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Science Comments

This section contains comments on science, including experiments and analysis.

We believe this manuscript focuses on a very interesting topic important for mitigating acid rain and keeping plants healthy. To further strengthen your report, we require a few changes regarding more detail and discussion. This will help strengthen your argument and provide more clarity. We also strongly recommend some changes focused on replicating data and gaining statistical information to further support your observations. We do think the paper is interesting, and believe the study was carried out well!

Required Changes

We believe that these revisions must be made in order to publish in JEI. If any changes are impossible, please include an explanation in your cover letter.

- Please provide the results of your testing of the pH of rainwater. In the manuscript, you note that it was "always around 4.8", but we need to see the evidence of this either in graph or table form. Please provide the details of how you collected this rainwater, how many samples you collected, etc. You later mention that this shows the "universality of acid rain in our country". This is overstating as the only way to determine this would be to collect rainwater from multiple sites. Are there any published studies that support this claim?

  Change: Thank you so much for pointing out this problem, I suppose my statements are unconvincing here. I couldn't find a recent report about rainwater's pH values around the country, the latest information online is from 2002. I have friends and colleagues from different states in the United States, and they supported me by collecting rainwater and recording the data. The data from different states are listed in the result. I have made this more clear. At the same time I will combine it with the data sources I found on the internet to prove my point that the universality of acid rain in the US.

- Maybe there is a publication showing the average pH of rainwater from each state/region.

  Change: The best publication is about rainwater acidity in 2002, but we used it as a reference and compared it to the sample we collected in 2022 in 6 different states in the U.S.

- Please provide details/rationale of pH measurement. Is measuring the pH of the water escaping the soil the best way to measure soil pH? Why only measure after 30 minutes? What would happen after a longer period of time? Including longer time points would be ideal. We understand if you cannot do longer measurements, but please address the rationale of the pH measurement.

  Change: Thank you, I did realize that the measurement was not rational enough. Therefore, I came up with this solution to get a better pH value for the soil which is to grind the soil into very tiny particles and try to make it soluble in the water solution. The more detailed process of measuring the pH of the soil is described in the result. And also, according to your suggestion, I changed the measuring time from 30 minutes to 1 hour, because that's the longest time I could get in school.

- Please add more discussion of the results, particularly of the rainwater. Please add a standard deviation to the mean rain pH (how did it vary?) and consider adding a figure to go with it. This is an interesting aspect of the work and it is kind of hidden at the moment!

  Change: The deviations are shown in the graph in the form of an error bar.

- I am slightly confused about why the pH of the collected water changes over time, when the acid-base reaction happens instantly. Does it take that long for the solutions to mix? Please clarify this.

  Change: The reason why the change of the pH value is not instantaneous is that it took some time for the acidic and alkaline solution to fully infiltrate the soil and react in the tray. The table shows the changes in the pH value in an hour because the soil may change the pH value of the solution and it increases the level of accuracy if we wait long enough for it to change completely.

Recommended Changes

We have compiled a list of recommended revisions that would help further improve the manuscript. These recommended revisions are not required for publication, but we strongly encourage you to seriously consider them. These revisions will further improve the scientific rigor of the manuscript.

- If possible, we strongly recommend repeating your experiment at least three times and performing a statistical test (for example- student's T test, or average results across three replicates within your groups at the least) on pH values to determine if they are significant and reproducible results. It is important in science to test things multiple times to make sure that what you observe is not an outlier. If possible obtain this data, please do so.

Change: The process of neutralizing the solutions infiltrated through the soil is repeated three times. The mean values of the pH level at each time frame of both solutions were put into a table and were then turned into Graph 2. The point of this process is to determine how long it takes for farmers or daily planters to neutralize the soil and form salt fertilizer for their plants or agricultural products.

- Please consider running a regression to see if there is a significant relationship between the pH values and time – you should be able to do this in excel.

Change: I did this in Google sheet (Graph 3) and the result of the relationship between the pH values and the time has two characteristics:

1. Before equilibrium, the longer the time that the solutions infiltrated from the soil reacted, the more neutralized the solution in the tray would be.
2. The reaction can be completed within 60 min, and the solutions in the tray reach the equilibrium state at a fixed time frame.

