INVESTIGATING THE EFFECTS OF SUNDRY DISINFECTION AGENTS ON THE GERMINATION OF GLYCINE MAX

Introduction Paper

Plants are a fundamental component of all life on earth; they are very much like humans. They start as a seed like the first stage of a baby when still in the womb. This stage from seed to plant is called germination. It's the most critical stage in a plant's life cycle. Water is very common as an implication for seed germination upon gardeners. Germination can only occur through implications for seed-like water. It has been shown that disinfecting seeds removes all bacteria that could cause disease and removes any pathogens. How does disinfecting seeds remove pathogens and viruses? Basically, the disinfectant breaks the cell walls of microbes or it will interfere with their metabolism, which is a form of decontamination. Disinfecting your seed allows more oxygen to be absorbed (LSU Ag Center Research). So in this experiment, we will be testing the effect of various types of disinfectants on the germination of soybean seeds. This topic was chosen to see how applying disinfectants to seeds affects germination compared to just soaking them in water.

The need for this experiment was to test and observe the effects of disinfection on plant seeds. We wanted to test it because from our background research we found that disinfectants are key for seeds to germinate properly. We have always thought these disinfectants contain chemicals that would be harmful to seeds to germinate, but it turned out not to be. So we wanted to test to see if this was true in the experiment. The purpose of the experiment was to study the effects of various disinfectants used to sterilize soybean seeds to see how it affected the seeds' germination. The goal of this experiment was to determine how different types of disinfectants affect seed germination. Whether it promotes germination or reduces it.

The hypothesis is that if hydrogen peroxide does the best in sterilizing soybean seeds, then a 3% concentrated hydrogen peroxide solution should be the best disinfectant for seed.

germination. This hypothesis is supported by the research that has been done which states that soaking seeds using a 3% hydrogen peroxide solution does the best because the peroxide allows more oxygen to be absorbed, and from our background information, we found that oxygen is key for seeds to germinate properly.

Literature Review:

The first research paper that was used to base our topic is called, “EFFECTIVENESS OF ALOE VERA GEL AND COCONUT WATER AS A BIOREGULATOR ON SEED GERMINATION OF DENDROBIUM ORCHID”. This research paper describes the effect of coconut water and aloe vera gel as an organic substitute for Dendrobium Orchid seed germination. This is relevant to our project because both projects are on using organic disinfectants to sterilize seeds for germination. In our experiment, we will be using aloe vera juice.

The second paper that was used to base our topic on was, “Effect of Plant Extracts on Seed Germination Behaviour and Vigour of Okra”. The paper goes over why okra was used for the experiment and the effect of plant extracts on seed germination. In other words, testing the effects of organic components of a plant to see if it causes any change in behavior when it’s germinating. It’s similar to our project because again it’s testing the effects of disinfectants that are organic and inorganic, on the plant seeds.

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Methodology Paper:

This experiment will be conducted in the basement of my house. To begin the experiment, gather the following materials: one bag of soybeans, filtered water water, seed trays with a dome to cover, 2 bottles of hydrogen peroxide, 2 bottles of bleach, computer to record progress, cheesecloth, 5 jars, cups for measurement and gloves.

The first part of the experiment was to have soybean seeds split into 5 groups of 10 seeds since we are testing 4 different concentrations of the disinfectants excluding filtered water. Once the seeds are grouped, go ahead and place each group of seeds into a jar and pour enough of the disinfectant solution to where it covers all of the seeds. After about 15 minutes of the seeds being soaked in the disinfectant, go ahead and cut a square off of our cheesecloth, which should be big enough to cover the entire top of the jar. Then start pouring the disinfectant solution into a bucket to filter the disinfectant from the seeds. After filtering the disinfectants from the jars, grab our seeds trays and rip pieces of tissue paper to be placed inside each pocket of the seeds mat. Then pour a few drops of regular tap water onto the pieces of tissue paper for it to soak. We are using taps just to provide a wet and moist environment for the seeds to germinate in. Then place each of the 5 seeds in each column and label each column with which disinfectant was used to sterilize the seeds. After all, the seeds are placed in a pocket, covering the tray with the dome to create a moist environment for the seeds to germinate. Then place the tray on the heating mat to regulate the temperature of the environment inside the dome. The heating mat is used because the time the experiment will be conducted is when the outside temperature is 30 and below, so the basement will be about 60 degrees Fahrenheit, which is not good for germinating seeds. Between 70 - 85 degrees is recommended for seeds to germinate right. When all the temperature is all set for the seeds, store the tray in a dark room with no light to make it possible for the seeds

to germinate best. Obviously for our experiment in order to make progress checks, we will have to expose the seeds to some light in order to record any changes. This experiment will be conducted for 14 days which should give the seeds enough time to germinate or not?

