CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Priyanka V. Athavale

Project Number
S1701

Project Title
The Effects of TMV on Pinto Bean Plants after the Initial Innoculation of a Weaker Strain

Abstract

Objectives/Goals
The tobacco mosaic virus is a very common plant virus which infects more than 100 types of herbaceous, dicotyledonous plants including many vegetables, flowers, and weeds. The virus causes mottling of leaves, de-veining, and local lesions on the plant. The main goal of this project was to determine the effects of TMV on pinto bean plants after previous exposure to a weaker strain. If a weak strain of TMV is inoculated into a susceptible (or hypersensitive host) host, then the host will become more resistant to the common strain after inoculation. Due to naturally occurring cell-by-cell defenses within the plant, the host will develop immunity to the common strain after being exposed to an initial weaker strain.

Methods/Materials
To weaken the virus, the TMV was diluted to various concentrations and heated to different temperatures. First, plants were inoculated with the stock solution of TMV, various dilutions of TMV, and TMV that was heated to different temperatures. Then, for the plants that were inoculated with the diluted and heated strain of TMV, after exactly five days, the same plants were inoculated with the stock solution of TMV. The effects of TMV were measured by counting the number of local lesion per leaf.

Results
ANOVA and standard t-tests were used to determine the difference between the variables. The plants that were inoculated with an initial weaker strain had significantly less lesions than those inoculated with the stock solution of TMV. When the plant is exposed to an initial weaker strain of TMV, it develops resistance to the virus due to salicylic acid. Salicylic acid aids in plant defense by signaling pathogenesis related proteins, and is only synthesized by local lesions. Thus, the plant only developed resistance after exposure to an initial weaker strain.

Conclusions/Discussion
This experiment shows how plants, despite of a lacking a somatic immune system, can develop some immunity to a toxic virus. This means that if plants can use internal defense systems to protect themselves from viruses, they can probably also do similarly against bacteria and other pathogenic organisms.

Summary Statement
An study on the effectiveness of TMV on pinto bean plants after the initial inoculation of a diluted or heated strain.

Help Received
I acknowledge my parents for their moral support. Also Ms. Loia and Mrs. Alonzo for being great advisors. Lastly, I would like to thank Mr. Bryce Falk (Plant Pathology Dept., UC Davis) who helped me obtain the TMV.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Mary Clare Bernal; Jacquelynn Besse

Project Number

S1702

Project Title

The Effects of Shortwave UV-C Radiation on Pea Plant Seedlings

Abstract

Objectives/Goals

To assess UV-C (at 254 nm) on the germination, growth rate, height, and biomass of pea seedlings. Does UV-C affect the germination percentage, the growth pattern and rate, the height at harvest, and the biomass? Assertion: UV-C causes #stunting# of the seedlings. Much attention has been given to the adverse effects of the ultraviolet components of sunlight (UV-A and UV-B) on human skin, yet many people do not give UV its due regard. Animal tests are difficult to perform, so this project uses plants to reveal that UV has adverse effects on living tissues. It is believed that UV-C will affect the genetic material of the seeds and cause #stunting# in seedlings.

Methods/Materials

20 seeds were randomly selected for the Treatment Group and exposed for 24 hours to UV-C and 20 seeds were randomly selected from the same population for the Control Group. They were kept at ambient conditions exposed to the visible light spectrum. All seeds were planted in a uniform soil mixture under grow lights with heating substrates. The plants were culled to 8 plants for each group and transplanted. These plants were then culled to 5 plants in each group accounting for #transplantation shock.# Plants were grown to #maturity,# depotted and weighed by components (total, leaves, stems, and roots). Data was analyzed. A germination experiment was performed by germinating 10 treatment seeds (exposed to UV-C for 24 hours) and 10 control seeds (exposed to ambient light) to determine germination percentage. Data was analyzed using EDA and Student's-t test.

Results

Germination percentage was not affected. The growth pattern and rate of the groups did not differ significantly. The controls yielded taller plants with more variability than the Treatment Group. The treatments had more biomass. The plant components of treatments showed less variability. In the germination experiment all plants germinated. Genomic studies could determine the impact of UV-C.

Conclusions/Discussion

UV-C radiation has an effect on the development and growth of pea seedlings. The assertion is supported. UV-C passes into the dormant seeds and affects the genetic material. Selection of plants reduced variability in both groups. The survivors in treatments appear stronger than those in controls indicating removal of weaker plants in treatments. The plants in controls showed more variability.

Summary Statement

The effects of UV-C radiation on the growth and development of peas seedlings was assessed in a controlled experiment.

Help Received

Dr. John C. Howe provided on-going mentoring, and our parents provided financial support.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Matthew Bowen; Sam Munoz

Project Number

S1703

Project Title

Micropropagation of Explants from Mature Tissue of Quercus lobata

Abstract

Objectives/Goals

This study was undertaken to evaluate the optimum protocol for micropropagation using 1-year-old and 2-year-old plant tissue for the regeneration of valley oak in vitro.

Methods/Materials

Acorns were collected and germinated under clinical conditions during the fall of 2005, 2006, and 2007. Stem segments with a single axillary bud were obtained from six-month-old,one-year-old, and 2-year-old the valley oak seedlings. Each explant was cut to a length of approximately 1 cm, retaining the axillary bud, and placed in a petri dish containing 35 ml of Lloyd and McCown culture medium. The number of shoots on each explant was recorded after six and nine weeks. Statistical analyses were completed with the Statistical Analysis System.

