CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Glen L. Alameda

Project Number
J1601

Project Title
CO(2): Friend or Foe?

Abstract

Objectives/Goals
My goal is to help the greenhouse industry produce bettter and more fruit production.

Methods/Materials
1. Commercial Greenhouse 2. 36 tomatoe plants 3. 2"X 10' PVC pipe 4.2 PVC end caps 5. 1 drill 6. 1 drill bit 7.two air blowers 8. one roll of duct tape 9. two cylinders of CO2 10. 2" X 6' hoses 11. Hand held CO2 meter 12. one pound reading scale 13. 2 CO2 flow regulators

Results
Sample C(which was control) had the best tomato fruit production at 4.29 lbs average. Sample A (1000-1100 ppm) did second best with 4.01 lbs average. Sample B (600-700) came in last with 3.96 lbs average.

Conclusions/Discussion
I found out that CO2 was not necessary in this perticular greenhouse environment. There was enough atmospheric CO2 coming in the greenhouse. In other greenhouse facilities it may be different. On a sunny day adding CO2 may help tomato fruit production, because the plants take in more CO2 on a sunny day because they need CO2 and sun to make photosynthsis and they need photosynthsis to live.

Summary Statement
Inducing CO2 into greenhouse tomtato plants to monitor there growth and devolopment of the plant fruit by weight.

Help Received
Ciro Garcia day to day manegment; Rene Beusen mentor; TopFlavor Farms for letting me use the facilities

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Rahul Basu

Project Number
J1602

Project Title
The Effect of Hydrogen Peroxide on the Rooting of Plant Cuttings and Seed Germination

Abstract

Objectives/Goals
I conducted this experiment to find out the effect of Hydrogen Peroxide (H(2)O(2)) on the rooting of plant cuttings and seed germination.

Methods/Materials
I used two sets of materials: one for the seeds and one for the cuttings. The materials for the seeds were: Seeds of mung beans, broccoli, bok choy, black eye bean, garbanzo bean; H(2)O(2), petri dishes, filter paper, marker, and masking tape. The materials for the cuttings were: Cuttings of jade plant, ivy, coleus, donkey-tail, etc., flasks, H(2)O(2), plant nutrients, knife (to make cuttings), marker, and masking tape. For the seeds, I used 4 dishes for each concentration (10mL, 30mL and 50mL of H(2)O(2) in 473 mL water). I placed 5 seeds in each dish. I used blackeye beans, garbanzo beans, bok choy, mung beans, and broccoli. For the cuttings, I used 4 flasks for each concentration (30 mL H(2)O(2) in 908 mL water) and used jade-plant, ivy, and donkey-tail cuttings.

Results
I found that all bean plants watered with a concentration of H(2)O(2) had lighter leaves and longer roots than the controls. Another interesting observation was that all jade-plant concentrations had no roots below the water. In the ivy, the control group was much healthier than the variables. I didn't find conclusive results with the donkey-tail samples.

Conclusions/Discussion
I found that while H(2)O(2) helps with germination, toxicity in the chemical eventually kills the plant. Chlorophyll production was decreased, deteriorating the health of the plant. For best results, I would suggest using H(2)O(2) for germination and using water afterwards.

Summary Statement
My project is about the effect of Hydrogen Peroxide (H2O2) on the rooting of plant cuttings and seed germination.

Help Received
My teacher, Mr. Francis Lee, supervised and guided me through my work in the school science lab and brought me the chemicals. My parents helped me with Star Office graphing tool and reviews.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jonathan B. Beckman

Project Number
J1603

Project Title
Stomata Junction: What's Your Function?

Abstract

Objectives/Goals
The project purpose was to determine whether the number of stomata on a leaf's surface affects volume of water transpired in 24 hours. After testing environmental effects on stomata distribution, I explored the actual transpiration of water vapor through a plant's leaves. I had to determine the number of stomata on the leaves of two plants from three different growing environments: full sunlight, partial sunlight, and full shade. I then measured the volume of water transpired in relation to the growing environment and number of stomata.

Methods/Materials
In order to obtain average stomata per square millimeter on each leaf, I painted clear nail polish onto the leaf's surface. This quickly created a cast of the leaf's surface. This method was thought of after unsuccessfully tearing the leaf in an attempt to view a sample of the thin layer on which the stomata are visible and using acetone to make and impression of the leaf's surface on the plastic slip cover. After the nail polish dried, I carefully removed a section of the cast using clear tape. I then placed sample under a previously measured microscope. I counted the number of stomata in five randomly selected areas and then found the average number. After all six plants had been tested, I placed a sample of the plant into a potometer to measure the amount of water taken up through the stem of a plant and therefore, the amount of water vapor released through it's leaves. I constructed a potometer. When the potometer was set up, I turned on an indoor growth light which was suspended above the potometer. After the plant was in a stopper at the top of an uncalibrated burette tube, I filled the apparatus with water so that a calibrated burette tube read 0ml. I then placed a small beaker over the calibrated burette tube so that no water would evaporate and affect my results.

Results
In my tests, I found that plants that grew in full sunlight had more stomata than those that grew in shade. The plants that grew in partial sunlight had a number of stomata between full sunlight and full shade plants. In testing for the volume of water transpired in relation to stomata distribution, I found that, generally, the plants that grow best in full sunlight transpired the most and those that grow best in full shade transpired the least. The plants that grow best in partial sunlight transpired a similar amount to those that grow in full shade.

Summary Statement
My project tests the relationship between growing environment, distribution of stomata, and water transpiration in plants.

Help Received
I Used lab equipment from the St. Joseph's science laboratory.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kyle P. Burdick

Project Number
J1604

Project Title
The Effect of Salinity on the Growth of Ice Plant at the Ballona Wetlands

Abstract

Objectives/Goals
The objective of my project is to determine why the ice plant grows over the salt grass but stops at the pickleweed near the edge of the channels in the Ballona Wetlands. The pattern of growth, in which the salinity of the soil does not let certain plants grow, will be the main idea of my research. My hypothesis is that ice plant has a low salinity tolerance; therefore it does not grow near the waters edge. Because there is a lot of salt in the water, the farther away from the ocean tidal gates, the more ice plant there will be.

Methods/Materials
I selected 8 sites based upon the distance from the tidal gates. I constructed a quadrat sampling frame to put around the site. I then took a sample at high and low tides of the soil and water over a five week period. I then tested the soil and water samples for salinity levels. I performed three different types of tests. First, the water salinity tests showed that the water has a higher salinity concentration on average near the tidal gates compared to the water near the end of the water channels. Second, the patterns of salinity in the soil show that the soil has higher salinity concentrations the closer it is to the tidal gates. Also, the soil salinity is more concentrated the closer it is to the high tide water line in the channel. Third, I made observations and took measurements that showed the ice plant grows more and closer to the water where the soil and water have lower salinity levels.

Results
The farther from the tidal gates, which bring in salt water, the more ice plant there is. My water and soil tests prove there is more salinity closer to the gates than farther away from the gates. At the Ballona Wetlands, Pickleweed can tolerate high levels of salinity so it grows closest to the water where it will usually be submerged at the high tide. Salt grass is less tolerant to salinity and the tidal flow so it grows higher on the wetland banks. Ice plant is the least tolerant of salinity and grows farthest from the water and the high tide line.

