The Influence of Roadside Conditions on the Shoot Growth of Wisconsin Fast Plants (*Brassica rapa*)

Kayley Tezbir & Dr. Kerrie Sendall
Department of Biology, Behavioral Neuroscience and Health Sciences, Rider University

Introduction

Impermeable surfaces such as roads or parking lots cause urban runoff from rain or snowmelt events. This runoff can cause flooding and contains a multitude of pollutants such as salt from road deicing efforts or motor oil from leaky cars. These contaminants can affect surrounding soils and bodies of water, and therefore vegetation.

- Objective: See how increased salinity, motor oil pollution, or soil compaction (which is linked to flooded conditions) affects the aboveground growth of three varieties of Wisconsin Fast Plants (*Brassica rapa*) over a 5-week period.
- Hypothesis: Treatments of salinity, oil, and compaction will cause a reduction in aboveground plant growth when compared to the control.



Methods

- For each treatment, there was a total of 18 nursery pots (n = 6 per group) devoted to either the standard, petite, or tall plant seed varieties. Three seeds were planted per pot.
- *Salinity Treatments:* were watered with 50mL of either a 230mg NaCl/L, 4g NaCl/L or 35g NaCl/2L solution once a week and watered with distilled water twice a week.
- *Oil Pollution Treatments:* Grown in soil polluted with full synthetic motor oil (5% oil w/w or 10% oil w/w)
- *Compaction Treatments:* Grown in soil that was compacted either 1.5 cm or 3.0 cm prior to planting seeds.
- Plants were grown for 5-weeks and were watered 3x per week. The aboveground growth of each plant was measured once a week. Following the growth period, data was analyzed using multi-factor ANOVAs.

References

1. Müller, A., Österlund, H., Marsalek, J., & Viklander, M. (2020). The pollution conveyed by urban runoff: A review of sources. *Science of the Total Environment, 709.* https://doi.org/10.1016/j.scitotenv.2019.136125.
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3. Ilyas, N., Shoukat, U., Saeed, M., Akhtar, N., Yasmin, H., Khan, W., & Iqbal, S. (2021). Comparison of plant growth and remediation potential of pyrochar and thermal desorption for crude oil-contaminated soils. *Scientific Reports, 11*, 2817. https://www.nature.com/articles/s41598-021-82243-y#citeas.

Results

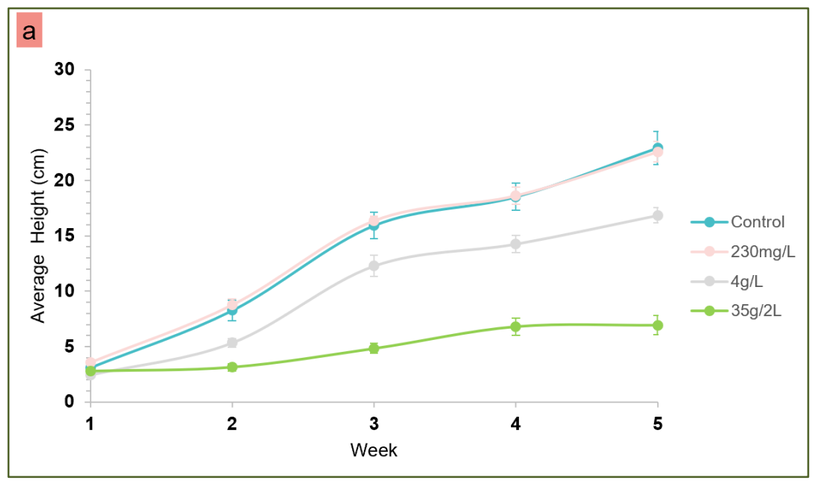

Figure 1. Average height (cm) ± SE for (a) standard, (b) petite, and (c) tall plant seed varieties in control, 230 mg/L, 4 g/L and 35 g/2L salinity treatments grown over 5 weeks. The p-values of treatment, time and seed variety are < 0.001.