Results

To investigate the germination of the Valley Oak qualitative accounts of the explants# growth were taken along with a quantitative analysis of shoot numbers. The initial initiation for each group tested tissue (6-month old tissue; 1 year old tissue; and 2-year old tissue) began with 6 explants each. As suspected the immature tissues of the six month old nodule segments appeared to be the healthiest and were easily sub-cultured. From initiation through four separate sub-cultures the 6-month old tissue produced 36 shoots in total (Fig. 2) This was due in fact to a large amount of shoot growth, although explants were either successful or were overtaken by contamination. While the one year explants did germinate and produce healthy stems their numbers were not as great as the six month old explants in that we began with 6 explants and ended up with 18 sub-cultured shoots. Oddly, the two year nodules survived and thrived. They produced 122 shoots by the end of the fourth sub-culturing.

Conclusions/Discussion

In conclusion, the data supported the hypothesis that the Lloyd & McCown Woody Plant Basal Medium with Vitamins will be an effective medium to use in the micropropagation of tissue ranging in age of 1 and 2-year-old of Valley Oaks (Quercus).

Summary Statement

This research evaluated the proper protocol and media for various ages of the explant tissue in the micropropagation of Quercus lobata.

Help Received

Lab equipment located at the North High Agriculture Department's tissue lab was used. Direction and assistance was given by Dr. Eric Mercure and Christine Dickson.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Shadman M. Chowdhury

Project Number
S1704

Project Title
The Effects of Elevated Carbon Dioxide Levels on the Transpiratoin Rates of Zonal Geranium Plants

Abstract

Objectives/Goals
The objective of this experiment was to find a correlation between increasing the carbon dioxide levels that the Zonal Geranium Plant is exposed to and how that affects the plant's transpiration rate by using an apparatus I developed for this experiment.

Methods/Materials
The leaves of the Zonal Geranium plants were cut off and placed into a potometer. An apparatus (which was a closed system) was then developed and used along with the potometer in order to demonstrate the effects of carbon dioxide on the plant#s transpiration rate. A pilot project was done prior to the experiment to determine the optimal time for the plant#s transpiration (between 12 AM and 6 AM). Three Zonal Geranium leaves were placed into separate setups, each having all factors the same except for a different level of Carbon Dioxide: the control chamber (1000 PPM), and two experimental chambers one doubling (2000 PPM) and other tripling (3000 PPM) the carbon dioxide level of the control chamber were used. The leaves were set in the apparatus, as they transpired, they pulled up water from the calibrated pipette. Water loss from the pipette was measured after the six-hour transpiration period. A carbon dioxide probe continuously monitored the carbon dioxide levels within each tube. The latter experiment was carried out twenty times for each of the two experimental and the control variable, totaling sixty of the apparatuses set up through out this experiment.

Results
At the end of the 6-hour period, the average amount of water displaced from the calibrated glass pipettes was .56 mL for the control, .265 mL for the chamber with double the carbon dioxide, and 0.07 mL for the chamber with the carbon dioxide level tripled compared to the control.

Conclusions/Discussion
At the end of the 6-hour period, result averages for water displaced were control = .57 mL, double carbon dioxide = .25 mL, and triple carbon dioxide = 0.08 mL. My results indicate that there is an inverse relationship between elevated carbon dioxide levels and the amount of transpiration that the plant demonstrates. This experiment can be applied to foresee how increasing green house gas levels, of which carbon dioxide is said to double within the next century, can employ plants as a tool for global warming.

Summary Statement
Zonal Gernaium plants were exposed to elevated levels of carbon dioxide and their rate of transpiration was observed.

Help Received
Advisor Dr. Pal helped me obtain materials; Mother helped me obtain plants.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Jonathan P. Enns

Project Number
S1705

Project Title
Marvelous Mycorrhizal Fungi

Abstract

Objectives/Goals
The objective of this project was to determine if adding mycorrhizal fungi to the irrigation water as wheat seed is planted would stimulate root growth, enabling a young wheat seedling plant to extract more water, fertilizer and nutrients from the soil, resulting in a healthier, more vigorous plant.

Methods/Materials
Wheat seed was planted in twenty 1/2 gallon containers of sandy loam soil. A powdered inoculum consisting of a blend of spores of four endomycorrhizal fungi species was mixed with water and applied to ten of the containers, while the other ten containers received only untreated water. The containers were placed under plant grow lamps, operated with a timer to simulate normal daylight hours. A mixture of water and fertilizer was added as needed, to preserve soil moisture during the ten-week period after planting. The containers were then soaked with water to soften the soil and the soil was rinsed from the plant roots. The plant weights were recorded using a digital gram scale.

Results
The average weight of the ten plants that received the fungi treatment was .92 gram, or 48% greater than the .62 gram average weight of the plants that did not receive the treatment.

Conclusions/Discussion
The results illustrated that the application of the mycorrhizal fungi increased overall plant health and vigor as hypothesized. Further experiments, including tissue analyses, would be useful in determining plant health and the potential impact on yields.

Summary Statement
The objective of this project is to determine if adding mycorrhizal fungi to the irrigation water as wheat seed is planted will stimulate root growth, resulting in a healthier, more vigorous plant.

Help Received
Vernon Crawford, Wilbur-Ellis Company in Shafter, suggested evaluating the effect of applying mycorrhyzal fungi to seedling plants. Dr. Greg Cluff, professor of agricultural science at Bakersfield College, offered suggestions for sample sizes and fertilzation requirements.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Fritz Foo

Project Number

S1706

Project Title

Deciphering the Genotypes of Zea Mays: An Analysis of the Chi-Square Test and Genetic Make-Up

Abstract

Objectives/Goals

"Deciphering Zea mays" tests the viability of the Chi-Square Test in determining the genotypes and respective alleles of organisms whose phenotypes are known but genotypes are not. The sample will include three variations of Zea mays (American corn) with phenotypes representing kernel color (yellow and purple) and kernel shape (smooth, dimpled, and wrinkled). Because the chi-square test analyzes statistical significance and error between predicted and actual outcomes, the experiment requires initial theoretical genotypes based upon observations, samplings of kernel color/shape, and finally the application of the Chi-Square.

