CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Garrett Angres; Viraj Jain

Project Number
J1901

Project Title
How to Grow the Best Drought Resistant Lawn

Abstract

Objectives/Goals
Our goal of this experiment was to create a perfect combination of seeds and soils to keep a healthy green lawn in drought conditions. The problem that sparked my experiment was the almost 4 year California drought that lead to brown lawns all over the state. Our question was How to grow the Best Drought Resistant Lawn.

Methods/Materials
The method we used to conduct our experiment was by creating a 3x3 array of grass seed placed vertically on the array and soils placed horizontally on the array creating 9 unique samples. We labeled each container by the grass type in it and the soil it is growing in. We drilled 6 - water drainage holes at the circular base of each container.

Our materials we used were our three grasses(Bermuda Grass, Blue Grass, and Fescue Grass.)Our three soils which were(Organic Soil, Peat Moss, and Potting Soil.)9 containers with a 3" radius and 1.5" height, A 75 watt grow bulb, A water spray bottle, weight scale, and a ruler.

Results
Our results showed that Bermuda grass didn't grow at all as we thought it would in our hypothesis, with further research we found that while Bermuda Grass is known to be robust, it grows dormant in cold temperatures similar to those while we conducted our experiments.

Our results for height showed that Blue Grass grew tallest in Peat Moss, This is an important aspect as height can affect how healthy a blade of grass is. Fescue Grass was about half an inch away from meeting the same height as Blue Grass.

In our results for the grass densities, Fescue Grass had the highest density with Blue Grass having 11 less blades per square foot of lawn.

Conclusions/Discussion
Our conclusion to our experiment showed that Fescue Grass in Peat Moss soil was the best combination in order to grow the best drought resistant lawn as it would achieve a dense and tall lawn. Although this contradicts our hypothesis that Bermuda Grass with Peat Moss would grow best in drought conditions, with further research we found that Bermuda grass goes dormant in cold temperatures.

Summary Statement
We investigated which seeds grow in which soil with less water.

Help Received
We performed this experiment by ourselves, But recieved information on grass from Laura Torchin at UC Davis

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Lauren G. Billnitzer

Project Number
J1902

Project Title
I Wet My Plants... with Hydrogen Peroxide: The Effects of H2O2 on Seed Germination and Stem Cuttings

Abstract

Objectives/Goals
Improved methods of producing healthy crops in environmentally-friendly manners are desirable. The purpose of my experiment was to determine the effects of hydrogen peroxide on seed germination and stem cuttings.

Methods/Materials
I used four different growing solutions of H2O2 in water and a control of water to wet basil seeds and basil stem cuttings growing in a greenhouse environment. I checked daily for seed germination for three weeks. I measured stem cutting growth by root development in the roots to shoot ratio after three weeks of growing. I used 10 basil seeds and 3 stem cuttings for each solution per trial, and I ran three trials.

Results
My results showed that a 6% H2O2 solution yielded beneficial results for both seed germination and stem cuttings, however only by a small percentage, and more testing would be needed to completely confirm these results.

Conclusions/Discussion
These positive results occurred because H2O2 dismutated, or broke into a water compound and an oxygen atom, supplying beneficial amounts of oxygen and water directly to the plants. The single reactive atom of oxygen from the H2O2 dismutation also oxidized harmful bacteria on the plants. A larger concentration of H2O2 was too acidic and provided more pure oxygen to the plants than was healthy, and a smaller concentration provided insufficient H2O2 to help.

Summary Statement
I showed that a 6% solution of H2O2 in water provides beneficial results for seed germination and the growth of stem cuttings.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Sullivan Braun-Slavin

Project Number
J1903

Project Title
Synthetic Insecticides in GMO Plants: Necessary or Avoidable?

Abstract

Objectives/Goals

GMOs (Genetically Modified Organisms) are controversial. GMO plants are designed to increase yield and resilience against environmental threats. GMOs are attractive to scientists and food producers, but pest resistance by splicing poisons into plant DNA could have negative effects on human health, beneficial insects, soil and surrounding plants.

In my research I learned people have been using natural pesticides for centuries. I decided to study and test non-synthetic substances for pest control, to see if there are effective and safe alternatives to GMOs.

Methods/Materials

I planted 80 radish seeds in 20 pots, divided into 5 groups. All groups got equal water, sunlight, and exposure to rose bushes infested with aphids. Once plants sprouted I treated 4 groups with different oil solutions (Citrus, Eucalyptus, Peppermint and Neem). A control set got no solution.

I monitored each plant for 1 month and recorded observation data for pest infestation (visible pests/holes in leaves) and general heath (plant size and color/droopiness of leaves). Results were based on observation data and precise measurement of plant yield (weight of radishes and leaves).

Results

I hypothesized Peppermint would be most effective against pests due to its anti-microbial properties, and that Neem would also be effective due to its use as an herbicide in India and for killing lice on humans.

My data showed Neem is the best natural pesticide: plants were untouched by aphids and had the most yield of all plants treated (largest/healthiest leaves, most vegetables). Peppermint plants were healthy, but showed infestation. Eucalyptus and Citrus oils had low infestation, but also low yields and damaged plants. Control plants had the most infestation, but also highest yield.

Conclusions/Discussion

Natural substances can be effective pesticides and may be considered viable alternatives to GMOs. However more experiment and research is necessary to understand the relationship of healthy plants and yield of edible vegetables.

Future experiments could test variable potency of oil solutions to achieve a balance of pest resistance, healthy plants and maximum yield. I#d like to test GMO seeds against natural pesticides to compare

Summary Statement

My project investigates the effectiveness of several natural substances as non-synthetic organic pesticides, as possible alternatives to controversial GMO pesticide resistant plants.

Help Received

My parents helped by printing my report and pictures for my project board. My science teacher gave me feedback on my report and project board.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Caleb A.G. Carver

Project Number
J1904

Project Title
Fish Factor

Abstract

Objectives/Goals
The objective of this study was to see if plants would grow better in aquaponics or soil.

Methods/Materials
1. See through plastic tote
2. 5#X5#X8# vinyl fence post with cap
3. 3#X8# PVC sewer line X2
4. Eye bolt, 2 washers & nut
5. Piece of plastic cut to square inserted into post cap
6. 1/2# PVC slip to thread pipe fitting
7. 9# aquarium hose
8. Vinyl fence post glue
9. Clear aquarium caulk
10. Aquarium pump (8# rise)
11. 24 3# hydroponic root cups
12. Aquarium filter padding
13. 1 bag hydroton for media
14. 55 gallon aquarium heater
15. Medium aquarium bubbler pump, 4# tubing & large bubbler head
16. 100 goldfish
17. 24 starter plants (vegetables/herbs)
18. Fish food flakes

Tools
Compound miter saw
Drill and bits
Caulking gun
Roto-Saw and bits
Sand pape
Screw drivers

Results
The aquaponic plants grew astronomically bigger than the soil grown plants.

