CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Sarah K. Ando

Project Number
J1901

Project Title
Water vs. Greywater: Does Watering with Greywater Affect the Growth of the Tomato Plant Compared to Using Tap Water?

Abstract

Objectives/Goals
The purpose of my investigation is to find out if greywater or tap water improves the growth of the tomato plant. If greywater improves the growth of tomato plants, then it would be more eco-friendly. We could use greywater and save lots water. I believe greywater will improve the growth of the tomato plant.

Methods/Materials
For my project, I tested ten heirloom tomato plants. Five plants were watered with tap water, and the other five were watered with greywater from a bathroom sink. The plants were watered everyday for a period of 35 days and observed every five days.

Results
The tomato plants' heights were averaged. The highest average on day 35 belonged to the tap water plants. The average was 22.85 cm. The greywater plants' average on day 35 was 22.05 cm. The difference between the averages was 0.80 cm.

Conclusions/Discussion
In conclusion, my hypothesis was wrong. In the beginning of my science project I thought greywater will improve the growth of the tomato plant because it has many other qualities compared to tap water. All in all, the tap water improved the growth of the tomato plant, but greywater is still appropriate for watering plants.

Summary Statement
My project was observing tomato plants using greywater and tap water.

Help Received
Science Teacher guided me through the project; Mother bought supplies

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nate J. Burrill

Project Number
J1902

Project Title
To Pee or Not to Pee?

Abstract

Objectives/Goals
The experiment was constructed to determine whether the concentration of urine used to treat grass affected the healthiness, in terms of height and color, of grass.

Methods/Materials
Sections of grass were treated daily with undiluted urine, a 1/4 dilution of urine, a 1/8 dilution of urine, a 1/16 dilution of urine, a 1/32 dilution of urine, or tap water. The height and color of the grass was measured once a week for four weeks.

Results
After three weeks, grass treated with a 1/8, 1/16, or 1/32 dilution of urine was the healthiest, being the tallest and the deepest shade of green. Grass treated with tap water was less healthy than grass treated with a 1/8, 1/16, or 1/32 dilution of urine, but it was not dead. Grass treated with undiluted urine or a 1/4 dilution of urine died after two and three weeks respectively.

Conclusions/Discussion
Treating grass with diluted urine will produce healthier grass than treating it with undiluted urine or tap water. These results show that human urine can be used as an effective fertilizer, which is increasingly useful given that California is in the midst of a devastating drought.

Summary Statement
I tested the effects of different concentrations urine on the height and color of grass.

Help Received
Father showed me how to use Excel and digital color meter; Parents proofread poster.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Mahima S. Chillakanti

Project Number
J1903

Project Title
Soil Compaction and Root Growth

Abstract

Objectives/Goals
Soil compaction, the compressing of soil particles which lessens pore space, limits circulation of water, air, and nutrients throughout the soil. A major issue in many agricultural regions, compaction leads to high annual yield reductions. My experiment tests the effect of subsurface compaction on root growth of plants to determine the optimum level of compaction.

Methods/Materials
To begin my experiment, I gathered twelve pots (for three types of plants and four levels of compaction-51.73%, 31.34%, 23.88%, and no additional compaction). I used a heavy handle to compact the soil at different amounts, and measured the compaction by calculating the reduction of porosity. I then planted lima bean, okra, and tomato seeds, and I watered the plants daily with a constant amount. At the end of two months, I analyzed the root growth by carefully separating the plants from the soil, in the process measuring the depth of the roots in the soil and the volume of soil the roots held. Once the plants were completely removed, I measured the actual length of their roots.

Results
Roots that grew under the 53.73% compaction had the least depth in the soil, growing horizontally rather than vertically. Because of this, the roots were unable to absorb water and nutrients, which resulted in unhealthy yield (dry, short, weak stem, yellow leaves). Moreover, roots grown under no additional compaction held the least amount of soil, since the soil was very loose. The second and third levels of compaction allowed the roots to hold the most soil and grow the deepest to absorb water and nutrients.

Conclusions/Discussion
According to the results, some amount of compaction is needed for healthy growth of plants. Based on the results, I concluded that levels between 23.88% and 31.34% compaction are optimum amounts, which can be implemented in agriculture to lower annual yield losses.

Summary Statement
Using three different plants, I measured the impact of subsurface compaction on root growth to determine the optimum range of compaction for healthy yield.

Help Received
My father bought the materials needed for the experiment.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Hunter D. Davis

Project Number
J1904

Project Title
Give Me Room to Grow: How Spacing Affects Tree Growth

Abstract

Objectives/Goals
People seem to like big trees. On public lands people like to see big trees in the forest; while on private lands, the owners want to see their trees get bigger faster so they can harvest them. My science fair project last year looked at how precipitation effected diameter growth of trees. This year I went another step farther to see how spacing effected the diameter growth. My hypothesis is that a tree's diameter growth will decrease if there are a lot of trees tightly spaced together in an area because they will have smaller crowns and there will be less sunlight reaching the crowns.

Methods/Materials
I established 12 random 1/50 acre plots in Douglas-fir and ponderosa pine stands. On each plot I measured the diameter of each tree using a diameter tape and recorded the species of each tree. I bored sample trees to determine the age of the stand.

Results
More trees equal less growth. I found on the plots I measured that the trees with smaller diameters were in tightly spaced stands. As the trees per acre decreased the trees diameter increased. In the plots averaging less than 200 trees per acre the average diameter was 14.3 inches. Plots with 200-300 trees per acre the average diameter was 11.5 inches. In plots with 300 or more trees per acre the average diameter was 8.8 inches.

Conclusions/Discussion
I found that fewer trees per acre results in bigger diameters and the more trees per acre results in smaller diameters. The trees with space between them do not have to compete for sunlight. While the bottom branches on the trees with no space are competing to get sunlight.

My hypothesis that a tree's diameter growth will decrease if there are a lot of tightly spaced trees in an area because they will have smaller crowns and there is less sunlight the crowns was proven correct.

This project would help me if I was planting trees, and I wanted them to have a bigger diameter, I would know to spread the trees farther apart from each other. In stands with older or larger trees I also now know that if some of the trees are removed, it will allow the remaining trees to grow to a larger diameter faster.

