

The Effects of Acid Rain and Soil Pollution on the Growth of *Brassicca rapa*



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Results & Data

Introduction

- The purpose of our experiment is to analyze the effect of acid rain in conjunction with pollution on the Carolina Fast Plant (*Brassicca rapa*). As the global population increases and the amount of disposable plastic items are consumed and discarded, plastic and foam pollution increases in the environment (Derraik 2002). We wanted to determine whether or not this increasing amount of pollution in the waters and on land around the world affected plant growth.
- Another world problem with increased industrialization and manufacturing is chemical pollution in the air. Although acid rain levels in the United States have been greatly reduced thanks to implementation of pollution regulation laws in the 1970s by the EPA (Weiss 2012), acid rain continues to be an issue in other major countries around the world such as in China (Jin *et al.* 2016) and in India (Singh *et al.* 2007). One of the major factors in increased acid rain levels is the amount of sulfur dioxide (SO₂) in the air (Singh *et al.* 2007) that mixes with rain water to decrease its pH.
- We designed our hypothesis to test whether acid rain in conjunction with soil pollutants affect plant growth, and if so then in what way.

Materials & Methods

- Our plants were divided into 8 treatment groups with 24 plants each.
- By mixing sulfuric acid and water we achieved the desired pH concentrations for the acid treatments.
- Half of our plants were germinated in soil with a mixture of Styrofoam and plastic particles while the other half were planted in standard potting mix.
- Once a week for three weeks our plants were watered with 20mL of acid solution depending on their treatment group. Plant height and number of leaves was also measured at this time.
- Plants were watered to saturation with tap water as needed throughout the experiment.
- After harvesting our plants we took shoot biomass and stem diameter measurements for each of the plants.
- A two-way ANOVA was conducted to analyze our data and produce P-values.

