Project ID: 751

Junior Division

Plant Sciences

Taiye Bland Aruya

Chula Vista Middle School

Gr. 8

Can Sugar Water Improve the Growth of the Mung Bean Plant?

This experiment aimed to determine an alternative for hydrating or "watering" mung bean seedlings to promote their growth. The research question was, "Can sugar water improve the growth of the mung bean plant?" The hypothesis was, "If the mung bean plant is watered with sugar water, it will grow faster and taller than when watered with plain water." To conduct this experiment, I boiled one cup of water and added two tablespoons of pure cane sugar. I also collected one cup of plain tap water, which was used to water the row of mung bean seedlings labeled plain water over the course of two and a half weeks. The results of the experiment showed that sugar water did not promote the growth of the mung bean seedlings, instead, it led to decreased growth and eventual death of the plants, resulting in zero growth for all 25 seedlings in that row. The hypothesis was refuted because plain water had the highest growth, with the tallest plant reaching 12 cm in height after two weeks, and the median growth of the additional 25 mung bean sprouts was 8 cm. The contribution this experiment established was That there is no significant ingredient that would cause a plant to grow faster and taller to add into water.

Project ID: 752

Junior Division

Plant Sciences

Devyn Delacruz

St. Michael's School - Poway

Gr. 8

How Natural vs. Artificial Light Affects the Amount of Chlorophyll in Broccoli as Tested in Paper Chromatography

The purpose of this experiment is to determine whether or not artificial or natural light is better for a plant's growth, development, and overall health. This is tested by measuring the chlorophyll amounts in plants grown under artificial light vs. natural sunlight. This is important to research because of the environmental impact of switching to artificial light for crop growing. If the broccoli plants are exposed to natural sunlight, then they will exhibit better growth, enhanced development, and improved health compared to those subjected to artificial light because natural light provides a broader spectrum of light and nutrients.

This process included first sprouting 100 raab broccoli seeds in paper towels for 2-3 weeks, then planting them into 48 different cups. From there, the plants cups were separated with one group under a plant growing lamp, and one in sunlight. After a month, chlorophyll levels were measured through paper chromatography.

My hypothesis was supported by this evidence because through this experiment I found that there was no visible xanthophyll carotenoids measured in the artificial light plants. Trial 3 presented the greatest retardation factor of the plants under natural light. The mean retardation factor of chlorophyll in plants under natural light is about 0.34, whereas is is about 0.29 in artificial light.

Science is the process of trial and error. After many separate tests on this project, I have yet to achieve the desired results I strive to acquire. Despite this, I will continue researching and testing my project's thesis.

Project ID: 753

Junior Division

Plant Sciences

Ibrahim Essa
Bright Horizon Academy
Gr. 7

Unleashing the Potential of Algae for Sustainable Biofuels

AWARDS:

Office of Naval Research - Junior Division Winner

The objective of this project is to see how different levels of carbon dioxide, fertilizer, and light exposure affect algae growth, which is vital for making oxygen. The hypothesis was that fertilizer would have the biggest impact on algae growth. The experiment involved testing 50 ml of cultured algae under various conditions for a month: three CO2 concentrations (5%, 10%, 20%), three fertilizer concentrations (5%, 10%, 20%), and continuous light exposure. Algae growth was measured using a spectrophotometer.

Results showed that the 20% carbon dioxide concentration was best for algae growth. Higher fertilizer concentrations slowed algae growth, and continuous light exposure reduced growth significantly. Surprisingly, fertilizer didn't have the most impact on growth; the control group without CO2 or fertilizer performed the worst.

In conclusion, this project investigated how different levels of carbon dioxide, fertilizer, and exposure to direct light affect algae growth. Higher levels of carbon dioxide and fertilizer helped algae grow better, especially the highest level of carbon dioxide. But constant exposure to direct light hurt algae growth by damaging the tissue. These findings show that environmental factors are crucial for growing algae effectively. Further research could explore more ways to improve algae cultivation for things like making biofuel and treating wastewater.