Last year my project was to find if rainfall effected the diameter growth of trees. I found that the wet years did not have much of an effect while the dry years did have a small affect. Based on the results from my

Summary Statement
My project is about how spacing effects the diameter growth of trees.

Help Received
My father helped me with the data collection and analysis and my mother helped me with the backboard.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Cheyenne Espinosa; Riley Espinosa

Project Number
J1905

Project Title
Terraforming Mars! Seed Germination under Mars-Like Conditions

Abstract

Objectives/Goals
To find which seeds (if any) are more successful in germinating under Mars-like conditions (low atmospheric pressure, freezing temperatures, and in carbon dioxide).

Methods/Materials
To germinate the seeds we placed 10 seeds (of each type: corn, beans, lettuce, and alflafa) on a moist paper towel and placed it in a plastic sandwich bag (and then labeled the bag). We placed a set of 4 seed bags (1 each of corn, beans, lettuce, and alfalfa) in the 3 different Mars-like conditions (Carbon Dioxide, low atmospheric pressure, freezing temperatures, and a control). We observed the seeds on a daily basis over the course of one week and recorded our observations.

Results
Lettuce seeds were the highest germinating in all the environments with Alfalfa a close second. The freezing temperature group did not germinate any seeds.

Conclusions/Discussion
Our hypotheses were incorrect, the beans did not germinate the best, rather the lettuce did. And of the three Mars-likes environments that we tested, the freezing temperatures appear to be the biggest hurdle facing terraforming.

Summary Statement
Germinating Seeds under Mars-like conditions with the intent to Terraform the red planet.

Help Received
Mother helped type the report, father and uncle provided us with vacuum chamber and carbon dioxide canister.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Brooke C. Fairfield

Project Number
J1906

Project Title
Green to Red: The Change of Leaves' Colors over Time

Abstract

Objectives/Goals
My goal is to understand why leaves change colors at different rates. My hypothesis is: If the pH in the soil is lower, the trees' leaves will change colors sooner, compared to the trees with higher pH in the soil.

Methods/Materials
Selecting 57 Liquidambar trees in the city of Goleta, I took six pictures for each tree over the course of three months (October-December). The pH level in the soil was measured for each tree. All the data points were placed in six groups, classified by the level of pH that was found in the soil. I then found the average amount of days it took the trees to begin to change colors (when the first colored yellow/orange/red leaves appeared on a tree) for all the groups.

Results
The higher the level of pH was, the longer it took for the trees' leaves to begin to change color. In general, I see a positive correlation between the pH level in the soil and the rate at which the trees' leaves begin to change colors. The graph created by plotting average days and pH groups is roughly linear. The equation obtained from the graph has a constant of variation, k, of 2.68.

Conclusions/Discussion
I noticed that when the pH reaches 6.1, the line on the graph stays around an average of 16 days. I think my results mean that the level of pH is going to affect the rate of color change for these trees until it reaches a less acidic level (higher pH). At this point, the time needed for the trees' leaves to change colors seems to be unaffected by the acidity of the ground. To show that my results where significant, I conducted a t-test. By looking at the t-test values I was able to prove my hypothesis. This project could have potential implications for farming, textiles, city planning and the environment.

Summary Statement
My project is about how the pH of the soil affects the rate at which trees' leaves change color.

Help Received
Science Teacher helped me consider my variables, Aunt and Cousin helped review data, Parents helped gather data and type.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Alexandra Y. Grishchenko

Project Number

J1907

Project Title

Could Harmful Algal Blooms Be Expelled from Water Sources using Colored Light Filters?

Abstract

Objectives/Goals

For this year's science project I chose to investigate: Could Algal Blooms be Expelled from Water Sources Using Colored Light Filters? I am interested in this topic because it seems that people are little aware of this sizeable problem around the world. I want to see if I can find a solution to this ecological issue, and help the eco-system. The amount of money the U.S. loses because of algal blooms is unreasonable. I hope to find a solution to this problem through this experiment.

Methods/Materials

After obtaining 4 dark boxes (so unwanted light cannot affect the experiment), 3 sheets of colored light filters (green, blue, and red) algae samples, and large aquarium, begin your experiment. Let the algae grow in the aquarium for 1-2 weeks. Then, separate algae into the 4 containers equally, covering three of them with light filters and one uncovered. To formulate results, take drops of water for samples from each box. Using a microscope, count the number of algae and repeat with 5 drops from each container, and find average of the 5. Record in logbook. The algae number is likely affected by the independent variable, the colored light filters.

Results

Through my investigation, I found that the green colored light filter hampered the growth of algae the most when compared to the naturally growing uncovered box. Slightly more algae grew in the blue light filter, but still less than in the uncovered container. The red filter however, encouraged the growth of algae and consistently contained more algae than the uncovered container.

Conclusions/Discussion

I concluded that I did prove my hypothesis. I will explain why my experiment happened the way it did. The biggest influence on the results of this experiment is Photomorphogenesis of plants. The process is controlled by photoreceptors that trigger actions taken by the plant. The Phytochrome controls responding to far-red and red light wavelengths,Cryptochromes and Phototropins are photoreceptors that react to blue light. It has been shown that these receptors may be key to stomatal opening. Triggering these photoreceptors was critical,as the reproduction system was affected by the blue and green light waves. Using these conclusions, light filters could help eliminate Algae Blooms. My experiment was unique in that all studies have been done on land plants, not algae, and that I used these concepts to try to find a way to eliminate plants, not promote growth.

Summary Statement

I was finding an alternative eco-friendly way to slow down spread of Algal Blooms in water, for which I used light filters.

Help Received

School provided materials for experiment

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Connor B. Harden

Project Number
J1908

Project Title
Cloning Cabbages

Abstract

Objectives/Goals
The objective of my project was to see which piece of a cabbages stem would grow the best if the stem pieces were placed under the same conditions. My hypothesis states that I believe that the bottom stem piece will grow the best and this is beacause I know that the bottom part of a cabbages stem recieves nutrients first in a whole cabbage and I believed that this fact would be noticable in my results.

