CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Aicha S. Abderrahman

Project Number
J1701

Project Title
Salinity and Its Effect on Lettuce Seeds' Germination

Abstract

Objectives/Goals
To see if different amounts of salt in water effects the germination of lettuce seeds

Methods/Materials
Materials: 1. Bleach, 2. Water, 3. Lettuce Seeds, 4. Paper filter, 5. Petri dishes, 6. Salt, 7. Beakers, 8. A dark place, 9. Ruler, 10. Plastic Bags, 11. Measuring cup, 12. Teaspoon.

Methods: 1. First you take the seeds and treat them in a bleach solution consisting of 10% bleach and 90% water for 20 minutes. 2. Then rinse 5 times with water (this kills all the fungal spores that will delay germination). 3. Take 6 Petri dishes and place paper filter in it and label them with the amount of salt in it. (make a salt solution consisting of 0.2m of salt and 11.69g of water) Put amount of salt solution and water the amount graph says. 4. In each dish put 4-5 lettuce seeds spaced out evenly on the filter paper so they don#t touch each other. 5. Put the dishes in a plastic bag and put it in the dark at a constant temperature for 5 days. 6. After 5 days see how many seeds germinated and measure the root length. Look carefully and make sure to only measure the roots and not the seed.

Results
Yes, salt does effect germination of lettuce seeds. The salt worked as an inhibitor, which means it slowed down the process of germination. The seeds in the solution with the most amount of salt took a much longer to germinate than the seeds with the least amount of salt.

Conclusions/Discussion
In my project i found out that the more salt there is in the water the slower the germination and the the less salt there is in the water the faster the germination. So the salt really does affect the germination of lettuce seeds and i also learned that if you want to plant lettuce seeds you must let them germinate in light before you plant them in soil because in the soil the seeds wont get the light it needs for it to germinate (because it has a thin seed coat.

Summary Statement
To see if different amounts of salt will effect lettuce seed germination

Help Received
Mother and father bought supplies and encouraged me through out the research of the project

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Flora E. Barbash

Project Number
J1702

Project Title
Generation Pink! Mutations in Flower Color

Abstract

Objectives/Goals
I was determining whether or not the plant species Bluebell Hyacinthoid, Non-scripta (found in my yard) after producing pink flowers last year, would once again bloom pink, when in the last 20 years they have continuously flowered blue. I believe that this was a cause of mutation, due to dominant and recessive genes, and that the offspring would inherit the characteristic.

Methods/Materials
Forty-five Bluebell bulbs, of various sizes (age), were collected from the pink Bluebell site. I divided them up into three even piles by size, with different planting methods for each pot:
1.) natural habitat; outside
2.) potting soil; inside and
3.) refrigerated first, potting soil; inside.
I found the sunrise and sunset times for the time-period that they would normally be developing vegetation to emulate the time with a timer and grow lights (documented by photos).

Results
The pot that was first refrigerated and planted inside had the quickest growth time, producing five blue flowers, while the pot that was planted inside with no refrigeration (chill factor) flowered in the slowest amount of time, developing only two blue flowers.

Conclusions/Discussion
In conclusion, the pot that was in its natural environment produced seven flowers, one of which was pink. Since the color trait passed on to the scion plant, it shows that the original color change was a result of mutation. Thorough research led me to learn about the flower industry and how it uses these mutations in our every day lives, and about the controversy over genetic engineering.

Summary Statement
This was a yearlong study of plant mechanics with the experiment focused on #forcing# two rare pink (recessive genes) Bluebell bulbs, under controlled conditions, to bloom pink once again when they have always flowered blue.

Help Received
Mother drove me to interviews and library; had an interview with Tim Crockenberg of Sun Valley Floral Farms in Arcata; had an interview with Debra Girard from the Department of Agriculture and Natural Recourses at the U.C.; had an interview with Mary Barber of Miller Farms Nursery

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Steven M. Bowman

Project Number
J1703

Project Title
Plant Populations and Seedling Growth

Abstract

Objectives/Goals
The objective was to test various seedling populations of two different crops to find the best plant growth for the farmer using the least amount of nursery space. Onion and spinach are used in this experiment because they are important crops, they grow well in the winter season and they are very different types of a crop from each other.

Methods/Materials
200 cell seedling trays were filled with growing medium. Depressions were made in each cell and seed was placed in the depressions. Populations of 1, 2 and 3 seeds per cell was used for each type of seed. This process was repeated until there were three replications each for both the onions and spinach. The trays were topped off with growing medium, placed in a greenhouse and watered everyday. Fertilizer was added to the water every third day at the same rate for all trays. After thirty days, plant weight and total plant mass was recorded. In addition, the plants were examined and compared against the ideal transplant characteristics.

Results
The onions had little or no individual seedling size reduction over all the populations so could be successfully grown at higher populations while using space more efficiently. Total mass for the spinach increased as the populations were increased however mass per plant dropped rapidly at 2 and 3 plants / cell.Thus for spinach the best quality transplant was produced at 1 plant per cell.

Conclusions/Discussion
I conclude that with a plant like onion having adventitious roots and upright growth, the best results were at higher plant populations thus a farmer can grow more onion seedlings in less greenhouse space. For spinach, single plants / cell were the largest and best. At higher populations the individual spinach seedlings were smaller, the roots were entangled and the leaves easily damaged.

Summary Statement
Testing various seedling populations of Onion and Spinach to find the ones best suited to the farmer.

Help Received
Used greenhouse and scales at father's work.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Wilder Bunke; Han Kim; Karl Marrett

Project Number
J1704

Project Title
Do Palm Trees Make Poor Street Trees?

Abstract

Objectives/Goals
The objective was to test which evergreen street tree had the highest carbon and ozone uptake (calculated over a year) for the following three species: California palm, Mugo pine, and Coastal live oak.

Methods/Materials
Materials: 3 oaks, 3 pines, 3 palms, notebook, plant gas exchange system, planimeter, micrometer, ruler.
Methods: We used a gas exchange machine, which measured the amount of carbon dioxide taken up by the leaf , and the amount of water released from the leaf, which was proportional to the amount of ozone absorbed, using a conversion factor. We clipped the machine onto a single leaf, and set a constant leaf temperature, light level, and air humidity, close to the outside conditions. We measured 3 leaves on each tree, and 3 trees of each species. We used data from already published scientific papers for average summer time gas exchange of the same or similar species. We measured leaf area of a subsample of leaves on the tree, and estimated the number of leaves per tree to calculate leaf surface area per tree. We used algebraic equations to calculate the photosynthetic rate and ozone uptake of the whole tree over a whole year. The winter photosynthetic rate was multiplied by the total leaf area of the tree (in meters square) and by the total amount of time the leaf might photosynthesize in the winter (4 months x 8 hours per day x 60 minutes per hour x 60 seconds per minute). Similarly, summer carbon and ozone uptake was calculated for the rest of the year using published photosynthetic and water loss rates.

Results
Palm trees had the highest rate of photosynthesis per leaf area during the wintertime measurements. The total absorption of ozone and carbon per plant was much less than any other species due to its small leaf area. Coast live oak had the highest rate of carbon uptake, but not the most ozone in the winter time measurements. Oak took up 17 times more ozone, and 14 times more carbon than palm. It did not have the highest leaf area but it was much more than palm. Mugo pine had the highest leaf area per plant. The pine absorbed the most carbon of the three trees at 20 times more than palm but lacked in ozone uptake with only 1.2 times greater than palm.

Conclusions/Discussion
Pines absorbed the most carbon and oak absorbed the most ozone. Palm trees make poor street trees due to low carbon and ozone absorption, primarily due to low leaf area per plant.

Summary Statement
Pine took up the most carbon, oak absorbed the most ozone, and palm trees, although a Californian icon, make poor street trees.

Help Received
Nancy Grulke, USDA Forest Service, provided a calibrated gas exchange system and micrometer. Eric Bunke of Krieger and Stewart, Inc., provided the planimeter. Nancy Grulke helped simplify how to estimate whole tree leaf area, and talked us through how to calculate carbon and ozone uptake over the

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Aleena Byrne

Project Number
J1705

Project Title
How Does Gravity Affect the Growth Angles of Radish Seeds?

Abstract

Objectives/Goals
This research project was conducted to study what effects that gravity has on the growth angles of radish seeds. I recently read an article published by the National Aeronautics and Space Administration (NASA), which discussed a test on how plants grew in space. The NASA found that most of the plants grew randomly because there was not gravity in space. In my research project, I planned to identify an experimental method to simulate a directional change in gravity and to see how the sprouting angles of radish seeds respond to the change.

