SPIDER PLANT SENSITIVITY TOWARDS WATER UPSTREAM AND DOWNSTREAM OF A WATER TREATMENT PLANT

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Abstract

The purpose of this project was to find out if spider plants (Chlorophytum comosum) were to be more or less sensitive with water upstream and downstream of the Smithville Wastewater Treatment Plant. The hypothesis was that the water from upstream will affect the spider plant positively while water collected downstream of the Treatment Plant will affect the spider plant negatively. My research question: Are spider plants positively or negatively affected from water collected upstream and downstream of the Wastewater Treatment Plant?
There were twenty spider plants separated into two different groups, one for water collected upstream and the other water collected downstream of the treatment plant. The data did not support the hypothesis. The plants were under observation for twenty-one days. Eighteen of the plants decreased in mass, not mattering if they were watered with water from upstream or downstream of the water treatment plant. Only two plants increased in mass, which occurred because of root growth. The data shows the plants' mass were not affected by the water types, though the plants watered with water from upstream of the plant seamed to wilt faster. Other relevant research can be done in the future such as using indicator fish species such as are used at the Ashland Water Treatment Plant.

Key Words: spider plants, upstream water, downstream water, water treatment plant

Research Question

Treatment Plant? If I water spider plants with water upstream and downstream from a water treatment plant, will I see a difference between the two groups of spider plants? Could this experiment be applied to areas such as East Palestine?

Water quality helps us understand what is going on in the subsurface. We need to understand water quality so we can protect our health and the health of the ecosystem. If we use spider plants, or other more sensitive plants, you can tell how clean the water is. Further studies can be done using different organisms to test the water to see if it is okay for human consumption.

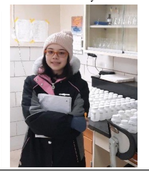
My experimental methods include getting twenty spider plants, removing the dirt from each, washing the roots, drying the roots, measure the mass of each plant, replanting the plants, and collecting water Are spider plants positively or negatively affected from water collected upstream and downstream of the Wastewater from upstream and downstream of the Smithville Wastewater Treatment Plant. Water plants one through ten with water from upstream of the treatment plant. Water plants eleven through twenty with water from downstream of the treatment plant. Fill two tubs with all the plants according to their water types. After twenty-one days remove dirt from each plant, washing and drying the roots, then measure the mass of each plant.

Introduction

I wanted to do something about water pollution. Next, I started looking through some of Connie Atkinson's GLOBE Program students' research around Flint, Michigan and the lead contamination of the water in the area. I had never heard of lead pollution in my area, so I began looking at water treatment plants and their possible role in generating of reducing water pollution.

One of the projects found is called "Is There A Difference in Urban River Water Quality Between Michigan and Ohio Rivers". This project addresses the Flint, Michigan water quality. It was written by student number 1221. His report was to see if any of the four rivers tested would have a more improved environment for benthic macroinvertebrate life. In a research journal, Sewerage Water Treatment Using Phytoremediation, Noor Omar, Muhamad Wahap, and Zubaidi Johar, used aquatic plants to test wastewater from a treatment plant. In the European Journal of Chemistry, Mohammad Suhail was trying to figure out the easiest way to remove pollutants from polluted water. In the Water Quality Index Prediction for Improvement of Treatment Processes on Drinking Water Treatment Plant, Goran Volf, Ivana Čule, Elivix Žic, and Sonja Zorko were testing parameters, such as temperature, pH, turbifity, KMnO4, NH4, Mn(magnesium), Al (aluminum), and Fe (iron).

Soil Fertility protocol was used to see if any of the important minerals were missing from the soil of the twenty plants. The minerals tested included nitrogen, phosphorus, potassium, magnesium, sulfur, and calcium. I would be able to tell if any of the missing minerals had an impact on my results.



Research Methods

PREPARATION

1. obtain twenty spider plants (they were selected because of their sensitivity to water pollution and/or chemicals)
2. remove dirt from each plant
3. wash the roots with distilled water
4. dry the roots with a paper towel
5. obtain the mass of each plant using a PCC digital pocket scale (this model was selected because it will record mass to the 0.001 of a gram)
6. replant the spider plants into plastic pots
7. collect water approximately 100 meters (safety of collection was foremost here) upstream and downstream from the Smithville Water Treatment Plant

WATERING

1. water spider plants 1-10 with water upstream of the treatment plant every 7 days as recommended by Oakland Nursery
2. water spider plants 11-20 with water downstream of the treatment plant every 7 days as recommended by Oakland Nursery
3. fill the two tubs 30cm wide by 43cm long by 5cm deep with all of the repotted plants according to their water types

DATA COLLECTION

1. repeat steps 2 – 6 from the preparation steps
2. record dead or yellowed leaves for each plant
3. compare data from before and after this research and between each study group

Each plant was measured on a scale being weighed for mass using grams.
20 plants were measured before the experiment, 20 plants were measured after the experiment, 10 plants watered from upstream and 10 plants watered from downstream of the water treatment plant. Observation logs were made every day for 21 days as part of the data collection procedure.

GLOBE Data Used

GLOBE Protocol used: Soil Fertility was used to see if any of the important minerals were missing from the soil of the twenty plants. The minerals tested included nitrogen, phosphorus, potassium, magnesium, sulfur, and calcium. I would be able to tell if any of the missing minerals had an impact on my results.

Carrying Out Investigations

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During my research, the data did not support the hypothesis. The hypothesis was: Water upstream would positively affect the plants while water downstream would affect the plant negatively. During all twenty-one days of testing and observing, nothing really changed, but upstream had ninety-two healthy leaves, nine dead leaves, and thirty-eight withering tips. Downstream had ninety-three healthy leaves, sixteen dead leaves, and thirty-eight withering tips. According to the results, downstream was slightly negatively affected.

