

# ***The Effects of Classical Music on the Growth of Vernalized Radish Plants***

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# Background

Traditionally, radish seeds are vernalized, sown in colder temperatures ranging from 12 to 24 degrees C, to ensure they mature and flower when warmer weather and longer days set in (Bouché et al., 2015). The problem is the drastic increases in temperature that are caused by climate change and allow radishes to bolt, or flower too early. As a result, the radishes have a bitter taste and woody texture (Tilley, 2023). A possible solution for this issue is the use of classical music to “de-stress” the radish plants that are exposed to heat. According to a study conducted in 2020, the growth of plants in association with classical music upregulated heat response genes in *Arabidopsis Thaliana* (Bhandawat et al., 2020).

## Hypothesis:

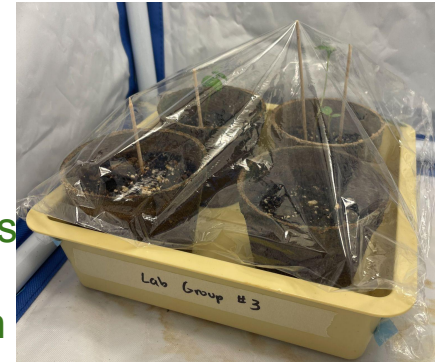
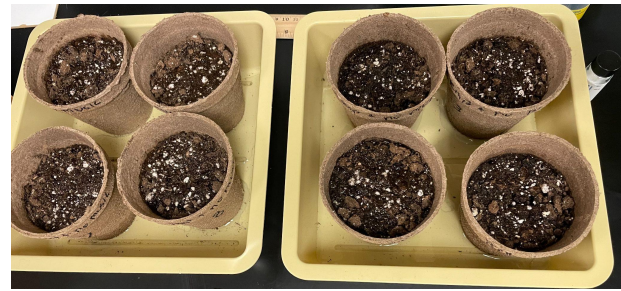
Growing vernalized radish plants with classical music will reduce the effects of devernalization through heat stress.

# Materials

- ❑ 8 Jiffy 3-inch Peat Pots
- ❑ 16 Radish seeds from Carolina Biological Supply
- ❑ Pro-Mix for Potting & Seeding
- ❑ Refrigerator set to 4 degrees Celsius
- ❑ Incubator(Incubator-Shaker Mini from Benchmark Scientific)
- ❑ Plant Light House with Light Bulbs from Carolina Biological Supply
- ❑ Plastic Cling Wrap
- ❑ Ruler
- ❑ Computer(or device with bluetooth)
- ❑ Tribit XSound Go Bluetooth Speaker

# Procedures

- 1) Planted/Vernalized 16 radish seeds:
  - a) Each pot was filled with soil mix until about an inch from the rim and two seeds were planted per pot
  - b) The pots were divided into four groups and labeled according to the treatment they were going to receive
    - i) Group 1: Room temperature + No music
    - ii) Group 2: Heat + No Music
    - iii) Group 3: Room temperature + Music
    - iv) Group 4: Heat + Music
  - c) Seeds were watered sufficiently and placed in the refrigerator for six weeks
- 2) Vernalized seeds were removed from the fridge. Plastic cling wrap was placed to cover the top of the pots and maintain moisture. Plants were then moved into the Plant Light House. The plastic wrap was removed and plants were watered before administration of each treatment (approximately every other day).



# Treatments/Data Analysis Procedure

Treatment for groups 1 and 4 were administered at the same time. Treatment for groups 2 and 3 were administered at the same time. Each treatment was given for a time period of one hour, and after, the pots were covered back up with plastic cling wrap and placed in the Light House.

- 1) Group 1 plants were removed from the Plant Light House and placed in front of a window
- 2) Bluetooth speaker was connected to a laptop and placed inside the incubator set up to play classical music("Classical Music for Studying & Brain Power | Mozart, Vivaldi, Tchaikovsky..." on YouTube). Then, the Group 4 plants were placed in the incubator set to 30 degrees Celsius along. (The volume setting of the speaker was taken note of to ensure the music was played at the same volume for every treatment.)
- 3) Group 2 plants were placed in the emptied incubator set to 30 degrees.
- 4) Group 3 plants were placed near a window next to the bluetooth speaker set to play classical music

Plants were treated every other day for four weeks and their growth was monitored over time.

After the treatments, the height of each plant was measured and recorded. Then, the average height of the plants was calculated and compared with each other, after disregarding the seeds that did not sprout.

