



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Anna Afasizheva	Project Number S1601
Project Title Color Crime	
Abstract Objectives/Goals Plants are found all around us, and often arouse a healthy interest. So, I designed a project intended to increase my knowledge of the world I live in. Five experiments were conducted comparing the pigment composition of various parts of different plants, thus determining what happens to it in different scenarios. Methods/Materials For each experiment, pigment was extracted from the specified plants. Then, for each sample, a chromatography strip was prepared and run for one and a half hours. The remaining pigment extracts from each sample were analyzed with a UV/VIS spectrophotometer at particular wavelengths. Finally, as an addition to the original experiment, some well-separated strips of the chromatograms were cut out to elute the individual pigments. In turn, each individual #clean# pigment was analyzed with the same spectrophotometer at the matching wavelengths. Results Ex.1: [What happens to pigment as leaves change color with seasons?] It was shown that in a series of green, yellow, red, and brown leaves the quantities of different pigments diminish or increase accordingly to replace the previous color of a leaf. Ex. 2: [Why are two leaves of the same tree different in color intensity # one is lighter while the other is darker green?] The lighter leaf contained more of the lighter chlorophyll a, while the darker leaf contained more of the darker chlorophyll b. Ex. 3: [Does the temperature of a refrigerator have an effect on a plants pigment composition?] The refrigerated plant showed no difference* in composition when compared to a fresh plant. Ex. 4 and 5: [Compared different, yet similarly colored parts of the plant to determine whether or not the coloring pigment was the same] The root-crops, leaves, and petals showed no difference* in composition when compared to each other. *it is meant that the graphs constructed from the spectrophotometer#s data had corresponding peaks. Conclusions/Discussion Ex. 1: The pigment in a leaf deteriorates with time, giving way to another pigment, causing a change in color. Ex. 2: The color intensity difference is caused by varying forms of chlorophyll as well as the amounts of pigment found in each leaf. Ex. 3: The temperature of a refrigerator has no effect on the pigment composition of a plant. Ex. 4 and 5: The pigment which gives a certain color to various parts of the plant is the same in all those	
Summary Statement "Color Crime" is designed to create a better understanding of our surrounding flora through analyzing and comparing their pigment composition.	
Help Received Assistance with handling equipment was received from Inna Afassijeva Ph. D.; Lab space provided at University of California in Irvine by Asistant Professor Ruslan Aphasizhev	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Christine A. Blauvelt	Project Number S1602
Project Title Parameters Affecting the Conversion of Solar Energy to Grass Biomass	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals In our world today, due to global warming from burning fossil fuels and the rapid decrease in the supply of fossil fuels, it is necessary that we begin to turn to renewable energy sources. The objective of my experiment was to understand how sunlight exposure conditions affect the grass growth process in order to gain insights for achieving the best efficiency for converting solar energy into grass biomass energy.</p> <p>Methods/Materials The general procedure of the experiment was that 150 grass seeds were planted in each of various pots. After germinating outdoors, the grasses were grown indoors under controlled illumination conditions under an incandescent SoLux lamp with a spectrum similar to that of sunlight. A light meter was used to monitor the light intensities. The grasses were dried with a dehydrator, and the biomasses were weighed with an accurate scale.</p> <p>Results The dried biomasses were used to calculate production rates and conversion efficiencies. Preliminary tests were done with a variety of common lawn grasses to compare growth rates. Rye grass was found to have the fastest growth rate. As a result, it was used for the remaining tests, in which various trials with different daily durations of light exposure, light intensities, or growth durations were conducted to see the effect of the variables on grass growth. The results were plotted to observe trends.</p> <p>Conclusions/Discussion Significant grass growth was observed even in the absence of any light. After taking into account the dark growth, the grass biomass production was found to be proportional to light exposure up to moderate light levels and then saturated at high light intensities. This saturation led to a reduction in the efficiency of converting solar energy to biomass energy as the light intensity increased to high levels. The biomass production rates also increased as the growth duration increased. Understanding these processes and optimizing growth conditions for this application can lead to making grass a viable renewable energy source.</p>	
Summary Statement This project studies how parameters such as light exposure, light intensities, and growth duration affect conversion of solar energy to grass biomass energy.	
Help Received Parents purchased material and equipment for this project.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Brendan J. Chan	Project Number S1603
Project Title Secrets to Better Plant Growth	
Abstract Objectives/Goals My objective was to learn if watering with Liquid Plant Food will help plants grow faster than using other solutions. The purpose of this project was to find out whether different solutions used to water a plant will make it grow faster. Methods/Materials Fifteen oregano cuttings were watered with five different solutions. The solutions were Liquid Plant Food, Hydrogen Peroxide, Fish Water, Water, and Green Tea. Three cuttings were watered with each solution. Measurements were taken over a period of 21 days. Plants received a total of ten to eleven hours of light using both sunlight and artificial light. At the end of 21 days, the total average net growth was calculated and analyzed. Results Plants watered with Fish Water had the largest total average net growth of 72.7 mm. Green Tea and Liquid Plant Food were tied in second place at 71.0 mm. Hydrogen Peroxide came in third at 66.3 mm, with Water having the least amount of growth at 58.0 mm. Conclusions/Discussion The data did not support my hypothesis that Liquid Plant Food would make plants grow the fastest. The Fish Water actually worked the best with 72.7 mm total average net growth, while the Liquid Plant Food tied with Green Tea in second place with 71.0 mm net growth. Though Liquid Plant Food will help plants grow faster, other solutions could be used to grow plants just as fast or faster at a more economical cost.	