Methods/Materials

Materials include 15 specimens of corn, 5 ears in 3 sub-species; rubber bands to segment each ear into quarters; and, masking tape to label each quadrant. Procedures: 1) Visually analyze each ear of corn to find phenotypic patterns, such as dominance in color/shape. 2) Using Mendelian laws and observed phenotypes, hypothesize a genotype for the ear and its parents. 3) Wrap two rubber bands along the ear#s lateral equators and label each quadrant with masking tape. 3) Record each type of kernel per row. 5) Use the Chi-Square Test to test the accuracy of the predicted genotypes with the actual result. 6) Repeat for each ear of corn.

Results

After counting each ear of corn and comparing the predicted genotypes with the actual phenotypes, Type 1 and Type 2 were found to have accurate readings when tested with at least one of the predicted genotypes. Given that the chi-square test was testing statistical significance to the 7th degree, each test was proven to have more than 60% accuracy and significance, with one sample being over 95% accurate. However, no correct predictions could be made about Type 3 corn because its complex phenotypic appearance could not yield a predicted genotype.

Conclusions/Discussion

Given successful tests of Type 1 and 2 corn, the experiment suggests that geneticists can use an organism#s phenotypes to determine its genotype. However, as the overall results imply, sufficient knowledge of the organism#s genotype must be known to provide an accurate prediction. Thus, the experiment reveals how statistical testing can essentially eliminate the trial-and-error process in predicting results. Furthermore, provided a case in which an organism#s genotype must be known, such as to determine carriers of disease, a mathematical approach can be taken.

Summary Statement

Given samples of Zea mays, or American corn, and knowledge of Mendelian laws of inheritance, the experiment explores the capacity of the chi-square test in determining the genotypes of an organism, whose genotypic properties are established

Help Received

I would like to thank Mrs. Robin Pearce for providing me the sample corn, purchased from Carolina Biological Supply Company

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Emerson W. Glassey

Project Number
S1707

Project Title
Photosynthesis and CO(2) Consumption

Abstract

Objectives/Goals
My goal was to determine the correlation between light intensity and a plants rate of photosynthesis. I also tried to distinguish what the correlation was.

Methods/Materials
I placed a Dieffenbachia inside of a 1' x 1' x 2' airtight enclosure. I placed 4 2' fluorescent bulbs about 3'9" from the enclosure, spaced equally. I changed the light levels between No Lights, 2 Lights, and 4 Lights. I used a CO(2) and a O(2) sensor to measure the rate of photosynthesis. By measuring the rate of decline of the CO(2) and the rate of incline of the O(2) I was able to estimate the rate of photosynthesis.

Results
I found that as the light intensity increased the rate of descent of the amount of CO(2) went up and the rate of ascent of the O(2) rose as well. This meant that the rate of photosynthesis was rising.

Conclusions/Discussion
I concluded that yes, the light intensity does effect the rate of photosynthesis, as the light intensity increased the rate of photosynthesis increased. In the future I want to test the effect of temperature on the rate of respiration. Then I would be able to create an equation that links oxygen slope, carbon dioxide slope, light, and temperature together.

Summary Statement
I tested to find the correlation between light intensity and a plants rate of photosynthesis.

Help Received
The chemistry teacher at the Willits High School lent me sensors; students in my biology class and my biology teacher helped proofread.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Darrick L. Gowens

Project Number
S1708

Project Title
Effectiveness of Contaminants of Wood Ash as a Fertilizer on the Germination and Growth Rate of a Radish Seed

Abstract

Objectives/Goals
Have you ever planted a garden and wanted to produce fruits and vegetables at a faster rate? Many farmers spend countless dollars on fertilizers, hoping to accomplish this. I have found that wood ash produces a strong plant faster than the average store brought fertilizers.

Methods/Materials
The 1/4-cup of wood ash contaminated with pesticides was mixed with two cups of soil to produce a quick germination rate, as well as a long thick taproot. I contaminated two piles of wood chips one with pesticides and the other with gasoline. Then the wood chips were burned, and the ash was used as a fertilizer. I filtered out the large debris, and then two radish seeds were placed in each plant box and covered with their specific type of soil.

Results
Within 2.9 days, the seeds covered by the wood ash that was contaminated with a pesticide germinated. The plant was thicker and taller than the control group.

Conclusions/Discussion
This project contributes to the agricultural industry because it is efficient in the way it produces results quicker, and is cost effective. My original objective wasn't confirmed because the results didn't support my hypothesis.

Summary Statement
To analyze the effectiveness of contaminates in wood ash as a fertilizer on seed germination and growth.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Christina C. Gunzenhauser

Project Number
S1709

Project Title
Comparison of Phenological Development of Rhus integrifolia During a Dry and Wet Year in a Coastal Sage Community

Abstract

Objectives/Goals
The objective is to compare growth characteristics of the coastal sage scrub during consecutive dry and wet years.

Methods/Materials
Six plants from the Portuguese Bend nature preserve were selected and monitored. Growth characteristics were measured monthly from January 2007 to January 2008, including branch length and diameter; number of leaves, empty nodes, and flowers; and the presence of fruit. Rain and temperature information were obtained from on-line weather resources. Temporal growth characteristics were plotted to determine patterns of plant growth and relationships with weather.

Results
Branch length, number of leaves, number of empty nodes, number of flowers, and the presence of fruit were positively associated with rainfall and temperature. Branch diameter showed minimal positive association, but manifested little change during the study period. The number of negative nodes was negatively associated with weather, due to the fact that less leaves fell off branches during periods of increased precipitation and temperature.

