CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Nikole M. Ankrom

Project Number
J1601

Project Title
Growing Plants under Different Types of Light

Abstract

Objectives/Goals
The objective of this experiment was to determine if different types of light affects the growth of plants. It was hypothesized that if a plant is grown under a light that contains lots of red and blue light (like sunlight) it will grow taller and faster than a plant grown under light that contains some red and blue light (like fluorescent light), and a plant grown under light that does not contain red or blue light (like black light) will be the least healthy out of the three.

Methods/Materials
Three types of plants were chosen: snapdragon, cabbage, and onion. A seedling of each type of plant was placed under one of the three different types of light: sunlight, fluorescent light, or black light, for a total of nine plants. The plants being grown under sunlight were placed on a windowsill which received direct sunlight for most of the day. The plants which were grown under fluorescent light were placed in a closed closet with a fluorescent light. The light was on a timer to turn on at sunrise and turn off at sunset. The plants that were being grown under a black light were treated in the same fashion. Each plant received equal amounts of water. Each plant was measured every other day for twenty-one days.

Results
All the plants grown in the sunlight were healthier than the plants grown under fluorescent light or black light. The plants grown under the fluorescent light were the second healthiest but some of the plants where starting to die while the plants under the black light were all dying.

Conclusions/Discussion
My conclusion is that the type of light that a plant is grown under has an affect on the plant growth. Plants require light of specific wavelengths to grow. I used sunlight which emits lots of both red and blue light, fluorescent light which emits some blue light and very little red light, and black light which emits very little blue light and no red light. Chlorophyll, a substance in plant leaves that absorbs light energy to help make a plant's food, absorbs mainly red and blue light and reflects green light. This is what makes a plant look green. Therefore the plants grown under sunlight were the healthiest while the plants under fluorescent light were the second healthiest, and the plants under the black light were the least healthy.

Summary Statement
My project demonstrates that a plant's growth is affected by the type (wavelengths) of light it is grown under.

Help Received
My sister helped me come up with the idea. My parents helped me with buying the materials for the project and with submitting the application.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Eric M. Battles; Wyatt J. Torosian

Project Number
J1602

Project Title
Where Are the Sweetest Oranges Found?

Abstract

Objectives/Goals
Our goal was to provide information for "Washington Navel" orange growers to know about where they can find the sweetest oranges on an orange tree for a preferred quality of oranges to sell to their customers.

Methods/Materials
We decided to test the sugar-to-acid ratio of the oranges from four marked-off portions of the tree; North, South, East, and West, respectively. We used the refractometer to test the sugar content, and then we used the hydrometer to test the acid level. We tested this over a period of three days for two years and during the same time each year.

Results
We concluded that over a two-year period of time that the South side of the tree had the sweetest oranges consistently thorughout our testing.

Conclusions/Discussion
Our results showed us that the South side of the orange tree has the sweetest oranges because the sunlight hits the oranges for a longer period of time. This causes the orange tree to receive much more sunlight- a major ingredient in photosynthesis, which helps the tree to increase glucose production and causes the sugar content to be higher in the oranges.

Summary Statement
Our project is about finding which side of a "Washington Navel" orange tree has a higher sugar-to-acid ratio.

Help Received
Mother helped with the board, Father took us to an orange grove, Mr. Doug Sankey from Sunwest Citrus Packing Company helped us with our procedure.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Matthew J. Bauer

Project Number

J1603

Project Title

Characterization of Two Alleles Affecting Hypocotyl Length in Arabidopsis thaliana

Abstract

Objectives/Goals

Characterizing genes that control photomorphogenesis in Arabidopsis thaliana. Knowledge from this may allow crops to be genetically engineered so that they may grow under different light conditions and to control the height of crops.

Methods/Materials

Strains: Arabidopsis strain ARR21 and ARR90 (long hypocotyl), and 2CAC/COL (wild type) were obtained from Dr. Tom Schultz.

Segregation Analysis: ARR21 and ARR90 were crossed with A. Landsberg erecta (Laer). Seeds from the ARR90xLaer and ARR21xLaer F-2 generations; ARR90(M3), ARR21(M3), and 2CAC/COL grown in a 23oC incubator for 7 days. The plants received 8 hours white light / 16 hours of dark. After 7 days, the hypocotyls of all plants were measured.

Light and Hypocotyl Length: ARR21, ARR90 and 2CAC/COL were grown in continuous red, blue, or no light; 8 hours light / 16 hours dark, 12 hours light / 12 hours dark, 16 hours light / 8 hours, or continuous white light . After seven days, the hypocotyl lengths were measured.

PCR Mapping: Pooled DNA was isolated from twenty long hypocotyl plants from ARR90xLaer(F2) and ARR21xLaer(F2). PCR using chromosome specific primers was done to map Hy21 and Hy90 to specific chromosomes.

Results

Segregation analysis showed that the gene that causes the long hypocotyl phenotype in ARR21 (Hy21) is recessive and that gene that causes the long hypocotyl phenotype in ARR90 (Hy90) appears to be co-dominate. PCR mapping indicates that Hy21 is located on chromosome number 3. ARR21 and ARR90 were shown to be sensitive to continuous white light but when they were put under short and long day conditions, their long hypocotyl phenotype became clearer. When grown in continuous red light, ARR90 exhibited the long hypocotyl phenotype, but ARR21 did not. Both ARR21 and ARR90 were sensitive to continuous blue light.

Conclusions/Discussion

Hy21 is recessive and Hy90 is co-dominant. Hy21 appears to be located on chromosome number 3. ARR21 and ARR90 were sensitive to continuous white light, but when grown under short and long day

Summary Statement

To identify and characterize genes in Arabidopsis thaliana that affect photomorphogenesis.

Help Received

Dr. Steve A. Kay from TSRI for allowing me to work in his lab. Dr. Tom Schultz for teaching me about genetics and for mentoring me. Leo for teaching me how to do PCR reactions.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Hallie Boldt

Project Number
J1604

Project Title
Fooling Mother Nature

Abstract

Objectives/Goals
My objective is to utilize cuttings from various fruit trees and grafting them to root stocks to bring them out of the dormant stage with the use of artificial light and home heating.