Methods/Materials
For my project I used three cabbages,a cutting board,knife,nine paper towels,nine sealable plastic bags,water,permanent marker,a large tray,lab notebook,and a camera. Using these materials I conducted my project. First I stripped the leaves off the stem of the cabbages and then cut those stems into three pieces. Then I took those nine stem pieces and put them into labeled resealable plastic bags with a damp paper towel to provide the cabbages with water. Those stem pieces in their corresponding labeled plastic bags were then put into a large tray and photographed and some physical data was recorded on a graph. The tray with plastic bags was placed under a window to provide sunlight for photosynthesis and every day I blew carbon dioxide from my breaths into the bag to again allow the plant to survive. I also recorded important differences in the stem pieces such as when I noticed that one of the bottom stem pieces had started growing leaves

Results
I found that the bottom stem piece of my cabbage grew the best after all the tests. This result is on average over a test of nine cabbage pieces with three of each type, the types being a top, middle, and a bottom piece. The results were surprising to me especially considering that

Conclusions/Discussion
After the completion of my project I found that my results had shown that on average the bottom stem piece did grow the best. This data also supported my hypothesis. The information collected from this project has already provided me with knowledge on how many plants reproduce using assexual reproduction.

Summary Statement
This project is about learning which part of a cabbages stem can reproduce through assexual reproduction the best.

Help Received
My parents provided me with my supplies.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Abdullah Hasan

Project Number
J1909

Project Title
Give Soil Some Oil?

Abstract

Objectives/Goals
This project was designed to find out if adding vegetable oil to soil will preserve moisture and thereby allow the plant to grow better. It was expected that a layer of vegetable oil would enable the plant to grow well.

Methods/Materials
This experiment was performed outdoors using twenty Primrose plants, water, and vegetable oil. Ten of the Primrose plants were watered with one cup of water each week, and the other ten plants were watered with both one cup of water and 2.5 mL of vegetable oil each week for three consecutive weeks.

Results
Based on the data collected, the plants that were watered with vegetable oil grew better with an average growth of 4.57 centimeters. On the other hand, the plants that were watered with water only showed an average growth of 0.85 centimeters. Vegetable oil helps increase plant growth by preserving the moisture in soil and by supplying the plant with certain nutrients. Care should be taken to add only a small quantity of oil.

Conclusions/Discussion
The hypothesis that plants that will grow better if vegetable oil is added in small quantities was strongly supported by the results. If this experiment was to be repeated, different types of plants, oils, and soils would be tested. This project is relevant to the present-day shortage of water in California.

Summary Statement
This project was experimented to determine whether vegetable oil helps plants grow better and taller.

Help Received
Father helped buy materials;

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Michael H. Ho

Project Number
J1910

Project Title
Carbon Dioxide: The Indispensable Role It Plays in Photosynthesis for Aquatic Plants

Abstract

Objectives/Goals
The purpose of my experiment was to examine how carbon dioxide affects an aquatic plants growth speed. My goal was to figure out whether or not the plants were influenced by the increased amount of CO2 concentration their surroundings contained.

Methods/Materials
During my experimentation, I tested 2 of the same types of plants that were placed in separate containers under the same environment and conditions(amount of light, temp.,water). One of the plants however, was grown with a DIY CO2 system kit that produced carbon dioxide using the reactions between citric acid, baking soda, and water. The other plant had an air pump that generated the necessary amount of carbon dioxide the plant needed to survive. The growth rate(GR)was monitored and determined for each plant. Unfortunately, I wasn't able to record the percentage of the amount of CO2 concentration in the environment because the equipment needed for that information was way over my budgets expenses.

Results
The plant that demonstrated the greatest rise in GR was the one with the CO2 system kit. The whole experiment took a total of exactly 8 weeks. At the end of the experimentation the plant with the CO2 system kit turned out to be 145g and the plant without it turned out to be 55g. Both plants started at 15g and made progress in growth as each week passed. The plant with the increased dosage of CO2 weighed nearly 3x more than the plant without it. That means that increasing CO2 concentration in the photosynthesis process is nearly 3x more effective than the process with just regular air.

Conclusions/Discussion
In the end of my experiment, my hypothesis was correct. It was correct because I have always thought that carbon dioxide majorly impacted a plants growth rate ever since the beginning of my project. I came to my conclusion because as I observed the data, the plant with the more concentrated CO2 environment had a much faster growth rate than the other. I can now conclude that carbon dioxide plays an INDISPENSABLE role and is also considered as an important feature in the photosynthetic function.

Summary Statement
The significant role carbon dioxide plays in photosynthesis and whether or not the dosage will affect a plants growth rate.

Help Received
father supplied all the materials and covered the costs as well

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Will Hoadley-Brill; Henry Tull

Project Number
J1911

Project Title
Rad Radish Forest

Abstract

Objectives/Goals
This experiment was conducted, to discover if one specific nutrient was more important for a seeds growth than another. The expected results were, that the Potassium solution would produce the most successful growth. This was expected because, Potassium is the most abundant cation in plant cells, therefore supplying the increased amount will help stimulate plant growth.

Methods/Materials
100 radish seeds were planted into 25 different containers filled with 50 mL of hydroponics, (4 seeds per container), 3 cm below the surface of the hydroponics. 65 mL of each nutrient solution was mixed with 2625 mL of water in separate containers. Each day for 21 days, every container was watered with 25 mL of that container#s specific nutrient solution. Every three days, the sprouts were observed upon and measured.

Results
The seeds watered with the Calcium grew the tallest averaging at 3.44 centimeters. The plants that grew the shortest stems, were the plants watered with the Potassium averaging at 1.6 centimeters. The roots that grew the longest were the ones watered by the Magnesium averaging at 3.56 centimeters. The shallowest roots were the ones watered with Potassium, once again, averaging at 1.2 centimeters.

Conclusions/Discussion
The results of this experiment didn#t support the hypothesis, however, they answered the objective. The expected results were that the Potassium solution would create the most successful plants, however, there was split results between the root depth and stem height. The results did clearly show us what nutrient solution is best for plants growth.

Summary Statement
Using the nutrient solutions of plain water, Iron, Calcium, Potassium, and Magnesium, we discovered which nutrients are best for radish stem growth and radish root depth.

Help Received
My Mother drove us where we needed to go; Henry's mother found and bought our materials; Mrs. Hoffman supported all of our little issues we had; Mrs. Bellinghiere was extremely supportive of all the decisions we made; Mrs. Williams helped us with all of the scientific processes; Everyone at the Los

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Zachary Huang-Ogata

Project Number
J1912

Project Title
Different Liquids on Plants

Abstract

Objectives/Goals
My project was done to determine whether alkaline water, acid water, sugar water, or regular tap water would help plants germinate faster and bigger. My goal is to prove which water is the best for plants, to change the world of agriculture.

