

Finding how live classical music will affect the growth rate of plants

Abstract

This study investigates how classical music will affect the growth rate of plants. There are four different types of music: live classical music, classical recording, clapping, and metal. All music types are played for a different period of time: 10 min, 20 min, and 30 min. The control is also added into the experiment where the plant will not listen to any music to compare whether music helps the growth of the plant. As a result, there are two conclusions for the first experiment. (1) Music helps the plant grow at a faster rate compared to the control. (2) Another is that the live and recording of classical music significantly increases the rate of growth the most compared to other types of music.(3) Longer playing time promotes the higher growth rate. The second experiment goes a step further into the experiment in which only the live and recording are compared. I played the violin while recording myself and also recording the decibel meter, so that I could make sure the recording of my playing is played at the same volume as my live playing. This time, the time periods are split into: 10 min, 20 min, 30 min, 40 min, and 50 min. The experimental results demonstrate that the classical violin music played on the scene increases the growth rate of the recording, and the 30-minute playing time will have the best growth rate instead of the longest 50 minutes playing time. The phenomenon and result will be explained in detail later in this article.

Introduction

Many researches done before have shown the possibility and potential of music affecting plants such as how different types of music can affect the growth of plants. It has been found that sound waves from music causes vibrations within the plant which stimulates the growth of plants [3]. Another researcher believed that since music can help people relax it will have the same effect on plants [4]. However, there has never been any research done before comparing the effects of recorded and live music on the growth of the plants. Therefore, in this experiment, we want to compare the effect recorded and live music on the growth of the plants. To do that, we will prepare four different types of music: playing live classical music using the violin, playing the recorded version of the live classical music on the violin using the same volume, clapping music, and metal music. In addition these types of music would be played at a fixed time every day and compared to the control group. Plant growth would be observed and the length of the plant would be recorded down each day. A picture of the plants would also be taken for further analysis. To examine how different amount of times where different types of music played will affect the rate of plant growth, we will first set different amount of times the music would be played (from 10 to 50 minutes), play it at the fixed time every day, and take a picture to compare with the control group. We would also observe the amount of plant growth and record the length of the plant every day. Afterwards we would then examine how live music would affect the rate of plant growth. To do so, we will use live classical music and the recording of the live classical music as the experimental groups and play them for a fixed amount of time to the plant. Observations would then be made where the lengths of

the plant would be recorded down to be made into a graph for further analysis. Once we make the graph, we would then explain the results of the experiment.

Method

To prove that live music would affect the growth rate of plants, we first have to choose what type of plant and the different music we will be using for the experiment. For the plant, we chose to use green bean sprouts because it is convenient to get and can be planted easily. Once we plant the green bean sprouts, we will play music for the plants at a fixed time each day and observe/record how much the plant has grown. The period of time we would be observing each plant will be one week; this is because we have found that once the plant has been growing for one week, the plant will start growing leaves in which the weight of it would make the plant dip. For choosing the different types of music, we decided on four types: live classical music on the violin, the recorded version of the live classical music on the violin that will be played at the same volume as if it was live, clapping music, and metal music. We will be comparing the plant growth of the groups in each category of the music to the control group (the group in which no music would be played for). As a result of these experiments, we can compare how live and recorded music would affect the growth rate; in addition, we can also compare how the different types of music would affect the growth rate. At the same time, in order to see whether the amount of time the plants hear the music will be a factor, we set a different amount of time for each group of plants in each category of music (10, 20, 30, 40, 50 minutes). This will allow us to find a detailed result that will show how it affects the plant growth.

Process

1. Preparing the green bean sprouts and other materials

First we prepare the green bean sprouts by taking approximately 200 beans from the bag of green bean sprouts. They will be soaked into a bowl of water to soak for 36 hours; the purpose of this is to let some of the beans start growing sprouts. Next, we will also prepare the green bean growing environment by taking a few cotton sheets to put on the bottom of the Petri dishes (according to the size of the dish). Then we take a few cotton balls and pull them apart so they hang together loosely and put it on the top of the cotton sheets; this is so that the bean sprouts can absorb water from the cotton balls. When we grow the bean sprouts, we will use the small measuring cup and pour 30 mL of water into each petri dish. Then, we use tweezers to take out the beans that have already sprouted from the bowl and put it in an orderly fashion in the petri dish (9 bean sprouts spread apart in each dish).