Summary Statement
I achieved plant growth rates from each types of growing

Help Received
My dad assisted me in the construction of my aquaponic tower.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Katie P. Champion

Project Number
J1905

Project Title
Creating Food Options for People Allergic to Heavy Metals

Abstract

Objectives/Goals
About 3-5% of the world's population, including my dad, have an allergy to Chromium and Nickel. Since many foods contain Chromium and Nickel, people with metal allergies have to go on restricted diets and use medications to prevent reactions. I want to prove that it is sensible to grow potatoes without the presence of Chromium and Nickel to offer people with allergies more food options. My hypothesis was that if potatoes are grown in a hydroponic system without the presence of heavy metal allergens such as Chromium and Nickel, they will produce as good a yield as when grown in the presence of metals.

Methods/Materials
In my experiment I grew three types of potatoes, Red Thumb, All Blue, and Kennebec, in an ebb and flow hydroponic system in a green house environment. I grew potatoes because they absorb high quantities of metals and people allergic to metals are unable to eat potatoes. Each type was grown hydroponically with concentrations of chromium and nickel that replicate allergen free soil, typical soil, and polluted soils. There were four trials for each varietal, in each concentration of the metals, for a total of 36 trials. There were an additional four potatoes of each varietal grown in potting mix, for a total of 12 control potatoes, which where exposed to the natural environment. I then compared the yield and growth of the potatoes grown in the absence of metals to those grown with metals.

Results
My experiment collected data on potato growth rates, yield mass and yield volume for three potato varietals when grown hydroponically in three metal concentrations. The differences in mass and volume were visually observable, and all of the varietals of potatoes grown without chromium and nickel were larger in mass and volume.

Conclusions/Discussion
Overall, my experiment confirmed my hypothesis as all three potato varietals grown without the chromium and nickel produced a larger yield and grew larger than the control sets. Growing allergen free foods, without chromium and nickel, could improve the quality of life for people with metal allergies.

Summary Statement
My research and experiment were centered around successfully growing potatoes without the presence of chromium and nickel for my dad who has an allergy to these metals, and for others who suffer from similar allergies.

Help Received
My science teacher and parents guided me throughout the process of developing the idea of the experiment. I conducted the experiment myself under supervision. Elka Worner and Joseph McCorkle reviewed my board.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Catherine Diyakonov

Project Number
J1906

Project Title
Are Vitamins Plant Friendly?

Abstract

Objectives/Goals
My goal was to determine if sweet pepper plants (capsicum annuum) would grow taller when they were be watered with Vitamin C solution, Vitamin D3 solution, or water.

Methods/Materials
I labeled 5 sweet pepper plant cups with a "C" since I would be watering those 5 plants with Vitamin C solution. Then, I labeled 5 sweet pepper plant cups with a "D3" since I would be watering those 5 plants with Vitamin D3 solution. I left 5 sweet pepper plant cups unmarked since I would be watering those 5 plants with water and because this was my control group. In one measuring cup, I dissolved two tablets (500 mg each) of Vitamin C in 100 mL of water as much as possible. In a second measuring cup, I dissolved one tablet (1000 IU each) of Vitamin D3 in 200 mL of water as much as possible. In a third measuring cup, I filled up as much water as I wanted. Every other day, I repeated the previous three steps and watered the appropriate plants with 50 mL of each specific solution, along with measuring them. This experiment was conducted over the course of 15 days.

Results
According to the average plant height data, the plants watered with Vitamin D3 solution outgrew the rest, growing on an average of 10.42 cm. The sweet pepper plants watered with water grew on an average of 8.16 cm while the plants watered with Vitamin C solution grew on an average of 7.76 cm.

Conclusions/Discussion
In conclusion, the sweet pepper plants watered with Vitamin D3 solution grew the tallest, followed by the plants watered with water, and then the ones watered with Vitamin C solution. The results of my science experiment can be applied greatly to those who develop and use fertilizers. If Vitamin D3 is incorporated into fertilizers and then put into the soil in which plants grow, the plants will grow quicker and require less water in the process.

Summary Statement
My science project tested if Vitamin D3 or Vitamin C benefited the growth of sweet pepper plants (capsicum annuum).

Help Received
My science fair coordinator, Mrs. Robin Norfleet, provided information about the science fair regulations.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Mia L. Dostal

Project Number
J1907

Project Title
Comparing Plant Growth in Aquaponic Systems to Traditional Soil Farming

Abstract

Objectives/Goals
The purpose of this project was to find out which plants grow best in aquaponic systems so we can take advantage of these water saving systems and replace regular, drought creating farms, with aquaponics systems that save 20 times as much water.

Methods/Materials
24 plant seedlings, 8 seedlings of each kind of plant, 20 gallon fish tank, 2 long pieces of PVC pipe, 1 small piece of PVC pipe, 6 small blocks, fish tank gravel, 10 shibunkin goldfish, power head pump, tubing, netting baskets, planting pots, soil,and PVC pipe elbow connectors and ends.

Results
The results of this experiment were that the broccoli plants grew the widest, growing 5.08cm wider than the control, the lettuce grew the deepest growing 5.4cm deeper than its control, and the lettuce grew the tallest out of all three, none of the aquaponic plants grew taller than the controls, so the lettuce grew -2.04cm taller than the control. Compared to their controls, the lettuce control grew 2.04cm taller, 5.4cm less deep,
and 1.51cm skinnier than the average of the aquaponic lettuce, the chives control grew 2.91cm taller, .02cm less deep, and 1.62cm skinnier than the aquaponic chives, and the broccoli control grew 3.02cm taller, .62cm less deep, and 5.08cm wider than the aquaponic broccoli.

Conclusions/Discussion
The tests for this experiment failed to disprove my hypothesis, which was " That the lettuce will grow the best if it's compared to chives and broccoli, because leafy plants need higher nitrogen levels, then the lettuce will be able to thrive with the nitrogen produced by the fish." The lettuce grew the best out of the plants by growing the deepest and tallest. It grew 5.4cm deeper than its control and though none of the aquaponic plants grew taller than the controls, it grew the closest. Now that we know which plants can grow best and we can replace industrial soil farms that grow things like lettuce, i.e. kale, arugula, and cabbage. Also, we can save wildlife and make our plants healthier by reducing the use of pesticides on crops.

Summary Statement
I tested to see if what kind of plants grown in aquaponic systems grow taller, wider, or deeper then plants grown in soil and found that lettuce plants grow the best in aquaponic systems compared to broccoli and chives.

