A Novel Technique for Rapidly Separating Willow Roots from Clay Soil

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INTRODUCTION

- Roots are an integral component of plant morphology and physiology, in addition to an important constituent of the plant carbon sink. Therefore, documenting root growth dynamics, in particular the fine root fraction, is essential.
- Numerous studies have examined roots dynamics in sandy to loamy textured soils, using soil coring and minirhizotron techniques. However, neither approach is well suited for studying roots in soils with high clay content.

OBJECTIVE

- Test the efficacy of an inexpensive soil core washing pre-treatment, using baking soda ($NaHCO_3$), for facilitating the separation of willow roots from a Sutherland Association Orthic Vertisol with 70% clay.

MATERIALS & METHODS

- Soil cores were collected from a plot of Tully Champion willow (*Salix viminalis* x *S. miyabeana*) and were either conventionally washed (i.e., no pre-treatment) or washed following a pre-treatment consisting of shaking the sample for 15 minutes with either deionized water or 1.2*M* $NaHCO_3$.
- Measurement variables included washing duration, water usage, recovery of fine (< 2 mm) and coarse roots, and willow stem biomass.

RESULTS

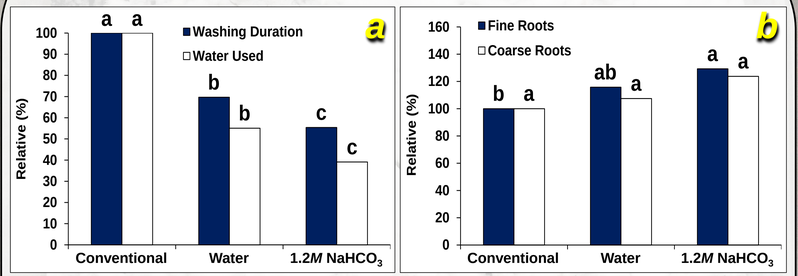

Figure 1. Mean (n = 12) washing duration and water used to separate willow roots from a heavy clay soil core (a) and fine (< 2 mm) and coarse root biomass recovered (b), washed conventionally or following a pre-treatment consisting of shaking the core in solution for 15 minutes with either deionized water or 1.2M $NaHCO_3$. Bars with the same letter are not significantly different (P >0.05) using LSD. Note: only means comparisons within a measurement variable are valid.

- Compared to conventional washing, the 1.2*M* $NaHCO_3$ pre-treatment reduced the washing duration and water usage by 45 and 61%, respectively, while increasing fine-root recovery by 29% (Figure 1a and b). There was no significant difference ($P > 0.05$) in coarse root recovery among the three washing methods.
- Willow stem biomass was only correlated with the fine root biomass recovered after the 1.2*M* $NaHCO_3$ pre-treatment (data not shown).

DISCUSSION & CONCLUSION

- The Na^+ in the 1.2*M* $NaHCO_3$ solution exchanged with the Ca^{2+} on the clay mineral surfaces, deflocculating the soil aggregates, thus creating a dispersive environment that was more conducive for root separation.
- Minimizing the washing duration enabled a greater recovery of fine roots, especially the smaller higher-order fine root fraction (< 0.5 mm) that can comprise the majority of willow fine roots. This would explain the correlation of the 1.2*M* $NaHCO_3$ pre-treatment fine root biomass data with willow stem biomass, unlike the other two treatments.
- A quicker technique of separating willow roots from high clay content soil, which also conserves water and increases fine root recovery, should facilitate further investigations of root growth dynamics in this traditionally difficult soil type.

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