

Effects Hydrochloric Acid 1

Running Head: EFFECTS OF HYDROCHLORIC ACID ON PLANTS

The Effects of Hydrochloric Acid Concentrations on the Growth of the Plant Brassica Rapa

Author(s) Redacted

Worcester State College

Introduction

Acid rain, a form of precipitation with heavy concentrations of sulfuric and nitric acid, has become an environmental problem in our ecologic system. Although it is most severe in urban and industrial areas, large amounts of acid rain can be transported to distant regions. Emission into the atmosphere of sulfur dioxide and nitrogen oxide is caused by the release of these chemicals from automobiles, industrial operations, and power plants that burn fossil fuels such as oil and coal. When these gases mix with the water vapor in clouds, they then form sulfuric and nitric acid. Rain is highly acidic, often with a pH of 5.6 or lower. In some locations in the eastern United States and Western Europe, pH values have been recorded as low as 2.0-3.0 (Beven & Beven, 2007).

Acid rain is known to be harmful to plants and is particularly noticed in crops and trees, mainly by inhibiting nitrogen fixation and leaching nutrients from foliage (Beven & Beven, 2007). The aim of this research project was to detect the effects of acid rain on the growth of plants. Groups of plants were grown in separate plots that were treated with different acidic solutions: pH 2.0, pH 4.0 and pH 6.0. Treatments were given once a week for 4 weeks by adding two and four drops of acidic solution to each plant. The growth of each plant was compared between the acid-treated and control plants. For this experiment we aim to prove that the acidic solutions have a negative effect on the plants development.

Given what we know about the effect acid rain has on crops and trees. We expect that the development of the plants, *Brassica rapa*, will be affected by the acidic solution. The growth of

plants with higher concentration of acidic solution will be affected the most in that they will have stunted growth.

Method

Materials

- 32 Brassica Rapa seeds
- Potting soil
- Felt sheet
- Foam Carrier
- Solutions of water with pH2,pH4, & pH6
- Pipet
- Light fixture
- Metric ruler
- Fertilizer pellets

Procedure

Thirty two seeds were obtained and planted using the same soil. Each plant was watered using a felt sheet that was placed underneath the foam carrier. Two or four, depending on the cube, drops of different pH solutions were deposited into the soil (TABLE- 1). The pH solutions ranged from 0 to 6 and eight plants were assigned to each pH level (TABLE 1). Each seed was watered with the appropriate pH solution for 3 weeks under the same lighting and temperature conditions. The height of each plant was then measured and recorded in the data sheet. Subjective data about the appearance of the plants was also recorded.

Effects Hydrochloric Acid 4

Cube #4 pH6 2 drops	Cube #5 pH4 2 drops	Cube #6 pH2 2 drops	Cube #7 CONTROL
Cube #3 pH6 4 drops	Cube # 2 pH4 4 drops	Cube #1 pH2 4 drops	Cube # 0 CONTROL

