CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Noorhan Z. Amani

Project Number

J1901

Project Title

Biochar: A Rediscovered Soil Amendment and Its Effects on Plant Growth

Abstract

Objectives/Goals

A safe, sustainable, and environment-friendly soil additive is a demand of the time. Biochar is one such soil amendment which is a finely grained charcoal made by pyrolysis, the process of heating biomass with limited or no oxygen. The purpose of this project was to evaluate the effect of different concentrations of biochar on plant growth and soil quality and compare its effectiveness with regular fertilizer.

Methods/Materials

Soil containing different concentrations of biochar were used to compare their effect on plant growth over three, four week long period. For each trial seven flower pots were filled as follows:
#1: Nutrient poor sandy loam soil
#2: Sandy loam mixed with fertilizer
#3: Sandy loam mixed with 10% Biochar
#4: Sandy loam mixed with 25% Biochar
#5: Sandy loam mixed with 50% Biochar
#6: Sandy loam mixed with acid and 50% Biochar
#7: Sandy loam mixed with fertilizer and 50% Biochar
20 radish seeds were planted in each pot. After germination the seedlings were thinned out leaving five plants in each pot. The height, biomass and root length of the plants were recorded at the end of the four week period. Soil from each pot was tested for soil bulk density, water retention capacity, and pH.

Results

The results showed that there is a positive relationship between plant growth (height and biomass) and concentration of biochar in the soil. Plant growth was enhanced as the concentration of biochar was increased and plants grew better in soil with the highest concentration of biochar compared to soil containing only fertilizer. It was also found that biochar enhanced soil quality by reducing soil bulk density and increasing soil water retention capacity and pH. Overall, the use of biochar had a positive influence on plant growth in all the samples, the exception being acidic soil sample where it failed to improve plant growth. The pH of all the soil samples increased due to biochar.

Conclusions/Discussion

A significant improvement in growth (both height and biomass) is seen in plants as the concentration of biochar increases in soil.It was also found that biochar application reduces soil bulk density, increases soil water retention capacity, and increases soil pH. Findings from this project show that biochar offers promise to be an essential soil amendment in both the home garden and the farm in the future.

Summary Statement

Effect of different concentration of biochar on plant growth and soil quality compared to fertilizer.

Help Received

Science teacher provided pH meter and weighing scale.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Hannah O. Cevasco

Project Number
J1902

Project Title
Cuckoo for Coconuts

Abstract

Objectives/Goals
The purpose of this experiment is to see if coco coir, an eco-friendly, sustainable growing medium, can be used as a substitute for non-sustainable growing mediums. If coco coir is a successful alternative, it will reduce the amount of marshlands and trees that are harvested to produce non-sustainable growing mediums.

Methods/Materials
To conduct this experiment, 473 quarts of coco coir, "Earthgro" potting soil, and a custom blend of growing mediums labeled as "RCN" mix were evenly divided into 96 (43) ounce pots. Then, 402 quarts of peat moss and 71 quarts of perlite were mixed together and divided in to 32 pots for a total of 128 pots. 32 geraniums, euphorbia, and fuchsias were planted in 96 pots(1 per pot). The remaining pots were filled with 2 radish seeds each. All 128 of the plants were then placed in a greenhouse for the duration of the experiment. The height of each plant and the moisture content and ph of each growing medium category was measured on a weekly basis. Dry weight measurements and an advanced chemical analysis from a laboratory was done at the end of the experiment.

Results
The results showed that coco coir produced nearly the same data as the industry standard peat moss and perlite mix. Coco Coir was superior to the "RCN" mix and the "Earthgro" potting soil in all of the measurements. The moisture chart shows that coco coir has a high water capacity and the data in the ph chart was similar in all of the collections. In the dry weight measurements, coco coir and the peat moss and perlite mix produced plants with the most dry weight. Plants grown in "RCN" mix were heavier that plants grown in "Earthgro" potting soil. The chemical analysis shows that all of the soils are within the general guidelines for potted plants.

Conclusions/Discussion
The conclusion for this experiment is that coco coir can be used as a substitute for the non-sustainable growing mediums it was compared to. This conclusion is significant to our environment because coco coir is a natural and eco-friendly alternative to growing mediums that can harm our environment.

Summary Statement
Comparing an eco-friendly growing medium to non-sustainable mediums to save our environment.

Help Received
Mother reviewed written work . Mother and Uncle accompanied me to weekly data collection and helped me figure out when to water the plants and how to care for them best.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
James D. Cobb

Project Number
J1903

Project Title
Does Garden Safe Weed Preventer Hurt Plants?

Abstract

Objectives/Goals
Test if pre-emergents effect the growth the raddish plants.

Methods/Materials
Planted 3 raddish seeds (72 individual containers)
remove unhealthy plants, only one healthy plant per container.
broke 72 containers into 3 sections (24 a piece)
added pre emergent (recommended amount into one section) (2x recommended in second section)
(3rd section is the control)
allow plants to grow. (2 weeks)
measure root lengths

Results
Control averaged 9.75 cm (root growth)
recommended 11.25
2X 11.75

Conclusions/Discussion
I learned that the pre-emergent not only doesn't hurt the plant, but helps growth, while preventing weed growth.

Summary Statement
Does Pre emergent impact plant growth?

Help Received
Teacher taught scientific method, provided classroom help with experiment. Parents helped in purchasing materials. They also helped put board together.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Marvia Cunanan; Katie Land

Project Number
J1904

Project Title
The Fruit Factor

Abstract

Objectives/Goals
Will a wounded avocado produce more ethylene gas than an avocado simply left alone?

Methods/Materials
4 Kitagawa tubes
1 Kitagawa aspiration pump
4 unripe bright green Haas avocados
Small notebook
Pencil
4 plastic large airtight snapware containers
Methods: Wound 2 avocados and leave 2 unwounded. All 4 avocados were placed in containers for 24 hours. After 24 hours, use Kitagawa tubes with aspiration pump to measure ethylene gas produced.

Results
Wounded avocados produce less ethylene gas than non-wounded avocados.

Conclusions/Discussion
Based on research, avocados are major ethylene producers and we hypothesized that wounded avocados would produce more ethylene gas than non-wounded avocados, because wounded fruits are supposed to produce ethylene faster than non-wounded fruits. However, our results proved otherwise. Thus, it is important to protect avocados during transport so they can produce more ethylene gas.

Summary Statement
Wounded avocados produce less ethylene gas.

Help Received
Friend helped lend Kitagawa aspiration pump.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Danielle M. DeBrine

Project Number
J1905

Project Title
It Is Clear to the Naked Eye... That Plants Grow Best Under PSI!

Abstract

Objectives/Goals
The purpose of this experiment is to determine whether plants grow best under low or high pressure, or at no pressure at all.