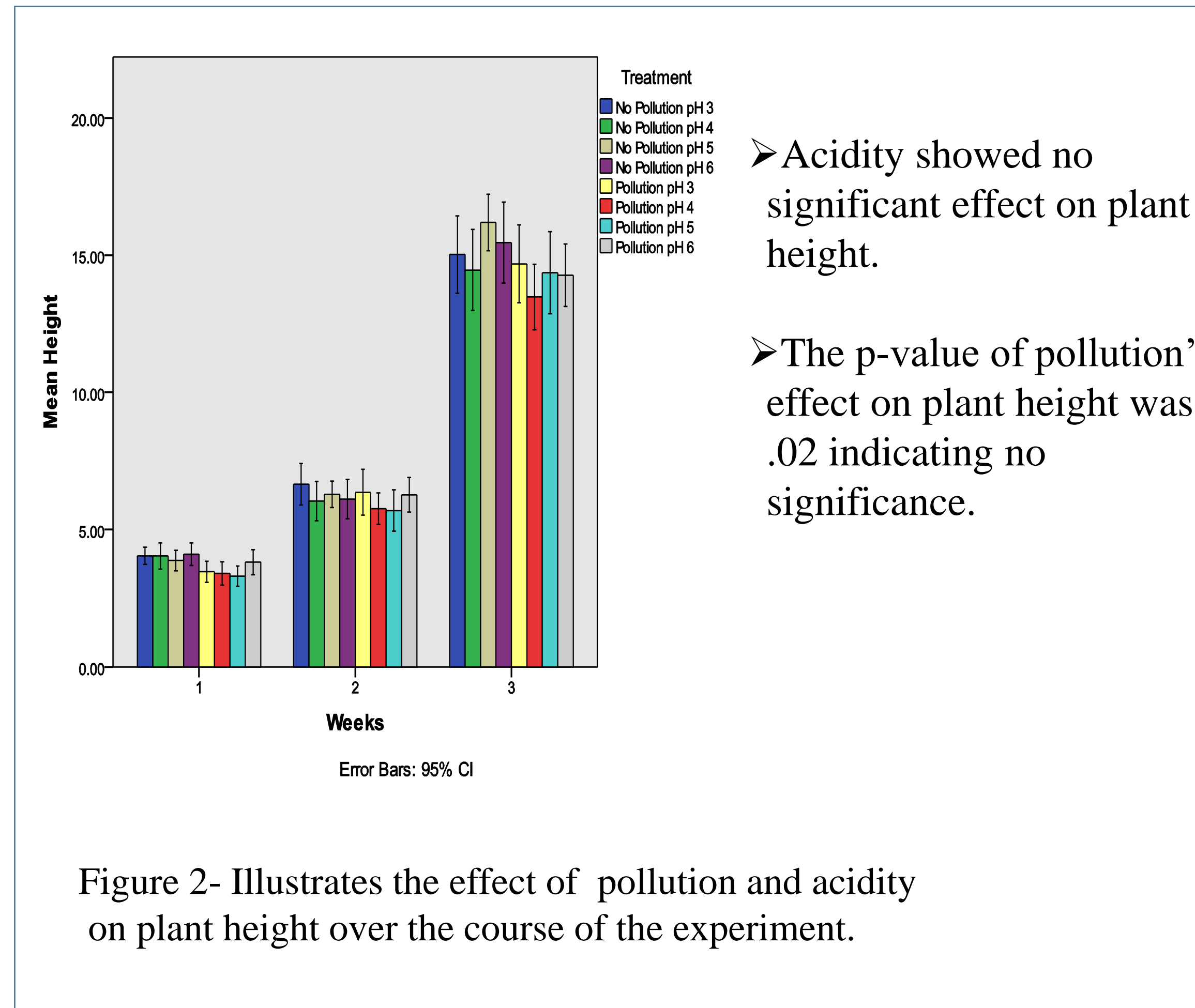


Figure 2- Illustrates the effect of pollution and acidity on plant height over the course of the experiment.