Methods/Materials
In this research project, I established two test groups, Group A and Group B. Group A tests were conducted by simulating a directional change of gravity. This was done by placing Group A samples on a rotating electrical ceiling fan. I calculated the centrifical force relative to the earth gravitational force by using the following equation: Fr = 0.204 x V2/D (ASGSB, 2005) Where, Fr: relative centrifugal force (m/s2), V: peripheral speed of sample locations on the fan (m/s), D: diameter of the circle of rotation (m). Relative to gravity, this equation gives the predicted angle of 64 degrees. This angle would be the simulated direction of gravity that the seeds would grow towards. Group B is a control group, Group B samples were placed on bookcase, at the same height of the fan (the bookcase was located near the fan,) where gravitational force would be zero degrees from the center of the earth. Group A and Group B tests were conducted concurrently for the purpose of comparison.
Radish seeds were selected as testing materials and 6 containers were used to plant these radish seeds.

Results
After four days of seeds growing tests, it was found that most seed roots grew well corresponding to the simulating angle (64 degrees) of gravity in Group A. The seeds in Group A sprouted in angles between 50 to 60 degrees throughout the whole growth time. Group B seeds roots were found to grow approximately straight down (0 degrees) toward the center of the earth.

Conclusions/Discussion
These tests have supported my hypothesis. My hypothesis is that the plant roots grow toward the angle where gravity is pulling. Hopefully, in the future, scientists will be able to conduct more tests like mine, but in outer space.

Summary Statement
My project is to study how plant growth responds to angle changes in gravity, and to hopefully find more information on how plants would be bale to grow in space.

Help Received
Mr. Popick (my science teacher) helped come up with the ideas of my project and father helped attached containers to the fan.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Joseph G. Chernabaeff

Project Number
J1706

Project Title
What Effect Will the Plant Hormone Naphthyl Acetic Acid Have on Seed Germination?

Abstract

Objectives/Goals
The question is what effect will the plant hormone naphthyl acetic acid have on seed germination?

Methods/Materials
1. Plant grass seeds in soil in small bowls. Repeat 10 times
2. Add 30cc of tap water to 5 of the bowls
3. Add 30cc of water with 1/16 of a teaspoon of naphthyl acetic acid to the remaining bowls.
4. Place in room with regular sunlight
5. Water as steps 2 and 3 state three days

Results
The results are as follows: Seed dish number one and two with plant hormone were at the full size at day fifteen with very green and thick blades. Seed dish number one and two with only water took twenty-one days to bee at full growth or four inches.
Note: This is the results for the first time this project was done. I am in the middle of the next project which has more tests and repetitions.

Conclusions/Discussion
My hypothesis was correct because the seeds with the plant hormone naphthyl acetic acid did increase the rate at which the seeds germinated. The seeds with the hormone grew faster because of the hydroxamic acid vitamin B1 that it contains. The hydroxamic acid makes the plant cells enlarge, therefore the plant grows larger faster. The vitamin B1 made the seed crack its outer shell and begin to sprout at a faster rate. The results showed that the hormone made the seed sprout and grow faster.

Summary Statement
Investigating the efect of the plant hormone naphthyl acetic acid on seed germination.

Help Received
Mother helped set up display board

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Quinn Costello

Project Number
J1707

Project Title
Cut, Connect, and Grow

Abstract

Objectives/Goals
My goal is to produce a successful graft between different species of cacti. Studying grafting can add to research in the field of plant biology, and help expand knowledge in other scientific fields. For example, grafting is also used for medical purposes such as skin grafting for burn victims. My research in grafting cacti can hopefully spur others on to further research.

Methods/Materials
I first set up my cacti in their pots, and left them for a week to habituate them to the surrounding climate. Next, I cut each Cereus cactus 1-2 centimeters from the top (depending on what would make the diameter equal to that of its corresponding scion), and each Astrophytum Myriostigma and Gymnocalycium Calochlorum about 1 centimeter from the base. Once done, I placed each of my Astrophytum Myriostigma on top of its corresponding Cereus partner, aligned the inner cores, and placed rubber bands on top of the cotton balls (to alleviate pressure) over the graft. I waited a few weeks for the cacti#s tissues to fuse together into a graft, occasionally misting the grafting cuts to prevent them from drying out and causing the cacti to die. Finally, once every 5 days I recorded the characteristics of my newly grafted cacti into my scientific logbook.

Results
All my cacti survived, except for 1 Astrophytum Myriostigma-Cereus cactus, which I believe died from a lack of moisture in the cut wound. By the end of my experiment, 2 remaining Astrophytum Myriostigma-Cereus cacti were 11.9 centimeters and 13.2 centimeters, and Gymnocalycium Calochlorum-Cereus cacti were all healthy, growing to heights of 7.9, 10.7, and 11.8 centimeters. They have since grown little, because in winter most species of cacti remain dormant.

Conclusions/Discussion
I conclude from my experiment that it is possible to achieve a successful graft between several different species of cacti using simple methods and materials. I learned that to achieve a successful graft the subject cacti must be consistently monitored to make sure the cuts do not become infected. I would change two things if I were to repeat the experiment. I would not use seedling cacti, but more hardy varieties. Secondly, I would graft in early spring so the cacti would not be dormant during the healing and tissue fusion period. These results can be linked to medical grafting. Just as plant tissue grafting is a precarious and long process, so is medical grafting.

Summary Statement
My project is about succesfully grafting different species of cacti for the benefit of botanical and scientific research.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jonathan J. Crowther

Project Number
J1708

Project Title
Mutualism: It's All About the Teamwork

Abstract

Objectives/Goals
My objective is to demonstrate the benefit of the presence of earthworms to plants. I believe that plants exposed to earthworms will grow better than plants without earthworms.

Methods/Materials
Two variegated ivy plants were planted in clear pots made from 2-Liter bottles. Soil was cleaned of earthworms and mixed with an equal volume of potting soil, a source of dead plant material for the worms. Layers of cornstarch were added to show worm activity. Six earthworms were placed in one plant (named Plant A). Plant B had no earthworms. Black paper was used to limit light exposure. I tested weekly for the number of stems, stem length (from the soil surface), and number of leaves for 65 days after planting. Additional materials used include a decking screw, a screen box with 1.3 cm squares, digging spade, bucket, garden cultivator, two plastic TV dinner trays, scissors, a 178 cm^3 (3/4 Cup) measuring cup, a 14.8 cm^3 (1 tablespoon) measuring spoon, cm ruler, measuring cup, black pen, black Sharpie, notebook, digital camera, Scotch tape, black paper, and butter tub.

Results
My hypothesis was proven, but not by the quantitative growth indicators, which showed that both plants grew about the same, and Plant B actually grew more leaves. However, the qualitative data that I collected indicated that the plant with earthworms had healthier roots, stronger stems, and larger leaves.

Conclusions/Discussion
Qualitative evaluation of the plants showed that with earthworms, Plant A#s root hairs were more numerous and durable, roots were thicker, leaves larger, stems sturdier and more upright. Growth was more balanced across the stems than Plant B. The overall appearance was healthier than Plant B. The earthworms acted like mini-rototillers to stir up the soil and keep it fluffy giving the roots more air and less resistance to root growth. Most of Plant B#s growth was on the three longest stems (was it trying to escape from poor soil conditions and root out somewhere else?).

Summary Statement
Determine if mutualism exists between earthworms and plants by observing effects of the presence or absence of earthworms on plant growth.

Help Received
My Dad assisted with set-up and data collection. He took pictures. He taught me how to use Microsoft Excel, and advised me on my report. My Mom provided me with writing tips and motivation.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Emily A. Danko

Project Number
J1709

Project Title
How Does Excess Carbon Dioxide Affect Plant Growth?

Abstract

Objectives/Goals

My experiment had two purposes: first, to see if excessive amounts of CO2 would affect plant and seed growth and second, to see if the CO2 would affect the temperature of the air around the plants. I could get carbon dioxide very easily from dry ice. Dry ice is the solid form of carbon dioxide. It does not melt like water; it goes straight to gaseous form in a process call sublimation. So by controlling the amount of dry ice I placed next to each plant, I could control how much CO2 each would be exposed to.