Conclusions/Discussion
The patterns show that salinity is higher at points closer to the ocean, while the ice plant growth is greater at points farther from the ocean where water and soil salinity is lower. In conclusion, my data proves my hypothesis to be correct because ice plant does not grow as much in areas with higher salinity.

Summary Statement
My project is about why ice plant grows where it does based on the salinity levels in the soil and water at the Ballona Wetlands.

Help Received
My dad helped buy supplies and drove me to the Ballona Wetlands. Dr. Pippa Drennan (Proffesor at LMU) helped to develop my hypothesis and allowed me to use her refractometer and flame photometer.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Brenna Jean Cherry

Project Number
J1605

Project Title
The Effects of Light Variation on Lima Bean Growth

Abstract

Objectives/Goals
The objective was to determine the growth effects of various light sources: incandescent, fluorescent, and natural sunlight on lima bean seedlings. I propose that plants grown under fluorescent light should grow the most, since fluorescent light emits both red and blue rays that are essential in healthy plant growth. I further propose that sunlit plants would be next, and that incandescent lit plants would grow the least since it only emits red rays.

Methods/Materials
I planted six one-inch diameter pots containing three seeds each in commercially prepared potting soil. Two pots were placed in a south facing window to maximize solar energy. Two pots were placed 36 inches below a 25W incandescent bulb and two pots were placed 36 inches underneath a 25W fluorescent bulb. The artificial lights were kept on from sunup to sundown (6am-6pm). Each pot was watered the same amount, 50 ml per pot per day. The measurements that were to be recorded were: height of plant, number of leaves, length of leaves, and width of leaves.

Results
After analyzing my data, I found that the plants grown under the fluorescent light grew much more than the plants grown under the natural sunlight or under the incandescent light. I concluded that my original hypothesis had been proven correct. The fluorescent lit plants lead in growth in all areas measured. However, my secondary hypothesis was proven false. The plants that grew the least were the ones grown in natural light.

Conclusions/Discussion
My original hypothesis was proven correct. After reviewing my research, it completely makes sense. Fluorescent lights emit both red and blue rays,the plants were able to grow in both heigth of plant and height and width of leaves, while the plants under incandescent lights grew only in height and at a much slower pace than the fluorescent lit plants. I thought; however, that sunlight containing both red and blue rays, would grow faster than the plants grown under incandescent light. I now understand that, although I was able to choose the intensity and distance of my artificial lighting, I was not able to manipulate these variables in natural sunlight. Further, during the three weeks of my experiment, we had nearly two weeks of rain. These unfavorable weather conditions, reduced the insolation of the sun and the penetration of the visible rays. This reduced the rate of photosynthesis in the solar lit plants.

Summary Statement
My project is about the way that different types of light: incandescent, fluorescent, and solar, effect the growth rate of lima bean seedlings.

Help Received
My mother helped me cut and paste my boards.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Twyla D. Elhardt

Project Number
J1606

Project Title
Earthworm Castings: Is There Too Much of a Good Thing?

Abstract

Objectives/Goals
The goal of the experiment was to find out what the ideal proportion of earthworm castings to soil is for young garden plants. I hypothesized that plants would grow best in 100% earthworm castings.

Methods/Materials
Series of ten pots were filled with mixtures of earthworm castings and potting soil. Three series each held 0%, 20%, 40%, 60%, 80% and 100% earthworm castings respectively, for a total of three sets of 60 pots. A different variety of plant- tagetes, lactuca sativa, and viola tricolor- was planted in each set of pots. All pots of a variety received equal amounts of water and light. At the end of the experiment, each series of plants was harvested and photographed. Each plant was weighed and the average weight of the plants in each series, both leaves and roots, was calculated.

Results
The replacement of potting soil with earthworm castings increased the average plant weight up to 389%. The tagetes and lactuca sativa in the medium consisting of 80% earthworm castings produced the most plant growth, while the average weight of the viola tricolor grown in 100% earthworm castings was highest.

Conclusions/Discussion
I conclude that my hypothesis was incorrect and a medium containing 80% earthworm castings promotes more plant growth than one containing 100% earthworm castings. Since the data for viola tricolor in 80% and 100% series was based on a very small sample size, as most of the plants died, it is less reliable than the data for tagetes and lactuca sativa. The leaves of tagetes plants grown in 100% earthworm castings turned yellow, and plants grown in 40% castings had more flower buds than those grown in higher concentrations, indicating that overall plant development might be best at even lower concentrations of earthworm castings. Further research with much larger sample sizes of a single variety of plant, grown over a longer period of time would be necessary to confirm these results.

Summary Statement
This project tested the effect of the amount of earthworm castings in growing medium on plant growth.

Help Received
Mother advised me, helped me make 180 newspaper pots. Father showed me how to make graphs on the computer, printed photos for my board. My brother Noah mounted grow-lights onto the bottom of my bed, helped build mini-greenhouses, helped me select photos for the board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jillia Fongheiser

Project Number
J1607

Project Title
Can Tobacco Leaves Be Used as an Alternative to Chemical Plant Fertilizers?

Abstract

Objectives/Goals
This experiment was to determine if tobacco could be used as an alternative to chemical plant fertilizers.

Methods/Materials
15 syngonium plants
11g of tobacco
750ml water for tobacco mixture
5ml of Miracle-gro fertilizer
5L water
1NPK/pH test kit

Feed 5 plants fertilizer, 5plants tobacco mixture, 5 plants water every 2 weeks. Feed with tap water every week.

Results
Miracle Gro fertilizer was the best plant enhancer because it grew taller and more leaves. The tobacco fed plants grew taller on average than the water fed plants. The water fed plants grew more leaves than the tobacco fed plants. Overall, Miracle gro worked the best.

Conclusions/Discussion
For further experiments the entire tobacco plant should be used. The stem might have a greater sufficiency of NPK. Miracle gro could be tested against other fertilizers. Tobacco may not be the best fertilizer for the syngonium plant but it might work better on other house plants.

Summary Statement
To see if tobacco could have a positive use as a plant fertilizer.

Help Received
My mother boiled the tobacco mixture.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Austin T. Fullmer

Project Number
J1608

Project Title
Hydroponics: Can Blue Green Algae Be Used as a Substitute Hydroponics Solution and Sustain Plant Growth?

Abstract

Objectives/Goals
The objective was to determine if Blue-Green Algae could be used as a substitute hydroponics solution, which could successfully sustain plant growth.

Methods/Materials
Step #1 Build hydroponics apparatus.
Step #2 Growing several types of Blue-Green Algae to compare with hydroponics solution, bacteria based bio formula, & aquaponics solution.
Step #3 Geminating seeds
Step #4 Measure and compare the height and weight of several plants grown in the different kinds of plant growing formulas.

Results
The plants that grew in a solution of Blue-Green were an average 20 percent taller and weighed 32 percent heavier than the plants that grew in formulated hydroponics formula.

