



CMG GardenNotes #636

Tree Planting Steps

This publication summarizes the tree-planting process. For an in-depth discussion on tree planting, refer to *CMG GardenNotes* #633, *The Science of Planting Trees*.

The science of planting trees is aimed at promoting rapid root growth (regeneration) to quickly reduce the water stress imposed by the harvest and planting process. *Post-planting stress* (transplant shock) consists of the stress factors induced by the reduced root system.

Planting trees too deeply has become an epidemic leading to the decline and death of landscape trees. In the landscape, trunk-girdling roots account for 57% of all tree deaths. Trunk-girdling roots develop when a tree is planted too deeply in the root ball and/or the root ball is planted too deeply in the planting hole. Trunk-girdling roots may lead to decline and death some 12 to 20 years after planting. Trunk-girdling roots may be below ground.

Step 1. Determine the depth of the planting hole

Depth of root ball in planting hole

To deal with the *soil texture interface* (differences in soil pore space) between the root-ball soil and backfill soil, it is imperative that the root ball rise slightly above grade with no backfill soil over top of the root ball. For small (one-inch caliper) trees, the top of the root ball should be about one inch above grade. For larger (2-4 inch caliper) trees, the top of the root ball should be about two inches above grade. Backfill soil should cover the “knees,” tapering down to grade. [Figure 6]

Depth of tree in the root ball

- Generally, at least two structural roots should be within the top 1-3 inches of the root ball, measured 3-4 inches from the trunk.
- On species prone to trunk-circling roots (Crabapples, Green Ash, Hackberry, Littleleaf

Linden, Poplar, Red Maple, and other species with aggressive root systems), the top structural root should be within the top one inch of the root ball.

Checking depth of tree in root ball – Check depth of the tree in the root ball. Do not assume that it was planted correctly at the nursery.

- The presence of the root flare is an indication of good planting depth. However, small trees may have minimal root flare development making it difficult to determine. Be careful not to mistake swelling of the trunk below the graft as the root flare.
- A good way to evaluate planting depth in the root ball is with a slender implement like a slender screwdriver, knitting needle or barbecue skewer. Systematically probe the root ball 3-4 inches out from the trunk to locate structural roots and determine depth. [Figure 1]



Figure 1. Systematically probe the root ball with a slender screwdriver. Generally, at least two structural roots should be found in the top 1-3 inches of soil, 3-4 inches out from the trunk. On species prone to trunk-circling roots, the top structural root should be within the top one inch of the root ball.

If the tree is planted too deeply in the root ball, excess soil should be removed from the top in the backfill step of the planting process. Adjust the depth of the planting hole to compensate. [Figure 2]

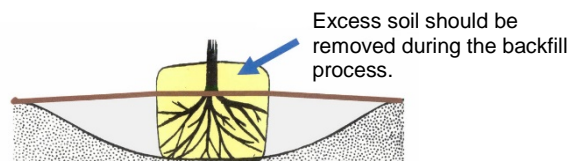


Figure 2. Adjust the depth of the planting hole to bring the root flare to the correct depth.

The depth of the planting hole should be 1-2 inches less than the height of the root ball. However, planting hole depth may need to be adjusted to correct the depth of the tree in the root ball.

Step 2. Dig a saucer-shaped planting hole three times the root ball diameter

- To maximize soil oxygen levels the top of the root ball rises 1-2 inches above grade (adjusted for proper rooting depth as determined in step 1).
- The root ball sits on undug soil, stabilizing the tree and preventing sinking and tilting.
- A saucer-shaped planting hole three times the root ball diameter with sloping sides allows the root system to grow rapidly to 400% of the root ball volume before being slowed by the lower oxygen levels in the site soil. This is enough to minimize post-planting stress in normal planting situations.
- The wide, saucer-shaped planting hole gives the tree more tolerance to over-watering problems and waterlogged soils.
- The wide planting hole allows for root ball wrappings to be removed after the tree is situated in the planting hole.
- A labor-saving technique is to dig the planting hole about two times the root ball diameter with somewhat vertical sides, then widen the hole into the desired saucer shape with the shovel during the backfill process. [Figure 3]

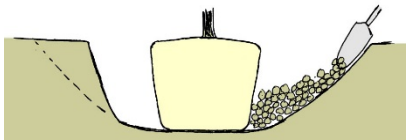
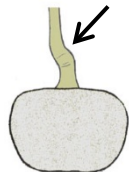


Figure 3. A labor-saving technique is to widen the planting hole into the desired saucer shape, three times the root ball diameter during the during backfill process.