Methods/Materials
Fruit tree cuttings and root stocks were grafted in three containers. All containers were placed under two 24 inch florescent lights where the light cycle was increased 10 minutes each day for 28 days. Observations were taken daily.

Results
Two of the four grafts came out of the dormant stage and blossomed. All four of the root stocks were alive and showed growth of foilage. This suggests that the graft did not take on two of the grafted plants.

Conclusions/Discussion
It is possible to bring fruit trees out of their dormant stage by increasing the light intake and the additon of warmth.

Summary Statement
My project was to determine if I could bring fruit trees out of their dormant stage using root stocks and fruit cuttings

Help Received
My dad help me in the technique of grafting cutting to root stocks. My mom help put my backboard together. My dad purchased the florescent lights for my project.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Derk E. Bramer

Project Number
J1605

Project Title
Orange A-peel: How Does a Fruit's Internal Ethanol Levels Affect External Rind Stress?

Abstract

Objectives/Goals
The goal of my project was to find the link between an orange's internal ethanol conditions and its external rind stress. I believe that the Wax category will do the best because it has a protective wax coating that protects it from harm and decay.

Methods/Materials
I started the experiment by collecting oranges (TI Navel variety) from an orange grove. I took these oranges to a packing house, where I separated them into three different groups, called Control, No Wax, and Wax. No Wax was run through the machinery, while Wax was run through it with a waxing treatment as well. I then took these oranges to the USDA Field Station in Parlier, where I kept them in a temperature-controlled room at 50 degrees Fahrenheit. Once a week I weighed the oranges, checked the visual appearance, and tested them for pressure, solids, and taste. About once every three weeks, I sent oranges from each category to Pent-A-Vate Labs in Lindsay to have their ethanol levels measured. A few more of my materials included a penetrometer (for measuring pressure, measured in pounds) and a refractometer (for measuring solids, measured in degrees brix).

Results
The Wax category had the highest ethanol level throughout the experiment, because its wax coating caused the oranges' ventilation to be cut off. However, the Wax group also had very little mold because the wax on it had fungicide in it. The No Wax category ended up in the worst physical shape, because the conveyor process bumped and bruised it, leaving it open to attack from mold spores without the fungicide protection of a wax coating. The Control group did the best as far as physical appearance and lower ethanol levels.

Conclusions/Discussion
In the last ethanol test taken, there were two samples of 6-8 oranges per category instead of just one sample per category. One sample had the best-looking oranges of what was left, while the other had the worst. The sample with the nicer fruits had lower ethanol levels than the one that looked worse. This indicated that fruit with higher rind stress also had a higher ethanol levels. So, if orange packing houses wanted to decide where to send the oranges they have, they may want to check the ethanol level first, because if they sent fruit with higher ethanol levels overseas, it may not make the trip.

Summary Statement
I wanted to find the link between internal ethanol levels and external rind stress, using a multitude of tests such as weight, physical appearance, pressure, solids, and taste.

Help Received
Stored and weighed oranges at the USDA Field Station in Parlier under the supervision of Dr. Joe Smilenack; Mother taught me painting techniques to decorate the board; Father drove me to and from the USDA Field Station; Dr. Patrick Malloy at Pent-A-Vate Labs measured ethanol levels of the oranges.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Kelsey L. Capron

Project Number
J1606

Project Title
The Dead Seed Scrolls

Abstract

Objectives/Goals
To find the effect of the salinity of water on seed germination.

Methods/Materials
1 packet of lettuce seeds, 1 packet of radish seeds, 1 packet of paper coffee filters, ten 5" x 5" plastic square containers, distilled water, salt with no iodine, 4 jars, spoon, tray, tweezers, metric ruler, and lab book.

I mixed the solutions by mixing a consistant amount of water with varying amounts of salt. The amounts were distilled water, 2.5 grams of salt per liter of disilled water (g/l), 5 g/l, 10 g/l, and 15 g/l. I had 5 containers for each kind of seed (radish and lettuce), and each container had one of the solutions. There were 20 seeds in each container. I waited 2 days until I recorded my observations. I measured the lengths of each seed that had sprouted and counted how many seeds had germinated in each container.

Results
My results were that pure distilled water and 2.5 g/l resulted in high rates of germination and sprout lengths. As the g/l went up, the rates of germination and lengths of sprouts dropped. The 10 g/l and 15 g/l containers had no germination.

Conclusions/Discussion
There was a definite effect on the germination of the seeds. The average lengths of sprouts for lettuce and radish seeds had a consistent drop as the level of salinity went up. The solution that had 2.5 grams of salt per liter of distilled water (g/l) had more germinated seeds than the distilled water sample did, although this may be a statistically insignificant difference. In conclusion, the salinity of water does have an effect on the germination of seeds. As the level of salinity increases, the sprout lengths and germination rates go down.

Summary Statement
I wanted to discover the effect of different levels of salinity on the germination of seeds.

Help Received
Father helped occasionally in procedure; Mother helped prepare board.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Merv D. Carter

Project Number
J1607

Project Title
The Gravitropic Response in Maize Roots

Abstract

Objectives/Goals
The objectives of this experiment is to provide evidence that germinating maize roots (Zea Mays var. rugosa) sense and respond to altered gravitational forces (Gravitropism) applied in both length and direction of the field applied more rapidly than those not exposed to this altered environment. Additionally, this experiment will demonstrate that the gravitropically germinated seedlings when transplanted in pots, displayed measurable differences in the average root and shoot growth rates in maize plants exposed to the "signal" of gravitropism.

Methods/Materials
In this experiment, a centrifuge apparatus was constructed which housed the experimental maize seed samples germinated with agar in petri dishes. The tests were carried out under simulated greenhouse conditions, with all other variables (light, temperature, moisture) remaining constant. This altered gravitational field (gravitropic) allowed the seeds to get a "head start" and created an environment designed to signal the maize roots to emerge faster and in the direction of the force applied (Positive Gravitropism). This "signal" was further dispatched when germinated seedlings were transplanted in potting soil and allowed to thrive motionless under greenhouse conditions. Daily measurements of the average root and shoot growth rates were taken and recorded against control samples.