Conclusions/Discussion
The particular concentration of living Blue-Green that I grew in beakers provided a more nutritious growing solution than the optimum concentration of EcoGrow. The ecogrow was designed for optimum plant growth. I believe the Blue-Green algae which collects energy directly from the sun, has a lot of important vitamins, minerals or other nutritious components that are valuable for plant growth.

Summary Statement
Determining if Blue-Green Algae can be used as a hydroponics solution, which supports plant growth.

Help Received
Father helped purchase algae and miscellaneous parts. Father helped glue PVC pipe.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Brian W. Gac

Project Number
J1609

Project Title
The Effects of Ash on Radish Plants

Abstract

Objectives/Goals
The objective of this project was to find the effects of ash on radish plants.

Methods/Materials
The experimenter used ash from Julian, California; potting soil; Burpee radish seeds; two bags of Jiffy Pots; and a dual beam balence. The experimenter first planted 64 radishes in the Jiffy Pots. One group of 16 radishes were planted in a soil to ash ratio of 3:1, another group in 4:1, one group in 5:1, and a control with no ash. The experimenter kept the plants evenly moist by watering them every day for 28 days and observed them every 3 days. On the last day, the experimenter carefully removed the ash from the pots. The experimenter then washed them and dried them with a paper towel. The experimenter then massed the plants on the dual beam balence.

Results
The experimenter found that all of the experimental groups had a negative effect on the radishes compared to the control. The 4:1 ratio had the most negative effect, follwed by the 3:1, and then the 5:1.

Conclusions/Discussion
The experimenter thinks that the way the plants grew turned out that way because the plants were in potting soil. The ash caused the radishes' soil to become too acidic and caused the negative growth.

Summary Statement
This project is testing to find the effects of ash on radish plants.

Help Received
Father helped plant and radish plants. Mrs. Sniffen and Mrs. Taylor helped me decide what to do for my project. Mother and Sister helped me type the report and decide what to do for my project.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Taylor Gillis; Cooper Louie

Project Number
J1610

Project Title
Humic Acid: The Root to Healthy Plant Growth

Abstract

Objectives/Goals
The objective of our project is to determine which soils will yield the greatest plant growth, root length, and root weight: soil without additives, soil with dry humic acid, soil with liquid humic acid, or soil with a combination of dry and liquid humic acid. We believe that the combination of dry and liquid humic acids will yield the best results.

Methods/Materials
Sixty pots were filled with potting soil. Dry humic acid was added to 30 of those pots. We put all the pots in a cold frame we built to keep the plants warm and enhance growth. Over the next two months we watered 30 pots with plain water and 30 pots with liquid humic acid. Two months later we pulled our plants and began gathering data, using the carrots, which grew the best. We measured the root and plant growth, and weighed the roots. After calculating the average weight and length of the roots and the average plant growth we developed graphs of our results.

Results
We measured the carrots in several different ways. The greatest root lengths were in soil without any additives. This is the opposite of what we hypothesized. Second we measured the plant growth. Once again the results did not support our hypothesis. After we measured all of our roots and plants, we dried the roots at a low temperature to remove moisture that had been absorbed while growing. When we weighed the roots the results supported our hypothesis.

Conclusions/Discussion
The hypothesis was partially supported by our data. A combination of liquid and dry humic acid in soil did produce the highest root weight. However, this combination did not produce the highest root length and plant growth. We think it would be valuable to complete more trials when our plants can be grown in warmer weather and aver a longer period of time. In addition, we would be interested in looking at the amount of minerals humic acid helps the plants to absorb.

Summary Statement
Our project was about testing the effects of dry and liquid humic acid on root length, root weight, and plant growth.

Help Received
Borrowed triple beam balance from science teacher and father supervised building of our cold frame.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kellie E. Henderson

Project Number
J1611

Project Title
Jack and the Frozen Beanstalk

Abstract

Objectives/Goals
My project was to determine if cold or freezing temperatures would negatively affect lima bean and radish seed germination.

Methods/Materials
Using lima bean seeds from the same lot number and radish seeds from the same lot number, 3 seeds from each category were placed in zip-lock bags, labled and placed in the freezer and refridgerator for a maxium of 10 days and a minimum of 1 day. The control seeds were not chilled or frozen. The seeds were then placed in individual peat pots, labled, observed and measured daily and documented every 4th day for sprouting and growth. The experiment was done twice for comparison purposes.

Results
The lima bean and radish seeds were not affected by the cold or freezing temperatures. All of the seeds sprouted and grew normally in comparison to the control seeds. They had no signs of damage in the sprouting and growth stage.

Conclusions/Discussion
My experiment showed that the seeds were not affected by the cold temperatures and in fact may have helped the seeds become healthier, due to the destroying of fungal or bacterial imperfections within the seeds.

Summary Statement
Whether or not cold or freezing temperatures affects seed germination.

Help Received
David Dougherty background; Mom helped type, cut and glue board pieces; Dad showed me how to do power point bar graphs

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Tyler P. Hines

Project Number
J1612

Project Title
The Evaluation of Nitrogen, Phosphorus, and Potassium in Corn Grown Hydroponically

Abstract

Objectives/Goals
The purpose of this experiment was to evaluate the growth pattern of corn plants when limiting critical macronutrients in hydroponic growing solutions. My hypothesis is that plants grown hydroponically with the right amounts of Nitrogen, Phosphorus, and Potassium should grow better than those plants with elements omitted from their growing solutions, because when these elements are eliminated plants begin to show signs of deficiencies in their growth.

Methods/Materials
First I gathered 30 growth pouches and placed two seeds in each. Then, I placed 100ml of distilled water into each pouch. Each pouch was placed in the wooden slot box and covered with foil. The boxes were put in a window greenhouse, until they sprouted. The nutrient solutions were prepared and added to the appropriate experimental group.The solution levels were monitored weekly.Four plants, with the best growth rate, in each experimental group, were measured using the tallest leaf of each plant. Each plant was then cut right above the root system and weighed.

Results
The plants grown in solutions with all the nutrients present had the highest growth rates. Solution 1 (all nutrients) performed the best in both height, 44.13 cm, and weight, 3.85 g. Solution 3 (without phosphorus)performed the second best in both height, 39.38 cm, and weight, 2.22g. Solution 2 (without nitrogen) performed the third best in both height, 24.63 cm, and weight, .94 g. Solution 5 (no nutrients)performed the fourth best in both height, 20.75 cm, and weight, .52 g. Solution 4 (without potassium)performed the worst in both height, 8.13 cm, and weight, .05 g.

Conclusions/Discussion
The results of this investigation concluded that the plant requirements for Nitrogen and Potassium are more critical than the requirements for phosphorus. Additionally, to achieve optimum plant growth it is critical to supply all three of these macronutrients.

Summary Statement
The purpose of my experiment was to evaluate the growth of corn plants grown hydroponically using Nitrogen, Phosphorus, and Potassium; the data showed that plants receiving equal amounts of each nutrient had the best growth rates.

Help Received
Mother helped with the board, typing , and with the measuring.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Maxx G. Jennings

Project Number
J1613

Project Title
40 Acres and a Mule: Soil Selection for Living the American Dream

Abstract

Objectives/Goals
My project's objective is to classify the available soil types on my rural property, and then identify which of the classified types performs best for planting a family garden.