Project ID: 754

Junior Division

Plant Sciences

Estela Levine

The Children's School

Gr. 8

The Effect of Increased Fog Acidity on Plant Growth in San Diego

This project tested the effects of acidic fog and rain in California on Watercress. This was tested because there is extremely acidic fog in California and it could harm crops growing in this area. The levels tested were pH 2, pH 3, pH, 4, and pH 6 (the control group.) It was hypothesized that if the plants are grown with an acidity of 4 they will grow the tallest. It was tested by having four groups of seeds, each was watered with a different level of pH to see which grew the fastest and tallest. The height was measured to determine which was the fastest-growing plant with the level of pH. The results showed that the plants growing with a pH of 6 grew the tallest and sprouted first. The pH 6 plants sprouted the fourth day after planting and the average height was 2.9 cm. This occurred because as research indicates, plants need a balance of acidic and alkaline water to thrive. Watering them with a pH of 6 is a good balance between alkaline and acidity. That means that the hypothesis was incorrect. It was concluded that the acidic fog in California does harm the crops growing here. The pH level of the fog was matched in this experiment and plants that were watered with that pH level grew slower and shorter than the other plants. If I were to continue this experiment, I would test alkaline water to see if it has a similar effect.

Project ID: 755

Junior Division

Plant Sciences

Jack Nash
Nazareth School
Gr. 7

Does Rainwater Make Up for Less Than Optimal Sunlight?

Our hypothesis was that rainwater would compensate for fewer hours under a grow light for seedlings. In a state where water is scarce and most people irrigate with tap water, some gardeners collect rain with barrels or cisterns, and go to great effort to use it for their plants. We chose this project to determine whether rain actually gets better growth results.

First we tested all three groups of water (rain, tap, and distilled) to determine how they varied. Then, we planted two separate sets of seedlings; one group that would spend 12 hours under a grow light for 19 days, and the other group for 16 hours for 19 days. Within each group, one third was watered with tap water, one third with distilled, and one third with rain.

Our water testing kits detected differences between the different groups of water. Tap had higher levels of pH, alkalinity, nitrates, copper, and chlorine compared to the others. However, when it came to the growth of the actual seedlings, the results did not align with our expectations. Of the 75 seedlings that we planted, only about 40 actually sprouted. On top of that, the median seedling length of both tap water groups were higher than those of the rainwater and distilled water groups.

Our hypothesis was that rainwater would make up for less time under the grow light. Therefore, our hypothesis was not supported by this experiment.

Project ID: 756

Junior Division

Plant Sciences

Ella Raspotnik

The Children's School

Gr. 8

The Effect of Granular Mycorrhizae on Plants When Exposed to Seasonal Sunlight

AWARDS:

Association for Women in Science - Winner

Does Granular Mycorrhizae help plants with less sunlight grow better? If I add Granular Mycorrhizae to radish Microgreens with less sunlight, they will grow more than (the control group) the plants without. I will also compare plants grown in summer to plants grown in winter, with the mycorrhizae. First, I collected all the supplies. The soil was split and put it in the containers, and then mycorrhizae was added to Group A and Group C. These were placed in a closet and left for two weeks, watering them the same amount every day. There were no results in the first five days. On day six, the seeds grew but still did not show large signs of growth. After some research, I realized that the radish seeds (Bracca family) do not respond to mycorrhizae. The experiment was redone with carrot microgreens. After 11 days, Group A (the summer group with mycorrhizae) grew eight centimeters, Group B (the summer group without mycorrhizae) grew 4.3 centimeters, Group C (the winter group with mycorrhizae) grew 6.5 centimeters, and Group D (winter group without mycorrhizae) grew a total of three inches. When comparing Group B (summer light, no mycorrhizae) and C (winter light, mycorrhizae), group C grew 2.3 centimeters more proving my hypothesis that mycorrhizae can help plants exposed to less sunlight grow the same as plants exposed to more sunlight. This increase in growth with mycorrhizae could benefit farmers tremendously when trying to increase production during the winter months.

