



How to Grow a Better City Tree

TREE CITY USA®
BULLETIN

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If there is one thing on which every community can agree it is that money is one of the things that does not grow on trees. With more expected from small budgets coupled with higher demands for service and savings, it is time to pay more attention to the quality of trees purchased for streets, parks and other public grounds and how they are planted. A few principles can guide the way.

Who would buy a new car without looking at its engine, perhaps kicking its tires and most certainly considering the size of the garage or other space where it will be parked? Yet every year thousands of trees are purchased without a clear understanding of the condition they should be in upon arrival or how they should be treated to assure the best chances of long, healthy lives.

Charlotte, North Carolina, is a good example of how city arborists have found a solution to this problem. Working in partnership with the nonprofit group TreesCharlotte, this Tree City USA community plants over 15,000 trees annually as it works toward the goal of having 50 percent canopy cover by 2050. Like other communities that recognize the importance of trees and of doing the job right when trees

are selected and planted, Charlotte addresses the three keys to better street trees: (1) quality nursery stock, (2) space for the roots, and (3) pruning young trees for structure.

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Charlotte's city arborists work in close partnership with city engineers and landscape architects in designing projects and they rely on regional nurseries for their planting stock. Contractors are used for some planting projects and volunteers with TreesCharlotte carry a large part of the load. In all cases, *quality* is clearly specified before any work begins and inspections take place before any finished work is accepted.

In this bulletin, the key principles for growing better city trees are presented along with helpful links to additional information as noted on page 8. Our goal: growing better city trees for long term savings and safer, healthier tree canopies in all Tree City USA communities.

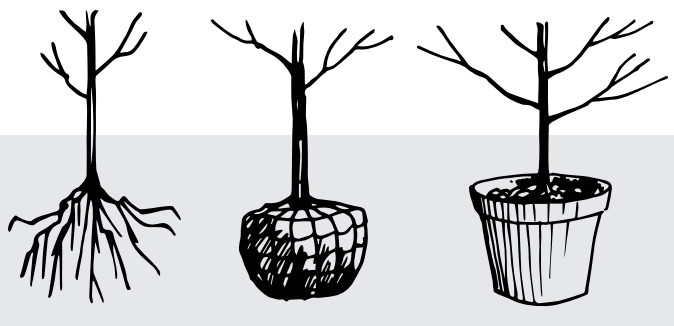


Arbor Day Foundation
100 Arbor Avenue • Nebraska City, NE 68410

Principle 1: Make Sure the Roots are Right

Trees in public places add value to the city infrastructure as they grow, and longer serviceable lives mean greater benefits with the passing years. Healthy, long-lived trees should be the goal of every community and it all starts at the nursery.

Tree nurseries are the foundation of urban forestry. Reputable commercial growers strive to provide stock of high genetic quality that is dependably uniform, free of insects and diseases, and carefully handled during the transplanting phase of the operation. As a business, growers of these



The three principle ways nursery stock is provided for planting city trees.

slow-maturing crops are faced with the challenge of knowing or estimating the demand for particular species and sizes, usually years in advance of the actual sale, and providing proper care over several growing seasons. It is a formidable challenge.

Basically, trees are grown and shipped at commercial nurseries in three ways – bare-root, balled and burlapped, or container-grown. All methods have their advantages and disadvantages and all are used for urban trees throughout the country. The key point in purchasing trees is: *make certain the roots are healthy and well structured.* This means:

- the roots are moist and have been kept moist.
- the root ball is adequate for the size of tree.
- there are few circling roots.
- the root collar, or flare, is at or just below the soil surface rather than deep in the root ball.

BALLED AND BURLAPPED (B&B)



In the balled and burlapped method, a soil ball is kept intact around the portion of roots that remain after the tree is lifted from the nursery bed by a special machine. The soil is then wrapped in what traditionally was burlap, but today is a variety of fabrics, and secured with chord or wire. **Suggestion:** During planting, be sure to remove the wrapping material after the tree is in the hole. Thousands of dollars have been wasted when this simple step is overlooked. A wire basket is more difficult to remove completely, but at minimum, cut it and remove or bend down the upper two thirds.

IS THE SOIL ADEQUATE TO SUPPORT GROWTH?