Summary Statement This project is about growing oregano cuttings with different solutions and measuring which has the largest total average net growth to see if Liquid Plant Food works the best.	
Help Received Dad helped me obtain all the materials. Mom proofread my project and helped when an extra pair of hands was needed (e.g. measuring plants and gluing the project together). Also, Lori, with Orchard Supply Hardware, showed me how to plant oregano cuttings.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Christina M. Chu	Project Number S1604
Project Title Live and Let Die	
Abstract Objectives/Goals My objective was to test the application of positive and negative words on the growth of 2 types of plants. Methods/Materials I used two types of systems for delivering the postive and negative words. One was words written on separate water jugs and the other was separating individual plants and talking to them. There was a control plant that received neither positive or negative words. I used 2 different types of plants and water jugs, while the lighting and temperature was exactly the same. Results My results were very dramatic with spider plants and resulting in proving my hypothesis. The results using violets were not as dramatic but still proved my hypothesis. My hypothesis was that the plants that received the positive words would grow faster than the control plant and considerable better than the plant receiving the negative words. Conclusions/Discussion I believe that using water with words such as Love, Compassion, etc and saying to the plants that it was beautiful and I loved it, aided in the plants growth. Using words like Hate, War, Prejudice, etc. and telling the plant it was ugly and stupid made the plant sickly and lessened its growth. Although this type of energy can not be measured by any known means I used the scientific method to prove my hypothesis.	
Summary Statement To see the effects of positive and negative energies of words on plant growth and health	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Natalie M. Garcia	Project Number S1605
Project Title How Will Coca-Cola Affect the Growth of Plants?	
Abstract Objectives/Goals For my science fair experiment I wanted to find out how will Coca-Cola affect the growth of plants. I hypothesized that the plants would grow taller and grow more leaves. Methods/Materials In my experiment I got three groups of plants and gave one group Coca-Cola, one group water, and one group nothing. At the end of each week I would measure the growth of the plants by measuring how tall each plant was and how many leaves each plant had. I then compared the growth of the plants according to their height and the number of leaves on each plant. Results My results were that the Coca-Cola plants died quicker, grew smaller, and did not grow more leaves. The plants that were given water stayed about the same height and grew a few more leaves. The plants that were given nothing ended up dying very quickly and they dried up very quickly. Also Coca-Cola causes for a foul odor to develop in the soil of the plants and for flies and ants to come and invade the plants. Conclusions/Discussion In conclusion my hypothesis was not supported through my data and experiment. Coca-Cola does not cause for plants to grow taller and grow more leaves. In the end Coca-Cola is very bad for plants and causes for them to dry up faster, die quicker, grow smaller and not to grow as many leaves. My experiment showed that Coca-Cola is not good for plant growth.	
Summary Statement My project is about how will the growth of plants be affected by the plants being given Coca-Cola instead of water.	
Help Received I did my project all on my own. I did not receive help from anyone else.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Berenice Gonzalez	Project Number S1606
Project Title Plants and Salinity	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To find out what different concentrations of salt do to plant growth.</p> <p>Methods/Materials Materials: Salt water; 50 large plastic cups; Potting soil; Water; Seeds (peas); A nail; Permanent marker; Plastic Crates; Paper and pencil; Ruler.</p> <p>Methods: Label the fifty cups with permanent marker (Separate into groups of ten: ten with pure water, ten with 1/10 saltwater, ten with 1/4 saltwater, ten with 1/2 saltwater, and ten with pure saltwater). Poke five holes at the bottom of each cup with a hot nail. Put about two inches of potting soil into each cup. Put one seed into each cup and cover with 1 1/2"-2" of potting soil. Prepare water by mixing salt water with pure water(one half saltwater + one half pure water; 9/10 pure water +1/10 saltwater; and 1/4 saltwater + 3/4 pure water). Water each group with corresponding water every other day and record growth (measure growth with a ruler).</p> <p>Results Plants with all salt water showed no growth. The ones with 1/2 salt grew an average of 1.4 cm. Plants with 1/4 salt grew an average of 4.9 cm. Plants with 1/10 salt grew an average of 14.4 cm. and pure water plants grew an average of 24.4 cm.</p> <p>Conclusions/Discussion My results came out to be what I expected. My hypothesis was supported. The plants that were watered with higher concentrations of salt, grew less (slower) than the pure water plants. My data also came out to be significant. All of my data was at least 68% significant. If I were to do this project again I would do it with different plants and different concentrations of salt in the water. From this project, I learned that salt in water makes plants take longer to grow and affects other things such as their color.</p>	
Summary Statement My project is about the effects of salt on plant growth.	
Help Received Mom helped with planting seeds and collecting water. Mr. Callaway helped with statistical analysis.	



CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s) Luke B. Hampton	Project Number S1607
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Project Title
Difficulties of Farming in Karst Topography: Adsorption of Iron in Collard Greens in Limestone

Abstract

Objectives/Goals
To analyze the absorption of iron in collard greens in the presence of limestone.

Methods/Materials
Collard greens were grown in silica sand with varying amounts of steel wool. Half of each cultivar contained 5 grams of calcium carbonate after 8 weeks 5 grams of plant material was harvested, ashed in HCl, filtered and bonded to potassium thiocyanate. Solutions were placed into a spectrophotometer. The absorptions were compared to a known set of standards. From a standard graph the grams of iron per gram of plant were calculated.

Results
The control absorbed the least iron from the steel wool followed by the 0.5 g steel wool cultivar. There was a large jump from the 0.5 g steel wool to the 1.0g and the 1.0g to the 1.5g. The greatest amount of iron was found in the 1.5 g cultivar containing 0.0000100 grams of steel wool per gram of collard green. The 2.0g cultivar contained slightly less iron than the 1.5 g. It was found that 1.5 grams of steel wool produces the most iron in the plants.
The cups that contained the limestone chips yielded less iron in the plants even though they contained the same amount of steel wool as the cultivar they were in. There was no difference in the amount of iron absorbed in the control plants with and without limestone. The greatest variation was found in the 1.0 g plants. There was 7.5×10^{-6} of iron per gram of plant. There was a significant decrease in the amount of iron with calcium carbonate: 5.1×10^{-6} grams Fe/ 1.0 g plant. There was no difference in the 2.0 g cultivar when grown with limestone.

Conclusions/Discussion
There very little iron recorded in the control. The cups containing 0.5 grams of steel wool had significantly more iron absorbed than the control simply due to more iron in the sand. The data proves the hypothesis correct that growing plants in soil with limestone greatly decreases the amount of iron absorbed by the plants. This is shown through the 0.5, 1.0, and 1.5 gram cultivars. Limestone produces carbonate in the soil which hydrolyzes water to produce hydroxide.
$$\text{CaCO}_3(\text{s}) \rightleftharpoons \text{Ca}^{2+} + \text{CO}_3^{2-}$$
$$\text{CO}_3^{2-}(\text{aq}) + 2 \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{H}_2\text{CO}_3(\text{aq}) + 2 \text{OH}^{-}(\text{aq})$$
The hydroxide then bonds to the iron making an insoluble solid that cannot be absorbed by the plants. The bar graph shows this in that the plants grown in limestone chips produced less iron.
$$\text{Fe}^{+3}(\text{aq}) + 3 \text{OH}^{-}(\text{aq}) \rightleftharpoons \text{Fe}(\text{OH})_3(\text{s})$$

Summary Statement
To find the affect of limestone on the absorption of iron in collard greens.

Help Received
Mother helped with project.



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Oliver Glenn V. Hernaez	Project Number S1608
Project Title Determination of Cyanide Content in Philippine Cassava	
Abstract Objectives/Goals Cassava is a staple crop in many third world countries that is an edible but poisonous plant. It produces a cyanogenic glucoside called linamarin, which is hydrolyzed by the linamarase enzyme. The question being answered was: "Is the hydrogen cyanide content of the Philippine cassava root, sap, leaf, and flour samples, over the toxic level of thirty ppm?" Methods/Materials Using the picrate test method, cyanide levels of the cassava root, leaf, sap, and flour were determined. Linamarase enzyme was used to enhance linamarin hydrolysis. Picrate paper and phosphate buffer paper with pH of 6.0 were prepared with the use of filter paper. In conducting the experiment, phosphate buffer paper was placed in a film canister and 0.1 mL of linamarase was added. a sample was added followed by 0.5 mL of water. After that, a picrate paper was inserted before the container was sealed and set at room temperature overnight. A color chart was used to determine the cyanide level in ppm. Ten samples of each kind, roots, leaves, sap, and flour, were tested. Results Sample averages were 23.5 ppm for the roots, 15.5 ppm for the leaves, 8.0 ppm for the sap, and 7.0 ppm for the flour. A person must eat at least 1.28 kg. of roots, 1.94 kg of leaves, 3.75 kg of sap, and 4.29 kg of flour to reach the danger level for being prone to intoxication of cyanide. Conclusions/Discussion These were below the suggested danger level of 30 ppm. Testing the total cyanogenic glucosides through varieties of cassava samples would conclude which type of species of cassava have higher levels of cyanide. The picrate test method is essential in determining cyanogenic levels in cassava plants to ensure safety of populations consuming cassava crops.	
Summary Statement This project is about the amount of cyanide poison in the cassava plant because it helps people, especially in third world countries, be aware of its danger and ensures their safety.	
Help Received Conducted parts of the experiment at Don Mariano Marcus Memorial State University in La Union, Philippines under supervision of Dr. Leonora Ngilangil; Victoria Acquistapace helped with guidance through the application process	