2. The effect live classical music and the different set times they are played at on the growth rate of plants

First we will prepare different types of music where we will prepare two different types of music situations: one will be live classical music on the violin and the other will be the recorded version of it played at the same volume. These two different music situations will be compared to the control group in which no music will be played. Once the green bean sprouts have started to grow, we will start the experiment the next day and record the height of the plant before playing the music at 8:00 pm every night. We need to prepare 10 Petri dishes (the two different types of music multiplied by five different set times (10, 20, 30, 30, 40, and 50 minutes) they will be played at) plus one Petri dish for

the control group. Live classical music on the violin (Tchaikovsky Violin Concerto in D major, Op. 35, 3rd Movement) will be played first while a recording device would be on record to record the live version. Five Petri dishes filled with 9 green bean sprouts in each dish will be set on the side (each dish will either listen for 10, 20, 30, 40, or 50 minutes). The sound level meter should also be on the side to record the volume of the live music. Next, we will be playing the recorded version to another 5 Petri dishes filled with green bean sprouts (each dish will listen for either 10, 20, 30, 40, or 50 minutes) at the same volume as the live version. We will repeat this process for 7 days and measure the length of the bean sprouts at the same time each day and record down the results on the sheet to do further analysis.

Note: Data from the green sprouts in the petri dishes designated for live and recorded classical music for 10, 20, and 30 minutes in this experiment are not reused from the same data from the previous experiment.

3. Processing the data from the raw data

Once the green bean sprouts have started to grow, we will start the experiment the next day and record the height of the plant before playing the music at 8:00 pm every night. To prevent possible errors from affecting the data, we used nine green bean sprouts for each Petri dish. If the results of the raw data produce outliers, we will take out the outliers. We determine outliers by calculating the average. If the data is more than 20% away from the average, it is an outlier. Taking out outliers will prevent errors that will affect the processed data of the experiment. From all the times we have done the experiment (approximately 30 times), we found that there is an average of 2 outliers in each Petri dish. Therefore, the data we can use from each Petri dish is around 7.

Result and Discussion

For the experiment, we discussed how different types of music and the different time period they are played at will affect the rate of plant growth. We found from the 20 and 30-minute graphs that live classical music produces a better result than the recorded version of the live classical music. However, for the 10-minute graph, it showed that live classical music was not necessarily better than other types of music in terms of producing the best result. Because of this interesting trend, we decided to take the experiment a step further by comparing the effects of live classical music and the recorded version on the growth of the plants. We will use the set time period of 10, 20, 30, 40, and 50 minutes for both types of music situations.

Image 1 and 2 show the most recent trial of the experiment in comparing the effects of live classical music and the recorded version on the growth of the plants. Image 1 shows the effects starting from day 1 to day 4. The top row in the image is the live classical music group whereas the bottom row is the recorded version of live classical music group. There are five different periods of time the music will be played which therefore means there will be 5 Petri dishes for each music criterion. From left to right, the Petri dishes are put in the order 10, 20, 30, 40, and 50 minutes. In image 1 shows the first day (top left), the second day (top right), the third day (bottom left), and the fourth day (bottom right). Image 2 shows the results from the fifth day to the seventh day. Similar to the previous image, the top row is live classical music and the bottom row is recorded version of live classical music group. The Petri dishes are also put in the order of 10, 20, 30, 40, and 50 minutes. Image 2 shows the fifth day (top), sixth day (middle), seventh day (bottom). We take all of the results and process the data into graphs. Image 3 (top) shows the daily

growth of the plant over a seven-day period where both types of music were only played to the plants for 10 minutes; the image shows the recorded version of the live classical music (left) and live classical music (right). Every Petri dish contains 9 green bean sprouts in order to prevent outliers from affecting the overall data. In image 3, two outliers are taken out for each of the graphs where the average (purple line) is then found based on the remaining seven results. Image 3 (middle) shows the daily growth of the plant over a seven-day period where both types of music were only played to the plants for 20 minutes; the image shows the recorded version of the live classical music (left) and live classical music (right). Because there are no outliers found in either graph, the average (purple line) is found based on the nine results of the nine green bean sprouts in each Petri dish. Image 3 (bottom) shows the daily growth of the plant over a seven-day period where both types of music were only played to the plants for 30 minutes; the image shows the recorded version of the live classical music (left) and live classical music (right). Similar to image 3 (top) there were some outliers taken out to; therefore, the average (purple line) is found based on the remaining eight results. Image 4 (top) shows the daily growth of the plant over a seven-day period where both types of music were only played to the plants for 40 minutes; the image shows the recorded version of the live classical music (left) and live classical music (right). There were also outliers found and the average is shown through the purple line. Image 4 (bottom) shows the daily growth of the plant over a seven-day period where both types of music were only played to the plants for 50 minutes; the image shows the recorded version of the live classical music (left) and live classical music (right). Outliers were found and the average is shown through the purple line.

To further delve into how different kinds of music affect the growth of plants, we first took all of the averages (the purple line) of the 10-minute graphs of live and recorded version of the classical music from image 3 along with the line showing the growth of the control group and compared them to each other. This is shown in image 5. From the graph in image 5, we can see that the growth of the control group is the slowest and the growth in the plants listening to live classical music is the fastest. In addition to the comparison of the averages of the 10-minute graphs for each type of music, we also compared the averages of the 20-minute and 30-minute graphs. This is also shown in image 5. From the comparisons in image 5, we can see that the growth in the plants listening to live classical music is the fastest. This trend is also shown as well in image 6. Image 6 compares the averages of the 40-minute graph and compares the averages of the 50-minute graph.