Methods/Materials
For each of the five types of waters, (alkaline, acid, sugar, and tap), had five plants each. Every plant was the same, with each cup with 20 oz. The only difference among the plants was the type of liquid given to it. Each cup was filled with 6.5 cm of soil, and given a seed. Then it was covered with 2 cm of soil. Each plant received 40 milliliters of the specific water they were assigned, and were 20 total plants. I observed the plants and recieved data over a 10-day germination period.

Results
Tap water plants had the best results, with four out of five plants germinated. Acid water plants did the second best, with three out of five plants germinated. Alkaline and sugar water plants tied for the worst results, with two out of five plants germinated. The tap and acid water plants grew the biggest, and the alkaline and sugar water plants were the smallest in size.

Conclusions/Discussion
My conclusion is that water with a neutral pH of 7 given to plants helps it germinate faster and grow bigger. Although alkaline water contains healthy minerals like potassium, magnesium, and calcium, which benefit our body, it does not help plants. Plants are adapted to getting their own nutrients on their own, so there is no need to overfeed it with these extra nutrients. In this experiment, I learned that giving plants rich nutrient water doesn't really help speed up its growth process. The best water to give plants is regular water with a neutral pH, of 7.

Summary Statement
My project is about finding what type of liquid, (acidic, neutral, or alkaline), will help plants germinate the fastest, and have the best results.

Help Received
Mother bought materials like cups and soil. Science teacher gave me suggestions with my project.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Joseph A. Huitt

Project Number

J1913

Project Title

The Effect of Endomycorrhizea Fungi on Corn Growth and Production

Abstract

Objectives/Goals

My objective is to determine what effect the inoculation of corn seeds at planting with endomycorrhizae fungi would have on both the overall growth of the corn plant and the fruitfulness of fresh market corn. A bigger corn plant with a bigger root mass should grow a stronger corn plant, able to extract more water and nutrients ultimately leading to increased corn production.

Methods/Materials

Endomycorrhizae fungi were inoculated onto 5 pounds of corn seeds before planting. In a field growing corn, eight rows were planted using inoculated seeds and eight rows were planted without inoculation. Corn plant seedlings were weighed and measured at six weeks and photographed. At eight weeks I limited water on half of the rows of each treatment to observe the effect of water stress and drought tolerance. When the crop matured overall crop growth and crop production was determined for each treatment.

Results

The results of this experiment at six weeks showed that the addition of mycorrhizal fungi increased plant weight from an average of .12 grams for the control to an average of .28 grams for the treated plants. Mature corn stalks grew an average of six feet in height when inoculated and only five feet 6 inches in the control. Corn production averaged two ears when inoculated and 1.7 ears in the control. After limiting water from my drought rows for two weeks, I observed that the inoculated rows had continued to grow at the same rate as fully irrigated plants whereas the control had stopped growing and appeared wilted and were turning yellow at the base.

Conclusions/Discussion

The results of this experiment supported my original hypothesis that inoculating corn seeds at the time of planting with endomycorrhizae fungi increased the overall size of the plant, significantly increased the crop production and greatly enhanced the plants ability to withstand water deprivation during plant development. Future research will be conducted on vegetable transplants this growing season to discover if transplant shock can be reduced with the use of mycorrhizal.

Summary Statement

I tested the effect of endomycorrhizae fungi on corn to see if fresh market corn production could be increased and become more drought tolerant.

Help Received

My mother provided the seeds, endomycorrhizae, land and growing equipment.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Jamie K. Lau

Project Number
J1914

Project Title
Will the Demise of Incandescent Bulbs Affect Our Houseplants?

Abstract

Objectives/Goals
In recent years, millions of households across the country have committed to conserving energy by changing the household light sources from incandescent bulbs to light emitting diodes (LED) or Compact fluorescent lamps (CFL). Different lights with varied wavelengths can affect the photosynthetic process of plants. This investigation will examine the effects of each type of light on the growth rate of the common houseplant Dracaena Sanderiana over the course of 17 days.

Methods/Materials
Five separate plants were grown under each light. Plants were grown at an ambient temperature of 65° F in potting soil and exposed to 12 hours/day for 17 days. All bulbs generated 600-800 lumens.
LED, CFL, and Incandescent Light Bulb; Lamp cord spliced for multiple bulb sockets; Dracaena Sanderiana Plant (Lucky Bamboo).

Results
Incandescent bulbs clearly promote the largest percent change in number of leaves on the plant (Table below). Availability in the broadest wavelength promotes the most amount of photosynthetic activity in Dracaena Sanderiana, which confirms that Incandescent lamps stimulate healthy growth for the Dracaena Sanderiana.

Vertical growth of the Dracaena Sanderiana under different types of light shows less variation with a range from 0.4%-1.1%.

Type of Light	Percent Change in Leaf Count
A=Sunlight	25%
B=Incandescent	70%
C=LED	23%
D=CFL	18%

Conclusions/Discussion
This study suggest that incandescent light is best to promote houseplant growth. The basis of this may be related to the broader emission of wavelengths of incandescent light compared with LED and CFL lights. We know energy conservation is beneficial for our community and the animals of our ecosystem; however, common houseplants utilizing other sources of light, such as LED and CFL may not thrive as well.

Summary Statement
The emission amplitude and spectral distribution of different household light sources will cause a change in the growth of common household plants.

Help Received
Teacher helped supply lab equipment. Father helped set up board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Eliza K. Lyday

Project Number
J1915

Project Title
Cotton: Got Soil?

Abstract

Objectives/Goals
My objective was to determine which type of soil would best promote growing cotton.

Methods/Materials
I used four very different types of soil (dirt from a dormant cotton field, dirt from a river bottom, Miracle Grow potting soil and vermiculite) and filled 11 growing tubes of each soil (44 in all), making sure to scatter the samples in a tray that held the tubes so as to obtain a random sampling. I then watered and measured daily to compare how the cotton grew in each soil.

Results
After averaging my data, I came to the conclusion that the soil from the river bottom grew the overall tallest plants.

