**Planting Techniques for Trees and Shrubs**

Employing proper site preparation and planting techniques means that plants will be more tolerant of adverse weather conditions, and be less prone to attack by insect and disease organisms. Planting technique affects water quality because proper installation minimizes water use, fertilizer, and pesticide use. When making decisions on planting techniques, you should consider the plant’s drainage requirements, the soil conditions, and the availability of irrigation water. While the contractor should always try to locate plants based on the planting plan, he/she may need to make adjustments in the field to address unforeseen complications. As with all other aspects of landscape installation, it is essential that you build a good relationship with the landscape architect or project supervisor.

**Planting Stock and Quality**

Horticultural researchers estimate that root loss on field-grown nursery stock can range from 50% to 90% (Gilman 1988, Harris and Gilman 1993). Water stress, due to removal of most water absorbing roots or improper watering, can cause transplant failure in a manner similar to during drought (Gilman 1988). Most water absorption occurs in small, fibrous roots. These roots suffer first from water loss during planting and establishment.

**American Standard for Nursery Stock**

All landscape professionals should be familiar with the American Nursery and Landscape Association (ANLA) publication “American Standard for Nursery Stock” (ANSI Z60.1-2004). The purpose of this booklet is to provide buyers and sellers of landscape plants a reference, with common terminology and descriptions. It does not provide assurance that plants are healthy, but that they meet certain, standard specifications. The standards establish an accepted format for a) measuring plants, b) specifying the size of plants, c) establishing the relationship between height and caliper, and/or

![Diagram of tree measurement](image)
height and width and d) establishing the relationship between rootball size and overall plant size.

There are 13 different categories for plant materials in the ANSI Z60.1-2004 Standards, including everything from 'Shade and Flowering Trees' to 'Christmas Trees'. The information for all plant groups include how the plants in that group are measured, the correct terminology for determining the measurements, and the division of different plants within the particular group.

If you want more information on the ANSI Standards check out their website at:

http://www.ansi.org/

Plant Material

Landscape contractors can choose from a wide variety of plant material in North Carolina, but plants must conform to specifications in the landscape plan. Growers produce plants bareroot, ball and burlap, and in various styles of container- most common being plastic and fabric. Nurseries mechanically dig most large landscape trees with a tree-spade placing rootballs in burlap and then wire baskets. Each of these growing and harvesting techniques requires specific handling, planting and watering techniques. Environmental conditions determine planting dates most appropriate for each stock type. Planting within these times will help ensure the most successful transplanting. For example, ball and burlap plants will require much less additional water to ensure transplant success if you plant these between November and March, as compared to planting in late spring and summer. Often, however, specifications require contractors to install plants based on occupancy constraints and other contractual obligations. This may be opportune for the contract, but not so for the plant material and may require the contractor renegotiate watering and plant warrantees.

**Bareroot plants:** Advantages of planting bareroot plants are mostly economical, but also include ease of harvesting, storage and shipping, and the plant maintains 100% of its root system. Many species respond well to bareroot harvesting. You can easily inspect roots for defects and remove damaged roots before planting. Install bareroot plants only when
dormant. Landscape-sized bareroot trees usually require staking. It is often difficult to find landscape size plants, and a wide variety of species.

**Ball and burlap Plants:** Major advantages of ball and burlap (B&B) landscape plants are large plant size and a wide range of available species. The American Standard for Nursery Stock is the standardized formula for sizing root balls. The main disadvantage of B&B material is the loss of up to ¾ of the root system during harvest. Growers can decrease root loss by engaging in a sound fertilization and irrigation program, and by performing annual root pruning during production. Most plants are best dug B&B during dormancy, either spring or late fall. Some species do tolerate summer digging, but once transplanted into the landscape watering will become more challenging. Order plants as far in advance as possible to get the sizes and cultivars required by the design. With a reduced root system, water is the critical element in successful transplanting of B&B materials.

**Container-Grown Plants:** The advantage of using plants grown in containers is that 100% of the roots are maintained. Thus, the plant goes through limited transplant shock if given adequate follow-up care. You can install container-grown plants year round. Container-grown plants are produced in soilless medium (usually pine bark and sand), are much lighter than B&B material, but dry out more quickly.