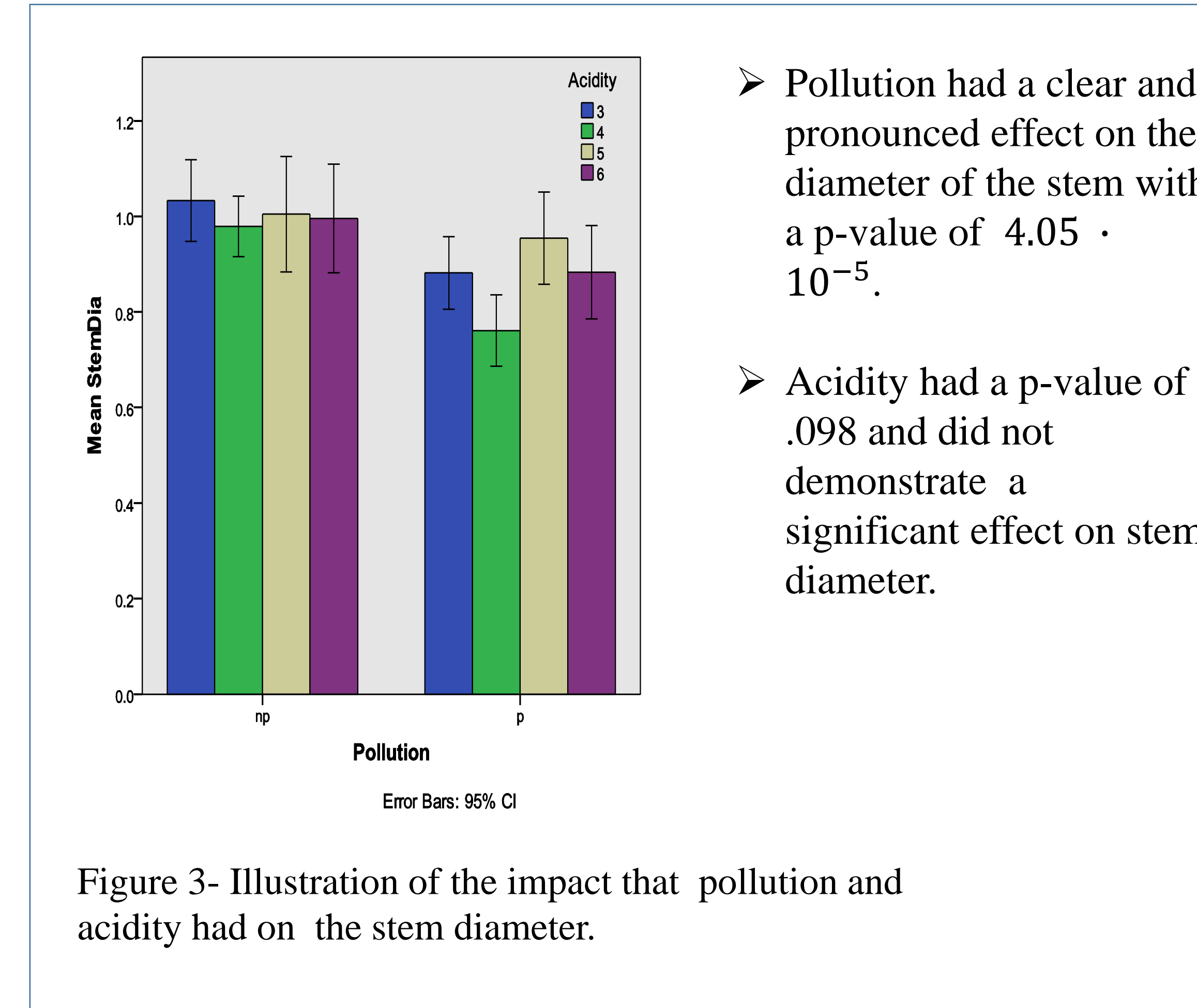


Figure 3- Illustration of the impact that pollution and acidity had on the stem diameter.

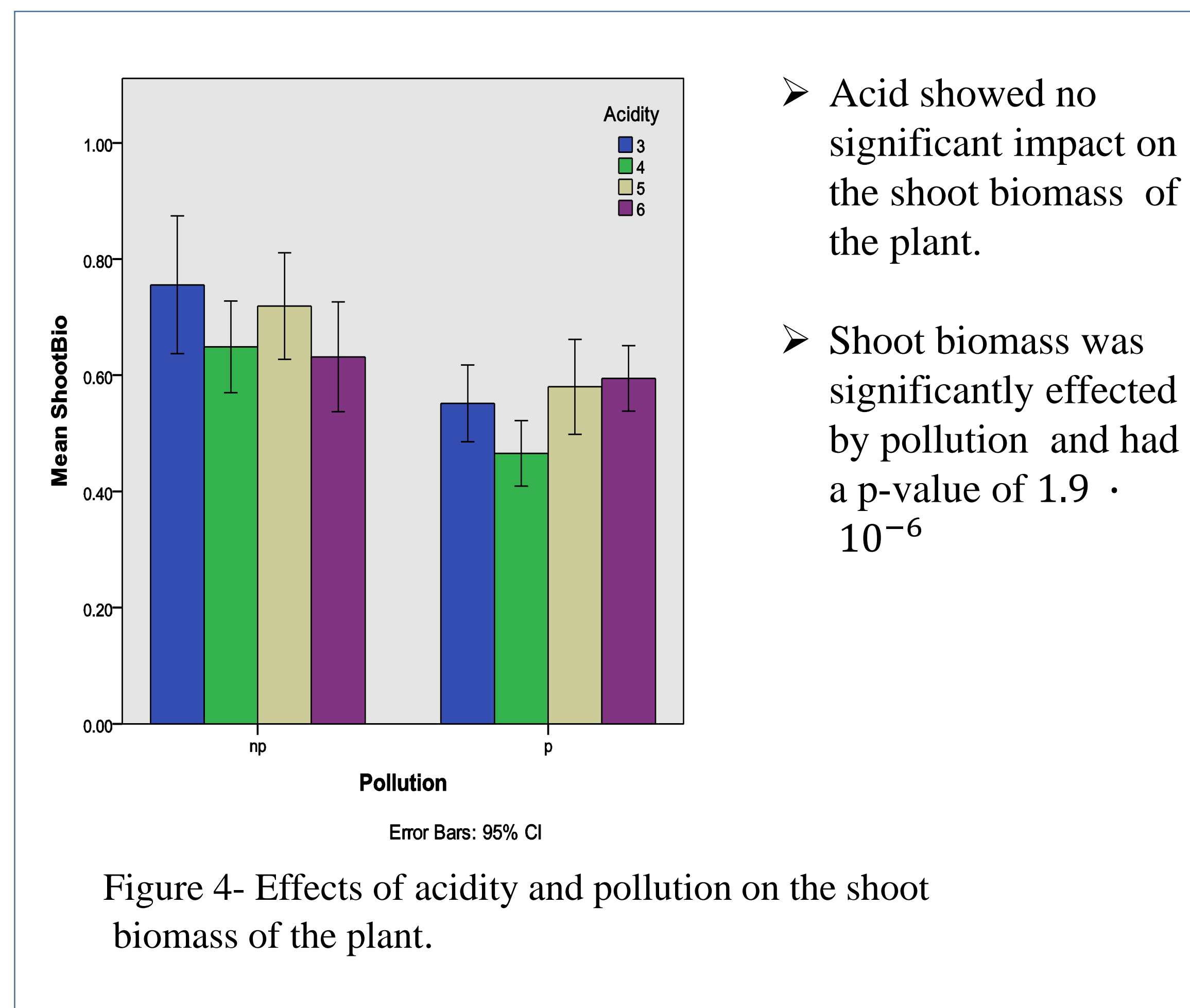


Figure 4- Effects of acidity and pollution on the shoot biomass of the plant.