Methods/Materials
The method for this experiment included growing plants in containers at different levels under water. The containers were covered with a balloon to allow the pressure to enter the container. The following is the method and materials used:
First, cut four 8 x 8 squares out of paper towel. Add 2 ml of water to the paper towel squares after you place them in the bottles and place three radish seeds on each of the squares. Cover the top of each bottle with a balloon so the pressure can enter the bottle. Then, suspend the bottles into the water using the string/brick contraption. Be sure that the bottles are at the following depths:
- 7 feet 3 inches (on the bottom of the pool)
- 3 feet 3 inches (floating at a mid depth)
- 4 inches (floating near top of pool)

Repeat 3 times for replicate trials.

Results
The results of this experiment show that plants under greater pressure grow much faster. For example, the one under 3.3 psi (on the bottom of the pool) on day 3, trial 3, had grown 2.5 cm roots, while the control (which wasn't under any pressure) had only grown 1cm roots. Also, on day 7, trial 2 the plant at the 7 foot 3 inch depth had growth 3 cm while the plant at the 4 inch depth only had 1 cm of growth.

Conclusions/Discussion
The hypothesis was that plants would grow best under greater pressure, and the results have proven this. The results have proven the hypothesis because the seeds under greater pressure grew faster than the seeds exposed to lower pressure. This experiment expands our knowledge about plant biology because it shows that under pressure plants grow faster.

Summary Statement
The purpose of this experiment is to determine whether plants grow best under pressure.

Help Received
For assistance with this project, I got help from my Mom to edit my report. She also taught me how to make graphs on excel. My Dad also helped me take the pictures in this experiment. My Uncle, who is a physicist, also told me the effect the balloon had on the pressure in the container.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Grace A. Doyle

Project Number
J1906

Project Title
Measuring Plant Growth Using Greywater from Different Laundry Detergent Solutions

Abstract

Objectives/Goals
I wanted to know which laundry soap solutions would be safe for our garden plants and our local environment (garden drains to a local creek). Would laundry solutions be safe for the plants or kill them? My hypothesis was that plants watered with laundry solutions containing perfume, dyes and bleach would not sprout, die sooner or seem less healthy than plants watered with bio-degradable solutions free of perfume, dyes or bleach. I thought that plants that were watered with plain tap water would be the healthiest.

Methods/Materials
Potting mix, seeds, starter plants, combinations of laundry soaps: Red Solution: 2X Ultra All liquid with dye and perfume, Purple Solution: Arm and Hammer powdered detergent - free of perfume and dye, Yellow Solution: Trader Joe's liquid laundry detergent with AND (Blue Solutions:)without liquid Bleach, Tap water.

Results
Red Solution: average growth of 6.58 inches. The plants seem to be healthy. Purple Solution: average growth of 2.08 inches. These plants seemed to grow more slowly and one seed sprouted and then died. Yellow Solution: average growth of 6.41 inches and these plants seemed very healthy. Blue Solution: average growth of 7.86 inches and seemed very healthy. Tap Water: average growth of 5 inches. One plant died just after it sprouted. These plants seems to have average health.

Conclusions/Discussion
My hypothesis was mostly wrong. The plants watered with solutions that had perfume, dye and bleach did well, better then than the plants watered with tap water. The Arm and Hammer solution plants were the worst, it was the only powdered detergent. I learned that powdered detergent sometimes has other chemicals not found in liquid detergent that can harm the environment . For the plants that did well, even with bleach, perhaps the soil absorbed some of the harmful chemicals. If that is true, then soil is holding these chemicals and they could be washed into our local creek if we use them so they should be avoided. I did not grow the plants to their full life or taste the radishes or snap peas to see if the different solutions effect taste. This may make a difference and I will find out when we use some of these solutions in our garden this summer.

Summary Statement
I used different greywater laundry detergent solutions to water plants to determine which solutions produce the healthiest plants

Help Received
My Father was with me when I recorded the data each week and my Mother showed me how to make graphs and charts with my data

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Kalea R. Fajardo

Project Number
J1907

Project Title
Does Talking to Plants in Different Tones of Voice Affect Their Growth?

Abstract

Objectives/Goals
The objective of this experimentation was to determine whether or not talking to plants in different tones of voices would affect how tall they could grow in a seven-day period.

Methods/Materials
Materials included mung beans, water, paper towels, a small bowl, scissors, three eighteen-ounce cups, and soil. To conduct this experiment, I planted the mung beans and spoke in different tones to each plant. One tone was mean; one was nice; and another was left as a control. Three trials were performed.

Results
The ones that were nicely talked to grew the tallest in two out of three trials. In all three trials, the plants spoken to meanly did not grow very well. This means that plants respond well to encouraging dialogue.

Conclusions/Discussion
The hypothesis for this project was actually correct. I have learned that plants do respond differently to different tones of voice. Next time, I would like to conduct this experiment in the spring. These results could be taken further by scientists. They could test more tones of voice, and with their findings, they could help farmersâ## crops grow better by communicating to them which tones stimulate plant growth the best.

Summary Statement
My project is about the effect of different tones of voices on plantsâ## growth.

Help Received
Mother helped design the board. Grandparents gave advice on how to best grow the plants. Mrs. Vena, my science teacher, guided me in executing a successful and well put together project.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Garrett C. Gaines

Project Number
J1908

Project Title
Fertilizer and Water

Abstract

Objectives/Goals
My objective was to determine how different types of water (tap vs. distilled) and fertilizer (organic vs. inorganic) affected plant growth.

Methods/Materials
Experiment was done in two stages. Stage one was the germination process, growing 150 Alaska Pea Plant (Pisum Sativm) seeds in a greenhouse kit to seedlings in a 14 day period using tap and distilled water. Stage two, seedling to plant, was 15 days long and involved 8 different conditions of 32 seedlings (91 total trials) that were grown in 18 ounce plastic cups. One organic and two inorganic potting soils (independent & categorical variables) were used, as well as soil from my front yard that wasn't fertilized, which was the control condition. Each soil mix was watered with distilled and tap water (independent & categorical variables). Measurements were taken weekly in centimeters(cm) to ascertain which of the 8 conditions resulted in the Alaska Pea Plant growing the most (dependent & continuous variables).

Results
The second stage of the experiment provided the data that enabled me to determine if my hypothesis was supported. A detailed data summary analysis (Table 5) highlights the mean, median, minimum and maximum plant growth of Pea Plants grown in the four soil mixes by liquid type (Tap or Distilled).

Conclusions/Discussion
My hypothesis was proven correct. Seedlings planted in inorganic potting soil and watered with distilled water resulted in the Alaska Pea Plant growing the most. Soil mix and liquid type both contribute positively to plant growth, but the liquid type chosen has more impact on plant growth than any soil mix. When compared with the control soil mix, real dirt, there's a 36.4% increase in the average plant growth rate of all inorganic and organic soil mixes whose liquid source is distilled water vs. 6.9% growth rate when tap water is utilized.