Methods/Materials
I first identified and classified-then collected (6) naturally occurring and (1) non-naturally occurring soil samples from the rural 40 acre property I live on. The samples were tested for their pH, nitrogen, phosphorus and potash levels to determine their relative acidity/alkalinity and amount of essential plant nutrients they contained. Alfalfa seeds were planted in each of the (7) soil types as a controlled test crop. After 18 days of growth the yield of each soil type's crop was analyzed. Based on this yield analysis, the classified soil types were ranked from best to least productive. This procedure was repeated three times.

Results
Soil type #2 ("Under Deciduous Trees") had the highest yield of all naturally occurring soil types, closely followed by soil type #3 ("Marsh"). Soil #2 was over 350% more productive than the least productive soil type (soil #7 "Alluvial Plain"). All the naturally occurring soils had very low nitrogen levels. However the man-made soil, soil type #1 ("Amended Alluvial/Under Deciduous Trees") had extremely high nutrient ratings and yielded 65% more plant product than the best naturally occurring soil type.

Conclusions/Discussion
Careful native soil selection can be very important to the growth results obtainable from a family garden, and therefore to the realization of the American Dream of personal independence. There was a significant difference in plant yield amongst the naturally occurring soils which was not at all predictable from the results of an off-the-shelf soil test kit. This indicates that there is much more to obtaining good plant growth results than a common home soil test kit will tell you. Carefully amending a native soil is very beneficial for plant growth and therefore recommended to the home gardener.

Summary Statement
I am trying to determine which available soil type on my 40 acre homestead will produce the greatest plant yield, therefore demonstrating which soil type is best for planting a family garden.

Help Received
My dad served as my scientific process mentor, results critic, and consulting editor to my published results. He gave me advice on how I might classify soils, structure their tests, eliminate or control for test variables, and then present the testing results in a clear manner.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
William C. Jordan

Project Number
J1614

Project Title
The Effects of Acid Precipitation on Root Growth

Abstract

Objectives/Goals
I believe that both plants, epipremnum aureum and plectranthus verticillatus, will be stunted or halt totally in root growth when placed in a container containing either acid solution of pH 6.0 or pH 3.0 (to simulate acid precipitation).

Methods/Materials
I conducted the tests on two different plant species, epipremnum and plectranthus,using two acid solutions of a pH 3 and pH 6 (to simulate acid precipitation). I used distilled water with a pH 7 as a control. I measured root growth of the plants for 15 days and recorded root growth and any other changes in the plants appearance.

Results
The control and the low strength acid groups grew at almost a parallel rate whereas the high strength acid group#s growth came to a complete halt and then died.

Conclusions/Discussion
From the information I have acquired through the testing I have conducted I can conclude that my hypothesis was generally incorrect. I had hypothesized that, within the course of my testing, both plant groups (epipremnum aureum and plectranthus verticillatus) in either low or high strength acid solution would be halted in root growth. Whereas the results of my testing showed that the plants in the low acid solution both continued to grow in parallel to those growing in the control group. Nonetheless, the plants in the low strength acid group did begin to show signs of stress not totally apparent in the control group plants. However, the epipremnum aureum in the high strength acid group did totally halt in root growth as I had expected and then began to deteriorate. The condition of the plectranthus verticillatus suggested that over a longer period of time the plants may have died totally and began to deteriorate more rapidly. It became obvious that P. verticillatus apparently began the same process at a much slower pace; the roots began deteriorating or darkening at the tips and the leaves began to show stress and yellowing.

Summary Statement
I tested the effects of acid precipitation on plant root growth.

Help Received
My mom drove me to the nursery.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Morgan S. Keefe

Project Number
J1615

Project Title
Is It Ripe Yet?

Abstract

Objectives/Goals
The purpose of this project was to find the optimal conditions for fruit ripening, and to determine which technique is the most accurate, as well as efficient, to measure the ripeness of the fruit.

Methods/Materials
Thirty-four bananas and twenty mangos were tested in different conditions with different variables such as light, dark, warm, cold, and in/out of paper or plastic bag. Also, there were three methods used to determine the ripeness of each fruit. These three techniques are the #squeeze test# using the indentometer to measure the amount of fore it takes to indent the fruit in Newtons, daily weight measurements, and changes in the color of fruit as assessed by digital photos and Red/Green/Blue assessment using a photo analysis program.

Results
The most optimal condition for fruit ripening is the multiple fruits in a paper bag at room temperature. The most efficient way to measure the ripeness of fruits is the #squeeze test# using the indentometer.

Conclusions/Discussion
Multiple fruit in a paper bag at room temperature proved to be the most optimal condition for fruit ripening. The paper bag concentrates ethylene gas, the main factor in inducing enzymes for fruit ripening, because it is a larger molecule. Oxygen is able to enter the bag more easily because it is a smaller molecule. The oxygen acts as a co-factor with ethylene gas in enzyme production. These enzymes, which are proteins, cause the fruit to ripen (and eventually over ripen!). The squeeze test (measured by the indentometer) was the most efficient technique used to measure the ripeness of each fruit.

Summary Statement
The purpose of this project was to test fruits and see what the optimal condition for fruit ripening is and which technique is most efficient for measuring the ripeness of the fruits.

Help Received
Mother helped edit report; Father helped build "indentometer and edit graphs; Mother helped put together poster

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Nichele R. Lee

Project Number
J1616

Project Title
Photosynthesis: What Color Light Helps Plants Grow?

Abstract

Objectives/Goals
My goal for this project was to learn how the color of light affected photosynthesis on plant growth. I believed that the red light would have the best effect and green light would have the worst effect on plant growth.

Methods/Materials
I soaked kidney beans in a bowl of water for 24 hours and then planted 4 beans in each of the 6 pots filled with topsoil. I watered each pot and placed them on a tray. Meanwhile, I assembled six greenhouses using 2-liter soda bottles, colored Christmas light bulbs and aluminum foil. After that, I placed the assembled greenhouses on top of the pots. Each pot was labeled to the colored light inserted in its greenhouse. I left the lights on the entire duration of the experiment. I watered and checked the plants each day for 3 weeks. I measured the plant height everyday after seed sprouted and recorded all observations and data in a notebook. After three weeks, I repeated the procedure for Trail 2. The height measurements were tabulated and charted to compare plant growth of each color light. The appearances of the plants were used to evaluate the effect of the color light on the plants.

Results
The bean plants in red light grew the tallest and healthiest with dark green leaves and thick stem. The beans in green light germinated the fastest but the plants appeared weakest with pale yellow leaves and thin stems.

Conclusions/Discussion
The reason light can effect the growth of a plant is that it provides the energy to activate the photosynthesis process inside the plant once the light is absorbed. The results of Trail 1 showed that red light had the best effect on plant growth and green light had the worst effect probably because green light did not get fully absorbed by the bean plant since the plant pigment, chlorophyll, reflected green light. In Trail 2, I discovered that heat was just as important as light in plant growth. If a farmer were to grow kidney beans in a green house, I would recommend her to use green light to germinate the beans and red light to grow the bean plants.

Summary Statement
My project examines how photosynthesis work and what color light helps plants grow best.