- Please consider testing the effect that pH has on plant health. This could be tested by watering identical plants with the same three conditions (water only, water with acid, water with acid, and base) over time to see which plants survive. Plants could be purchased from a store fully grown to minimize the time spent growing plants. Another experiment that could look at the germination rate/survival of seedlings in these three conditions. An easy plant to

use for this would be cat grass which grows quickly and is readily available at stores like Pikes or Walmart. You could germinate a certain number of seeds and only water with the three conditions (water only, water with acid, water with acid, and base), to determine if the acid has any effect, and then count how many seedlings grow/survive over a certain amount of time. This would greatly bolster your claims that acid rain has an effect on plants. If anything, this would be a really interesting follow-up study to conduct!

Changes: Thank you so much for your clarification, your advice is very much appreciated. All of the steps you listed above are feasible, and I did the same thing. Detailed steps are revised in the research paper. However, I only used one box of cat grass seed from Petco because that is the last box they had. Then after those seeds germinated and the grass grew to a height of 5 centimeters, I divided the box of soil and plants into 6 completely equal(shape, size) parts and continued the experiment using the steps mentioned in the result part of my research paper.

Presentation Comments

This section contains feedback on the clarity of writing and the presentation of data.

This manuscript has many of the important pieces of a paper, though we recommend moving these pieces around to better fit the format of a JEI article. We recommend keeping your audience in mind while restructuring and adding to the manuscript. But generally, we applaud you on this manuscript!

Required Changes

We believe that these revisions must be made in order to publish in JEI. If any changes are impossible, please include an explanation in your cover letter.

General changes

- Referencing literature and providing more background: Please provide evidence from peer-reviewed sources on the significance of acid rain on agricultural production. There is no evidence provided in the manuscript that alludes to this, only generalizations such as it has "detrimental effects on trees". What acidity over what amount of time has the most significant effect on plants? Is acid rain more prevalent in areas with more pollution? Your manuscript will be strengthened if you can ensure everyone that reads this paper clearly sees why the effect of acid rain should be studied. This will mainly be in your introduction.

  Changes:(mostly in introduction part)

1. Added the significance of acid rain on agricultural production.
2. Determining what amount of time the acidity has the most significant effects on trees.
3. Explained whether acid rain is more prevalent in areas with more pollutants.

Summary

- The Abstract is called a Summary in JEI articles – please change this heading accordingly.
- Word count: The Summary should be under 250 words (currently it is 285). You did a good job describing the significance of acid rain, but I think you can cut down the first 8 sentences to make it shorter. However, these sentences could (and should) be included in the Introduction.

  Changes:

1. Changed title from abstract to summary
2. Shortened the paragraph and left with better-phrased sentences.

Introduction

- Restructuring the introduction: You have a good start on your Introduction, but it could benefit from a bit of restructuring. Think of the structure as an "inverted pyramid" that starts with very broad facts before focusing on the specific question and hypothesis toward the end. In general, it should include:
  - The overarching scientific topic of the paper.
  - Background information such that the audience understands the question being asked and why this question is of interest.
  - A clearly stated hypothesis. Note: This should not be phrased as a question.
  - Summary of the conclusions drawn from the research.
- Enhance clarity with more detail in the introduction/background: To ensure everyone reading your manuscript understands this, please include the following:
  - What is acid rain and how is it different from regular rain?
  - Why is acid rain a problem? Who is it a problem for? Why should we care about this as a society?

    - What is the gap in knowledge about acid rain that needs to be addressed? (Yours would be something along the lines of "how do we reduce the effects of acidic rain on plants?".)
    - How are you going to address this question/gap in knowledge? In your case, it would be by testing to see if the nitrogenous fertilizers can affect soil pH.
    - What do you expect to happen (ie. your hypothesis)?
    - What impact would your experiments have on society as a whole? Think of the big picture. Maybe farmers could start applying more fertilizer, etc. You can give a brief introduction to acids/ammonium nitrate and sulfate but remember to only include relevant information. Boiling points may not be relevant, for example.
- Paragraph 2: you went into detail about the impact of acid rain on the environment in the Summary, but less so here. As mentioned above, you can move/add these sentences to your Introduction. Generally, the Summary is considered to stand alone from the rest of the paper, so it is okay to discuss these ideas again and in greater detail in the Introduction.
- Paragraph/sentence flow and order:
    - Your introduction has a 2-4 sentence paragraph which gives a choppy appearance. Please flush this out with the above notes and merge some thoughts to create 5-8 sentence paragraphs that flow.
    - When reworking the introduction, please focus on order. A logical flow might be starting with your hypothesis and then move into your plans for experiments.
- Cut extraneous information: There is some extraneous information included in this section such as the properties of pure sulfuric and nitric acid. These properties will not be relevant to you as you will only be working with dilute solutions. Some of the important aspects to discuss are that they are major components of rain and they cause undesirable impacts on the environment.
- Grammar and format:
    - P3L42, the word acid is not a proper noun and therefore should not be capitalized in the middle of a sentence.
    - P4L4, the words sulfuric and nitric are not proper nouns and do not need to be capitalized. Please correct this throughout your manuscript.
    - P4L9, the 2 and 4 in the chemical formulas should be subscripts.