All water is not equal. Distilled water's impact on plant growth is much greater than tap water. The chemicals and impurities that are in tap water(chlorine,fluoride,etc.) obviously can negatively impact the growth rate of plants. The type of water used is more important with household plants than outdoor plants because of the chemical buildup that takes place in the soil around the root ball. The results of my experiment are very relevant to the household gardener, who should carefully evaluate the best type of liquid source for indoor plants.

Summary Statement
To determine the effect different types of water (tap vs. distilled) and different types of fertilizers (embedded in organic & inorganic "potting soils") have on plant growth.

Help Received
My dad bought the materials for the experiment, assisted in setting up the experiment, and helped edit my report.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Megan A. Greenwood

Project Number
J1909

Project Title
Investigating the Effectiveness of Aquatic Duckweed in Testing Agricultural Soils for Their Fertility Level

Abstract

Objectives/Goals
My project was to determine if aquatic duckweed is effective in testing agricultural soils fertility levels.

Methods/Materials
Soil samples from five different agricultural crops were obtained (almond, orange, vineyard, strawberry, and vegetable crops). A solution was made using distilled water and 2 cups soil, and straining through cheese cloth. The solution was equally divided among 5 glass containers. This procedure was repeated for the other four soil samples. A control with 60 duckweed fronds and distilled water was set aside. 60 duckweed fronds were placed in each of the 25 glass containers. Every 7 days for 21 days the contents of each glass container was counted and compared to the control. Trial 2 was performed in the same manner.

Results
Trial 1 indicated that almond was the most fertile when compared to the other soil/solution samples and the control sample. At the 21st day almond averaged 145.8 duckweed fronds per container compared with control at 101, vineyard at 106.6, vegetable at 105, orange at 107.6, and strawberry at 104 duckweed fronds per container.

Trial 2 indicated that strawberry was the most fertile when compared to the other soil/solution samples and the control sample. At the 21st day strawberry averaged 114.2 duckweed fronds per container compared with control at 98.6, vineyard at 109, vegetable at 97.4, almond at 109.6, and orange at 110.6 duckweed fronds per container.

Conclusions/Discussion
Duckweed was effective in determining agricultural soils fertility levels. In trial 1 the growth of duckweed in the almond soil solution was higher than the growth in the control and other soil solutions tested.

In trial 2, the growth of duckweed in the strawberry sample was higher than the growth in the control and other soil solutions tested.

Summary Statement
My project determines that aquatic duckweed is effective in testing agricultural soils for its fertility level.

Help Received
Father helped put board together, mother typed report, neighbor helped obtain duckweed

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Sophia A. Harrison

Project Number
J1910

Project Title
The Effect of Temperature on the Growth of Red Radishes with Symbiotic Endomycorrhizae

Abstract

Objectives/Goals
To find the optimal temperature range for endomycorrhizal radish root colonization and the effect of endomycorrhizae and temperature on production of radish biomass.

Methods/Materials
I placed six identical storage bins with sterilized soil in three different temperature zones: 7C, 18C, 26C. Each temperature zone had one bin with 120 grams of endomycorrhizal fungi and one without. I placed four 50 watt growing lamps in the 7C and 18C zones mimicking outdoor photo period. The 26C zone was covered with plastic wrap and put in the sun to produce enough heat. Each bin was planted with red radish seeds. After 4 weeks I extracted the radishes and measured fresh weight. I measured mycorrhizal colonization of the roots using .05% acidic stain. I counted the total horizontal and vertical intersections of the roots with a graph paper grid. Under a microscope I counted intersections where the root was mycorrhizal (stained pink). The sum of the mycorrhizal intersections divided by the sum of total intersections equals the percentage of colonization. Lastly I dried all radish roots and measured dry weight.

Results
Measured in grams FW: Fresh Weight DW: Dry Weight. 7C with fungi FW: 13 DW: 3 75% colonization. 7C without FW:4 DW: 1. 18C with fungi FW:20 DW:4 40% colonization. 18C without FW: 16 DW: 3. 26C with fungi FW:3 DW:0.5 21% colonization. 26C without FW: 2 DW: 0.2

Conclusions/Discussion
Radishes grown with endomycorhizae in all climates produced more biomass than the non-mycorrhizal radishes. Mycorrhizae improves uptake of essential plant nutrients and water. At 18C, radishes with and without fungi had their maximum growth. At this temperature both bins had the highest biomass because 18C is the idea temperature for growing radishes. The mycorrhizal colonization of radishes was highest at the lowest temperature 7C. Endomycorrhizae lives in soil at the same depth as radish roots. The average temperature at that depth is about 5C which is close to the temperature where I found mycorrhizal colonization to be highest. By natural selection the mycorrhizal enzyme system evolved to function best at 5C.

Summary Statement
Finding the temperature at which endomycorrhizae and radishes produce the most biomass can improve agriculture in poor soil and drought conditions as well as show a producer which temperature yields the most crop with the fungi.

Help Received
Mrs. Levine, my science teacher, helped me with experimental design and helped answer many of my questions. My parents bought materials and helped type.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Ananya Karthik

Project Number

J1911

Project Title

Mighty Microgreens? Investigating the Effect of the Maturity of Plant Greens on Their Nutrient Contents Using HPLC

Abstract

Objectives/Goals

The benefits of plant nutrients are studied extensively for cancer prevention, blood sugar, and cardiovascular diseases. Greens provide an abundance of vitamins for human health. Microgreens are immature, vibrant, and flavorful greens harvested at the cotyledon stage that have become a popular culinary trend. Scientific data on the nutrient content of microgreens is very limited, so this project investigated how the maturity of plant greens affects their nutrient contents. Based on research, it was hypothesized that the nutrient content will decrease as the maturity of the plant increases.

Methods/Materials

6 microgreens chosen: kale, chard, cilantro, mustard, arugula, and red cabbage; 4 vitamins tested for: B9, C, E, and K. Independent variable: maturity of the greens. Dependent variable: nutrient content of the greens. Controls: vitamin standards. Sample preparation involved juicing, high speed centrifugation, and filtration (0.45 µm nylon filter), followed by addition of water:methanol:acetonitrile (60:30:10 v/v). Vitamin content of the microgreens was determined by reverse-phase HPLC with a mobile phase of water:methanol:acetonitrile (60:30:10 v/v) . Chromatogram was used for qualitative and quantitative analysis of the data. Tests were in triplicates to ensure consistent results. Vitamin concentrations of microgreens and mature greens (USDA national nutrient database) were compared.