Conclusions/Discussion
Coastal sage scrub is an important member of ecological communities in southern California coastal areas and has been reduced in population by urban development. Understanding its growth characteristics is fundamental to predicting its survival under various threats, including global warming. During the entire study period, all plants grew measurably, showing remarkable resiliency in time of a severe drought. Growth was positively associated with increased temperature and rain.

Summary Statement
This study establishes baseline growth characteristics of the coastal sage scrub. R. integrifolia, during periods of drought and rain.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Olivia L. Joncich

Project Number
S1710

Project Title
Soil Matters! What Is the Best Type of Soil to Use when Growing Beans?

Abstract

Objectives/Goals
I conducted my experiment in order to find the most efficient soil to grow vegetables in, such as the snap bean. I hypothesized that the organic potting soil will produce the healthiest plants because it has the highest amount of organic matter in it.

Methods/Materials
This test was between 15 different pots containing organic potting soil, inorganic topsoil, and homemade mulch and took place over several weeks.

Results
Throughout my experiment only certain pots had growing plants. In addition to the organic potting soil producing healthy sprouts, the mulch also provided the beans with enough nutrients to sprout.

Conclusions/Discussion
The topsoil did not have enough organic matter for the beans to grow. Measuring the result of prolonged plant growth in each individual soil could further improve this project.

Summary Statement
This project exemplified the most efficient type of soil to use in order to grow the tallest, healthiest bean plants.

Help Received
Father helped in transportation of materials.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Daniel M. Kari

Project Number
S1711

Project Title
Helping Pinus ponderosa Fight Dendroctonus brevicomis and Dendroctonus ponderosae: Year II

Abstract

Objectives/Goals
This project focuses on discovering natural ways to best preserve Pinus ponderosa from attacks by Dendroctonus brevicomis and Dendroctonus ponderosae, the bark beetles affecting these pine trees.

Methods/Materials
The first part of the project was conducted in two locations in the San Bernardino National Forest, Barton Flats and Angelus Oaks, where a density check of two, one-acre lots was conducted at each site by counting all trees and observing which plants surrounded dead pines and which plants surrounded healthy pines. Since Black Oak trees and Manzanita bushes proved to be the most prominent plants in this region, tests were conducted to evaluate the tannin content in each plant, tannin being the most powerful acid in their leaves. The assay used was for total Phenols. First ferric chloride (FeCl(3)) was mixed with HCl to make a pale yellow solution. A separate solution of potassium ferricyanide (K(3)Fe(CN)(6) was diluted in water. Each substance was stabilized before mixing each leaf sample in what is called the Prussian Blue Test. Gallic acid (pure tannin) was employed to standardize the spectrometer readings.

Results
The survey at Barton Flats found numerous Black Oaks, yet the Ponderosa Pines still experienced high fatalities from bark beetle attacks, especially as the density of Black Oaks increased. In contrast, the survey at Angelus Oaks found greater diversity in varieties of trees, and only one fatality near the Manzanita bushes common there. Tests proved that Manzanita leaves have a tannin content of 2.5 times that found in Black Oak leaves.

Conclusions/Discussion
These observations led to the conclusion that Manzanita has a positive effect on Ponderosa pines by making the bark beetles# environment too acidic to be habitable, while not competing with trees for resources of water and minerals. This experiment also proved that diversity in species of trees and plants helps ensure a healthy forest, and that, in contrast, high density makes pines more vulnerable to bark beetles.

Summary Statement
This project evaluates natural methods for preventing attacks by bark beetles on pine trees and concludes that plant diversity, low density, and Manzanita are especially effective in deterring such attacks.

Help Received
Used lab equipment at Vanguard University with the supervision of Dr. Ted Lorance. Received help from California Department of Forestry. Photography by Dr. Daven M. Kari.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Joshua J. Kim

Project Number
S1712

Project Title
The Effect of Charcoal on the Germination and Growth of Corn

Abstract

Objectives/Goals
The objective of this project is to investigate the effect of charcoal mixed in soil on the germination and growth of corn. It is hypothesized that the set of corn plants growing in the soil with the addition of charcoal will grow bigger than the corn plants growing in the regular soil since the charcoal will improve the quality of the soil and will adsorb (not absorb) any harmful materials in the soil.

Methods/Materials
Two sets of 10 corn plants were grown in pots of the same size during winter. One set of plants grew in the soil with 25% charcoal and the other set grew in the soil without charcoal. Three corn seeds were planted in each pot. The pots were placed in a temperature-controlled sunroom. The plants were watered equally and regularly. The time to germination, plant height, and the number of leaves were recorded every week. The pH level of the soil was tested using a probe monitor after about two months to see if there was any difference in the quality of the soil.

Results
The results showed that the plants growing in the soil with the addition of charcoal had a higher (average 27% per seed) germination rate, had a greater number of leaves (average 0.2 more per plant), and grew to be taller (average 3-4.5cm per plant). The pH levels of the soil suggest, although inconclusive, that the soil with the addition of charcoal is more alkaline and thus more favorable for growth of corn.

Conclusions/Discussion
The experiment concluded that, when properly mixed with soil, charcoal can help corn germinate and grow faster in cold weather. These results are consistent with success stories of charcoal farming in agricultural communities, but are new in that the experiment was conducted in cold environment. Further research should be performed to repeat the experiment with a larger sample size, in warm, growing seasons, and also for plants other than corn.

Summary Statement
This project investigates the effect of charcoal mixed in soil for germinating and growing corn using two sets of pots and shows that charcoal helps corn germinate faster and grow bigger in cold weather.