**CALIFORNIA STATE SCIENCE FAIR
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Name(s) Elizabeth Jimenez	Project Number S1609
Project Title The Effects of Gibberellic Acid on Seed Germination	
Objectives/Goals Seed germination is the process in which a shoot and a root emerge from a seed thereby ending its dormant stage. Gibberellic Acid is a naturally occurring plant hormone that triggers germination of seeds by helping them sprout. By manipulating the level of Gibberellic Acid seeds are exposed to, farmers are able to better control when their crops will sprout. As a result, farmers are able to better gauge when to harvest their crops. In my experiment I decided to study the effect of Gibberellic Acid on seed germination. I hypothesized that if Gibberellic Acid is added to seeds when they are germinating, then the seeds will germinate faster than if they were treated with only water.	
Abstract Results For two weeks I recorded any changes that had occurred. However I was unable to collect enough data to definitely determine whether or not farmers should routinely use Gibberellic Acid.	
Summary Statement My project focused on the effect of adding Gibberellic Acid to germinating seeds.	
Help Received Ms. Honeycutt helped revise my report and helped with statistical analysis.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Kehly D. Kirk	Project Number S1610
Project Title Adding H(2)O(2) to the Mix: Effects of Hydrogen Peroxide on Germination and Plant Growth	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Hydrogen peroxide can benefit plant growth in two major ways: 1) improved aeration; and 2) killing microorganisms that may be harmful to plant growth through its bactericidal/algaecidal/fungicidal qualities. This project was designed to test the effects of various concentrations of hydrogen peroxide on germination and plant growth.</p> <p>Methods/Materials 20 Petri dishes, filter paper, 3 Jiffy Easy Grow Greenhouse Kits, potting soil, tap water, hydrogen peroxide solution, and seeds (cantaloupe, cucumber, radish, spinach, watermelon) were used. The Control Group was watered with tap water as needed and the Experimental Group was treated with one of three different concentrations (low, nominal and high) of hydrogen peroxide solution as needed. Petri dishes and greenhouses were checked for seeds that had germinated and data recorded daily. After most of the plants in the greenhouses had germinated, additional data including leaf color intensity, stem height, and overall appearance was collected weekly.</p> <p>Results Data results indicated significantly better results in Experimental Group vs. Control Group in some areas. For cantaloupe: better germination in the Petri dish and greenhouse kit at nominal concentration. For radish: better greenhouse growth and color at low concentration and germination in the Petri dish at nominal and high concentrations. For watermelon: better germination in the Petri dish at nominal concentration. Other results (Experimental Group vs. Control) were essentially similar, significantly worse, or unable to determine due to small sample size. Therefore, data collected from the experiment only partially supports the hypothesis.</p> <p>Conclusions/Discussion Application of hydrogen peroxide was found to have significant benefit for cantaloupe, radish, and watermelon. Depending on the plant, too little hydrogen peroxide was ineffective while too high a concentration proved to be toxic. Further research should be conducted to determine optimal concentrations for different plant types.</p>	
Summary Statement This project was designed to test the effects of various concentrations of hydrogen peroxide on germination and plant growth.	
Help Received Parents purchased the materials and provided oversight when I gathered my data to double-check for accuracy; Father assisted in preparation of charts and graphs.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Brianna L. Lawrence	Project Number S1611
Project Title Growing Plants in a Hydroponics System vs. a Traditional Soil Based System: A Comparison of Cost, Growth, & Maintenance	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals In a climate like the Desert, non-native plants to the area are hard to grow outside without constant watch. Gardeners in such a climate could grow these non-native plants inside. Usually, indoor plants are grown in soil. However, growing plants using hydroponics is another method. This experiment compares growing plants in a hydroponics system vs. growing plants in a traditional soil system. The growth, maintenance, and cost were factors that determined the better process.</p> <p>Methods/Materials Lettuce, basil, and spinach were selected because of their rapid growth rate. Seeds from each plant type were placed between wet paper towels in bags to germinate. These bags were placed in a bathroom with the heat lamp on. They germinated until the seeds had root lengths of 3 inches. Then, the seedlings were placed in their growing systems. Only 1 spinach seed germinated, so spinach was removed from the experiment. In the soil system, 5 lettuce and 3 basil seedlings were planted in a large pot filled with a soil that contained fertilizer. These plants were then measured, watered, and set in a window sill. The hydroponics system was set-up from a kit called the Waterfarm. This kit was assembled and purified water with the recommended nutrient solution was added to it. The pH of the nutrient solution was tested and adjusted. 5 lettuce seedling and 3 basil seedlings were planted in the Waterfarm. The Waterfarm was placed in the window sill next to the soil system. After 6 weeks of growing, all the data from the plants was collected and used to form a conclusion.</p> <p>Results The soil system cost \$18. The hydroponics system cost \$67.50. The soil system obviously cost less. The hydroponics system required a lot of maintenance. The pH of the nutrient solution had to be checked every 3 days and changed every 9-14 days. The nutrient solution level also had to be checked and adjusted. The air pump and drip ring had to be checked for proper functioning daily. The soil system simply needed to be watered as needed. In growth, the soil lettuce grew 8 1/2 inches and the soil basil grew 5 inches. However, the hydroponics lettuce only grew 5 inches and the basil only grew 2 1/2 inches. The soil plant growth doubled the hydroponic plant growth.</p> <p>Conclusions/Discussion The soil system is a better choice when gardening inside. The system showed better results in cost, maintenance, and growth compared to the hydroponics system.</p>	
Summary Statement This project compares two different growing systems (traditional soil and hydroponics) with factors such as cost, maintenance, and growth.	
Help Received Mother helped put board together	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Ken L.M. Lozano	Project Number S1612