Results

Rainbow chard had the highest vitamin C content (27 times greater than mature chard); cilantro had the least. Vitamin B9 was highest in kale (26 times greater than mature kale); lowest was in red cabbage. All microgreens tested had higher vitamin C and B9 contents compared to their mature counterparts. Data for vitamin E and K was not interpretable after trials.

Conclusions/Discussion

Since microgreens are harvested right after germination, all the nutrients they need to grow are present. Therefore, nutritional compounds in the microgreens are highly concentrated. Hypothesis was supported. Simultaneous analysis of water and fat soluble vitamins is a difficult task due to the range of chemical structures involved - the reason for uninterpretable data for vitamins E and K. My experiment may be used as a reference for health agencies' recommendations, consumers' choice of vegetables, and as part of school lunches. Microgreens may help eliminate the practice of replacing whole food nutrition with vitamin supplements.

Summary Statement

This novel project investigates the nutrient contents of microgreens compared to mature greens; it introduces microgreens as a convenient, concentrated, and flavorful means for a daily shot of vitamins, leading to a healthy life.

Help Received

I acknowledge my family and teacher for their support; Dr. Terrill from SJSU for guidance with the HPLC.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Alisa Khodos

Project Number
J1912

Project Title
Plants: Who's the Waterholic?

Abstract

Objectives/Goals
My objective was to prove that different types of plants have different evapotranspiration rates, which affect the amount of water they use. I predict that cactuses would evapotranspirate the least, succulents- a little more, and flowers- the most water.

Methods/Materials
5 succulents, 5 cactuses, and 5 flowers were planted in same-size pots with same-type soil. Throughout 6 days, the plants were daily weighed on a gramm scale and watered with the amount of water they evapotranspirated during the 24 hours. The obtained data of evapotranspirated water was recorded and used to calculate the total and the average daily evapotranspiration rate for each type of plant to compare their water use.

Results
The average daily evapotranspiration rate in flowers was approximately 4 times higher than in cactuses or succulents. But cactuses and succulents required almost equal amounts of water.

Conclusions/Discussion
My hypothesis was correct: cactuses and succulents do require less water that flowers. This knowledge can be used in landscaping in California and other dry-climate areas to conserve water by planting drought-tolerant plants.

Summary Statement
I studied evapotranspiration rate to prove that different types of plants require different amount of water.

Help Received
My mother bought the equipment and helped me with Excel, and my father made a board stable.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Kendyl M. Lassley

Project Number
J1913

Project Title
What Effect Do Different Fertilizers Have on the Vitamin C Content of Steamed Vegetables?

Abstract

Objectives/Goals
The purpose of my science project is to determine what effect different fertilizers have on the vitamin C content of steamed vegetables. The reason I am doing this investigation is to find the healthiest way to grow vegetables. If we are going to eat vegetables to keep us healthy we should try to maintain its nutritional benefits. I am using organic and inorganic as my fertilizers to grow vegetables.

Methods/Materials
1. Garden pots 9. carrot seeds 17.Steaming basket
2. Water 10. Broccoli seeds 18. Stove top
3. Potting soil 11. Winter squash seeds 19. Drainer
4. Organic fertilizer 12. summer squash sees 20. Test tubes
5. Inert fertilizer 13. Measuring cup 21. Marker
6. Green house 14. Knife 22. Log book
7. Seed starter 15. Cooking pot 23. Gloves
8. Cutting board 16. Vitamin c test solution 24. Vitamin c control

I will be using plain potting soil to grow vegetables as my control. Which I will steam vegetables for 5 minutes, I will then use a food nutrient kit to determine the levels of vitamin C, and will record results in data book. In my testing I will add fertilizer to soil to grow vegetables. Then I will steam vegetables for 5 minutes, I will then use a food nutrient kit to determine the levels of vitamin C, and will record results in data book. I will repeat this test with other fertilizer and perform 10 trials per test group. The experimental test variables that I am using in my science project are: organic and inorganic fertilizer.The vegetables that I am using are broccoli, carrots, winter squash and zucchini.

Results
The results of my investigation to determine what effect different fertilizers have on the vitamin c content of vegetables show that all the methods of growing vegetables contained vitamin C, However growing broccoli with inorganic fertilizer was slightly more effective.

Conclusions/Discussion
After completing my project what effect do different fertilizers have on the Vitamin C content of vegetables, I have found that my hypothesis is incorrect, growing broccoli with Inorganic fertilizer actually maintained and supplied the most vitamin C.

Summary Statement
Picking vegetables, grown and prepared the right way will allow us to get the most nutritional benefits: if we are going to eat our vegetables to stay healthy we should grow and prepare them in a way that wil offer the most nutrients.

Help Received
Mother helped with typing

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Sydney L. Marler

Project Number
J1914

Project Title
The Effect of the Strengths of Electromagnetic Fields on Various Characteristics of Garden Bean Development

Abstract

Objectives/Goals
My objective is to discover what effect the occasional presence of electromagnetic fields of varying strengths have on aspects of height, width, and pigment of a garden bean plant indoors in partial sunlight.

Methods/Materials
Using 3 "seed starting" containers with ten soil pods and dividers, I planted 30 Garden Bean seeds exactly 1 centimeter into the soil. I constructed a copper wire apparatus (wrapped 6x around the Group A container and 4x around the Group B container). Both copper wires were connected to an "on/off" switch and powered by a battery. One container had no electromagnetic field apparatus and was reffered to as the control group. All plants were given the same amount of water on the same days and the temperature never fell below 72 degrees. Each day, between the hours of 5 and 8 pm the electromagnetic field was "on" for exactly 30 minutes. This occurred for six weeks, taking observations and photos every Sunday.

Results
When the experiment was conducted, there proved to be a tremendously noticeable growth speed in plant Group A. At week 4 of development, Group A#s average height was substantially different from Group B or C. At the end of six weeks, Group A was 33% taller on average than Group B and 31% taller than Group C. Group C was a close 2% taller than Group B on average. In terms of width, Group A was 36% wider on average than group B and 34% wider than Group C. Again, Group C was 2% wider than group B. A total of 12 bean seeds showed no growth in height or width and were possibly losing out in competition for water with bigger plants. Pigment results were as expected and did not seem to have any correlation to the electromagnetic fields. The majority of plants had a medium green pigment. Several plants lost pigment as the experiment progressed, but it was evident that taller plants prevented proper chloroplast production with sunlight.

Conclusions/Discussion
My conclusion is that the strongest electromagnetic field in group A impacted the plants' productivity and speed significantly compared to other plant groups. However the slight increase in growth in group C compared to Group B could be a result of a minimal changes such as the placement of plants or Group C receiving a byproduct of the nearby electromagnetic fields.

Summary Statement
I researched the effects of occasional electromagnetic fields on Garden Bean plants in terms of height, width, and pigment.

