Do Pharmaceuticals in the Water Affect Seed Germination?

#4033

Category: PS
Division: Senior
Science Type Project

Abstract can be found at the sefmd.org website

Introduction:

- Pharmaceuticals are often the buzzword these days. They manufacture these medicines to help humans to heal, then they take them off the market because it is dangerous for us to consume them.
- If you have listened to the newest ‘wonder drug’ in the television commercials, you see how fantastic they can make life out to be once you start taking this drug. Then you listen to all the terrible side effects they race through at the end of the commercial. They either speak at the speed of light or the print is so small you need a huge hand lens to read the thing!
- Pharmaceuticals are becoming a huge challenge in the environment as they end up in the water and current methods of water purification are unable to remove them. There are very many people taking these drugs.

Introduction:

- Pharmaceuticals are various substances used in making drugs or medicines. Some herbicides and pesticides are considered pharmaceuticals. For the purpose of this research, only medicinal drugs will be considered.
- These pharmaceuticals affect edible plant growth and development. One of the ones most affected are those most of us consume to keep us healthy: vegetables and leaf lettuce.
- Different plant groups are affected differently by the sub groups of pharmaceuticals. Each plant expressed their distress in a different way.

Methods:
What is the experimental design?

- The purpose of this research is to determine if pharmaceuticals in the water will affect a seed's ability to germinate. Raphanus sativus seeds will be used, due to their short germination time and the shortness of research time for this project.
- The hypothesis being researched is that pharmaceuticals do have an effect on the seed germination of Raphanus sativus plants because they ingest the medicinal while growing.
- The expectation is that there will be a negative effect on the germination of these Raphanus sativus seeds.
- Four common pharmaceuticals will be tested on Raphanus sativus seeds. These will be compared to the control sample.

Methods:
What is the experimental design?

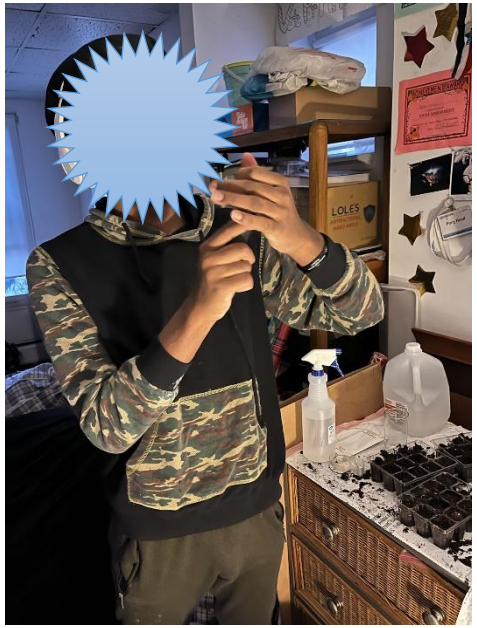
- Each pharmaceutical will be performed on ten trials and compared to the Control Variable, which was hydrated with a water known to be free of pharmaceuticals.
- These pharmaceuticals were: Tylenol, aspirin, loratadine, and lisinopril. The control sample used only distilled water.
- These pharmaceuticals were placed into city tap water; three pills per 1 quart water. The water pH protocols were performed before and after these medicinals were added to the water and recorded in logbook. The control water was also tested and recorded. No pharmaceutical was added to the control unit. Soil pH was also performed and recorded. All data was uploaded to the GLOBE database.
- Five separate seed starter trays were filled with the same soil and one seed was placed in each of the pods. There were twelve trials in all, although we only counted ten of them for this research.
- Each pod was labeled as to which trial it represented.
- On the first day, each pod was hydrated with the same amount of water.

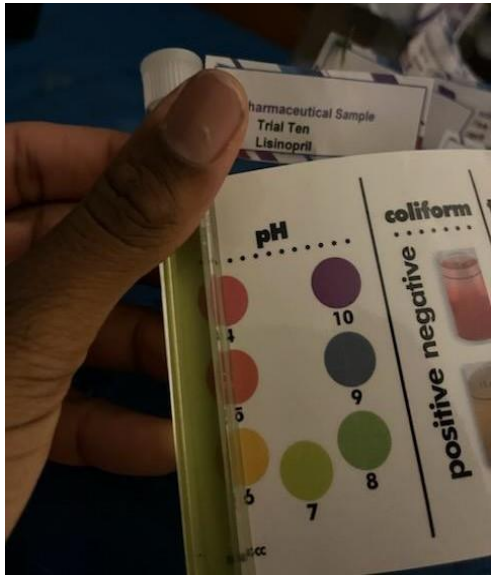
  Wait for any germination to occur and count the days from seed planting until germination.

Results:
What did the data show?

After four days, the seeds began to show germination. It appeared that the germination was going to disprove the hypothesis as germination took place in every tray seeds were planted in.

Checking the pH level of the soil to compare it after being watered by the pharmaceutical-laced water. For the short time period, the pH changed only slightly but it was enough for the plants to notice!



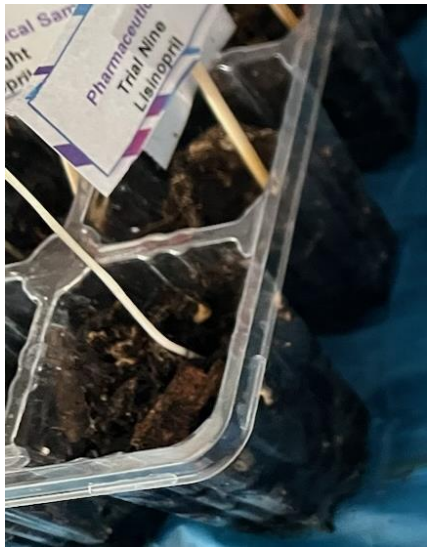


Results:
What did the data show?