Help Received
My mother bought the kidney beans and Christmas lights for my experiment. She also helped me with project design, editing and display layout. My father gave me the idea of wrapping my greenhouses in aluminum foil.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Taran J. Lu

Project Number
J1617

Project Title
The Effects of Different Amounts of Light Energy on Plant Growth and Development

Abstract

Objectives/Goals
In my project I investigated the effects of different amounts of light energy on plant growth.

Methods/Materials
My four light treatments were 0 Watts, 4 Watts, 25 Watts, and 100 Watts. Ten Wisconsin Fast Plants were subjected to each different level of light. I measured the number of days the plants lived, how long it took to produce their first flower, and how many flowers they produced over a 28 day period.

Results
The light treatments produced very different growth among the plants. The dark-grown plants lived an average of 12.6 days and did not produce any flowers. The plants grown under 4 Watts of light lived an average of 15.9 days and did not produce any flowers. All plants grown under 25 Watts of light lived through the 28 days, started producing flowers after an average of 21.9 days, and produced an average of 3.9 flowers per plant. All plants grown under 100 Watts of energy lived through the 28 days, started producing flowers after an average of 24.3 days, and produced an average of 1.7 flowers per plant.

Conclusions/Discussion
In conclusion I have found that plant growth is altered under different amounts of light. The plants grown 85cm below 0, 4, and 100 Watts of light energy all had a less productive growth pattern than those grown under 25 Watts based on how much of the 28 day period they survived, how quickly they flowered, and how many flowers they produced.

Summary Statement
I studied the effects of different amounts of light energy on plant growth and development as measured by flower production, and number of days lived.

Help Received
Parents helped gather materials for growing plants, proof read my writing, and suggested ways to improve it.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Susie S. Nazlikian

Project Number
J1618

Project Title
Find the Hidden Colors

Abstract

Objectives/Goals
The objective of this project is to find hidden colors in plant leaf tissue.

Methods/Materials
The pigment spot was not immersed into the developer. The top end of the reaction chamber was tapered so that it will hold the chromatography paper strip at the desired distance. The paper strip level was ensured so that it does not touch the walls of the reaction chamber. The screw cap was placed over the chamber and the developer was allowed to advance up the paper without agitating the reaction chamber. Within 8-10 minutes you will notice bands of color have separated. The chromatogram was removed from the chamber when the developer front reaches near the top of the paper and allowed the air to dry. The chromatogram was saved for comparison to the ones produced with developers II, and III. Steps 3 through 6 were repeated, using developer II, and III. Within 15 minutes you will notice certain bands of colors that have separated in each of the chromatograms. The chromatograms were removed from the chromatography chambers to air dry.

Results
The results for the projects show the R(f) values for every band. The chromatogram shows 4 individual faint plant pigments of carotenes, xanthophylls, chlorophyll a and chlorophyll b by using developer IV.

Conclusions/Discussion
This project has demonstrated that the presence of chlorophyll, being the predominant pigment of green plants, masks the color of carotenes and xanthophylls in leaves. However, during autumn chlorophyll starts to break down, allowing these pigments to show their colors of red, orange, and yellow. For example, red pigments are usually masked by the green pigment chlorophyll during spring and summer, in the fall, the leaves lose their chlorophyll and the red pigments become visible. This project has demonstrated that the hidden colors don't really disappear. They are only masked by the leave pigments according to seasonal changes which determine the amount of sunlight received by the plant. Thus, paper chromatography continues to have an impact in the advancement of knowledge and understanding of every field of biology and chemistry. This project can be used in areas such as medicine, forensic chemistry, and differentiate individual plant pigment bonds. It can also be used in the separation of organic and biological compounds for forensic purposes that can be used as fingerprints.

Summary Statement
This project states how to find the hidden colors using paper chromatography.

Help Received
The help that I received was from a science advisor, mother, and sister.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Alex L. Nothnagel

Project Number
J1619

Project Title
Going, Going, Gone! Loss of Pigments and Proteins during Natural Leaf Senescence in Mulberry (Morus alba L.)

Abstract

Objectives/Goals
Change in the color of tree leaves is often associated with autumn. What causes this change in color? The objective of this project was to measure changes in the amounts of leaf pigments during natural senescence of the mulberry tree in my backyard. Because these leaves usually change from green to yellow before they abscise, my hypothesis was that chlorophyll would be lost first, leaving the yellow carotenoid and xanthophyll pigments behind. Based on background reading, I further hypothesized that protein would be lost from the leaves at about the same rate as the chlorophyll.

Methods/Materials
Leaf samples were collected weekly during autumn. To check for possible differences in different parts of the tree canopy, one leaf from the outer part of the canopy and another leaf from the inner part of the canopy on each of the four cardinal sides of the tree were collected at each week. Five 12-mm diameter disks were cut from each leaf and chopped in 80% acetone to extract the pigments. The acetone-insoluble residue was suspended in water to extract protein. Pigment levels in the acetone extracts were determined by measurement of absorption of light, and protein levels in water extracts were determined by colorimetric assay.

Results
Chlorophyll levels were fairly stable from mid-October to mid-November and then began a gradual decline that accelerated in mid-December until the leaves were lost in early January. As the chlorophyll was lost, the chlorophyll A to B ratio was fairly stable. The total chlorophyll to carotenoid ratio gradually declined until mid-December, after which it fell sharply. The drop in protein content was similar to the drop in chlorophyll content, and the chlorophyll to protein ratio was stable until late November, at which it started to make a gradual decline. In late December, it made a rapid descent and then remained stable for the last two weeks.

Conclusions/Discussion
The results are consistent with the hypothesis that chlorophyll is lost first, leaving the carotenoids and xanthophylls behind to make the leaves yellow. The hypothesis that protein would be lost from the leaves at about the same rate as the chlorophyll is only partially correct because the protein loss late in senescence did not accelerate as much as the chlorophyll loss.

Summary Statement
The aim of the project was to find out which pigment is lost first during natural leaf senescence in mulberry and how fast the leaf proteins are lost during senescence.

Help Received
I did the lab work at UC Riverside with my dad's supervision.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Stacy H. Perez

Project Number
J1620

Project Title
The Effect of Temperature of Water that is Given to Radishes

Abstract

Objectives/Goals
The objective is to find how the temperature of the water that is given to radishes affects their growth.

Methods/Materials
Three identicle plastic pots and filled with MIricle Growth Soil. Second, i planted one radish seed 13mm deep in each pot.I labeled each plant either A, b, or C I watered each plant with 125mL of water that was 21˚C or room temperature. i watered each plant like this every day until the radishes were 50mm high. When Plant A was 50mm tall,I watered it with 125ml of water that was 2˚C. When Plant B is 50mm tall, I watered it with 125mL of water that was 82˚C. When plant C was 50mm tall, i watered it with 125mL of water that was 21˚C. I repeat this process every other day for 14 days.

Results
At the end of the experiment, Plant C was the healthiest. It grew up to 132mm and had a taproot that was 20mm wide. Plant C had very healthy and full leaves, with no browning.
Plant B was the second tallest radish. It was 120mm tall and its taproot was 6mm wide. Plant B was not as healthy as Plant C. One of Plant B#s leaf#s edges was dead. Plant B was the second tallest plant, but it had the least healthy leaves. Most of its leaves were a yellow-green color.
Plant A was the smallest. It was only 107mm tall but its taproot was 7mm wide. Its leaves were all two colors: an unhealthy lime green color and the healthy green color that Plant C had.