TABLE 1- Plotting scheme

Results

Objective Data

Average height of plant (cm) per week

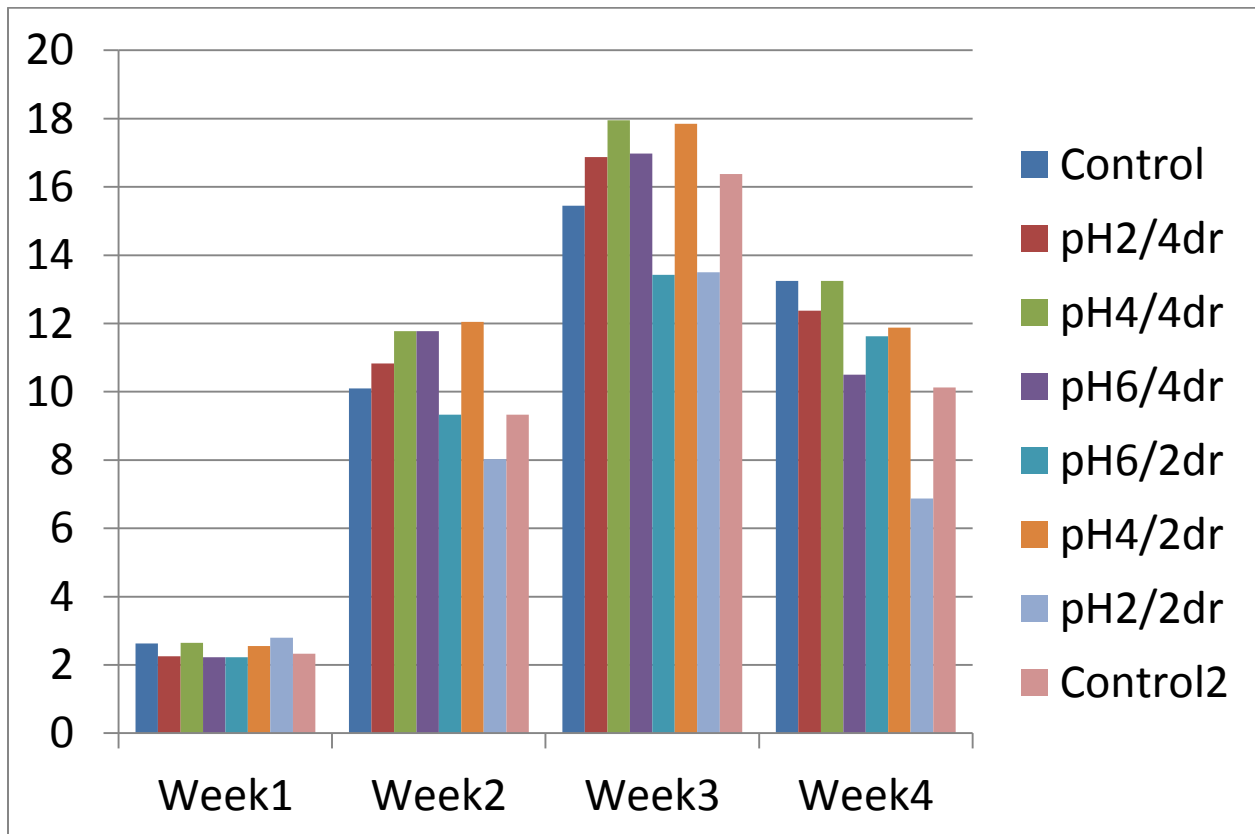


FIGURE 1- Height (cm) per week in each cubical.