Methods/Materials

The materials used were:
6 large glass jars, 7 thermometers, dowels and paper rulers to make the measuring sticks, a measuring cup for watering the plants, grow light, potting soil, wheat grass seeds, wheat grass, Tupperware containers and terracotta pots to plant the grass in, a scale, dry ice, protective gloves, a hammer, and a screwdriver.

The procedure calls for two phases of experiments; one with seeds and one with plants. The steps of both phases were almost identical. Six test seeds or six test plants were placed in glass jars. Two were control groups, two were exposed to 10 grams of dry ice daily, and two were exposed to 20 grams of dry ice daily. The amount of growth and the temperature were measured daily.

Results

During both the seed germination phase and the plant growth phase, the temperatures did not significantly vary from jar to jar.

The only seeds that grew were in the control group. Those seeds sprouted and grew to a height of 3 centimeters within seven days. None of the other seeds sprouted.

The growth of the plants did show significant differences. The more CO2 the plants were exposed to, the less they grew. The most growth was found in the control group, at 12.5 centimeters while the least was found in the group exposed to 20 grams of CO2. This plant only grew to 7.5 centimeters.

Conclusions/Discussion

None of the seeds exposed to CO2 sprouted. However, no conclusion can be drawn about whether the failure to sprout was due to CO2 because one of the two control groups did not sprout either.

The growing plants exposed to CO2 resulted in dramatic changes and the results were consistent: both of the control group plants flourished while the plants exposed to CO2 grew less. In fact, the more CO2 the plants were exposed to, the less they grew. This experiment proved that high doses of CO2 adversely affects plant growth.

Summary Statement

The purpose is to see whether excessive amounts of carbon dioxide will cause the temperature of air in a contained space to rise and to see how carbon dioxide affects the growth of plants and seeds.

Help Received

Mother helped me get all necessary materials; Father proofread my board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alexandra E. Dusenberry

Project Number
J1710

Project Title
Allelopathy: A Plant's Defense

Abstract

Objectives/Goals
The project experiment was to determine, whether or not, growing lima beans with eucalyptus leaves, would have any alleopathic effects on the growth of the lima beans. I believe the eucalyptus will negatively affect the growth of the lima beans, as in comparison to the beans grown in pure water.

Methods/Materials
The project experiment included four bags with 20 numbered lima beans in each bag. Three bags had equal amounts of eucalyptus leaf liquid and 20 numbered lima beans. One bag had only pure water and 20 numbered lima beans. Each bean was measured daily to observe the growth rates.

Results
The one bag of 20 numbered lima beans grown in pure water, grew an average of 2 centimeters longer, than the three bags of 20 numbered lima beans grown in eucalyptus leaf liquid.

Conclusions/Discussion
The project experiment conclusion is; Eucalyptus ideed, has a negative alleopathic effect on the growth of lima beans.

Summary Statement
The project experiment was to test for any alleopathic effects of eucalyptus on the growth of lima beans.

Help Received
My Mom drove me to the garden nursery supply to purchase lima beans.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jonathan P. Enns

Project Number
J1711

Project Title
Mycorrhizal Fungi

Abstract

Objectives/Goals
My objective was to determine if adding mycorrhizal fungi to the soil at the time of planting alfalfa seed would cause a young seedling alfalfa plant to grow more root mass and result in a healthier plant, able to extract more water, fertilizer, other nutrients from the soil.

Methods/Materials
Un-inoculated alfalfa seed was planted in 10 containers of fumigated soil. 5 containers were irrigated with a mixture of water and mycorrhizal fungi and 5 containers were irrigated with pure water. After 7 weeks, the containers were soaked in water and the plants were removed. The wet soil was rinsed from the plants roots, and the plants were photographed and weighed on a digital gram scale.

Results
The results of the experiment showed that the addition of mycorrhizal fungi to the soil as the alfalfa seed are planted and irrigated increased weights from an average of .12 grams for the untreated plants, to an average of .28 grams for the treated plants. The fungi enhanced the early root development of the seedling alfalfa plant and also promoted increased size of the plant above ground level. As a result of this larger plant, it seems reasonable to conclude that it could more efficiently extract water, fertilizer and other nutrients from the soil. However, further testing would be needed to determine whether the growth response resulted from the increased uptake of water, fertilizer, nutrients, or a specific combination of these elements.

Conclusions/Discussion
The results of this experiment seemed to support the original hypothesis that adding mycorrhizal fungi to the soil at the time of planting would enhance the growth of the young alfalfa plant. The problems that occurred were unexpected and raised some questions about the variation in the results. The main reason for the variation could be that since the soil fumigation eliminated the naturally occurring mycorrhizal fungi, it caused a need to add both nitrogen fertilizer and microbial bacteria to the irrigation of the plants in order to promote healthy growth. Since the bacteria were difficult to blend with the water, it is difficult to know whether the mixture was equally applied to the plants. It might have worked better if the bacteria was mixed with the dry soil prior to irrigating the seeds and starting off with a small amount of low analysis fertilizer to speed up the beginning growth of the alfalfa plants.

Summary Statement
The project is about the effect of mycorrhizal fungi on the early growth stage of seedling alfalfa plants, in relation to root mass and plant vigor resulting from enhanced water and nutrient uptake.

Help Received
Dr. Greg Cluff, Professor, Bakersfield College, provided advice on project design and modification to experiment. Vernon Crawford, P.C.A., Wilbur-Ellis Co., provided raw materials for experiment. My Father gave oversight, particularly when materials were mixed and applied.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Emerson W. Glassey

Project Number
J1712

Project Title
Photosynthesis

Abstract

Objectives/Goals
My objective was to find out whether or not the rate of phtosynthesis changed as light intensity was increased or decreased.

Methods/Materials
I used a jar, for the airtight container; a carbon dioxide sensor; an oxygen sensor; a light sensor; a blanket; a temperature sensor; LabPro; Logger Pro; a computer; two 40 watt incandescent bulbs, with holders; a variable resistor; and two Chamaedorea Elegans or Chamaedorea Neanthe bellas. I used the carbon dioxide and oxygen sensors to measure the rate of photosynthesis. If oxygen goes up and carbon dioxide goes down then the rate of phtosynthesis must be rising. The temperature and light sensors were also collecting data at the same time. All of this plugged into the LabPro, which went to the computer and was recorded by Logger Pro. The plants were inside the jar with the sensors in the jar lid, except the light sensor which was next to the jar. Samples were taken every half-minute for 11 hours.

Results
At no light, carbon dioxide levels rose and oxygen levels decreased. At 33 lumens, carbon dioxide levels rose slower and oxygen levels decreased at a lower rate. At 66 lumens, carbon dioxide ranged from rising to staying level. At 100 lumens, the carbon dioxide levels went down or stayed level and oxygen levels either went up or stayed level.

Conclusions/Discussion
Although the oxygen never significantly went up, nor the carbon dioxide down, it was obvious to me that the rate of phtosynthesis went up as the light intensity was increased. Basically this is what happened: As the heat rose in the jar due to the lights, the rate of respiration went up, in order to cool off the plant. This caused the amount of carbon dioxide to rise. Respiration consumes oxygen and gives off carbon dioxide; but, at the same time the rate of photosynthesis rose becuase of the increased light intensity. So at 100 lumens, they canceled each other out, but at 0, 33, and 66 lumens the rate of respiration was faster than phtosynthesis. So, yes, the rate of photosynthesis increased as light intensity was increased.

Summary Statement
I tested to see how the rate of photosynthesis for a Chamaedorea Elegans changed under 0, 33, 66, and 100 Lumens.

Help Received
A friend's father lent me most of the sensors, software, and interfaces from Willits High School (he's the chemistry teacher).

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Collette K. Hamamah

Project Number
J1713

Project Title
How Does Acceleration Affect the Direction of Plant Root Growth?

Abstract

Objectives/Goals
The purpose of this experiment is to determine how acceleration affects the direction of root growth. My independent variable is the direction of the force applied to the plant seed which is directly related to the radius of rotation (cm). My dependant variable is the direction of plant root growth (degrees of angle). I hypothesized that the root will grow toward the direction of the force applied to the seed.

Methods/Materials
Approximately ten lentil seeds in each of six CD boxes, filled halfway with cotton (as growth medium), were placed on a turntable and allowed to turn for two weeks at 78 rpm. Two trials were performed. Watering was performed twice daily. The angle of root growth was measured, plotted against the radius (distance from center of turntable to seed), and compared to the calculated angle (based on the vector sum of gravity and acceleration due to rotation).