Project ID: 757

Junior Division

Plant Sciences

Leilani Schelper

The Children's School

Gr. 8

The Effect of Fertilizer on Plant Life with Rising Temperatures

AWARDS:

CSEF Qualified

Thermo Fisher Scientific Junior Innovators Challenge Nominee

Climate change is getting worse, and both humans and animals rely on plants to survive. If the temperature keeps increasing in California, we don't know how the plants will react and how quickly they will die off. With my experiment, we can know how plants react to increased heat and if fertilizer might be a way to help them thrive longer. I hypothesized that if you expose plants with fertilizer and plants without fertilizer to more heat than they usually get, then the ones with fertilizer will die slower.

To test my hypothesis, I had 120 plants that were evenly separated into four trays. Half of the plants (60) had fertilizer. Thirty of the plants with fertilizer and 30 of the plants without fertilizer were put under a heat lamp to increase the heat, and the rest were kept under regular sunlight. For eight days, I recorded the percentage of green, brown, and mixed leaves and tracked how many plants fully died.

On Day 8, the average percentage of brown leaves that Tray D (fertilizer and heat lamp) had was 20.54%, which was the lowest of all four trays by about 12%. This data proved my hypothesis correct because the fertilizer made it die slower and let the plants in that tray live longer. If this project were to be continued, I would test for even longer and with different types of plants.

Project ID: 758

Junior Division

Plant Sciences

Ritam Sen
Francis Parker School
Gr. 8

Can Elemental Sulfur Influence the Growth of Different Plants in Lunar Regolith?

AWARDS:

Society of American Military Engineers - San Diego Post - Junior Division Winner
CSEF Qualified
Thermo Fisher Scientific Junior Innovators Challenge Nominee

Background: In the recent Moon mission by the ISRO (Indian Space Research Organization) to the Lunar south pole, the ISRO's Chandrain-3 rover identified higher amounts of sulfur on the Lunar Highland soil than was ever thought to exist. Planetary scientists now believe that Lunar Highland soil has greater sulfur availability near the Lunar south pole. In the near future, following NASA's ISRU practice (In-Situation Resource Utilization, Reference #2) sulfur-based fertilizers can be produced and utilized for growing crops on Lunar base, eliminating the need to carry an extra weight of fertilizer for moon harvesting.

Procedure: Four different soil compositions were created: (Control) 100% Earth Soil, 100% Regolith pots, 70% Regolith + 20% Earth soil + 10% fertilizer, 50% Regolith + 40% Earth soil + 10% fertilizer, with 4 different amendments each: (Control) No Sulfur, 2.834g Sulfur, 5.669g Sulfur, 34.019g Sulfur with 3 different plants: Chia, Butterhead Lettuce, and Arugula to see which pot would grow the healthiest, tallest plants.
Results: The plants with the highest amounts of added Sulfur (34.019g) grew an average of 11.853cm tall throughout the three plants. Compared to the other amounts of added Elemental Sulfur these plants grew an average of 5.78cm taller.

Conclusion: Conclusion from my experiment is that sulfur not only reduced the regolith soil pH, but also supplied the nutrients needed for plant growth. The pots with 100% Lunar regolith with the most sulfur (34.019g) grew the tallest (average of 11.853cm) for all 3 plants of our choice. This data partially confirms our hypothesis, the plants with more sulfur grew the tallest, but they grew taller in lunar regolith, without fertilizer and earth soil. Our experiment has concluded that sulfur is a great way to tackle the high pH levels of lunar soil and supply essential nutrients to make the growth of chia, butterhead lettuce, and arugula improve substantially.

Project ID: 759

Junior Division

Plant Sciences

Dorian Smith

St. Mary Star of the Sea School

Gr. 8

The Effect Colored Light Has on Helianthus annuus Growth

Indoor lighting is a popular way to grow plants and they have different chemicals in them in order to produce their color. What if these chemicals alter sunflower growth in a positive way? A way we can test this is by planting four sets of six sunflower seeds; one outside, one under a red light, a blue light, and a green light. Measure every week for one month and see results. The results that came from this were as follows. Out of 24 seeds planted, 13 survived to the end. The sunflowers grown in green light grew 40% more than the control sunflowers, 32% more than the red light, and 18% more than the blue light. The green light had a 25% higher survivability rate than any other sunflowers.