Help Received
I designed and built my tank by myself, but my parents helped me with cutting PVC pipe. I had help from Rebecca Bainbridge, who is a scientist that works at Aquaponics U.K., I also got to use the work shop at the Monterey Bay Aquarium Exhibit Production, where I put together my tank and cut the PVC pipe.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

John B. Estrada

Project Number

J1908

Project Title

Effects of Different Light Wavelengths on Corn (Zea mays) Growth and Chlorophyll Content

Abstract

Objectives/Goals

The objective of this study is to determine if exposure to red and blue light, absorbed specifically by chlorophyll a and b, improves growth and chlorophyll content in corn seedlings.

Methods/Materials

Early maturing sweet corn seedlings exposed to different light wavelengths: red (660nm), blue (465 nm), blue + red (465 + 660 nm), and natural light (10nm - 0.01 cm). Plant height, root weight, chlorophyll content and total biomass production (mg) were measured. The chlorophyll content was measured with a SPAD handheld meter. Fall and winter season trials were conducted with growth parameters and chlorophyll content measured at 12 days after sowing (DAS), 16 DAS, 20 DAS, and 24 DAS. The study was terminated and final measurements were obtained at 20 DAS for fall trial and 24 DAS for winter trial.

Results

The results from winter trial showed that plants exposed to combination light wavelengths (red + blue) produced the heaviest roots (966.67 mg) which also yielded the highest total biomass production (1,516.67 mg). The high production of roots resulted in at least a 20% increase in total biomass yield compared to the other treatments. In addition, plants exposed to the combination light wavelengths produced the highest amount of chlorophyll in the leaves (29.28) compared to seedlings exposed to blue light (27.03), red light (24.17), and natural light (21.33). Similar trends on biomass yield, root yield, and leaf chlorophyll content were observed in the fall trial.

Conclusions/Discussion

The combination of blue and red lights produced significantly higher chlorophyll content, total root weight and biomass yield, thus, improving the overall growth of the corn seedlings. Exposure to both light wavelengths maximized photosynthesis, glucose production and synthesis of organic materials which lead to healthier plants and higher biomass yield. Farmers and seedling growers can use the combination of blue and red lights to produce healthy and hardy seedlings for field transplantation. Higher survival rate after transplantation due to the improved overall growth and health of the seedlings can potentially increase crop yield.

Summary Statement

This project is about the effect of different light wavelengths on corn seedling growth and corn leaf chlorophyll content.

Help Received

Over the past two years, my mother has taught me how to use and understand the statistical data that I discovered while completing this project. The actual project was done entirely by me.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Alyssa J. Fraser

Project Number
J1909

Project Title
The Effect of Fertilizer on Java Moss Growth

Abstract

Objectives/Goals
My goal was to discover which of the chosen fertilizers had the largest effect on java moss.

Methods/Materials
To do this, I grew 12 strands of java moss using different kinds of fertilizer. They were grown in a box with a grow light and heating pad.

Results
The java moss that grew the most was surprisingly the one without fertilizer. Fish Emulsion grew the next best, followed by Soul Grow and finally Miracle Gro, proving my hypothesis wrong.

Conclusions/Discussion
Something I learned from this project was that the healthier moss you grow, the less algae grows, bringing a healthier environment. I observed this during the growth of the Java Moss, and it was not part of my experiment.

Summary Statement
I tested different fertilizers on a plant called Java Moss.

Help Received
My dad helped me assemble the grow light and heating pad into the box.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Jason E. Gravori

Project Number
J1910

Project Title
Salvage or Sabotage?

Abstract

Objectives/Goals
The purpose of this experiment was to test if the best irrigation water temperature for cress was related to the ambient temperature.

Methods/Materials
To conduct this experiment I used cress seeds, paper towels, plates, spray cans, water, a food scale, a thermometer, a ruler, a camera  and a light meter. I first used the light meter to find an indoor and outdoor area that received the same amount of light. I then planted six plants of cress in each location. Two of the indoor cress plants were irrigated with water whose temperature matched the ambient temperature. Two indoor cress plants received water 5 degrees Celsius colder than the ambient temperature, and two received water 5 degrees Celsius warmer than the ambient temperature. The same was done with the outdoor plants. Everyday I measured the two tallest shoots of each plant as well as the weight of the plant.

Results
My data showed that amongst the indoor plants, the plants watered with ambient water fared best. However, amongst the outdoor plants, the ones watered with ambient plus 5 degrees Celsius water fared best. This difference between the patterns of the indoor and outdoor plants showed that the best irrigation water temperature was not related to the temperature of the environment. Upon further analysis, I concluded that the best irrigation water temperature for cress falls between 21.38 degrees Celsius and 21.55 degrees Celsius, regardless of the ambient temperature.

Conclusions/Discussion
Before this experiment, I thought that the best irrigation water temperature for cress was related to ambient temperature. The results did not support my hypothesis. However, the results did teach me that is important to water cress with irrigation water that is between 21.38 degrees Celsius and 21.55 degrees Celsius. Doing this will maximize crop growth.

Summary Statement
While testing if the best irrigation water temperature for cress was related to ambient temperature, I discovered that the best water temperature for cress was between 21.38 and 21.55 degrees Celsius REGARDLESS of the ambient temperature.

Help Received
My teacher suggested that I look at the temperature variability outdoors as a source of error. My mom watered the plants for me on days when I was running late to school.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Hamna Khan

Project Number

J1911

Project Title

The Antioxidant Mystery: The Effects of Antioxidants and Free Radicals on Seed Germination

Abstract

Objectives/Goals

The purpose of this project was to determine which type of vitamin is most effective for protecting plant cells against free radicals.

Methods/Materials

Radish and bean seeds, Vitamins: A,C and E, hydrogen peroxide.This science fair experiment involved placing bean and radish seeds in a hostile, artificial environment which contained hydrogen peroxide as a source of free radicals. Vitamin A,C and E were added to these groups of seeds to study their protective effects as antioxidants.

Results

Results indicated that in all seed germination trials, vitamin A was consistently the vitamin that allowed the most seed germination. In the radish seed trials, the seeds exposed to hydrogen peroxide had the least percentage of germination.

Conclusions/Discussion

In this experiment, the effects of antioxidants on germinating seeds exposed to free radicals (hydrogen peroxide) were studies. It was determined in the experiment that among vitamin A, E, and C, vitamins with antioxidant properties, Vitamin A consistently allowed the largest percentage of germination to occur. This was proven true in both the radish and bean seed trials. Vitamin C was consistently the vitamin that germinated the smallest percentage of seeds. The beneficial antioxidant effects of Vitamin E are often publicized, and in the hypothesis it was speculated that Vitamin E would be the best antioxidant. However this assumption has been receiving a lot of attention, as more recent studied have indicated that Vitamin E might not have all the benefits attributed to it earlier.