Results
It was found that as the radius increased, the angle of the direction of root growth also increased, supporting my hypothesis. Despite the scatter, the graph trendline supported my statement. The measured and calculated angles showed differences. However, when plotted together against the radius the trendline of both were similar.

Conclusions/Discussion
I conclude that the direction of root growth depends on the acceleration applied to it. Some reasons of errors include uneven cotton thickness, difficulty in distinguishing the main root from its branches, and unequally distributed water.

Summary Statement
Using lentil seeds, different accelerations were applied by using a turntable and its effect on direction of root growth was measured.

Help Received
My parents and Dr. Injeyan helped me obtain material and setup for my experiment.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alison F. Hoffman

Project Number
J1714

Project Title
To Float or Not to Float: Seed Dispersal in Sea Rocket

Abstract

Objectives/Goals
Growing in the sand is the plant Sea Rocket (Cakile edentula) that produces a floating fruit in order to spread its seeds along the beach. The fruit of the Sea Rocket is divided into two parts: a tip and a base. When the seeds are ripe and ready to drop, the top section of the fruit drops first and when close to the water will float away. Can the fruit bases also float in the ocean, and if so, will they float as long as the tips? Maybe they are supposed to also float but not travel as far.

Methods/Materials
I collected 100 tips and 100 bases from plants growing on the beach. I floated all the tips and bases in two separate containers filled with ocean water. Once a day I counted, removed and recorded all the sunken tips and bases.

Results
I found that the bases of the fruit do float, but not as long as the tips. Most of the bases sank on the 4th day. Most of the tips sank on the 12th and 14th days. Only 25% of the bases were still floating after four days, where 97% of the tips were still floating. By the time 97% of the bases had sunk (on the eighth day) only 34% of the tips had sunk.

Conclusions/Discussion
The fruit of the Sea Rocket that is separated into two parts, allows the tips of the plants to float longer in ocean water and therefore travel farther in the waves before sinking in the sand and producing a new plant. The bases of the fruit can also float, but not as long, so the seeds in this part will make a new plant closer to the plant they came from. My results did support my hypothesis.

Summary Statement
The floating ability of two different fruit parts from the Sea Rocket plant.

Help Received
Mother helped with discussion of project methods, driving to the beach and typing. Father helped with graph.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Dahlton J. Hubbard

Project Number
J1715

Project Title
It's Not Nice to Fool Mother Nature

Abstract

Objectives/Goals
Everything needs to adapt in order to survive. Man is now venturing into space, will he be able to take plants with him? I did my project on whether a plant would be able to adapt to a microgravity environment. In order to test this I designed a grow box with 2 halves. One side contained the control group plants, the other side housed the plants which I suspended upside down. I watered the control group plants as normal & provided a light source as normal. On the side with microgravity I watered the plants from the top (thru the roots) and placed a light source from the bottom. I cared for and monitored all four plants for approximately a year. The results were amazing!

Methods/Materials
Grow 2 plants (control group) normally, 2 plants suspended upside down for a year. Water the suspended plants from the top and place the light source from the bottom. Materials: grow box, peg board, lights, plywood, funnel, fertilizer, threaded rods, nuts, mist bottle, water meter, and plants.

Results
All four plants lived and grew. During their development they had very close to the same number of leaf loss, and the same number of blooms. The plants suspended upside down had a noticeable change in their growth pattern.

Conclusions/Discussion
Plants can adapt to an environment absent of gravity, though the processes brought on by gravity are omitted sending the plants into a state of confusion. The plants responded by growing in a spiral fashion. It was amazing to watch it unfold.

Summary Statement
Growing plants in a microgravity environment to see if they can adapt and survive.

Help Received
Father helped build my grow box and science board, Mother helped select the plants and nagged me often to water and mist my plants.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Karen E. Joyce

Project Number

J1716

Project Title

Saving Coastal Sage: Methods of Eradicating Invasive Fennel (Foeniculum vulgare)

Abstract

Objectives/Goals

Fennel has invaded the coastal sage scrub that covers a portion of my property. Coastal sage scrub is an endangered ecosystem that supports a number of endangered species. I wondered what would be the most effective way to eradicate fennel from coastal sage scrub. I knew I could use herbicides, but I hoped to find another solution. I researched and found that digging up 10 cm of each fennel plant's bulb at the top of the root would be a way to eliminate the fennel. My hypothesis was that this method might be difficult to carry out, but both effective and more environmentally friendly than using herbicides.

Methods/Materials

I tested 120 fennel plants. I divided the plants into 6 experimental groups. In one group I tried digging up the root, in another I cut the stalks, in two other testing areas I sprayed two different types of weed killer, and then I tried my own idea which involved applying two different concentrations of a urea solution. I checked the fennel plants every other day for 80 days to see how the fennel plants responded to the various treatments.

Results

After cutting the stalks of 20 fennel plants twice, none of these plants were successfully eradicated. In contrast, digging up the taproot of the fennel was 95% effective. The first type of weed killer (Roundup Weed and Grass Killer) eradicated 85% of the plants, while the second type of weed killer (Roundup Tough Brush Killer) eradicated 80%. The first urea solution (24 ppt), only killed 5% of the fennel. A second solution (240 ppt) only eliminated 15% of the fennel plants.

Conclusions/Discussion

Digging up 10 cm of the taproot was the most effective method of eradication. I hypothesized that it would be difficult to dig up the taproots, but I found that after heavy rain the plants can be pulled up easily and without disturbing the soil. Roundup was effective in killing the fennel plants, but is a non-selective herbicide, and it was difficult to avoid killing some of the native plants around the fennel testing areas. I was incorrect in hypothesizing that the urea solution would be effective in eradicating the fennel, although regrowth did lessen slightly. Plants whose stalks were cut twice continued to grow, as I expected.

Summary Statement

This project involved testing six methods of eradicating invasive fennel from an area of endangered coastal sage scrub.

Help Received

Maryanne Bache, Education & Outreach Director at the San Elijo Lagoon Conservatory, gave me information about fennel.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Adam B. Kaplan

Project Number
J1717

Project Title
Space Farming

Abstract

Objectives/Goals
To complete an investigation to determine if vegetable seeds under artificial gravity or an electromagnetic field germinate faster or grow better. The product of these effects could then be used to grow fresh food, improving the physical and emotional health of future long-distance astronauts.
My goal is to have an advanced version of this experiment travel into space on a NASA Space Shuttle or be installed on the International Space Station for thorough operational testing.

Methods/Materials
Germinating seedlings will be placed on static, slow and fast rotating turntables and other samples will be placed in, and isolated from, an electromagnetic field. The seedlings will be observed and measured daily to chart growth or germination. Seedlings will be extracted from the soil and examined. These observations will be compared to a control group that will not be rotated or exposed to electromagnetic energy.

Results
ELECTROMAGNETISM - The electromagnet did not make all of the seeds germinate more rapidly. However, the electromagnet gave some of the seeds an initial jump-start.
HYPERGRAVITY - Rotation has a beneficial affect on seedling germination. The radishes on the rotating turntables had both larger and longer stems and roots.

Conclusions/Discussion
The Hypergravitational effect definitely had positive results and would be a great thing to have in space where there is zero-gravity. My hypothesis appears partially right; hypergravity using rotation could be more advantageous than regular germination and growth. It is likely additional water will be required due to increased evaporation with this method.
The Electromagnet did not make the seeds germinate faster overall, it provided a jump-start in the beginning. Light is key to germinating seeds. My hypothesis appears to be somewhat incorrect. It is unresolved whether electromagnetism has an overall beneficial affect on germinating seeds.

Summary Statement
Providing a healthy, fresh food source for future long-distance astronauts, thereby improving their physical and emotional wellbeing.

Help Received
Father helped build apparatus. Teacher provided encouragement and advice.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jordan C. Kelterer

Project Number
J1718

Project Title
Why Do Leaves Change Color?

Abstract

Objectives/Goals
The objective is to determine how light affects the color development of leaves of the Liquid Amber Tree (Liquidambar styraciflua) and the Photinia Tree, (Photinia x fraseri). I predict the 110 green leaves, each one being partially covered in aluminum foil, will not change color underneath the foiled part of the leaf because of the deprivation of sunlight during the autumn season.

Methods/Materials
I selected three Liquid Amber trees and two Photinia Frateri trees, both classified as deciduous trees,and all receiving sunlight. I partially covered 22 green leaves on each of the 5 trees with aluminum foil to manipulate the variable. I used a Color Chart to establish the color green at the time of covering the leaves. After the leaves changed color I carefully removed the aluminum foil and determined the color green, using the Color Chart to measure the experiment. I photograped the leaves to document changes to the leaves. The leaves were preserved by waxing.