From the first part of the experiment, we have found that the plant group that listened to live classical music for 30 minutes grew the most. We were curious to see if the plant will grow taller the longer we play the live classical music. Therefore, in the next part of the experiment, we started to experiment whether the plant will grow taller if the plant heard the live classical music for a longer period of time. In image 7, we compared the averages of the 10, 20, 30, 40, and 50-minute graphs of the live classical music along with the growth of the control group. We can see that the control group still doesn't grow as tall compared to other groups that listened to live classical music. However, the graph makes it hard to show whether the 10, 20, 30, 40, or 50-minute of live classical music produces the best result in the growth of the plants. Therefore, we took the growth of the plant in each plant group (different plant groups that listened to live classical music for a different

length of time) from day 2 to day 6 and calculated the average length of the plant. We took out the plant length of day 1 since the bean sprouts have not grown that much at all. We then made a graph (shown in image 8) comparing the average of the plant length that listened to live classical music for different lengths of time (10, 20, 30, 40, and 50-minute). We can see from image 8 that listening to live classical music for 30 minutes produces the best result in the growth of the plant.

From the experimental results above, we can conclude that when there is no music, the growth rate of the plant is the slowest; however, when there is no music, no matter what type, the growth rate of the plant would be faster. In addition, under the same volume of sound, live classical music allows a faster growth rate than recorded classical music. However, the longer the live classical music is played does not mean a better growth rate. Therefore, our final conclusion is: playing live classical music to the plants for 30 minutes per day would allow the best growth rate.

What we really wanted to discuss in this experiment is how live classical music would affect the growth rate of plants since it is a topic that has never been discussed or researched before. Researchers have found that the reason why music helps plant growth is that the sound waves would cause vibrations within the plant, thus stimulating plant growth [3]. Another explanation is that music can allow people to relax therefore music would most likely have the same effect on plants [4]. One plant expert believes that every music note and the plant DNA pattern/amino acid/plant cells have a specific connection [5] therefore some music notes would stimulate certain components of the plant. Thence, specific types of music would have a great effect on specific types of plants

which means specific types of music would also not have a great effect on specific types of plants. In other words, plants have specific types of music they will respond to similar to how people have different types of music they like so the reactions to the music would be different. Our idea of playing live music to plants also comes from our experiences with music ourselves. When we listen to music, we would all prefer to listen to music played live at concerts rather than played from CDs or the computer. We tend to hear the passion of the artist and thus feel more from the music when played live. Plants and people are living beings, therefore I believe plants would have similar reactions to live music as people do. Our initial idea is proven to be true from the conclusion we have drawn from the experiment: the plant's growth rate is the fastest after hearing classical music played live. As we can see from image 8, classical music played live for 30 minutes would allow the plant to grow to an average of 10.47 cm as compared to the average height of the plant of 8.36 cm, which means live classical music played for 30 minutes can raise the height of the plant by 25%.

Conclusion

From this experiment, we have found that live classical music compared to recorded classical music would allow a faster growth rate for plants. It is found that live classical music can raise the plant growth by 25%. We used two different types of music and five different lengths of time the music will be played. Music will be played to the plants for a set period of time each day where the height of the plant each day will be recorded down. By using the recorded results and making graphs from it, we can compare the growth of

plants under different conditions we have set for each group. Thus from the comparisons we made we drew several conclusions:

1. Effect of live classical music on the growth rate of the plant
 - a. In these experiments, whether it's 10, 20, 30, 40, or 50 minutes, live classical music allows a faster growth rate compared to recorded classical music.
 - b. From the experimental results, the growth rate increases as the length of time the music is played increases. This is true when the music is played for 10 minutes to 30 minutes. However, when the music is played for 40 and 50 minutes, the growth rate of the plant decreases. This shows that a longer playing time for the music does not necessarily mean a greater growth rate. The conclusion of the experiment is that the growth rate of the plant will be the fastest when live classical music is played for 30 minutes.
2. Reason live classical music affects the growth rate of the plant
 - a. In our experiment, whether it's 10, 20, 30, 40, or 50 minutes of playing, live classical music can allow a faster growth rate than recorded classical music. We think that this is due to the reason that plants are also living organisms where they have a more positive response to live music rather than recorded music.
 - b. According to the experimental results, if we let the plant listen to live classical music for 30 minutes each day, the growth rate can increase by 25%.

Ultimately, we want to be able to apply the experimental results we have found to daily life. For example, the experimental outcome can result in increasing the growth rate of plants which can help in farming and agriculture. This experiment can also be extended further by using different kinds of plants such as flowers or certain types of trees instead of only limited to green bean sprouts. Furthermore, we can also take a look at how different types of live performances in music other than just classical music will have a different effect on the growth of plants. Most importantly, we hope that in the future we can also provide a more thorough explanation of the effect music has on plants such as quantifying its effects and finding an equation where we can find the effects.