Summary Statement

The effects of antioxidants on germinating seeds exposed to free radicals (hydrogen peroxide) were studied, and it was later determined that vitamin A is the most effective antioxidant.

Help Received

I performed the experiment myself with the advice given by by coordinator.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Amanda K. Lazaro

Project Number
J1912

Project Title
The Study of the Effects of Electricity on Seed Germination and Plant Growth of Contender Bush Beans

Abstract

Objectives/Goals
The objective of this experiment was to study the effects of electricity on seed germination and the overall growth of Contender Bush beans. I hypothesized that electricity would increase germination rate, as well as increase plant growth of the bean plants.

Methods/Materials
Thirty Contender Bush bean seeds were planted among six different pots. I created an electrical field for each individual pot by using a 9-volt battery along with insulated wires connected to a copper rod on one end of the pot and a galvanized nail on the other end of the pot. An additional thirty Contender Bush beans were planted among six other pots without the presence of an electrical field. I measured daily when germination occurred for each seed. I also measured the growth in terms of height for each individual plant. Daily voltage measurements for each electrical field were also recorded.

Results
The seeds that were exposed to an electrical field germinated one day earlier than the control seeds. And during the first two days of the experiment, the germination percentage was the highest among the seeds exposed to an electrical field. Also after the first few days of germination when measured voltages were at its highest, plant growth was the highest for those plants exposed to an electrical field.

Conclusions/Discussion
Electricity did increase seed germination rate and it also had a positive effect on plant growth. During the time when recorded voltages were at its highest, it showed to have a positive influence on germination rate and on plant growth. However, since I was unable to maintain a consistent level of voltage among the plants exposed to the electrical field throughout the study, the voltage exposed plants did not maintain its superior growth compared to the control plants.

Summary Statement
This study examined the effects of an electrical field on seed germination and plant growth of Contender Bush beans.

Help Received
I received assistance from my father in setting up the electrical components of the study.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Estrella Leal Martinez

Project Number
J1913

Project Title
Comparing Soil Fertility Levels Collected from Different Orchards and Vineyards

Abstract

Objectives/Goals
I wanted to learn if soils in different types of fruit orchards and vineyards would have different fertility levels.

Methods/Materials
I developed a Wick Hydroponic System in my investigation. I collected soil from 3 different orange, pomegranate, and grape fields. For my control, I collected soil from the adjacent area from the 3 orange, pomegranate, and grape fields. The control was the soil that has not been exposed to the tree/vine fruits and leaves that have decomposed into the soil. I placed 10 radish seeds on the cotton balls in the Hydroponic System. The fabric wick was used to extract the nutrients form the soil and water solution. Then, I measured the plant growth in centimeters on day 7 and 14.

Results
The results from my investigation indicated that soils in different types of fruit orchards and vineyards did have different fertility levels. The average plant growth from the different soil solutions on Day 7 varied from pomegranates 1.0 cm., oranges 1.1 cm., and grapes 1.4 cm. The average plant growth from the different soil solutions on Day 14 varied from pomegranates 1.6 cm., oranges 1.8 cm., and grapes 2.0 cm.

Conclusions/Discussion
After completing my investigation, I discovered that my hypothesis was correct. Every fruit orchard and vineyard soil had a different fertility level that determined the average plant growth. In addition, the soil collected from the grape vineyards had the highest fertility level based on the average plant growth of 2.0 cm. In comparison to the soil collected from the pomegranate orchards that had the lowest fertility level based on the average plant growth of 1.6 cm.

Summary Statement
I developed a hydroponic system to compare soil fertility levels from orange/pomegranate orchards and grape vineyards.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Emma V. Lenchenkova

Project Number

J1914

Project Title

Saline Hydroponics

Abstract

Objectives/Goals

I wanted to learn if the concentration of NaCl in the water used to grow Jade Plants hydroponically would affect their growth. I believe the concentration of NaCl will affect their growth and condition.

Methods/Materials

Using 21 clippings of Jade Plant (each with a five cm stem and six leaves), I placed these into 21 jars, marked and divided into groups of 7. Into the first seven, I poured 75 mL of distilled water. For the next seven, I dissolved 15 g of NaCl in a liter of distilled water to get roughly estuary salinity-15ppt. I measured out 75 mL of this solution into the next seven jars. Then I did the same for the next seven, except with 35 g of NaCl for roughly ocean salinity-35ppt.

Results

The plants in "ocean" water fared worst. Their stems and leaves broke down, decomposing, and no roots formed. Those in the "estuary" water fared slightly better; some hadn#t yet completely collapsed. The specimens in the distilled water proved to grow best of all. They grew roots and remained firm to the touch, green, and sturdy. This shows a clear negative correlation between the concentration of salt and the plant condition/growth.

Conclusions/Discussion

This proves that the concentration of NaCl in the water used to grow Jade Plants hydroponically affects the growth of the plants negatively. The NaCl must have dehydrated the plants, and caused necrosis, which was the reason for their quick deterioration in health. This shows that saline water also dehydrates plants, and that their cytoplasm salinity is less than the water around it, which was why they tried to dissolve the salt water and withered up.

Summary Statement

High concentrations of NaCl in the water used to grow Jade Plants hydroponically negatively impact their growth and present condition.

Help Received

None. I designed, created, and performed this experiment by myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Emily M. Lickiss

Project Number
J1915

Project Title
Dietary Protein, Dog Urine, and Its Effect on Your Lawn

Abstract

Objectives/Goals
The objective was to determine how dietary protein would affect grass morbidity in response to dog urine.

Methods/Materials
A children#s swimming pool was planted with soil and sod. Two dogs were fed a diet with 18% protein. Samples of urine were collected daily from each dog. The samples were applied to sections of the grass for 6 days in 2 sections per dog. The dogs were then transferred to a 30% protein diet and urine samples were collected. The samples were applied to the grass for 6 days in 2 sections per dog. Urine pH and concentration were evaluated. Volunteers blindly evaluated grass morbidity/damage 7 days after the urine was applied. The results were analyzed.

Results
Urine from dogs on the higher protein diet caused more grass morbidity than urine from dogs on the lower protein diet. On a scale of 1-5, the average morbidity score for the higher protein diet section was 3.7 whereas the average morbidity score for the lower protein diet section was 2.7.

Conclusions/Discussion
Because of diets effect on nitrogen levels, a lower protein diet can help reduce the amount of damage dog urine does to your lawn.

Summary Statement
I showed that higher amounts of dietary protein in dog food can increase that amount of damage that the dog's urine causes to lawns.