The main disadvantage of container-grown plants is the possibility of deformed roots or root bound containers. Girdling roots often form if plants are not root-pruned
prior to up-canning. These circling roots will impede future root growth and development of the plant. If you find girdling roots at planting time, it is critical that you correct this by loosening the root mass, cutting about 1” from the rootball edge and bottom, or prune off these roots. Plants may experience slow growth and establishment if girdling roots remain. However, trees can survive a long time with girdling roots, but become highly susceptible to failure at the root plate, as the tree puts on size. “Root bound” plants have typically been left in the container too long and much of the media has broken down. You must break apart these root masses and water frequently once installed. Surrounding soil may remain wetter than the rootball of a container-grown plant.

Container-grown and bareroot plants typically establish faster than large B&B plants and are more economical. Many consumers however, want the “instant” landscape that you get with B&B. Nurseries can produce 6” and larger caliper trees using large mechanical digging equipment. Although these large trees provide the “instant” effect, costs increase, handling becomes an issue, and there is a longer establishment period where plants are under extended stress. This should not dissuade you from using large B&B; in fact, most landscape architects specify B&B plants whenever possible. Container-grown trees are a critical option for ornamental plants, and offer a perfectly acceptable alternative.

**Fabric containers:** A relatively new production system is the use of fabric containers or bags. Plants are grown in bags made of special fabric that must be removed at installation. Growers can produce plants with most of the root system, and under field production practices. Two problems with this production method are 1) Bags may be hard to remove due to outgrowth of roots through fabric, and 2) can be an expensive method.

**Transporting and Handling**

Good horticultural practices begin with proper loading and transport of plants. The landscape professional should: protect roots, stems, and foliage during
transport. Shield plant tops from wind by using a tarp or burlap sheet over the load.

Trees are particularly vulnerable to damage after growth has started. In spring, bark is easily damaged during transport, particularly on B&B trees. Lift plants below the root ball, typically with skid steer forks, a forklift or planting slings.

Always handle containerized plants by the container and never by the plant itself. Load containers on their side, and if stacking is necessary, safely secure the containers so they will not slide, shift or fall during transit.

If you must hold or store plants on the job site, place them in a location protected from wind and sun. Do not let roots freeze or dry out during storage. If the delay in planting is more than a few days, “heal-in” B&B material by covering roots with soil, bark or compost. Supplemental irrigation is critical for nursery stock during this holding period. Make arrangements for storage space and watering before plants are delivered.

**The Planting Hole- Plant Installation**

**Ball and burlap (B&B) trees and shrubs:**

It is best to prepare an entire bed area or landscape. This means you will till the entire planting area. As stated earlier, this makes planting more efficient and easier, plus it is the best practice for plants. If you must install a pit or hole for individual plants, the following explains how.

Planting pit:

- should be at least **2 times** the diameter of rootball and no deeper than height of rootball
- plant at grade, where possible, and no more than 2 - 3” above grade (this may not always be possible on a steep slope)
- Do not plant too deep or too high as plants will either suffer root rot or root drying, respectively
- If bareroot, hole will be shallow, but extend
outward to accommodate roots
- If site is poorly drained or compacted, pit should be **3 times** or more than diameter of root ball
- Scarify sides of pit

**Tree placement:**

- Lift plant into pit using rootball, place on solid, not loosened soil base to avoid settling
- Remove all twine around trunk and that holding burlap and basket together (if B&B)
- If B&B: use heavy duty wire cutters to remove top 1/2 to 1/3 of basket and discard or recycle; pull down or cut off top ½ of burlap
- Be sure to remove plastic liners or synthetic burlap materials after plant is partially planted, not before placing in planting hole

**Backfilling:**

- Add some backfill, water to minimize large air spaces and repeat until pit is full; some contractors prefer to use the shovel to work soil in around the rootball (B&B), both methods are acceptable
- Some instructions indicate the addition of organic matter (OM) to the backfill (2/3 backfill soil and 1/3 organic matter); however, most research indicates the addition of OM to a planting pit does nothing to encourage plant establishment (see Site Preparation above)
- Backfill should be free of large stones and foreign debris
- It is fine to foot tamp soil around the lowest portion of a B&B plant, where there are not and will not be roots to help hold a tree upright; compacting more backfill than this compacts the soil in which roots are attempting to grow

There is a great deal of discussion surrounding use of a watering berm. Use your own judgment. If you choose to install a watering berm, use backfill to develop a 4 – 6” berm placed at the outer edge of the hole, not directly adjacent to rootball. This allows water to infiltrate both to roots and soil surrounding the ball.
If you have not yet removed tree wrap (typically paper used to protect trees during transport), do so now. Research indicates that removing tree wrap does not lead to development of frost cracks or prevent sunscald (Litzow and Pellet 1973; Hart and Dennis 1978). You may use plastic guards to protect trunks from physical injuries (vehicular damage, vandalism, and chewing animals). These should be loose-fitting and removed before trees outgrow the guard.