Figures

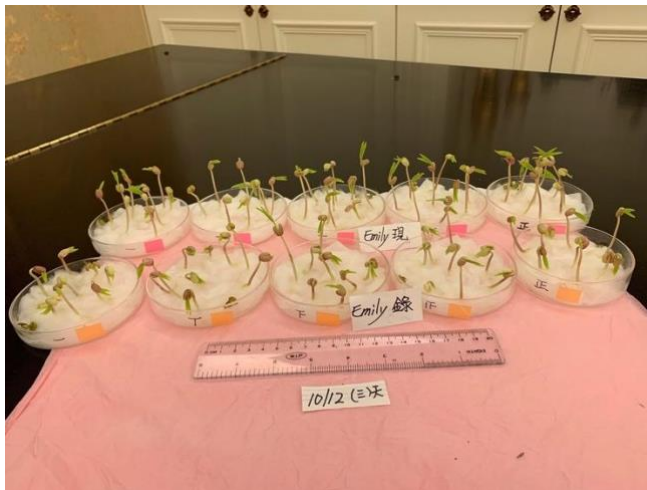
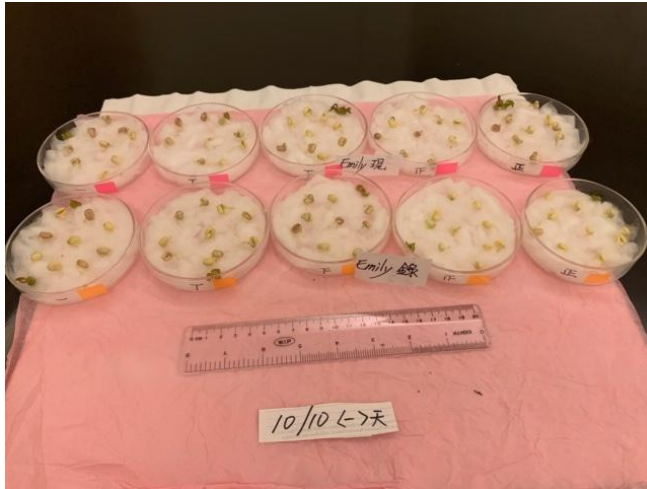


Image 1. Live classical music results (top row) and recorded classical music results (bottom row). First day (top right), second day (top left), third day (bottom left), fourth day (bottom right).



Image 2. Live classical music (top row) and recorded classical music results (bottom row). Fifth day (top), sixth day (middle), seventh day (bottom).