Results
Leaves deprived of light do not change color. 58 of 110 manipulated leaves survived the 59 days of the experiment. All 58 of the 110 manipulated leaves survived the 59 days of the experiment. All 58 of the manipulated leaves, which were partially deprived of sunlight, remained the same color green on the day they were harvested, between Nov. 17 - Dec. 30, 2006, under the foils as they were on the day the leaves were partially wrapped in foil, Nov. 3, 2006. Not only does light affect leaves changing color by breaking down chlorophyll but it speeds up the process.

Conclusions/Discussion
The experiment concluded that leaves deprived of light do not change color. Further, it proves that the light breaks down the chlorophyll, allowing the natural pigments of carotene and anthocyanin to show through.

Summary Statement
This experiment shows how light and chlorophyll are significant factors in leaves changing color in deciduous trees.

Help Received
Mrs. Wentz, St. Anne Teacher & Advisor Pamela Kelterer, Mother, Assistant for Ladder and Foiling

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jennie D. Kim

Project Number
J1719

Project Title
Transpiration Is a Fact, but Is a Pattern an Act?

Abstract

Objectives/Goals
The objective of this experiment was to determine if there was a relationship between a pattern of transpiration and how long plants are in the sun. The hypothesis was that there would be a pattern in transpiration the plant will lose approximately 1 gram of water, every two hours of sunlight

Methods/Materials
The experiment was possible with the materials: three identical plants, plastic sandwich bags, twisty ties, a scale, a black permanent marker, tap water, and three 8 fl. oz. cups. A few of the plastic sandwich bags and twisty ties are weighed beforehand. The weights of each are then averaged. The plants# pots are labeled 2 hours, 4 hours, and 6 hours, as well as Plant 1, Plant 2, and Plant 3. The plastic bags are put on a leaf of each plant, tightening the ends with the twisty tie. The plant is then watered, with the 8 fl. oz. cups, and put in the sun for as long as it is labeled, in the morning at 8:00 a.m. After the plants receive the scheduled amount of sunlight; it is taken to a place without direct sunlight. The bags are carefully taken off and the bag is weighted. The data is recorded; the total weight is subtracted by the weight of both the bag and twisty tie. The data is recorded.

Results
After all trials were completed, the averages of the three plants concluded that there is no pattern of transpiration, and so approximately 1 gram was not lost every two hours. The averages of each plant were all not even 1 gram: which Plant 3#s average was 0.88 gram, approximately 1 gram. Plant 1 lost 0.385 gram total in average, and Plant 2 had lost 0.6 gram. By subtracting for the differences, the plants had lost approximately a little over 0.2 gram. Even during the experimenting, it was possible to realize there wouldn#t be a pattern. For example, on some days Plant 1 and 2 will have the same results, like Day 1 and 6; it was 0.35 for both plants and 0.55 for the Day 6. In plants, there is no transpiration pattern relating to its time in the sun.

Conclusions/Discussion
The hypothesis was not supported by the data. The hypothesis was that there will be a pattern in transpiration and every 2 hours (2 hours, 4 hours, and 6 hours) the plants will lose approximately 1 gram. Instead there was no pattern but varying amounts of water loss during all the time intervals. The plants had released different amounts of water loss for the majority of the trials, and it usually wasn#t even1 gram.

Summary Statement
Will there be transpiration pattern every two hours, for a plant, or not?

Help Received
My mother bought the supplies I needed, and my grandmother let in the plants inside at their scheduled times, while I was at school.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jenna A. King

Project Number
J1720

Project Title
How Does the Size of a Pumpkin Affect the Number of Seeds It Produces?

Abstract

Objectives/Goals
For my project, I decided to see whether or not the size of a pumpkin affected how many seeds it produces. I hypothesized that the large pumpkins would have fewer seeds. The pumpkins would have fewer seeds because when the pumpkin's size is greater, the seeds will be larger and there will not be a lot of space for many pumpkin seeds.

Methods/Materials
To compare their sizes, I weighed and measured five large, five medium and five small pumpkins. I cut the pumpkins and washed the seeds using a colander. I counted the seeds and recorded the results. In order to find the density of the pumpkins I had to find their volume and mass. These were determined using mathematical formulas. I also found the area of the pumpkins. A postal scale was used to weigh the pumpkins.

Results
The larger pumpkins had more seeds than the smaller pumpkins. The size of the seeds from the larger pumpkins were also larger than the seeds from the smaller pumpkins.

Conclusions/Discussion
To conclude, my hypothesis was incorrect. I hypothesized that there would be fewer pumpkin seeds from the large pumpkins, but there are many more pumpkin seeds from the large pumpkins. This study suggests that if you want to maximize the number of seeds you get out of a pumpkin it would be better to buy a larger size.

Summary Statement
How the size of a pumpkin affects the number of seeds it contains.

Help Received
Mr. Yutan helped me find the formulas for volume, density, and mass in order to find the size of the pumpkins.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Emma K. Lay

Project Number
J1721

Project Title
The Effect of Colored Light on the Growth of Italian Bush Beans

Abstract

Objectives/Goals
The objective of this investigation was to learn if colored light effects the growth of Italian Bush Beans. The operational hypothesis was that if Italian Bush Bean seeds are exposed to different colored light it will effect their growth.

Methods/Materials
Materials: ruler, Italian Bush Bean seeds, potting soil, paper, pen/pencil, seeds pot(8x6 pack), 4 aluminum foil baking trays, red, blue, and clear cellophane, stapler, aluminum foil, camera, water, watering jug, measuring cup. Method: 48 beans were planted in a 6x8 packs of seeds pots. Each 6 pack was covered with a 5 sided cover of either red, blue, clear cellophane, or aluminum foil. They were placed in a sunny, warm area and left to grow for 15 days.

Results
The results of data collected through observations showed that clear light helped the Italian Bush Beans grow the best. The average height of Italian Bush Bean seeds after 15 days under clear light was 40mm. This was followed by an average of 39mm for blue light. Red light had an average of 34mm. The control with no light had an average of 19mm.

Conclusions/Discussion
The results collected in this study did support the hypothesis that if Italian Bush Bean seeds are exposed to different colored light then it will effect their growth. The beans did not grow as well under red and blue light as they did under clear light.

Summary Statement
My project was about looking at the effect of colored light on the growth of Italian Bush Beans.

Help Received
My Mother and Father helped me make cellophane "tent" covers, took some photos, proofread my work, and helped with board layout.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Tessa A. Opalach

Project Number
J1722

Project Title
A Lotta Jubata

Abstract

Objectives/Goals
The prevalence of two related non-native species was examined and compared throughout Humboldt County. Both species are commonly known as pampas grass, but their scientific names are Cortaderia selloana and Cortaderia jubata. Background research suggested Cortaderia jubata would be the dominant of the two due to its reproductive strategy and growing range.

Methods/Materials
Eight different pampas grass infested micro-environments were sampled. Within each infestation three 10x25 foot plots were marked with stakes and flagging. The two pampas grass species on each plot, if present, were counted in clumps and recorded on a plot card created for this study. Ranges of stem heights and tussock heights were also measured and recorded. All other plant species on the plot were identified and also recorded. For this study a Field Identification Guide was created using published literature and information downloaded from the internet. Its purpose was to aid in correctly identifying these two closely related pampas grass species.

Results
Every micro-environment was dominated by Cortaderia jubata as predicted. In fact, Cortaderia selloana was not found on any of the study plots. The stem height to tussock height ratios varied significantly, even more so than that reported in the literature. This could be because the micro-environments sampled included some extreme conditions.

Conclusions/Discussion
Although the literature says that Cortaderia selloana is a problematic invasive specie in Humboldt County, none was found in the pampas grass infestations sampled. The real problem in Humboldt County is Cortaderia jubata, hence the name of my study: #A Lotta Jubata.# To prevent Cortaderia selloana from becoming a huge problem it is recommended that any known plant of this specie should be removed so that it does not have a chance to reproduce.

Summary Statement
The prevalence of two related non-native species, commonly known as pampas grass, was examined and compared throughout Humboldt County.

Help Received
Father helped with graphing and identification of species; Mother helped with backboard design; Tony LaBanca helped with background research.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Bryan C. Pearn

Project Number
J1723

Project Title
Moonstruck: Are Plants Affected or Influenced by the Moon?

