CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Ananta Amin; Ronak Mody

Project Number
S1701

Project Title
Allium cepa vs. Agrobacterium tumefaciens

Abstract

Objectives/Goals
Agrobacterium tumefaciens is a bacterium which causes the disease crown gall, or a plant tumor. Allium cepa, or commonly called onion, is known to have many beneficial effects related to medicine. Therefore, in this experiment, we are going to test whether the application of Allium cepa helps alleviate/rid the plant of the tumors produced via the bacteria.

Methods/Materials
First, we will scrape Agrobacterium tumefaciens off the blood agar using a sterile inoculating loop, and mix it in a cup with distilled water. Then, inject 1 c.c. of this solution in the root of the plants and after two weeks, record the number of plant tumors. Then, inject 1 c.c. of onion paste into the root, and after two weeks, record the number of remaining tumors (galls).

Results
After observing 15 trials, we noticed the onion had a relatively alleviating effect on the crown galls. The sizes of the galls would greatly decrease or completely disappear, proving that onion was in fact beneficial in the treatment of plant tumors.

Conclusions/Discussion
This experiment was an extension of a project from last year, in which we tested the effect of Allium sativum (garlic) on the same bacteria. The main difference in the extension was the variable used. We chose onion this year because of the similar properties of allicin (active ingredient), and the experiment was a success. The purpose of both experiments is to ultimately find a substance to cure one of the largest agricultural problems today.

Summary Statement
This is an experiment to test what effect the application of Allium cepa, commonly referred to as onion, has on plants injected with Agrobacterium tumefaciens, which causes plant tumors.

Help Received
Leonard Bullas from LLU who supplied us with the bacteria, inoculating loops, and distilled water; Dr. Kishor Sanghvi who supplied us with sterile syringes.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Stacey K. Barnett

Project Number
S1702

Project Title
Getting to the Root of Chemical Warfare

Abstract

Objectives/Goals
The purpose of this project is to determine which plants are affected by which allelochemicals and to what extent.

Methods/Materials
I used a variety of plants with known allelochemicals which I boiled in water, strained and reserved the water of each in a labled pitcher. I used a variety of seeds, dishes lined with paper filters which were watered regularly with eyedroppers and kept in a controlled environment. After ten days I repeated the process.

Results
Appearance and growth rate varied in each seed and with each water type. The seeds watered with pure water were clearly superior.

Conclusions/Discussion
My hypothesis was not fully supported by my results.
The field of allelopathy is already being studied a great deal because of its potential in the agriculture industry.

Summary Statement
This experiment is based on the adverse affects of allelopathic plants on seedlings.

Help Received
My mom and aunt helped me brainstorm ideas and my parents provided all the supplies and support.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Albert Chen; Sharon Hu; Andrew Lin

Project Number
S1703

Project Title
The Aluminum Accumulating Abilities of Cicer arietinum

Abstract

Objectives/Goals
To determine whether the leaves, stems, or roots of the Cicer arietinum are most efficient for storing aluminum.

Methods/Materials
Cicer arietinum beans were grown in individual containers under controlled lighting. After planting, the experimental group was watered with a saturated aluminum solution and the control group was watered with tap water every other day for a period of eleven days. The plants were then rinsed in deionized water and divided into roots, stems, and leaves. A rapid titrimetric method was used to determine quantitative amounts of aluminum ions.

Results
The rapid titrimetric method helped us determine amounts and concentrations of aluminum ions in the leaves, stems, and roots of the plants. Comparing two-sample t-tests allowed us to see that there were both significantly higher amounts and concentrations of aluminum ions in the leaves of the plants when compared to roots and stems.

Conclusions/Discussion
The results show that the majority of the absorbed aluminum is stored in the leaves of the Cicer arietinum. With this knowledge, bioremediation techniques can be altered to become more efficient. Further research can be done using different plants and different metals to see if storage varies depending on the plant and/or metal.

Summary Statement
This experiment compared amounts and concentrations of aluminum ions in different sections of contaminated C. arietinum.

Help Received
Dr. Rocklin helped provided guidance on titrations. Mrs. Alonzo advised us on how to improve the project. Lynbrook High School provided equipment.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Shadman M. Chowdhury

Project Number
S1704

Project Title
An Innovative Method of Measuring Respiration in Germinating Seeds

Abstract

Objectives/Goals
The goal of this experiment was to test a simple innovative method that measures the respiration rate in seeds.