Help Received
Father and Mother funded experiment: Father turned "on" the electromagnetic fields while I was away.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Eric N. Nguyen

Project Number

J1915

Project Title

The Effects of Container Size on the Ascorbic Acid Content of Solanum lycopersicum

Abstract

Objectives/Goals

The objective is to determine whether potted Solanum lycopersicum plants' container size can affect the ascorbic acid production by its fruits.

Methods/Materials

Six Solanum lycopersicum plants were grown in three different container sizes (24.57 L, 15.14 L, and 10.85 L) over a period of 2.75 months and watered regularly. Afterwards, two fruits were harvested from each of the plants and blended. Using a starch-iodine titration, the ascorbic acid content of each plant's tomatoes was calculated. The data of each plant's tomatoes was then analyzed and compared to those of the other fruits tested.

Results

It was found that Solanum lycopersicum plants grown in the largest containers had fruits with an average Vitamin C ratio of 1.3636mg per given tomato volume of 10cm3, whereas those in the smallest containers had 0.96365mg of Vitamin C/ 10cm3. Solanum lycopersicum plants grown in the middle sized containers had an average of 1mg/10cm3.

Conclusions/Discussion

The results indicate that increasing container size does have a positive effect on the ascorbic acid production by the fruits of the Solanum lycopersicum, supporting the hypothesis. As more soil space is given to the plants, a better development of the plant was established. Thus, more ascorbic acid was produced by the fruits, providing for a more nutritionally efficient harvest.

Summary Statement

Different sized containers were used to grow Solanum lycopersicum plants to test its effect on the fruits' ascorbic acid production.

Help Received

Family helped construct the board; Ridgecrest Intermediate School lent measurement lab tools.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Jacquelyn B. Opalach

Project Number
J1916

Project Title
Can Plants Predict?

Abstract

Objectives/Goals
The objective was to determine if the undergrowth species in a redwood forest can act as an indicator of the growth potential of overstory redwood trees. My hypothesis was that redwood trees would grow the best in areas where sword fern dominated the undergrowth.

Methods/Materials
To do this project, I went to three 31 year old redwood forest stands, each with a different dominant undergrowth species#sword fern, huckleberry, and salal. Using an increment borer, I extracted 10 increment core samples from 10 different redwood trees at each site, and then measured the past ten years of growth on each core. I also collected additional information by counting the number of neighboring trees within 10 feet around each sample tree and by measuring the diameter of each sample tree using a diameter tape.

Results
Over the past 10 years, redwood trees growing in the area dominated by sword fern had an average growth of 48.6 mm. while trees in the huckleberry area averaged 22.9 mm, and trees in the salal area averaged 29.3 mm. My data shows some interesting relationships between tree growth, neighboring trees, and tree diameter. In general, trees that had few neighbors grew exceedingly well while trees with many neighbors grew much less. Also, I found that larger trees grew faster than smaller ones.

Conclusions/Discussion
The results supported my hypothesis by showing that trees growing in association with sword fern have been growing almost twice as much as those growing with huckleberry or salal. The moist environment that sword ferns enjoy also benefits redwood trees tremendously. Foresters and botanists may find this information useful as they could easily identify the most productive areas of the forest without spending a lot of time and effort extracting and measuring increment cores.

Summary Statement
The purpose of this study is to determine if undergrowth species in a redwood forest could be indicators of the growth potential of overstory redwood trees.

Help Received
Father helped locate forest stands, extract increment cores, and assemble backboard. Brian Watson helped prepare map showing location of the three study sites.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Alexander M. Poirier

Project Number
J1917

Project Title
Aquaponics, Hydroponics, or Soil Farming? Determining the Most Eco-Friendly Approach to Feeding the World

Abstract

Objectives/Goals
The goal of this experiment was to compare and contrast growing vegetables using aquaponics, pH-controlled aquaponics, hydroponics and soil farming to determine the best growth rate, taste, density, and cost efficiency.

Methods/Materials
A four section vegetable grow test bed was built with 2x4" and 2x8" lumber, plywood, .25mm plastic sheeting, Styrofoam panels, soil, and drainage rock. An aquaculture system was assembled to raise tilapia and generate water for the aquaponics using a 55 gallon drum, air pump, heater, 50 gallons of water, thermometer, 500mg vitamin C, chlorine test kit, ammonia test kit, and pH test kit, insulation blanket and twelve tilapia fingerlings.

Lettuce, dill and basil were simultaneously grown in each of the four test beds while being measured daily for height, density, and growth rate. The experiment was conducted using 84 plants run twice to compare results. Data was collected and analysis was run on the cost of each method. Finally, the different lettuces were put through a taste test to determine if there was any noticeable variation.

Results
The growth testing showed plants in the hydroponic solution were the fastest growing, followed by pH-controlled aquaponics solution, regular aquaponics solution, and soil. The growth space efficiency testing showed a 140% increase in density for hydroponics, aquaponics vs. soil. The hydroponics method was the least expensive however the aquaponics method also produced fish for protein. In the taste testing there was no significant difference found between any of the methods.

Conclusions/Discussion
The purpose of this experiment was to evaluate different techniques that modern scientists are using to help solve world hunger, minimize pollution, and lower the cost to feed people. Both hydroponics and aquaponics were faster, more space efficient, and more eco-friendly than traditional farming. Aquaponics uses 95% less water than traditional farming, no soil, and additionally produces protein for the community with fish in the aquaponics system.

This experiment showed that aquaponics is viable, from a small backyard system all the way to full-scale production. It is environmentally friendly, cost efficient, and a viable option for farmers as part of solving the international food crisis.

Summary Statement
This experiment evaluated growing vegetables in an aquaponics system, hydroponics system, and through traditional soil farming to determine if using aquaponics was a more efficient, eco-friendly and cost efficient than traditional farming.

Help Received
I would like to thank my teacher Mrs. Gillum, for the many hours spent mentoring and reviewing my work, Sherilin Heise (aka Tilapia Mama) for her seminar on aquaponics, my dad and mom for helping me through the entire experiment, and my sister for helping with planting and feeding the fish.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Lucas Popescu

Project Number
J1918

Project Title
The Effects of IAA and Urea on Bean Plant Germination

Abstract

Objectives/Goals
The objective of my experiment was to compare the effects of the hormone IAA and the fertilizer urea, on bean plant germination.

Methods/Materials
Three rows of six petri dishes per row were aligned, each of the three rows having three different concentrations of IAA, urea and control. For each of the substances and concentrations two pairs of petri dishes were used. Once all the appropriate concentrations were added, the petri dishes were put into the incubator for 7 days at 30 degrees Celsius and observed over a one-week period.