Conclusions/Discussion
After reaching my conclusion, I found that my hypothesis was correct. I learned that cotton is not only a fast-growing plant, but it is also a large part of our economy.

Summary Statement
My research project determined which of four very different soils would grow the tallest cotton plants

Help Received
Borrowed growing equipment and consulted with Treanna Pierce at Shafter Cotton Research Station

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nathan G. Mermilliod

Project Number
J1916

Project Title
Plant Transpiration Under Light Sources

Abstract

Objectives/Goals
The objective of this experiment is to test the rate of plant transpiration under different light sources.

Methods/Materials
Two experiments were conducted. In the first experiment, three different kinds of plants were placed in 2-liter terrariums under three different light sources-sunlight, incandescent light, and fluorescent light. The plants were watered with the same amount of water at the same time each day for five days. After eight hours, the transpired water was collected using a spatula and measured using measuring cups and spoons. The second experiment was performed in much the same way, except that three samples of the same type of plant were placed under each light source and a fourth light source, a plant light bulb, was added. In addition, taller 2-liter tops were placed over samples planted in regular pots, a swamp cooler was used in the sunlight room to better control room temperature, the plants under sunlight were placed in a dark closet outside the hours of the experiment, and the experiment was carried out for ten days.

Results
In both experiments, the data showed that the plants under sunlight had the highest rate of transpiration, particularly on sunny days, the plants under regular incandescent light produced a lower, more consistent rate of transpiration, and the plants under fluorescent light did not transpire. The plant bulb in the second experiment produced a very low and consistent rate of transpiration.

Conclusions/Discussion
The data supports the original hypothesis in that the plants under sunlight, the hottest light source, transpired the most. Environmental condition resistance did affect transpiration under the cooler artificial light sources. In addition, none of the artificial light bulbs, including the plant light, was able to mimic the effects of the white light of the sun, which provides both the blue and red light plants are most sensitive to for stomatal opening and efficient transpiration, photosynthesis, and growth. The results of the project may help us become better plant growers, increase our understanding of the water cycle or lead to improvements in green house construction.

Summary Statement
My project tested the plant transpiration rate under different light sources.

Help Received
Jenessa Stemke, graduate student in Department of Enviromental Science, UCR, was my mentor for Experiment II; Parents helped with data collection and board assembly.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Georgia G. Miller

Project Number
J1917

Project Title
How Does the Wavelength of Light Affect Photosynthesis in Elodea?

Abstract

Objectives/Goals
The objective is to compare the effect of short versus long wavelengths of light on photosynthesis in elodea, or pond weed, to test the hypothesis that high energy wavelengths are most effective at producing photosynthesis.

Methods/Materials
Colored light gels are taped over clamp lamps to turn light into five separate colors: violet, blue, green, yellow and red. A control lamp has no colored gel. The lights are positioned over test tubes that contain a three-inch-long strand of elodea floating in a solution of Bromothymol blue. The color of Bromothymol blue acts as a measure of photosynthesis by indicating the uptake of carbon dioxide over time.

Results
In a series of three experiments, variables were adjusted to compare the effect of violet-blue light (short wavelength) and red-yellow light (long wavelength.) After two experiments with inconclusive results, the third procedure showed a clear difference in the rate of photosynthesis. The data showed that the short wavelength light produced photosynthesis at twice the rate of the long wavelength light.

Conclusions/Discussion
The first two of the three experiments did not produce usable data, but they were helpful because they showed how the experiment should be redesigned. This was a valuable lesson in using the scientific method. Even though the hypothesis was proven correct, the conclusion cannot be drawn that one wavelength is more important than others. Plants develop best under a balanced light spectrum. Photosynthesis has been studied for more than 100 years, but we do not know everything about how the process of photosynthesis differs by plant. In that way, this project contributed to the body of research on photosynthesis.

Summary Statement
This project is about how the wavelength of light affects the rate of photosynthesis.

Help Received
Father helped set up the lights for the experiment in the garage.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Olivia Myers; Grace Niccum

Project Number
J1918

Project Title
How Do Different Fertilizers Affect the Growth of Sweet Peas?

Abstract

Objectives/Goals
The objective of our Science Fair project was to determine how different fertilizers affected the growth of sweet peas. We hypothesized that seaweed would most effectively strengthen and quicken the growth of our sweet pea plants.

Methods/Materials
We planted 50 sweet pea seeds in Miracle Grow Seed Starting Potting Mix. One row was fertilized with commercial fertilizer, one with molasses, one with seaweed, one with coffee grounds, and the last row was a control group with only the potting soil. We fertilized the seedlings every two weeks and watered them every other day. Every Friday, we measured and recorded the plants# heights.

Results
By the end of six weeks, on average, the control group and the seaweed group had the same amount of growth. The molasses and the coffee grounds group grew less and the commercial fertilizer group grew the least.

Conclusions/Discussion
We conclude that the seed starting potting soil worked most effectively on sprouting seeds when used by itself. According to our data it appears that the seaweed addition neither helped nor harmed the seedlings. Our results indicate that when the potting soil and the commercial fertilizer are used together the effect was detrimental because the plants were overfertilized. A question for further experimentation would be what effect the fertilizers would have if applied to seedlings in potting soil without seed starting fertilizer or if applied later in the growth cycle.

Summary Statement
How do different fertilizers affect the growth of sweet pea seedlings?

Help Received
Science teacher provided our board, Garden teacher let us use the garden to house our plants, mothers helped with purchases and applications

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Isaiah L.D. O'Neal

Project Number
J1919

Project Title
For the Venus Flytrap, Does Food Type Affect the Speed of a Trap's Closure and the Duration of the Trap's Closed State?

Abstract

Objectives/Goals
This experiment builds on a body of knowledge in the field of carnivorous plants. It investigates an area in which little is known: In a Venus flytrap, does food type affect the speed of trap closure or the duration of its closed state? The hypothesis was that food type would not affect the speed of trap closure but would affect the duration of its closed state.

Methods/Materials
An experiment was conducted, involving six Venus flytraps labeled Plants #1-6, which received six separate foods. Trap closing time was measured using a slow motion camera running at 600 frames per second. The duration of closure was measured using timelapse video cameras shooting at 1 frame every 80 seconds. The experiment was repeated three times over the course of six weeks.