Methods/Materials
Four kinds of germinating seeds were used to measure respiration rates: Cucumber seeds, Pea seeds, Pumpkin seeds, and Squash seeds. All four seeds were chosen because they all have fast germination rates. A dormant version of each seed was used as the control. Two seeds of each kind were placed into a pipette containing a cotton ball with 1% NaOH solution. The pipettes were placed over petri dishes filled with water. When the germinating seeds respire, they produce carbon dioxide. Carbon dioxide is trapped with NaOH resulting in water moving up the pipette. The movement of water up the pipette was recorded in centimeters, giving an idea of the amount of respiration going on amongst the seeds. Using the method described above ten pipettes containing germinating seeds and ten pipettes containing the control dormant seeds were set up for each seed type tested. Therefore, for each seed type tested 80 pipettes (forty of which served as the control) were used. The experiment was then repeated twice, resulting in experimental data from a total of two hundred and forty pipettes (one hundred twenty of those serving as the control). This data was then compared to the data obtained using Carbon Dioxide Probes.

Results
At the end of a 12-hour period the average rise of water in the pipettes in the experimental group containing the germinating seeds were Pumpkin (3.2 cm), Pea (2.9 cm), Squash (2.6 cm), and Cucumber (2.2 cm). This data was significantly different compared to the control groups of dormant seeds of each kind (0.5 cm). Using the Carbon Dioxide probe resulted in similar results. Germinating Pumpkin seeds produced the highest amount of carbon dioxide (1912 ppm), followed by Pea seed (1586 ppm), Squash seeds (1219 ppm) and Cucumber seeds (863 ppm) respectively.

Conclusions/Discussion
The results show that this simple innovative method can be used to measure the respiration rate in seeds. The results of this method was further supported by the data using the carbon dioxide probes. Germinating seeds have an increased respiration rate when compared to the dormant seeds. This inexpensive and innovative method could be very useful for agriculturalists. It would help them to determine whether a seed is dormant or dead without the use of expensive equipment.

Summary Statement
This project was about testing a simple innovative method that measures respiration in seeds, and backing up the method by measuring the respiration of the seeds by using carbon dioxide probes to see if both types of results were similar.

Help Received
Mother bought seeds. Father took pictures of me during various stages of my experiment. Dr. Pal supplied pipettes and 1% Sodium Hydroxide.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Darrick L. Gowens

Project Number
S1705

Project Title
Effectiveness of Different Amounts of Almond Ash as a Fertilizer on the Germination and Growth Rate of a Radish Seed

Abstract

Objectives/Goals
My goal is to determine if wood ash at various amounts have any effect on germination rate and if it will produce a stronger and healthier plant.

Methods/Materials
I obtained soil from a field and ashes from a fireplace. I made 3 soil mixtures containing different amounts of ash. All contained 2 cups of soil. The various amounts of ash used were 1 cup, 1/2 cup, and 1/4 cup. I placed the same amount of soil into four (50-cup) planter boxes. I planted the radish seed 1/4" deep. After 7 weeks I harvested the plant and recorded the height, weight, length and width of the plant.

Results
The control group averaged 5 days to germinate. The average plant height is 23 cm, taproot length is 17 cm long and width is .030. The average width of the plant stem is .125 and weight is 1.5 grams. The difference between the plants that have 1/4-cup ash added took 2 days to germinate. They were about is 4 cm taller, the taproot was 4 cm longer and about .02 wider. The average stem width was .02 wider and average weight was .96 of a gram more. The smaller amount of ash that is placed in the soil the faster the plant germinated, the bigger and healthier the plant becomes than the plants with more than a 1/4 of a cup of ash. The more percentage of ash that was added to the soil the lower the growth rate. When more ash was added to the soil the higher the Ph level increased and the plant size and weight decreased.

Conclusions/Discussion
The control group averaged 5 days to germinate. The average plant height is 23 cm, taproot length is 17 cm long and width is .030. The average width of the plant stem is .125 and weight is 1.5 grams. The difference between the plants that have 1/4-cup ash added took 2 days to germinate. They were about 4 cm taller, the taproot was 4 cm longer and about .02 wider. The average stem width was .02 wider and average weights were .96 of a gram more. The smaller amount of ash that is placed in the soil the faster the plant germinated, the bigger and healthier the plant became than plants with more than a 1/4-cup of ash. The more percentage of ash that was added to the soil the lower the growth rate. When more ash was added to the soil the higher the Ph level increased and the plant size and weight decreased.