Results
I learned that the plants I added the hormone IAA and fertilizer urea, actually grew less than the control group plants. For the IAA plant group, only one concentration grew with an average of 16.5 hairs, and a root length of 1.25 centimeters. For the urea group the largest average amount of hairs that grew was 11.5 hairs, and at most 1.75 centimeters of root length. For my control group, the highest average for root hairs was 14, and the largest root length average was 4 centimeters

Conclusions/Discussion
I believe that my results could have occurred this way for multiple reasons. First, it is possible that the concentration of urea might have been too high. From the articles I read I learned that urea releases pollutants as it decomposes, and could even possibly burn plants from its acidity. Secondly, I think the plants with IAA might have grown this way, not because the concentration was too high, but maybe the hormone helped them adapt better, so they would have better living conditions later on. For example, the large amount of hairs on the IAA group can be because those hairs would make it easier to absorb water and nutrients during growth.
Even though my experiment did not confirm my hypothesis, I learned about lab safety, using incubators, about hormones and plants, how to do background research, and how to present my science fair project correctly. I am planning to continue this experiment next year, and look at the bean plant#s overall growth, not just its germination, as well as trying to use various other concentrations of IAA and urea. I also believe that I need to learn more about the role of root hairs (branches) because I am still wondering why the IAA had more effect on the hair growth compared to the root growth.

Summary Statement
My project compares how the plant hormone IAA and the fertilizer urea affect the germination of bean plants.

Help Received
My mother helped me with lab equipment, spellchecking and with the board. My father helped me Excel and how to create my graphs.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Tess N. Rodriguez

Project Number
J1919

Project Title
Effects of Near Infrared Light on Plant Growth

Abstract

Objectives/Goals
My brother broke vertebrae and required a surgery binding the vertebrae. My family and I were told about a about near infrared (NIR) light healing therapy. Harvard Medical School believes that the near infrared (NIR) light therapy stimulates mitochondrial activity and promotes healing. It appeared to have a very positive effect on my brother, and his doctors were impressed with how quickly my brother#s bones fused. Since the near infrared light stimulates mitochondria, I was curious to see if it might also have a positive effect on plants. I believe that the NIR light may have a positive Effect on the growth of the plants. I decided to test tall fescue dwarf lawn seed grass.

Methods/Materials
I tested a total of 40 plant samples, 20 grass samples were control, and 20 were experimental. I planted the grass seeds in 40 pots and the pots were moved every other day to make sure the position was not a factor in growth. Each plant was watered daily; I tested the soil with a moisture meter. I positioned the near infrared (NIR) laser light over the experimental group of grass for ten minutes, three times daily. I did this for thirty days. I recorded observations daily and documented blade heights weekly.

Results
According to my results, there was a significant difference in grass blade heights when a near infrared light was applied to the grass samples for ten minutes three times a day. The near infrared light did not significantly affect the temperature of the grass, I confirmed this with the use of a infrared camera (i7FLIR) that measured in degrees Celsius to the nearest tenth while the NIR was on the sample. I checked soil temperatures in the samples and found no significant differences. The average blade heights for the control samples after a period of 30 days was 9.06 cm. The average blade heights for the experimental (NIR) samples was 13.83cm. This meant there was a 52.65% average difference in the blade height between the control and experimental groups. The difference was dramatic.

Conclusions/Discussion
Scientists have found that oil can be extracted from algae. Since near infrared (NIR) laser light appeared to accelerate the growth of grass, I believe this technology could also be applied to algae. Near infrared, #cold# infrared, light exposure might significantly enhance the growth of algae aqua cultures.

Summary Statement
My project tested the effects of NIR light on the growth of tall fescue grass

Help Received
I would like to thank my science teacher for loaning me some of the equipment that helped me preform this project.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Jack L. Shepard

Project Number
J1920

Project Title
The Amazing Chia Seed

Abstract

Objectives/Goals
This experiment was designed to determine if chia seeds have a measureable advantage over similar seeds in terms of water absorption. The chia seed is believed to absorb over nine times it weight in water, which makes it popular among distance runners and other types of athletes. I wondered if other seeds may share this same characteristic, or if the chia seed is unique in its absorptive ability.

Methods/Materials
Each seed type (chia, sesame, poppy, and flax) is carefully weighed to 5 grams and placed in a small, airtight container. This is repeated so that there are two containers of each seed, eight containers in total. Fifty milliliters of water is added to each container. Containers are sealed and then agitated every twenty minutes for two hours. They are then left undisturbed overnight. Twelve hours later, liquid remaining in the container in canted off, measured, and recorded. Each container is weighed. Comparison of absorbed fluid among seeds is made.

Results
Chia seeds did, in fact, absorb a significantly higher percentage of the water over a twelve-hour period. The chia seed actually absorbed all of the available water, which is equivalent to ten times their weight. The flax seed behaved closest to the chia seed, but only absorbed 30% of the available water. Poppy and sesame seeds were far behind at 15% and 12% respectively. In the end, it was calculated that the chia seed absorbed ten times their weight in water during the twelve hour period. Flax seeds absorbed 3.3 times, poppy seeds absorbed 1.5 times, and sesame seeds absorbed 1.2 times their weight in water over the twelve hour period.

Conclusions/Discussion
This experiment demonstrates that chia seeds did absorb an amazing amount of water compared to their weight. Ten times, in fact. This property seems unique to the chia seeds, although not all types of seed were tested. In this experiment, seeds most resembling chia seeds in size and shape were selected. The absorptive capability of the chia seed is likely one of the reasons that the seeds are favored by athletes who must sustain hydration over long periods of exertion. Future experiments could involve different fluids that more closely resemble saliva or gastric juice, or grinding the seeds to see if that helps other kinds of seeds absorb more fluid.

Summary Statement
How the amazing chia seed absorbs water ten times its weight.

Help Received
My mom helped me measure water content and my dad helped with somy typing.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Serena B. Suggs

Project Number
J1921

Project Title
Aquaponics vs. Soil

Abstract

Objectives/Goals
My goal was to see which method of gardening was better: aquaponics or soil gardening. Aquaponics is the combination of hydroponics and aquaculture, which means growing plants without soil and using the liquid waste from fish as nutrients for the plants.

Methods/Materials
The plant bed and fish tank were made out of two plastic bins. The plants I used were kale and cabbage, which were grown in clay pebbles. The fish tank, of course, was filled with regular water and goldfish. The plant bed rested on top of the fish tank and the two were connected with pipes, which delivered dirty water to the plants. The plants soaked up the liquid waste and the clean water went back into the fish tank. To compare the growth between soil gardening and aquaponics, I had a pot of soil with kale and cabbage grown in it as well.

Results
In the end my hypothesis was right. My hypothesis was that the plants grown in aquaponics would be taller/ wider than plants grown in soil. The plants grown in aquaponics were about one and a half inches taller/ wider than the plants grown in soil.