Abstract

Objectives/Goals
The project's objective was to determine if the light and gravitational changes found in each of the four moon phases, Apogee/Perigee Moon Cycles, Ascending and Descending Moon Cycles, and the moon's Ascending and Descending Nodes would have an affect on seed germination and plant growth.

Methods/Materials
A mini greenhouse kit was planted with radish seeds two days before each of the four moon phases. The seed germination date and plant growth were recorded and averaged. Plant failures were factored in the averages. The Apogee/Perigee, Lunar Nodes, Ascending and Descending Moon Cycles, and Moon Phases were charted and the results compared. The experiment was repeated for two Lunar Cycles.

Results
I discovered that my hypothesis was correct. I stated in my hypothesis that I believed that seed germination and plant growth would be best in the New Moon Cycle, when lunar forces are strongest. The New Moon Cycle had the fastest seed germination for each Lunar Cycle experiment. The radishes planted on the New Moon Cycle-1st Lunar Cycle grew 0.9 centimeters higher on average than any other moon phase. The radishes planted on the New Moon Cycle-2nd Lunar Cycle grew 0.1 centimeters higher on average than any other moon phase. The Perigee Cycle appeared to have a small negative influence on plant growth, while the Apogee Cycle indicated plant growth acceleration. The Descending Moon Cycle data indicated a negative influence on germination of seeds and on plant growth. The Ascending Moon Cycle indicated a small positive influence on both plant growth and seed germination. The Moon Nodes data showed no influence.

Conclusions/Discussion
My hypothesis proved to be correct. The New Moon Cycle influence produced the fastest seed germination and plant growth. I feel that some unseen variables may have affected the results. Inconsistent weather conditions may have affected the light creating false growth results. Inconsistent moisture due to temperature changes may have affected the plants corrupting the data results. Increasing daylight hours may have also corrupted my plant growth data. My experiment's data may have indicated subtle influences by the Moon's Cycles, but I am not confident the corrupted data by these unseen variables, established any real pattern. To establish any real scientific results this experiment would have to be repeated over a very long period of time.

Summary Statement
My project was an attempt to discover if the changing light, gravitation, and magnetism that occur during the numerous Moon Cycles have an affect on the germination of plant seeds and plant growth.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jacqueline C. Peterson

Project Number
J1724

Project Title
It's the Source, of Course! How Different Sources of Water Affect Lima Bean Plant Growth

Abstract

Objectives/Goals
The objective is to determine how different sources of water affect lima bean plant growth. The hypothesis states that lima bean seeds watered with marsh water will produce healthier plants than those watered with other water sources in terms of plant height, leaf color, leaf size, and the amount of leaves.

Methods/Materials
Two lima bean seeds covered in fungicide were planted in eight 1-gallon pots approximately three feet below a fluorescent light for 18 hours a day. The seeds were watered with well, delta, marsh, hot tub, tap, sparkling mineral, distilled and bottled water with fluoride, and measured for 50 days. Leaves were measured and pictures were taken at 10 day intervals.

Results
Roughly half the seeds germinated. The experiment showed intriguing results with plants from six water sources having strange colors and unique leaf deformities. The only plant that appeared to look healthy was the plant watered with well water. It had a rich green color, large leaves and was slightly taller than the rest of the plants. The plant that grew the worst was the one watered with hot tub water. It was small and yellowish in color and the leaves were very dry and brown.

Conclusions/Discussion
The hypothesis was incorrect because the seeds watered with marsh water did not germinate. Only the plant watered with well water had many sets of green, healthy, large, well formed leaves. Perhaps this was because all the other water sources had chemicals or impurities in them that harmed the plant. Chlorine in the hot tub water dissolved quickly but may still have caused the plant to grow poorly.

Summary Statement
This project analyzes how eight different sources of water affect lima bean plant growth.

Help Received
Mom helped type the report and assisted in creating graphs and tables.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alena J. Raymond

Project Number
J1725

Project Title
There's a Fungus Among Us! The Effect of Mycorrhizae on the Growth Rate of Redwood Tree Seedlings

Abstract

Objectives/Goals
Most of us only think of fungi as pathogens, parasites and decomposers. The purpose of my project is to call attention to the important role of fungi in symbiosis with plant life. Mycorrhizae is the symbiotic association between certain species of fungi and the roots of most plant species.
My objective is to discover if mycorrhizae forming fungi have an effect on the growth rate of coast redwood seedlings (Sequoia sempervirens). Also, I hoped to determine if this effect is greater in seedlings that have been inoculated with mycorrhizae at germination compared to those that have mycorrhizae added later.

Methods/Materials
The growth of forty redwood seedlings was measured, recorded, averaged, and compared before and after a period of 8 weeks. The parameters of growth measured were shoot height, longest root length, shoot and root volume, and shoot diameter. The seedlings were divided into four groups. Environmental conditions were controlled for.

Results
All the plants (except for two from Group D that died) showed new growth in every parameter measured, as well as, in the number and length of new branches. Group B, with added mycorrhizae but not inoculated at germination, showed the greatest amount of growth in every measured parameter.

Conclusions/Discussion
Over all, the evidence of growth and success of bringing the seedlings out of their period of dormancy was very interesting and exciting. The results of this study did not support my hypothesis. I thought the seedlings inoculated at germination and with mycorrhizae added at the time of planting (Group D) would show the greatest amount of growth because of being the most highly infected of all the groups. The only identified difference between Group A and Group B, besides genetic make up, is the addition of mycorrhizal forming fungi at planting time. The outcome of my experiment suggests that the greater measured growth of Group B could be attributed to the benefits of mycorrhizae. The outcome from groups C and D could be the result of damage to the roots when transplanted. I am still working on being able to determine which plants in my study are in fact infected with mycorrhizal fungi by sectioning, staining, and observing for the presence of mycorrhizae under a microscope.

Summary Statement
My project compares the growth rate of coast redwood seedlings that have been inoculated with mycorrhizae forming fungi with those that have not.

Help Received
Glenn Lehar, Green Diamond Resource Co. Nursery Superintendent, generously donated coast redwood seedlings, the mycorrhizal fungi inoculum and his expertise; Dr. Terry Henkel, fungi specialist, and Dr. William Bigg, forest physiology and biometrics specialist, both offered their expertise and support.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Rachel A. Reese

Project Number
J1726

Project Title
Reclaiming Farmland: The Effect of Gypsum on the Germination of Onion Seeds in Sodic Soil

Abstract

Objectives/Goals
Sodium in the soil is a growing problem for the agricultural industry. About one third of the land in the US has some degree of salt buildup. My objective was to determine the optimum amount of gypsum, a calcium fertilizer, for the reclamation, by cation exchange, of salty agricultural soil. I used the germination rates of onion seeds to measure the soil suitability with various rates of gypsum; onions have low tolerance to salty soil.

Methods/Materials
I collected salty topsoil. Sodium levels were previously determined by laboratory analysis. I collected slightly salty, intermediate salty, and extremely salty soil samples. I calculated soil and gypsum ratios to create equivalents to tons per acre rates. For every soil sample, I ran ten trials each of 0 (control), 2.5, 5, 10 and 20 tons per acre of gypsum. I used a gram scale to measure the appropriate amounts of gypsum and soil. I mixed the different gypsum rates with the soil. I used a small amount of pea gravel at the bottom of the containers to help with drainage. After doing this, I placed the different mixtures into containers and planted one onion seed in each of the containers. I watered the soil and placed containers in a plant incubator. I recorded germination each day in my science notebook.

Results
In slightly salty soil, the germination rate in the control containers was 80%. The germination rate was slightly less at 2.5 tons of gypsum per acre (T/A) and 5 T/A gypsum. At 10 T/A gypsum, the germination rate improved to 100%. At 20 T/A, the germination rate dropped back to 80%. In moderately salty soil, the control (untreated) containers had a germination rate of 10%. The germination rate at 5 T/A gypsum was also 10% and was 0% for the 2.5 and 20 T/A treatments. Again, the 10 T/A gypsum treatment showed a higher germination rate, 50%. In the extremely salty soil, there was no germination of seed at any rate of gypsum application. In my trials I found that the gypsum at 10 tons per acre worked best in reclaiming salty soil.

Conclusions/Discussion
My project showed increased germination with gypsum applied at 10 tons/acre. With the increasing problem of salty soils in San Joaquin farmland, the use of gypsum needs further study to determine optimal levels for maximum benefits. My project suggests that 10 T/A of gypsum is most helpful to germination rates. This rate is higher than usual gypsum treatment levels.