Summary Statement
Analyzing the effectiveness of different amounts of wood ash as a fertilizer on seed germination and growth.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Hong Huynh; Elaine Trinh

Project Number
S1706

Project Title
Stay Away from My Territory! The Effect of Eucalyptus leucoxylon 'Rosea' on the Growth of Radishes

Abstract

Objectives/Goals
Eucalyptus is a prolific litter producer, prone to dropping leaves and barks, and Eucalyptus trees rarely have an understory. If allelochemicals are released from Eucalyptus litter, their accumulation in the soil could result in poor vegetation by other flora even after the trees have been removed for restoration projects. Since Eucalyptus spp. shed bark, leaves, and pods it is hypothesized that all of these plant parts will inhibit plant germination and growth.

Methods/Materials
Both pulverized powder and water extracts of Eucalyptus leucoxylon were used to investigate their effects on germination and seedling growth of Raphanus sativus. Samples of leaves, bark, pods, and soil from under the canopy were gathered from local Eucalyptus trees. Dried plant samples were extracted by soaking (24 hours) at R.T., boiling (5 min) or pulverized into fine powder. Pots were filled with potting soil (52.52g) and one radish seed. For the first experiment, we compared leaves and bark prepared three different ways with five pots per experimental group. The experiment was repeated with the second batch of components: soil, pods, and a mixture of all four components. Everyday the plants were kept in an incubator, exposed to light for 8 hours, and watered with 10ml of extracted sample or pulverized powder.

Results
All plant extracts and soil delayed germination and had an inhibiting effect on radish plant height. The greatest effect was seen with bark: followed by the mixture, soil, pods, and leaves with decreasing effect. The trials on average showed that crushed bark and soil were the most effective inhibitors relative to the control. This outcome is reasonable knowing the trait of Eucalyptus to excessively shed bark. It is reasonable to conclude from the data that Eucalyptus extracts in their natural form (pulverized) were most effective and that the effective agent(s) is water soluble.

Conclusions/Discussion
The current restoration projects, intended to replace the habitats having prolific growth of Eucalyptus plant species, should be reconsidered before taking any preliminary actions. Due to its ability to suppress outside vegetation it should be considered that the possible effects of existing allelochemicals in the soil may interfere with the establishment of other flora. However, testing other varying species of plants will provide a broader assessment of Eucalyptus inhibitory effect on seedling germination and growth.

Summary Statement
The project studies the ability of Eucalyptus plants' secretion of chemicals to protect their growth territory.

Help Received
Used lab equipment at Silver Creek High School under the supervision of Mr. Cervantes.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Daniel M. Kari

Project Number
S1707

Project Title
Helping Pinus ponderosa Fight Dendroctonus brevicomis and Dendroctonus ponderosae

Abstract

Objectives/Goals
The objective of this project was to explore the best natural ways to deter Dendroctonus brevicomis and Dendroctonus ponderosae from attacking Pinus ponderosa in the San Bernardino National Forest and the surrounding areas. Secondary research indicated that using pesticides and deterrents related to verbenone antiaggregates have to date proven expensive (costing $3.60 to $14.50 per tree perseason), ineffective beyond one season, and destructive of all insects in the areas treated, thereby deteriorating the ecosystem. This same literature, combined with interviews with botanists working for the U.S. Forest Service and the California Department of Forestry, confirmed that the best defense against bark beetle attacks is a healthy tree.

Methods/Materials
This project examined 50 Pinus ponderosa in the Barton Flats Camp Ground where stand management and thinning has taken place since the early 1950s, and 50 Pinus ponderosa around the Blue Sky Science Institute several miles away on Highway 38 where few or no attempts have been made to manage bark beetle infestations. Trees in both locations were selected that were 6 inches or larger since smaller ones were relatively immune to bark beetle attacks. Trees were examined for signs of attack (such as bark beetle holes) and dead branches. Woodpecker holes were also noted as evidence of bark beetle infestation.

Results
Examination of 50 trees selected in the Barton Flats Camp Ground showed 8 attacks and only 2 trees had died as a result of bark beetle attacks. The survival rate for these trees was 96 percent. Examination of 50 trees selected in the Blue Sky Science Institute showed 17 attacks and 19 trees had died, two from causes other than bark beetles. The survival rate of trees at this location was only 62 percent. Fatalities among trees of the Blue Sky Science Institute were 8.5 times higher than those among trees at the Barton Flats Camp Ground.