Summary Statement
Testing which method of gardening is more efficient/ better: aquaponics or soil.

Help Received
My dad helped with building the aquaponics system.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Kevin E. Viers

Project Number
J1922

Project Title
Fertilizer Faceoff

Abstract

Objectives/Goals
I wanted to see which was more beneficial to plants-commercial or homemade fertilizer

Methods/Materials
Materials:
15 butter lettuce plants
Unfertilized soil
15 pots
Miracle-gro fertilizer
homemade plant fertilizer (12 eggshells, 3 banana peels, 3 tablespoons of coffee grounds, # cup of milk)
water
Procedure:
1. Plant all plants in unfertilized soil. 2. Water all plants at the same time with the same amount of water, enough to wet soil but not rise above soil level. 3. Put all materials for the homemade fertilizer in a food processor and blend until it looks like a smoothie. 4. Make commercial fertilizer according to box directions. 5. Use fertilizer on homemade and commercial every 2 weeks. When applying fertilizer, apply 1c. commercial, ¼ c. homemade + 1c. water, and the control with 1c. regular water.

Results
In my experiment, the commercial was far and away more beneficial than the control or the homemade. Surprisingly, the homemade was only slightly more beneficial than the control, which had no fertilizer at all.

Conclusions/Discussion
The commercial fertilizer was more beneficial because the commercial fertilizer only has nutrients, has the right amount of each element, and dissolves into the water, so it gets more evenly dispersed than the homemade. The homemade fertilizer just sat on top of the soil and slowly went slightly more and more into the soil as the plants got watered. The control did the worst, as predicted, because it didn#t have access to many of the required nutrients.

For most people, commercial is the best fertilizer for many reasons. Some are that it is inexpensive, easy to use, effective, and readily available. The only reason that a person would use the homemade fertilizer would be because they are allergic to the chemicals in commercial fertilizer, they have #little people# that might ingest the chemicals, or if they wanted to attract flies (it was very good at that).

Summary Statement
I am determining whether commercial or homemade fertilizer is more beneficial to lettuce plants.

Help Received
My mom helped me create my display board.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Whitney W. Wachtel

Project Number
J1923

Project Title
Water Wonder

Abstract

Objectives/Goals
Within this project, I wanted learn how Smart Water, Refreshe, and tap water affect plant growth.

Methods/Materials
1. Soil- I filled each planter to the brim.
2. 27 radish seeds
3. Three bottles of Smart Water
4. Three bottles of Refreshe
5. 105 tablespoons of tap water
6. Nine planting containers
7. One tablespoon

Results
After measuring the radish seeds for five weeks, I finally came up with the averages of the radish seeds watered with Smart Water, Refreshe, and tap water. The average 'height' means how many centimeters tall the radish was from the base of the plant to the top of the radish. The seeds that were watered with Smart Water had an average height of 12.1 centimeters. The radishes that used Refreshe had an average height of 11.9 centimeters. Lastly, the seeds that used tap water had an average height of 15.7 centimeters.

Conclusions/Discussion
As a result of this experiment, I now know that tap water is the superior fluid for hydrating plants compared to Smart Water or Refreshe. The radish seeds watered with tap water grew an average of 2.52 centimeters taller than the seeds watered with other types of water. Additionally, from their physical features, I noticed the tap water radishes appeared healthier and their leaves stood erect.

My hypothesis was that the different types of water would not make a difference to the radish seeds growth; however, that was proven incorrect. (The tap water seeds grew the most.)

The process of growing the seeds went smoothly. In the future, I plan on growing my own flowers, and I learned for better results and to save money, I should water them exclusively, with tap water. In my opinion, tap water was the most convenient (the seeds were in pots right by the kitchen sink), and, as previously noted, it made the plant flourish.

If I were to perform this experiment again, I would test the growth of plants outside, as I feel that the tinted glass window filtered out the sunlight which made them appear leggy. Additionally, I could compare the measurements of the outdoor radishes with this experiment.

Summary Statement
In this experiment, I tested Smart Water, Refreshe, and tap water on radish seeds to learn how the various water affected the seeds' growth.

Help Received
Other than my mother purchasing the supplies for the lab, I had no additional help.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Deshun D. Washington, Jr.

Project Number
J1924

Project Title
What Is Organic Gardening? The Effects of Natural Fertilizers and Pesticides on Plants

Abstract

Objectives/Goals
Through this experiment, it is my mission to determine whether or not I will be able to successfully create a suburban home garden without the use of harsh pesticides and fertilizers. I chose this problem in order to answer the question, what is organic gardening?

Methods/Materials
How I Grew My Own Organic Garden:
1. Prepare your soil-We had hard, clay-like and sandy soil with rocks, glass and debris that had not been gardened in over a decade. #Turn Soil -Start Composting #Add animal manure #We used leftover anchovies from fishing to increase the nitrogen levels in the soil to give the plants more nutrients. 2. Germinate seeds indoors or buy plant seedlings. 3. Transplant seedlings to ground. 4. Water plants regularly. 5. Fertilize plants naturally. 6. Wire plants to sticks or cages when they cant support themselves. 7. Prune dead leaves & add to compost. 8. Monitor for bugs/animals & use natural pesticides like canola oil & cayenne pepper. 9. Re-plant plants that need different locations. 10. Use the plant buddy system-some plants like shade of and support of other plants.

Results
Over the course of several months, I was able to collect data that demonstrated how I prevented garden pests without harsh pesticides and my plants grew well and produced vegetables/fruits with only organic fertilizers.

Conclusions/Discussion
Through this experiment, I discovered that a fruit, herb, and vegetable garden can be grown in the backyard of a Northern California suburban home without the use of pesticides or chemical fertilizers that damage the environment and reduce the nutrient value of the plants. With the use of proper soil preparation, composting, organic fertilizer and natural pest control, you can build a successful ecosystem. There were many unknown benefits and applications to my project. I discovered the potentiality for sustainable future for my family, lowered produce grocery bills, healthier diet, relaxation and exercise.

Summary Statement
A thriving home garden can be created without the use of harsh pesticides and fertilizers.

Help Received
Mom helped transfer handwritten project to typed format; Mom and Dad helped maintain plant watering schedule. Local nursury gave planting advice.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Younji Youn

Project Number
J1925

Project Title
What Is the Best Way of Protection that Prevents the Fruits in a Refrigerator from Withering?

Abstract

Objectives/Goals
My objective was to decide which of the protective materials is more effective at preventing the over-ripening of tomatoes.

Methods/Materials
27 tomatoes were divided into 3 groups with 3 specimens each for a control group and wrapping two different protective material; newspaper and plastic wrap. The specimens were stored in the same container of a refrigerator for 14 days, and chroma/weight were measured every 3 days, firmness/sugar content every 6 days. Weight was measured with a kitchen scale, chroma with program 'ImageJ' (Optical density analysis), firmness with a durometer (Hardness Tester A), and sugar content with a refractometer.