Help Received
Father assisted in gathering experiment materials, designing the watering system, and constructing the board. School science teacher proofread the text.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sophia D. Lin

Project Number
S1713

Project Title
How Plants Respond to Ultraviolet Light

Abstract

Objectives/Goals
Plants rely on photosensory receptors to mediate light regulation of growth and development. The photoreceptors and the signaling proteins responsible for plant perception of visible light (~400-700nm) are relatively well understood, but those responsible for UV (ultraviolet) light (~150-400nm) are poorly understood. I aim to better understand how plants respond to UV light.

Methods/Materials
I analyzed the effects of UV light on hypocotyl seedling growth in the model plant Arabidopsis thaliana and I have used molecular genetic approaches to identify three genes invovled in this response.

Results
The red/far-red light (~600-700nm) photoreceptor phyA and the visible light downstream signaling protein HY5 are both involved in UV-A light (~320nm-400nm) response in plants, and the novel gene LSD1 (light signaling and development 1) is involved in UV-B light (~280nm-320nm) response in plants.

Conclusions/Discussion
Red/far-red light photoreceptor phyA can act as a UV-A photoreceptor. The transcription factor HY5, previously known to be involved in visible light response, is also involved in UV-A signal transduction. The LSD1 gene encodes a putative RING-finger E3 ubiquitin ligase involved in UV-B signal transduction. Continued studies of these genes will help us understand how plants respond to UV light, and thus help us react effectively to the increasing amount of UV rays penetrating the atmosphere due to the depletion of the ozone layer.

Summary Statement
I have studied Arabidopsis UV light response and cloned three genes involved in the process.

Help Received
My mentors were Dr. Xuhong Yu and Dr. Hongtao Liu and I used lab equipment in Dr. Chentao Lin's laboratory in Department of Molecular Cell and Developmental Biology at UCLA.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Kyle S. Metcalfe

Project Number
S1714

Project Title
The Effects of Elevated Levels of Carbon Dioxide on Plant Growth

Abstract

Objectives/Goals
Over the past many years, scientists have discovered that the concentration of carbon dioxide has been growing drastically since the Industrial Revolution. Some scientists, such as Sherwood B. Idso, believe that the raised concentrations of CO(2) will be favorable for plant life, increasing growth. In this experiment, I will test the effects of concentration of CO(2) on plant growth.

Methods/Materials
I dropped Alka-Seltzers into root beer bottles filled with water to produce carbon dioxide, which I then captured in balloons. This carbon dioxide was than infused into a jar holding a common bean plant. This was repeated for each jar that was testing for the effects of low levels of carbon dioxide (4 jars). I used the carbon dioxide from two Alka-Seltzers to simulate the effects of high concentrations of carbon dioxide (4 jars). There was a control set of plants without extra carbon dioxide as well (4 jars).
Materials: 12 glass canning jars; 12 Common beans (Phaseolus vulgaris); 12 bendy straws; Enough clay to cover the second hole in each jar. 2 boxes of "Alka-Seltzer Gold"; 12 oz glass bottle; Balloons; Water (in significant quantity); Potting soil; A south-facing window; Paper clips for every straw.

Results
Percentage growth of plants

	No CO2	Low CO(2)	High CO2
Jar # 1	1,900 %	7,300 %	13 %
Jar # 2	0 %	3,980 %	7,900 %
Jar # 3	125 %	257 %	191 %
Jar # 4	110 %	104 %	145 %
Average	533.75 %	2910 %	2,062.25 %

Conclusions/Discussion
The jars with low CO2 grew the most (2910 % growth), while the jars with high CO2 grew the tallest (avg. height of 16.4 cm). However, the fact that the low CO2 plants grew more than the high CO2 plants reveals that the effects of CO2 on plant growth is not a linear function, but rather more of a curve. The idea that higher CO2 concentrations make for healthier plants is only partly true, from what I have demonstrated in this experiment. Idso insists that higher CO2 means a better environment, but this is not altogether true. If the trend shown by my Graph 1 continues with higher concentrations of carbon dioxide, plants will begin to grow worse than they would have under normal atmospheric conditions. From what I#ve found in this experiment, higher concentration of CO2 does not equal healthier plants.

Summary Statement
A study on the effects of elevated concentrations of carbon dioxide on the growth of bean plants.

Help Received
none.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sumit Mitra

Project Number
S1715

Project Title
The Effect of Water Quantity on Methane Emissions from Constructed Wetlands

Abstract

Objectives/Goals
My objective was to find out if varying water quantity in constructed wetlands will affect the methane emissions from them.

Methods/Materials
6 plastic containers, 36 L of sphagnum peat moss, 15 L of water, 1 L measuring cup, 3 plant lights, 3 light holders, 12 seedlings of Scirpus americanus (Three-square Bulrush), 6- 50 cm X 35 cm of clear plastic sheeting, Duct tape,7 syringes- 10 cc.,Gloves, Scissors, Labels, Table, Measuring tape, Gas chromatograph
Measure 6L of sphagnum peat moss soil and place it in each plastic container. Label them as Models A, B C, D, E and F 2.Pour 3.5L of water in models A and B, 5L of water in models C and D, 6.5 L of water in model E and F. Plant 2 seedlings of Scirpus americanus (Three-square Bulrush) in each container and let the plants grow under grow lights for 6 weeks. Then cover the plants with plastic sheeting to form airtight chamber and after 8 hours make a hole and take a sample of gas with the help of a syringe. Collect all the samples and take them to a lab for analysis in a gas chromatograph.