Conclusions/Discussion
This study helps demonstrate that the best defense against attacks by Dendroctonus brevicomis and Dendroctonus ponderosae is healthy trees, namely trees that can fight off attacks with good resin flow. Chemical treatments, in contrast, deteriorate the ecosystem and plants in the forest. Future research will examine the use of certain plants to deter the presence of bark beetles.

Summary Statement
This project demonstrates that when forests are properly managed through thinning dense growth and through removing trees already infested by bark beetles, then these forests are far less vulnerable to bark beetle attacks.

Help Received
For research design and interpretation, consulted with Dr. Nelson Samuel, a parasitologist, Dan Dresselhaus, a botanist for California Dept. of Forestry, and Katie VanZandt, botanist for the U.S. Forest Service; Dr. Daven M. Kari, my father, helped with photography, research, and transportation.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kehly D. Kirk

Project Number
S1708

Project Title
Adding H(2)O(2) to the Mix: Effects of Hydrogen Peroxide on Germination and Plant Growth - A Two-Year Study

Abstract

Objectives/Goals
Hydrogen peroxide can benefit plant growth in two major ways: 1) improved aeration; and 2) killing microorganisms that may be harmful to plant growth through its bactericidal/algaecidal/fungicidal qualities. This project was designed to test the effects of hydrogen peroxide on Champion Radish plant germination and growth.

Methods/Materials
20 Petri dishes, filter paper, 3 Jiffy Easy Grow Greenhouse Kits, potting soil, tap water, hydrogen peroxide solution, and seeds were used. The Control Group and an Experimental Group of radish seeds were placed on filter paper in separate petri dishes (200 seeds) and planted in potting soil (200 seeds) in the greenhouse kits. The Control Group was watered with tap water as needed and the Experimental Group was treated with a maintenance concentration of hydrogen peroxide solution as needed. Petri dishes and greenhouses were checked for seeds that had germinated and data recorded daily. After most of the plants in the greenhouses had germinated, additional data including leaf color intensity, stem height, and overall appearance were collected weekly. In all, 2200 individual observations were recorded.

Results
Data indicated statistically significant better results in Experimental Group vs. Control Group in five (5) evaluation criteria: Petri dish germination; greenhouse germination; greenhouse germination time; leaf coloration; and overall health at the final reading (day 20). Three (3) evaluation criteria were found to not be statistically different between the Control and Experimental Groups: Petri dish germination time; average growth (cm); and growth rate (cm/wk). Descriptive Statistics (Mean, Std Dev, 95% Confidence Level); t-Test: Two-Sample Assuming Unequal Variances (Alpha=0.05); and z-Test: Two Sample for Means (Alpha=0.05) were used to perform the analysis.

Conclusions/Discussion
The hypothesis was only supported by the data in five out of eight evaluation areas. Further research should be conducted to determine optimal concentrations and long-term effects.

Summary Statement
This project is the second year of a two-year study designed to test the effects of hydrogen peroxide (H2O2) on plant germination and growth--in this case, Champion Radish.

Help Received
My parents purchased the materials for this project. My father assisted me in understanding the statistical analysis methods used and in preparing the charts and graphs that accompany this project.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Lindsey Lewis; Kaitlin Wright

Project Number
S1709

Project Title
The Burning Bush: A Flammability Study of 30 Shrub Species Native to the Mojave Desert

Abstract

Objectives/Goals
If 30 native Mojave Desert shrub species are collected, then a relative flammability rating system can be developed based on the variables of combustibility, sustainability, ignitability, and consumability.

Methods/Materials
30 native Mojave Desert shrub species were collected in Dec. & dehydrated. One sample of each shrub species was transported to Edwards AFB Fire Station #2 where testing was conducted using a propane torch, a gallows-like hanging apparatus, moisture meter, triple beam balance, thermocouple, & thermal imager. Each shrub was weighed, tested for moisture %, & photographed against a grid. Each shrub was hung upside-down while a propane torch was swept under the lowest, most dense part. Independent ignition, total burn times, & ingnition temp. were recorded. While burning, a picture was taken of the thermal imager screen. After burning, shrub remains were collected, photographed, & weighed. Data was analyzed based on combustibility, measured by max. flame height; sustainability, by independent ignition & total burn times; consumability, the amount of shrub consumed while flaming; & ignitability, time to independent ignition & ignition temp.