Project ID: 760

Junior Division

Plant Sciences

Olympia Sternson

The Rhoades School

Gr. 6

Documenting the Effectiveness of Plant Allelochemicals as Eco-friendly Insect Repellents

AWARDS:

Association for Women in Science - Winner

Pests consume up to 20% of the world's crops. Pesticides can be harmful to humans and the environment. Some plants produce potent allelochemicals as natural defenses. I tested four allelochemical plant oils: basil, citronella, neem, and rosemary for their abilities to eliminate pests feasting on my kale plants. My hypothesis was that neem and citronella oils would be effective pest repellents because these oils are used to repel mosquitoes, an insect pest.

I planted 6 groups of 4 kale plants in individual pots. For 4 weeks, I sprayed the plants daily with either water (the negative control), water mixed with a dish soap emulsifier (another control) or oils from basil, citronella, neem or rosemary mixed with the emulsifier in water. I recorded indicators of pest presence: leaf holes, leaves destroyed, and numbers of pests. To monitor plant health, I recorded the incidence of chlorosis and leaf loss.

Pest repelling activity was greatest for plants treated with neem or citronella oil because they had fewer leaf holes and pests observed (slugs). The negative control plants, sprayed with water, exhibited the greatest number of leaf holes. Leaf health declined due to the emulsifier used to dissolve the oils, as compared to water treatment. Plants sprayed with citronella lost the most leaves.

Neem oil performed best as a natural pest repellent against slugs on the plants. Citronella was effective but less preferred because it caused more leaf loss than neem. Different emulsifiers may allow neem to protect against pests without reducing leaf health.

Project ID: 761

Junior Division

Plant Sciences

Ayrlanna Stewart

Chula Vista Middle School

Gr. 8

What's the Difference in Glucose Levels Between Organic and Inorganic Strawberries

The purpose of this experiment was to test the difference in the glucose levels between organic strawberries, and inorganic strawberries. The experimental question was, "what's the difference in glucose levels between organic and non-organic strawberries? The hypothesis was, if someone tests the difference between the glucose levels of inorganic vs organic, then the glucose levels of the inorganic strawberries would be less than the organic strawberries glucose levels because no chemicals were put on the organic strawberries that could have altered their glucose levels. To conduct this experiment, I got organic strawberries and inorganic strawberries from the store, I then smashed the strawberries in a bowl, filtered out the non-juice part of the strawberries, and tested the glucose level of the strawberry juice. The result of the experiment showed that the inorganic strawberries had a higher glucose level then the organic strawberries. The hypothesis was refuted because it claimed that the organic strawberries glucose level would be higher than the inorganic strawberries glucose level, but the inorganic strawberries average glucose level was higher than the organic strawberries. The contribution this experiment established was that the experiment lets people know the difference in glucose levels between the strawberries letting the results help them with which type of strawberry they would prefer to purchase.

Project ID: 762

Junior Division

Plant Sciences

Ava Trench

St. Michael's School - Poway

Gr. 8

Does a Chlorophyll Supplement Have More Chlorophyll Than a High-Chlorophyll Vegetable?

I learned about chlorophyll supplements, and I saw they were popular on social media. I wondered if the supplements would be more beneficial than plants in terms of chlorophyll amounts. I studied Kale, Spinach, Romaine lettuce, and three different chlorophyll supplements to see which one has the most chlorophyll. I extracted chlorophyll from the plants using isopropyl alcohol and diluted the pill form supplement with water. I then put three drops of the extracted chlorophyll onto a strip of chromatography paper allowing the chlorophyll to dry. I then put the strip directly above the water in a cup with the end of the paper touching the water. I waited twenty minutes and then pulled the chromatography paper out of the cup and measured the results. I measured from where I placed the drops to however far up the paper it went. I measured the growth with a ruler. The plant with the least amount of chlorophyll was the Romaine lettuce. Kale and spinach had relatively the same results, having more chlorophyll than the Romaine lettuce. The pill form of the supplement had a slightly larger amount of chlorophyll, and the liquid chlorophyll drops had the most. One thing I noticed is that the supplements only had chlorophyll type A, while the plants had type A and type B. After completing my experiment, I learned that the Mary Ruth vegan liquid drops have the most chlorophyll in total, but Spinach has the most chlorophyll type b.