Results
Gas Chromatograph Bin # Model Peak Height

19	A	4188
23	B	4200
18	C	4259
22	D	4205
17	E	4295
20	F	4291
21	Garage	4019

Conclusions/Discussion
The results supported the hypothesis, that Models E and F would release the greatest quantity of methane gas and models A and B with smallest water volume would release the smallest quantity of methane. Although the hypothesis was proved to be correct, the results of all the models were not very different from each other. There could have been various sources of error which would mean that the gas concentration would be more or less similar in all models. The garage had water heater in it and that emits methane and this was not taken into consideration while evaluating the results. As compared to Model C, Model D#s growth was stunted and this could have affected the results. The difference in methane data of

Summary Statement
This project is about finding out if water quantity affects the methane emissions in construted wetland so that greenhouse effect from wetlands can be minimized

Help Received
Prof Blake of UCI helped with the use of chromotagraph; #The staff of #Tree of Life# nursery in San Juan Capistrano helped in selecting the wetland plants and explained in detail on how to plant them; parents helped with the supplies; Irvine Ranch and Water District provided with the valuable reference of EPA

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Allison M. Park

Project Number
S1716

Project Title
The Correlation between the Aging in a Banana and the Amount of Potassium It Contains

Abstract

Objectives/Goals
The goals were to determine at what age of the banana contains the most amounts of potassium as well as at what age of the banana contains the least amounts of potassium.

Methods/Materials
The major materials utilized were ten bananas, distilled water, a Cardy K meter, standardized solution, and sampling sheets. The bananas were cut, pressed, and measured in a course of eight days. After each measurement, the meter was cleaned with distilled water to ensure accuracy in the results. The results were gathered as the bananas gradually ripened.

Results
On average, the bananas in the first day of experimentation contained the most amounts of potassium of 4300 ppm. However, bananans of day seven contained the least amounts of 2730 ppm. There was a drastic decrease.

Conclusions/Discussion
My conclusion was that the younger bananas will contain more amounts of potassium as opposed to the riper bananas. These results may prove beneficial to those who require the greater amounts of potassium in their daily diet.

Summary Statement
My project was about the comparison between the potassium levels in different ages of bananas.

Help Received
Mother helped purchase materials for experiment.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Cody A. Peterson

Project Number
S1717

Project Title
Do Monocots or Dicots Survive Better in High Methane Environments?

Abstract

Objectives/Goals
The objective of my project was to observe monocots and dicots in high methane environments to see which survived the best.

Methods/Materials
I placed 3 monocots and 3 dicots in sealed containers and then placed 3 more monocots and 3 dicots in sealed containers with methane. I observed them for 10 days, twice a day, taking a picture every morning, and documenting my observations. I then converted my data in to numbers and created a chart of my umerical data.

Results
As I stated in my hypothesis, I found that the monocots survived much better than the dicots do to their lower photosynthetic rates.

Conclusions/Discussion
In a high methane environment, the monocots would survive much better than the dictos because their lower photo synthetic rate. They, however, would provide a very specified environment because of the very small and distinct number of monocots.

Summary Statement
My project's goal was to see if monocots or dicots survived better with the bases of photosynthetic rates.

Help Received
My mother and father helped with the composition of my poster board.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Diane L. Polyakov

Project Number
S1718

Project Title
Effect of Ultraviolet Light on Plant Production

Abstract

Objectives/Goals
For my science fair project, I wanted to determine if Ultra-Violet (UV) light is harmful to plants. Specifically, I wanted to test whether reducing the amount of UV light that reaches a plant would result in an increase in the amount of fruit production by the plant.

Methods/Materials
To conduct my experiment, I decided to grow two sets of pea plants under similar conditions with the only difference being that one set of plants would receive UV light, while the second set would be shielded from UV light. Each set of pea plants grew under a separate piece of clear Plexiglas. However, one piece of Plexiglas was coated with a sheet of UV blocking film. I continually watered each set equally and measured the plant growth and development over a four month period. I removed the mature peas from the plants and measured them both for weight and size.

Results
The number of pea pods produced on the set receiving UV light was 85, while the set with UV light blocked only produced 58. The average size of a pea pod receiving UV light was 2.4 inches, and the average size of a pea pod with UV light blocked was 2.2 inches. Lastly, the average number of peas in a pod exposed to UV light was 5, while the average number of peas in a pod wit UV light blocked was 4.

Conclusions/Discussion
I concluded that the UV blocking film not only blocked out 99% of all UV rays, but also blocked out some visible sunlight. Without the sunlight, the pea plants were unable to photosynthesize as quickly and produce as much fruit.

Summary Statement
The project tested whether the UV light, which is known to be harmful, would have a negative effect on pea plant food production.

Help Received
Father helped build structure holding Plexiglas shields.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Timothy V. Santos

Project Number
S1719

Project Title
The Safer Way to Eat Lettuce

Abstract

Objectives/Goals
The goal of this experiment was to determine whether the bioaccumulation of perchlorate and nitrate is more substantial in the outer leaves of a romaine lettuce when compared with the inner leaves. Studies have shown that perchlorate and nitrate have harmful effects on humans, which would make this portion of the lettuce more hazardous for human consumption.

Methods/Materials
I took a relative quantitative approach in the determination of perchlorate and nitrate. I needed one kilogram of lettuce per inner and outer leaf. Each lettuce head was divided into outer and inner leaves by equal mass, blended, and filtered through cheesecloth. The lettuce juice was analyzed by means of ion chromatography-tandem mass spectrometry (IC-MS/MS).

Results
The data showed no significant evidence of the presence of perchlorate due to the interfering chemical compounds in the mass spectrometer. In three of the five samples, levels of nitrate were significantly higher in the outer leaves than the inner leaves. In the other two samples, there was a slightly higher amount of nitrate in the inner leaves compared to the outer leaves. The amount of nitrate was more substantial within the outer leaves since the data was consistent with the hypothesis. The nitrate levels had no significant relationships with the store or price at which they were bought.

Conclusions/Discussion
The two samples with nitrate levels higher in the outer leaves may have been caused by errors in the preparation. Avoiding the outer/wrapper leaves of romaine lettuce would be a healthful decision for those concerned about nitrate consumption. Precautions should be taken until more studies are conducted to determine the level of nitrate consumption that is considered harmful and subsequent long term effects.

