The Effects on *Brassica rapa* Grown with Altered Salinity and Sand Treatments

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Introduction

In the modern world it is difficult to grow plants under ideal growing conditions outside of a lab. A common concern in plant development is the effect of other environmental stimuli that might intrude on the growth process. Salinity and altered soil are some of the most common examples of growth inhibiters. Salt can enter the plant in many uncontrolled ways, even by passing cars and plows, causing the salt to possibly enter plant cells directly, resulting in reduced or even mutated plants (Perry, 2016). Along with salinity, unstable soil is a large concern because it is the habitat of the seed, and future plant (Chapman, 2016). Differing soil compositions create different infiltration rates, causing changes of the amount of water content that is taken up by the plant. (Brouwer et a. Chapter 2, 1985). Salt enters the soil through many different methods, and if not removed will begin to accumulate (Brouwer et al. Chapter 7, 1985). This is a problem since salt has been known to stunt the growth of many types of plants, and affect different aspects of their life cycle (Bernstein 1975).

We wanted to see what affects changing these two factors, soil type and salinity, would have on a plant. We chose Wisconsin Fast Plants as our subject because of their relatively quick germination and life cycle (Growth and Development). In an experiment done on horticultural plants, it was shown that limiting reagents would affect a plant's root-to-shoot biomass ratio (Prior et al. 2011). We decided to test and see if making water the limiting reagent would affect the Wisconsin Fast Plant's root-to-shoot ratio as well. We aimed to accomplish this by altering the sand content in the soil, and salinity content of the water the Wisconsin Fast plants received.

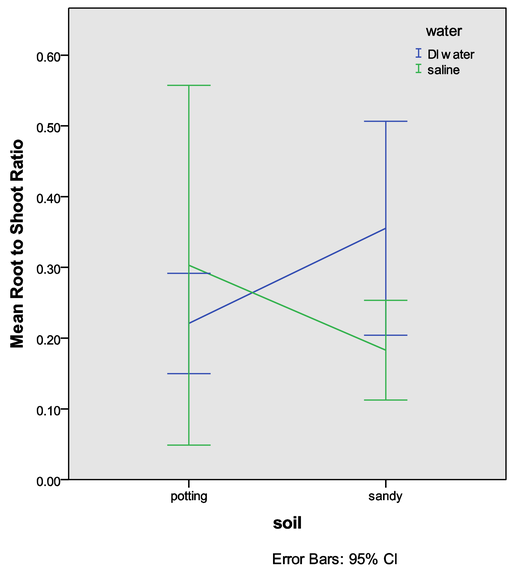
Materials & Methods

***First week (October 11, 2016)**
Ten Wisconsin Fast Plants were planted in 4 trays each (totaling 40 plants). The trays were labeled A, B, C, and D. The trays labeled A and B were planted with normal potting soil. The trays C and D were planted with a soil mixture with 75% soil and 25% sand.
***Second week (October 18, 2016)**
All 40 plants had germinated. The leaves were counted, as well as the heights were measured using cm. After data collection, all 4 trays were watered sufficiently with pure water. After watering, Trays B and D were watered with 10 mL of a salt water mixture on each plant as well.
***Third week (October 25, 2016)**
The same procedure was continued for the 3rd week as was done in the 2nd week. Along with this procedure, the reproductive buds, flowers, and color changes were also collected.
***Fourth week (November 1, 2016)**
The same procedure was continued as the 3rd week. This week, the Root and Shoot biomass was also measured, after all 40 plants were uprooted. The roots and shoots were separated from each other, washed thoroughly in water to removed excess dirt, and allowed the roots and shoots to dry before measuring their masses.

Treatments:

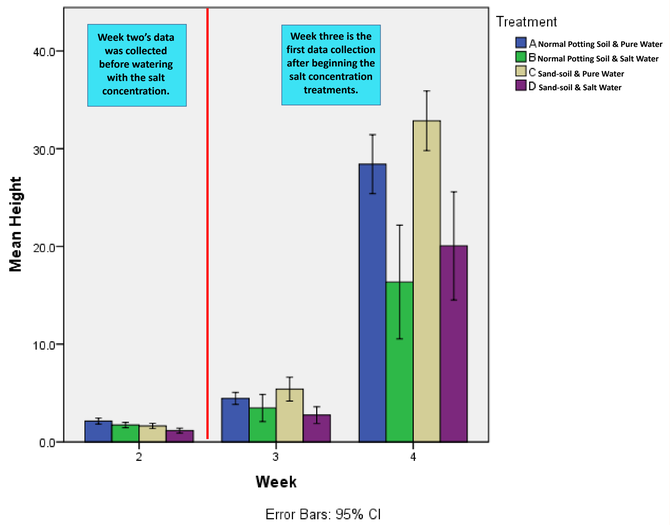
Normal Soil	A	B
Sandy Soil	C	D
	Pure Water	**Salt Water Mixture**