Results
An ordinal rating system was established after the testing. Each shrub was assigned a 1,2,or 3 to indicate low, moderate, or high flammability for ignitability, sustainability, combustibility, & consumability. Ratings were averaged to produce an overall flammability rating. Shrubs with the highest flammability rating were Chrysothamnus teretefolius (Needle-leaved Rabbitbrush) and Tetradymia axillaris var. longispina (Long#spined Cottonthorn) with overall ratings of 3. Eight other shrubs earned high flammability ratings of >2-3. The shrub with the lowest flammability rating was Lycium cooperi (Peachthorn) with an overall rating of 0.63. Two other shrubs earned low flammability ratings of 0-1; while 17 shrubs were classified as moderately flammable with ratings >1- 2.

Conclusions/Discussion
The data did support the hypothesis. The results show that it is possible to establish a flammability rating system by determining each shrub#s ignitability, consumability, combustibility, & sustainability. Although there are other flammability variables such as chemical composition, wind speed, season of collection & etc., this relative rating system is helpful when determining the potential flammability of these 30 native Mojave Desert shrubs.

Summary Statement
30 different species of shrubs native to the Mojave Desert were collected, and a relative flammability rating system was developed based on the variables of combustibility, sustainability, ignitability, and consumability.

Help Received
Mr. Daivid Charlton/Botanist/ helped with shrub collection; Edwards AFB Fire Station #2/supplied engine bay for testing and thermal imager; Parents/helped with testing.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Daniel M. Shane

Project Number
S1710

Project Title
Ozone Depletion: A Concern for More than Mankind: Year 2

Abstract

Objectives/Goals
This experiment explored the effects of increased intensities of UV radiation on two primary groups of chromophores in a plant.

Methods/Materials
After the plants were grown behind a glass window (a vacuum for UV), they were exposed to the planned UV intensity for the set duration. Once finished, a sample of one leaf was clipped, the mass documented, and pulverized into an aqueous solution with ethanol as the solvent. Next, the solution was filtered using a syringe .22um filter, and syringed into a vial. Then, the ethanol was pipetted into the spectrophotometer, and run as a baseline so that all light absorption of this would be deducted from the absorption of the sample. The samples were then scanned by the spectrometer, and then the peaks of the chlorophyll A and carotenoids were recorded. Finally, the chlorophyll A peak was scaled to equal the peak of the control, to find the amount of carotenoids relative to the chlorophyll. Three trials were done for each same time/duration series.

Results
Under mild illumination for 5 hours, the lima bean plant contained an average of 106.654% of its carotenoid molecules relative to chlorophyll. After 24 hours of mild illumination, the cartenoid depletion was 11.111% more than of the chlorophyll A. After 32 hours, in the samples exposed to mild illumination, 31.794% more carotenoids were damaged relative to chlorophyll A molecules. The outside sample for all these durations showed no chromophore loss.
Illuminated under intense UV for 30 minutes, the lima bean plant contained 67.218% of its original healthy carotenoids compared to healthy chlorophyll molecules. After 1 hour of intense UV, 58.408% of the carotenoids remained compared to the chlorophyll, and 78.123% after 2 hours. As shown last year, the plant lost all light-absorbing molecules after 10 hours of intense illumination.

Conclusions/Discussion
My hypothesis that the chlorophyll A would be more sensitive was proven incorrect, as the carotenoid contents decreased faster relative to the chlorophyll. With the color change phenomenon, increased UV is even more damaging to plants during the autumn and winter. During this time, carotenoids are responsible for sustaining the plants until the resurgence of chlorophyll in the spring, and they clearly suffered greater damage from the UV light than did the chlorophyll A molecules.

Summary Statement
My project explores the effect of highler levels of ultraviolet radiation on chromophores in Phaseolus limensis.

Help Received
Mother helped glue report; Father and Mother helped with transportation to and from lab; Used lab equipment at the University of California, Irvine under the supervision of Professor Eric Potma.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Preston J. Swovelin

Project Number
S1711

Project Title
The Best of Both Worlds

Abstract

Objectives/Goals
The purpose of this project is to achieve the best of both worlds for a C3 plant. This means that the C3 plant would act as a C4 and a CAM plant in the sense that the rate at which it normally absorbs water would be decreased.