There is something appealing about a large, tall tree being planted. But the critical thing is whether there are enough roots to support growth of the top. A rule of thumb is that the soil ball should be approximately 1' in diameter for every inch of caliper. Here are more precise recommendations based on the American National Standards Institute (See p. 8) for field-grown shade trees. The container-grown sizes are from Florida Grades and Standards:

CALIPER (INCHES)	MINIMUM DIAMETER BALL SIZE (INCHES)	MINIMUM CONTAINER SIZE (GALLONS)	TREE HEIGHTS (FEET)
1	16	5	5 – 10
2	24	20	8 – 14
3	32	45	9.5 – 16
4	42	95	10.5 – 18

BALLED AND BURLAPPED ADVANTAGES

- Soil is kept close to the roots throughout the transplanting process
- Roots grown in soil instead of potting media are likely to be more naturally arranged
- It is easier to keep the roots moist
- The interval between arrival and planting can be longer, providing more schedule flexibility
- Larger diameter trees can be used
- Staking is less necessary, or can be done with subsurface pins or stakes

BALLED AND BURLAPPED DISADVANTAGES

- More costly
- Trees can be very heavy and more difficult to handle
- Roots are severed in the lifting process, often resulting in 'shock' that can slow growth when planted.

BARE-ROOT STOCK

For city trees, this may be the most underutilized type of planting stock. In this method, the trees are planted in rows in the nurseries, usually as saplings, and grown to sizes up to about 2 inches in caliper. At the time of sale, they are pulled from the soil by a lifting machine, shaken to remove

the soil, and shipped with the roots packed in peat moss or other material to keep them moist. When roots are dipped in hydrogel to retain moisture, survival rates are given a boost. **Suggestion:** When shopping for trees, specify the hydrogel treatment.

BARE-ROOT STOCK ADVANTAGES

- When lifted from the soil, fewer roots are cut and left behind. A Cornell study found 200% more roots in bare-root trees than balled and burlapped trees of the same species and size.
- Less transplant shock
- Lighter weight, so cheaper to ship and easier to handle.
- In general, less expensive, so your budget allows more trees to be planted.
- Easier to see where the roots begin (root flare), so planting too deeply can be more easily avoided.
- Tree growth is usually as fast or faster than with comparable methods.

BARE-ROOT STOCK DISADVANTAGES

- Staking is necessary except with very small caliper stock.
- Greater care is necessary to prevent roots from drying during the planting process.
- Related to the above, the time between shipment arrival and planting must be kept brief.
- Stock can only be shipped and planted during dormancy.
- Size is limited to 2" caliper (much less for conifers)

THE MISSOURI GRAVEL BED

A drawback to the use of bare-root stock is the narrow window of opportunity for planting. Now, thanks to the University of Missouri Horticulture and Agroforestry Research Center, a simple method has been devised that allows planting throughout the spring and even into summer. It is called the Missouri Gravel Bed, and tests have confirmed outstanding success for a variety of species and sizes with survival rates as high as those for balled and burlapped trees.

Using this method, bare-root stock is not 'heeled in' mulch or sawdust, but rather in a bed of pea gravel. The layer of gravel should be 14 – 18 inches deep with a time-clock-controlled irrigation system. In Missouri, a drip system was set to come on for 3 – 5 minutes every 3 or 4 hours during the day, but this would vary depending on climate. On or the day before planting, the trees are easily removed from the gravel with little or no damage to the roots and kept moist until in the ground.

Fibrous root growth on trees being removed from a Missouri Gravel Bed in Fargo, North Dakota after an extended period of time.



Make Sure the Roots are Right (Continued)

CONTAINER-GROWN

Container-grown (also called potted) growing methods are popular in nurseries because they eliminate lifting from the soil and wrapping for transport. Each tree begins life in its own container as a seed, seedling or a cutting grafted onto special root stock and is often repotted one or more times as it grows. Instead of soil, the roots usually grow in a mixture of peat moss, sand, compost or other medium depending on the particular nursery's operations. Management of the process is more intense because watering (including the water's pH) and nutrient levels depend on the grower much more than when trees are grown in field soil.

Pot sizes are expressed numerically, with the numbers corresponding roughly to gallons. City trees from a nursery usually are at the upper end of sizes, typically in 15 or 25 gallon pots. **Suggestion:** Never plant the tree in its pot, even if the claim is that it is made of biodegradable material.

