Testing Acidity for Plant Growth and Germination in *Brassica rapa*

Chelsey Tiger, Alexis Whiles

Department of Plant Biology, Oklahoma State University, Stillwater, OK

Introduction

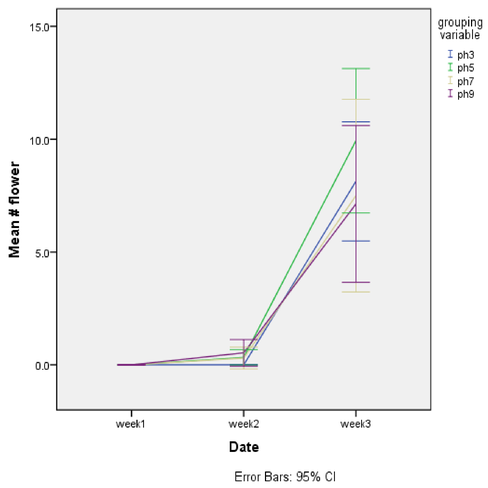
Varying levels of acidity and alkalinity in soils have been shown to affect the nutrient uptake of plants[1]. Only a few plant species grow equally well in both the acidic (pH of less than or equal to five) and the alkaline range (pH greater than seven)[2] . Our goal is to test the adaptability of plants and the effects pH has on plant growth by altering soil pH in growing *Brassica rapa* (Wisconsin fast plants). To furthermore test the effects pH has on *Brassica rapa,* we will run germination trials.

Methods

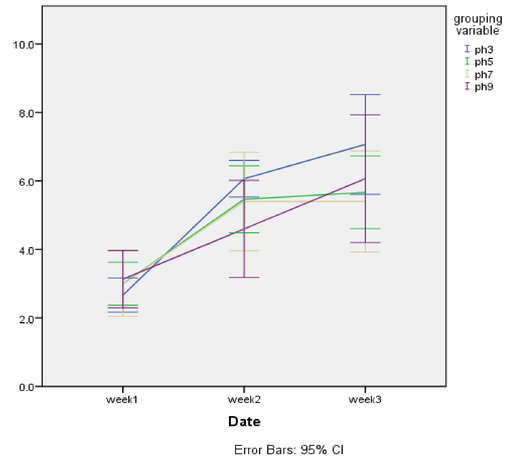
First, all seeds were planted in soil with a pH of 7.0. After growth was established in all plants, we altered soil pH by using sulfuric acid at pH levels of 3.0 and 5.0. We used only water on our control plant group for a pH of 7.0 . Finally, potassium hydroxide was used to bring soil pH to an alkaline 9.0. Each week for three weeks we measured growth based on the following metrics: leaf width, number of leaves, number of flowers, and stem diameter.

Figure 1. Photo taken of the plants on week 3 at the end of the experiment. From left to right: pH 3,5,9, and control 7.

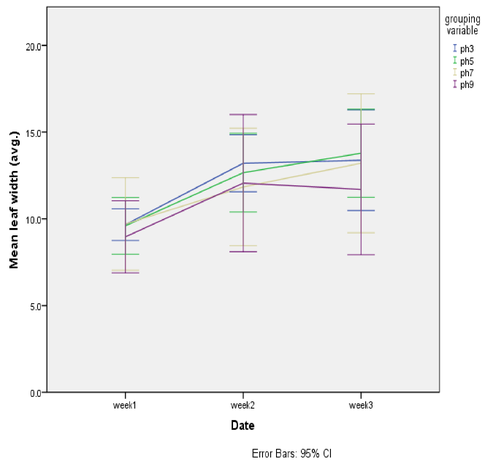
Results



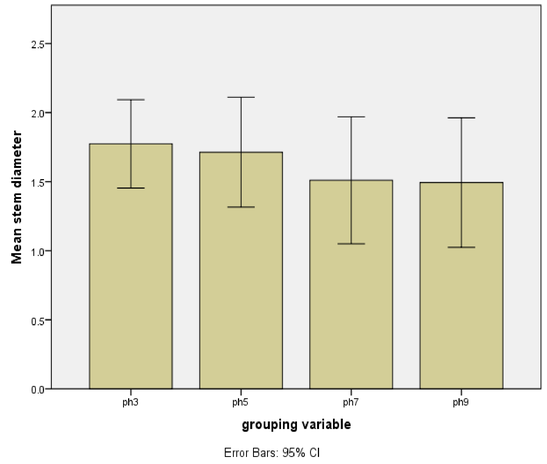
Graph 1. Number of flowers observed. Again, a large spread of data for each pH by the end of the trials.



Graph 2. Mean number of leaves. Note the large amount of variance in plants grown in pH 9 soils by week three.



Graph 2. The mean leaf width for plants grown in various pHs ranging from 3-9.



Graph 4. Mean stem diameter of each treatment group measured at the end of the trials.

Using SPSS, graphs were generated showing the results. We did not see a significant effect pH had on any of the growth metrics measured. There was a difference, however, in seed germination. Seeds did not germinate in sulfuric acid with a pH of 3.0. However, seeds did germinate in pH 5.0 (sulfuric acid), 7.0 (water), and 9.0 (potassium hydroxide).

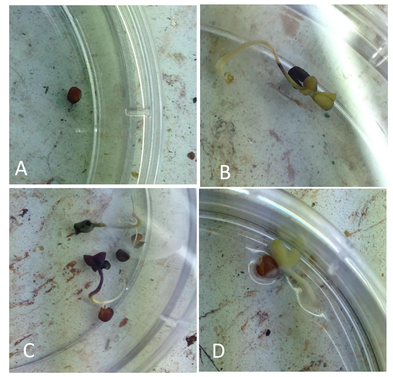


Image A shows the results of seed germination in sulfuric acid at a pH of 3.0. There is no germination. Image B is the result of seed germination in sulfuric acid at a pH of 5.0. This seed germinated and absorbed all of the liquid. Image C is the control with seed germination using water at a pH of 7.0. Image D is seed germination in potassium hydroxide at a pH of 9.0. All of the seeds germinated except for the seeds in sulfuric acid at a pH of 3.0

Discussion

We predict the reason why pH had little effect on plant growth is due to the quick buffering ability of soil. After each week, the soil pH reverted back to 6.0, showing that it acts as a buffer during growth. This also explains how seeds did not germinate in strong acid of 3.0 but germinated in every other environment.

Furthermore, we also attribute the lack of significance in our findings due to the variation of our starting population of plants, since we began trials after growth was established.

Our study showed that soil buffers acids to where there was so significant difference on plant growth in this experiment, which shows that soils can support plant growth in varying acidic and alkaline environments, but more studies should test the buffering capacity of soil. Future studies for soil acidity should start with premixed soils already at these pH levels before growth is established.

References

1. Baligar, V. C., N. K. Fageria, and Z. L. He. "Nutrient Use Efficiency in Plants." COMMUN. SOIL SCI. PLANT ANAL., 32(7&8), 921?950 (2001) NUTRIENT USE EFFICIENCY IN PLANTS 32.7-8 (2001): 921-50.
2. Rengel, Zdenko. "Role of PH in Availability of Ions in Soil." Handbook of Plant Growth: PH as the Master Variable. New York: Marcel Dekker, 2002. 323-50.