Results
An analysis of the data provided evidence that gravity could be overcome in the centrifuge apparatus, and that increased maize root growth rates occured in an organized fashion oriented according to the new stronger artificial gravitational forces (gravitropism). Furthermore, it was demonstrated that these germinated seeds displayed characteristics that remembered signals triggered by gravitropism. When tranplanted into potting soil and allowed to thrive, they responded with longer and stronger overall growth rates than those of the control groups.

Conclusions/Discussion
Gravitropism profoundly affects the growth of both roots and shoots in maize (Zea Mays var. rugosa) plants. Significant differences were observed and recorded for both gravitropic and non-gravitropic maize plants within the parameters measured. Responses of overall plant height and roots and root growth rates were markedly difference even in the absence of gravistimulation. This was evident in the potting experiment conducted.

Summary Statement
This experiment is about how Gravitropism affects the growth of germinating maize (Zea Mays var. rugosa) roots.

Help Received
No help was received in doing this project.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Michael C. de Lyon

Project Number
J1608

Project Title
The Germination of Corn, Radish, and Marigolds in Reduced Gravity Environments

Abstract

Objectives/Goals
My experiment was designed to test the germination and growth of corn, radish, and marigolds as the experiment's variable, gravity, was changed.

Methods/Materials
I examined gravity levels of 0g, 0.25g, 0.5g, 0.75g, and normal gravity. I took 10 seeds of each type and spun them around in a clinostat to simulate different gravity levels. After a period of 30 days, I removed the germinated seeds and analyzed the results, which included germination percentage, root/stem length, and root/stem shape.

Results
I found that plants grew very well under normal gravity, while plants rotated to simulate reduced gravity often grew poorly, with withered stems and roots pointing in random directions. In addition, the percentage germination of the plants in lower gravities was always less than or equal to the percentage germination of plants at normal gravity (with no rotation).

Conclusions/Discussion
The results of my experiment suggest that growth of food crops in reduced gravity environments like space may prove to be difficult.

Summary Statement
I germinated corn, radish, and marigold seeds in different gravities and recorded germination percentages, length, and shape.

Help Received
Father helped build the clinostats.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
April N. Duchanin

Project Number
J1609

Project Title
Cryogenics: How Low Can You Go?

Abstract

Objectives/Goals
Cryogenics is the new generation of cold storage. The theme of the following tests completed was to observe the characteristics and outcomes of cryogenically frozen seedlings over various time periods. This study specifically addressed the cause and effect of the seedling germination rate process. The purpose of these tests was to find out if the artificial freezing of plant tissues would be beneficial to farming and medical industries.

Methods/Materials
All four experiments (hypothesis) were conducted in basically the same way. Corn and bean seeds were suspended in liquid nitrogen for different amounts of time (depending on the experiment being tested)over a period of one to four days. Once these seedlings were removed from the liquid nitrogen, they were placed in petry dishes with cotton, saturated with water, and placed in the oven at about 70 to 80 degrees. The germination rate process was then measured and recorded every 24 hours until they were ready for planting.

Results
Corn seeds did extremely well with the cryogenic suspension process, however, the bea seeds had the tendency to pop and break, which caused the stressed scientist to redo that part of testing. Three day time period freezing seemed to germinate almost in the first 24 hour period and further more, corn seeds seemed to really benefit from the cryogenic freezing and it stimulated their germination rate process.

Conclusions/Discussion
A conclusion that has been drawn is that corn seeds, or monocot seeds, can withstand the intensity of cryogenic freezing in liquid nitrogen and has perhaps even benefited from this cooling process.This would be something the agricultural studies might want to investigate further. Diocot seeds, or bean seeds, on the other hand were more sensitive to liquid nitrogen and would not be a good choice for freezing due to the high rate of failure. Another conclusion that has been observed is the overall germination rate of the cryogenically frozen seeds. Their germination rate is much higher than the non-frozen seedlings.

Summary Statement
The study of this test is to cryogenically freeze monocot and diocot seeds(corn and bean seeds) in liquid nitrogen, measure their germination rate, and observe the effects of cryogenic freezing.

Help Received
Mother helped supervise experiment, sister took photographs, pete at So Cal Air Gas helped to get liquid nitrogen and how to use it, Morely(Mr.) Cohen my science teacher gave me helpful suggestions

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Jason A. Gomez

Project Number
J1610

Project Title
Stunned Growth

Abstract

Objectives/Goals
To see if plants can growth faster or slower in soil without microorganisms.

Methods/Materials
Materials:
36 zinnia seeds
soil (unbaked)
soil (baked to kill off microorganisms)
cooking pan to bake soil in
6 pots
oven

Procedures:
Baked half the soil to kill off the microorganisms
then put the baked soil in three of the 6 pots.
I then filled the other three pots with regular unbake soil.
I put 6 seeds in each pot and water daily.
recorded and measured daily

Results
The baked soil plants grew more than the regular soil plants.

Conclusions/Discussion
My hypothesis was wrong. The plants in the baked soil Grew faster than the plants in the regular soil because when I baked the soil the microorganisms died it converted the soil into fertilizer. For example, the indians used dead fish for the soil used to make corn and it helped them grow. Another example is compost such as manure, decomposing fruits and vegetables also help new plants grow. But after a few weeks this fertilizer effect dies out because the nutrients from the the fertilizer are used up. So at the end of the experiment the two plants started to level out in height. My hypothesis was wrong.

Summary Statement
To see if plants could grow without microorganisms in the soil

Help Received
Mrs. Viveros helped me paint my board.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Maya Griffin; Amanda McNutt

Project Number
J1611

Project Title
Transpiration

Abstract

Objectives/Goals
We tested whether different light conditions, fluorescent light, fluorescent light with a green filter, and no light affects how far blue colored water rises up celery xylem.

