Root regeneration after fall and spring root severance of two common urban tree species, *Acer platanoides* and *Betula nigra*.
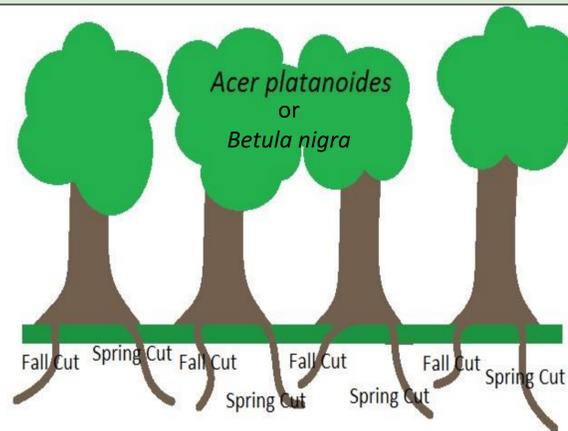
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Background

- Roots are severed when field grown trees are transplanted, affecting the trees' ability to absorb water until the lost roots are replaced[4]. Thus, root regeneration after transplanting is key for further success of the tree.
- We investigated root regeneration of two common urban tree species *(Acer platanoides* and *Betula nigra)* after fall and spring root severance to help understand how seasonal differences in root regeneration affect successful transplanting.
- Transplanting success can differ depending on season and species. *A. platanoides* is likely to succeed when transplanted either in spring or fall, but *B. nigra* only when transplanted in the spring. Root systems begin to grow at ~6° C and continue to grow more rapidly as temperature increases[3] with optimal root growth occurring between ~20-28° C[2]. Severed roots of trees that are transplanted in the fall are subject to harsh winters which may affect the initiation and growth of new roots from the cut end. Because of this, the fall cut roots may have reduced root regeneration and could account for poor transplant success of *B. nigra* in the fall.
- Our results better inform tree planting as urban and suburban sprawl continues to demand healthy trees.

6/12/18
93 days after cut

6/28/18
109 days after cut

7/11/18
122 days after cut

Images of mapped roots on Root Snap! of *B. nigra* tube 6 (spring cut roots). Red marked roots are "dead" (not used in data presented here), blue marked roots are "new" which were eventually compiled with "alive" roots, that are shown marked as green.

Materials and Methods

- Four *A. platanoides* trees from Cole Nursery Co. and four *B. nigra* trees from J. Frank Schmidt & Son Co. in The Morton Arboretum tree nursery were used.
- Two roots approximately 2 cm diameter approximately 1.5 m from the base of each tree were cut using a pruner, one in the fall of 2017 and one in the spring of 2018.
- Minirhizotron tubes were inserted into a 7 cm diameter hole dug by a power auger near the end of each cut root.
- Approximately every other week, starting in May 2018, the roots were scanned using a CI-600 In Situ Root Scanner.
  - Note: scan images from previous scans in February and April were also used in data analysis
- The images were stitched together in Microsoft Paint and the roots were mapped on RootSnap!
- Average total length of live roots for each scan date, season, and species was calculated.


Acer platanoides or *Betula nigra*

Fall Cut | Spring Cut | Fall Cut | Fall Cut | Spring Cut | Spring Cut

Four trees of either *Acer platanoides* or *Betula nigra* were used, Two roots were cut at the base of each tree, either in the fall or in the spring. Root length was measured as the cut roots regenerated.

A CI-600 In Situ root scanner was inserted into minirhizotron tubes at the base of each severed root. Scans were taken as the roots continued to regenerated around the tube surface.

Results

Seasonal Root Regeneration of Acer platanoides

Seasonal Root Regeneration of Betula nigra
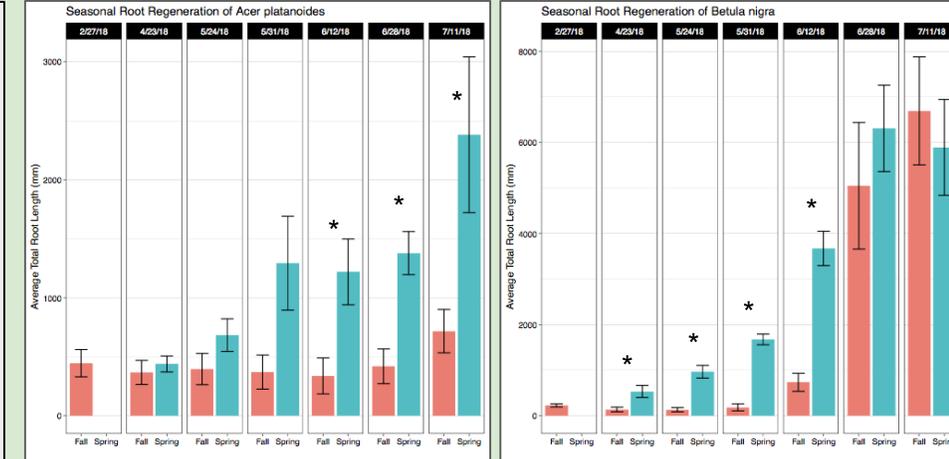
- Soil temperature was above 6° C throughout the entire day by 4/29/18 according to The Morton Arboretum weather data, marking the beginning of active root growth.
- In *A. platanoides* roots for both spring and fall cuts regenerated equally in the spring months.
- In *B. nigra* the spring cut roots regenerated significantly more than fall cut roots during the spring months.
- Towards the end of the summer, *A. platanoides* spring cut roots regenerated more than the fall cut roots.
- Root regeneration for *B. nigra* was similar by the end of the summer for fall and spring cut roots.

Conclusion and Future Directions

- The lack of root regeneration during the spring months for fall cut roots in *B. nigra* could be responsible for its poor transplant success in fall.
- Future research may be conducted to determine the reason for faster root regeneration for spring cut roots during summer, as observed in *A. platanoides*.
- Further research testing variables such as water absorption, soil temperature, and drought tolerance may provide further insight into variables affecting root regeneration.
- Results from this project as well as future research projects will help arborists and nurseries decide the best season to successfully transplant certain species of trees, creating greener and healthier cities.

References:
1. Hommel, R., Siegwolf, R., Zavadlav, S., Arend, M., Schaub, M., Galiano, L., . . . Gessler, A. (2016). Impact of interspecific competition and drought on the allocation of new assimilates in trees. Plant Biology,18(5), 785-796. doi:10.1111/plb.12461
2. Lyr, H., & Hoffmann, G. (1967). Growth Rates and Growth Periodicity of Tree Roots. International Review of Forestry Research,181-236.
3. Solfjeld, I. (2008). Root Growth After Transplanting: The Role of Transplant Timing, Root-Zone Temperature, and Adequate Soil Volume. The Landscape Below Ground, III, 230-236.
4. Struve, D. K., & Moser, B. C. (1984). Root System and Root Regeneration Characteristics of Pin and Scarlet Oak. Hort Science,19(1), 123-125.
5. Warren, R. (2008). Tree Root Characteristics and Growth from the Nursery Perspective. The Landscape Below Ground,III, 151-158
6. Nowak, D. J., Hoehn, R. E., III, Bodine, A. R., Crane, D. E., Dwyer, J. F., Bonnewell, V., & Watson, G. (2013). Urban trees and forests of the Chicago region:. Newtown Square, PA: United States Department of Agriculture, Forest Service, Northern Research Station.