Methods/Materials
By de-soiling the pothos I are able to determine exactly how much soil (20.4 g) and water (30 mL) was going to be used. In addition, placing the plants in test tubes would make it possible to measure how much water is being absorbed. However, that would not be complete true because of the water evaporating, so a extra test tube with just 20.4 g of soil and 30 mL of water was used to determine the rate of evaporation. Fifteen pothos were used and were order like this:
Plants numbers 1-3 were used as the controls.
Plants numbers 4-6 were coated with pure jojoba oil but only on the top of the leaves.
Plants numbers 7-9 were coated with pure jojoba oil on the tops and bottoms of the leaves.
Plants numbers 10-12 were coated with refined jojoba oil but only on the top of the leaves.
Plants numbers 13-15 were coated with refined jojoba oil on the tops and bottoms of the leaves.
All fifteen of the test tubes, including the test tube lacking a plant, were placed under two plants light for approximately 1 week's time in a typical southern California day.

Results
In the end, plants numbers 4-6 consumed the least amount of water by only absorbing 0.007 cm/hr compared to that of plants numbers 10-12 which absorbed 0.0014 cm/hr. Which right now doesn#t seem particularly great but in the long run could be quite cost effective.

Conclusions/Discussion
In conclusion, my hypothesis was correct, the pure jojoba did prove to be better than the refined, but not by much. The refined jojoba actually demonstrated to be slightly worse than the control group. After calculating the rate of evaporation, I was able to determine that plants numbers 4-6 proved to be the best in not needing as much water. The average rate of absorption for these plants were 0.007 cm/hr, which is only 0.001 less than the control group but in long run could prove to be quite cost effective.

Summary Statement
By applying a spray of liquid wax to plants' leaves, one is able control the rate of H(2)O evaporation from the leaves, which in turn decreases the rate of H(2)O absorption through the roots.

Help Received
No help was received

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kathleen Tan; Fanny Xu; Stephanie Zhao

Project Number
S1712

Project Title
Vinegar Rain: How Do Different Concentrations of Acetic Acid Affect the Development of Radish Plants?

Abstract

Objectives/Goals
The goal is to determine if greater concentrations of vinegar lead to declining health in radish plants (Raphanus sativus).

Methods/Materials
Each of the three group members purchased plastic pots, radish seeds, potting soil, and a supply of vinegar. Simple lab equipment consisted of rulers, beakers, and measuring cups. The more "high-tech" items comprised of a postal scale (to measure the initial mass of soil), and 3 Rapitest soil pH meters.

The project consisted of 3 different experiments that each group member performed. There were 75 radishes in total, with 25 plants per experiment. In each experiment, radishes were split into 5 groups of 5. Each radish was watered 20mL daily. The Control Group received only tap water. For Group 2, a solution of 10% vinegar was substituted for water at specific times. For Group 3, the solution was 20% vinegar, Group 4 30%, and Group 5 40%.

In the first experiment, the experimental plants were "watered" with the acidic solutions daily; in the second experiment, every three days; in the third, every week. Observations were recorded for each plant daily. Each experiment was terminated at 22 days.

Results
Despite the different watering schedules, the results were consistent throughout all three experiments: the lower the concentration of vinegar, the longer the plants lived. Plants that received a treatment of vinegar also halted in growth. Symptoms such as constricted stems, discolored leaves, and shriveled leaves appeared.

Conclusions/Discussion
Higher concentrations of vinegar inversely affected the plant#s health. Although the chemical properties of vinegar and acid rain are markedly different, observations from this project gives us insight into the effects of acid rain on crops.

Summary Statement
To learn about how acids affect plants, we recorded the effects of vinegar on radish development.

Help Received
Consulted biology teacher Dr. Jang and chemistry teacher Mr. Cameron; advice from Ralph Salier-Hellendag at AllExperts.com; Fanny's father helped gather supplies; siblings helped observe and record data; Stephanie's mother helped with board layout and design; biology teacher Ms. Traeger

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Robert E.S. Weller

Project Number
S1713

Project Title
The Adaptive Significance of Insectivory in the Venus Flytrap (Dionaea muscipula)

Abstract

Objectives/Goals
Insectivory in plants has been thought to be an adaptation for obtaining nutrients in the nutrient-poor environments where insectivorous plants typically occur. There have been few tests of this hypothesis, and none for the Venus flytrap, which has the most complex trapping mechanisms of any insectivorous species. My objective was to determine whether insect trapping in the Venus flytrap (Dionaea muscipula), leads to increased fitness, as measured through greater growth, nutrition,and reproduction.