Study Site: Smithville Water Treatment Plant: There are farm fields on one side and houses on the other. The treatment plant is surrounded by a wire fence. It was quite crisp out when I went there to collect water. The grass was crunchy, yet there was no snow. Sugar Creek has trees on both sides of the bank with rocks all over. The Sugar Creek waters were rushing very fast due to the rain that happened overnight before collection of the water.

Figure 1. Study Site: Smithville Water Treatment Plant

Results

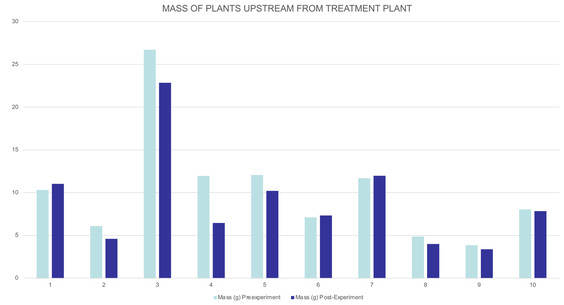
UPSTREAM

Plant One
Before: 13.13g
After: 11.44g
Plant Two
Before: 18.03g
After: 20.13g
Plant Three
Before: 5.95g
After: 4.95g
Plant Four
Before: 10.71g
After: 9.78g
Plant Five
Before: 5.28g
After: 4.94g
Plant Six
Before: 4.01g
After: 3.78g
Plant Seven
Before: 31.70g
After: 27.63g
Plant Eight
Before: 10.74
After: 10.22g
Plant Nine
Before: 7.19g
After: 7.02g
Plant Ten
Before: 8.80g
After: 8.02g
AVERAGE
Before: 11.554g
After: 10.791g

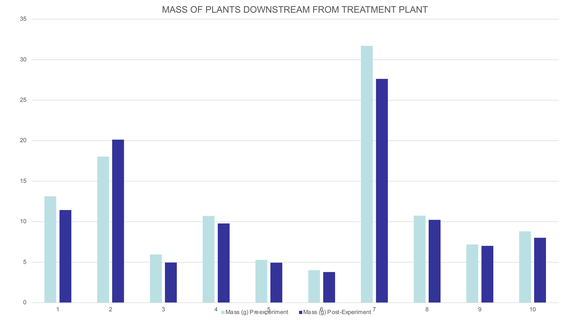
DOWNSTREAM

Plant Eleven
Before: 10.32g
After: 11.02g
Plant Twelve
Before: 6.10g
After: 4.60g
Plant Thirteen
Before: 26.71g
After: 22.85g
Plant Fourteen
Before: 11.96g
After: 6.46g
Plant Fifteen
Before: 12.07g
After: 10.20g
Plant Sixteen
Before: 7.11g
After: 7.33g
Plant Seventeen
Before: 11.69g
After: 11.98g
Plant Eighteen
Before: 4.87g
After: 3.99g
Plant Nineteen
Before: 3.86g
After: 3.38g
Plant Twenty
Before: 8.04g
After: 7.84g
AVERAGE
Before: 9.441g
After: 8.965g

Graph #1



Graph #2



Discussion

During my research, the data did not support the hypothesis. The hypothesis was: Water upstream would positively affect the plants while water downstream would affect the plant negatively. During all twenty-one days of testing and observing, nothing really changed, but upstream had ninety-two healthy leaves, nine dead leaves, and thirty-eight withering tips. Downstream had ninety-three healthy leaves, sixteen dead leaves, and thirty-eight withering tips. According to the results, downstream was slightly negatively affected.

The procedure involved obtaining twenty spider plants, removing the dirt from each, washing the roots, drying the roots, measuring the mass each plant, replanting plants, and collecting water from upstream and downstream of the Smithville Wastewater Treatment Plant. Plants one through ten were watered every seven days with water from upstream of the treatment plant. Plants eleven through twenty were watered every seven days with water from downstream of the treatment plant. Two tubs were filled with all the plants according to their water types. After twenty-one days, the dirt was removed from each plant, the roots were washed and dried, and each plant was measured again for the mass. The procedure was effective to the question except, I believe, the plants didn't get enough time to actually have significant changes. If the project were to be done again, the procedure would have been over more than two months, instead of twenty-one days.

I light of the tragedy at East Palestine, studies such as mine are even more relevant, at least to me. Concerns there are now being mentioned as to what we may see in the coming years or decades with possible ground water contamination. We have all seen the damage to the fish, crawfish, and stream water locally. This is another confirmation of me doing longer studies instead of just for a few weeks. Water truly affects us all, both in good and bad ways. It is up to all of us to diligently be watchful stewards of, again, at least to me, one our most precious, fragile, and valuable of resources: water.

Conclusions

The data collected did not support the hypothesis. Neither upstream nor downstream positively or negatively affected all of the twenty spider plants. The data confirmed two out of the twenty spider plants increased in mass while the other eighteen decreased in mass. I feel I did not give the experiment enough time (three weeks), so nothing major really happened.

When doing this experiment, the averages did not make sense. 90% of the plants decreased in mass, but the averages show the plants increased in mass before and after.

During the wastewater treatment plant tour, the guide said the water was tested with minnows. Specifically, Fathead Minnows (P. promelas), Water fleas (C. dubia), and plankton crustaceans (D. magna). If I were to do this experiment again, I would use the animals listed. Mr. Blowers said the animals would likely have a different effect on them than using plants.

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