Project Title Determination of Energy Content of Selected Herbs and Spices Classified According to TCD Energy Nature	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To determine if there is a relationship between the food energy content of selected herbs and spices categorized according to the Traditional Chinese Dietotherapy (TCD) energy nature of foods.</p> <p>Methods/Materials The materials and equipment used are as follows: Hot (green pepper and cinnamon bark), Warm (garlic and ginger), Cold (peppermint and marjoram), distilled water, double-wall calorimeter, improvised calorimeter, alcohol burner, thermometer, balance, ring stand, graduated cylinder, burette clamp, glass rod, beakers, watch glass, wash bottle, microwave, knife, chopping board, plates, paper towels, and aluminum foil boxes. The major steps are Preparation of the apparatus and food samples; Burning of the food samples; Observation of the change in water temperature and mass of food samples; Recording of results; and Computation of the energy content values of food samples. One experimental run per type of calorimeter using two different food samples per energy nature and three trials per food samples were conducted. The temperature and mass changes were recorded and were used in computing the energy content values per gram of food sample (in J/g).</p> <p>Results The computed energy content values for all the food samples showed that energy was released from the burning food sample and absorbed by water in the calorimeter. Analysis of these computed values showed a wide numerical range for all spices and herbs tested in both the improvised and laboratory calorimeters. Furthermore, the computed numerical averages of the three trials per food sample showed that a higher energy content in the warm (garlic and ginger) and cold (marjoram and peppermint) samples were obtained in the laboratory calorimeter compared to the improvised calorimeter.</p> <p>Conclusions/Discussion The computed energy content values per gram of selected herbs and spices showed that there is no apparent relationship between the energy content and the TCD energy nature classification of foods. The samples classified as high energy nature (hot) did not exhibit the highest computed energy content compared to the other samples classified as warm or cold. Further studies can be done to see if the energy content is more closely related to the chemical nature of food components and if the TCD energy nature is determined by the food interaction in the body of a person.</p>	
Summary Statement This project deals with the determination of a relationship between the energy content of selected herbs and spices and the energy nature categories of Traditional Chinese Dietotherapy (TCD).	
Help Received Mrs. Ruth M. Villareal, a retired chemist/plant pathologist for project planning advice, Mr. Leonardo C. P. Lozano for helping me put together the wood stands, and Mrs. Joji M. Lozano for guiding me through all the steps of making a science project.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Aaron W. McKinnon	Project Number S1613
Project Title Office Oxygen	
Abstract Objectives/Goals How much oxygen do plants small enough to be in an office give off under different ammounts of light? Methods/Materials Procedure- 1.Time candle light inside air tight box, 2.time candle light time with one plant, 3. test 3x under three different ammounts of light, 4.repeat steps 2 and 3 with a new plant then record and compare the data. Materials- air tight box, candle(s), matches, 2 plants, timer. Results The plants gave off app. 3-5 minutes of air under incondescent and flourescent light while under sunlight the plants gave off app. 10-15 minutes of air. Conclusions/Discussion In conclusion, the plants under incondescent and flourescent light made no significant changes in candle light time, on the other hand the plants under sunlight produced enough oxygen for the candle to stay lit for a significant 10-15 minutes. In simpler terms you should try and get an office with a window if you have a plant.	
Summary Statement My project is trying to find out if it is worth keeping a plant in your home or office as an alternative oxygen source.	
Help Received My father purchased the poster board. My teacher Mr. Casterson helped me with the idea of testing the plants under different ammounts of light.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Ashley N. Muirheid	Project Number S1614
Project Title A Fluoridation Revelation: How Does the Introduction of NaF Affect the Rate of Photosynthesis in Isolated Chloroplasts?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project investigates whether NaF concentrations above the optimum fluoride level (.7-1.2 ppm) would affect the rate of photosynthesis in isolated chloroplasts when exposed. I hypothesized that all chloroplast specimens tested within concentrations of NaF below or within the desired level will show no adverse effects.</p> <p>Methods/Materials The measurement technique involved with measuring the rate of photosynthesis deals with the reduction of the dye, DPIP, which acts as an electron acceptor. The transfer of electrons during light-dependent reactions of photosynthesis reduces DPIP, changing it from blue to colorless. I compared photosynthetic rates while exposing the chloroplasts to varying fluoride concentration levels.</p> <p>Three control groups for each of the three concentration levels for fluorine were used to eliminate any variations in consistency during experimentation. NaF concentration levels were tested at 1 ppm, 2 ppm, and 5 ppm, which reflect solution levels projected from the environment's accumulation of natural water runoff from water treatment facilities. The water in the control was left unaltered.</p> <p>Results I used statistical analysis to determine whether the difference between the control and the experimental groups was significant, or if it was due to chance alone, by using a t test as a probability guide for all of my results. I was able to reject the null hypothesis. Therefore, the results were not due to chance and I could conclude that probability supported the difference, which were the fluoride concentration variables of my experiment.</p> <p>Conclusions/Discussion I found that my hypothesis was partially supported in that water treated with concentrations above the optimum fluoride level (.7-1.2 ppm) affected the rate of photosynthesis when exposed. However, all the isolated chloroplasts tested at the 1 ppm concentration level also were affected, in terms of photosynthetic rate, by the fluoridation. For both the boiled and unboiled chloroplasts, as the fluoride levels increased the actual percentage of light transmittance was continuously lower and followed the trend of the control. As future research begins to bring potential ecological impacts of fluoride into better focus, it seems very likely that proof will develop that the ecosystem does suffer damage when fluoride levels of the magnitude discussed here are present.</p>	
Summary Statement If a significant threat is posed on certain autotrophic organisms by the presence of a fluoride compound, serious damage will result in the ecosystems upon which man is ultimately dependent.	