Results
When the experiment was complete, it became clear that, contrary to the hypothesis, food type affected not only the duration of trap closure, but also the speed of closure, as closing times varied from :00.139 seconds to :52.815 seconds and duration of closure varied from 6hrs. 32min. to 19 days, 21hrs. 41min.

Conclusions/Discussion
While the findings from the experiment have no known practical application at this time, they advance the knowledge of carnivorous plants, and as the study of these plants advances, new applications may emerge for data such as this.

Summary Statement
This experiment tests the effect of food type on a Venus flytrap's speed of trap closure as well as the duration of the trap's closed state.

Help Received
Father taught me how to use Final Cut Pro and MS Word.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Jacquelyn Opalach

Project Number
J1920

Project Title
Investigating the Accuracy of the Current Method Used to Measure Growth Rate on Redwood Trees

Abstract

Objectives/Goals
The objective of this experiment is to determine if the current method used to measure growth rate on redwood trees is accurate. I suspect that the method may be inaccurate because redwood trees grow in clusters, and the side of a tree that is accessible for extracting an increment core is not facing one of its neighbors in the cluster.

Methods/Materials
A recently thinned redwood forest was visited where fourteen tree disks were collected from accessible tree stumps. These tree disks came from stumps that had varying amounts of neighbors within their own sprout clump. The place on the disk where radial growth would most likely be measured by a forester was determined, followed by calculating the average growth by measuring radial growth in four places, adding them together and dividing by four. The forester#s estimate of growth was then compared to the average growth for each disk.

Results
It was found that nine out of fourteen times growth rate is overestimated by the forester#s method that relies on a single measurement. The average overestimation is eleven percent, and while there is no obvious relationship between the amounts of neighboring trees a tree has, it is believed that there would be a relationship between stand-alone trees and trees from sprout clumps.

Conclusions/Discussion
Although measuring in only a single place is expected to be accurate, this method is flawed when applied to redwood trees from sprout clumps. Estimates of growth rate are more likely going to accurate if the subject tree is either measured in more than one place, or the average growth rate is decreased by eleven percent if the current method based on a single measurement must be used.

Summary Statement
This experiment tested the accuracy of the current method used to measure growth rate on redwood trees which is expected to be questionable because redwood trees grow in sprout clumps.

Help Received
My Father helped me cut tree disks from stumps and he helped me with Microsoft Excel.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Perry M. Otto

Project Number
J1921

Project Title
Which Compost?

Abstract

Objectives/Goals
My objective was to see what kind of compost works the most efficient in growing kale and mustard plants. I also wanted to see the different levels in potash, nitrogen, and phosphorous.

Methods/Materials
Soil tests were used to test 3 nutrients in the mustard and kale plants. These 18 plants were placed into buckets with either mushroom, homemade, or EB Stone Organic store bought compost. They were watered with a consistent type of water and measured with a ruler. The first step made was to test the composts for nitrogen, potash, and phosphorous to determine my hypothesis. Then, I measured the plants daily and watered them the same amount when needed. In addition to watering them, I rotated them to ensure that they would have a similar access to sunlight.

Results
My results were that the homemade compost, made mainly of animal manure and kitchen scraps, had the highest content of nitrogen and was the compost that worked the most efficiently. I could tell because after looking at the total growth for each plant, the homemade compost was the definite winner.

Conclusions/Discussion
I thought that the homemade compost would have a greater chance of helping plants grow, because it had the best results from the soil test that I performed. My results show that the homemade compost did do the best. I think that it is because of the surplus of nitrogen in the compost. I could have added additional varieties of plants or compost to compare my results. If I were to research this project more, I would grow some plants in regular soil without compost to see if compost matters at all. Also, I would see if I could find out what causes the plants to spike while they are planted in homemade compost.

Summary Statement
What kind of compost is the most efficient for growing kale and mustard plants?

Help Received
Mr. Chris Nestlerode provided the soil tests; Mom took photos; Dad rotated plants when I wasn't available; Cheryl Potter provided homemade compost; Home Depot and Central Home supply discounted the price of compost.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Jocelyn X. Overmyer

Project Number
J1922

Project Title
Aquaponics: Food from Fish

Abstract

Objectives/Goals
My objective of this project is to grow plants using an eco-friendly environment with no pesticides. I predicted that if I grew plants in an Aquaponics system, that they would grow taller and healthier than plants grown in soil.

Methods/Materials
I built an Aquaponics system, which shelters fish. The fish adds nutrients to the water, which is pumped up to the plants. The cycle continues as it drips back down to the fish tank. The Aquaponics system ran for eight weeks, growing four lettuce plants. As the control group, a growbed was filled with soil. The Soil Growbed was also taken care of for the same eight weeks, growing four more lettuce plants. During those eight weeks, the heights and number of leaves of all eight plants were recorded weekly.

Results
The data after eight weeks showed that the plants grown in the Aquaponics system were about double the height of the plants grown in soil, with average height around 24cm. Both plants in the Aquaponics system and soil had an average of 10 leaves per plant.

Conclusions/Discussion
This shows that even though plants grown in the Aquaponics system grow twice as fast and tall, the plants were as sturdy and robust as the plants grown in soil. Overall, plants grown in an aquaponic system is more eco-friendly then growing plants in soil.

Summary Statement
My project is about comparing plants grown in an aquaponic system vs. growing plants in soil.

Help Received
My dad helped me build my design of an aquaponic system.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Lekha Pillarisetti

Project Number

J1923

Project Title

Effect of Different Types of Soil and Watering Schemes on Plant Growth

Abstract

Objectives/Goals

This project was triggered by a simple challenge that my mother made to use my skills to figure out why her plants do not grow as well as those of our neighbor. Hence I decided to study the effect of the two most important factors, soil and water, on plant growth. The objective was to do an analysis of relative contribution of different aspects of these factors to plant growth to determine which aspects influence plant growth the most.

Methods/Materials

For soil, I used 3 variables. They are Soil Nutrients (measured by N,P,K levels), Soil acidity (measured by pH level) and Soil texture (measured by water retention capacity). For water I used 2 variables which are total water quantity used in a day and timing (or frequency) of watering. I expected that Soil Nutrients would be the key factor in the plant growth.

For measuring Soil factors I used a commercial soil test kit. For water retention, I deviced my own method to measure water loss based on water that passes through the soil in a funnel. For watering, I came up with a schedule of different quantities and frequencies based on my understanding of the right range.