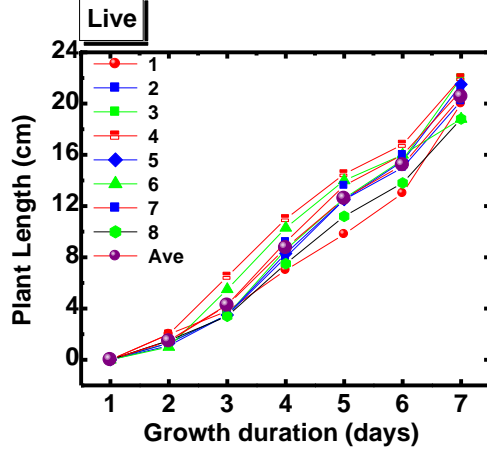
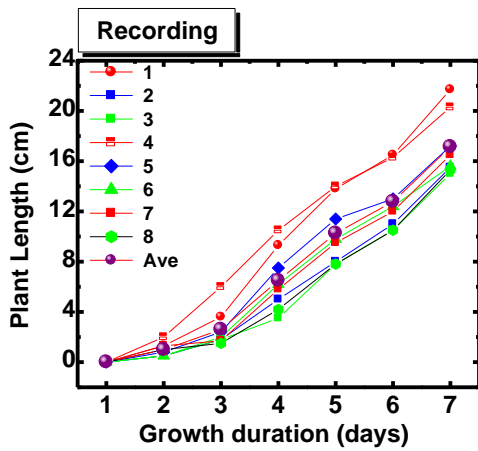
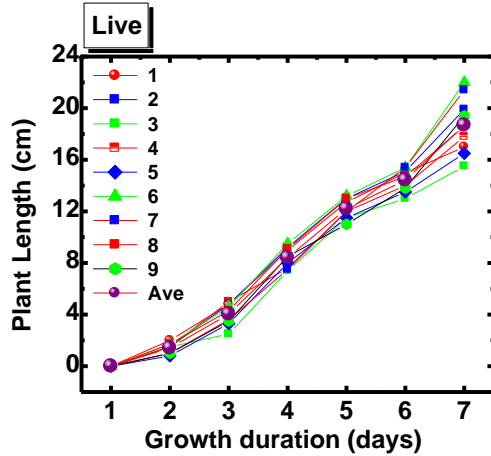
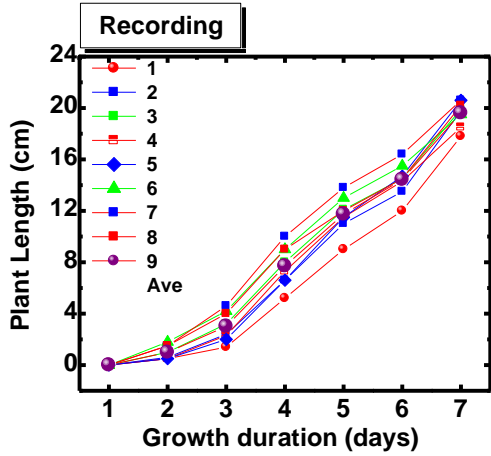
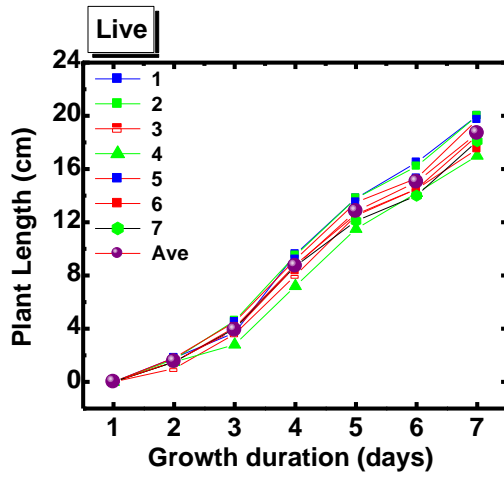
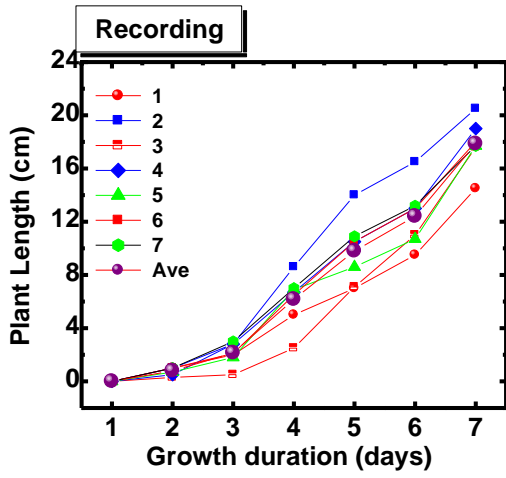


Image 3. Recorded classical music (left), live classical music (right). They are played for 10 (top), 20 (middle), 30 (bottom) minutes each day.

