

Effects of Common Urban Pollution and Runoff on the Development and Growth of Radishes

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Introduction:

Good growing conditions are essential to the healthiness of a plant. These conditions are significantly affected by pollution and runoff caused by human use.

Common forms of runoff include nitrogen runoff from over fertilization and highly basic substances such as soap, bleach and commercial cleaning products.

Goals:

To determine the effect of pollutant on plant growth and development, both singly and in combination.



Figure 1 - Control Plants 1 week after planting



Figure 2 - Control Plants 2 week after planting

Materials and Methods

Materials:

- During the experiment we used two different solutions to try and replicate common pollution in urban areas.
- A Potassium Hydroxide solution, with a pH of 11, was used to replicate the base pollution.
- A High Nitrogen Solution was used to replicate high nitrogen runoff. The solution was a full nutrients product that contained three times the recommended nitrogen.
- A full nutrients solution was used in the control group and the high pH group.

Methods:

- The solutions that were applied were applied 1 week post germination and were applied once a week after the plants were watered.
- The plants each received 10 ml of the given solution each week.
- The high pH and high nitrogen plants received 10 ml of each solution each week.
- The high pH plants received 10 ml of the basic nutrient solution as well as 10 ml of the potassium hydroxide.
- Leaf area, leaf count, and shoot length were measured each week during the application of each solutions.

Results

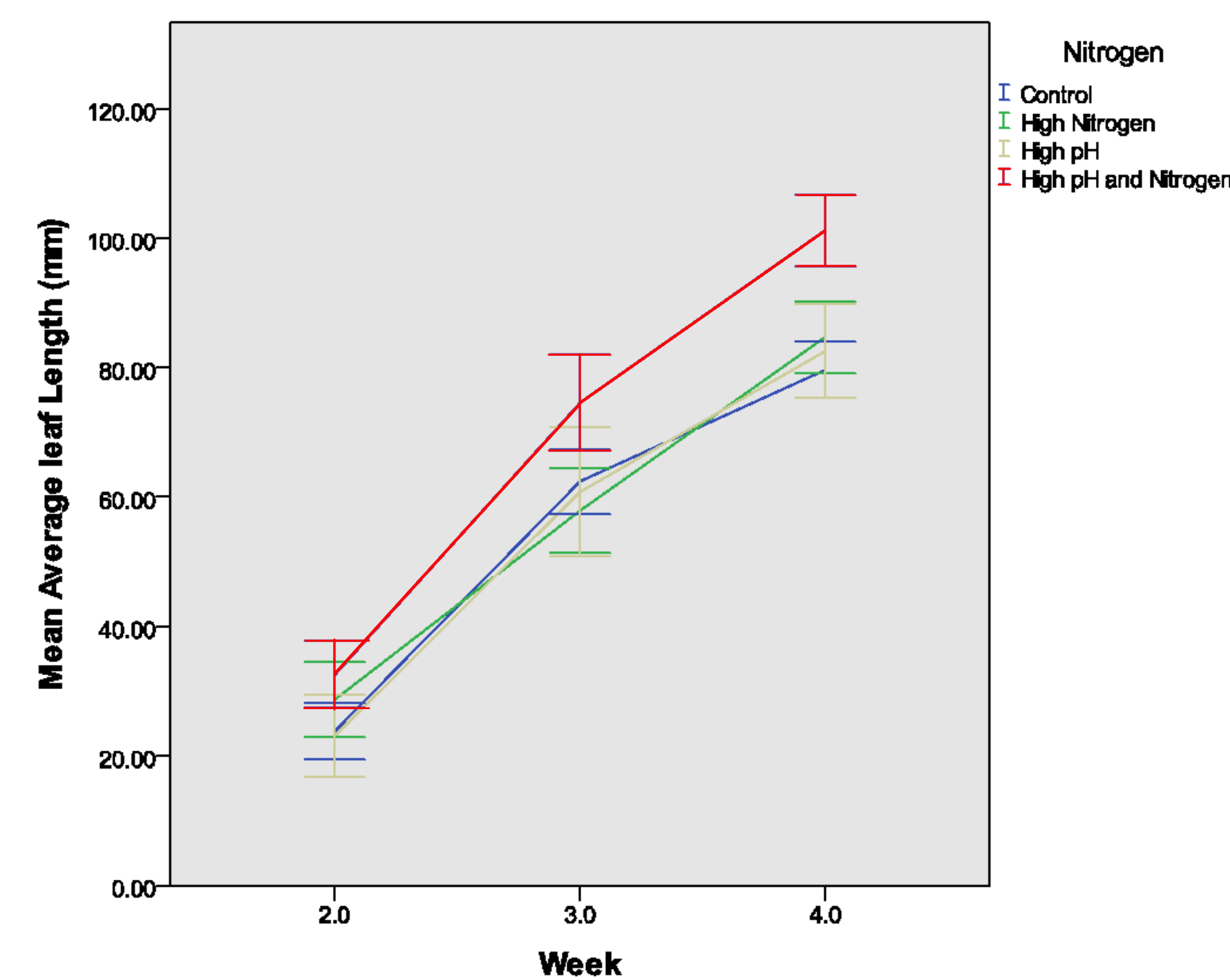


Figure 3 – Mean Average Leaf Length over three weeks after planting with 95% Confidence Intervals