Methods/Materials
We created a green filter by cutting the end of a 16-oz soda bottle and wrapping green wrap around it two times. We then placed nine jars in each of the three light conditions for seven hours. After seven hours, we took data on all twenty-seven jars by using a scalpel to expose the veins. Then we measured, in centimeters, how high the blue water went up the celery xylem.

Results
Out results proved that the nine jars under the fluorescent light transpired the most, the blue water traveling up an average of 25.09cm. The nine jars under the fluorescent light with a green filter had its blue water rise up an average of 13.36cm, almost the same as the nine jars in the cabinet, which rose an average of 13.27cm.

Conclusions/Discussion
We conclude that the amount of light absorbed by the leaves affects how much a plants photosynthesizes and transpires.

Summary Statement
We tested whether different light conditions, fluorescent light, fluorescent light with a green filter, and no light affects how far blue colored water rises up celery xylem.

Help Received
Our science teachers helped us edit and graph our data. Some of our friends helped paste things on the board also.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Morgan Ivens-Duran

Project Number
J1612

Project Title
Which Soil Amendment, Wood Ash, Coffee Grounds, or Leaves, Best Enhances the Development of Pea and Radish Plants?

Abstract

Objectives/Goals
My experiment was to test how pea and radish plants react to different soil amendments, specifically coffee grounds, wood ash, and fresh green avocado leaves.

Methods/Materials
To do my experiment, I first prepared my planting area. Next, I divided my planting area into 4 quadrants, collected the soil amendments (coffee grounds, wood ash, and shredded green avocado leaves), and placed them in the quadrants, leaving one with no added amendment as a control. I mixed the soil amendments in, then planted my radish and pea seeds in the prepared furrows. After planting, I watered my seeds. Finally, I made daily observations in my log book of how the plants grew, and watered when necessary. At the conclusion of the experiment, I took measurements of the plants.

Results
My hypothesis that coffee grounds would perform the best was only partially proved true. Fresh leaves and coffee grounds both performed well. The leaves performed well, I think, because my planting area had been amended with manure in previous years. Wood ash didn't perform well, I think, because it dramatically increased the soil salinity.

Conclusions/Discussion
My conclusion is that coffee grounds and leaves are good soil amendments in generally healthy soil and that ash can be toxic to plants. It was clear from my experiment that the soil was already healthy and full of essential nutrients because the plants in the un-amended soil did very well. Coffee grounds and leaves, however, did produce more abundant and larger plants than the un-amended soil, demonstrating that even healthy soil can use additional nitrogen and other nutrients. My hypothesis about the leaves, which was based on the information I learned in my research, was disproved. Perhaps because the fresh green leaf mulch was added to previously amended soil, the leaves benefitted rather than harmed the plants. Overall, the data demonstrated that green avocado leaves are a better soil amendmend for radishes and coffee grounds are a better soil amendment for peas. In addition, either one performed better than nothing at all.

Summary Statement
The impact of specific soil amendments (wood ash, coffee grounds, green leaves) on plant development (peas and radishes).

Help Received
My mother typed my report and shredded the avocado leaves in the chipper-shredder.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Kevin A. Jimenez

Project Number
J1613

Project Title
Gray Water/ Sod Growth

Abstract

Objectives/Goals

One of the main problems today is that people are running short on water. I have the answer for you; it is called gray water recycling. My project is the affects of gray water on plants. I used three different types of gray water. The first type was plain water. The second was water and laundry detergent, and the last was water, laundry detergent and fabric softener. Next I got six pieces of sod. Then I divided each piece in half. Then I watered four halves with water, another with gray water, and the last with gray water and fabric softener. I watered each half four cups of water twice a day for three weeks.

The plain water had the most growth at an average of three inches and the lushes green at splendor on the color chart. The gray water came in second with an average two and a half inches and parsley on the color chart. The gray water with fabric softener came in last with an average of two inches and a color of autumn crisp.

Methods/Materials

Items:Rubber dividers, Square sod holders, Six squares of Sod, Gray Water, Three Five-gallon buckets, Measuring cups, Paint color chart, Ruler.

Put each square of sod in a holder and divided each square in half with a rubber divider. Collect the gray water, gray water fabric softener, and water in the three five gallon buckets. Water four cups for each half for twice a day. Water for three weeks and record results each week.

Results

The sod that was watered with plain water had the most significant growth. At week one plain water sod measured at one and one half inches. At week two the plain water sod measured an average of 2 inches. On the last week the plain water sod measured an average of 3 inches. For a total growth of one and one half inch in three weeks, In contrast the sod watered with laundry detergent gray water only grew an average of one and one quarter inch over a three week period. The sod watered with laundry detergent plus fabric softener grew an average of one half inch. This last group was by far the poorest performance of the three.

Conclusions/Discussion

I was greatly surprised to see that the last group (the group with the laundry detergent plus fabric softener) performed so poorly. Plain water is still the best for your sod. Gray water with laundry detergent performed quite well. I was correct in my hypothesis. Further testing may show an even greater variance between the three groups.

Summary Statement

The Effects Of Gray Water On Sod Growth

Help Received

My dad bought the supplies I needed and help cut the sod, Mom helped assemble the back board.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Amy A. Kroll

Project Number
J1614

Project Title
Is Lautuca sativa, Used as a Bioassay Medium, Affected by Different Concentrations of NaCl?

Abstract

Objectives/Goals
The aim of the project was to determine how different concentrations of saline solution affect the growth of buttercrunch lettuce (Latucia sativa) seeds.

Methods/Materials
Four petri dishes for each of the six concentrations were set up and five seeds were placed in each dish. Each seed and dish were labled and after a growth period of five days, during which the seeds were left in darkness, the length of each sprout was measured.

Results
An increase in the concentration of the saline solution yielded a decrease in the average sprout length.

Conclusions/Discussion
In conclusion, saline solutions affect buttercrunch lettuce seeds immensely. When there is a higher concentration of salt, the lettuce does not grow as well. This is a concern for coastal agriculture, such as that in the Salinas Valley, which is now subject to much salt water intrusion.