Results
The control group's weight steadily dropped by approximately 1.1 gram, and the weight of tomatoes in newspaper dropped by 1.4 gram; but the weight of tomatoes in plastic wrapper only declined by about 0.25 gram. The chroma changes in plastic-wrapped tomatoes broke the same pattern of rise and fall of optical density (The rise and fall was the expected result, after watching time-lapse video of tomato rotting) shown in control and newspaper-wrapped group. The data of firmness was inaccurate because of its dependence on amount of pressure experimenter provides, and the data of sugar content could not also be mentioned as evidence because the effect of enzyme on increase of fructose didn't show obvious changes over the short experiment period.

Conclusions/Discussion
The tomatoes wrapped in plastic wrap proved to stay fresh longer than those in newspaper. The results were against my hypothesis, through which I predicted that plastic wrap, being tighter than newspaper, would create small-scale greenhouse effect on produced enzyme and quicken the ripening process. According to additional research, plastic wrap is effective at preventing the oxidation, which is another key factor of ripening besides the enzyme. Longer experiment period might have proven the ultimate way of protection which delays both major factors of ripening. Although there are many more possible ways of prevention of over ripening such as the use of chemicals, my project result might be useful in any places where fresh produces are stored post-harvest.

Summary Statement
My project is about the delaying of over-ripening of tomatoes achieved by protective materials, displayed by features such as chroma, weight, firmness, and sugar content.

Help Received
My father helped planning my experiment, taking pictures for analyzing optical density, recording the data, and creating the graphs and the board.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Ritesh Malpani

Project Number
J1997

Project Title
Effect of pH level on Plants

Abstract

Objectives/Goals
I had done this project to find out why the same plants grow better in certain soils than others. So, my goal was to learn which pH was best for certain plants and even if it affected the growth of plants.

Methods/Materials
For my procedure I needed to fill pots with soil. Then I had to check the pH of the soil using a pH meter. After that I changed the soil to match the pH levels 4 ,7, and 9. Then I had a green house to sustain wind and temprature of plants. Then I transplant my plants, and water my plants using their specific water. The materials I need are pots, soil, water, pH meter, lemon juice, Clorox, 9 Butter Crunch Lettuce, 2 three foot pipes, 2 four foot pipes, 2 looped pipes, 4 corners, plastic sheeting, hot glue sticks, hot glue gun, and table.

Results
My neutral plant grew the tallest and was green. However my acidic plant grew but not as significant as my acidic plant and the plant was yellow. The alkaline plant withered and became brown.

Conclusions/Discussion
My hypothesis was proved because the neutral plant grew the tall est and greenest.if I were to do this project again I would test more plants, different pH levels, and also different types of pots. This has real world importance because if farmers know the best pH levels for growing certain plants, they could grow better, so there could be more harvest of the plant in its season. If more plants are grown they can be sold for more money.

Summary Statement
Does the pH of soil affect plant growth.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Vincent A. Chen

Project Number
J1998

Project Title
The Effect of Water Priming on Salt Tolerance in Barley Seeds (Hordeum vulgare)

Abstract

Objectives/Goals
My objective was to examine the effects of water priming on the salt tolerance of barley seeds. My hypothesis was that water priming would increase salt tolerance in both germination and seedling growth.

Methods/Materials
Barley seeds were sterilized in 1% bleach for 5 min, dried, and primed in distilled water for 30 hours in the dark. They were germinated in a dual growth chamber constructed for this purpose with a Light/Dark cycle of 14/10. My experimental design was: Two seed types (primed and non-primed) examined under three germination conditions (with Water, 75 mM NaCl, and 150 mM NaCl). At 48, 72, and 96 hours I counted the number of seeds that germinated, the number of seeds that grew a coleoptile (stem-sheath), the length of the epicotyl (stem) emerging from the coleoptile, and the length of the roots.

Results
When seeds were grown in Water, or 75 mM saline, more water-primed seeds germinated than the non-primed seeds. In 150 mM NaCl, more primed seeds germinated than non-primed seeds in 2 of the 3 experiments. Results for seedling growth in 75 mM NaCl, indicated that priming resulted in:
A. An Increase in the number of stems; B. An Increase in stem length; C. An Increase in the number of stems with epicotyls; and D. An increase in the length of the epicotyls. No seeds grown in 150 mM NaCl grew epicotyls.

Conclusions/Discussion
Discussion: My results indicated barley seeds primed with water showed a greater tolerance to salt than non-primed seeds. Therefore, I have accepted my hypothesis as true. This can be seen by a greater number of seeds germinating under all growing conditions (Water, 75 mM, and 150 mM saline), except in one experiment, in which more seeds germinated from the non-primed group grown in 150mM NaCl. However, in this group less than 10% of the germinated seeds grew stems compared to 40% of the seeds from the primed group. Salt tolerance was also shown by the fact that primed seeds in 75 mM NaCl grew more coleoptiles, more epicotyls emerged from the coleoptiles, and the length of the coleoptile (plus epicotyl) was longer, compared to the non-primed group. Conclusion: Water priming of cereal crop seeds could be important in the future when the population of the world is expected to be over 9 billion people.

Summary Statement
My project is about water priming of barley seeds and the development of salt tolerance during subsequent germination and growth.

Help Received
I received help from my grandfather in photography, development of the tables and histograms, and in discussions of the results.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
Sabrina K. Martin

Project Number
J1999

Project Title
Pea Plant Party

Abstract

Objectives/Goals
The objective of the experiment is to test how the different amounts of Rhizobium bacteria will affect the growth of a pea plant starting from seed.

Methods/Materials
There were four different testing groups with six pots in each testing group. In the 1st group the pea seed were not exposed to any Rhizobium bacteria, in the next group the seed were exposed to 4 swabs of Rhizobium bacteria. In the 3rd group the pea seeds were exposed to 6 swabs of bacteria, and the last group was
exposed to 8 swabs of bacteria. The height of the plant was measured in centimeters everyday for 14 days straight

Results
The pea plants that were exposed to 8 swabs of bacteria grew the tallest compared to the pea plants not exposed to any bacteria. As the amount of bacteria increased, so did the height of the plant.

Conclusions/Discussion
Rhizobium bacteria is helpful to the pea plants, more specifically, legume plants. The more bacteria, the more beneficial it is to the plant.

Summary Statement
Exposing pea seeds to different amounts of Rhizobium bacteria to see how it would affect the growth.

Help Received
Ms. Fisher helped with supplies and making sure everything was going ok. Mrs. Diaz helped with our research reports. Jasmine helped with pictures and setting up the pots.