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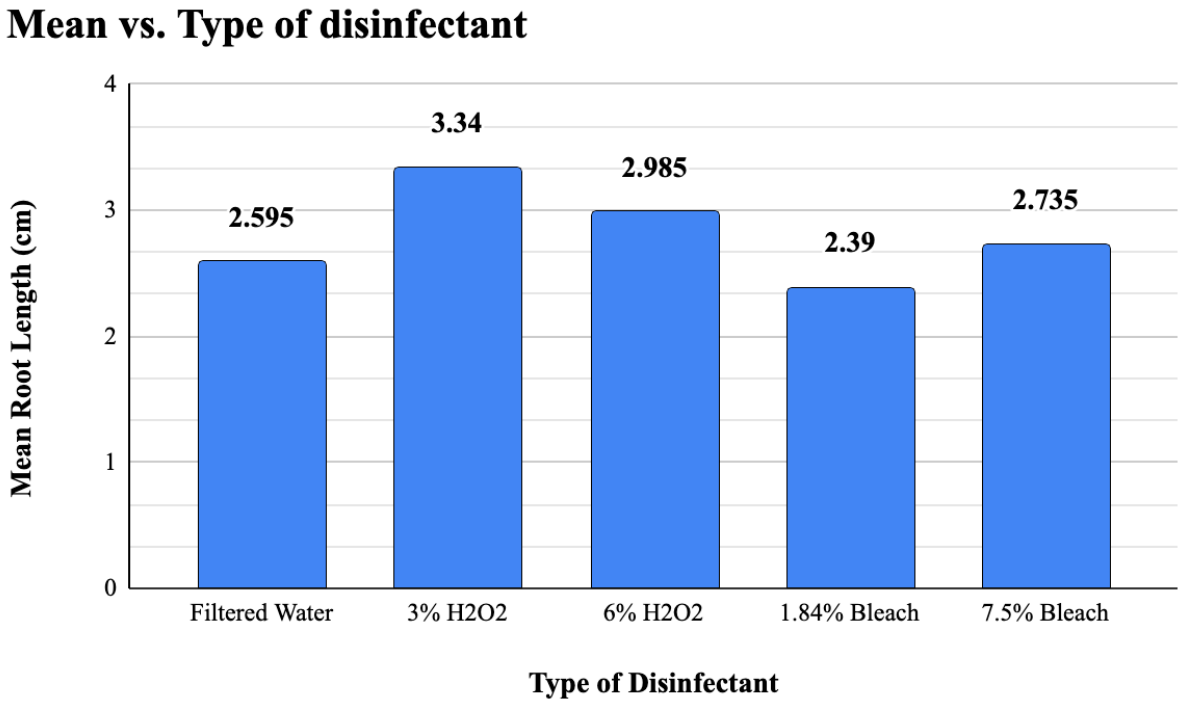
Table 1

Growth (cm)	(control) Filtered Water	3% H2O2	6% H2O2	1.84% Bleach	7.5% Bleach
Trial 1	0	7	0	0	8.55
Trial 2	6.9	0	0	3.5	0
Trial 3	0	0	6.75	4.5	4.5
Trial 4	0	0	0	4.4	0
Trial 5	1.55	3.2	4.5	0.8	6.85
Trial 6	0	5.5	0.65	5.1	0
Trial 7	5.2	7.8	6.25	0	2.55
Trial 8	7	2.55	0	0	0
Trial 9	0	1.55	3.7	5.6	4.9
Trial 10	5.3	5.8	8	0	0

Table 2

Type of disinfectant	Filtered Water	3% H2O2	6% H2O2	1.84% Bleach	7.5% Bleach
Mean (cm)	2.595	3.34	2.985	2.39	2.735
Variance	9.6446944	9.0354444	10.431694	5.861	10.665028
Stan. Dev.	3.1055908	3.0059016	3.2298134	2.4209502	3.2657354
1 SD (68% Band)	1.618 – 3.572	2.395 – 4.285	1.969 – 4.001	1.629 – 3.151	1.708 – 3.762
2 SD (95% Band)	0.670 – 4.520	1.477 – 5.203	0.983 – 4.987	0.890 – 3.890	0.711 – 4.759
3 SD (99% Band)	0.0653 – 5.125	0.892 – 5.788	0.354 – 5.616	0.418 – 4.362	0.0749 – 5.395
t-test result		t = -0.54509, p = .296192	t = -0.27525, p = .393131	t = 0.16463, p = .435535	t = -0.09824, p = .461415
df = 18, alpha = 0.05		not significant	not significant	not significant	not significant