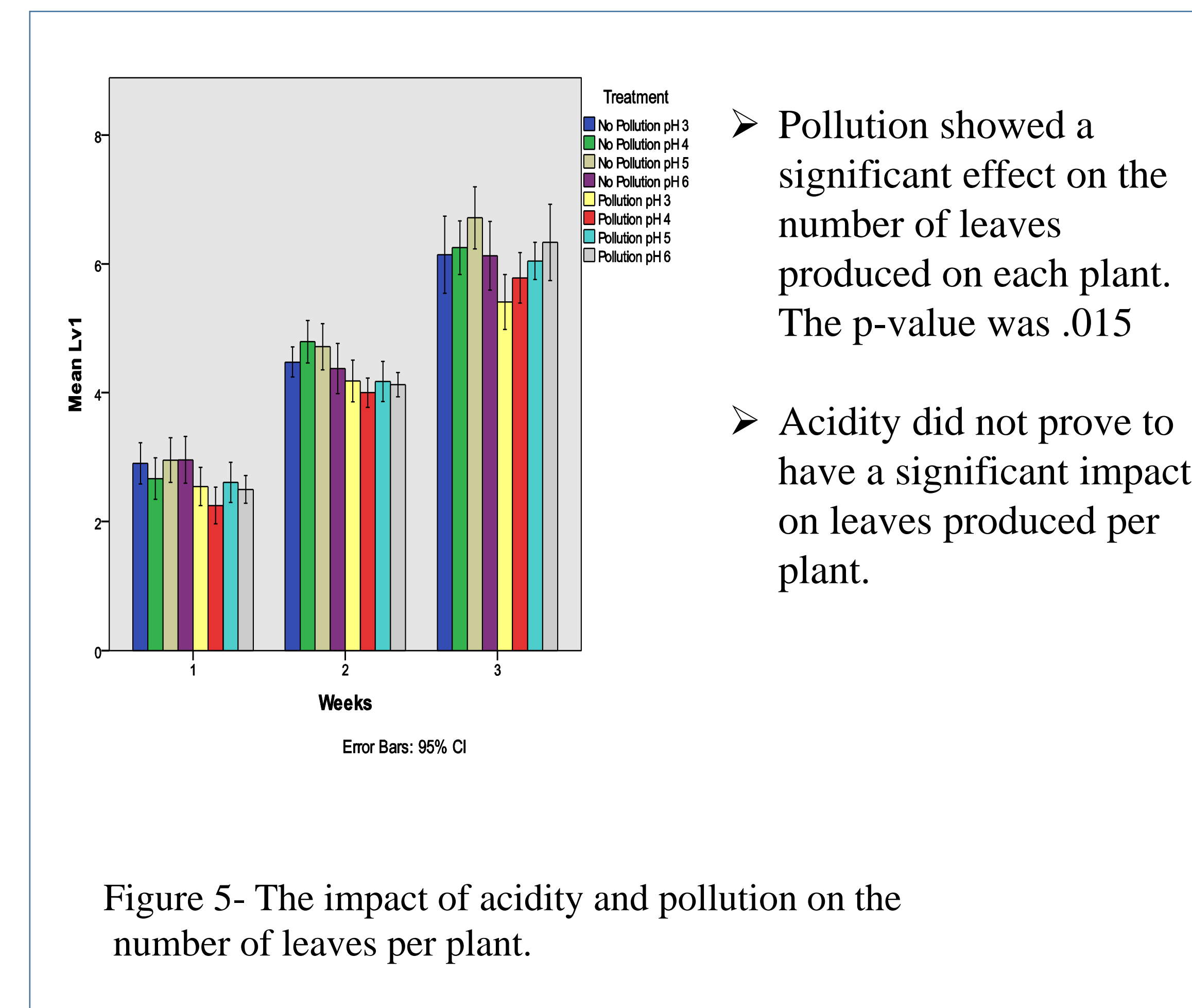


Figure 5- The impact of acidity and pollution on the number of leaves per plant.

