

Do Pharmaceuticals in the Water Affect Seed Germination?

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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 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.

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. One source states that "over 30 million a day are prescribed for various reasons across the

world”¹ and 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.

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.

Four common pharmaceuticals will be tested on *Raphanus sativus* seeds. Each pharmaceutical will be performed on ten trials and compared to the Control Variable, watered with a water known to be free of pharmaceuticals. These pharmaceuticals were: Tylenol, aspirin, loratadine, and lisinopril. The control water used distilled water.

The soil pH will be tested prior to adding the water for each substance. The pharmaceuticals will be added to city tap water which will also be tested for its pH level BEFORE and AFTER

adding the pharmaceutical to it. Each trial will receive daily watering with the appropriate sample and will be monitored for days to germination. Germination will be considered when a plant shows above the top of the soil.

The pH testing will be performed using LaMotte WQI protocols (water quality index). All data will be recorded and once complete, will be analyzed. The results will determine if the hypothesis is supported or denied.

The same seeds, soil, and sunlight was given to all the plants. The water pH was tested before and then labeled for accuracy. After

dissolving three pills in each container of water, the pH was tested again and the data recorded.

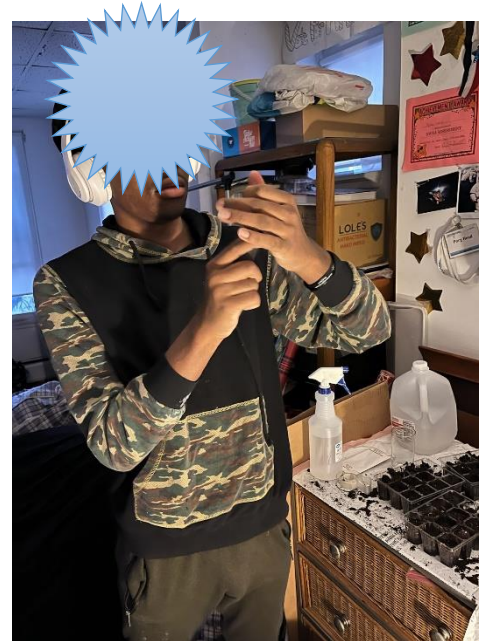


Healthy control to the right!



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 type of pharmaceutical used.

This is 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

The results did seem to support my hypothesis. This comparison of germination shows that the control germinated at

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

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 to die. At the time of this paper, the seedlings continue to grow and have developed their second set of leaves.

The germinated plants that seemed to fare the worse of those tested were those in the lisinopril sample. They appeared like it was all they could do to even germinate. The stems never gained the strength to stand upright and begin photosynthesis.

However, it should be noted that other studies show that specific mutations and distress happened to specific classes of edible plants.²

Discussion

This sample was very small and by using *Raphanus sativus* seeds, it did not take long for germination to either happen or not. From this sample, 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. 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 them!

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.

Next steps would be to expand the research to include larger sample sizes, different types of seeds, and longer time frames to monitor germination and growth.

This research would be beneficial to farmers, doctors, biologists and the general public who need to find a way to eat food that is not contaminated by pharmaceuticals.

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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[Nutrient availability and pH level affect germination traits and seedling development of *Conyza canadensis* | Scientific Reports \(nature.com\)](#)

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