Summary Statement
The project's aim was to determine the effects of saline solutions on Latucia sativa seeds, in order to determine effects of seawater intrusion in the Salinas Valley.

Help Received
The "Science Buddies" program in Monterey County mentored the project

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Jeorgina Lopez

Project Number
J1615

Project Title
The Effect of Bean Mass on Plant Height

Abstract

Objectives/Goals
To investigate whether the mass of a pinto bean affects the height of its plant. I believe that the beans with a larger mass will grow taller plants.

Methods/Materials
The first step was sorting the beans according to their masses. It was designated that the "large" beans would have a mass of 5-6 grams, the "medium" beans have a mass of 4 grams, and the "small" beans have a mass of 2-3 grams. Twenty-four beans from each size were chosen and each bean was planted in individual containers. I observed, monitored the progress, and recorded the data for eighteen days.

Results
The result of my experiment showed that the medium size beans grew the tallest plants. I also observed that the plants germinated faster in a darkened space.

Conclusions/Discussion
Based upon my data, it can be concluded that the medium size beans grow the tallest plants. Therefore, my hypothesis was incorrect. The heaviest cotyledons did not produce the tallest plants.

Summary Statement
I was testing to see if bean mass affected plant height.

Help Received
Mr. Ramirez and Mrs. Mele helped with various aspects of the projects.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Maya J. Mileck

Project Number
J1616

Project Title
Size vs. Depth: The Relationship Between the Size of a Seed and Its Ideal Planting Depth

Abstract

Objectives/Goals
The Objective of my project was to find if the size of the seed determines the ideal planting depth.

Methods/Materials
Six types of legume seeds were obtained and the weight and recommended planting depth recorded for each. Each type of seed was planted in a pot at five different depths, one seed at each depth. The shallowest being the surface, the deepest being twice the recommended planting depth, and the last three divided evenly between shallowest and deepest. This was repeated two times for a total of three pots for each type of seed. When the plants had grown for 17 days, their heights were measured and recorded. Finally, the entire experiment was repeated for verification.

Results
In general, the smaller seeds preferred shallower planting depths and the larger seeds, deeper planting depths. The larger the seed, the deeper the preferred planting depth.

Conclusions/Discussion
My conclusion is that, in most cases, there is a strong correlation between the size of a seed and its ideal planting depth.

Summary Statement
Size vs. Depth explores the relationship between seed size and ideal planting depth.

Help Received
Friend helped with layout, neighbor helped with photos, teacher helped with grammar, mother helped with typing, father helped with growing.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Catherine M. Nguyen

Project Number
J1617

Project Title
Germination Simulation

Abstract

Objectives/Goals
My objective is to determine the effects of artificial gravity, ultraviolet light, and magnetic field on seed germination and the growth of the root. I believe that artificial gravity will orient the seeds' roots towards the center of rotation due to the centripetal acceleration. The ultraviolet light's energy is in the short wavelength and I believe that it may burn the seeds. Lastly, I believe that a magnetic field will help the seeds germinate quicker by aligning the molecules of the root in a favorable condition.

Methods/Materials
For my normal condition experiment, I first soaked beet and radish seeds in water for 24 hours. I then placed the seeds in cotton balls and the cotton balls into plastic containers for observation. For my artificial gravity condition experiment, I built an apparatus using a fan motor,a rotating platform, and a speed controller. I then placed soaked seeds on cotton balls and into containers that were placed 3" from the center. For my ultraviolet light experiment, I placed soaked seeds in containers and containers under the ultraviolet light. For my magnetic field condition, I first placed two magnets 1 1/2" apart in the correct pole orientation (North/South). I then placed seeds in cotton balls and these cotton balls inside the magnetic field.

Results
The beet and radish seeds dried and eventually burnt under the ultraviolet light. The magnetic field quickened the growth rate of the beet and radish seeds. Lastly, the artificial gravity directed the root growth outside, but the stem growth towards the center of rotation.

Conclusions/Discussion
To germinate seeds in space, magnetic and artificial gravity fields would be recommended for better results. However, the exposure to ultraviolet lights must be minimized to prevent seeds from being burnt.

Summary Statement
I studied the effects of artificial gravity, ultraviolet lights, and magnetifc fields on seed germination and the growth of the root.

Help Received
Mother helped format report and father helped build apparatus.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Omar E. Njie

Project Number
J1618

Project Title
a-MAZE-ing Plants: What Amount of Light Makes a Plant Grow through a Maze the Farthest?

Abstract

Objectives/Goals
The goal of my project was to see what amount of light (a little or a lot)makes a plant grow through a maze the farthest.

Methods/Materials
Part 1: Making the Mazes
. I got 17 in. x 7 in. boxes
· I made 4.5 in. x 4 in. cardboard dividers for the maze and I hot glued them into the maze

Part 2: Transplant the Honeysuckle Green Sprouts
· I bought 18 honeysuckle green sprouts.
· I took them out of the containers they came in and transplanted into 3.5 in. jiffy pots with a diameter of 3 in.
· After I put the honeysuckle green sprouts into the jiffy pots I surrounded the plants with E.B Stone Organics Seed Starter Mix, all of the plants all started out at height of three centimeters tall.
Part 3: Putting the Plants in the Mazes
· When I was finished I put one plant in each maze that I built
· Five mazes had a small hole admitting light I called that type of Maze, Maze A. Five mazes had a medium hole admitting light I called that type of maze, Maze B, and the last five mazes had the whole top cut of and that is where the light was admitted, I called that type of maze, Maze C.
Part 4: Measuring Growth
· I measured the plants every day for the next three weeks using centimeters as my unit of measurement; every time I measured them I watered them.

Results
The plants in my Maze C group (the mazes in which the hole where light entered was the largest) grew the farthest throught the mazes.

Conclusions/Discussion
My hypothesis was correct and the plants in Maze C (the maze in which the most light was admitted) grew through threw the mazes the farthest over a three week time period. Since my control group (plants that was just in a box without a maze) grew taller, that means the limited light in the mazes slowed down the growth of the plants in the other three groups. One of the reasons that light was so limited in the mazes, besides the size of the hole where the light entered, was because the dividers in the maze blocked

Summary Statement
My project is about the impact of light on plants growing through mazes.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Morgan S. Peters

Project Number
J1619

Project Title
Does Location in an Orchard Affect Sugar Levels in Navel Oranges?

