

# Int task 3



**PURPOSE** The purpose of my experiment is to determine the effect of acid rain on seed germination. I chose this idea for a project because I have heard that acid rain is becoming a more prominent factor, around the world, due to pollution. I see reports of this in books and websites I've visited, as well as news articles I have read. **LITERATURE REVIEW** <http://www.selah.k12.wa.us/soar/sciproj99/CodySciProj.html> The germination test results from glass labeled " Trial 1" (100% water), and " Trial 5" (highest acid content) showed an 11% difference.

The more acid contained in the water resulted in less seeds germinating. <http://www.ncbi.nlm.nih.gov/pubmed/15859434> Rice, wheat and rape seeds were treated with simulated acid rain at pH 2. 0, 2. 5, 3. 0, 3. 5, 4. 0 and 5. 0 levels for 7 days in order to understand the effects of acid rain on seed germination of various acid-fast plants. The germination test showed that seed germination was absolutely inhibited at pH 2. 0 for three species. Rice and wheat seeds germinated abnormally at pH 2. 5. When pH values above 3. , percentage germination, germination energy, germination index, vigor index of rice, wheat and rape seeds increased in relation with decreased acidity levels. In contrast, the percentage of abnormal germination of rice and wheat decreased. The experiment data about physiological aspect demonstrated that water absorption rate, respiratory rate and storage reserve transformation rate of rice, wheat and rape seeds also increased with increased pH values. **RELEVENCE OF MY TESTABLE**

**QUESTION** The information gained from this experiment, I believe, can show people the negative effects that acid rain can have on seed germination.

This will eventually lead to large scale crop reduction, lower oxygen levels and higher amounts of atmospheric CO<sub>2</sub> levels. My goal is to show people the repercussions of pollution. EXPERIMENTAL DESIGN The constants in this study were: \* The type of radish seeds \* The type of acid \* The size of and type of paper towels \* The length of germination time \* The amount of light \* The temperature of germination environment \* Amount of water/acid mixture given to seeds The manipulated variable is the concentration of the acid solution.

The responding variable is the percentage of plant seeds that germinated in seven days. To measure the responding variable, I will count the total number of germinated seeds from each labeled solution. I will then calculate the percentage by dividing the number of germinated seeds, from each group, by 75. My definition of germination is when the initial green stem appears from the seed. MATERIALS Quantity | Item Description| 325 | Radish Seeds (packaged)| 1| Roll of 29 1/2 cm X 23 1/2 cm plastic wrap| 1 | Roll of 27 1/2 cm X 23 1/2 cm paper towel| | Container of nitric acid| 1| Pyrex measuring glass| 5| Glass canning jars ( 1 Quart)| PROCEDURES 1. Take two 27 1/2 X 23 1/2 cm paper towels and tear at perforated line. 2. Tear one sheet of plastic wrap that is 29 1/2 X 23 1/2 cm. 3. Count and separate seeds into 5 groups of. 4. Lightly dampen the two paper towels. 5. Sure that they are both wet to the touch. 6. Place the 75 seeds in a horizontal line on the skinny sides on one paper towel. 7. Roll the paper towel up with the seeds in it. 8. Get two strips of tape 3 centimeters long. 9.

Take the other paper towel and wrap it up around the other paper towel with the seeds in it. 10. Take the sheet of plastic wrap and you wrap it around the

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paper towels. 11. Pull the plastic up about an inch leaving one inch of paper towel without plastic on it at the bottom. 12. Fold the excess at the top over the top of the paper towel. 13. Tape the plastic to the other side of the plastic so it doesn't unravel 14. Set the paper towel roll inside the first glass and label Trial 1 15. Repeat steps 1-14, 4 more times, and label glasses as: Trial 2, Trial 3, etc. 16.

Measure 6oz of water and place in each glass 17. For one of the containers put 0 ml. of nitric acid in the water, put 2ml. in the second one, put 4 ml. in the third one, put 6 ml in the fourth one and 8 ml in the last one. 18. Wait 7 days with the paper towel roll in the carton at all times. 19. At the end of the 7 days take the paper towels out of the water and lay them down. 20.

Carefully slide the plastic off of the paper towels. 21. Slowly unroll the paper towels. 22. Calculate the percentage and record how many seeds germinate to the point that a green root is exposed.

The reason I have chosen this design plan is not only to replicate an experiment previously done, but because it is relatively simple for others to replicate as well. The convenience of this gives my hypothesis the ability to be either confirmed or disproved in later experiments. I made some changes to the model experiment that I am replicating, such as: type of seed, amount of seeds as well as germination time (due to a shorter germination time with radishes, compared to carrot seeds). All other controls in this experiment remain the same. THREAT REDUCTION TO INTERNAL VALIDITY

I will reduce the threat to internal validity by: - using a specific experimental design - reproducing the same controlled variable from a previous

experiment - Using reliable methods of measurement for exact replication and analysis

**HYPOTHESIS** My hypothesis is that the percentage of seeds that germinate will decrease as the amount of acid added to the water during germination time increases. I base my hypothesis on the following: word of mouth, TV news, prior science education in elementary, middle and high school; as well as news articles that I have read during my life.

#### DATA COLLECTION PROCEDURE

On day 7 of the germination experiment, I slid the plastic wrap off of the paper towel rolls; and slowly unrolled the paper towel. I then looked for, and counted, the precise number of seeds that had a small, green, root beginning to grow from the seed. I took the number of germinated seeds and divided by 75 ( the number of seeds in question) to derive my percentages. I did this for all 5 test subjects.

**RESULTS** The purpose of this experiment was to determine if a nitric mix of acid rain negatively affected the seed, in questions, germination. The results of the experiment were as I had predicted.

The trial with 0% acid had the highest number of seeds germinate. The trial with the highest percentage of acid had the lowest percentage of seeds that germinated. Finally, the trial that was performed with half the amount of acid to water, was towards the middle of the five germination rates.

**CONCLUSION** My hypothesis was that acid rain would have a negative impact on the rate of germination of seeds. This was validated by my experiment as you can see in the chart above, the higher the content of acid in the water, the lower the percentage of seeds that successfully germinated.

Experimental design is important as it sets forth the exact process you followed that gave you your results. This allows other people to replicate your experiment, which therefore validates your results and removes any possible accusation of scientific bias, as the experiment was performed by numerous 3rd parties.

REFERENCES

- 1) J, C. (1999). What are the effects of acid rain on germination?. Retrieved 9/9/11 from <http://www.selah.k12.wa.us/soar/sciproj99/CodySciProj.html>
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