# Pictures

room temp + no music



heat + no music



room temp + music



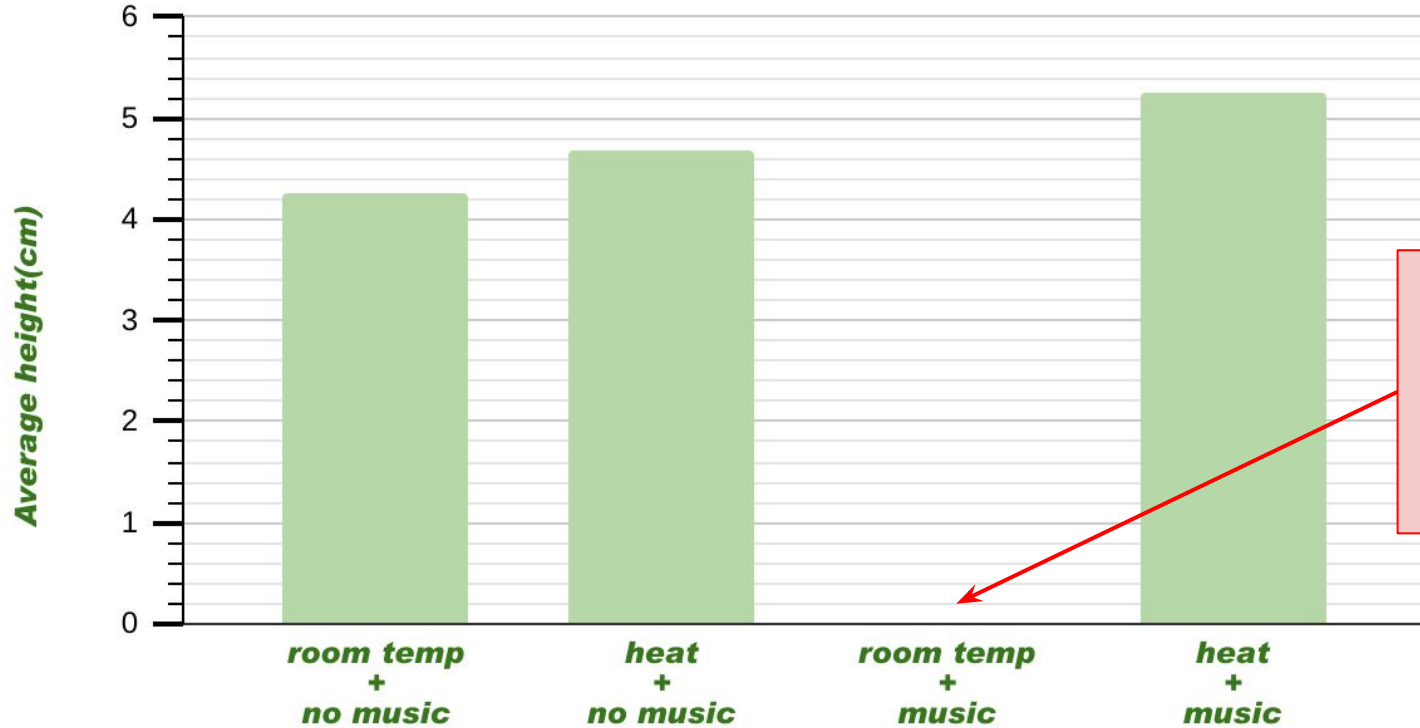
Heat + music

# Data Table

	Height of radish plant(cm)				
Group	Seed 1	Seed 2	Seed 3	Seed 4	Average(cm)
Room temp/no music	3.1	4.1	5.6	No growth	4.267
Heat/no music	2.2	5.2	5.6	5.7	4.675
Room temp/music	No growth	No growth	No growth	No growth	0.0
Heat/music	5.3	5.2	No growth	No growth	5.25

# Results

**The Affect of Classical Music on the Height(cm) of Vernalized and Devernalized Radish Plants**



**\*\*\*No growth**  
(will be addressed in  
"Possible Sources of Error")



# Analysis

Typically, devernalized radish plants, compared to those whose vernalized states are maintained, would have an increased growth rate, measured by height in centimeters at a given time, leading to premature flowering. This is supported by the data, as the average height of radish plants subjected to heat stress, 4.675 cm, without music surpassed those kept at room temperature with no musical intervention, 4.267 cm.

Contrary to the hypothesis, the data collected suggests that classical music does not increase the resistance of a radish plant to devernalization by heat stress because the average height of plants exposed to both classical music and heat, 5.25 cm, was greater than that of the plants subjected to only heat, 4.675 cm. Therefore, it can be inferred that the application of classical music during the growth of vernalized radish plants does not minimize the effects of devernalization by heat stress.

# Possible Sources of Error

- Radish seeds may have been sown too deep into the soil, preventing them from reaching the surface and receiving sufficient sunlight to develop stems.
- Inability to provide consistent treatments(every other day) due to weather conditions that lead to school closures
- Loud humming sound of incubator that Group 2 and Group 4 plants(heat + no music and heat + music) were placed in could have caused the music have a relatively low intensity when compared to that of the music played for Group 3(room temp + music)

# Modifications

Sow a larger number of seeds(around 10-20 per group) to decrease variability in collected data

Increase the time period of each treatment(3 to 4 hours)

Increase the volume of the music played when treating groups 3 and 4

## Ideas for Future Research

Study the effects of other possible solutions on the devernialization process of radish roots:

- Nutrient concentration of soil
- Light intensity
- Water supply

# Work Cited

Bhandawat, A., Jayaswall, K., Roy, J., Sharma, H. (2020). *Sound as a stimulus in associative learning for heat stress in Arabidopsis*. PubMed Central.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6973327/>

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