

DETERMINING IF THE SOUND A PLANT HEARS AFFECTS ITS GROWTH

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ABSTRACT

The purpose of the experiment was to determine whether the different sounds a plant heard in its environment effected its growth. The three environments were normal, soundproof, and listening to music. It was hypothesized that the music environment would help the Wisconsin Fast plant grow the best. In the experiment, eight Wisconsin Fast plants were planted in each pot and were watered daily. The music plant had headphones attached to it, the normal plant was the control and listened to everyday sounds, and one set of plants was put in a plastic container that was used as the soundproof environment. The height of each plant was measured daily and recorded. At the very end the average of each was taken. The plant that was tallest, greenest, stood tallest, and felt strong was determined to be the one that grew best. At the end of the experiment, it was determined that the hypothesis was wrong and the Soundproof plant grew 88.25 mm. The Control came second with 59.75 mm and the Music plant came last with 47.5 mm. Also, the Soundproof plant looked and felt the strongest and therefore it was determined that a plant in a soundproof environment grows best.

INTRODUCTION

The purpose of the experiment was to find out which conditions a Wisconsin Fast plant grows best in: in normal conditions with normal sounds, listening to music, or in a soundproof environment. The soundproof environment was an old Animal Cracker box and was made of plastic. The normal conditions were literally normal conditions. The plant sat in the light cart listening to normal sounds. Then the one listening to music had headphones near it so it could listen to the music the whole time from a radio.

How music is transmitted through speakers was researched. Music is transmitted through speakers by multiplexing. Multiplexing is when the main signal carries sound from either microphones or recordings. One of these goes on the left of the station and one of these goes on the right. The sounds reach a transmitter and the transmitter sends it out to a subcarrier signal and

the subcarrier signal send out the sound at a frequency of 38,000 cycles, a frequency that humans can't hear. Then, the subcarrier sends it out to a receiver at the left or right side of the station. The receiver sends it out to different speakers and then it finally comes out at just the right frequency so people can here it and listen to it. That works with live talk shows, commercials, and even recorded music.

A plant grows by using photosynthesis was also researched. Photosynthesis is when chlorophyll inside the plant gets energy from the sun and uses that energy to turn water and carbon dioxide into simple sugars that it can feast off of and then it can grow. Plants get energy from the sun's light. The light reflects down to the chloroplast. The chloroplast is a cell that holds chlorophyll. Chlorophyll practically "grabs" the sunlight and uses it to turn water and carbon dioxide into sugars. But not all of this happens at once. The whole process is split into two parts: the light reaction and the light independent reaction sometimes called the Dark Reaction or the Calvin Cycle. The light reaction is when chlorophyll captures light and pushes it into a chemical called ATP. The light independent reaction is when the ATP is used to make glucose. The plant can feed off of the glucose and therefore grow and become healthy and strong.

The Wisconsin Fast plant life cycle is very short. After 1-2 days the seed germinates. Then the stem pushes through the soil so it can sprout a plant at around day 3. The stem elongates (goes up higher) on day 4. On days 5-8 the stem goes up even higher and the plant starts to get ready to sprout leaves. At about day 9, leaves start sprouting and flower buds are beginning to come. On days 14-17 flowers start blooming. In days 18-20 eggs start reproducing new seeds for future Wisconsin Fast plants. From days 21-40 the plant slowly starts dying. Leaves fall off and it slowly turns brown but then the seeds that were on the plant before turn into new Wisconsin Fast plants and the cycle starts all over again.

The seeds planted Wisconsin Fast plants, were 1 mm in diameter and weighed 0.0004 grams and were mixes of dark and light brown. In the control, (plants not used for the experiment) after 1 day of watering they did not sprout or grow at all. The pot they were in was white and made of Styrofoam and had four separate pods with two seeds in each. Each pod had a

length of three centimeters and a width of three centimeters. That gave it 9 square centimeters of room to grow and the plant does not grow very high so it was in good conditions to grow fast and well.

Inside each pod is soil mixed with vermiculite, fertilizer, more soil, and then finally two seeds. The pots were kept under a light cart with fluorescent light shining on them 24/7. The light bulb was shining directly on it. The box/pot was kept on a towel on top of a plastic container.