Help Received
Dr. Stacy Pettigrew, a veterinarian at Jackson Creek Veterinary Clinic taught me how to preform a basic urinalysis and provided the tools for me to preform them.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Colin J. Manfredo

Project Number
J1916

Project Title
The Effects of Different Seawater Salinity Solutions on Plant Growth

Abstract

Objectives/Goals
The objective of this study is to see if diluting different seawater salinity levels would have a negative effect on plant growth and production. The purpose is to find an alternative water source for farmers during drought years.

Methods/Materials
Mixed ocean water and freshwater, measuring cups. Tested salinity levels with Hach Sension MM150, measured onions, lettuce, broccoli, cauliflower, tape measure, leaf count.

Results
The broccoli plants were not affected by any of the saltwater levels. The leaf count increased slightly in every level used. This shows that the seawater being irrigated was not impacting growth levels. Cauliflower also showed some of the same results except at 100% saltwater levels.

Conclusions/Discussion
Evidence showed that diluted saltwater will not effect the growth rate of certain plants, especially broccoli. I found that the 5% and 10% solutions all grew the best - proving that saltwater could be used as a form of irrigation for farmers. This is an alternative form of irrigating during drought years.

Summary Statement
I showed that certain vegetable plants can grow in diluted seawater solutions, proving that saltwater can be used as a form of irrigation for farmers.

Help Received
Jim Wegley - Civil Engineer, helped show me how to use the Hach Sension MM150. I designed, built, and performed the experiments myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Lily C. Oglesby

Project Number
J1917

Project Title
How Does Plant Growth Vary between Martian and Earth Soils?

Abstract

Objectives/Goals
The objective of the experiment was to see which type of soil (potting soil, topsoil, or martian simulant) would make plants grow the fastest and produce the most leaves.

Methods/Materials
1. 60 cups 8.89 by 8.89 centimeters by 8.89 centimeters
2. 4 trays to hold cups
3. 120 Cherry tomatoes (Solanum lycopersicum)
4. 30 coffee filters
5. 1.3 kg topsoil[1]
6. 1.3 kg Martian regolith from orbital technology corporation[2]
7. 1.3 kg Lowes Sta-growth potting mix[3]
8. 2 sun lamps
9. Spray bottle/tablespoon measure
10. Milligram scale
11. Distilled water

Put coffee filter in bottom of each cup. There were 20 cups for each soil type and 2 seeds in each cup. Plants were watered as needed, and sun lamps were provided. Each day, count the number of leaves, and at 50 days, measure total biomass across all cups of each soil type.

Results
The plants growing in the Martian simulant had the largest biomass and most leaves, followed by the plants in potting soil and topsoil. Two t-Tests were preformed to determine if there was a significant difference between the different soil types in the number of leaves produced. The first t-Test compared the leaves per cup (across all cups on the last day of the experiment) in the Martian soil to the leaves per cup in the potting soil. The number of leaves per cup in the Martian soil was significantly greater than that of the potting soil. The second t-Test compared the difference in leaves per plant (across all cups) in Mars soil and Potting Soil. The number of leaves per plant was not significantly different. Thus, the number of leaves per cup in the two soil types was significantly different because more plants grew in the Martian soil cups, and thus affected the leaf count.

Conclusions/Discussion
In conclusion, the data partially supported the hypothesis, which was that plants would grow better overall in Martian Soil than in topsoil, but worse than if grown in potting soil. Plants grown in simulated Martian

Summary Statement
Plant growth was tested in three soil types and found that Martian simulant grew plants the best, followed by potting soil, with topsoil performing the worst.

Help Received
Thanks to Laura McGeehan and David Oglesby for help with editing the poster as well as helping with the analysis part of the project.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Ahmed Owainat

Project Number
J1918

Project Title
Growing Plants in Volcanic Pumice to Mimic Soil on Mars

Abstract

Objectives/Goals
The objective of this study is to grow plants in simulated Mars conditions.

Methods/Materials
Take 6 planting pots with 6 holes in each. Fill twelve of them up with soil. In the other twelve, fill it up with volcanic pumice. In the last twelve, fill it up with half soil half volcanic pumice. Dig up a 5.08 cm hole in every cup, and place one Tasmanian Radish Seed in 6 pots for the soil, 6 pots for the volcanic pumice, and 6 pots for half-half. Repeat the procedure for the other 18 but with American Radish seeds. After that label 6 of the pots filled with Volcanic Pumice, AU radish seeds Volcanic Pumice. For the other 6 name it, U.S. radish seeds Volcanic Pumice. Do this for the last 4 pots except instead of Volcanic Pumice for two write down Soil, and the other two 50% Soil, 50% VP. Label the seeds by marking the positions in the planting holes. Once done with this step, place all the planting trays in the terrarium. Also, get two small cups and put 2/3 cups of vinegar and 1/4 tablespoon of baking soda in both cups. This is done to produce carbon dioxide, which is ninety-five percent of Mars atmosphere. After starting the project, water the plants with 3 teaspoons of water a day. Replenish the baking soda and vinegar every day to ensure a continued supply of CO2. Place the terrarium in a brightly lit part of the room to ensure enough light. Record observations for 2-3 weeks and figure out whether or not plants can grow in simulated Martian conditions.

Results
When I grew the plants in all soils, most plants grew large. At the end, my results proved my hypothesis correct.

Conclusions/Discussion
The goal of the experiment was to test the effect of volcanic pumice, soil, and a 50-50 combination of both on the growth of Australian and U.S. radish seeds. My hypothesis was that if AU and U.S. radish seeds were grown in volcanic pumice, soil, and a combination of both, the AU would grow better in a combination of both, because it has more nutrients and the AU seeds come from a volcanic region in Tasmania.

Summary Statement
I am comparing the germination and growth of Australian and U.S. radish seeds in volcanic pumice, soil, and a 50-50 combination of both.

Help Received
I would like to thank my mom and my science teacher, Mrs. Satya. Both of them helped me throughout my experiment and encouraged me to do good.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Zachary Patton

Project Number

J1919

Project Title

The Effect of Soaking Seeds on the Growth of Hordeum vulgare L. in a Fodder System

Abstract

Objectives/Goals

The goal of this project is to find out if presoaking Hordeum vulgare L. (barley seed) affects its total growth after an eight-day cycle using a fodder system. I wondered if there was an optimal soak time to produce the greatest yield. The hypothesis was if Hordeum vulgare L. was soaked for 90 minutes, then the seeds would produce the greatest yield after eight days.