Graph 1: Root to Shoot X Soil



Graph 1: Root to Shoot Biomass ratios of all four treatments. The data shows overlap in the 95% confidence intervals, revealing no significance of the individual treatments, but shows the interaction between water and soil type.

Graph 2: Height X Week



Graph 2: Heights of the plants after germination. The very top of the bars indicate the mean plant heights per week, and the error lines indicate 95% confidence interval for plant heights. When comparing week two's error lines to week three and four's, it is very obvious that salt greatly reduced the growth and production of the plants.

Image 1: Treatment A during Week 3 (taken on October 25th 2016), this was the first data collection after the salt treatments began.

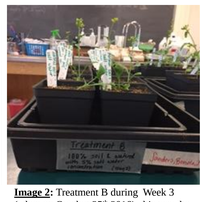


Image 2: Treatment B during Week 3 (taken on October 25th 2016), this was the first data collection after the salt treatments began.

Image 3: Treatment C during Week 3 (taken on October 25th 2016), this was the first data collection after the salt treatments began.

Image 4: Treatment D during Week 3 (taken on October 25th 2016), this was the first data collection after the salt treatments began.

Root to Shoot Ratio X Soil Results

This graph depicts both types of soils interacting with the two types of water. The blue lines indicate treatments watered with pure water, and the green lines represent the treatments watered with a salt water concentration.

The graph shows overlap in the 95% confidence intervals, revealing no significance. Although the individuals showed no significant data, their interactional relationship is clearly significant. The differing slopes show significance in the collaboration of water and soil. The perpendicular lines on the graph show that the soil type and salinity have a direct and significant effect on the growth cycle of plants.

Height X Week Results

This bar graph shows all four treatments over the course of three weeks. Week two was when the plants officially had germinated, so this is when the plants were first watered with the salt water concentration. However, the data for week two was collected prior to the first salt-water treatment. This is most likely why all week two's data is virtually the exact same for all treatments.

On the graphs, the top of the bars are the mean plant heights, and the error lines indicate 95% of the plant's heights. When comparing week two's error lines to week three and four's, that salt greatly reduced the growth and production of the plants.

Conclusion

When brainstorming for this experiment, the potential of observing environmental changes on these 40 plants was very intriguing. These four treatments allowed us to witness these altered life cycles. Conducting these experiments confirmed the fear of salinity and soil type affecting the plant's life cycle. As seen through our data collection, soil type and salinity within water have a clear and direct interactional relationship. This relationship affected the plant's Root to Shoot Biomass. Also, their interactions inhibited growth features, such as height. After conducting these experiments, over 4 weeks, our data concluded that salt reduced the growth of these plants, and soil type was not as significant.

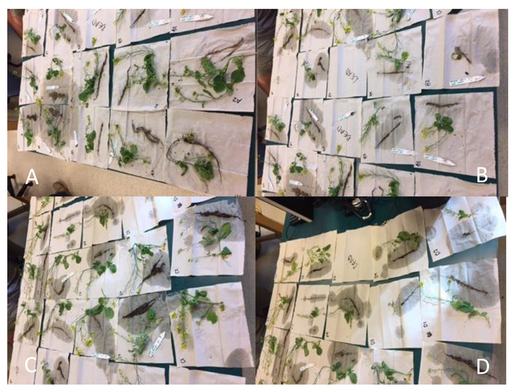


Image 5: All treatments were uprooted after 4 weeks, collecting Root to Shoot biomasses.

Image 6: All 10 plants of Treatments B uprooted after 4 weeks, collecting Root to Shoot biomasses.

Image 7: All 10 plants of Treatments C uprooted after 4 weeks, collecting Root to Shoot biomasses.

Image 8: All 10 plants of Treatments D uprooted after 4 weeks, collecting Root to Shoot biomasses.

Works Cited

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