Other experiments much like this one have been performed. In those experiments, a plant was put in a setting with just a tone playing constantly. Another plant was put in a setting where the tone was only played 3 hours a day, and in the last setting a plant was placed without any noise or tone. It was found that the plant that listened to music 3 hours a day grew the healthiest. In another experiment, a plant listened to a rock station and another one listened to a station that played slower music. It was found that the rock station plant died and the other one grew healthily. Not only were experiments like this performed on plants, they were also performed on people. It was found that factory workers worked harder and had more quality work when listening to music not the whole day but for some of the day. From these experiments, it is clear that music has an effect on peoples' and plants' behaviors.

It was hypothesized that the plant listening to music would grow better. The reasoning behind that is that music can calm the plant or even energize it and therefore make it grow faster and better. It was also hypothesized that the soundproof environment would work the least because plant need more than just sunlight to grow, they need noise.

MATERIALS & METHOD

- Wisconsin Fast Plants
- Vermiculite
- Fertilizer

- Potting soil
- Light cart
- Soundproof plastic container
- Water
- Headphones
- Boom-box
- Styrofoam pot
- Camera
- Ruler
- 2 pie plates
- Paper towels

In the experiment, eight Wisconsin Fast plant seeds were planted in a Styrofoam pot. Two were planted in each quad. These ones were not experimented on but were just used for observing. After four days they didn't grow so they were given up on. But, the process for planting every plant stayed the same.

First soil mixed with vermiculite was added to the pot to begin the planting process. Then fertilizer was added and then another soil and then vermiculite was sprinkled on top of the seeds. This process was used to plant all of the Wisconsin Fast plants. After all of the soil was added, two seeds were planted in one of the four pods in the Styrofoam pot. In the first pot, the eight seeds were planted and then put in a plastic container that was used as a soundproof environment. Then, for the second pot, the control, eight more seeds were planted using the same method. It was left on the light cart listening to normal sounds. Then, in the last pot, eight more seeds were planted, one in each pod, and then headphones were put near the seeds and played music from a boom-box and the plant listened to music for eight hour increments. It listened to pop music from the modern radio station, G105. All of the pots were left under a light cart with light shining on them 24/7. There were set down on a container lid with a cloth underneath.

Three more quads of plants were planted to ensure that some grew. All of the plants and seeds were watered daily and the growth of all of the seeds was observed. After all of them grew,

the one plant was pulled out from each quad if possible. The independent variable was the sounds the plant was listening to and the dependent variable was how high the plants grew and how healthy they were. How healthy they were was determined by how tall they were and also how green they were. Also, if they were wilting or falling over, they were not considered healthy.

An additional experiment involving Wisconsin Fast plants was performed. It was researched that Wisconsin Fast plants typically grow in a rocky environment so the plants were put in an environment with no vermiculite or rocks and just soil. They were observed to see if they could grow in just soil and plants were also put in a just vermiculite and rock environment to see if that affected its' growth.

A third experiment was performed. Four Wisconsin Fast plant seeds were put on a paper towel. The paper towel was folded over so the seeds were covered and then the paper towel was watered. The paper towel was placed on a pie plate. That was done twice. Headphones were attached to one of the pie plates to see if the music vibrating off the metal effected the plants' growth.

RESULTS & DISCUSSION

In the first experiment that was performed, it was determined that the plant in the soundproof environment grew best. 4 plants grew from it and the average growth was 88.25 mm. The plant in the music environment grew the least. 3 out of the 8 plants grew and the average height was 47.5 mm. The control plant grew 59.75 mm. 5 out of 8 grew but at Day 6 one of the plants died. The control plant started growing on the second day, the music plant started growing on the second day and the soundproof plant grew on the second day as well. From the very beginning the plant kept in the soundproof environment was the largest and it was also the greenest and strongest and was determined healthiest. The music plant was never the strongest, tallest, or healthiest. The soundproof environment's growth and health was almost double the music's and the soundproof was always much healthier and taller than the other two plants.