Methods/Materials

I constructed a hydroponic fodder system using plastic PVC pipe, grow trays, a water pump, and a timer. The project tested soak times of barley seed for 45 minutes, 90 minutes, and 180 minutes in an eight-tray hydroponic indoor rack. The eight trays were rotate down the rack daily placing the new seed tray at the top. The seeds were automatically watered 3 times a day for 5 minutes by a pump system controlled by an automatic timer. Each growth cycle consisted of 8 days of growth. The control group is at 0 minutes soak time, which is also measured every eight days as an end point. The independent variable is the soak time; the dependent variable is the amount of seeds and amount of water soaked.

Results

The system yielded on average 10 lbs. of fodder for every 2 lbs. of seeds. The average weight for 45 minutes soak time was 10.25 lbs.; 90 minutes soak time was 10.78 lbs.; 180 minutes soak time was 10.90 lbs.; 0 minutes soak time was10.60 lbs. The two pounds of grain produced about ten pounds of fodder, which is a 1:5 ratio. This means that the fodder system could grow 5 pounds of fodder for each pound of seed.

Conclusions/Discussion

After completing my project, I found that my hypothesis was not supported because there was not a significant difference between each of the four soak times, about .30 lb. This calculates to roughly about one more bite. A healthy cow needs to eat about 2.5% of its body weight. The average cow weighs roughly 1000 pounds which would calculate to about 25 pounds of feed each day. Although there was not a big difference in the yield, the system successfully grew fodder without mold that was readily eaten as supplemental food by my livestock.

Summary Statement

The purpose of this investigation was to find if there is an ideal length of time to pre-soak fodder seeds to achieve the most yield in weight using a hydroponic system.

Help Received

I conducted the project myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Peyton K. Pettyjohn

Project Number
J1920

Project Title
Cryogenic Seed Exposure

Abstract

Objectives/Goals
The purpose of this project is to see how freezing seeds using liquid nitrogen (-320 °F) affects seed germination rate, seed dormancy, and viability. This experiment will try to force dormancy, affect germination rate, and affect seed viability for tomato, sage, and sunflower seeds. We are using liquid nitrogen to try to cool the seeds to put them in a stationary state or dormant state by varying the length of time of exposure to liquid nitrogen.

Methods/Materials
Tomato, sunflower, sage seeds. Freeze seeds in liquid nitrogen for different lengths of time. Place seeds in petri dish inside incubator. Measure total seeds germinated and germination rate over time.

Results
The trial seeds germinated at the same rate and same percentage as the controls. The seeds were not affected by the liquid nitrogen.

Conclusions/Discussion
Freezing seeds in liquid nitrogen does not affect seed germination rate, or seed viability.

Summary Statement
I showed that freezing seeds in liquid nitrogen does not affect seed germination rate, or seed viability.

Help Received
My dad built the incubator and helped with Liquid Nitrogen safety.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Wynn Phaychanpheng; Audrey Sogata

Project Number

J1921

Project Title

The Effects of Varied Increments of Auxin and Gibberellin on Brassica rapa

Abstract

Objectives/Goals

Our objective is to find the correct increments of the hormones auxin and gibberellin to increase the growth of Brassica rapa. We want to find this so that farmers could spray those on the plants rather than their unnatural counterparts. This could lead to more organic produce available for sale.

Methods/Materials

We planted the plants using a self-watering system. In order to apply the auxin, we mixed it with water and poured it in the system. As for the gibberellin, we mixed the increments into boiling water and sprayed it on. We observed the plants until day 31 by measuring height, number of leaves, pods, buds, and flowers. We also decided to find the dry mass of the roots by weighing them on a scale.

Results

During observation we noticed the control plants were taller, but flimsy. The treated plants were stronger and sturdier. Our data shows that the control had the highest percent of increase for plant height and pods. 100% auxin had the highest percent of increase for flowers and leaves. 75% gibberellin and 25% auxin had the highest percent of increase for buds. Using averages, we found that 100% auxin had the average highest percent of change in growth. We also tested the dry mass of the roots, and found that the roots treated with auxin had heavier dry mass. Our results show that 100% auxin shows the most promise for future plans.

Conclusions/Discussion

In conclusion, our hypothesis was not supported. The combination of 75% gibberellin/ 25% auxin only had the highest percent of change for buds. Our data shows that 100% auxin had the highest percent of change overall for leaves, buds, flowers, and pods. We feel the concentration of 0.0005 percent auxin shows the most promise in our plans for replacing unnatural plant regulators with natural hormones.

Summary Statement

We applied auxin and gibberellin to brassica rapa, and found 100% auxin best increased rate of plant growth.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Caitlyn R. Robinson

Project Number
J1922

Project Title
Organic vs. Synthetic Fertilizers

Abstract

Objectives/Goals
The objective of this project is to determine if a synthetic fertilizer (miracle-gro) will make the plants grow at a faster rate than the organic fertilizer mixes. The goal of this project was to correlate pH, N, K and P levels within each soil mixture and determine how each soil / fertilizer mixture effects the height and stalk diameter growth of the plants over time. Additionally, pre-germination of the seeds was undertaken prior to planting to determine if this made a difference in plant growth.

Methods/Materials
Each organic fertilizer/soil mixture to be tested was generated by mixing 1 part of organic fertilizer with 3 parts of home garden soil. Each soil mixture was tested for pH, N, P and K at the start and at a 1 month time point during the experiment using a Luster Leaf Rapidtest soil test kit. In two separate experiments, seeds were either directly planted into the soil /fertilizer mixtures in individual pots; or pre-germinated prior to planting. Plant heights and stalk widths were measures at weekly intervals to generate growth curves.

Results
In experiment 1 where seeds were planted directly into the soil to germinate, the synthetic fertilizer soil mixture produced superior growth in both height ans stem thickness over a 3 month period. Of the organic fertilizer mixes, chicken manure produced the next highest growth and stem thickness. In experiment 2 where seeds were pre-germinated prior to planting in the early stages of plant growth the synthetic fertilizer produced superior growth in both stem and plant height. However at the end of the experiment the organic fertilizer mixes had plant and stalk thickness growth greater than the synthetic fertilizer. This may show that organic fertilizers slowly release their nutrients to the soil over time such that plants gain growth benefits longer.

Conclusions/Discussion
The results of my experiments have shown that synthetic, store bought fertilizers do indeed induce rapid growth among plants. Nevertheless, the natural and organic fertilizers we created and tested also produced healthy plants despite their early slower but steady growth rates. If organic farmers can supplement and condition their soils with natural fertilizers such as used in this experiment, then these fertilizers break down more slowly over time providing plants sustained nutrients over a longer time period.

Summary Statement
In this experiment I showed that synthetic fertilizers and organic fertilizers produced different plant growth patterns over time.

Help Received
I designed, built, and performed the experiments myself with the help of my Mum and Dad

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Mason L. Rodgers

Project Number
J1923

Project Title
The Effects of Different Water Sources on the Growth Rate of Wheat

Abstract

Objectives/Goals
My project objective was to grow wheat with distilled, tap, Colorado, and New River water and compare the growth rate.