Step 3. Set the tree in place, removing container/wrappings

In setting the tree into the planting hole, if the tree has a "dogleg" (a slight curve in the trunk just above the graft) the inside curve must face north to avoid winter bark injury. [Figure 4].

Figure 4. The inside curve of the graft crook or "dogleg" must go to the north to avoid winter bark injury.



Vertically align the tree, with the top centered above the root ball. Due to curves along the trunk, the trunk may not necessarily look straight. It will appear straighter with growth.

In this step, techniques vary for *Container-Grown Trees* and *Balled And Burlapped (B&B) Trees*.

Container-Grown Nursery Stock

"Container-grown nursery stock" describes a variety of production methods where the trees or shrubs are grown in containers (limiting root spread to the size of the container). In some systems, like "pot-in-pot" and "grow-bags," the container is in the ground. An advantage of container stock is that it can be planted in spring, summer, or fall.

Actual planting techniques in this step vary with the type of container and extent of root development.

Generic steps include:

- a) Lay the tree on its side in or near the planting hole.
 - b) Wiggle off or cut off the container.
 - c) Shave off the outer 1-1½ inches of the root ball with a pruning saw or pruners. This is to deal with circling roots.
 - d) Tilt the tree into place with the inside curve of any graft crook facing north.
 - e) Check the depth of the root ball in the planting hole. If needed, remove the tree and correct the hole depth.
 - f) Align vertically.
 - g) For stability, firm a shallow ring of soil around the bottom of the root ball. [Figure 5]
- The ideal container-grown tree has a nice network of roots holding the root ball together. After the container is removed, the tree is gently tilted into place.
 - If most of the soil falls off the roots, the tree is planted as a bare-root tree.
 - If some of the soil falls off (often on the bottom), it may be necessary to adjust the depth of the planting hole. Backfill and pack the bottom of the planting hole to the correct depth.
 - Fabric grow bags must be removed from the sides. They are generally cut away after setting the tree into place.
 - Generally, paper/pulp containers should be removed. Most are slow to decompose and will complicate soil texture interface issues. Pulp

containers often need to be cut off, as they may not slide off readily.

- In handling large trees (3-inch caliper and greater) it may be necessary to set the tree into place before removing the container.

Field-Grown, B&B Nursery Stock

Field-grown, balled and burlapped (B&B) trees and shrubs are dug from the growing field with the root ball soil intact. In the harvest process, only 5-20% of the feeder roots are retained in the root ball. B&B nursery stock is best transplanted in the cooler spring or fall season.

To prevent the root ball from breaking, the roots are balled and wrapped with burlap (or other fabrics) and twine (hence the name B&B). In nurseries today, there are many variations to the B&B technique. Some are also wrapped in plastic shrink-wrap, placed into a wire basket, or placed into a pot.

An advantage of the wider planting hole is that it gives room for the planter to remove root ball wrappings AFTER the tree is situated in the hole.

Based on research, **standard procedures are to remove root ball wrapping materials (burlap, fabric, grow bags, twine, ties, wire basket, etc.) from the upper 12 inches or 2/3 of the root ball, whichever is greater, AFTER the tree is set into place.** Materials under the root ball are not a concern since roots grow outward, not downward.

Actual planting techniques in this step vary with the type of wrapping on the root ball. Generic steps include:

- a) Remove extra root ball wrapping added for convenience in marketing (like shrink-wrap and a container). However, do NOT remove the burlap (or fabric), wire basket and twine that hold the root ball together until the tree is set into place.
- b) Set tree into place with the inside curve of any graft crook facing north.
- c) Check the depth of the root ball in the planting hole. If needed, removed the tree and correct the hole depth.
- d) Align vertically.
- e) For stability, firm a shallow ring of soil around the bottom of the root ball. [Figure 5]

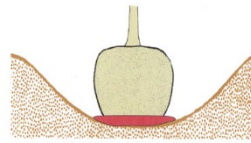


Figure 5. Stabilize the tree by firming a small ring of backfill soil around the base of the root ball

- f) Removed all the wrapping (burlap, fabric, twine, wire basket, etc.) on the upper 12 inches or upper 2/3 of the root ball, whichever is greater.
- g) If roots are found circling the root ball, shave off the outer 1-1½ inches of the root ball with a pruning saw or pruners.

The consensus from research is clear that leaving burlap, twine, and wire baskets on the sides of the root ball is not an acceptable planting technique.