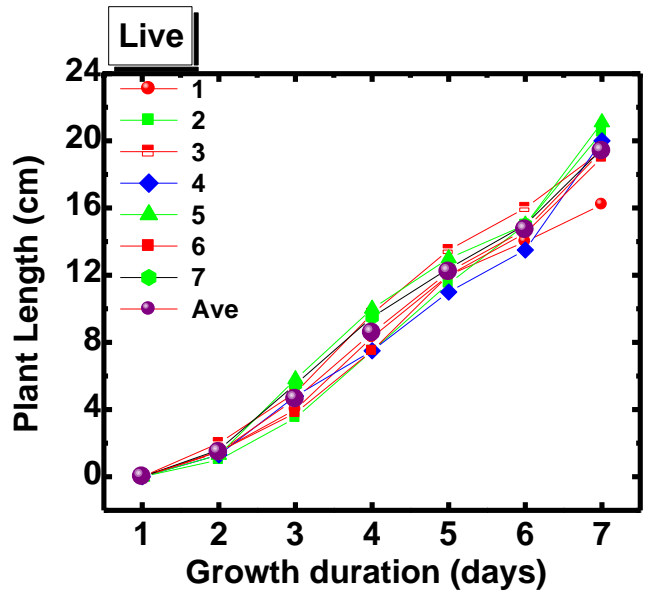
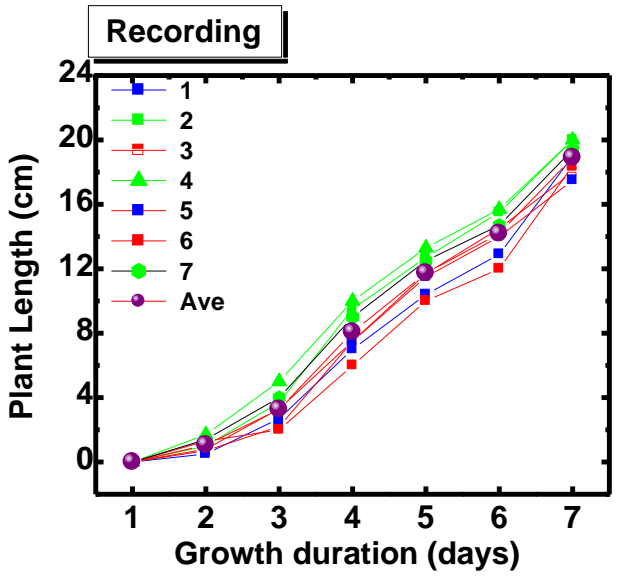
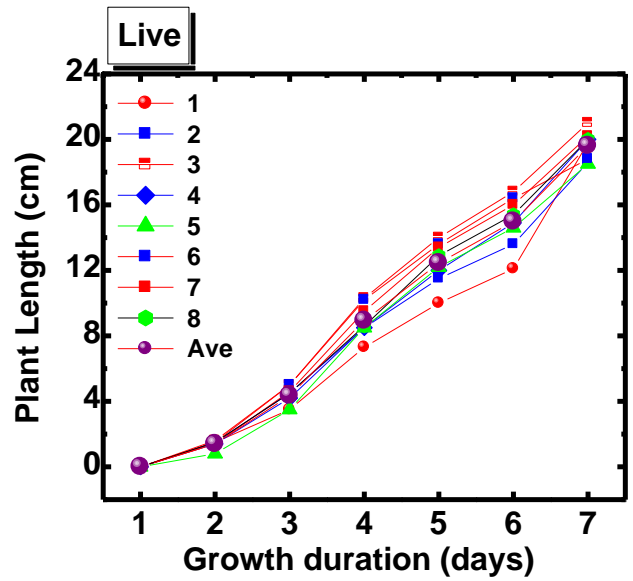
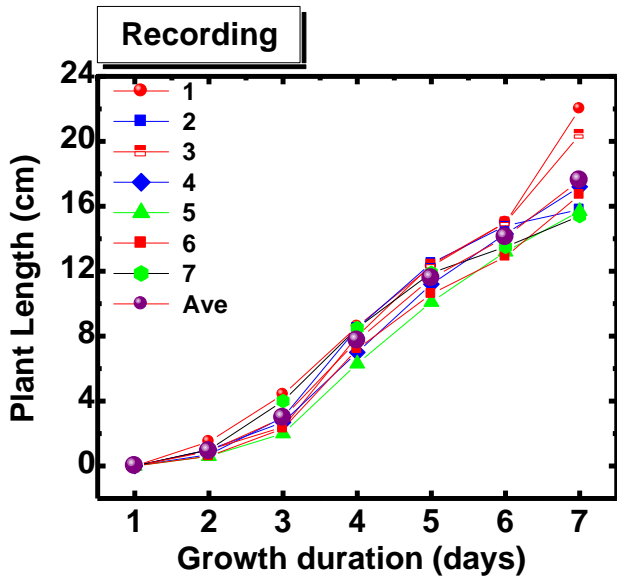


Image 4. Recorded classical music (left), live classical music (right). They are played for 40 (top) and 50 (bottom) minutes each day.

