

**OREGON DEPARTMENT OF AGRICULTURE
OAN NURSERY RESEARCH COMMITTEE**

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Principal Investigators:

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Title: Building a better root system: Container choice and nursery cultural practices

Collaborators:

Chris and Josh Robinson – Owners, Robinson Nursery

Sam Doane – Production Horticulturalist, J. Frank Schmidt and Son Nursery

Background

Naturally, trees establish in one place and grow root systems for years in close coordination with soil conditions. In contrast, nursery-grown trees are moved and replanted multiple times before being permanently planted into a landscape. At a field nursery, tree roots are often undercut during production, cut during digging, and pruned before storage and shipping. At a container nursery, pots are selected to maximize planting density and mobility but constrain root systems to relatively small rooting volumes. These production practices affect the viability of a tree because healthy rooting systems are essential for success in a landscape. Functional, healthy root systems are especially important in highly modified growing environments, like the destination for street trees or a newly graded commercial or residential developments.

There are dozens of different containers marketed to improve tree rooting in nursery conditions, and dozens of different perspectives regarding which of these root pruning practices and pots generate the best tree roots. However, there has been little publicly available research investigating how root pruning practices are affecting plant physiology and plant viability, and which method(s) are the best. Specifically, we stand to learn more about how root pruning affects plant-water relationships and interacts with irrigation practices. For example, many root pruning pots use a soil-air interface to naturally prune the roots (i.e., air pots). A trade-off is that these pots drain water and leach fertilizer more quickly than traditional polycans. Moreover, forestry nursery research has demonstrated that some root pruning can damage xylem and make the plant more vulnerable to drought. Currently, this information does not exist for broadleaf nursery-grown trees.

Project Objectives

We aim to investigate the effects of root manipulation production practices have on tree health and irrigation demand. We will focus on Oaks (*Quercus*) because they are an important tree group produced in Oregon nurseries. Depending on availability, the Oaks we propose to study include Swamp White Oak (*Q. bicolor*), Red Oak (*Q. rubra*), Burr Oak (*Q. macrocarpa*), Pin Oak (*Q. palustris*), and Oregon White Oak (*Q. garryana*). Oaks are also good study species because

they are tap-rooted and reportedly can have losses around 20% for bare-root production, which (we have been told) was part of the motivation for growers to shift more production to root bags, air-pots, and other product types. We will quantify the outcomes of different production practices in terms of plant aboveground growth, belowground growth, water-use efficiency, root hydraulics, and root carbohydrate storage.

Methods and Timeline

Winter 2021

- Receive stratified acorns or unpruned seedlings.
- Pinch the radicle on half the plants, leaving the other half intact,
- Plant seedlings of all species in eight different conditions: Field production; a standard polycan; a root bag; three different air pots; Root bag x air pot combination; and an Air pot x polycan combination.

Spring – Summer 2021

- Grow the seedlings in standard nursery conditions for one growing season.
- Evaluate plant development with monthly measurements from leaf bud break to leaf fall. Measurements will include height and caliper, and overall vigor, and pre-harvest (August 2021) root non-structural carbohydrates (NSC) for a sub-sample of each group to evaluate carbohydrate storage dynamics.

Autumn 2021

- Excavate the seedlings. Aboveground growth will be evaluated by height and caliper. Root growth will be evaluated by volume and length, size class distribution, and NSC (October 2021).

The Benefit to Nursery Industry

This experiment will provide a third-party, scientific, evaluation of materials and practices commonly used in Oregon nursery production to help develop BMP related to root production and irrigation. Additionally, this project will help increase the local expertise by providing training and teaching tools to Oregon students and Extension materials for Oregon growers, thereby building the human capital of Oregon Nurseries.

Oak production is typically a multiyear process. If the results are promising and the feedback from the industry is favorable we will consider requesting additional funding to evaluate production practices a second year, and therefore we will design the experiment so that we can test fully dormant (January 2022) NSC, and pre-shipping NSC April 2022, and growth during the following growing season (2022).

Budget summary

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| Post-doc wages and other payroll expenses (0.33 FTE) | \$22,000 |
| Materials and supplies NSC lab testing | \$5,000 |
| Total | \$27,000 |