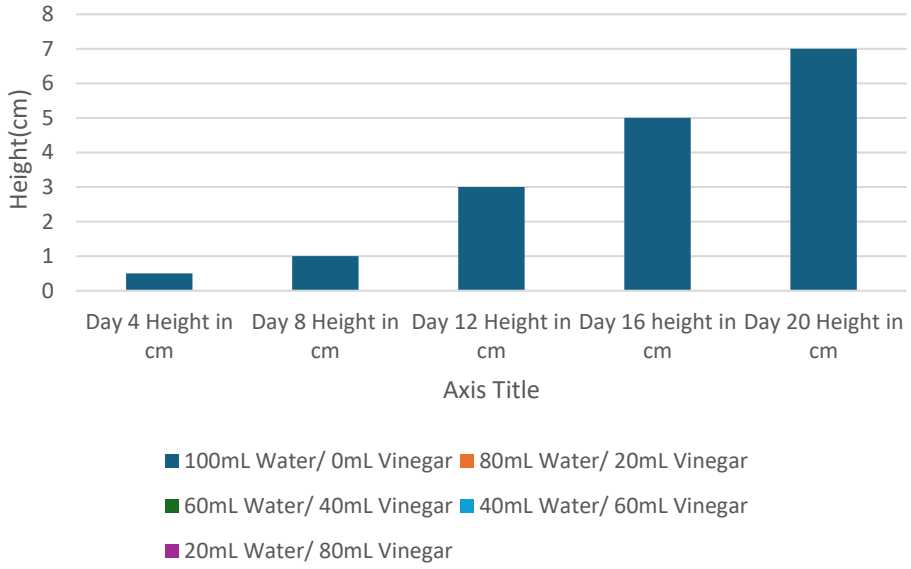
Vinegar Concentration and Its Effects on Plant Growth: Determining the Optimal Acetic Acid Level

Research Question: How does different concentrations of vinegar affect the growth of radish plants?

Independent: Vinegar Concentration
Dependent: Seed species, water amount, light exposure, pot brand and type
Control: One group of plants was watered without Vinegar



Procedure:
1:Four radish seeds were planted in the center of each pot.
2:Five vinegar solutions were prepared using distilled water and 5% acetic acid vinegar: (1) 100 mL water/0 mL vinegar (control), (2) 80 mL water/20 mL vinegar, (3) 60 mL water/40 mL vinegar, (4) 40 mL water/60 mL vinegar, and (5) 20 mL water/80 mL vinegar.
3: Water designated solution every two days.
5:Final heights were recorded after twenty days.

Conclusion:
Vinegar is a very effective killer of weeds and plants in the early sprouting stages as shown through no growth in all solutions with vinegar
This is due to the fact of the intense dehydration of the cells that the Acetic Acid causes
This is applicable in real life due to the fact that vinegar can be used in households and is an affordable weed killer

Vinegar

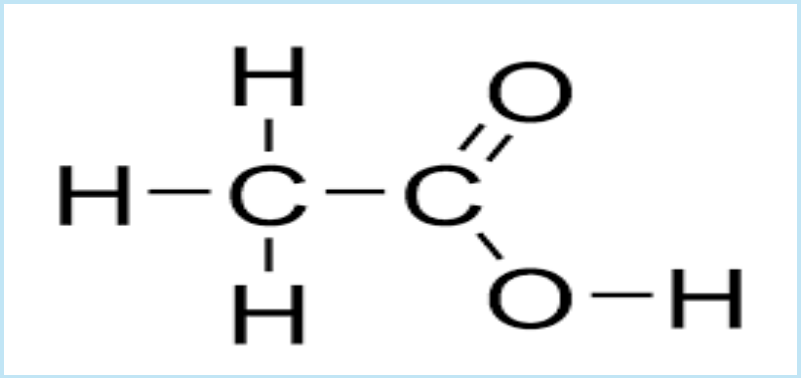
What is it

an acidic liquid produced through a two-step fermentation process where yeast converts sugars to alcohol, and bacteria (*Acetobacter*) convert that alcohol into acetic acid and water