Changes:

1. Defined acid rain.
2. Because of the altering of my experimental design which is mentioned in the result, I changed the information in the introduction based on the experimental necessity.
3. Deleted the unrelated information.
4. Provide the detailed background of acid rain.
5. Summarized the research result.
6. The knowledge gap is the lack of a daily method to reduce acid rain harm, and I addressed it by inventing a treatment that not only reduces the harm but also fertilized the soil and nourished the plants.
7. Proofread and changed grammar and format.
8. The big picture of how my experiment can benefit the whole society is mentioned.
9. Rearranged sentences into paragraphs in logical order.

Results:

- Restructuring the results section:
  - Paragraphs 2-~7: Most of your text in this section is more appropriate for the methods section. You should include a brief explanation of how the experiment was performed, not the details.
  - Paragraph 3: The first part of your first sentence is repetitive, as it has already been made clear what the major components of acid rain are. You can simply start by saying you don't have constant access to rainwater, so you made solutions of sulfuric acid and nitric acid as substitutes.
  - Paragraph 5: Calculations don't need to be included like this. Your first sentence in this paragraph would suffice.
- Overall, your results section should do the following:
  - Briefly describe the rationale for the experiment (you somewhat did this in paragraph 1).
  - Briefly explain how the experiment was performed (leaving lengthy details for the Materials and Methods section)
  - State your findings and briefly interpret the data, while referencing the figures that contain the results. You touch on this in the second to last paragraph, but largely this has not been addressed – this is one of the most important parts of your manuscript! We'll definitely help you refine it, but want you to provide the first go at this.

Change:

1. Designed several new experiments to explain some uncertainty in the former experiment and expand the original experiment.
2. Added the part that uses actual plants to test my theoretical results.
3. Move the detailed method and experimental process into the method part of the paper.
4. I deleted redundant descriptions about H_2SO_4 and HNO_3 acid solutions and mentioned that I use those two solutions because we don't have constant rainwater and precipitation.
5. Interpreted the data we recorded and analyzed the graph.
6. Because I changed and expanded the whole experiment and tested my former result on actual plants, the current result is changed as well based on my recent experiment. The analysis of the result has been changed as well.
7. Moved some specific steps into the method part and briefly explained how the experiment was completed.

Discussion

- Do you think the type of soil used might have any effect on your results? Please discuss.
- Paragraph 1: you can be clearer about the point that you are trying to make. Instead of saying "the solution," you can say something like "In this experiment, solutions that were designed to simulate acid rain were neutralized to pH 6.8 using a treatment of ammonium hydroxide.
- Paragraph 2 is quite short and could be tied into the first paragraph.
- Paragraph 3: Your limitations should be discussed in paragraph form, not in lists like this (JEI and most journals actually do not allow for straight lists). Additionally, these limitations are more along the lines of how your experimental process could impact the results, rather than what would have made it easier for you.
  - For example: The item in the list on tap water is a great point. You mentioned that you repeated the experiment by first measuring the pH of the water but tap water could contain trace contaminants of metals and other species. Would the presence of contaminants like this impact your results?

- Paragraph 4 describes the main limitation that I can think of, so great job including it. Another possible limitation for implementing this in actual households would be having someone without a background in chemistry calculate the amount of base to add and think about what would happen if too much or too little were to be added. You touch on determining a sort of formula in Paragraph 4, but I can imagine it would be different depending on location.

Change:

1. Discussed possible factors that could affect our experimental results.
2. Combined short paragraphs together in a logical way.
3. Cleared the point of the experiment.
4. Wrote everything in paragraphs instead of constructing it in a list format.
5. Because I expanded the whole experiment, the limitation and the possible studies in the future changed as well.