Conclusions/Discussion
The hypothesis was disproved. The radish that was given water that was 21˚C grew the best but the radishes that were given water that was at an extreme temperature did not die. Instead they were very small and unhealthy.
If this experiment was repeated a number of things should be done differently, First, the experimenter should grow at least six radishes instead of three. Then the results would have been more accurate. The way that the radishes are measured should also be changed. The original experimenter measured the radishes# height by measuring the tallest leaf with the metric side of a ruler, but by doing that the radishes appeared to grow backwards on several occasions when the radish leaves would point down instead of up at an angle. I would have also liked to repeat this experiment with the discussed corrections.

Summary Statement
This project is about the effect of the temperature of water that is given to radishes and the plants ability to perform phpotosynthesis.

Help Received
My parents purchased the supplies. Everything else was performed with absolutely no outside help.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Michael D. Quinones

Project Number
J1621

Project Title
Electric Bananas, Are You Ripe Yet? Predicting Banana Ripening Using Electrical Resistance

Abstract

Objectives/Goals
Objective: To predict the ripeness of bananas using electrical properties. I created a banana ripeness tester.

Methods/Materials
Methods: Group similar size bananas by peel color with ten bananas in each group: yellow-green, yellow, and yellow-brown. Label each banana with a permanent marker. Weigh and measure the length and diameter of each banana. Match each banana's peel color with the closest color square in a color standard chart. Check the multimeter against known resistors. Record room temperature and humidity. Insert multimeter probes into the banana. Measure the current in the banana every ten seconds for six readings and calculate the average current and voltage. Calculate the resistance of each banana. Remove and wipe the probes clean. Repeat for the next banana alternating between groups. Materials: Fifty-five Chiquita bananas, Celsius Alcohol Thermometer, Humidity Gauge, Radio Shack Digital Multimeter, Marker, Pen, Ruler, Tape Measure, Camera, Weight Watchers Official Scale, Resistors, Alligator Clips, Color Chart, Mask For Color Chart, Galvanized Nail, Copper Wire, Steel Probes.

Results
For experiment two, I plotted the average resistance for twenty-one bananas over a ten-day period. The resistance dropped over the ten day experiment. For experiment three, with yellow-green, yellow, and yellow-brown bananas, the average resistance decreased as the bananas ripened.

Conclusions/Discussion
During banana ripening, several chemical and physical and chemical changes take place in both the peel and the pulp. While the peel changes from green to yellow and from yellow to brown, the pulp carbohydrates are converted to sugar, the pulp acid is neutralized, the pulp softens, and odors develop. In general, factors such as ethylene, growth regulators, temperature, humidity, and carbon dioxide affect banana ripening. I discovered that the electrical resistance does decrease as bananas ripen. The least ripe yellow-green banana group had an average electrical resistance five percent higher than the yellow control group which had an average resistance six percent higher than the yellow-brown group.

Summary Statement
My project is about predicting banana ripening using electrical resistance.

Help Received
My Mom drove me to the supermarket where I bought bananas on several different days. My dad took me to Radio Shack where I bought a multimeter. My science teacher gave me some suggestions on improving my report.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jason R. Regier

Project Number
J1622

Project Title
Determining the Effects of Nutrient Concentrations on Hydroponic Lettuce

Abstract

Objectives/Goals
My project was to determine the effects of different concentrations of fertilizer on hydroponically grown lettuce.

Methods/Materials
Three separate tanks were constructed of wood and lined with plastic. Each tank held the plant solution and a styrofoam panel, designed to float in the solution. Holes were drilled through the styrofoam panels to form "pockets" for each starter cup. Aerators were connected to each tank to supply oxygen. Artifical plant lights were hung overhead to substitute for sunlight.

Results
Tank 2 with 1/4 tablespoon of fertilizer per gallon of water had a 74% increase in total plant weight than the control tank with 1/8 tablespoon per gallon of fertilizer. Tank 3 with 3/8 tablespoon per fertilizer per gallon of water had a 14% decrease in total plant weight compared to the control tank.

Conclusions/Discussion
My conclusion is that more fertilizer does not always guarantee better plant growth. Additional factors need to be considered such as, pH levels, lighting, and water circulation.

Summary Statement
To determine if different amounts of fertilizer would have a profound effect on the growth rate of hydroponic lettuce.

Help Received
Father assisted with the construction of hydroponic tanks. Mother helped with display board and typing. Interviewed owner of Tower Garden Supplies in Fresno.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jennifer Scarbrough; Makenna Thompson

Project Number
J1623

Project Title
Do Rooting Hormones Affect the Germination Rate of Seeds?

Abstract

Objectives/Goals
The purpose of this project is to determine if pre-treating seeds with rooting hormone affects the germination rate of the seeds.

Methods/Materials
(1) Put soil into 4" plastic baby flats. (2) Make a 1% solution of Rootone rooting hormone by putting 1 gram of rooting hormone into 100 ml of water. (3) Soak the seeds, in batches of 60, in the rooting hormone solution for 24 hr. (4) Plant 12 seeds in each baby flat. (5) Sprinkle soil over seeds to cover the seeds. (6) Water plants as needed. (7) Repeat steps 2-6 with Miracle Grow rooting hormone. (8) Look at the plants every day to see how many seeds have germinated, record observations.

Results
Our preliminary results indicate that soaking the seeds in rooting hormone did enhance the germination rate of the seeds. With the corn the rooting hormone had an affect with 3 more seeds germinating than the seeds with water. The rooting hormones also had an affect on the beans with two more seeds germinating than the seeds with water. The rooting hormone had the best effect on the peas with 10 more seeds germinating than with the seeds with water. In our initial experiment, Coleus also did well with more seeds germinating than with the water only treatment. The rooting hormones did not have much of an effect on the sunflower seeds, however, with only one more seed germinating than the seeds with water. Overall the rooting hormones did have an effect.

Conclusions/Discussion
Our hypothesis was that the rooting hormones would affect the germination rate of the seeds. We think that it was worth buying the rooting hormones for the peas and Coleus. If you needed these seeds to germinate in a short length of time we would recommend the rooting hormone treatment. There was no effect with the sunflowers and not enough of an effect with the beans or corn to warrant the extra expense.
Indole-3-butyric acid (IBA), which was in the rooting hormones, is very similar to Indole-3-acetic acid (IAA), the most important auxin. We found that one of the roles auxins play in plant development is the regulation of the embryo development. We think that the IBA caused the seeds to germinate faster by affecting the embryo.

Summary Statement
The purpose of this project is to determine if pre-treating seeds with rooting hormone affects the germination rate of the seeds.

Help Received
Mr. Duerr helped us with experimental design and with advice on the design of grpahs on Microsoft Excel.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Karen L. Shein, Jr.

Project Number
J1624

Project Title
How Does the Intensity of Incandescent Light Affect the Growth of the Stems of Alfalfa Sprouts?