Days to Growth	control	aspirin	Tylenol	lisinopril	loratadine
1					
2					
3					
4	6	5	4	4	5
5	1	1	2	1	1
6					
7	3	1		1	1
Totals /10	10/10	7/10	6/10	6/10	7/10

The results did seem to support my hypothesis. This comparison of germination shows that the control germinated at 100% but none of the pharmaceuticals demonstrated such growth. The seedlings were spindly and several of them died. They never gained the greening they needed to produce and photosynthesize. Except for the control seedlings, most of the other seedlings began to shrivel up and die.

Soil pH was 6.5, too acidic for Raphanus sativus to grow well.



Lisinopril seedling still has no green to develop photosynthesis at the final day of research.

Discussion:
What did the data mean?

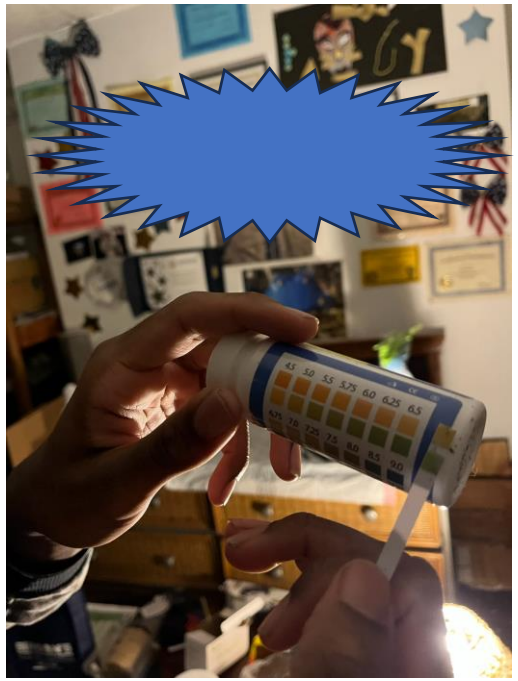
- Although this sample was very small, by using Raphanus sativus seeds, it did not take long for germination to either happen or not. From this sample set, the hypothesis was supported by the data we gathered. Having pharmaceuticals present in the water does have an effect on the edible plant life.
- What can be done about this dilemma? All living things need to eat and healthy is the way we should be going. At the present time, the water purification methods used today do not have the means to remove these pharmaceuticals from our water. It seems we need to be concentrating on a way to clean this water up.
- Many plants have the capacity to remove toxins from soil for plants to grow safely, perhaps there are plants that can do that for toxins in the water. One example might be the mangrove plant

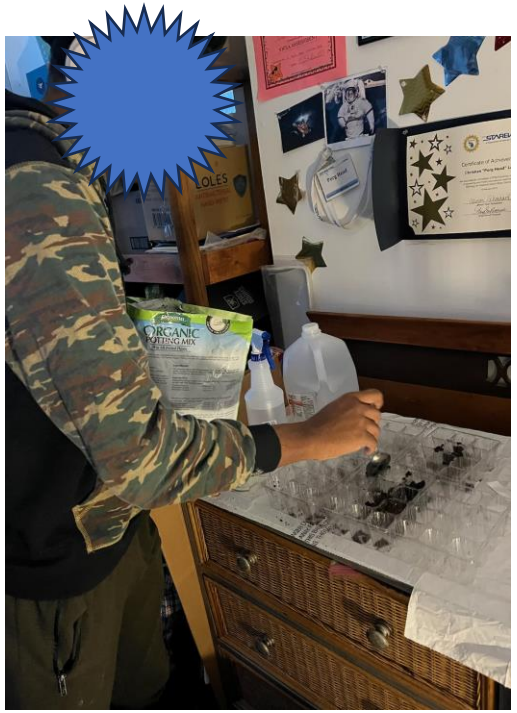
Discussion:
What did the data mean?

- One example might be the mangrove plant which has the ability to remove salt from ocean water so that it may grow and thrive.
- What happens if we just ignore this problem? We will most likely receive those pharmaceuticals at some point in our lives, so we get a head start on having those chemicals in our body.
- The issue it causes for humans is that we are getting dosed with medicinals we do not need and it affects our body. We become immune to their ability to heal before we even need to use t hem. If looking at the issues these pharmaceuticals cause the lants that are trying to grown, we can see how those mutations can cause havoc in our own bodies. Don’t use them before you need them. Some health care professionals feel it is like using a nuclear bomb to destroy an ant hill. You can use something more appropriate to the size of the problem.

Conclusion:

This research shows the need for further study and experimentation before the environment is completely destroyed and human life is mutated beyond our ability to repair it. Although this study has huge limitations there are other studies that show the same results using far more samples. A few are listed in the reference section. The shortness of time and the same sample size limit this research.





In conclusion, this research did support the stated hypothesis: that seeds would germinate, but there would be less germination in the seeds watered with pharmaceuticals than in the control sample which received only the distilled water for hydration. It has created enough concern that further research should be a vital necessity.

Works Cited

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Footnotes:

[1] University of Exeter. (2014, December 5). Drugs in the environment affect plant growth. *ScienceDaily*. Retrieved February 15, 2024

[2] University of Exeter. (2014, December 5). Drugs in the environment affect plant growth. *ScienceDaily*. Retrieved February 15, 2024