Methods/Materials
Silica sand was poured into 4 aluminum pans about 4 cm deep. Next, 250 milliliters of wheat seeds were poured over the silica sand and spread evenly. A small amount of silica sand was sprinkled over the seeds. After the seeds were prepared to grow, each pan was watered with 1000 milliliters each day with the designated water source. Finally, wheat growth was measured and data was recorded for 15 days.

Results
Colorado River water wheat growth was the greatest at 14 cm, a growth rate of .93 cm a day. Wheat growth from the tap water was the second greatest at 9 cm, a growth rate of .60 cm a day; distilled water wheat growth was third reaching 7 cm at a rate of .47 cm per day; and New River water had the least growth reaching only 4 cm, a rate of .27 cm per day

Conclusions/Discussion
Wheat growth was the greatest using Colorado River water most likely due to higher levels of nutrients and minerals. Mineral and nutrients in tap water may also explain why the wheat that received tap water had the second highest growth rate. On the contrary, the New River water is highly polluted with waste and agriculture run off and this pollution may have limited the growth of wheat.

Summary Statement
I grew wheat and measured the differences in wheat growth using difference sources of water.

Help Received
I prepared the seed beds, obtained the water sources, and measured the growth myself. A farmer provided the seed.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Aylin G. Salahifar

Project Number

J1924

Project Title

Comparing Effects of Biodegradable vs. Biobased Laundry Greywater on Impatiens Flowers

Abstract

Objectives/Goals

The objective of the study was to investigate which environmentally safe laundry detergent would be less detrimental towards plants in the effort to conserve household water by recycling laundry water in daily life.

Methods/Materials

Each trial of the experiment consisted of three Arabidopsis thaliana plants grown from the seed. One receiving a biobased laundry detergent greywater, the second one a biodegradable laundry detergent greywater, the final plant only tap water. Plant height and number of leaves were recorded over 3 replicates.

Results

The plant nourished with biodegradable laundry detergent greywater responded the most adversely to its solution. This plant displayed lower growth rates as well as decreased leaf counts. Contrarily, the plant nourished with biobased laundry detergent and the control plant grew at comparable rates with the control plant ending the experiment with a higher count of leaves.

Conclusions/Discussion

In conclusion, a system that might utilize household greywater to water vegetation and plants should consider using biobased laundry detergent greywater. The plant nourished by biobased laundry detergent greywater performed much better than the biodegradable laundry detergent greywater because of the organic and inorganic chemicals found in each detergent respectively. Ultimately, this will result in decreased consumption of clean household water for watering plants in an environmentally safe way.

Summary Statement

Three Arabidopsis thaliana plants were nourished with biobased and biodegradable laundry detergent greywater. By comparing the height and number of leaves of each plant, I am able to demonstrate that use of biobased laundry detergent grey w

Help Received

My mentor and teacher, Dr. Gregory Lampard, helped me obtain the Arabidopsis thaliana seeds necessary for the project. He also provided a protected environment in his classroom to grow the plants. My parents helped me prepare greywater solutions and purchased the necessary material for this experiment. I

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Trevor D. Schwarz

Project Number
J1925

Project Title
Grow with the Flow

Abstract

Objectives/Goals
The objective of this study is to determine which hydroponic soil supplies key nutrients to the plant in a hydroponic system.

Methods/Materials
283 liter tank, to store the water
40 liters of GS-1 Hydro Stones
40 liters of Hydrocorn
40 liters of regular potting soil
75 seedling pot holder
2 packs of Romaine Lettuce (each containing 100 seeds)
2 Hydroponics tray (250 cm by 182 cm)
Outdoor Garden
A Pump (Pump water to the top of the tray)
PVC pipes
Jiffy Pellets
Ebb and Flow System
Hydroponic pots
Ph Tester

Results
The GS-1 Hydro Stones in the experiment were the pest hydroponic soil in the experiment because it supplied key nutrients to the plant. The performance of the Regular Potting Soil was shown to be more effective.

Conclusions/Discussion
The performance of the Hydrocorn for trying to help supply ket nutrients to the plant was more effective than Regular Potting Soil. This means the GS-1 Hydro Stones can provide key nutrients to the plant.

Summary Statement
I grew Romaine Lettuce seedling from start then transferred them into a hydroponic system to test which soil is the best and supplies key nutrients to the plant.

Help Received
My math, science teacher and administrator for ASB explained the goals I have to achive for this project.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Jada Smith

Project Number
J1926

Project Title
Hydroponic vs. Soil

Abstract

Objectives/Goals
Design a hydroponic system. Record differences in growth (height, weight leaf area and color) between the hydroponic system and the soil grown plants.

Methods/Materials
Hydroponic system made from aquarium and various other parts, fertilizer, soil, grow light, digital scale, photoshop. Record and compare height, weight, leaf area, and color.

Results
I grew radish plants two different ways to compare their health based on, height, weight, leaf area, and color. There were three trials for each procedure of growing radishes to ensure accurate results. At the end of three weeks, the soil grown radishes measured to be healthier in every way by my standards.

Conclusions/Discussion
The purpose of my project was to determine if hydroponics produced healthier plants than soil grown plants. Although my experiment implies that soil is the better choice, this is not necessarily the case. My project shows that hydroponics can be complicated and needs more expertise to be done correctly. Because my experiment did not go as planned, I can come up with ideas on how to revise and redo this project .

Summary Statement
My hypothesis that hydroponically grown radishes will be healthier based on height, weight, leaf area, and color, was not supported by my experiment.

Help Received
I was helped with the design and construction of my hydroponic system by my dad. Everything else, from experiment to observations, was done by myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Vybhav Upadhyayula

Project Number
J1927

Project Title
The Effect of Irradiation on Radish Plants

Abstract

Objectives/Goals
The objective was to determine the effects of 50krads, 150krads, 500krads, and 4000krads versus 0krads of gamma ray exposure on the vertical stem growth and physical appearance (number of leaves, steam thickness, and root length) of radish plants.

Methods/Materials
Irradiated radish seeds ordered from a supply company were grown under a 60 watt grow light and were given 75 mL of water every alternative day for 3 weeks. At the end of 3 weeks' recordings of their final vertical stem growth and physical appearance were recorded in the log book.

Results
The radish seeds which were exposed to less amounts of radiation had significantly larger stem growth, healthier physical appearance (more leaves, thicker stems, and longer roots). The control which was not exposed to any radiation did the best, the next best was seeds exposed to 50krads, and so on.