Results

The results were very different than what I expected. Soil texture seems to contribute a lot to plant growth. Increasing soil nutrients beyond current levels did not really help that much. Watering schedules show that plants favor certain optimum levels and over-watering does not result in better growth. Also, for same quantity, night watering is better than day watering.

Conclusions/Discussion

My conclusions were two fold. First, for better plant growth it is most critical to improve soil texture (higher water retention capacity) than any other factor. Also, day time watering should be avoided as it really does not help plants and is just a waste of water.

Both of these conclusions lead me to believe that there is a lot of scope to reduce over-watering at our homes without impacting plant growth. This can potentially save a lot of water, which is critical now due to the drought conditions in our state.

Summary Statement

I analyzed relative contribution of different factors to plant growth to determine which factors influence plant growth the most, which led me to the conclusion that soil texture and optimum water levels are the key influencing factors.

Help Received

My mother#s challenge in her backyard was the inspiration for this project. My father helped me to get the pots, different types of soils and type the report. My science teacher guided me on how to organize the information on the poster board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Andee L. Poole

Project Number
J1924

Project Title
Investigating if Aged Bovine Manure Loses Its Nutrient Levels and Effectiveness as a Plant Fertilizer

Abstract

Objectives/Goals
The objective of my project was to investigate if bovine manure loses its nutrient levels and effectiveness as a plant fertilizer as it decomposes.

Methods/Materials
Three ages of bovine manure were collected; the oldest manure was 6 months old, the middle- aged manure was 2-3 months old, and the youngest manure was fresh. After creating a mixture of manure and water by adding 175mL water to 10 grams of a specific manure age, radish and fescue seeds were planted hydroponically. The seeds were allowed to grow in 9oz SOLO cups for 14 days, and the average plant heights were measured.

To test the amounts of nitrogen, phosphorus, and potassium within each age of manure, the Rapitest Soil Test Kit was used. A four to one solution of water and manure was allowed to settle for three hours; then the liquid of the solution was placed in the test comparator. A pill was mixed in the water, and the water colors were compared to determine nutrient levels.

Results
After my experiment, my results indicated that the oldest manure contained the highest levels of nitrogen, potassium, and phosphorus. The oldest manure acted as the best fertilizer for the radish plants, and the middle- aged manure was the best fertilizer for the fescue grass. The youngest manure contained the lowest nutrient levels and acted as the worst fertilizer for both the fescue grass and the radish plants.

Conclusions/Discussion
Contrary to my hypotheses, which stated that the youngest manure would act as the most effective fertilizer and contain the highest nutrient levels,the oldest manure contained the most nutrients. The oldest and middle- aged manures were also the best plant fertilizers. Soil tests should be conducted to measure necessary nutrients needed to cater to certain crops since there is a relationship between nutrient abundances and effective fertilizers. Aged manure should also be used as fertilizer instead of younger manure to achieve potential plant growth

Summary Statement
My project will determine at what age, or level of decomposition, bovine manure should be used as a plant fertilizer based on its effectiveness and the level of nutrients it contains.

Help Received
Mother helped take photographs of the experiment and arrange the science board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Jadie A. Pruitt

Project Number
J1925

Project Title
Hermie the Worm

Abstract

Objectives/Goals
The purpose of this experiment was to answer this question: Will introducing European Nightcrawler into to the soil of potted winter/rocket snap dragons help them grow taller?

Methods/Materials
Nine snapdragons were given the same amount of soil, water, and sunshine for three weeks. These snapdragons were into three groups of three, and the only difference between these groups was that one group had two European night-crawlers, a breed of earthworm, in the soil, another group had five earthworms, and the last group had none. The last group was the control group of this experiment. Apple slices of the same weight were placed in each pot everyday to feed the worms. The plants were measured on the first and last day of the experiment.

Results
This experiment proved that the snapdragons that received worms grew taller in three weeks than the control group which did not. The results also showed that the plants that received two worms grew taller in three weeks than the plants with five worms. This suggests that there are too many worms in this pot and a bigger pot might produce the same result as was received from the pots with two worms.

Conclusions/Discussion
It was concluded that adding European night-crawlers, a breed of earthworm, to the soil of potted snapdragons will their help them grow taller. It was also concluded that adding 2 worms increases the flowers' heights more than adding five worms for this pot size. This suggests that the 5 worms did not have enough room and that there were too many worms in those pots. This might not be this way had the flowers been in a bigger pot, but this is a good indicator of what the best worm to soil ratio is.

Summary Statement
The object of the experiment was to determine whether introducing European night-crawlers into the soil of potted snapdragons will help them to grow taller.

Help Received
Mom bought supplies; family friend watered the plants one day while I was out of town

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Luciano F. Scarpello

Project Number
J1926

Project Title
Well, Well, Well

Abstract

Objectives/Goals
My goal was to determine whether well water or city water was better in growing longer roots, taller plants, and more leaves. I used ebb and flow hydroponics to truly test the water with no variable of soil. I used twenty basil in well water and twenty basil plants in city water.

Methods/Materials
My materials consisted of two eighteen gallon plastic buckets, two large, short and long plastic buckets, four, two foot lengths of half inch black hose, two submersible water pumps, four plastic fittings to ebb and flow the water, forty small basil plants, twenty gallons of water per week, thirty teaspoons of Maxigrow nutrients per week, one bag of pea gravel, forty plastic netted posts, fluorescent grow lights, and plug-in timer.

Results
I found that the well water was more effective in growing basil plants than city water hydroponically. I believe this is because when I tested the two types of water, I found that well water was harder and had more nitrates. This means that it had more magnesium and nitrogen which is essential to plant growth.

Conclusions/Discussion
After analyzing my data, I found that my hypothesis was correct, that well water would be more effective to grow basil plants. throughout the testing process, the well water was more green and the roots were long and bright white On the other hand, the city water was brown and the roots looked unhealthy.

Summary Statement
Testing whether well water or city water was more effective in growing basil plants hydroponically.