Methods/Materials
Five of ten Venus flytraps were randomly chosen for feeding. These plants were fed two cricket each week. Every month, the plants' trap length and petiole width were measured. When the plants flowered, the height and number of inflorescences and the number of flowers per inflorescence were measured. At the end of the experiment, samples from each plant and the cricket were analyzed by an isotope ratio mass spectrometer for delta carbon-13 values and delta nitrogen-15 values, the percent N and percent C, and the C:N ratio. The delta carbon-13 and delta nitrogen-15 values were used to calculate the percent of nitrogen and carbon (by weight) that came from the crickets.

Results
Plants that were fed had larger traps and wider petioles, more flowers per inflorescence, higher percent nitrogen and percent carbon by weight, and a lower C:N ratio. Based on the stable isotope measurements, sixty-seven percent of the nitrogen and seven percent of the carbon in the plants that were fed came from the crickets. In the first flowering cycle after feeding, plants that were fed did not have significantly more inflorescences or significantly taller inflorescences, but they did have more flowers per inflorescence. In the second flowering cycle, a year after termination of feeding, fed plants had significantly more inflorescences than the control group.

Conclusions/Discussion
My conclusion is that Venus flytraps benefit in growth and reproduction from supplemental feeding. These results suggest that insectivory evolved as an adaptation for obtaining nutrients in nutrient-poor environments.

Summary Statement
The potential adaptive significance of insectivory in the Venus flytrap was investigated by comparing fitness in plants that were supplementally fed insects to an unfed control group.

Help Received
My father helped with the statistical functions in Excel, and my mother showed me how to use Sigmaplot and Google Scholar. Dr. Diane Pataki at the University of California at Irvine ran the samples for the stable isotope analysis on her isotope ratio mass spectrometer.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Francesca A. Damkar

Project Number
S1799

Project Title
The Effect of Magnets on Ripening of Strawberries

Abstract

Objectives/Goals
Query: Research has been conducted on the effect of magnetic influence on increasing vigor and germination of seeds. If this effect is observed on seeds, does it also occur on fruits with external seeds, such as strawberries?
Objective of this project: To determine if strawberries would ripen faster when exposed to magnetic influence.

Methods/Materials
Methods: Methods for testing were based on exposure of unripened strawberries to magnetic influence, created through the use of round, 65 power magnets. Unripened strawberries were divided into four experimental groups[room temperature, room temperature with magnet, refrigerator, refrigerator with magnet]. Initial readings of sugar content on the Brix scale were taken. These four groups were then subjected to various conditions using variables of temperature, light, and magnetic influence. Strawberries were visually inspected daily for ripeness using the 2/3 red scale practiced by the California strawberry industry. The experiment ended when the control group [room temperature] reached full redness (average 4 days). Readings of sugar content on the Brix scale were taken again, compared and scored to determine the extent of ripeness. This experiment was replicated three times.

Results
Results: The results indicated that the strawberries exposed to room temperature, light and magnetic influence ripened more quickly than strawberries exposed to room temperature and light alone. Furthermore, the experiment showed that the strawberries which ripened most slowly were also exposed to magnetic influence, in refrigerated and darkened conditions. One unexpected result was that those strawberries exposed to magnetic influence were very firm, solid and had no mold or spoilage while the non-magnetic strawberries were very juicy but showed signs of mold or spoilage.

Conclusions/Discussion
Conclusions: Magnetic influence can affect the ripening process of strawberries, increasing ripening speed when also exposed to other controlled conditions of room temperature and light.
Discussion: These results can have potential application in the harvest times for strawberries. Exposure to magnetic influence can help to ripen berries and potentially retard spoilage, producing berries suited for food processing or preservation. Non-exposure to magnetic influence produces juicer berries more suited for fresh consumption or juice extraction.

Summary Statement
Determine if strawberries will ripen at a more rapid rate if exposed to magnetic influence.

Help Received
Parents obtained some of the materials, my biology teacher helped me with the standard deviation /t-tests and Driscoll's, Inc. donated the strawberries used for the experiment.