Research Summary on Pot-in-Pot Production and Planting Depth

by

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Abstract

This focus of this research study investigates the nursery practice of placing trees deeply in containers to prevent wind-throw and excessive lean. After four months of observation, tree lean, caliper and root volume were analyzed, and results showed no association between planting depth and occurrence of windthrow. A lower proportion of trees required staking when planted at greater depth of soil. Species-specific associations between planting depth and root volume and caliper were observed, and these findings can help inform standard nursery practices.

Methods

In June 2002, 360 bare root trees were out-planted in a pot-in-pot production field in a commercial wholesale nursery in a randomized block design. Standard nursery planting practices were followed, and staking was avoided when possible. Irrigation and fertilization were provided by onsite nursery staff. Blocks of trees were planted at 0, 5, 10 and 15 cm of soil over the first order roots.

In this four-month study, 60 trees of 4 different species of were tested: *Betula platyphylla x japonica* 'Whitespire', *Fraxinus pennsylvanica*, *Malus* 'Spring Snow', and *Quercus bicolor*.

Over the course of the study, the following observations recorded weekly:

1. Tree-lean: using a plumb-bob and a centimeter gauged ruler
2. Occurrence of socketing
3. Tree mortality status
4. drainage problems
5. wind-throw: on-site Watch Dog® weather station recorded wind speeds during the 4 months of the experiment.

The following data were collected at pot-up and end of the study (See figures 1-5):

1. Stem caliper: initial pot-up at 6 inches above the first order roots, and final caliper was recorded during harvest at 6 inches above the soil line.
2. Root volume: initial pot-up and final measurement at harvest by water displacement (figure 1).

Figure 1. Measuring root volume using water displacement

Image source: University of Minnesota UFOR staff

Figures 2-5. Initial and final study photos of root systems

Figure 2. Pre-planted Green Ash (10 cm depth)

Figure 3. Pre-planted Whitespire birch (15 cm depth)

Figure 4. Post-study Green Ash (10 cm depth)

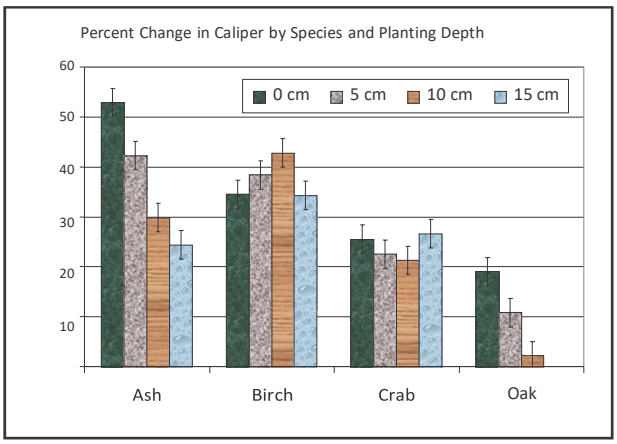
Figure 5. Post-study Whitespire birch (15 cm depth)

Images source: University of Minnesota UFOR staff

Results

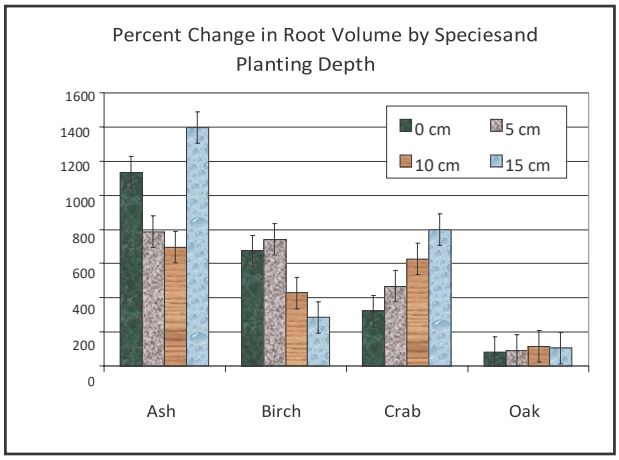
1. Caliper (figure 6)

Figure 6. Percent change in caliper across species and planting depth.



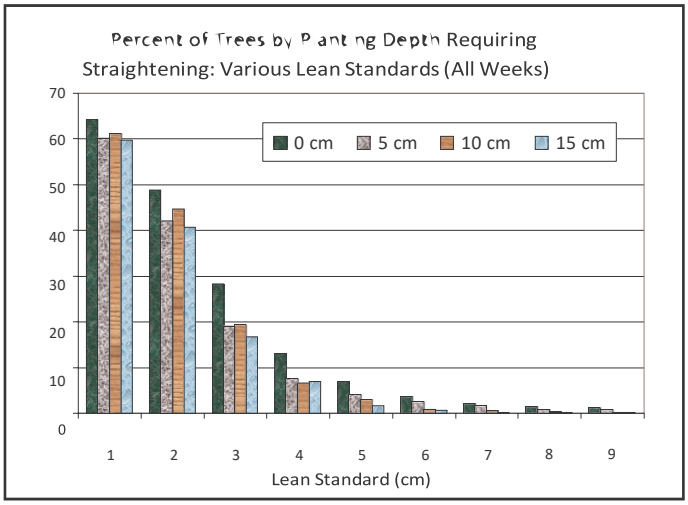
2. Root Volume (figure 7)

Figure 7. Percent change in root volume across species and planting depth.



3. Straightening (figure 8)

Figure 8. Proportion of trees needing straightening by planting depth



Discussion

Trees are routinely straightened or staked until their roots "lock" into the container media. The nursery involved in this study indicated that they typically stake trees for 4-6 weeks. Trees demonstrated a slight difference in the proportion requiring staking across planting depths. This suggests that standard nursery practice may be helpful for trees planted at shallow container depth. No significant increases in windthrow occurred at 0 cm planting depth.

'SpringSnow' crabapples and the green ash liked the deep planting. The crabapples were extremely prolific and filled the containers,while the green ash put on a phenomenal number of adventitious roots (see figure 9). However, looking at the root volume 'percent change' overall the trend was downward as planting depth increased.

Figure 9. Adventitious roots growth observed in green ash planted at greater depth.

Image Source: University of Minnesota UFOR staff

Crab apples and the birches didn't show statistically significant differences in caliper across the planting depth treatments. However, the green ash and the bicolor oak had significantly better caliper growth at the 0 cm planting depth when compared to the 15 cm planting depth.

Figure 10. Severe leaning in Quercus bicolor following planting in containers.

Image Source: University of Minnesota UFOR staff

The choice of *Quercus bicolor* for this study turned out somewhat problematic as the root systems were locked in solid, but the stems became limber as the growing season progressed (see figure 10). Several oaks were subsequently staked. Results from this research study provide context for some standard nursery practices to prevent leaning and the likelihood of windthrow in containers.