Help Received My science fair advisor graciously provided me with the majority of the materials that I needed to conduct my experiment, along with the laboratory space.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Astasia S. Myers	Project Number S1615
Project Title Impact of Elevated CO(2) Atmosphere on Germination of Jasper Ridge Plants	
Abstract Objectives/Goals One component of Global Warming is the influence of green house gasses such as CO ₂ . In order to better understand the potential effect on flora, I evaluated the impact of elevated CO ₂ on the germination of native California plants to assess their capacity to adapt to increasing concentrations of atmospheric CO ₂ . Methods/Materials 19 species (17 Jasper Ridge indigenous, 1 invader, 1 control) were tested in 6 greenhouse-based ecosystems alternating 3 elevated CO ₂ (700ppm) and 3 ambient air (350ppm). 450 chambers/flat/ecosystem were planted with 36 seeds/species/flat. 3 replicates were completed. Germination date, total germination, average germination/day, 50% germination day, and germination peak were determined. Mean, standard deviation, standard error and T-test to 5% were calculated. Results All 9 species that tested to 5% error demonstrated a change in germination pattern in elevated CO ₂ . 4 species, Avena fatua, Bromus diandrus, Elymus glaucus, and Nassella pulchra, germinated more plants and 5 species, Bromus hordeaceus, Lolium multiflorum, Arabidopsis thaliana, Brachypodium distachyon, and Vulpia bromoides, germinated fewer plants. Additionally, 3 species, Elymus glaucus, Nassella pulchra, and Arabidopsis thaliana germinated at a statistically significantly slower rate in elevated CO ₂ than their ambient air counterparts. Conclusions/Discussion Atmospheric concentrations of CO ₂ are expected to rise significantly, potentially doubling, in the next 50 years. Studying CO ₂ 's effect on the ecosystem is crucial to understanding the environment's future. As there are feedbacks between the plant-soil system and the atmosphere, knowing how plants respond to the atmosphere tells us something about how the atmosphere, and associated factors like rainfall and temperature, will appear in the future. Additionally, as plants are the base of the food chain, changes in plant growth could also translate to alterations in organisms at other tropic levels. Elevated CO ₂ does appear to impact the germination of native California plants. The specific effect on growth quantity and rate was unique to each species tested. These results suggest that elevated atmospheric CO ₂ could cause changes in native California flora communities by modifying each species' competitive germination advantage or disadvantage. Should this be the case, the effects of elevated CO ₂ on vegetation could be an important concern of Global Warming.	
Summary Statement The project's purpose was to study if CO ₂ , a component of Global Warming, will affect the germination of native Californian plants.	
Help Received Stanford Global Ecology Department Director Dr. Chris Field, who mentored; Dr. Nona Chiariello for useful advice; Mr. Todd Tobeck for help with project design and construction; Dr. Sue Thayer introduced me to Stanford research; Dr. Noel Gurwick for help with analysis	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Hannah C. Rempel	Project Number S1616
Project Title The Growing of Grass	
Abstract Objectives/Goals To determine which grasses grow the best under various levels of soil salinization. Methods/Materials Three types of grass seeds(vetch, clover, and fescue),six salt-water solutions, and one control were used to determine how soil salinity affects plant growth. All the seeds were treated under the same conditions except for the various salinity levels applied to the soils. Results I found that the grasses with lower soil salinity levels consistantly grew better than the seeds with higher levels of salinization. Conclusions/Discussion My conclusion is that the level of salinization directly effects plant growth. I also found that vetch is the most resistant to soil salinity. Knowing the salinity of a soil may affect what we plant and ultimately grow in the soil.	
Summary Statement How soil salinization effects the growth of grass seeds.	
Help Received Project advisor helped collect materials and design experiment. Mother helped glue project to board.	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Lazaro Sandoval	Project Number S1617
Project Title The Invasion of Foreign Allelopathic Plants in Santa Cruz County	
Objectives/Goals The purpose of this study is to determine the relative inhibitory plant growth effects of allelochemicals from foreign plants on a variety of plants native to the Santa Cruz County. Through this I plan to see what effect these chemicals have upon the seeds to aid us in understanding how these foreign plants have become successful in their takeover. Question: Which foreign plant tested inhibits more native seed germination? Hypothesis: I believe that the Eucalyptus Tree allelochemicals will inhibit the germination of more native plant seeds than Cape Verde and Japanese Black Pine.	
Abstract	
Methods/Materials 1. Take your 3 foreign plant samples and put each into a jar and fill it with 500ml of distilled water. Let the jars sit for 2 days 2. Prepare 3 54-seed space flat with potting soil in each seed holder 3. Take 50 seeds from #Native seed 1# and plant them in 50 spaces 4. Repeat steps 2-3 for each seed type 5. Begin to apply 1 tsp. of "Cape Verde tea" to 50 of each seed type. 6. Apply 1 tsp. " Japanese Black Pine Tea " to 50 of each seed type 7 Apply 1 tsp. " Eucalyptus Tree Tea " to 50 of each seed type 8. Apply 1 tsp. of water (control) to 50 of each seed type 9. Inspect the flats for germination of the seeds, collect and record data of how many have germinate of the seeds, collect and record data of how many have germinate	
Results The first trial showed Cape Verde tea being the least effective inhibitor, Eucalyptus Tree Tea being the most effective respect to seed 1 and 2. Japanese Black Pine was the most effective inhibitor with seed 3. The second trial showed Cape Verde tea being the least effective inhibitor, Eucalyptus Tree Tea being the most effective respect to seed 1 and 2. Japanese Black Pine was the most effective inhibitor with seed 3	
Conclusions/Discussion The results illustrate the substantial impact of allelochemicals from three foreign invasive plants on the germination of three native plants. Allelochemicals. That was clearly seen in both trial 1 and 2. Cape Verde was the least effective and Eucalyptus was the most effective germination inhibitor with respect to seed 1 and 2. In contrast, Japanese Black Pine allelochemicals were most effective on seed 3 (Figures 1 and 2). In lieu of these findings, further research is warranted with respect to the relationship between	
Summary Statement A study of the affect of Foreign Allelocheicals on Native Plant Seeds	
Help Received Dr. Kaplan allowed me to use the Soquel High Agriculture Greenhouse, she also supervised my project's report	