Abstract

Objectives/Goals
My objective was to determine the optimum intensity of incandescent light for growing alfalfa sprouts.

Methods/Materials
There were twelve pots filled with soil and alfalfa seeds in each. Each were filled with water and placed in a section of a box. The boxes were completely closed and therefore the plants only received the assigned light. Four different intensities of light were used: 25-watts, 40-watts, 75-watts, and 100-watts. Every other day 50 ml of water was poured into each pot. Everyday for twelve days all stems were measured.

Results
The sprouts under the 40-watt lights grew the tallest. Then the plants under the 25-watt lights. Third, the 75-watt lights. Lastly, the 100-watt lights. The sprouts under the 100-watt lights were too hot to grow, while the sprouts under the 25-watt lights contained too much water to grow.

Conclusions/Discussion
My conclusion is that a middle intensity of incandescent light grows alfalfa sprouts the tallest.

Summary Statement
Finding the best intensity of light for growing alfalfa sprouts.

Help Received
Father helped construct boxes.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
David B. Tannin

Project Number
J1625

Project Title
Hydroponics: An Interpretation in Cultivation

Abstract

Objectives/Goals
To find out whether hydroponics is a better form of cultivation and should be used to improve many aspects of agricultural farming.

Methods/Materials
MATERIALS: bucket tape,1gallon plastic jug with cap,6 dwarf tomato plants,1 tbls. of plant fertilizer(5-10-5),1 tsp.-Epsom salt,3 7oz. Paper cups,1tsp. of ammonia,papertowels,3 pint glass jars,tin foil,pen,tap water.PROCEDURE:Fill bucket with tap water, let water sit to evaporate chlorine.nutrient solution:Fill milk jug 1/4 with water.Add fertilizer, Epsom salt, and ammonia.cover jug and shake. Mix well. Fill rest of way. Take a tomato plant out of pot.Gently take soil off.Don#t damage roots.Then rinse them in water to remove all dirt. Cut hole in bottom of paper cup to allow 1/4 of roots to stay in cup.Support plant with paper towel.Put cup inside jar.Mark bottom of cup on jar.Add nutrient solution to mark. Keep solution at mark during experiment.Place cup in jar.Put tin foil on jar to prevent algae.Repeat steps 4-11 for two other plants.Put in direct sunlight.Set three other tomato plants in pots in same place as hydroponicums for comparison.Water as needed, with tap water.Measure plants, record observations

Results
Plant Growth in Milimeters

	Hydro A	Hydro B	Hydro C	Reg 1	Reg 2	Reg 3
Average Total Growth	232	271	312	214	156	100

The Hydroponic plants were much healthier,and the leaves were much greener and lusher. There were more flowers and it produced more fruit. Hydroponics turned out to be superior.

Conclusions/Discussion
The plants were much healthier and thrived in a hydroponic system while the other plants were not as healthy. This was due to malnutrition from the tapwater. I learned that mold is fatal to plants when the cup and roots got moldy. Hydroponics though, has many problems. It is expensive for real systems and if defective, the plants can die. After one day of forgetting to refill the hydroponics system, the plant started to welt. This shows that the plants need help retaining moisture. Lastly, I found out that hydroponics has a greater output than other plants. Even though the starting expense seems greater, you still do not need to buy weed killer and sometimes pesticides. Less work is put into these plants and more produce is obtained. Overall, Hydroponics is a more useful form of cultivation and can increase productivity making a large benefit. If used more in the future, it could solve many world problems.

Summary Statement
My project is about hydroponics, and how it compares to growing without fertilizer and just tap water.

Help Received
Mother helped buy suplies, gave moral support, helped format some charts.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Amanda C. Turk

Project Number
J1626

Project Title
Organic vs. Synthetic: The Effect of Fertilizer on Plant Growth

Abstract

Objectives/Goals
I am a gardener, and have always wondered if organic fertilizer works better than synthetic fertilizer. The purpose of this project was to see if I have been using the best method of fertilization in my garden.

Methods/Materials
For this experiment, I had three different planter boxes; one treated with organic fertilizer, one treated with synthetic fertilizer, and one treated with no fertilizer. (This was my control group.) In each planter, I planted five bean seeds and 10ml of grass seed. I kept all the planters in the same window, at the same temperature, and gave them the exact same amount of water. The only difference in their treatment was the difference of fertilizers received. Every three days I measured the height of each plant, and recorded it. After sixty days, I cleaned all the soil from the roots and weighed the plants for a biomass. (I measured the biomass of the beans only, because the grass would not completely separate from the soil.)

Results
The results of my experiment were as follows: The organic grass grew to be the tallest of the three grasses (12.7cm) with synthetic at the second highest(11.4cm), and control the lowest (10.8cm) However, the control beans had the greatest average height (74.7cm) and biomass (13.06g), with synthetic in second (70.9cm, 10.114g), and organic in last (48.4cm, 6.192g).

Conclusions/Discussion
I concluded that the results from the grass supported my hypothesis; the organically grown grass was clearly larger at the end of 60 days. For the beans the results did not support my hypothesis, as the organic group was beaten by the other two groups by a large margin. I conducted further research, and concluded that 60 days was not enough time for the bean plants, which have a larger seed than the grass, to begin drawing from nutrients outside of the seed pod (In this case, the fertilizer. I felt that the results would have been different if the beans had been fully mature.

One large question that arose from this experiment was; what would have happened if the bean plants had been grown for a longer period of time? I also think that it would be interesting to see the long term effects of treating soil with the two fertilizers. This could be tested by growing new plants in soil treated with fertilizer from a previous experiment.

Summary Statement
My project tests if organic plant fertilization methods work better than synthetic plant fertilization methods.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Bryce A. Vlach

Project Number
J1627

Project Title
Does Carbon Dioxide Affect the Production of Oxygen by Elodea?

Abstract

Objectives/Goals
The purpose of my project is to determine if placing Elodea in a pure carbon dioxide environment affects the production of oxygen by the Elodea.

Methods/Materials
(1) Place 5cm water into large container. (2) Cut forty-two inch long Elodea segments and insert each into individual test tubes filled with water. (3) Flip each test tube upside down in the container so that no air enters the tube. (4) Divide test tubes up into four groups of ten and put each group in a rack. (5) Fill two-one gallon jars with water and flip them upside down under water so no air enters the jars. (6) Insert one test tube rack into the jar and fill with C02. (7) Repeat with second jar. (8) Repeat steps 5 -7 with normal air. (9) Wait four days and then measure the air levels in all of the test tubes separately by placing air from the test tube into a graduated cylinder.

Results
My preliminary results indicate that the Elodea placed in a pure carbon dioxide environment produced 219 ml of oxygen while the Elodea in the normal air environment produced 28 ml of oxygen.

Conclusions/Discussion
A pure carbon dioxide environment makes the Elodea produce more oxygen than Elodea grown in a normal atmosphere environment. All materials a plant needs to undergo photosynthesis and produce oxygen are carbon dioxide, sunlight, and water. By increasing carbon dioxide levels in the Elodea#s environment, the chemical reaction of photosynthesis increased because more particles of carbon dioxide were available to react in the process of photosynthesis.