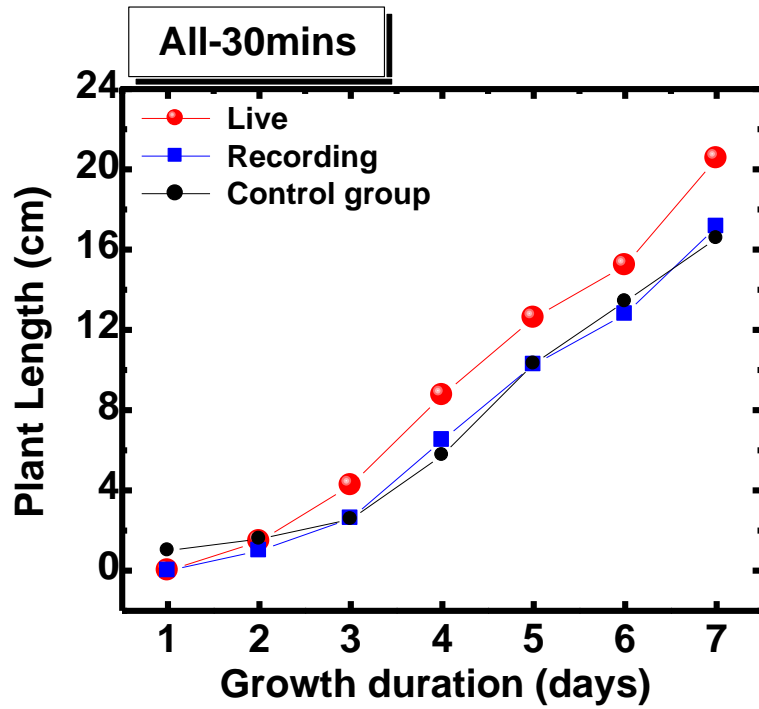
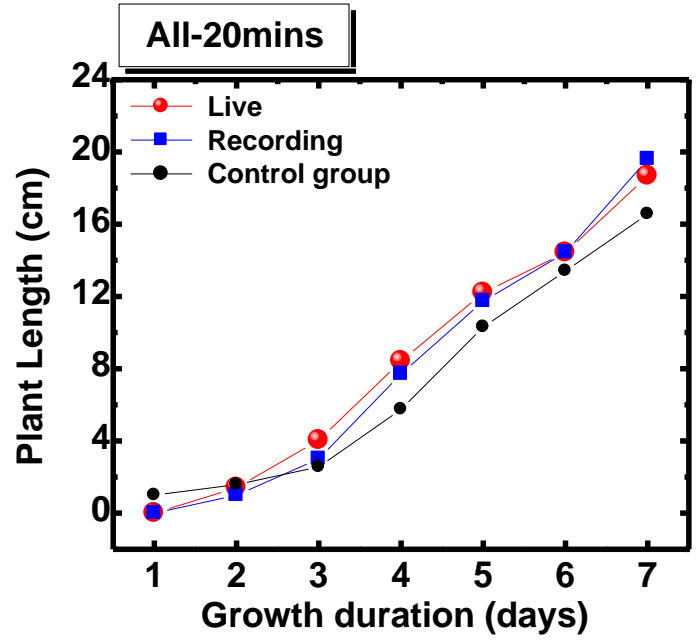
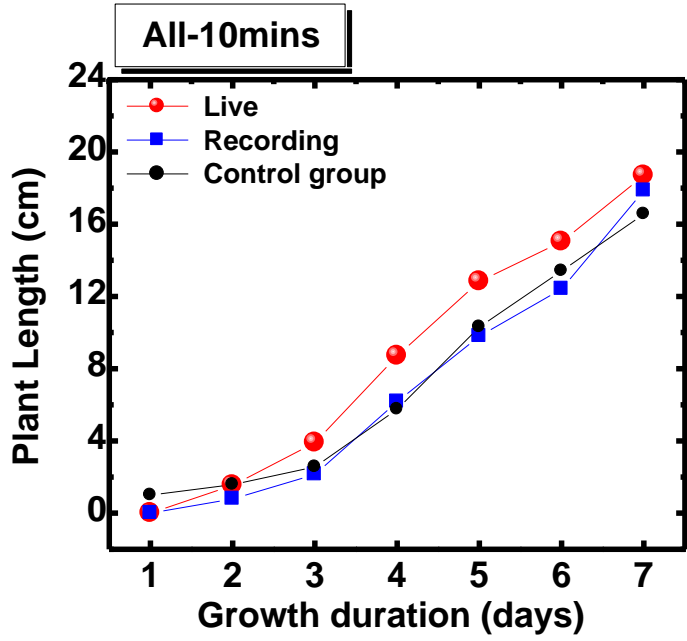


Image 5. Comparison between live and recorded classical music, of which they are played for 10, 20, and 30 minutes each day.

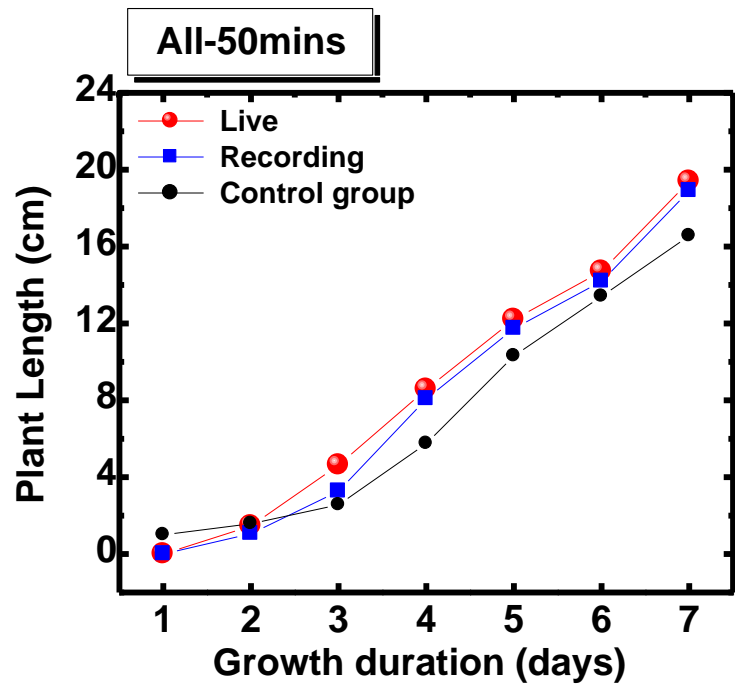
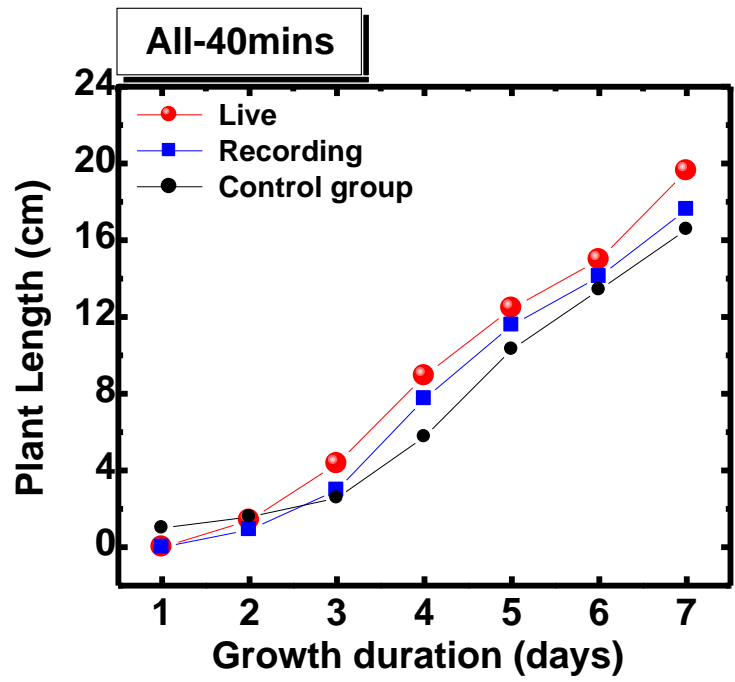


