A Greenhouse Experiment to Test Salinity Tolerance in the Key Tree Cactus

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BACKGROUND

Increased soil salinity from storm surge and sea level rise may be a contributing factor to the recent sharp decline of the Key tree cactus *(Pilosocereus robinii)* in the Florida Keys. If salinity is the major contributor to *P.robinii* mortality, then it is constraining where the species can persist. Prior to conducting any reintroductions, it is important to define the range of its salinity tolerance and the range of salinity present at any proposed recipient site. Thus, we initiated salinity tolerance studies and compare these to salinity measures of wild sites.

Figure 1. Key tree cactus survey results.

EXPERIMENTAL METHODS

On Jan 28, 2011 we cut stems from 130 seedlings germinated in 2008.Seedlings originated from seeds of single fruits collected from two maternal lines; 91 cuttings came from Maternal 1, a plant cultivated in a private garden in Miami originally purchased at a plant sale, and 39 cuttings came from Maternal 2, plant formerly growing in the lower Florida Keys.

We assigned 26 cuttings into one of five salinity treatment groups and watered them every other day for seven weeks with 600 ml of salt solution.
Treatments:

1) 0 mM NaCl control plants received only reverse-osmosis water with no detectable sodum ions;
2) 2 mM NaCl, representing low soil sodium concentrations we detected at one proposed reintroduction site;
3) 15 mM NaCl, representing the mean soil sodium concentration detected at BPKE, where *P. robinii* had low mortality between 1994 and 2007;
4) 40 mM NaCl, the threshold for osmotic stress in salt-sensitive plants and comparable to the mean soil sodium concentrations measured at at site in the lower keys
5) 80 mM NaCl, representing twice the concentration of threshold stress sodium concentrations.

To supply the plants with some nutrition, we watered all cuttings with 50 ml of 0.1% Hoagland's solution once a week for seven weeks.

We measured differences in growth of shoots and roots, physiology (transpiration and photosynthetic pathway) and tissue electrical conductivity (CEC) and sodium (Na) and potassium (K) ion concentrations in *P. robinii* grown in the varying salinity treatments.

RESULTS

Growth

Maternal line influenced the degree to which stem growth and root:shoot ratios changed across salinity treatments. There was a significant interaction between maternal lines and salinity treatment. Maternal 2 had significantly decreased shoot growth and reduced root:shoot ratio at 80 mM NaCl, however maternal 1 did not. Surprisingly, both maternal lines experienced increased stem growth up to 15 mM NaCl. While Maternal 1 stem growth significantly increased at 40 mM NaCl, Maternal 2 growth at 40 mM NaCl was not significantly different than controls.

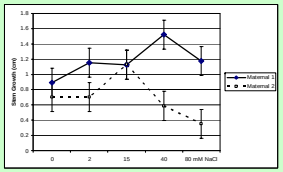


Figure 2. Stem growth

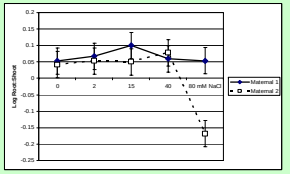


Figure 3. Root:Shoot ratio

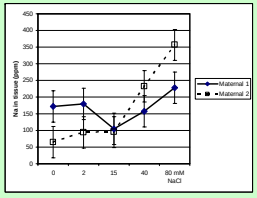


Figure 4. Mean Na in plant tissue

Levels of Sodium in Plant Tissue

Sodium ions tended to accumulate in plant tissue as the concentration of salt in treatment solutions increased. There was some evidence that Maternal 1 plants actively decreased Na at 15 mM NaCl concentrations, because levels of accumulated Na were slightly, though not significantly lower than in the control group. Sodium accumulated in Maternal line 2 tissue growing in the 80 mM NaCl treatment, however it only slightly accumulated above control levels in Maternal 1.

CONCLUSIONS

1) There was variation in salt tolerance across maternal lines of Key tree cactus. BPK collection was very salt sensitive.

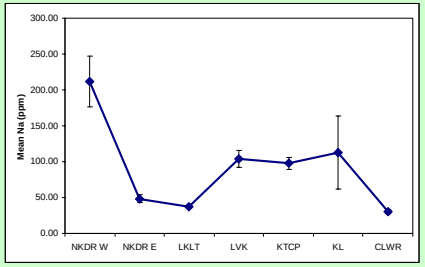
2) At least one reintroduction site (CLWR) had salinity levels well within the tolerance of both maternal lines that were tested.

3) BPKW salinity levels were significantly greater than other sites even 4 yrs post storm-surge event.

4) Reintroductions with some salt-tolerant genotypes would be beneficial.

5) A second source of mortality may have been inundation. Trials are underway.

SODIUM CONCENTRATIONS AT WILD SITES



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