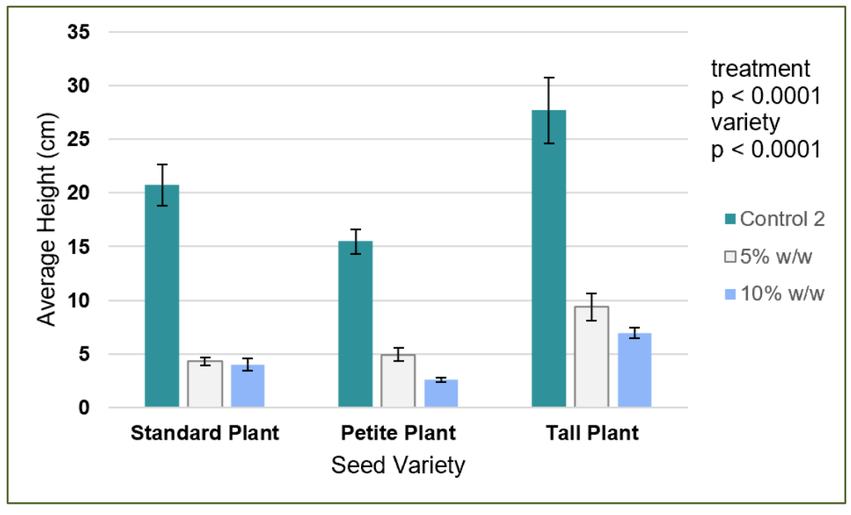

Figure 2. Average height (cm) ± SE for each of the seed varieties in control, 5% w/w, and 10% w/w oil treatments. The p-values of treatment and seed variety are < 0.001.

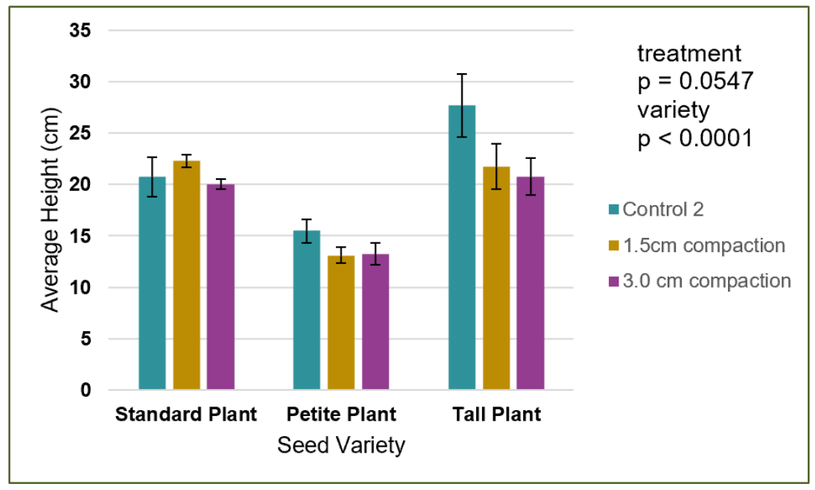

Figure 3 Mean height (cm) ± SE for each of the seed varieties in control, 1.5cm compaction, and 3.0cm compaction treatments. The treatment p-value = 0.0547 and the seed variety p-value is < 0.001

- Over a 5-week period, increased salinity led to a significant reduction in growth for all seed varieties, with the 35g/2L treatment leading to the greatest reduction in growth ($p < 0.0001$).
- Oil pollution of both 5% w/w and 10% w/w led to a significant reduction in aboveground growth of all seed varieties ($p < 0.0001$).
- 1.5 and 3.0 cm compaction led to a marginal reduction in aboveground growth for all seed varieties ($p = 0.0547$).


Conclusion

Results from this study mostly support our hypothesis and suggest that Wisconsin Fast Plants are sensitive to higher levels of salinity and to oil polluted soil ($p < 0.0001$) but they are tolerant to some amount of soil compaction ($p = 0.0547$).

The components of urban runoff should be more closely monitored in order to allow roadside vegetation to grow successfully and help prevent soil erosion and excess flooding. Efforts should be made to find better alternatives to road salt for deicing efforts and to emphasize the necessity of regularly maintaining cars.

Future directions: In a future study, it may be interesting to see how multiple elements (e.g. excess salinity and motor oil combined) affect the growth of vegetation. Furthermore, it may be beneficial to use existing roadside grasses or wildflowers instead of Wisconsin Fast Plants.