Abstract

Objectives/Goals
The objective of my project was to determine if location in an orchard effected the sugar levels in Navel oranges.

Methods/Materials
Randomly collected Navel oranges from six different sections of each tree, in five seperate locations of the orchard. Tested sugar levels of each orange with the refractometer. Then compiled data from the testing.

Results
After testing over three hundred Navel oranges in five various locations of two seperate orchards, my results showed that the hightest sugar levels were found in the oranges on the outside crown of the tree on the South side of the grove.

Conclusions/Discussion
After completing my investigation of the sugar levels of approximately three hundred oranges. I found there were no significant differences in the overall sugar level of the five areas tested. The highest levels were found on the South side of the grove, on the outside crown of the tree. I also discovered that there are several factors that contribute to the sweetness of an orange. Such as a balance of nutrients, nitrogen, phosohorus, potasium, and soil type.

Summary Statement
My project is how location effects sugar levels in Navel oranges.

Help Received
Dad helped by transporting me to the orchards, Mr. Peter Anderson ; farmer I interviewed

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Jason N. Pollack

Project Number
J1620

Project Title
The Effects of Different Sunlight Regimes on Raphanus sativus

Abstract

Objectives/Goals
My objectives and goals were to find out how well Raphanus sativus can grow in totally dfferent sunlight regimes.

Methods/Materials
I used 90 10.16 cm.(4inch) pots. I used 10 seeds of 3 different types of Raphanus sativus and grew them. I put 10 of each type in 3 different areas.

Results
The project went well. 2 out of 3 area grew very well. The radishes that grew were large, but not huge.

Conclusions/Discussion
Radishes do not grow very well in the winter, but mine grew very large.The largest one was 22cm.

Summary Statement
My project was to test and explain how different sunlight regimes effect the growth of Raphanus sativus

Help Received
My mother helped type and re-organize my boards.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Stephen A. Raab

Project Number
J1621

Project Title
Plants Under the Rainbow

Abstract

Objectives/Goals
The purpose was to discover how plants use the different colors of light that are all present in white light. The plants will grow under a single color light to see which color is most utilized. The results would determine if it would be beneficial for greenhouses to use single colored lights during a plant's growing cycle.

Methods/Materials
Build 6 light chambers by cutting 2 holes on the bottom of 5 large planters. Use small planters to hold a number of colored lights, to produce equal light intensity, through colored filters. Attach a PCV elbow to a piece of air duct and to a small electric fan. The fan will serve as a source of fresh air and a cooling agent for the lights. Measure the plants then place them with seeds in the 6 chambers, (white, red, orange, blue, green, and no light). Water all the plants the same amount every 4th day, and the seeds every day. Record data every week measuring the plant's growth, leaves and flowers. Follow this procedure for 3 weeks.

Results
The plants under the white light grew the most efficiently. The plants under red light grew fast, at first, but then started to die. The plants under the orange light grew at a very slow, even pace. The plants under the blue light grew slow at first, but then started to grow faster by the 2nd week. The plants under the green light and no lights did not grow, but withered. The seeds under the blue light did the best and the ones under the orange did not grow at all. Plants under the green, and red developed thinner stems. The plants under the blue light developed thicker stems. The plant's stems under white, orange, and no light remained the same.

Conclusions/Discussion
Plants need white light to grow efficiently because plants need all parts of the light spectrum. This experiment showed that red light is most affective on younger plants. Therefore, a greenhouse could provide young seedlings with more red light if they want to encourage quick growth. Orange light could be used only if slow growth was wanted and if the greenhouses wanted the plants to stay about the same size. Blue light is more affective on older plants. Most of the plants under the blue light grew slow at first but after reaching a certain height, they started to grow faster. Green light and no light are highly not recommended. Young sprouts do not use light until they grow leaves and begin the photosynthesis process.

Summary Statement
This experiment was designed to explore how different colors from a light source affect how a plant grows.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Courtney J. Smith

Project Number
J1622

Project Title
It's a Miracle: The Effect of Fertilizers on Plants Grown in Various Soil Types

Abstract

Objectives/Goals
My project was to determine the effect of fertilizers on plants grown in various soil types.

Methods/Materials
A total of 96 radish plants were grown from seed. The project included 12 subject plants for each of the 8 categories in this project. The 8 categories were based on 4 types of soil: potting, loam, sand, and clay. One half of the plants were grown with fertilier and water, while the other half were grown with water only. Each plant was measured once a week for a one month period. The average plant growth was compared for each of the eight categories. The impact on plant growth was determined by comparing the average plant growth with fertilizer to the average plant growth with water only for each type of soil.

Results
Fertilizer and water had the biggest impact on the plants grown in clay, showing a 20.97% increase in growth. Fertilizer and water had the smallest impact on the plants grown in sand, showing a 4.35% increase.

Conclusions/Discussion
I was able to conclude that fertilizer and water had the biggest impact on the plants grown in soil that lacked a balance of the major nutients (nitrogen, phosphorus, and potassium)needed for optimal plant growth.

Summary Statement
The purpose of my project was to determine if fertilizer had an effect on plants grown in different soil types; the data showed that plants grown in various soils receiving fertilizer grew at different rates.

Help Received
Mother helped me type. My father helped me learn how to organize my data into graphs.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Raquel E. Solis

Project Number
J1623

Project Title
Does a Greenhouse's Glass Affect Plant Growth?

Abstract

Objectives/Goals
My objective is to determine whether the thickness of the glass walls of a greenhouse affects plant growth.

Methods/Materials
Four glass cubes with thickness of : 1/16", 3/16", 1/8", and 1/4". Five thermometers were used to mesure temperature as well as a centimeter ruler to mesure growth. Planted radish seeds in five containers. The fifth container was used as a control. The control was outside of any glass. Mesured growth and temperature and growth for eleven days. Waterde when necessary.