Summary Statement
My project explores salty soil reclaimation with various rates of gypsum, a calcium fertilizer.

Help Received
Father drove to fields to collect salty soil samples and helped glue papers on my board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Elijah B. Roth

Project Number
J1727

Project Title
Little Green Men

Abstract

Objectives/Goals
The purpose of this experiment is to find if plants will survive in a Martian Soil with the aid of fertilizer and plant supplements or not. My hypothesis is that if a Martian Soil can be produced and plants planted in it, then the Acorus grass, along with the help of fertilizers, hormones, and plant supplements, will grow the best, due to its grass and weed like ability to grow in most places.

Methods/Materials
After determining my question I performed my experiment by creating a replica Martian Soil using the chemicaks obtained by the chemists, planting the desired plants in it, and observing them.

Results
I found that the Lily Turf in the regular and fertilized Martian Soil faired the best and both the Acorus grass in the fertilized and regular Martian Soil did the worst.

Conclusions/Discussion
Based on the results from this project I have concluded that the Lily Turf will grow the best in a Martian Soil and that the Acorus grass would do the worst because of its need for excessive amounts of water

Summary Statement
I performed my project to determine which plant (if any) would survive best in a Martian Soil or if it needed a fertalizer.

Help Received
Father performed helpful mathematical equations to determine amounts of chemicals for soil; Dr. John Voth, the Lab and Tech Manager at Monterey Ag Resources, supplied information and chemicals for project; Used chemicals under supervision of my father

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Thomas D. Salinas

Project Number
J1728

Project Title
The Effects of Plant Overcrowding with Limited Resources

Abstract

Objectives/Goals
The objective of this project is to show the effect of overcrowding on plant quality.

Methods/Materials
Radish plants were selected for this experiment because of their quick growth and maturation cycle. Four sets of seeds were set up in planters per seed manufacturer#s recommendations for seed spacing as the control group. Four additional sets of seeds were set up in planters using 5 times the number of seeds per recommended spacing requirements as the variable group. All planters were exposed to identical growing conditions and received identical amounts of resources (light exposure, water) over the period of one month.

Results
Results showed the control group to have 100% germination versus 49% germination in the variable group. The control group produced 32 viable plants out of 32 and the variable group produced 78 viable plants out of 160. The variable group plants had an average of 6.00 cm for root length whereas the control group average root length was 5.14 cm. Visual comparisons showed the following: control plants had a larger root system (thicker, shorter and more substantial); variable plants had a thinner root mass and long thin roots. Control plants produced shorter but thicker stems while the variable plants produced tall, thin, fragile plants. Control plants produced several large flat leaves while the variable group produced more leaves but they were smaller in size and tended to be curled rather than flat; leaf color was also lighter than control group. Red maturation color was darker and more frequent on control plants versus variable plants with lighter color and less production.

Conclusions/Discussion
When necessary resources were in limited supply, the variable group plants were forced to compete for these resources more thereby lowering survival rate and plant quality whereas the control group exhibited complete germination and healthier, heartier plant production supporting my hypothesis.

Further experiments regarding plant overcrowding could include providing additional resources to variable group and determining if given enough resources for survival, if sheer space constraints produce similar or very different results. Data of this sort could perhaps be applied to getting greater food production from smaller growing areas.

Summary Statement
Effects of plant overcrowding with limited resources.

Help Received
Assistance with production of graphs due to unfamiliarity with software program; Mother assisted with abstract composition and submission.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jacob D. Seabury

Project Number
J1729

Project Title
CO+F(2)+E(2) Brewing Organic Gardens: Benefits of Recycling Coffee Grinds

Abstract

Objectives/Goals
My hypothesis is used coffee grinds can be recycled, add value to improve plant growth and help the environment#but a proper ratio of coffee to soil probably is necessary for different types of plants.

Methods/Materials
Three tests were conducted to evaluate the effects of coffee grounds in the soil with seven varieties of plants and grass. Soil tests measuring three major nutrients (Nitrogen, Phosphorus and Potash) were completed on all soil combinations used for the project. The primary test evaluated coffee versus fertilizer versus soil only. The secondary test measured the effects different ratios of coffee to soil on the plants. The third test provided more definitive results on coffee to soil ratios using Biomass. Watering amounts were aided by using a moisture meter and Biomass was measure with a triple-beam balance scale.

Results
Results of the Primary test concluded that the used coffee grinds produced results better than or equal to fertilizer sticks and much better than soil only. Results of the Secondary test showed that when mixing both soil and coffee grinds together, a 1:3 ratio of coffee to soil is an optimal level for most plants. Results of the Biomass tests showed that a 1:1 ratio was a healthy mixture for grasses, and test samples with coffee and soil produced 15% to 280% more biomass. Plant varieties responded positively but with different degrees to the use of coffee grinds and the different percentages of coffee to soil mixtures.

Conclusions/Discussion
The plant family that benefited most was in the Violaceae family (Pansy and Viola). Coffee grinds add to both the composition of the soil and nutrients needed by the plants. Coffee is an organic by-product and recycling it back into the earth would prevent millions of tons of used coffee grinds being dumped in our landfills. Recycling would help reduce the use of man-made fertilizers and reduce possible runoff of unused chemicals and fertilizer.

Summary Statement
I researched, tested and evaluated the contribution of the nutrients of coffee grinds for plants; the chemical changes in the soil; and the physical characteristics of the plants samples using coffee as an organic fertilizer.

Help Received
Parents helped with board assembly, proofreading, and driving to pick up supplies. Father supervised testing and assisted in formatting graphs. Mr. Al Remyn (Arborist) and Carlos Ruiz at Flowerdale Nursery helped with consultation and suggestions. Starbucks, Pete#s Coffee, and Deidrich#s Coffee,

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Quinn I. Strauser

Project Number
J1730

Project Title
The Effect of Different Colored Light on Plant Growth

Abstract

Objectives/Goals
Plants need light to perform photosynthesis and to grow. Do different colors of light lead to different rates of plant growth?

Methods/Materials
I made a greenhouse with four sections and covered each section with a different color of cellophane; green, red, clear, and violet. I put 10 pole bean plants in each section, and then I counted the number of leaves and measured the height of each plant every other day, except for when I went on vacation. I watered the plants with ½ a cup of water every week.

Results
I measured each plant on days 7, 9, 11, 13, 15, 20, and 32, after planting. The plants under the green cellophane grew the most in every measurement. The biggest growth spurt for the plants under the green cellophane was from day seven to day nine. By day 13, the plants under the purple and red cellophane started to grow at similar rates as compared with those under the green cellophane. By day 32, the plants underneath the green cellophane were the tallest, with an average height of 38.3 cm. The plants under the clear cellophane experienced the least amount of growth at every measurement except day seven. For the first 15 days, there was no differentiation in number of leaves. By day 32, the plants under the clear cellophane had the most leaves, with an average of 5.9 leaves per plant.

Conclusions/Discussion
Different colors of light do seem to lead to a different growth rate. Plants grown under green cellophane grew taller and faster than plants grown under other colors of cellophane. In the future, I would put different types of plants underneath the same color of cellophane to see if the light had the same effect that it did on the pole bean plants. I would also weigh the plants to find out their overall mass. I would also find out how much sugar is being produced by photosynthesis.

Summary Statement
I assessed how different colors of light affect plant growth in plant height and number of leaves.

Help Received
My Mom, Dad, Ms. Stephens, Mr. Fleck, Mr. Mertz, and Fooroozian Science Centers helped me on my project.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Emily M. Wachsner

Project Number
J1731

Project Title
How Do Different Variables Affect the Growth and Germination of Black and Lima Beans?

Abstract

Objectives/Goals
The purpose was to determine the effects of light&temperature on black and lima beans, the depth of the beans planted, type of beans planted,&inoculant on the root structure of beans.

Results
Lima beans would not germinate in soil with a temperature of less than 70°F.Black beans needed soil temperature of at least 60°F.For packaged vs.store bought black and lima beans, there wasn't much difference in growth;they all sprouted near same time.Black beans in the light spouted about three to five days earlier than in the dark.Lima beans in the light and dark sprouted in five days.Deep planted black and lima beans had more sprouts than the shallow planted beans.The root structure of inoculant plants clung to the dirt more, there wasn't much difference with growth.

