QUANTITIVE ANALYSIS OF HOW SODIUM AND LIGHT INTENSITY AFFECTS *RAPHANUS SATIVUS* DEVLEOPMENT AND GROWTH

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INTRODUCTION

Raphanus sativus (radishes) is an edible root vegetable in a Bassicaceae family. The seed germinates fast in three to four days in moist conditions. Growth analyzed through leaf color, leaf expansion, texture, height, and nutrient uses. Salinity causes yield reductions in many glycophyte crop plants throughout the world (Marcelis and Hooijdonk, 1999). High salinity can result in too high internal ion concentration and cause growth reduction(Greenway and Munns, 1980). Distilled water is flushed of it's minerals in the water, therefore we used this to see growth versus sodium chloride affects. As well as light intensity, it manufactures plant food, stem length, leaf color, and flowering. Low light intensity tends to have lighter leaves and high intensity tends to grow larger, and dark green leaves (Grumbach and Lichtenthaler, 1982). *Raphanus sativus* requires 6 hours of sun per day, and duration and intensity of light have been shown to increase the elongation of the radish and allow it's maximum growth. (Hall, 1990).
In our experiment, we are testing the light intensity and salinity level on radishes (*Raphanus sativus*) growth and germination. By adding sodium chloride and then adding distilled water with high and low intensities of light. We expected the salinity to decrease the growth of the radishes, and the high intensity to increase growth.

MATERIALS AND METHODS

Plants: We placed 3 seeds of *Raphanus sativus* planted 1 ½ inches deep in un-supplemented potting soil in a 3 ½" x 3 ½" x 3 ½" pot. Total 40 pots. An additive of fertilizer (Osmocote ™) was added the second week.
2 independent variables- 2x2 experimental design
4 treatments:

High Int. with NaCl	High Int. with Distilled
Low Int. with NaCl	Low Int. with Distilled

Light intensity: Constant for 3 weeks: Light intensity kept under high, a foot close to the lamps. The low intensity sat 4 feet away from the lamps.
Salinity: Once a week for 3 weeks, 1 mL of sodium chloride with distilled water applied with syringe. 1 mL distilled water from faucet applied with syringe.
Measured once a week: By hand, stem length to apical meristem, width of the biggest cotyledon leaf, stem width (measured with caliper), and counted the true leaves.
Measured at harvest: Biomass of *Raphanus sativus* on a digital scale.

ACKNOWLEDGEMENTS

We would like to give a special thank you to Dr. Doust for his guidance, willingness, and devotion for making this project possible. To Ky Shen for advising and assisting us along the way to make our projects to the best of our ability. Also, Dylan Franks for his assistance during lab as well.

RESULTS

In regards to biomass, the p-values are as follows:
Salt: 0.01155
Light: 3.499e-15
Interaction: 0.001039

Here are the p-values for the width of the stem over 3 weeks
Week 1
Salt: 0.002525
Light: 2.2023
Interaction: 0.4409
Week 2
Salt: 0.2435
Light: 1.202e-13
Interaction: 0.1697
Week 3
Salt: 0.4704
Light: 4.673e-06
Interaction: 0.03877

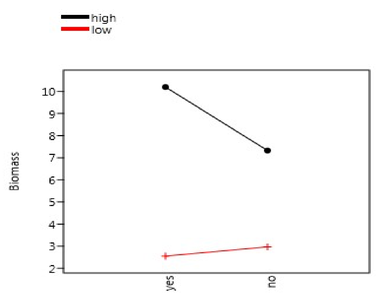

Figure 1.1 Shows the biomass of the salt and light. High intensity light with salt increased the biomass dramatically. Whereas no salt with low intensity didn't grow bulbs of radish.

Examples of width from week 3. (Left) is High intensity, the bulb is clearly shown. (Right) Low intensity with thin width shown.

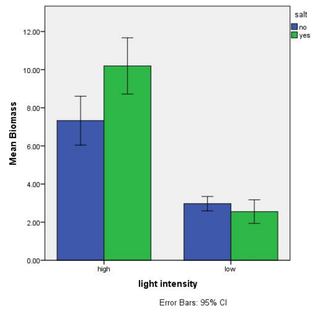

Figure 1.2 The high light intensity without salt the biomass increased more than no salt. The low light intensities no matter the salt concentration didn't develop radish bulbs.

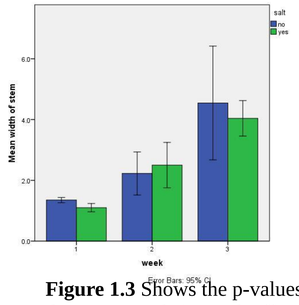

Figure 1.3 Shows the p-values of the width of the stem. Week 1 no salt affected the radish. Following weeks shows salt and light increased the width of the stem.

DISCUSSION

We found that the aspect that was affected the most was the biomass of the radishes. There was a significant interaction between salt and light intensity. We found that in the radishes treated with high intensity light, the plants with the salt had a higher biomass than the ones without salt. Whereas, in the low intensity treatment group, it was the exact opposite.
When we looked at the results for the width of the stems and the affects the treatments had on them, we found something interesting. In the first week, we found that only the salt concentrations had a significant effect on the plants. In week two and three, we found that only the intensity of light had a significant effect on the plants; however, the interaction was significant between salt and light intensity in week three. We do not know why this is the case.

CONCLUSION

The salinity concentration caused a reduction in the chlorophyll of the plant. The shoots of the plant seemed to elongate, but as the biomass at the end of the experiment indicated, the *Raphanus sativus* did not produce an edible bulb at the root. Sodium seems to inhibit the ability for the plant to properly under photosynthesis. The light intensity under high lamps grew a significant amount of leaf hairs, as the low intensity had a green pigment with taller plants. In conclusion, the less sale city the soil contains, the more beneficial it is to the ability for the plant to establish root growth.

REFERENCES

Greenway H and Munns R. 1980 Mechanisms of salt tolerance in nonhalophytes. Ann. Rev. Plant Pysiol. 31, 149-190.
Grumbach Karl. H, Lichtenthaler Hartmut K. 1982 Cholroplast pigments and their biosynthesis in relation to light intensity. Photochemisty and Photobiology. 35: 209-212.
Hall, B. C. 1990 Relation of light intensity to radish root shape. University of Florida, IFAS Vegteable Crops Department. Soc. 103: 100-101.
Marcelis L F M, Heuvelink E and Goudriaan J 1998 Modelling biomass production and yield in horticultural crops: a review. Scientia Hortic. 74, 83–111.
Marcelis L F M, Hooijdook J. Van 1999 Effect of salinity on growth, water use and nutrient use in radish (*Raphanus sativus* L.). Kluwer Academic Publishers. 215: 57-64.