Summary Statement
The focus of this experiment was to determine whether the bioaccumulation of perchlorate and nitrate is more substantial in the outer leaves of a romaine lettuce when compared with the inner leaves.

Help Received
Used mass spectrometer at the Chevron Laboratory (Richmond) under the supervision of Michael Cheng (chemist).

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Daniel M. Shane

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

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Alexandria P. Sharpe

Project Number
S1721

Project Title
Crassulacean Acid Metabolism Plants

Abstract

Objectives/Goals
My goal is to prove that Crassulacean acid metabolism plants give off more humidity at night then at day.

Methods/Materials
Materials: Ten Jade plants, Four plastic boxes, XL zip lock bags, Hygrometer, Veriner oxygen probe, Vernier carbon dioxide probe, Laptop, Two heat lamps

Results
My results ened out great for both of my test . they both had more that a 5% significance.

Conclusions/Discussion
conclusion
I support my hypothesis because it shows at least 5% significance. Humidity percentages shot up from an average of 68% to 90% in the dark and in the light the average was 60% to 77%. Also the oxygen levels shot up in the dark from an average of 72.7ppt to 167.2ppt and in the light the average of oxygen levels was 108.3ppt to 159.2ppt. Carbon dioxide levels also showed a steady average for the dark 4.78ppt to 4.305ppt and for the light a steady average too, 4.77ppt to 4.825ppt. There is an average of 22% difference of rise in humidity for the dark and 17% difference of rise in humidity in the light. Also for oxygen there is an average of 94.5ppt difference of rise in the dark and for the light there is only 50.9ppt difference on average. Carbon dioxide there was an average drop of .475ppt in the dark and for the light there was a rise of .055ppt. My second test worked out great too. The Jade plants that I first put into the light, then into the dark shot up in humidity, oxygen, and went down in carbon dioxide; which is very good. It shows that the Jade plants are doing photosynthesis in the dark. The other half of the Jade plants that stayed in the dark were able to do a little bit of photosynthesis but the carbon dioxide levels stayed leveled; which is good too because it shows even though Jade plants have no access to light they can still produce photosynthesis. I think that#s amazing. Unfortunately we unable to produce temperatures like the desert or any other arid place would, which probably would change the data significantly, that would have been very interesting to see.

Summary Statement
It show the different levles of humididty, carbon dioxide, and oxygen of CAM (crassulacean acid metabolism) plants.

Help Received
Used equpment at school under the supervision of Mr. Callway

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Sheena W. Song

Project Number
S1722

Project Title
The Effects of Recycled Water on the Native Plant Species: Bouteloua gracilis, Juncus patens, and Nasella cernua

Abstract

Objectives/Goals
With the growing demand on a limited water supply, the use of recycled water for irrigation offers both a long term sustainable approach as well as a cost effective plan. However, the effects of recycled water on native plant species are virtually unknown and may therefore pose a risk to the well being of plants. If native plant species are watered with recycled water, then native plants with higher exposures to recycled water are subject to ailments.

Methods/Materials
In this experiment, three water treatments were used to evaluate the responses of the three native plant species, Bouteloua gracilis, Juncus patens, and Nasella cernua. These treatments included recycled water, an alternating combination of recycled water and tap water, and regular tap water. Measurements of height and stem abundance were recorded approximately every one and a half weeks for 14 weeks. The roots# were examined at the end of the fourteen week period, and the roots# wet and dry masses were also determined.

Results
In the end, usage of recycled water on the three native plant species produced mixed results. In the two species Bouteloua gracilis and Nasella cernua, the plants watered with recycled water generally exhibited stunted growth, compared to those treated with tap water. In Juncus patens, however, plants treated with recycled water showed more overall growth.

Conclusions/Discussion
The experiment provided useful information regarding whether or not recycled water is harmful to plants. By applying the results to daily life, it is realistic to presume that recycled water may be used as a sustainable solution to the world#s limited fresh water supply in certain plants species.

Summary Statement
The purpose of this experiment was to determine whether or not recycled (reclaimed) water would harm California native plant species.

Help Received
Mother and Father drove me to Cal State Dominguez Hills, library, and Kinkos several times; Used lab equipment at the Cal State Dominguez Hills under the supervision of Dr. Vadheim; Dr. Vadheim supervised me when transplanting plants and observing them

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

Van Tran; Katerina Trinh

Project Number

S1723

Project Title

Quantitative Determination of Pigments in Phaeseolus vulgaris and Spinacia oleracea: Chromatography and UV-vis

Abstract

Objectives/Goals

The purpose of our experimentation is to find out whether or not the conditions at which green beans and spinach are packaged affect the quantity of their pigments. We want to find this out by using thin-layer chromatography, paper chromatography, column chromatography, and ultra-violet visible spectrophotometry. We hypothesized that canned green beans and spinach will contain the least amount of pigments and that fresh green beans and spinach will contain the most pigments.

Methods/Materials

By utilizing three different methods of chromatography and a UV-vis, we extracted pigments from fresh, frozen, and canned green beans and spinach, and quantitized the amounts of chlorophyll a, chlorophyll b, beta-carotene, and lutein.

Results

Our results yielded from analyzing the vegetables with the UV-vis supported part of our hypothesis. As we predicted, canned green beans and canned spinach showed the most degraded pigments because their peaks barely showed up on the spectrophotometer graphs. Fresh and frozen of both types of vegetables showed very similar peaks in chlorophyll a, only differing by less than 1.0 nanometer and 0.2 absorbance. With chromatography, we were not able to receive exact measurements, but we found that fresh and frozen green beans and spinach's pigments showed up more darkly and clearly than canned green bean's pigments.