CALIFORNIA STATE SCIENCE FAIR 2006 PROJECT SUMMARY

Name(s) Daniel M. Shane	Project Number S1618
Project Title Ozone Depletion: A Concern for More than Just Mankind	
Objectives/Goals This experiment looked to discover the effects of higher levels of UV radiation on the health of plants. To determine the health of the plant, I calculated relative amounts of chlorophyll (in %) compared to the control series.	
Abstract Methods/Materials First, I grew ten samples of each plant behind a glass window, with ten seeds of Botanical Interests wheatgrass seeds or Lilly Miller Lima Bean seeds to be sheltered from UV. For each given duration, one sample was placed under the Mineral Light Mild UV lamp, one under the Rayonet Photochemical Reactor Intense UV lamp, and one outdoors. Results would thus compare effects of higher levels of UV on the plant compared to what is currently reaching them with the current strength of the ozone layer. After time elapsed, leaves were clipped from each sample, separately pulverized into aqueous solutions using the 75 HT VWR Sonicator and Coors Scientific pulverizing device, and run through the Cary 50 Scan spectrophotometer. According to the absorption rates of the altered samples compared to the control, percentage losses of chlorophyll molecules were calculated.	
Results In terms of percentage of chlorophyll molecules retained after illumination: Lima Bean: 5 hour mild-66% 10 hour mild- 20% 1 hour intense- 66% 5 hour intense- 20% 10 hour intense- 0% 15 hour intense not included, as plant had already lost all chlorophyll at an earlier time Wheatgrass: 5 hour mild- 92% 10 hour mild- 66% 20 hour- 7% 1 hour intense- 81% 5 hour intense- 7% 15 hour intense- 0% 10 hour no visible change, left in for extra 5 hours, and results followed trend.	
Conclusions/Discussion Global warming is currently cooling the Earth's stratosphere, creating an ideal environment for ozone depletion. Because the UV intensity that reaches the stratosphere (0.08 mW/cm ² /sec) is so comparable to the 0.05 of the "mild" lamp, the effects of the UV on the plants in the mild series would actually occur if the ozone layer were to deplete by 38%. Additionally, this projects will help if humans one day desire to cultivate plants in space as a result of future exploration. Certain planets or moons may have different or no atmospheres and this project shows that UV shelters must be erected to filter the UV intensity that reaches the plants to below 0.05 milliWatts. If one day nations engage in nuclear warfare, or a powerplant facility malfunctions, the effects on nearby plants would be similar to the intense series.	
Summary Statement This experiment explored the effects of higher levels of Ultra Violet radiation on the chlorophyll molecules in plants.	
Help Received Mother helped glue board; Used lab equipment at the University of California, Irvine under the supervision of Professor Eric Potma; Professor Potma helped with data analysis	