Image 6. Comparison between live and recorded classical music, of which they are played for 40 and 50 minutes each day.

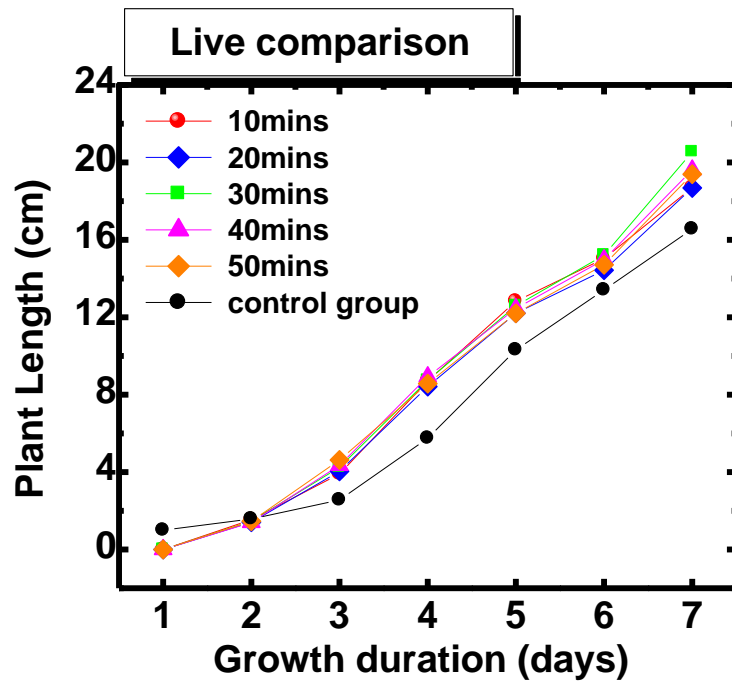


Image 7. Comparison of the growth rate of plants listening to live classical music for 10, 20, 30, 40, and 50 minutes each day.

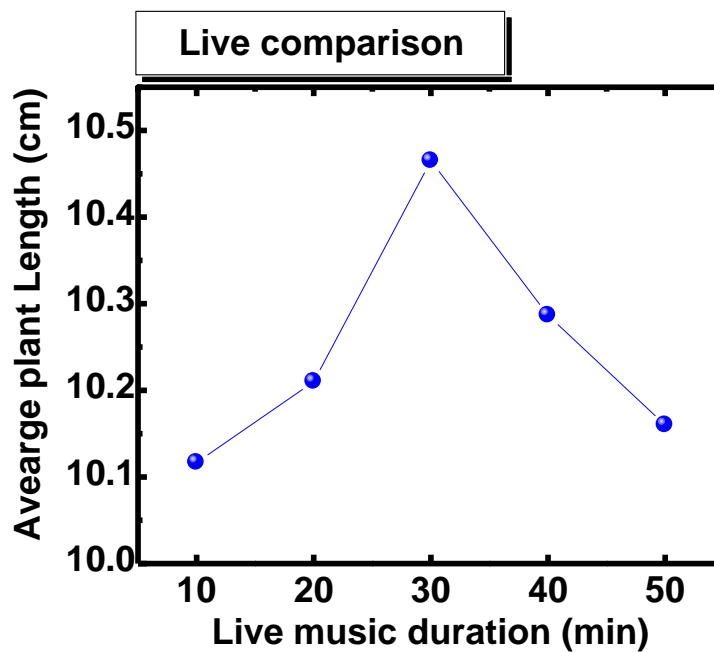


Image 8. Comparison of the average growth of plants listening to live classical music for different periods of time.

Reference

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