- Burlap may be slow to decompose and will complicate soil texture interface issues.
- Burlap that comes to the surface wicks moisture from the root ball, leading to dry soils.
- Jute twine left around the trunk will be slow to decompose, often girdling the tree.
- Nylon twine never decomposes in the soil, often girdling the tree several years after planting.
- Wire baskets take 30-plus years to decompose and interfere with long-term root growth.
- Some planters find it easier to cut off the bottom of a tapered wire basket before setting the tree into the hole. The basket can still be used to help move the tree and is then easy to remove by simply cutting the rings on the side.

Optional Step 4. **Underground stabilization**

When properly planted, set on undug soil, most trees in the landscape do not require staking or underground stabilization. Staking or underground stabilization may be needed in windy areas. For additional information on staking, refer *CMG GardenNotes* #634, Tree Staking and Underground Stabilization.

Step 5. Backfill

When backfilling, be careful not to over-pack the soil, which reduces large pore space and thus soil oxygen levels. A good method is to simply return soil and allow water to settle it when irrigated.

Soil “peds” (dirt clods) up to the size of a small fist are acceptable in tree planting. In clayey soils, it is

undesirable to pulverize the soil, as this destroys large pore space.

Changes in soil texture (actually changes in pore space) between the root ball soil and the backfill soil create a *soil texture interface* that impedes water and air movement across the interface. To deal with the interface, the top of the root ball must come to the surface (that is, no backfill soil must cover the top of the root ball). Backfill soil should cover the root ball knees, gradually tapering down.

Optional Step 6. Staking

When properly planted, set on un-dug soil, most trees in the landscape do not require staking or underground stabilization. Staking may be desirable to protect the trees from human activities. Staking or underground stabilization may be needed in windy areas.

Install staking before watering so the planting crew does not pack down the wet soil. For additional information on staking, refer to *CMG GardenNotes* #634, Tree Staking and Underground Stabilization.

Step 7. Water to settle soil

Step 8. Final grade

With the wide planting hole, the backfill soil may settle in watering. Final grading may be needed after watering.

Step 9. Mulch

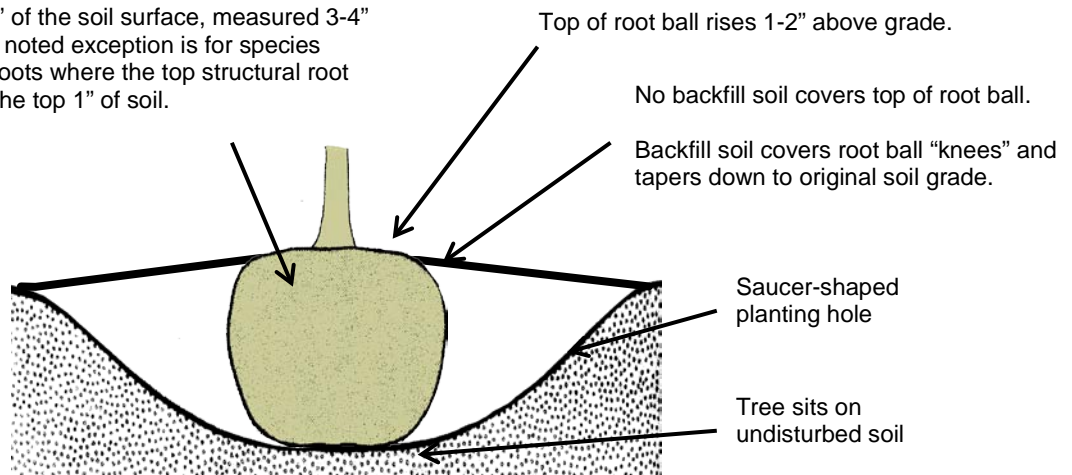
Do not place mulch directly over the root ball on newly planted trees. As a rule of thumb, 3-4 inches of wood/bark chips gives better weed control and prevents soil compaction from foot traffic when placed over the backfill area and beyond. Additional amounts may reduce soil oxygen.

Do not place wood/bark chips up against the trunk. Do not make mulch volcanoes. On wet soils, mulch may help hold excessive moisture and be undesirable. Wood/bark chips are not suitable in open windy areas.

Figure 6. Planting Summary

Generally, at least two structural roots should be within the top 1-3" of the soil surface, measured 3-4" from the trunk. A noted exception is for species prone to circling roots where the top structural root should be within the top 1" of soil.

For best root growth potential, make saucer-shaped planting hole three times root ball diameter.



Author: David Whiting (CSU Extension, retired), with Alison O'Connor (CSU Extension). Line drawings by David Whiting; used by permission.

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