to see interior structures. Pulverize the massed 1 square inch of surface area into solution. Insert solution into the spectrometer, and scan. Place plant in normal environment (outside) for specified duration. Repeat steps for massing, imaging, and scanning. Repeat for all trials of all durations. Analyze the masses, images, and peaks of spectrometric results.

Results
The data showed that the UV light damaged the leaf by causing water loss in addition to chromophore depletion. Flavonoids, structures designed to protect photosynthetic light receptors in plants, were clearly damaged by the radiation, as their peaks in the UV spectrum diminished in the spectrometric graphs. However, imaging before the recovery period showed that the chromophores seemed to be intact. After the recovery period, the mass of the leaf decreased immensely, flavonoid concentration remained low, chromophore absorption was greatly diminished, and imaging revealed damage to the structure of these pigments.

Conclusions/Discussion
The plant was not able to repair the damage caused by the UV light and died from only two days of illumination. The low masses of the leaves after the recovery period reveal that the water loss is permanent: the UV causes the inability of the leaves to retain water. The plant did synthesize more chromophores in an attempt to maintain light absorption for photosynthesis, however the lack of flavonoids made even the level of UV in the current atmosphere damaging to the unprotected chromophores.

Summary Statement
The effects of UV on Phaseolus vulgaris, and whether or not the plant can repair damage caused by the radiation.

Help Received
Mother helped glue board; Used lab equipment at UC Irvine under the supervision of Mercedes Lin and Eric Potma