Can be in found in most households as it is a commonly used cleaning supply

Found in different concentrations and strengths of the acid to get different results

It was chosen because of its accessibility and cheap cost



https://www.britannica.com/topic/vinegar

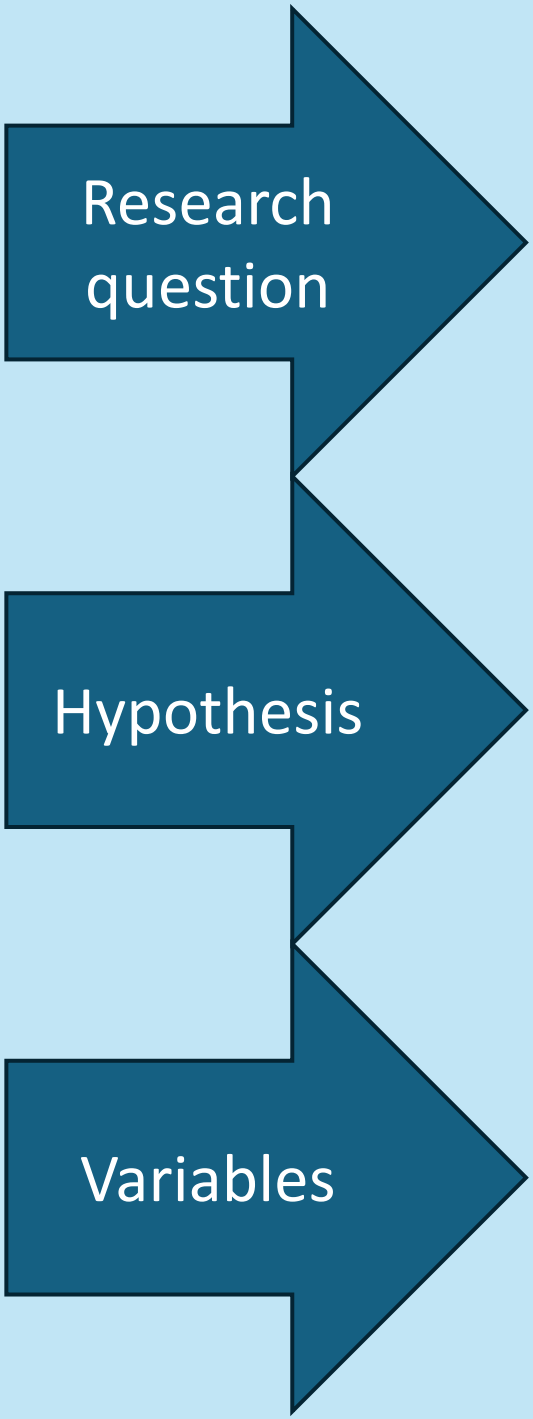
Radish Seed

What is it

-Radish seeds (*Raphanus sativus*) are among the fastest-growing garden seeds
-Sprouting in 3-4 days and maturing in 25-30 days, making them ideal for quick harvests
-They require direct sowing, full sun, cool temperatures

-Chosen because of the quick sprouting and relatively low maintenance and care required

https://nhm.org/learning-resource/radish-plant guide



Research Question: How does different concentrations of vinegar affect the growth of radish plants?

Hypothesis: As vinegar concentration increases radish plant height will decrease

Independent: Vinegar Concentration
Dependent: Seed species, water amount, light exposure, pot brand and type
Control: One group of plants was watered without Vinegar