CONTAINER-GROWN ADVANTAGES

- Potted trees are usually smaller and easier to handle than B&B stock
- Roots are not severed, therefore transplant shock is minimized

CONTAINER-GROWN DISADVANTAGES

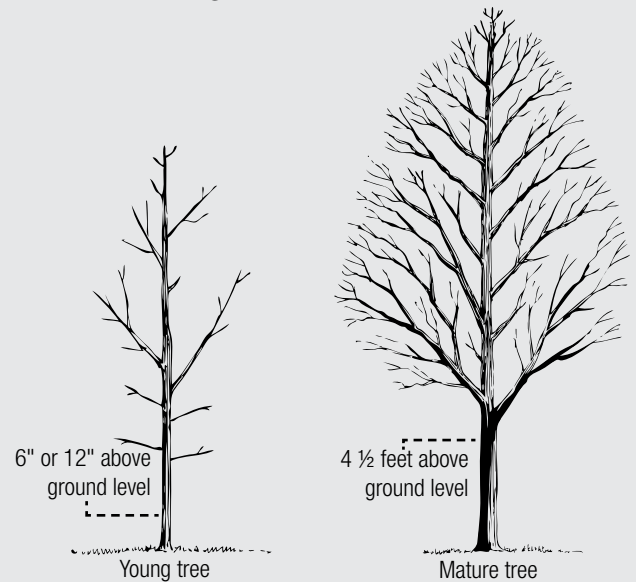
- Cost
- Larger trees can be heavy and removal from the pot before planting can be a challenge
- The rooting medium may conceal root flare, leading to the tree being planted too deep
- If grown too long in a pot, the roots circle



Container-grown trees are popular and have many advantages, but the greatest disadvantage is the danger of circling roots and buried root collars.

WHAT IS MEANT BY CALIPER?

Trunk diameter on young trees is referred to as 'caliper.' For standardization, this measurement is taken 6" above the ground on trees with a stem diameter of 4" or smaller, and 12" above the ground on larger planting stock. The diameter of larger trees is measured approximately 4 1/2 feet above ground level and is expressed as diameter breast high (DBH).