Summary Statement
The purpose of my project is to determine if placing Elodea in a pure carbon dioxide environment affects the production of oxygen by the Elodea.

Help Received
Mr. Duerr helped me with experimental design and advised me on the design of my graphs on Microsoft Excel.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Sarah Waliany

Project Number
J1628

Project Title
The Effect of Estrogen on the Growth of Cruciferous Vegetables

Abstract

Objectives/Goals
The objective was to evaluate the relationship between the phytonutrient I3C, found in Cruciferous vegetables, and estrogen in the soil, and to show if estrogen in the soil can promote the growth of these vegetables by acting like auxin (a natural plant hormone that promotes the growth of these vegetables).

Methods/Materials
During a seven month period, estrogen tablets were grinded and mixed with 240 ml of water, and 10 ml of this solution was given to 48 broccoli and 41 cabbage plants labeled as "Group II," while another 48 broccoli and 41 cabbage plants in Group I did not receive estrogen. The growth of these plants was measured in inches and was recorded.

Results
The average growth for the broccoli plants that received estrogen was 19 inches compared to 16 inches for broccoli plants that did not receive estrogen. The average growth for cabbage plants that received estrogen was 7 inches compared to 6 inches for plants that did not receive estrogen.

Conclusions/Discussion
The study showed that the plants that received estrogen had a higher growth rate compared to plants that did not receive estrogen. The phytonutrient I3C probably reacted with estrogen, and estrogen could have acted like auxin to promote the growth of these vegetables.

Summary Statement
My project was conducted to find the effect of estrogen on the growth of Cruciferous vegetables.

Help Received
Father brought estrogen tablets, soil, seeds, and pots.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Avery G. Yu

Project Number
J1629

Project Title
How Does the Intensity of Light Affect the Speed of Phototropism?

Abstract

Objectives/Goals
The purpose of my project was to see how the intensity of light affected the speed of phototropism.

Methods/Materials
I placed 3 different sets of four plants each at different distances from the light. I placed the first set of plants 0cm away from the light, the second set of plants 30.5cm(1 foot) away from the light, and the third set of plants 91.5cm(3 feet) away from the light source. The plants were grown up to 3 inches tall before the experimentation. Also, I built a box around the plants to block out extraneous light. I covered it with newspaper so that light would not be able to get through. A hole was cut on the left and right side in order to put a desk lamp through it. I placed the light on the left side at first and then when the plants grew at a 90-degree angle toward the light, I shifted the light to the right side. Also, when light was shifted from left to right, the plants were also shifted according to their right distances from the light source, in order to receive the same light intensity. For example, the first set of plants was shifted so that it was always 0cm away from the light source, no matter where the light was placed. The second set of plants was always 31.5cm away from the light source and the third set of plants was always 91.5cm away. Then, I shifted the light to left and when the plants bended at a 90-degree angle as a sign of positive phototropism, I shifted the light to the right. There was a total of 6 exposures to light and 5 light position shifts between left to right.

Results
The plants at a distance of 91.5cm (3 feet) away from the light took the longest time to react 90 degrees toward the light. The plants that were 0cm away from the light took the fastest amount of time to bend 90-degrees. Time decreased as light was shifted repeatedly.

Conclusions/Discussion
Through this experiment, I learned that as the intensity of light decreased, the speed of phototropism increased. That means that the plants that received the lowest intensity of light took the longest time in showing effects of positive phototropism than the plants that received the highest. The plants that received the highest intensity of light took the fastest time in showing effects of phototropism. Also, as the light was repeatedly shifted from left to right, the speed of phototropism decreased and all the plants were able to adapt better to the source of light and react faster.

Summary Statement
My project is about how the amount of light received by plants affect the time it takes for plants to show effects of positive phototropism.

Help Received
Parents helped build the box.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Madison A. Zeller

Project Number
J1630

Project Title
Does the Density of Stomata in a Plant's Leaf Affect the Amount of Water Lost?

Abstract

Objectives/Goals
I investigated whether or not the density of stomata in a plant's leaf affects how much water is lost during transpiration. My hypothesis was that different numbers of stomata would have an affect.

Methods/Materials
I placed four different plant species into separate graduated cylinders filled with 10 ml of water. A controlled cylinder held no plant. I let them sit for three days and then calculated each plant's average water loss.

Results
The average losses and standard deviation values were Diefienbacia 3.9/2.6 ml, Spathafillum 3.3/2.3 ml, Philodendron 2.4/1 ml, Ivy 1.9/0.7 ml, and the control 0.4/0 ml.

Conclusions/Discussion
After performing a statistical analysis on the results, I concluded that stomata numbers do not affect water loss amounts. My hypothesis was proven wrong, though differences in plant characteristics such as a stem's thickness could have impacted the water loss results.

Summary Statement
My project is about how the density of a plant's stomata affects the amount of water lost during transpiration.

Help Received
Borrowed microscope and slides from Sierra Canyon School; Parents helped gather supplies and explained graphing program.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Xiafei Zhang

Project Number
J1631

Project Title
The Effects of Temperature and pH on the Germination and Early Growth of Mung Beans

Abstract

Objectives/Goals
My objective was to study how temperature and pH affect the germination and early growth of Mung Beans.

Methods/Materials
My experiment was done in 2 groups, temperature and pH. For the temperature group, I did conditions at -8^oC, 5^oC, 10^oC, 20^oC, 30^oC, 40^oC. I controlled the pH value of the water (pH6.8), the air, and the moisture. I measured the number of beans germinated and the length of the sprout of the Mung Beans across time. For the pH group, I did conditions at pH 4.2, pH5.4, pH6.8, pH8.2, and pH9.1. I controlled the temperature (at 20^oC), the air, and the moisture. I measured the number of beans germinated and the length of the sprout of the Mung Beans across time. I observed the germination and early growth mung beans 6 to 7 times in a maximum of 72hrs. I had 10 trials for each condition, 50 beans for each trial, and 9 conditions for the project. I used the following materials: Mung Beans, Pincers, Sponges, Water, Thermometer, Metric Ruler, See-Through Glass Vessel, Water bath, Sodium Phosphate Monobasic, Sodium Phosphate Dibasic, Magnetic Stirrer, Stirring Bar, pH paper, Gloves.

Results
For the temperature group, beans at 20^oC, 30^oC, 40^oC germinated but beans at -8^oC, 5^oC, 10^oC did not. Beans at 40^oC germinated and grew better than beans at 30^oC, beans at 30^oC germinated and grew better than beans at 20^oC. For the pH group, beans at pH5.4, pH6.8, and pH8.2 germinated but beans at pH9.1 and pH4.2 did not. Beans at pH 6.8 germinated and grew better than beans at pH5.4. Beans at pH5.4 germinated and grew better than beans at pH8.2.

Conclusions/Discussion
Within the temperature range that mung beans can germinate and grow, the higher the temperature, the better the mung beans will germinate and grow. Neutral pH is the best pH environment for the germination and early growth of Mung Beans. Basic and acidic pH environment can slow down or even stop the germination and early growth of Mung Beans.

Summary Statement
Temperature and pH significantly affect the germination and early growth of Mung Beans.

Help Received
Dad helped me do part of the graphs, and look over grammar mistakes.