Results
Radishes in the 3/16" cube and in the natural enviroment (the control) grew faster.They grew bigger in the 1/4" cube. 1/8" cube had the slowest growing plant. The plant in the 1/16" cube grew at a steady rate.

Conclusions/Discussion
My project proved me half right. I thought that the plant in the 1/4" cube would grow faster and bigger. It only grew bigger.

Summary Statement
My project is to test the affectsof the thickness of greenhouse glass on plant growth.

Help Received
Mother helped decorate; Father glued the glass together (it was too sharp for me); Used teacher's laptop

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Samuel C. Spevack

Project Number
J1624

Project Title
The Effects of Angle V Graft on Nerium Oleander

Abstract

Objectives/Goals
Grafting is regularly used to asexually propagate fruit trees and repair trunk damage. This experiment's goal was to see which Angle V graft would produce the best results or healthiest plants.

Methods/Materials
Nerium Oleander White Single-leafed was used because it is the best for beginning grafters to work with. This experiment was repeated twice, in the winter of 2001-2002, (Group B) and the winter of 2002-2003, (Group A). Angle V cut of 10, 20, 30 and 40 degrees were tested in Group B and 10, 20 and 30 in Group A. The focus of this report is on the results of Group A. The strength of the grafts were measured by the angle of the graft to host. The higher degree of angle, the better strength of the graft. Success of (Group B) was defined simply by the survival rate of graft vs. angle cut. The experimenter considered the methodology for measurement of success in (Group A), a more accurate means of determining the strength and quality of the graft.

Results
The experimenter found a strong correlation between angle cut and success of grafting. The lower angle that the Angle V graft was, the stronger the graft became. The best results were obtained on plants which the experimenter used an Angle V cut of 10 degrees. A statistical analysis was performed and showed that there was less than a 5% chance that this corrreltaion was the result of chance

Conclusions/Discussion
In conclusion, the 10 degree Angle V graft was not only the strongest of all the experimental groups, but the most consistent. The experimenter thinks that this was due to the fact that the steeper the angle graft the more area of cambium layer on the graft exposed to the cambium layer on the host. Overall, the experimenter comes to the conclusion that the steeper the Angle V Graft, the stronger the graft will be.

Summary Statement
This project about angle V grafts and there effects on Nerium Oleander plants.

Help Received
My mother helped me with typing and purchased the Oleander plants.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Andy M. Van Noy

Project Number
J1625

Project Title
More Than Just a Hill of Beans: Is It Possible to Grow a Better Bean?

Abstract

Objectives/Goals
The objective was to determine whether or not crezacin, a synthetic plant adaptogen, would improve the germination rate, growth and/or weight of pole bean plants.

Methods/Materials
Crezacin was measured with a gram weight scale and three concentrations of solution were made up of crezacin and water. Seventy-two pole bean seeds were divided into four groups, including a Control Group and three Variable Groups representing the different concentrations of crezacin. Variables of light and temperature were restricted to one location. Germination rate was recorded, and growth rate was measured until the beans were harvested. Final height, weight and number of beans germinated were calculated to gain my results.

Results
My results showed that crezacin did not improve the germination rate, growth rate, or weight of the beans. However, the Variable 1x grew to surpass the Control Group in weight.

Conclusions/Discussion
Crezacin, a synthetic plant adaptogen derived from Eleutherococcus senticosus, has been used in Russia to improve crop production and has shown favorable results in field trials on cotton here in the United States. I believed that I would show the same results in pole beans of improved germination rates, increased growth rates and increased weight of plants. My experiment did not show these results. In fact, the greater the concentration of crezacin, the worse the results. In the future, I would like to do this experiment growing the beans for a longer period of time and using hydroponics as a growing environment.

Summary Statement
My project was intended to show whether crezacin would improve the germination rate, growth and weight of pole beans.

Help Received
Mother helped with some of the typing; Father helped with measuring the crezacin concentrations; Dr. Ben Tabachnik helped by providing me with concentration levels used in agriculture and by giving me the cotton trial reference paper.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Colin S. Van Zandt

Project Number
J1626

Project Title
Edible Acorns

Abstract

Objectives/Goals
My objective was to find out what temperature of water would leach the tannins out of acorns using the least amount of water.

Methods/Materials
First, I gathered, cracked and ground acorns. Second I placed 3/4 cup of the acorn meal into a jelly bag and poured a quart of water into the bag. I let the jelly bag sit in a bowl for one minute before lifting it and letting the water drain out. I continued this process until the acorn inside the jelly bag was leached. I marked down my results.

Results
I found out that cold water took 9 quarts and that boling water took 10 quarts to leach.

Conclusions/Discussion
My hypothesis was incorrect, boiling water didn't use less water than cold water.

Summary Statement
What temperature of water leaches acorns using the least amount of water?

Help Received
Dad helped me think of idea. Older brother helped me pour the boiling water. Both my parents proofread my report.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Dylan P. Webster

Project Number
J1627

Project Title
Living With Drought

Abstract

Objectives/Goals
The objective was to determine the most drought resistant grass. I believed that Annual Ryegrass would grow the best, and prove to be the most drought resistant grass.

Methods/Materials
Four types of grass were tested in three different experiments. Experiments one and three measured growth of height of each grass. Experiment one received 150 ml of water per week for five weeks, and experiment three received 210 ml per week for three weeks. Experiment two measured number of seeds germinated, receiving 30 ml of water per week for three weeks. Experiments two and three were repeated twice each. The grasses were placed under growing lamps for 24 hours per day.

Results
Tall Fescue consistently grew the best in all of the experiments. Bermuda consistently grew the least.

Conclusions/Discussion
My conclusion is that Tall Fescue proved to be the most drought resistant grass out of the grasses I tested.

Summary Statement
My project was to find out the most drought resistant grass.