Materials/methods:

- This section needs to be rewritten – you have a good start and details in other parts of your manuscript already. The methods should be described in enough detail so that another scientist could perform the same experiments and obtain the same results. I suggest reading through this section as if you have never done it before or have someone else read it that was not involved in the project, to make sure you have included all of the important details. Please review the online JEI guidelines or see a published article online to see the best way to format this section.
    - You are missing several important details. For example, there is no information about the concentrations of your acidic and basic solutions, pH values are missing, type of water is missing, etc.
    - Additionally, this section should be written in paragraph form. You did this at the beginning, but you stopped toward the end when you started mentioning the different groups.
    - Please remove the interpretation from this section (move the first 3 sentences to the discussion).
- What type of soil was used in the pots? Please specify if possible.

Change:

1. Described the materials we used in a paragraph.
2. Detail describes the methods we used in the experiment which is removed from the result part of the paper.
3. Put all those steps together to form a well-phrased paragraph instead of leaving them in the list format.
4. Because of the addition of new experiments, I add new methods to the paragraphs.

Recommended Changes

We have also compiled a list of recommended changes. These are not required for publication, but we strongly encourage you to consider them. These revisions will further improve your manuscript and show you examples of good scientific writing.

General changes

- In either your introduction or conclusion, please consider discussion fertilizer. Please research the amount of nitrogen-containing fertilizer that is detrimental to plants. What if

you can neutralize the effect of acid rain but end up killing the plant because too much fertilizer is released? Also, excess fertilizer can run off and enter our water supply and also cause lasting environmental damage, please consider addressing this.

Change: Thank you for your advice. In our experiment, nitrogen fertilizers didn't show any harm to the cat grass, therefore all the changes in the amount of fertilizer and possible disadvantages of nitrogen fertilizers are mentioned in the discussion part.

- Typesetting math in Word can help you with putting the equations for your calculations in a form that is more readable.

Change: completed

Title

- Please consider changing the title as it currently reads as a fragment.

Change: completed

Summary

- Please avoid using the word "your" in scientific writing.

Change: Rephrased sentences with the word "your"

- There is some tense (past, present, etc.) confusion in the abstract. I find the best way to correct this is to read the section out loud to catch some of these occurrences.

Change: revised all the tense problems I could find.

Introduction

- Please consider ending your introduction with a paragraph that acts as a sort of road sign for your readers to orient them. One sentence outlining your study approach, followed by a sentence or two defining your hypotheses, then a sentence that hints at your results would improve the paper.

Change: I added details and sentences to outline my study approach and defined my hypothesis.

Results

- Please precisely articulate these results. The use of words such as "the results were always around 4.8" is not ideal because they can convey you are uncertain about your results. It is okay to list an average with a standard deviation to show the range of values you saw as standard deviation is considered an exact calculation (even though it represents variation).
- Please also try to keep the results section to only results, without any interpretation. This means moving the statements such as "this result showed… which means our experiment is meaningful…" to the discussion.
- Please make sure arduous experimental data is moved to materials and methods (also move calculations).

Change: all the changes above are completed. The advice and the recommended changes are very meaningful and important to the whole experiment, and I appreciated them. All the recommended changes were made during revision, thank you again!

Figure Comments

This section contains comments on the presentation of the data in figures and tables.

Required Changes

We believe that these revisions must be made in order to publish in JEI. If any changes are impossible, please include an explanation in your cover letter.

- Error: If it is possible to determine the error associated with your pH measurements, please include error bars in your figure. pH probes tend to deviate a fair amount.
- You have analyses of the pH of rain samples, but is there a figure way that you can display the results of the data? Maybe a histogram?
- Detail: For reference, a figure should be able to be read and interpreted independently from the rest of your manuscript – let that dictate how much detail to include.
    - In Figure 1, it is unclear how quickly you are adding the solutions and in what volume. Please change your figure description to include this information.
    - Please include full chemical names for abbreviated chemicals and what you want readers to take away from the figures.

Recommended Changes

We have compiled a list of recommended revisions that would help further improve the figures. These recommended revisions are not required for publication, but we strongly encourage you to consider them. These revisions will further improve the data visualization and aesthetics of your figures.

- I think it would be great to include a picture of your setup to help the reader understand how you irrigated and collected the water. This would add to your paper; however, I am putting this in “recommended changes” in case you do not have the materials anymore.
- I recommend changing the color of the text in your figure to black.

Changes:
Thank you for your advice, I redid most of the experiment, and all the required and recommended changes could be put into the papers.