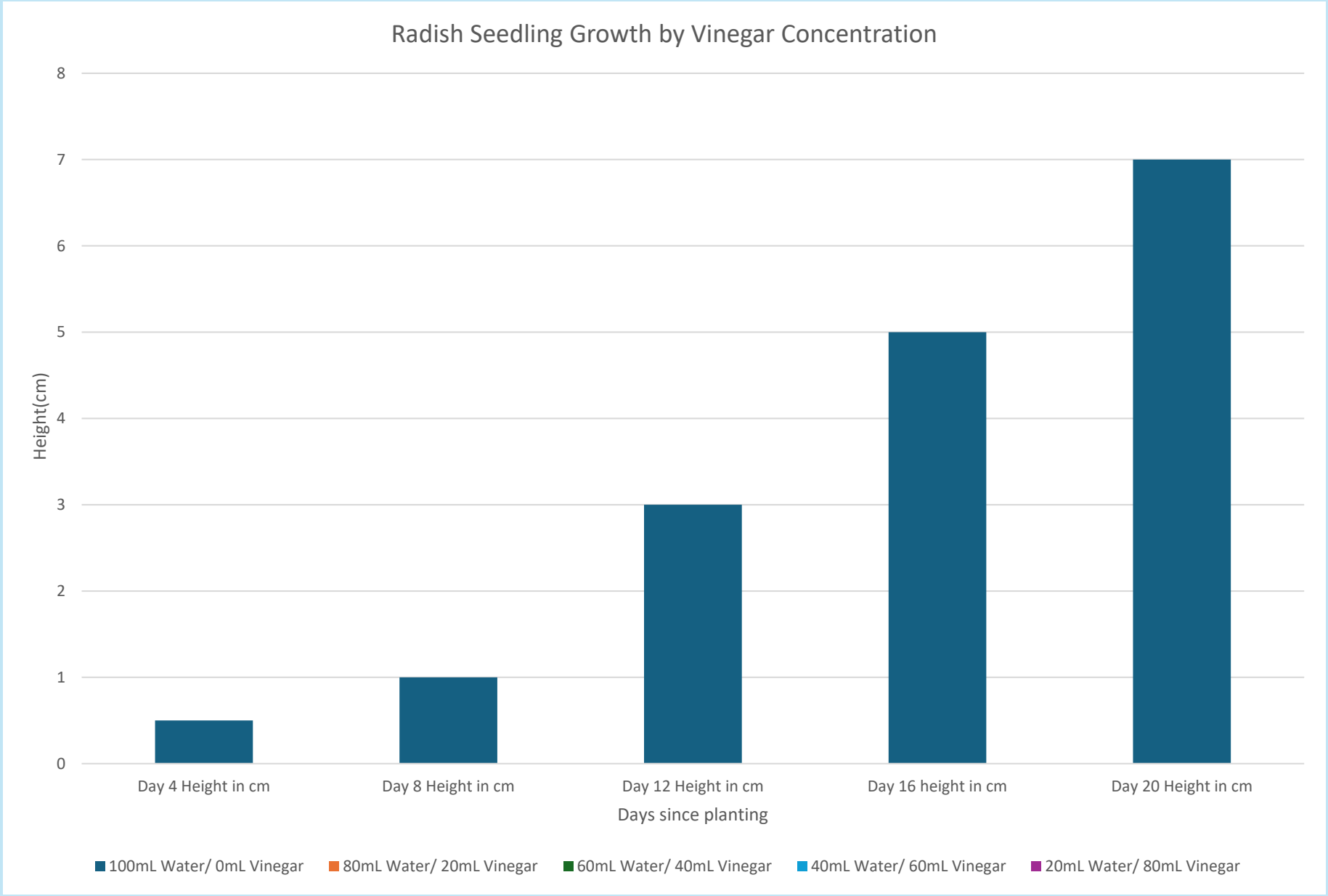
Procedure

- 1:All materials were gathered and made readily available, and the space for the experiment was cleared.
- 2:Each pot was labeled with the assigned vinegar dilution, and two pots were designated for each dilution group.
- 3:Each 3x3 inch pot was filled to the top with soil
- 4:Four radish seeds were planted in the center of each pot.
- 5:The pots were placed on a tray and located in an area that received natural sunlight.
- 6:Five vinegar solutions were prepared using distilled water and 5% acetic acid vinegar: (1) 100 mL water/0 mL vinegar (control), (2) 80 mL water/20 mL vinegar, (3) 60 mL water/40 mL vinegar, (4) 40 mL water/60 mL vinegar, and (5) 20 mL water/80 mL vinegar.
- 7:Each solution was mixed thoroughly.
- 8:Each pot was watered with 40 mL of its designated solution every two days.
- 9:The height of each plant was measured every four days and recorded on a data table that remained unchanged throughout the experiment.
- 10:Final heights were recorded after twenty days.
- 11:The experiment area was cleared, and all materials were disposed of properly.