Figure 1



The growth of each seed at each disinfectant level is shown in Table 1. The effect of each disinfectant level on the length of the root is summarized in Table 2 and in Figure 1. As shown in Table 1 7.5% Bleach had no effect on the germination rate at which both the disinfectant and filtered water germinated half of the seeds. The 6% H2O2 and 1.84% Bleach had a greater germination rate than the control, with a germination rate of 60%. The 3% H2O2 had the greatest germination rate with a 70% germination rate. From this bit of data, it supports our research hypothesis; if hydrogen peroxide does the best in sterilizing soybean seeds, then a 3% concentrated hydrogen peroxide solution should be the best disinfectant for seed germination. From looking at our data, we can also see that some of the germinated seeds' roots didn't grow as much as the other roots, which we aren't sure why that occurred but then again, not all of the seeds sprouted at the same time and grew at the same rate.

The descriptive statistics in Table 2 and the graph show the means of each disinfectant, and as you can see, 3% H2O2 had the largest mean value because it had the greatest germination rate. 1.84% bleach has a smaller mean value despite having a greater germination rate than 7.5% bleach disinfectant. This is due to most of the seeds sterilized in 7.5% bleach having much longer root lengths than the 1.84% bleach disinfectant. If we look at the variance and the standard deviation, they look like they correlate with each other. For example, the 1.84% bleach level had the smallest variance value and the smallest standard deviation value. The 7.5 % bleach level had the largest variance value and standard deviation value. Now we think the reason that the 1.84% level had the least variance and standard deviation value compared to the 7.5% level is because it's root lengths weren't as large, or it ranked least in having the largest roots, while the 7.5% level had the largest root with a length of 8.55cm. We think this could be the reason why the other independent levels have their variance and standard deviation values. Now our t-test results show that none of the independent variables had a significant result when tested with the control which was filtered water. We think this was due to the fact that since root lengths varied so much, the t-test wasn't able to consider that. Because we know from table one that all the soybean seeds germinated at different times and at different rates. We also need to consider that not all of the seeds germinated, which our goal was to see how the different disinfectants affect the germination rate of soybean seeds. Regardless of the t-test rejecting our null hypothesis, our data in Table 1 supports our research hypothesis.

Conclusion

The purpose of the experiment was to study the effects of various disinfectants used to sterilize soybean seeds to see how it affect the seeds' germination. The goal of this experiment is to determine how different types of disinfectants affect seed germination. Whether it promotes germination or reduces it. The 7.5% bleach had no effect on the germination rate. The 6% H2O2 and 1.84% bleach had a greater germination rate (60%). The 3% H2O2 had the greatest germination rate (70%) which supports my research hypothesis. 1.84% bleach has a smaller mean value despite having a greater germination rate than the 7.5% bleach disinfectant. This is because the 7.5% produced the largest root out of all of the disinfectants, while the 1.84% had the smallest when comparing which produced the largest root. In the end, the rate of germination is more important than the root length. The descriptive data does support my null hypothesis, as it shows it's not significant. This is because the data values of all the data vary so much due to the difference in root lengths and the number of zeros compared to the ones that did. In conclusion, the goal of the experiment was completed, and the research hypothesis was supported from the data. The 6% H2O2, 1.84% bleach and 3% H2O2 should be used if the person is using filtered water to germinate their seeds because these disinfecting agents increase the germination rate. The research that was derived seemed to be accurate about the best disinfectant for sterilizing soybean seeds. The biggest takeaways from our research and experiment are that people can use cleaning disinfecting solutions or medical disinfecting solutions to disinfect their seeds for better germination. I would also like to note that the use of distilled water wasn't ignored, and I was aware that it's better to use it than tap or filtered water. This experiment was to study and compare the effects of using cleaning solutions versus filtered water to sterilize soybean seeds.

INVESTIGATING THE EFFECTS OF SUNDRY DISINFECTION AGENTS ON THE GERMINATION OF GLYCINE MAX

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