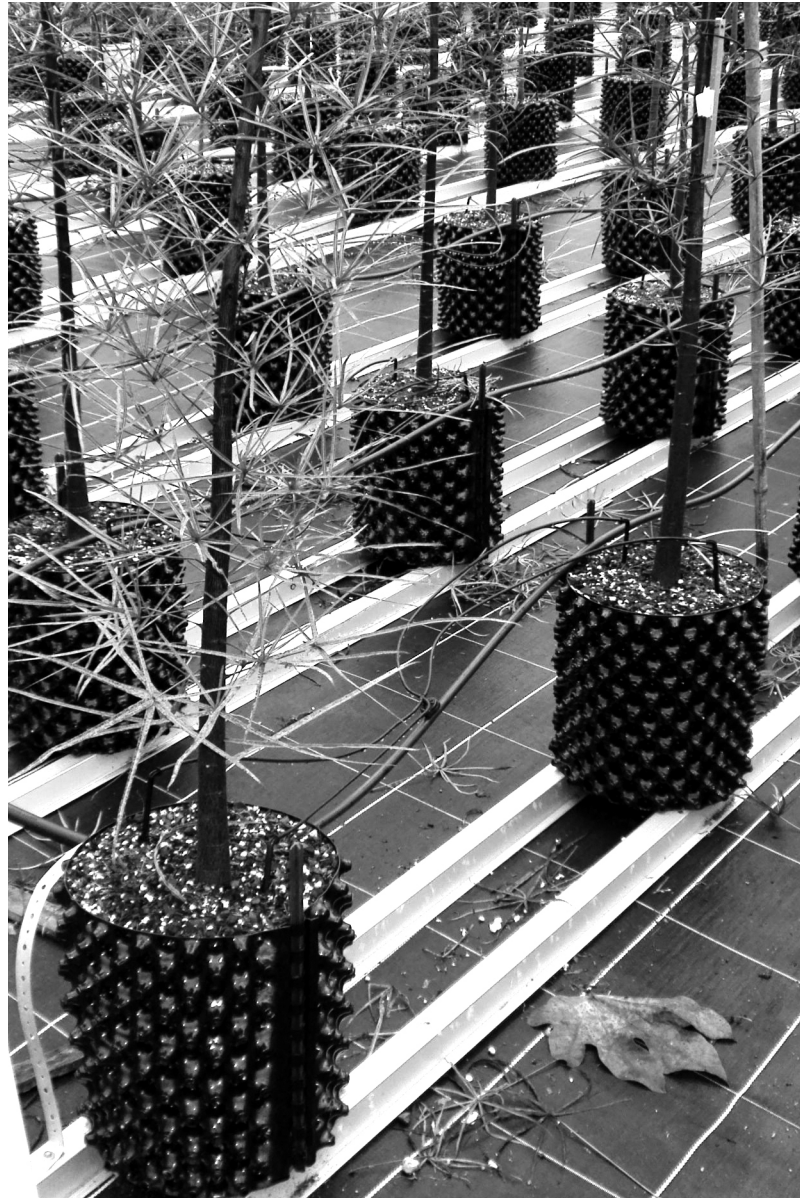
How to Correct Root Problems

Most tree problems occur out of sight beneath the soil. Other than root severance during construction, circling roots and deep root collars are probably the most common causes of poor tree growth or even mortality. Once a root begins to circle its efficiency in transporting water and nutrients is compromised and it will grow in that position and constrict or strangle other roots. The damage may take many years to show up and the tree becomes weaker and more vulnerable to being blown over by wind. Similarly, when root collars are too deep, the tree is sure to develop problems.

Although root problems are better prevented than cured, communities are sometimes faced with less-than-perfect planting stock that must be used. Here are some ways to prevent the disappointment and danger resulting from circling roots.

1. Check the process being used by your nursery. There *are* methods available that produce fibrous, spreading roots. One is timing, i.e. not holding trees in the nursery so long that they outgrow their pots or root ball wraps. Another is 'air pruning.' In this method, trees are grown in pots with holes. As root tips reach the drier air outside, they tend to dehydrate or become 'air pruned.' This stimulates secondary root growth closer to the trunk, resulting in a more fibrous, well-developed root system. Pots lined with root barrier chemicals (basically, herbicides) also have the effect of preventing circling.
2. Inspect the roots of B&B and container-grown trees before accepting delivery. If time and circumstance allow, reject trees with roots that circle, girdle, are kinked, or 'dive' (make a 90-degree turn downward). Also reject those with root collars buried more than about 1/3 the depth of the soil ball.
3. 'Root washing' has been suggested as a way to thoroughly inspect and correct roots that come from the nursery as B&B or potted trees. In this method, a tub or hose is used for removing the soil from around the roots and making the corrections noted below in No. 4.
4. If roots are small and flexible enough, they can — and should be — straightened in the planting hole. Larger, inflexible roots, can be cut where they originate, and those that dive should be cut at the point just before where they turn downward.

CIRCLING ROOTS ARE PROBABLY
THE *MOST COMMON CAUSE*
OF POOR TREE GROWTH
OR EVEN MORTALITY.



Trees grown in air-pruning pots develop healthier, more fibrous roots than when roots circle and cause problems after planting.



THIS



NOT THIS

The goal for planting stock used for city trees.

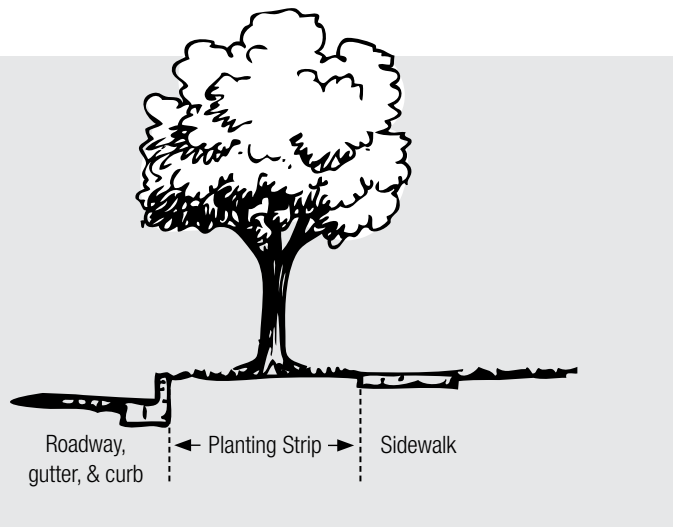
Principle 2: Provide Safe Space to Grow

When planning to plant, consider the planting site and think ahead to the mature size of the species you select for that space. The space it needs is both below the ground and above. Safe space means that the roots will have room to grow without danger from compaction, cutting, or becoming a disruption to underground utilities. Above ground, safe space is where limbs at maturity will stay out of trouble with utilities and buildings.