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Meghna Soni	Project Number S1619
Project Title Does the Type of Soil Affect the Growth Rate of Plants?	
Abstract Objectives/Goals The objective was to investigate how different soils affect plant growth. It was hypothesized that when radish seeds are placed in potting soil, local soil, sand, and gravel, the potting soil will produce the most growth, followed by local soil; minimal growth will be seen in sand and gravel. Methods/Materials The four different soils were tested for their pH level and macronutrients: Nitrogen, phosphorous and potassium using soil testing kits. The texture and permeability of the four different soils was also recorded. Three radish seeds were placed in 10 cups each of potting soil, local soil, sand, and gravel. Half a cup of room temperature tap water was added to each cup to saturate the soil. The 40 cups were placed outside on the sunny southern side. Every two days each cup received half a cup of room temperature water. The first observation was made after 7 days and thereafter an observation was made every 5 days for a total of 4 observations. At each observation the number of germinating plants, the height of the plants, and the surface area of the leaves (L X W) were recorded for each plant. Results Potting soil had optimal pH level and adequate amounts of nitrogen, potassium, and phosphorous compared to other soils. Results for the final observation for plant growth were: Average rate of germination: Potting soil (3 plants), gravel, (3 plants), local soil (2.23 plants) and sand (1 plant). Average height of plants: Potting soil (33.2mm), local soil (14.1mm), gravel (9.5mm), and sand (5.9mm). Average surface area of leaves was: potting soil (331.2mm ²), local soil (164.7mm ²), gravel (129.2mm ²), and sand (58.5mm ²). The results indicate that plants grown in potting soil had the highest rate of germination, the most height, and largest surface area of leaves as compared to plants grown in local soil, sand, and gravel. Conclusions/Discussion Potting soil had the best plant growth because it had the right amount of sand, silt, and clay, as well as an optimum pH level. It also contained adequate macronutrients like nitrogen, potassium and phosphorous thus promoting better plant growth. Local soil performed better than gravel and sand. Sand was the poorest medium for plant growth. This information is useful to farmers and gardeners because it helps identify which soil is best for growing healthy plants.	
Summary Statement This experiment helped understand what type of soil and its attributes are best for healthy plant growth.	
Help Received Mother helped with purchasing materials; science teacher Mrs. Olivares helped answer questions.	



CALIFORNIA STATE SCIENCE FAIR 2006 PROJECT SUMMARY

Name(s) T.J. Thomas	Project Number S1620
Project Title The Effect of Runoff Water on Corn Plant Growth	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This experiment tested the effect of common types of runoff water on corn plant growth. Runoff is an important issue in our communities. There are several types of runoff water in my community that might be harmful to plant growth.</p> <p>Methods/Materials Four types of runoff water from my neighborhood were tested: street gutter runoff, gas station runoff, garden runoff, and Bushy Dell Creek water. Spring water was used as the control. One hundred corn seeds were planted, twenty for each experimental group. The five experimental groups of plants were each watered with a different type of water. Growth was measured and recorded for a period of 22 days. On the final day, root length was also measured. The Paired Two Sample for Means t-Test was used to analyze the significance in differences in growth between the control and the experimental groups. The runoff waters and spring water were tested with a water test kit for bacteria, lead, pesticides, nitrate/nitrite, nitrite, chlorine, pH, and hardness.</p> <p>Results By Day 13, all of the experimental groups, gutter runoff ($p = 0.04$), Bushy Dell Creek water ($p = 0.004$), gas station runoff ($p = 0.004$), and garden runoff ($p = 0.00008$) experimental groups showed statistical significance compared to the control group. The water sample testing indicated that none of the water types had levels beyond EPA standard guidelines for lead, pesticides, nitrate/nitrite, nitrite, pH, or chlorine. Only gas station and gutter runoff tested positive for bacteria. Only Bushy Dell Creek water tested positive for chlorine (2.0 ppm), although this was below EPA standards. Except for gas station runoff, all of the water samples had above EPA standards for hardness. Hardness is the mineral content of water. This may suggest that spring water has a lot of minerals. Gas station water had the lowest level of hardness (50 ppm), while garden runoff had the highest level of hardness (250 ppm).</p> <p>Conclusions/Discussion The hypothesis tested was that runoff water would adversely affect corn plant growth. The experimental results supported the hypothesis. The results were statistically significant, so the conclusion was that the tested runoff samples adversely affected corn plant growth. Possible causes for the adverse effect of runoff water on corn plant growth were suggested.</p>	
Summary Statement This experiment tested the effect of common types of runoff water on corn plant growth.	
Help Received My mother helped me obtain plant supplies and runoff water.	