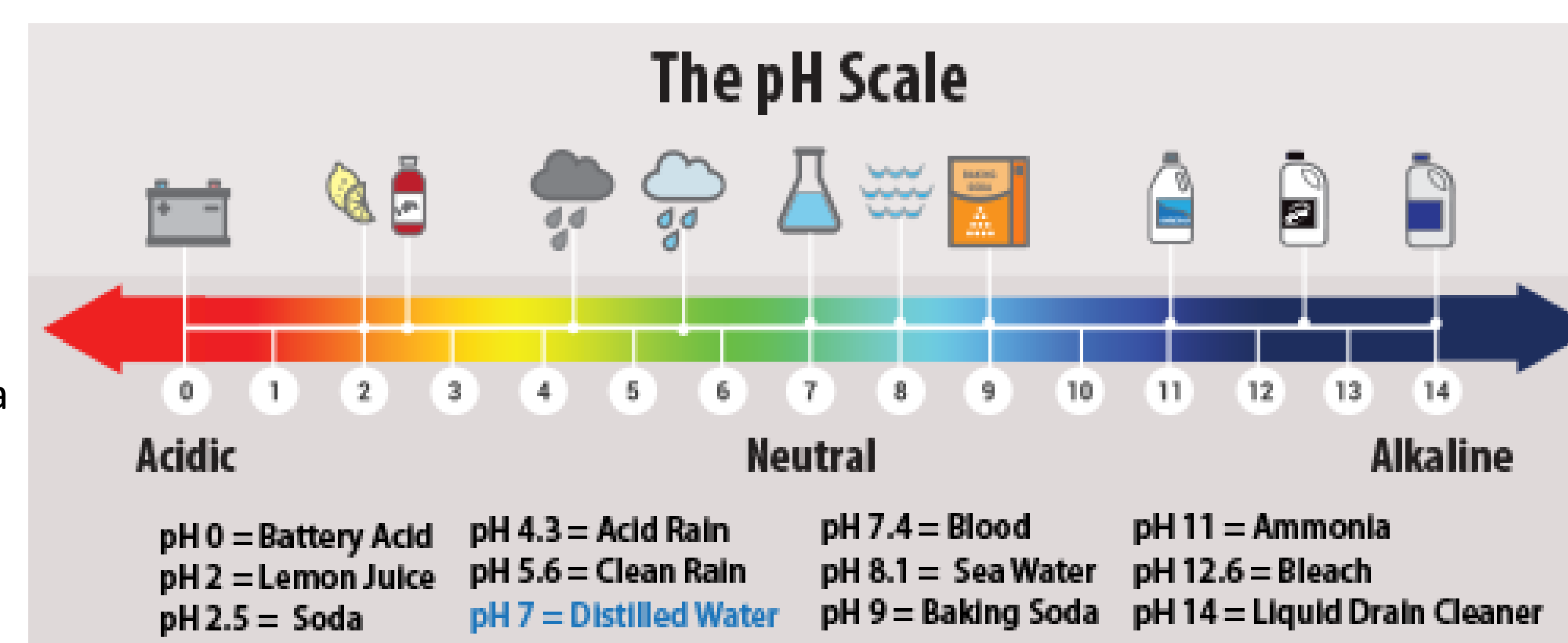
Discussion/Conclusion

- All of our measurements indicated that pollution treatments had a more clear and pronounced effect on plant physiology than acid rain treatments.
- The buffering capacity of our soil, which wasn't taken into consideration, may have negated the effects of our acidified water. According to a research paper about nutrient cycling, "A greater pH buffering capacity leads to slower pH change" (Xu, Zhao, Yuan, & Jiang, 2012).
- Negative effects observed on the plants physiology from pollution might have been caused by lack of space in the growth medium due to the Styrofoam. According to a study conducted with cucumbers, "Root restriction strongly depressed total dry matter production in both root and shoot." (Kharkina, 1999)
- In hindsight, better results might have been obtained using more frequent acid rain treatments and larger pots in order to minimize confounding variables present in the experiment.
- Although more research is needed, it is clear that acid rain and pollution should be monitored and controlled when possible. Based on our results, pollution in certain circumstances can significantly impact plant growth. A society too dependent on plastics and disposable products will only further the damage done to the environment. Awareness and regulation are important when dealing with pollution.



Figure 1 (left) shows all treatments included in the experiment at week 3 of growth.

Figure 6 (right) shows a pH scale with common substances for reference (epa.org)



Literature Cited

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