Materials

- Radish Seeds: The plants used for testing
- 10 Small Plastic pots 3x3: This is used to grow plants and keep conditions the same
- Potting soil: Same type used for all plants
- Distilled water: Used for the diluted vinegar solutions, also for watering the control group
- Vinegar(5% Acetic Solution): Used to create vinegar solutions
- Measuring tools: Used to measure plant height after intervals
- Marker: To signify what pot has what solution
- Sunlight: Sunlight is necessary for plant growth so there needs to be equal amounts of sunlight
- Notebook: used to record data
- Tray: To place pots upon
- Sanitization material: to prevent germ spread

Test Results



Observation Data

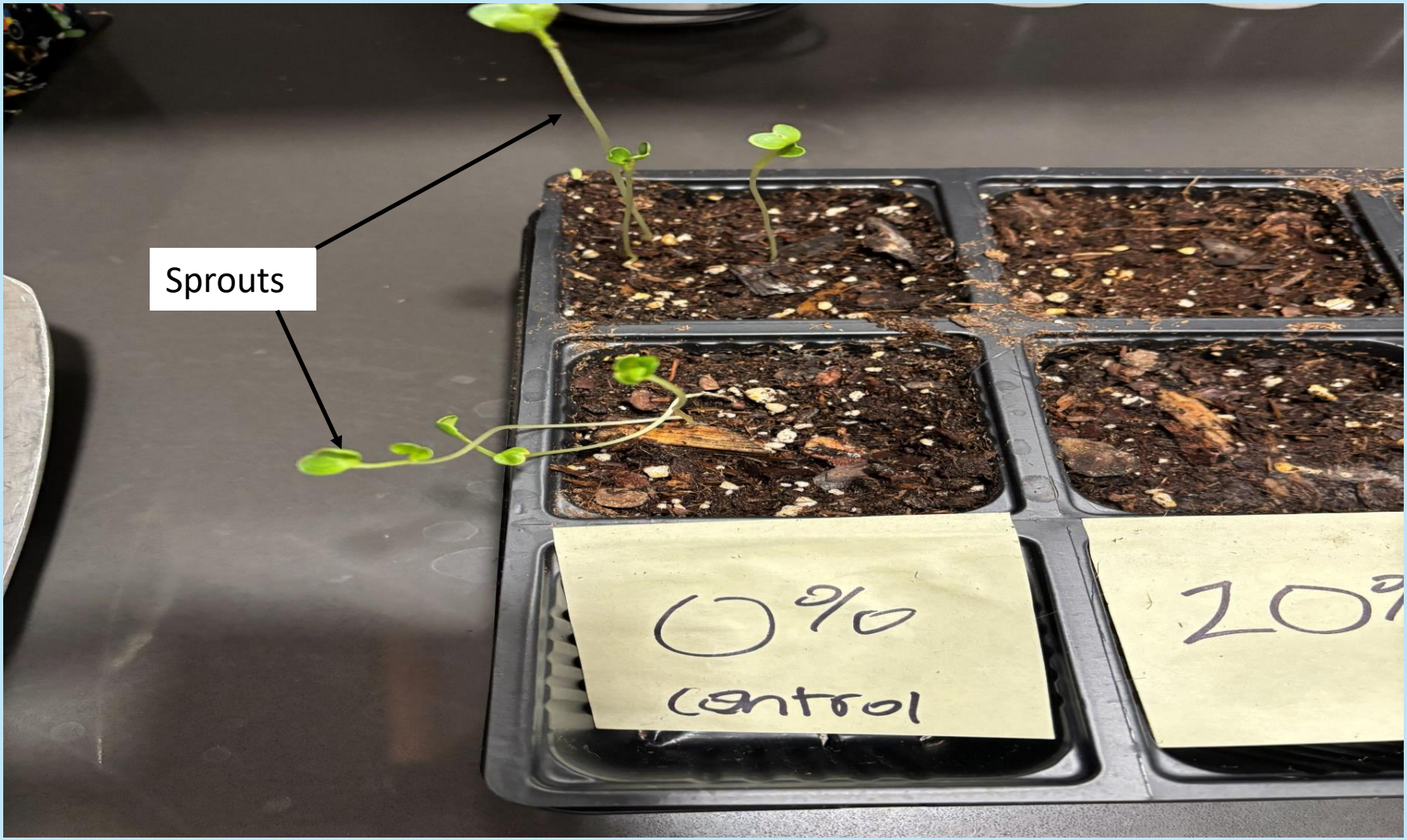
Vinegar Concentrations Water mL/Vinegar mL	Leaf Color	Number of Leaves	Color of Stem
100mL Water/ 0mL Vinegar	Green	4	Green
80mL Water/ 20mL Vinegar	N/A	N/A	N/A
60mL Water/ 40mL Vinegar	N/A	N/A	N/A
40mL Water/ 60mL Vinegar	N/A	N/A	N/A
20mL Water/ 80mL Vinegar	N/A	N/A	N/A

