

Roots of change for the better

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Roots in natural settings

Perhaps one in a billion seeds becomes a mature tree. In the forest, rodents eat seeds, some are devoured by insects, some seeds rot, and some produce poorly formed root systems. Roots on trees in nature result from seeds germinating on the forest floor. Root systems on mature trees have distinct characteristics that allow them to become large. They develop a spreading array of 6 to 12 relatively straight, large diameter roots growing radially and mostly horizontally outward from the trunk (Fig. 1).

We expect the trees we plant in a landscape to become large and produce benefits for everyone to enjoy. This makes it especially important that root systems have characteristics allowing them to grow to maturity. This process begins early in the first stage of propagation when the seed or rooted cutting forms its first roots.

Propagating liners

Most growers germinate seeds or stick cuttings directly in the field, in small containers, or in common trays of substrate. Trees in common trays must be carefully transplanted to a container of some type or planted into field soil. Root defects can form when a tap root is bent at planting. Bent tap roots are hard to correct and can negatively impact tree health and stability.

The goal is to produce a root system with straight roots growing radially away from the trunk, not deflected down or around the pot.

Trees propagated in containers have their challenges, but technology can help. Roots grow around the pot and down to the bottom naturally, or they are deflected there by container walls. This root form can result in tree instability and an abnormally deep root system not well suited for compacted soil in urban landscapes (Fig. 2).

New propagation techniques including pots of thin paper, Oasis® cubes, and others show promise in producing quality root systems. Roots should be straight and may



Figure 1. (Above) Roots of forest trees grow mostly straight.

Figure 2. (Below) Roots deflected down by container wall.





Figure 3. Quality liner root system with few deflected roots.

branch (**Fig. 3**), but should not be directed down or around the container wall. These defects can become a permanent part of the root system and hamper proper growth, or could predispose the tree to instability or an early death. Once roots begin circling or diving down the side of the pot they should be removed entirely when shifting to larger containers (**Fig. 4**) so retained root segments are radially oriented, relatively straight and growing mostly horizontally from the trunk. A look inside root balls that we typically plant shows that this is not happening with enough regularity.

Roots in container nursery

Root management continues in a container nursery that grows finished landscape trees. The goal is to produce a root system with straight roots growing radially away from the trunk (**Fig. 5**), not deflected down or around the pot. If this does not occur, 'shaving' off the root ball periphery at each shift to a larger container (**Fig. 6**) appears to accomplish the same objective (**Fig. 7**). Our research shows that if you manage irrigation carefully following treatment, caliper and height should not slow appreciably (1) as a result of treatment. Some nurseries in Florida and California are practicing a version of this and learning how to use it. In addition, root flare should be at or close to the surface. If the root flare is just a couple inches beneath the



Figure 4. (Above) Eliminating defects by removing liner root ball periphery.

Figure 5. (Center) Quality root ball grown in 3 gallon container without root pruning.



Figure 6. (Below) Shaving root ball periphery prior to shifting or planting into field.





Figure 7. (Above) Quality 15 gallon root ball resulting from shaving the 3 gallon prior to shifting.

Figure 8. (Centerw) Quality field-grown root ball resulting from multiple root prunings.



Fig 9. (Below) Removing root ball periphery immediately after planting 15 gallon container.



substrate surface, roots deflected by the container wall can girdle the stem.

Roots in field nursery

Roots pruned several times in the nursery grow denser with smaller diameter roots and fewer large roots (Fig. 8). This has been shown to increase digging survival and improve landscape performance (3). Nurseries that routinely move trees from one field to another during production automatically prune roots. Quality nurseries that produce certain trees without moving them practice root pruning in place.

Manage roots at planting

Root defects including those circling the trunk or growing downward should always be corrected before planting. This can be done by cutting away the outer 1/2 to 1 inch of the root ball periphery where the roots are often matted, or deflected around or downward by the inside surface of the container. It's also important to remove excess soil on the top of the root ball down to where the first main roots originate to check for circling roots close to the trunk. A sharp digging spade or hand-saw can be used to shave peripheral roots on container grown trees (Fig. 9). Radially slicing of the root ball, a more conventional treatment, is less effective (2). Roots matted against burlap on field grown trees should be also shaved at planting. If the root ball has no serious defects within the interior, this procedure will help ensure that most circling and diving roots are severed and that the new roots will grow outward, horizontal to soil surface to better stabilize trees.

Cited literature:

1. Gilman, E.F., C. Harchick, and M. Paz. 2010. Root ball shaving improves root systems on seven tree species in containers. *J. Environ. Hort.* (In review)
2. Gilman, E.F., C. Harchick, and M. Paz. 2009. Pruning roots affects tree quality in container-grown oaks. *J. Environ. Hort.* 27: 7-11.
3. Gilman, E.F. and P. Anderson. 2006. Root pruning and transplant success for Cathedral Oak® live oaks. *J. Environ. Hort.* 24: 13-17.

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