# The Effects of Nitrogen and Surfactants on Plant Germination and Growth in *Raphanus Satibus* (Radishes)

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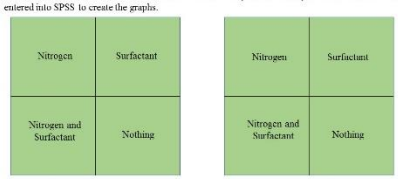
## Introduction

- *Raphanus sativus*, or radishes, are plants within the Brassicaceae family which also includes turnips, cabbages, and horse radishes. Although *Raphanus sativus L* is a product of human intervention through selective breeding, studies have shown that it evolved in the eastern Mediterranean region (5).
- Germination is the awakening of the metabolic activity in a plant (2). Different environmental conditions may effect the germination process (4).
- Surfactants and nitrogen are found in run off water, such as the water in Boomer Lake, in amounts of up to 0.002 g/L (7).
- Overall, increasing amounts of surfactants have negative effects on plant growth and survival. In an experiment on Sorghum Seedlings, those who were exposed to solutions of surfactant wilted in 2 to 3 days. Roots and shoots showed sever damage at higher concentrations (3).
- Nitrogen is an essential macronutrient for all plants. Particularly in plant tissues and roots, nitrogen plays an important role in plant growth, development, and nutrient and water uptake (1).
- We hypothesize that the growth in radish plants will increase by optimizing the nitrogen levels and that the growth will be inhibited by adding in a surfactant.
- A germination experiment will be conducted as an exploratory experiment.

## Materials and Methods

- We obtained four planting boxes with 36 individual planting slots each, then planted two radish seeds in each slot.
- After sufficient watering, two of the planter boxes were treated with either nitrogen, surfactant, both, or neither. This was the before germination treatment of our experiment.
- All of the planting boxes were covered in plastic wrap to hold water in during germination and watered when needed for the next seven days.
- The next week, all of the plant heights were measured and recorded, then the after germination treatment was applied to the two planter boxes that did not receive anything the week before.
- In the last week, all of the plant heights were measured and recorded again, then every plant was uprooted, cleaned, and weighed for plant biomass.
- All the data was entered into PAST in order to do a two way ANOVA analysis for our data and then entered into SPSS to create the graphs.




## Results

### Germination Trial:

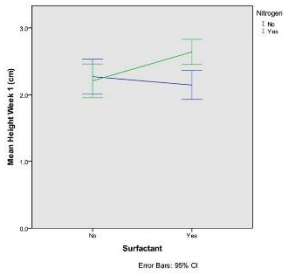



Fig. 1 The interaction between nitrogen and surfactant is significant (p=0.015).

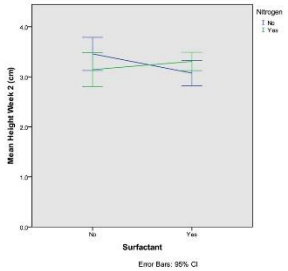



Fig. 2 The interaction between nitrogen and surfactant is significant (p=0.05).

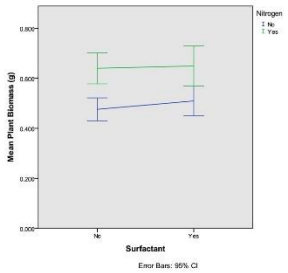



Fig. 3 The nitrogen is very significant (p<0.001).

### Growth Trial:

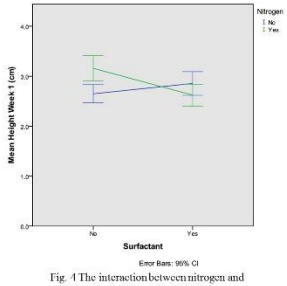



Fig. 4 The interaction between nitrogen and surfactant is significant (p=0.001)

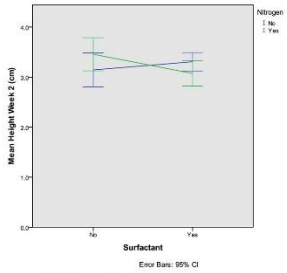



Fig. 5 The surfactant is significant (p=0.026).

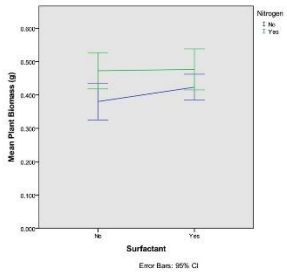



Fig. 6 The nitrogen is significant (p=0.006).

## Discussion

- The results led us to accept part of our hypothesis that increased growth would occur with greater amounts of nitrogen.
- The results from the first week of the growth trial are interesting because the plants were not given the treatment until after measurements had been taken. The data for week two continued to show the same height results for the growth trial therefore the height measurements for the growth trial have to be dismissed when considering the results of the overall trial.
- The heights for week 1 in the germination trial versus the growth trail were inverse, yet the data still showed the interaction was significant.
- Errors in measuring heights due to soil sinkage could have lead to slightly skewed data. Height in radishes can become more difficult to measure as the plants mature.
- Biomass is a good measurement in radishes since they produce a lot of their mass under the ground.
- Possible contamination from the germination trial pots could have resulted in skewed data. Variations in lighting conditions could also have played a role in the differing results.
- Not very much variation between germination and growth. Slightly different coloration, germination trial appeared to have a much redder tint at the bottom of the stem.
- One study found that surfactants did not effect the root systems of plants as much as the shoot systems (6). Our results lead to the same conclusion.

Fig. 7 Germination trial plants appeared to have a much redder stem than the growth trial plants.

## Acknowledgments

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## References

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