Help Received
Used growing lamps at Alta Sierra Intermediate lab under the supervision of Mr. Piercy; mother and father helped with matting of pages.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Geoffrey H. Woo

Project Number
J1628

Project Title
Hybrid Apple Trees: Creating the Ideal Tree

Abstract

Objectives/Goals
The objective of this experiment was to determine if a hybrid tree, consisting of the fast-maturing Golden Dorsett's stock with popular Granny Smith scions grafted onto it, would take the best qualities of both trees, creating a fast-growing, yet popular fruit tree. I hypothesize that the hybrid would grow faster than a regular Granny Smith, but still produce Granny Smith leaves and fruit.

Methods/Materials
I used two Golden Dorsetts and one Granny Smith to form the control and manipulated variables. Clippers, sharp cutting knife, and tape were needed to facilitate grafting the scions on to the stock. Soil, fertilizer, and water were needed to keep the plants alive. The sun was also needed to allow photosynthesis, however any strong source of light could also fill this purpose. I used the Ti-83 Plus Silver Edition to plot the lines of regression of the leaves and height of the trees. I grafted six Granny Smith scions to one Golden Dorsett, creating the hybrid. Letting the three trees grow, I counted the leaves and measured the height determining which plant grew the fastest.

Results
The hybrid had the highest rate of growth, growing almost 1300% in leaves and in height, grew 5.8% comparing from initial count to final count. The Granny Smith grew 386% more leaves and 5.2% in height. The Golden Dorsett grew 539% more leaves and 8.7% in height.

Conclusions/Discussion
These results show that the hybrid has grown faster than the Granny Smith, supporting my hypothesis. The hybrid has grown Granny Smith leaves at a much faster pace. This concept could apply to other plants, so people could create other quickly grown, but tasty fruit tree.

Summary Statement
By using grafts, I created a hybrid apple tree that takes on the best quality of both the Granny Smith and the Golden Dorsett, creating a fast-growing, yet popular fruit.

Help Received
Friend taught me grafting, grandfather helped take care of plants, brother helped count leaves

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Christopher G. Yu

Project Number
J1629

Project Title
How Does the Position of the Light Affect Phototropism in Plants?

Abstract

Objectives/Goals
This project investigates how light affects the time it takes for phototropism to take place in plants. My project consitsted of seven cups, which were filled with 3 inches of soil and with 40 cat grass seeds in them. I had a regualar schedule of watering with 2 tablespoons of water everyday. I placed a lamp on top of the cups until the seeds grew to be a 6.5 inches from the soil. After this measurement, I placed the lamp on the left side of the cups, until there was a positive phototropism of 90 degrees to the light. Afterwards, I placed the lamp to the right side, and after waiting for all the grass in the cups to be straight again, I marked how much time it took for the grass to bend to the right side. I tested each cup 4 times and the time was measured in hrs. Through this experiment, it was found that the more times the grass is exposed to the light, the more sensitive it became to any change in the light position.

Methods/Materials

Name	List	Quantity	Brand
Bag of Soil	1		Coles Premuium
Packages Of Cups	2		Party America
Package of Seeds	1		Pet Grass
Tablespoon	1	~	
Tap Water	~	~	
Desk Lamp	1		Penn Plax
75 watt lightbulb	1		Smart&Final

Conclusions/Discussion
Through this experiment, I found that as the trials increased, the plants responded to change in the light's position faster than the first time. I found that the plants are more responsive when the lamp or light source was on the right side. For example, when the light source was first on the left side, it took nearly 61.3 hrs for it to be completly 90 degrees with the light, while with the second move to the right side took only took 39.9 hrs. As each trial went on, the plants became more responsive to where the light source was placed and that contradicts my hypothesis because I guessed that the exact opposite would happen even though it slightly increased after a major decrease on both sides of the plants.

Summary Statement
Using seven cups filled with three inches of soil and fourty cat grass seeds in them, I investigated how long it would take for the plants to respond to light on the left and right side of the plants.

Help Received
Mother took photographs.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
John G. Reid

Project Number
J1699

Project Title
The Effect of Biuret and Urea on Citrus Leaf Necrosis and Growth

Abstract

Objectives/Goals
I wanted to find out how various levels of biuret in urea fertilizer affect citrus leaves, specifically in relation to toxic effects. I also wanted to find out how different levels of urea fertilizer affect the growth of leaves on young citrus trees. This is important because citrus growers need to use the right balance of nitrogen on their groves to get the best growth without damaging their trees or polluting the groundwater. It is especially important when trying to get young trees into production as quickly as possible.

Methods/Materials
I chose 65 young navel orange trees in my family's citrus grove. I marked 130 branchlets on the selected trees with ID tags. I made 6 concentrations of low biuret (LBU)urea fertilizer (less than .1% biuret) and 6 concentrations of high biuret (HBU)urea fertilizer (between .65% and .80% biuret). I then painted the leaves of 120 of the marked branchlets with the assigned urea forumlation, and used 10 branchlets as controls. Over the next month, I evaluated the 130 replicates using rating scales for necrosis and growth.

Results
Significant necrosis occurred at urea concentrations of 0.32 and 0.64, regardless of biuret content. At the 0.64 concentration, the mean necrosis for HBU urea was 3.8 compared to LBU urea necrosis of 2.4. At the 0.16 concentrations and lower, necrosis was minimal regardless of biuret content. All concentrations of LBU urea produced more growth than equivalent HBU urea concentrations, except at the 0.02 and 0.04 concentrations. For those concentrations, the HBU urea produced significantly more growth than equivalent LBU urea concentrations.

Conclusions/Discussion
Citrus growers avoid HBU urea because of its reputation for nitrogen burn (necrosis). Growers must also work to prevent groundwater contamination from urea (nitrogen) use. LBU urea at the 0.08 and 0.16 concentrations produced the best growth with the least necrosis. However, HBU urea at the 0.02 and 0.04 concentrations also produced minimal necrosis and very good growth. These data suggest that HBU urea at lower concentrations may be a viable foliar fertilizer for young citrus trees. Because biuret degrades more slowly that urea, this could reduce groundwater contamination and improve grower economics.

Summary Statement
My project investigates how biuret and urea affect the health and growth of young navel orange trees.

Help Received
Mother helped with typing and research. Dr. Krueger helped with project design.