ACRRE ALBERTA CENTRE FOR RECLAMATION AND RESTORATION ECOLOGY
RESEARCH NOTES
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Rat root plants may not be suitable for reclaiming oil sands tailing ponds

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The Challenge

Reclamation projects underway in northern Alberta aim to convert tailings ponds—a byproduct of oil sands production that typically have high pH and salinity—into constructed wetlands. Though research suggests that these wetlands can support healthy aquatic plant communities, we know little about the combined effects of high pH and salinity on plant growth.

Rat root (*Acorus americanus* Raf.) is a native species that has been effectively used in reclamation projects outside of the oil sands region, as it has high ecological value and significant cultural value to First Nations groups. This study tested the ability of rat root to grow in a high pH/high salinity environment, similar to that of a constructed wetland.

The Approach

Growth of rat root was tested in two different experiments. The first tested plant response to seven different pH levels (range 6.0-9.5). The second experiment tested four different salinity levels (range 0-100mmol/L) while holding pH constant at either neutral (7.0) or high (8.5) levels. Throughout the study researchers measured a series of variables (growth rate, plant mortality, leaf transpiration rates, chlorophyll concentration, nutrient uptake) to quantify rat root growth and development.

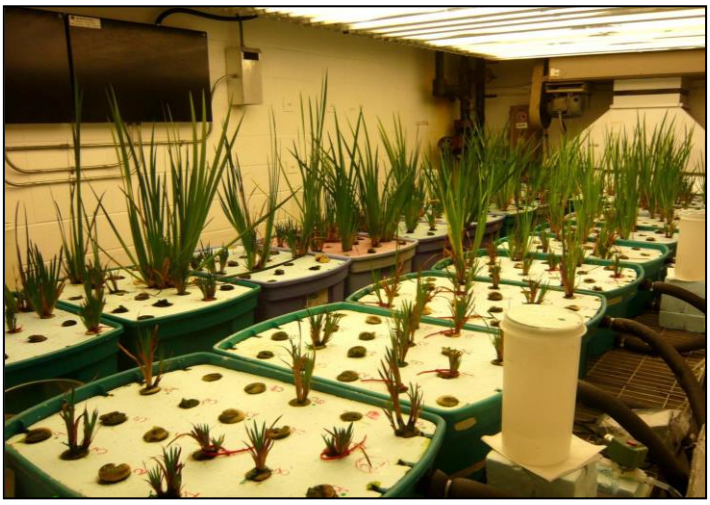

Fig. 1 Rat root trials after 3 months exposure to high pH

The Results

The researchers found that increasing pH alone had less of an impact on plant development than the combination of high pH and high salinity.

As pH increased, rat root growth rates were initially reduced, though the effect was minimal over time. Chlorophyll concentrations decreased with increasing pH, which could affect long term plant growth, and root growth was stunted at higher pH.

With increasing salinity, however, there was a decline in rat root growth rate, transpiration rate, and chlorophyll concentrations – these effects were even greater with high pH. The rat root had reduced shoot growth, and eventually died as both salinity and pH increased.

The researchers then compared their study results with other research on plants used in constructed wetlands, to assess the relative performance of rat root in a reclamation program.

Management Implications

- Rat root appears to have a lower salinity tolerance than other plants commonly used in constructed wetlands.
- A pH greater than 7.5 and salinity values greater than 25 mmol/L will have a negative impact on rat root growth.
- Despite its ecological and cultural significance, rat root may not be an appropriate species to use in tailings pond reclamation in the oil sands region.

Further Reading

Calvo-Polanco, M. *et al.* 2014. Responses of rat root (*Acorus americanus* Raf.) plants to salinity and pH conditions. *Journal of Environmental Quality* **43**: 578-586.

Equiza, M.A. and J.J. Zwiazek. 2014. Nitrogen form affects physiological responses and root expansigenous honeycomb aerenchyma in the emergent macrophyte *Acorus americanus*. *Botany* **92**: 541-550.

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