Average height of plant (cm) per week

Variable: # of drops

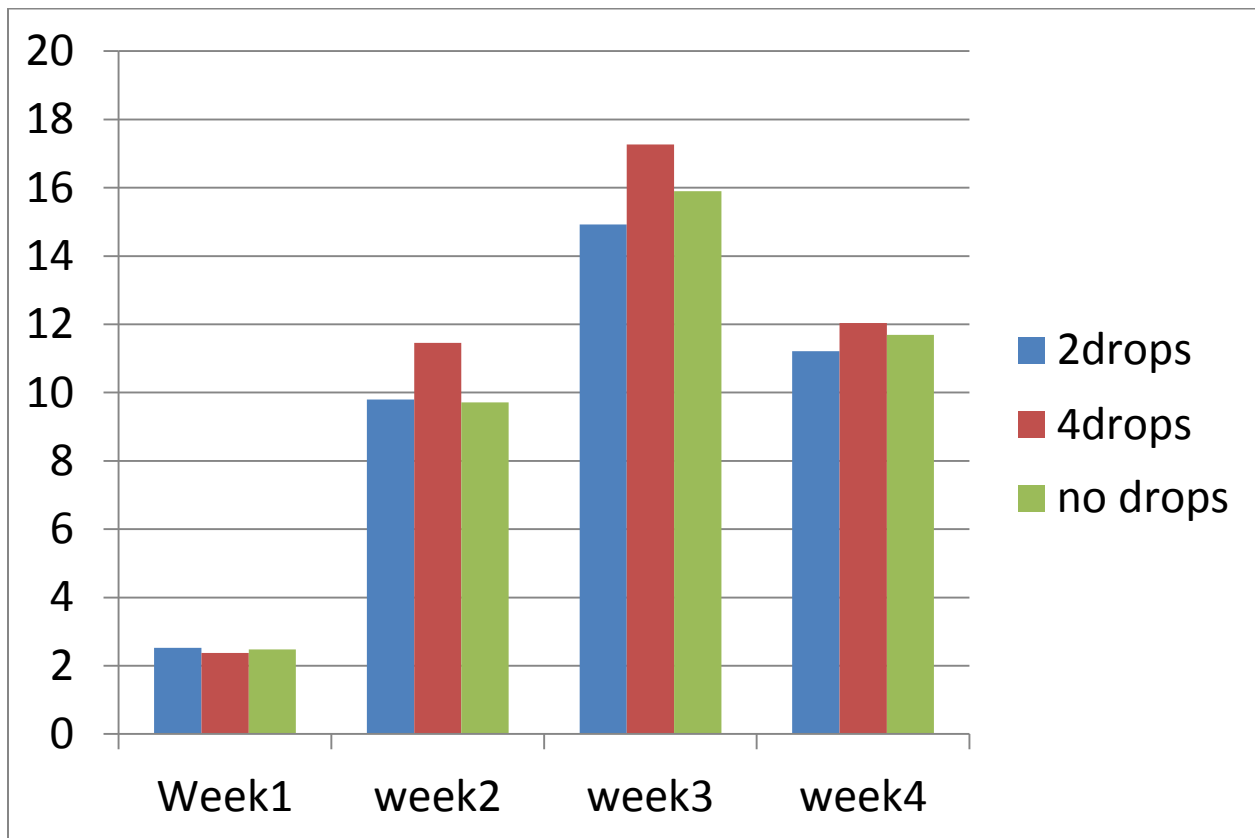


FIGURE 2- Height (cm) per week in cubicles that received the same number of drops.