SPACE FOR THE TRUNK

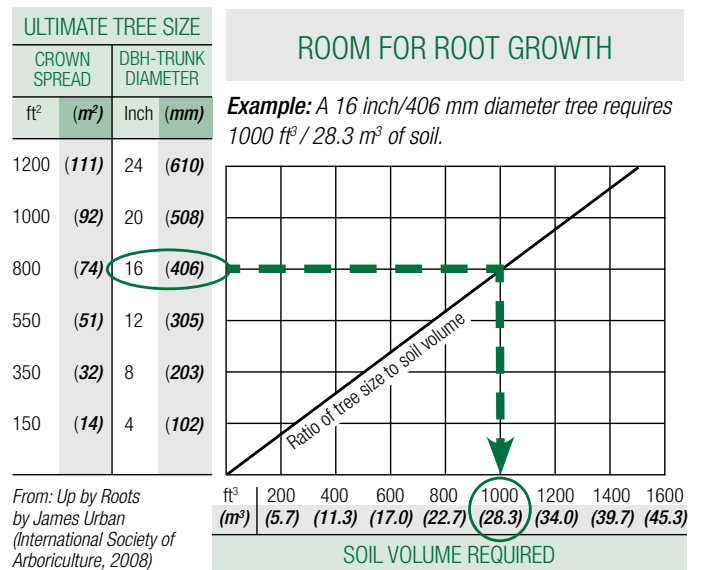
Where space is constricted, such as on planting strips (the space between sidewalk and street), mature trunk size is critical to prevent problems.

PLANTING STRIP WIDTH	SPECIES SIZE AT MATURITY
4 – 6'	Small with narrow crown
6 – 8'	Medium
8' +	Large



SPACE FOR THE ROOTS

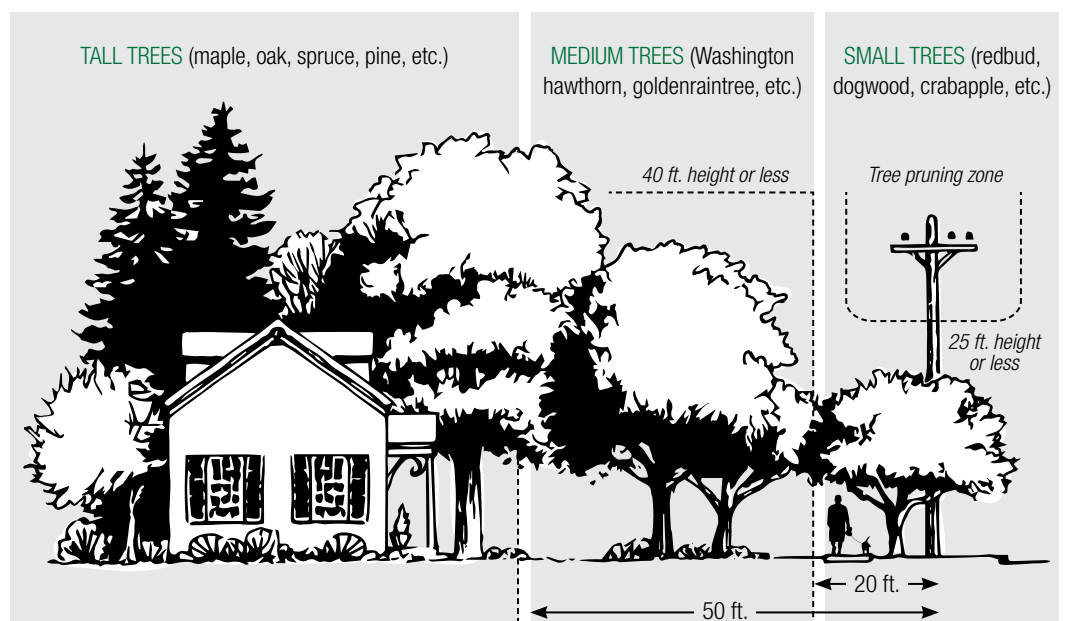
This is the most overlooked aspect of growing better street trees. Traditional 4' x 4' x 4' holes have been called death vaults. They simply do not provide enough space for healthy root growth and they contribute to dangerous trees and shortened life spans. A number of methods have been developed to provide more growing space, especially beneath sidewalks. Two of these are C-U Structural Soil and Silva Cells. See page 8 for links to both.