Help Received
Dad helped with construction

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Leeluleilani N. Stockton

Project Number
J1927

Project Title
Plant Chemistry

Abstract

Objectives/Goals
The objective of this project was to determine how the main chemicals in plant fertilizers individually effect plant growth. Due to my research, I found out each chemicals benefit to plants. I hypothesized the following: the Magnesium Group would be strong, sturdy, and would have a vibrant green color; the Potassium Group would be very sturdy and substantially sized; the Nitrogen Group would grow at a quicker pace and should have a vibrant green color, and the Control Group would be well-built, but average, since these plants were not treated with any chemical to benefit plant growth.

Methods/Materials
I researched the main chemicals in plant fertilizers, and with the help of my Science Teacher we were able to obtain the chemicals Magnesium Oxide, Potassium Citrate, and Sodium Nitrate. There were 4 groups of 10 radish plants; the Control Group, Magnesium Oxide Group, Potassium Citrate Group, and Sodium Nitrate Group. These 40 radish plants were watered every day for a course of about 7 weeks. The Control Group was left to grow naturally with just water every day, while the other 3 groups were treated with a chemical solution every day.

Results
At the end of the 7 week growth period, the Control Group was robust, the Magnesium Oxide Group was very strong, sturdy, well developed, and held a vibrant green pigment, the Potassium Citrate Group was fairly strong, healthy looking, with few yellow leaves, and the Sodium Nitrate Group stunted growth within the 2nd week, and all plants in this group completely shriveled up and died within the 3rd week.

Conclusions/Discussion
My hypothesis was correct for the most part, but flawed in some areas. I hypothesized that the Magnesium Group would be sturdy and have a vibrant green color, which was true. I hypothesized that the Potassium Group would be very sturdy and substantially sized, but turned out to be 80% of what I was expecting. I hypothesized that the Nitrogen Group would grow at a quicker pace and would have a vibrant green color, which was incorrect; about 2 weeks into the 7 week growth period, they stunted growth, and by the 3rd week, they all died. I hypothesized that the Control Group would be well-built, but average; I was correct for the most part.

Summary Statement
The central focus of this project is to isolate the main chemicals found in plant fertilizers, individually test them on plants to find out each chemical's effect on plant growth, and compare the differences between them.

Help Received
Chemicals provided by Science Teacher; Science Teacher taught me how to properly and safely work with the chemicals.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Mary Rose Vadeboncoeur

Project Number
J1928

Project Title
Battleships in the Garden: Allelopathic Effects of Trees on Oat Grass

Abstract

Objectives/Goals
The purpose of this experiment was to test the allelopathic (seed growth suppressing) properties of four different types of trees on Oat Grass.

Methods/Materials
The trees used were Black Walnut (Juglans californica), Western Cottonwood (Populus fremontii), Olive (Olea europaea), and Silver Dollar Eucalyptus (Eucalyptus polyanthemos). The seed used was common Oat Grass (Avena sativa). Ten trials were performed in petri dishes. Each Petri dish contained fifteen ml of seed starting mix and ten Oat Grass seeds. Ten ml of finely ground leaf litter was added to the top, over the seeds. The control dishes had ten ml of additional seed starting mix added to the top of the seeds (no leaf litter). All dishes were watered daily for 14 days. The number of sprouts per dish was counted and each sprout was measured for length of growth.

Results
The control group showed an average sprout growth of 7.96 cm and an 84% germination rate. The Black Walnut group showed an average sprout growth of .792 cm and a 21% germination rate The Cottonwood group showed an average sprout growth of .691 cm and a 16% germination rate. The Olive group showed an average sprout growth of 1.757 cm and a 25% germination rate. The Eucalyptus group showed an average sprout growth of .463 cm and an 8% germination rate.

Conclusions/Discussion
All four of the different tree types showed substantial growth suppressing qualities compared to the control. The Eucalyptus treated group was the most suppressed. The hypothesis was not completely proven, as the prediction was that Black Walnut would be the most growth suppressing type of tree.

Summary Statement
This project tests the allelopathic effects of 4 types of trees on the germination and growth of Oat Grass.

Help Received
Teacher helped with format of binder; Mother helped locate some research sites.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Vincent A. Chen

Project Number
J1999

Project Title
Effects of Priming with Plant Hormones and Antioxidants on Salt Tolerance in Alfalfa Seeds (Medicago sativa)

Abstract

Objectives/Goals
It is known that priming seeds with water can enhance the tolerance to saline growth conditions compared to seeds that are not primed. My objective was to examine the effects of priming with salicylic acid and ascorbic acid on alfalfa seeds grown in saline conditions to evaluate whether or not these agents could increase salt tolerance above that induced with water-priming alone. My Null Hypothesis was: Priming with salicylic acid and ascorbic acid will not affect germination and growth of alfalfa seeds any different than that of priming with water.

Methods/Materials
Primed and unprimed alfalfa seeds were germinated and grown in water and various concentrations of NaCl. A 4 x 2 experimental design was used, consisting of 4 seed treatments (types) and 2 experimental conditons: unprimed seeds and those primed with water, 0.75 mM sodium ascorbate (also ascorbic acid, and 1 mM salicylic acid, and, growth in water or 140-150 mM NaCl. After drying back to their original weight, seeds were germinated and grown in water or NaCl for 60-90 hours. Measurements were made of the percent germination, root length, and opening of the dicotyledon leaves.

Results
Results indicate that, for the parameters measured (% germination, root length (mm), and % opening of the dicotyledon leaves), all primed seeds responded better than unprimed seeds. More importantly, seeds primed with Na-ascorbate or Salicylic acid exhibited a greater response than water-primed seeds. These results fail to support the Null Hypothesis, which must therefore be rejected in favor of an Alternative Hypothesis: Priming with Na-Ascorbate and Salicylic acid permits greater germination and growth in saline conditions (salt tolerance) than water-primed seeds.

Conclusions/Discussion
Salt tolerance of alfalfa seeds can be enhanced by priming with Na-Ascorbate or Salicylic acid to a greater extent than priming with water. These results are consistent with literature reports. Currently about 22% of world's farmland soil too salty to support crop growth. With soil salinity expected to increase over the next three decades, and the population of the world expected to increase by 2 billion people in the same time-period, priming the seeds of important foraging crops, such as alfalfa, seems to be an inexpensive and effective way to increase crop yield and stave off a potential world hunger crisis.

Summary Statement
Priming with sodium ascorbate and salcylic acid enhances salt tolerance of alfalfa seeds over that of water priming alone.

Help Received
Grandfather helped photography, some calculations, plotting, and discussions.