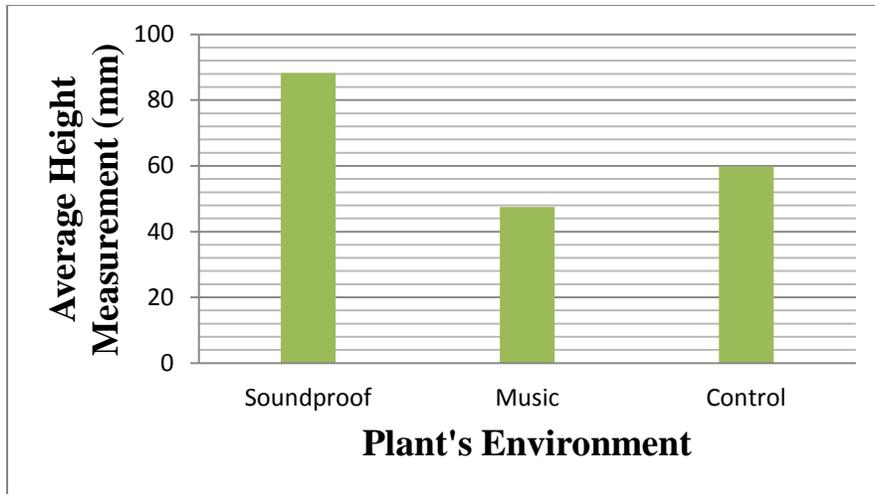


Figure 1 Average Height of plants in different environments



Figure 2 Control Plant: Last Day



Figure 3 Soundproof Plant: Last Day



Figure 4 Music Plant: Last Day

In the second experiment performed, the plants were only observed for 3 days. It was found that the plant in just soil grew an average of 7 mm and the plant in the vermiculite grew an average of 6 mm. In the third and final experiment, the plants did not germinate when they were inside the pie plate.

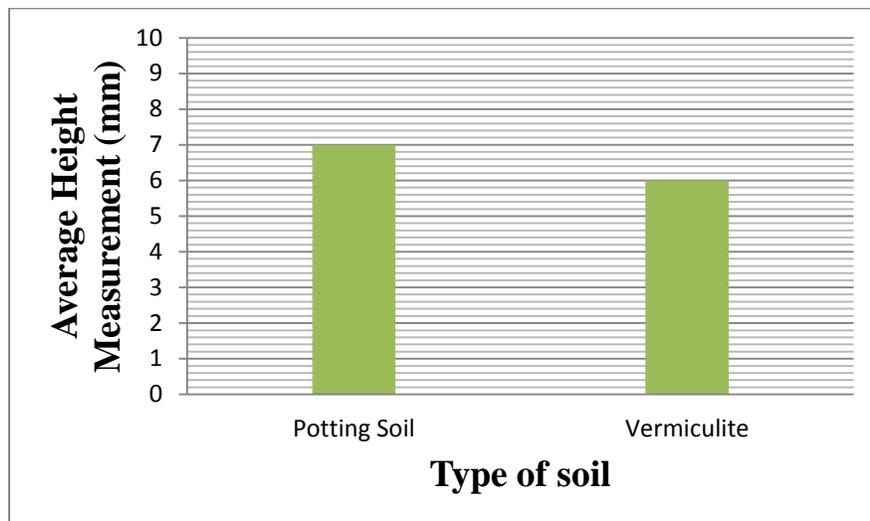


Figure 5 Average height growth in different types of soil

CONCLUSIONS

After the experiment was performed, it was determined that the hypothesis was incorrect. In the end, the plant that was in the soundproof environment grew the best and the plant in the

music environment, the plant that was predicted to grow the best, ended up growing the least. A reason why the soundproof might've grown better was because of the humidity in the soundproof area. It was very warm and humid and had mist circulating around it which could've helped the plant grow.

In the other experiment, it was predicted that the plant in vermiculite would grow better than the plant in the soil but that hypothesis was also wrong. The results were surprising because Wisconsin Fast plants grow in a rocky environment without much soil. They are used to living in a rocky environment and growing in a rocky environment so it was surprising that they grew better in potting soil than vermiculite. Vermiculite is a rock so it is interesting that they grew better in soil.

In the pie plate experiment, it was hypothesized that the pie plate and paper towel would keep the plant from growing and that hypothesis was correct. The paper towel dried up after only a couple of hours even after being soaked. Because of this, the plant could never really grow to its fullest and get the right amount of water that it needed to grow. Also, it was observed that it seemed that the paper towel was restricting the Wisconsin Fast plants from growing.

The experiment could be improved by doing the experiment for a longer amount of time. Also, different plants could be used. The most major thing though is performing and observing the experiment for a longer amount of time. Another addition that could be added is playing different types of music. Pop music and some rap music were played because it was listening to a basic radio station but it could be changed by listening to different music such as classical or even heavy metal. Future experiments could be that the plants could listen to music for different amounts of time per day or even per week to see how music on and off effects growth. Also, conducting an experiment like this on humans could see how music affects peoples' everyday lives.

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