Test 1 and 2 Setup(Before Watering)

Picture of sprout after 8 Days of Watering

Picture of control sprout after 16 Days of watering

Final Results- The sprout stopped growing as it outgrew the potting container after 20 days



Claim: Vinegar was very potent still made of acetic acid regardless of the dilution. These results shows that vinegar can be used as a makeshift weed-killer that you can just water over soil to decrease sprouting and unwanted seed growth

Evidence: 0 Growth even among very low 1% acetic acid mixtures show a huge potency and effect proving that vinegar is very strong, the growth grew from 1 in in the first measuring day to eventually 7 inches the final day of measuring.

Reasoning: Vinegar was able to prevent any seed growth, due to a weak root base from unmature seeds and the rapid dehydration due to acetic acid which causes destruction of the seeds cell membrames

Discussion

Lack Of Growth:

-I underestimated the potency of acetic acid and didn't come to realize that even low concentrations of vinegar (<1%) still can cause no growth in seedlings

Unpredicted Factor:

-The need to move the seedlings out of the pot container without damaging roots in order to get the best growth results

Bibliography

1: Kim, Jong-Myong, et al. “Acetate-Mediated Novel Survival Strategy against Drought in Plants.” *Nature Plants*, vol. 3, no. 7, June 2017, p. 17097. *DOI.org (Crossref)*, https://doi.org/10.1038/nplants.2017.97.

2: Lerner, Rosie. “Conquer Weeds with Vinegar?” *Indiana Yard and Garden - Purdue Consumer Horticulture*, 3 Apr. 2003, https://www.purdue.edu/hla/sites/yardandgarden/conquer-weeds-with-vinegar/.

3:Resources, Washington State Department of Natural. *Salt & Vinegar on Weeds? Save It for the Chips!* 12 June 2024, https://foreststewardshipnotes.wordpress.com/2024/06/12/salt-vinegar-on-weeds-save-it-for-the-chips/.

4: Vinegar: A Garden Miracle! – The Garden Professors™. 9 June 2011, https://gardenprofessors.com/vinegar-a-garden-miracle/.

5: What Is the Effect of Vinegar in Plant’s Growth? – Science Projects. https://www.scienceprojects.org/what-is-the-effect-of-vinegar-in-plants-growth/. Accessed 8 Dec. 2025.

6: Radish Planting Guide | Natural History Museum. https://nhm.org/learning-resource/radish-planting-guide. Accessed 11 Feb. 2026.