Conclusions/Discussion
The data recorded exactly reflected the hypothesis. The radish plants infected with more radiation did poor in vertical stem growth and the quantitative physical appearance, as the control averaged the best in both categories. As illustrated, drastic increase in gamma radiation has harmful effects on the radish plants hindering their ability to survive. Further research may include using a protein-hydrogen solution, which acts as a counter-agent to the radiation, to see whether it benefits the plant. Results of this project benefit the farmer population of the world.

Summary Statement
I found the effects of various amounts of gamma ray exposure on the vertical stem growth and physical appearance of radish plants.

Help Received
None. I researched and conducted the experiment myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Maggie R. Watts

Project Number
J1928

Project Title
Comparing Impacts of Different Hydroponic Methods on Plant Growth

Abstract

Objectives/Goals
I chose to investigate hydroponics because I was thinking of the future of environmental issues. The goal of this project was to test three methods of hydroponics and find the most effective method at the least expense. I tested three hydroponic methods: Coco/Fabric Pots, Clay Pebbles/Deep Water Culture and Rock Wool/Deep Water Culture. I hypothesized the most productive hydroponic method would be the Coco/Fabric Pot method because I thought the Coco/Fabric method would promote the best root growth.

Methods/Materials
My materials consisted of 36 pea plants and three different hydroponic systems. My 42 procedures were set up according to each hydroponic system. I followed the plants through the flowering and pea pod formation for approximately 60 days. I documented plant heights, pea blossom ratios, and plant survival.

Results
The largest percent change in plant height was the Clay Pebbles/Deep Water Culture, with a 40% average increase in plant height. Similarly, the Coco plants had a 36% average growth increase. The Rock Wool method plants reflected only a 5% growth increase. During the 60 day period, 33% of the Rock Wool plants died, 25% of the Clay Pebbles Plants perished, and at the end of the 60 day period, all of the Coco Plants were alive and healthy. I also measured blossoms and their conversions to peas. The Coco plants produced the most blossoms, 34, with 50% of those blossoms became peas. The Clay Pebbles produced 29 blossoms, with a 45% conversion rate to peas. The Rock Wool plants produced the fewest blossoms, 26, but 65% of those blossoms became peas.

Conclusions/Discussion
While observing these hydroponic plants, I found that the most effective hydroponic method was the Coco/Fabric Pot method. With the Coco/Fabric Pot method all of the plants flourished throughout the 60 day observation period. The Coco plants had stronger looking stems, a denser root system, and more leaves and blossoms than the other two methods.
Throughout this project I learned about how different hydroponic methods function, why they work that way, which of these methods are the most effective, general gardening information, history of hydroponics, and information on large hydroponic farms. This project is important for the future because when environmental issues become challenging, hydroponics might be a solution to keep the air clean, grow plants, enjoy gardening, and accomplish it all in a small space.

Summary Statement
The goal of my project was to test three methods of hydroponics and find the most effective method with the least expense.

Help Received
An employee at Encinitas Hydroponics taught me about hydroponics and gave me a student discount on my materials.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Xavier D. West

Project Number
J1929

Project Title
Cryogenics

Abstract

Objectives/Goals
The objective of this study is to measure the effect of cryogenic treatment on sunflower, cat grass, and pea seeds for efficacy of matter preservation.

Methods/Materials
Dry ice used to achieve a below-zero temperature environment. Some seeds immersed in dry ice for 24, 48, and 72 hrs and some seeds kept at room temp. After 3 days all seeds planted into seed starters with regular soil and watered every other day. Plant growth measured weekly.

Results
Cryogenics did not affect the rate of seed germination significantly. All plants grew; however, seed matter with cryogenics exposure grew slower than seed matter without it.

Conclusions/Discussion
The cryogenics effect on matter indicates living matter may be preserved during space travel or space living. Use of cryogenics could also extend into medical treatments, by preserving living matter until further treatment or testing may be done to stall disease processes.

Summary Statement
As measured by growth over time, I found that cryogenics harmlessly preserves living matter.

Help Received
My math teacher explained the statistical analysis of data I collected.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Kelly A. Zybura

Project Number
J1930

Project Title
Big vs. Tall: The Redwood

Abstract

Objectives/Goals
The objective is to determine if there is a ratio that describes the height of a redwood tree compared to its base circumference.

Methods/Materials
I used the equation of tangent, given the length one of the sides and the angle, to find the length of the other side. I built a protractor to use in gauging the angle (x) from the ground to the top of the tree from a distance of 20-200 feet. I measured the distance (A) to the base of the tree with my paces. I then measured the circumference of the base of the tree with a tape measure hand made from twine that could wrap around the trunk. I calculated the height of the tree (O) according to the following formulas: tan(x) = O/A, or O = A*tan(x).

Results
Several local trees were measured and their data graphed. The graph of tree height versus tree circumference shows a curve resembling the logarithmic relationship. This is represented by the formula f(x) = log(b) (x), where x is the tree circumference, f(x) is the tree height, and b is the logarithm base.

Conclusions/Discussion
Rather than a ratio, a distinct relationship called the logarithmic relationship was observed between a redwood tree's base circumference and its height. I believe I found this relationship to be true because of the nature of how redwood trees grow in clusters. I presume that these trees grow very tall very fast because they need to compete for sunlight. Also I conclude the redwood trees tend to slow their growing once they have reached a height where they can get enough sunlight to thrive. Meanwhile, the circumference of redwood trees continues to get larger no matter the height because the trees add a ring to their main trunk every year they are alive.

Summary Statement
I discovered a logarithmic relationship between the base circumference and height of redwood trees near my home in Santa Cruz county.

Help Received
I built the materials myself. My parents helped with performing measurements requiring more than two hands, and also helped me explore different mathematical relationships to explain my data.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Nicholas A. Toscano

Project Number
J1999

Project Title
Acid Rain and Aquatic Plants

Abstract

Objectives/Goals
The objective of the experiment was to determine the affects of acid rain, vinegar, on aquatic plants.

Methods/Materials
20 Bamboo plants
5 Identical 2 quart containers
Ruler
10 quarts of distilled water
250 Milliliters of vinegar
Small Rocks
Place 4 bamboo plants in 5 groups in the 2 quart containers that are filled with water and small rocks.
Measure each plants, with the designated amount of vinegar, every day for 20 days with a ruler.

Results
Several plants, which were put in groups of 4 and had a designated amount of vinegar, were measured for 20 days. Results determined that any group of bamboo plants that were exposed to vinegar had a drastic decrease in growth than the plants that were not exposed to vinegar.

Conclusions/Discussion
Results determined that acid rain, vinegar, made the plants grow less than they should.
This means acid rain does affect the growth of aquatic plants.

Summary Statement
I proved that acid rain, vinegar, affects aquatic plants in a negative way.

Help Received
The experiment was conducted on my own, but I was helped with the writing by my homeroom teacher.