Average height of plant (cm) per week
Variable: pH level

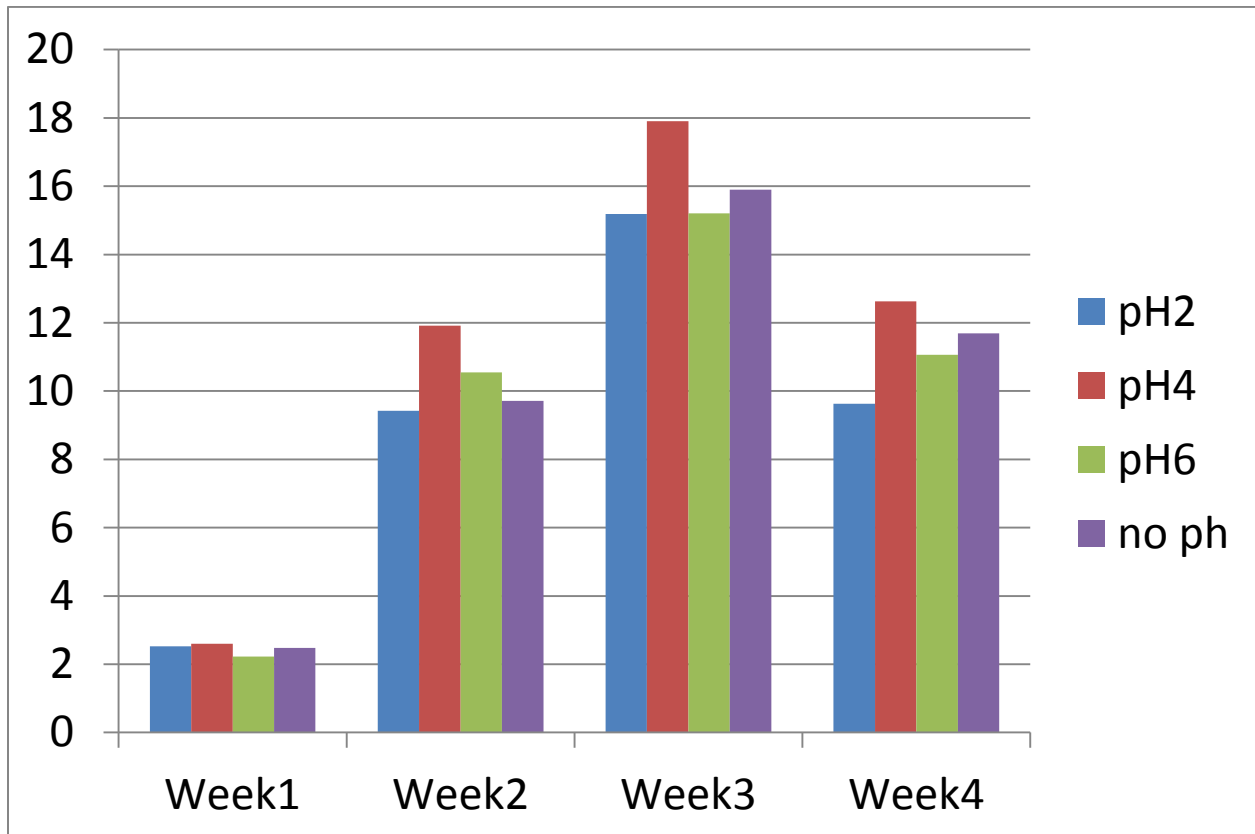


FIGURE 3- Height (cm) per week in cubicles that received the same pH level.

Subjective data

Week 1:

Observations: All plants seem to be growing at a steady rate. No acid has been added yet. Soil is moist.

Week 2:

Observations: One plant in cube# 6 (pH2, 2 drops) appears to be dead. Plants are still growing. Some leaves turning orange in color.

Week 3:

Observations: Stems very brittle, some flowering but falling off. Discolorations on leaves. Long stems but falling over, easy to break. Cube 4 looks the healthiest as it has peas sprouting and is comparatively less brittle. Soil is very dry but water is full.

Week 4:

Observations: Soil very dry, water full and cloth is wet. Cube #4 appears to be the healthiest with peas sprouting. Cube #1 has one plant with a strong stem. All other stems even more brittle, stems turning purple. Even controls are dying, brittle, and weak. More flowers fell off.

Conclusion

Overall, a damaging effect was observed on all plants (FIGURE 1). Greater variation between individual cubicles increased in later weeks (FIGURE 1). The acid had such a profound effect that even the control plants that did not receive direct drops of acid were negatively affected. Surprisingly, those plants which received four drops of acid rain were affected least in terms of vertical growth (FIGURE 2). However, in terms of subjective observations, cube 4 which received two drops of acid appeared to be the healthiest as it was producing pea pods. Interestingly, those plants which received a pH level of 4 grew the tallest, followed by the controls (FIGURE 3). One would expect pH6 to be the most nontoxic as it is closer to the pH of water. Not surprisingly, pH 2, the strongest acid, grew to the shortest average length (FIGURE 3). Some of the unexpected results may be contributable to the location of the plant, or to chance. An important observation to be noted is that the soil was consistently dry after administration of the acid, despite proper watering techniques. Perhaps the acid affected the overall moisture retention of the soil, and consequently affected the ability of the plants to obtain proper moisture. In conclusion, the administration of varying pH level of HCL to the plant, Brassica Rapa, negatively affected the growth, health, and overall appearance of the plants.

Effects Hydrochloric Acid 10

Discussion

Acid rain is known to be harmful to plants and is particularly noticed in crops and trees, mainly by inhibiting nitrogen fixation and leaching nutrients from foliage (Beven & Beven, 2007). The aim of this study was to determine the effect of pH level on the plant, Brassica Rapa. Devastating effects were observed across all pH variations and amounts, including the control groups. Efforts should be made to reduce emission into the atmosphere of sulfur dioxide and nitrogen oxide released from automobiles, industrial operations, and power plants that burn fossil fuels such as oil and coal.

References

Beven, K. J., & Beven, K. J. (2007). *Encyclopædia Britannica*. Retrieved May 1, 2008, from Encyclopædia

Britannica Online: <http://search.eb.com/eb/article?tocId=9003549>.