Conclusions/Discussion

Canned green beans and canned spinach's pigments degraded the most, and fresh and frozen green benas and spinach retained about the same amount of pigments. Canned green beans and spinach visibly showed the least pigments when we conducted the chromatography experiments. In addition, it showed fewer peaks with the UV-vis than fresh and frozen ahd shown. On the other hand, when we compared fresh and frozen green beans and spinach's pigments to the absorbance spectrum of chlorophyll a, we found that there were very few differences in quantity between the two conditions. In conclusion, the conditions at which green beans and spinach are packaged do indeed affect the quantity of pigments, and canning these kinds of vegetables reduces the amount of pigment the most while packaging them fresh or frozen allows them to retain the most pigments.

Summary Statement

Our project involves applying ultra-violet visible spectrophotometry and various types of chromatography to compare the amounts of certain photosynthetic pigments in fresh, frozen, and canned phaseolus vulgaris and spinacia olercea.

Help Received

Ms. Dely provided us with TLC silica gel plates; Mrs. Evans provided us with advice throughout the duration of our project; Mr. Allen helped taugh us how to operate the UV-vis; Mr. DeSousa helped us with paper chromatography.

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Carla L. Valladares

Project Number
S1724

Project Title
The Effects of Temperature on the Xylem of Tomato Plants

Abstract

Objectives/Goals
The objective of this experiment was to see if temperature does affect the size of the xylem of plants, especially Roma Tomato plants.

Methods/Materials
6 Roma Tomato plants; 6 planting pots; 1 bag of planting soil; 25 mL beaker; 1000 mL beaker; Blue dye; Water; Ice; Heat Lamp; Thermometer; Daily journal; Pen;
I placed six pairs of tomato plants in six different areas, each with different temperatures. The six different temperature areas were: under a heat lamp, in the shade, in direct sun, in a refrigerator, in a freezer, and in ice. I watered the plants everyday with 300mL of water that was dyed blue with 25mL of blue dye. I continued this for three weeks. After three weeks I cut a piece of each tomato plant 2 inches from the root and examined the xylem under the microscope. I then went up the stem 5mm and cut another piece. I did this in 5mm increments. I then measured the size of the xylem and compared them to see the effect that temperature had on the plants.

Results
After examining the 6 different plants I learned that temperature does affect the size of the xylem of the tomato plants. The tomato plants that were put in heat tended to have larger xylem. While the plants that were in the refrigerator tended to have xylem that were natural size. The tomato plants that were put in freezing temperatures had xylem that shrunk because they tended to freeze.

Conclusions/Discussion
In conclusion, I found that my hypothesis was correct in that temperature did affect the plants and the way that their nutrients were carried through their xylem. From this experiment I learned that the climate of the environment that a plant is in affects the plant positively or negatively. For the tomato plants that were in the hotter weather the blue dyed water tended to travel less than the plants that were put in colder climates. The dye seemed to move faster in the cold weather, because in the hot environments the plant dried out. In the colder environments the plants were able to stay saturated and took in the blue dyed water better than the plants in hot environments did. The xylem could be seen easier because the blue dyed water. Seeing as the xylem carries water all over the plant, it makes sense that the xylem was dyed blue by the water. The plants in hotter environments had visible xylems, but they were not dyed bluebecause the plants were too dried out to have enough of the blue water go through the xylem.

Summary Statement
My project is about observing the effects of extreme temperature on the xylem of a tomato plant.

Help Received
Teacher helped me narrow my topic; Mother helped me make display board

CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
Suh Young Woo

Project Number
S1725

Project Title
Photosynthetic CO(2) Uptake of a Southern California Coastal Sage Scrub Community

Abstract

Objectives/Goals
Because of the rising CO(2) concentrations in our environment, plants become important mechanisms in reducing the CO(2) in our atmosphere. This study compared the photosynthetic CO(2) uptake, water-use efficiency, transpiration, and leaf conductance to water vapor of evergreen and deciduous plants of the costal sage community. Through the results it examined the different strategies that plants use to cope with the Mediterranean-type environment. In addition, the relationship between the leaf lifespan and the photosynthetic carbon dioxide uptake was found.

Methods/Materials
A portable gas exchange system (LI-6400, LI-COR Inc., Lincoln, Nebraska, USA) was used to measure the maximum rates of net photosynthesis, stomatal conductance to water vapor, and water-use efficiency in three different shrub species. The shrub species included an evergreen, Rhus integrifolia (Lemonadeberry) , and two deciduous, Salvia mellifera (Black Sage) and Salvia leucophylla (Purple Sage).This study was performed at the greenhouse where optimum sunlight, water, and carbon dioxide were available and at the coastal sage scrub community in the Palos Verdes Peninsula.

Results
It was found that evergreen leaves have a low photosynthetic rate while the deciduous leaves had a high photosynthetic rate. The evergreen species save their water and carbon dioxide to use when not enough water is available during drought, but the deciduous plants use all the energy up for growth so that during drought, they remain dormant. When the CO(2) uptake in relation to leaf age was measured, it was found that the rate of photosynthetic carbon dioxide uptake decreases as the leaf#s age increases. The older leaves lost their ability to fix CO2 because they do not have enough enzymes and proteins available.

Conclusions/Discussion
This study clearly showed the difference between the photosynthetic carbon dioxide uptake of evergreen and deciduous species that live in the sage scrub community and the amount of CO(2) uptake in relation to leaf lifespan. But most important, this project addressed a possible solution for reducing the amount of carbon dioxide in the atmosphere.

Summary Statement
This project is about determining the photosynthetic CO(2) uptake of a deciduous and evergreen coastal sage species to determine which plants are more favorable to the increasing carbon dioxide of our environment.

Help Received
Used lab equipment at university of California Los Angeles under the supervision of Dr. Rasoul Sharifi