Staking:

Staking or guying trees is typically necessary in windy areas or for large bareroot plant materials. Staking may also be necessary when planting in very loose or sandy soil. Most specifications, however, still require staking. If required, stake as indicated in project specifications.

Water and mulch:

- Water plants thoroughly, then as needed based on weather, size, and species
- Watering bags are great for individual plants; drip irrigation in beds, and spray heads, rotors, etc. are necessary for lawn irrigation
- Add 2 - 3" of mulch around watering basin, keeping it away from trunk or crown of plant; Dr. E. Gilman suggests that in sandy soil, mulch should start at edge of rootball and extend outward, away from trunk
- Recent recommendations suggest fertilizer can be applied at planting but should be slow release and low in nitrogen; if concerned, wait until the following spring
  - Always follow label instructions

**Container-grown trees and shrubs**

The only difference between planting techniques for B&B and container-grown trees is in handling the root ball. In research done by Gilman and Wiese (2012), they found that container-grown trees planted in the landscape that had their root balls either shaved or sliced prior to planting produced greater cross-sectional trunk area and generated more roots in one growing season than those treated traditionally. Other researchers have found similar results. To help increase establishment success, one method is to shave off 5 – 10% of the sides and bottom of root ball. An alternative is to slice the rootball, every 3 – 4” radially. One final method is to “feather-out” the roots. This may be the best method for
dealing with smaller container-grown plants and those that have not been in the container for more than a year or so. The key is to encourage good root to soil contact.

Example of a container grown tree whose root ball was shaved (picture borrowed from www.hort.ifas.ufl.edu and is based on research done by Dr. Ed Gilman).

Bareroot trees and shrubs

Planting bareroot trees or shrubs is similar to that of container-grown or ball and burlap plants. Most bareroot trees, however, are fairly small diameter so this makes them easier to handle. Bareroot plants are not as readily available in larger stock and there are fewer
species available. The most important step is to prevent any root drying. Often to prevent desiccation, roots are treated with a hydrogel.

To plant, dig a shallow hole with a small mound in the middle. Place the mound directly beneath the trunk. The hole should be only deep enough to accommodate the root system.

Fill planting hole about half way, and then water-in. This is particularly important for bareroot plants to get firm root-soil contact. Finish adding soil to finished grade. Make small berm around the outside edge of the hole to help direct water toward roots.

**Planting beds**

Many landscape designs require large planting areas. When installing such an area, prepare the entire site by tilling the soil, adding sufficient organic matter (2” depth for every 12” depth of soil). The organic matter should be high quality and well composted, and uniformly tilled into soil. Preparing an entire site like this improves establishment and success of all plants.

In poorly drained soils, a drainage system under the beds may be necessary. Be sure the system (French or tile drain) drains downhill at a 2% minimum slope and there is an outlet. When setting plants, be certain to plant them a few inches high. If the poor drainage condition cannot be corrected, don’t plant a tree or shrub in this site, unless it can tolerate poor drainage. Be sure to crown the bed where runoff is directed to the edges.

**Pruning at Planting**

The only reason to prune at transplanting is to improve the structure or health of the plant. Remove overlapping, interfering, or damaged limbs. Do this while the tree is lying on its side, before placing it in planting pit. New research indicates it is fine to perform some light pruning on trees to correct any serious defects. Do not use tree paint or wound dressing.

Always prepare a plan for irrigation, no matter what you are planting.
**Planting specifications**

Many city foresters, planners, or landscape architects rely on detailed planting specifications regarding the installation of plants that often go out on contract. The following pictures illustrate a simplified version of this type of plan detail. Specifications will also include requirements such as height from top of rootball to the lowest limb, staking techniques (including when these will be removed), backfill materials, mulch type, and pruning wounds (and pruning at planting).

**Ball and burlap tree planting diagram**
Container grown tree planting diagram

**Literature Cited**


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