Conclusions/Discussion
Black beans and especially lima beans need warm soil for germination. Gardeners should not plant black or lima beans until spring temperatures reach around 70° F and should be sure to plant the beans at least a depth of 6 or 7 cm. Light does not seem to dramatically affect the germination of beans. About one week after germination, bean plants need to be transferred to a garden area to avoid spindly growth. The lima beans would not germinate in soil with a temperature of less than 70° F. Black beans needed a soil temperature of at least 60° F. For packaged vs. store bought black and lima beans, there was not much of a difference in their growth; they all sprouted in about the same amount of time. Black beans in the light spouted in about three to five days earlier than those grown in a dark environment, however, lima beans in the light and dark all sprouted in five days. The deep planted black and lima beans had more sprouts than the shallow planted beans. The deep grown lima beans were healthier, with a thicker stem, and were one centimeter taller with more new leaves. The root structure of the inoculant plants was much more fibrous and clung to the dirt more, but there was not much difference with its growth.

Summary Statement
The purpose was to determine the effects of light and temperature on black and lima beans, the effects of the depth of the beans planted, the effects of the type of beans planted, and the effects of inoculant on the root structure of beans.

Help Received
Tutor assisted set up of the display board, Mother helped buy supplies.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
John Waggoner; Alexander Williams

Project Number
J1732

Project Title
Plants on Fire

Abstract

Objectives/Goals
The objective was to determine if fire affects the germination of certain species of plants.

Methods/Materials
We tested fire and four components of fire; heat, smoke, ethylene (plant hormone), and charate. We tested three different plants; lettuce, a common vegetable; Ericameria, a native plant; and ice plant, an invasive plant. Seeds were germinated in Petri dishes with wet paper towels. We tested fire by putting seeds in jars with soil and burning Artemesia californica around the bottles. For heat we put the seeds in foil in an oven at 150 ºF for 15 minutes. We collected smoke by holding a sieve with wet paper towels over the fire. For ethylene we put a ninth of an apple in the Petri dish. We put the ground up, burnt remainders of the fire in the Petri dish for the charate. Our control was seed of each species without fire, just water.

Results
Ericameria seeds did not germinate well in any treatment in the first trial. Lettuce seeds germinated in response to charate and ethylene but were heat sensitive. Fire and heat resulted in no germination. The lettuce seeds in the charrate also sprouted early secondary roots. Ethylene had the fastest germination; however the plant's stems quickly turned back on themselves and rapidly died. The ice plant seeds germinated in response to fire and smoke. They are not as heat sensitive as lettuce.

Conclusions/Discussion
Plants respond to fire, it affects seed germination. Two out of three species germinated. We think the third species of plant (Ericameria) did not germinate because of some sort of unidentified dormancy. Lettuce seeds did not do well in fire and heat; from this we concluded that there is major heat sensitivity in the lettuce species. The ice plant was not as heat sensitive lettuce. The ice plant responded to smoke positively; more seeds germinated than the control. Lettuce germinated in smoke but less than the control. The lettuce seeds in charrate germinated more than they did in the control. It seems that some aspects of fire affect the germination of lettuce and ice plant positively. Which plants come back after a fire may depend on the species.

Summary Statement
The project demonstrated that fire and its components, heat, ethylene, smoke and charrate, affect the germination of lettuce, Ericameria, and ice plant seeds differently.

Help Received
Philippa Drennan of LMU helped with putting our hypothesis together. Pam Williams helped with transport during the project.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Adrian J. Weddington

Project Number
J1733

Project Title
Fruit Size in Tangelos: Year Two

Abstract

Objectives/Goals
My objective was to determine if fruit size in tangelos could be increased by manipulating the tree by pruning or using a growth regulating hormone. The cost of the treatment and crop value were analyzed. My hypothesis stated that the growth regulator would be best at increasing fruit size and would have the best economic return.

Methods/Materials
A randomized complete block design was used to compare the pruning, growth regulator, and control (standard farming practice) plots. Fruit size was measured monthly to determine if treatments affect growth rate. At harvest, all fruit was sized on 27 trees (3 replications of 3 treatments, with 3 trees per treatment) using commercial sizing rings. Treatment cost was determined from University of California cost sheets and actual costs. Crop value was determined by sales of previous year fruit for the individual sizes.

Results
Growth rate and harvested fruit size among treatments was not significantly different. However, the total number of fruit per tree were statistically greater for the pruning and growth regulator treatments compared to the control. Return on investment was highest for the growth regulator, followed by pruning, and lowest for the control.

Conclusions/Discussion
While average fruit size was not significantly different among the 3 treatments, the difference in fruit count resulted in an economic advantage for using the growth regulator or pruning treatment compared to the control. Fruit size may also have been influenced by the treatments, as there is a correlation between size and number of fruit per tree. My results show that the economically best treatment is the growth regulator.

Summary Statement
Two methods of increasing fruit size were evalutated for effectiveness and economic benefits.

Help Received
Farmer applied standard practices and growth regulator. Mother helped with experimental design and statistical analysis.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alanna K. Williams

Project Number
J1734

Project Title
Where Do Redwoods Grow?

Abstract

Objectives/Goals
My objective is to determine how and if elevation, bedrock type and distance from streams affect the distribution of coast redwoods in Santa Cruz mountain forests.

Methods/Materials
The materials I used were geologic and topographical maps, a tape measure, a ruler, transparencies, and a car. What I did was go up roads and every 160 meters record if there were no, few, some, mostly or all redwoods in that area. I then mapped out ten 50m x 50m test areas (two for each quantity of redwoods). I counted all the trees in the test areas and compared with the number of redwoods and found out what the bedrock and elevation were. These calibrated my eyeball estimates. I drew my tree count on transparencies that overlaid the topographical map and compared the different components.

Results
My results show that redwoods didn't grow much where elevations were above 2500 feet and not at all below 250 feet--most redwoods grew right in the middle. Also, the closer an area was to a stream, redwoods generally grew better there then farther away. Redwoods overall did not grow on sandstone very much; other types of bedrock didn't have much of an effect. Another interesting thing was that redwood distribution changed very quickly.

Conclusions/Discussion
In the end, distance from a stream made the most difference to where redwoods grow; the closer to a stream, the more likely there was to be abundant redwoods. Elevation's effect was only that redwoods didn't grow too high up or too low. Other than not usually growing in sandstone, bedrock didn't seem to have much of an effect, redwood trees were usually abundant in granite or schist that was near a stream.

Summary Statement
My project is about coast redwood distribution based on elevation, bedrock and distance from a stream.

Help Received
Mother helped drive me around and with board assembly.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Rachel A. Yardum

Project Number
J1735

Project Title
The Effect of Sodium Chloride on Lactuca sativa Plant Growth

Abstract

Objectives/Goals
This experiment will determine what happens to Oakleaf lettuce (luctuca sativa) when sodium chloride is added into the plants water. It is my hypothesis that the two plant groups that have salt added into their water (two grams and six grams) will not grow as well as the one group with no salt added.

Methods/Materials
In this experiment, I used 3 groups with 6 plant pots in each group. The first group will be watered with plain water. Water for the second group will contain 2 grams of salt per liter. Water for the third group will contain 6 grams of salt per liter. Each group will have six 8.5 centimeter high peat planting pots. Three Oakleaf lettuce (Luctuca sativa) seeds will be planted in each pot in case of germination faliure. Seeds will be planted at a depth of 2 centimeters. All test groups will be planted and monitored at the same time.

Results
After thirty days, the plant group with zero grams of added sodium chloride turned out to be the healthiest and tallest of all three groups. All seeds in this group germinated and grew at a steady rate to approximately 8.5 centimeters in height with no visible discoloration to the leaves. The second plant group with two added grams of sodium chloride grew to about 6.5 centimeters tall. All seeds in this group germinated, but the leaves were not as broad as the zero grams group and some slight discoloration developed. The third plant group with six grams of sodium chloride added was stunted and grew to approximately three centimeters in height.

Conclusions/Discussion
The group with no salt added to the water grew larger than the 2 other groups with salt added. The group with 2 grams grew less. The last group with 6 grams added grew the least. The last groups of plants (6 grams) were the shortest in height. I think this because as time went on, the salt builds up in the soil. This caused some of them to die. This took place in the second group too. The salt tolerance for oak leaf lettuce is 1.04 grams per liter. This explains why the 2 grams per liter group developed stunted growth. I would also like to have a little more time on the experiment just to see what the outcome would be. Another improvement would also be to repeat the experiment at least another time because if you repeat it the outcome might be different than the first trial.

Summary Statement
My project is about how different salt levels in water effect plant growth.

Help Received