Note: Another way to estimate is that 60 – 120 ft³ of soil is needed per inch of mature trunk diameter. In drier climates, the upper end of this range is necessary.

SPACE OVERHEAD

The ideal urban forest will have no trees in conflict with overhead lines (wires). The simple solution is to plant trees that will mature beneath any overhead or nearby lines. Where no lines exist, large-maturing trees will provide the greatest benefits over time.



RIGHT TREE, RIGHT PLACE

Principle 3: Prune Young Trees (If Needed)

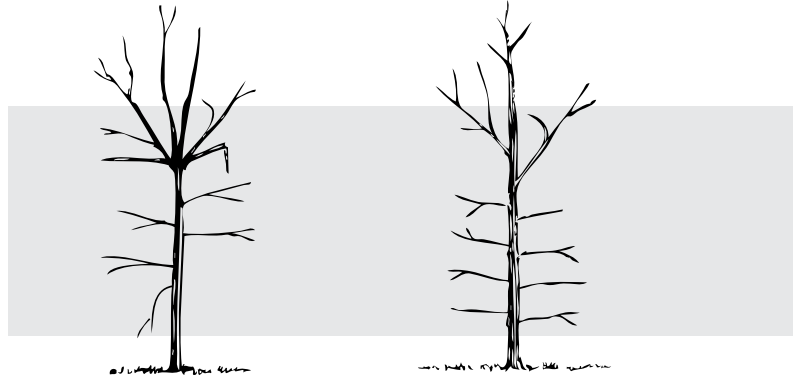
Actually, this is two principles in one. One is that the more leaves left in the crown, the more sugars are produced that nourish the tree and promote root growth. This should be a top priority for growing better city trees. Therefore, don't prune unless necessary. The second part of this is that a little necessary pruning early in the life of the tree will pay great dividends in the long run.

WHEN PRUNING IS BENEFICIAL

Quite simply, prune a newly planted shade tree if:

- a limb is dead, broken or infected with disease or an insect
- there is a double top (co-dominant leader)
- limbs cross and rub

Otherwise, pruning for structure, sidewalk clearance or other objectives should be postponed for a couple growing seasons until the roots are well established. This, like watering and stake removal, should be planned and not forgotten! And, of course, proper planting procedures can make all the difference in growing the kind of trees every community deserves.



A few moments with hand shears can help this newly planted tree. The cost is minimal at this point and the long term benefits are huge.

After an initial pruning. Although removal of the double top is essential (to prevent later splitting), there may be some advantage in leaving this, too, until a year or two later.



Delay most pruning of young trees until after the roots are well established.

Standards and Specs Prevent Misunderstanding and Disappointment

If there is any truth in the old adage about “an ounce of prevention,” it surely applies to the ordering of trees for community forestry. The cardinal rules for ordering better city trees are: (1) Write clear specifications when ordering, (2) base the language on standards as developed by industry experts and contained in *American Standard for Nursery Stock (ANSI Z60.1)*, and (3) inspect the trees before accepting delivery.

Dave Cable, director of TreesCharlotte, describes how his highly successful nonprofit organization and the City of Charlotte follow these rules:

Trees for our volunteer planting program are grown to our specifications which are consistent with the industry standards (ANSI). Sarah Morris (City of Charlotte Landscape Management) helped me establish our quality expectations, which include treated pots, with a keen eye on circling root and co-dominant stem issues. TreesCharlotte tree specs track with the City of Charlotte’s specifications for plant materials and industry standards. Our trees are delivered to our volunteer planting sites and are constantly evaluated by our TreeMasters, many of which are arborists, during the planting process.

The City has a rigorous inspection program to ensure the plant materials are suitable and consistent with the specifications.

Although the use of ANSI standards does not guarantee tree quality, the standards do provide common ground for language and measurements as well as helping to guide production methods in the nursery. Developing a good relationship with growers and communicating clearly will prevent the difficult — although sometimes necessary — task of rejecting poor planting stock.

FOR MORE INFORMATION...

For a direct link to ANSI Z60.1 and additional information about the topics mentioned in this bulletin, please visit arborday.org/bulletins, and navigate to the ‘Supplemental Resources Library’ for Bulletin No. 77.

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