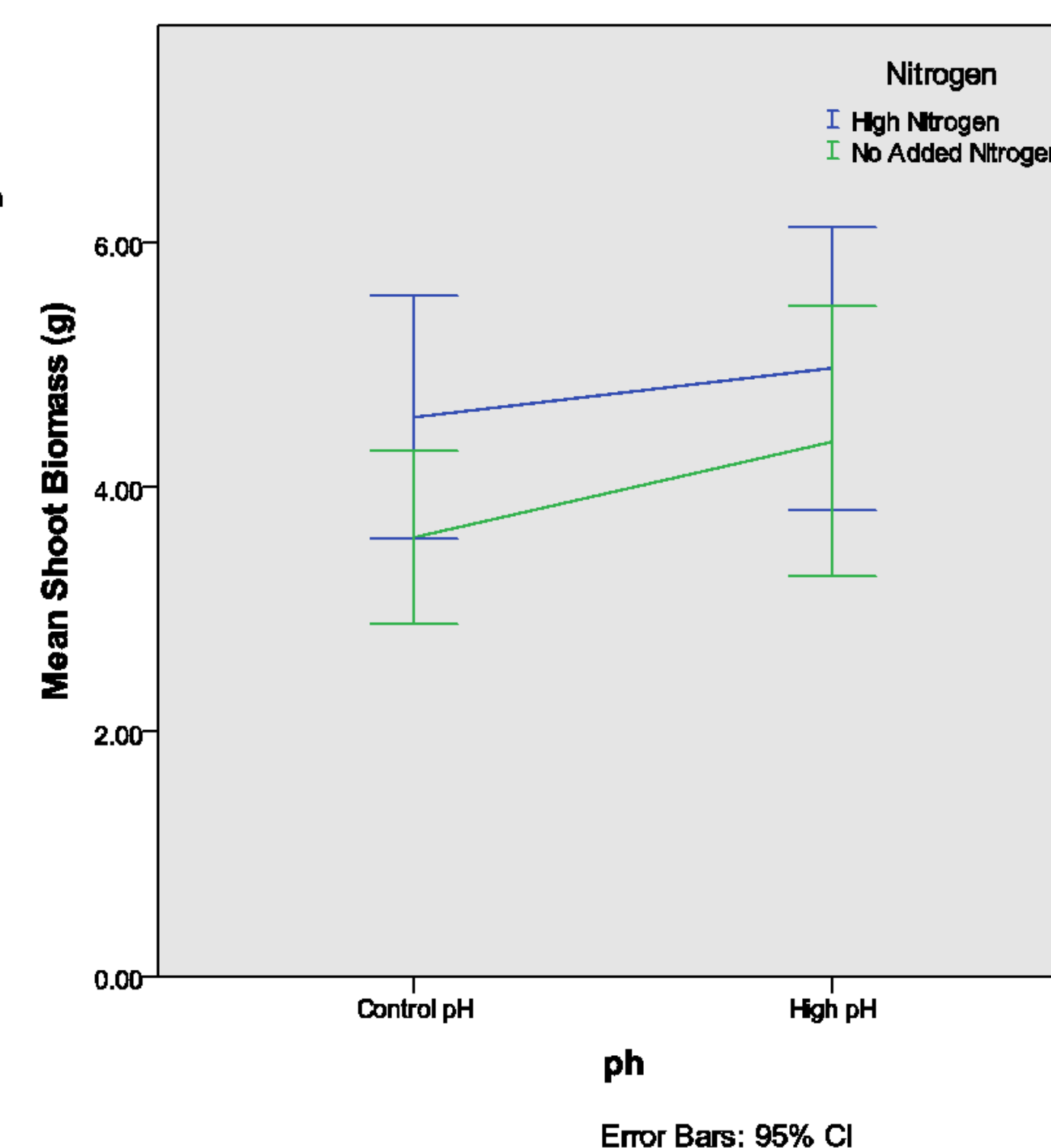


Figure 4 – Mean Shoot Biomass for test groups at end of growth with 95% confidence intervals

- Control and treated plants are shown in Figs. 1, 2, and 5
- The main difference in leaf length between the treatments was the consistently higher leaf lengths for the combined high pH and high nitrogen samples
- The effect of pH on leaf length at harvest was highly significant ($P < 0.001$)
- The effect of Nitrogen on leaf length was highly significant ($P < 0.001$)
- The effect of Nitrogen, pH, and the interaction of pH and Nitrogen was not significant
- The effects of both factors on root biomass was not significant



Figure 5 - Nitrogen being added to plants during the final week

Discussion:

The effects of the added nitrogen and increased pH were very significant for leaf length but not shoot biomass. Significance levels approached 0.05 for shoot biomass for nitrogen, and more replication would help in determining if the effect is real. We were surprised to see that added potassium hydroxide aided leaf growth, and that the two together had the greatest effects.

We also measured the effect of the variables on root biomass. The data that we pulled from the experiment was insignificant. This could be linked to experimental error due to not getting 100% of the soil out of the roots while weighing as well as possibly losing some of the root system in the soil while we were extracting the roots. More samples and better control of germination variability may help to determine whether some of the marginal differences are in fact significant.

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References

- Radish growing and planting tips: <http://www.growinganything.com/growing-radishes.html>
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- Effect of potassium Hydroxide (or increased pH) on most plants: <http://www.esf.edu/pubprog/brochure/soilph/soilph.htm>
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