

# SELECTING QUALITY TREES FROM THE NURSERY



PUBLICATION N°

**ENH 1060**

EDWARD F. GILMAN

LAURA SADOWSKI

**UF** UNIVERSITY of  
**FLORIDA**  
 IFAS Extension

## Introduction

Tree selection does not end with choosing the appropriate species or cultivar for the planting site. Suitable nursery stock must be chosen based on planting site conditions and intended after-care, which should dictate maximum tree size at planting, root ball characteristics, appropriate tree production method, and tree structure.

Nursery stock must be inspected carefully to pick high quality trees. Pay particular attention to roots. Trees of poor quality may be inexpensive, but might perform poorly in the landscape. Quality factors to evaluate include root ball defects, size, shape, and

structure of the canopy, nursery planting depth, presence of included bark, trunk form and branch arrangement, pruning cuts, presence of pests and disease, leaf color, top die-back, clear trunk length, and canopy uniformity.

## Important considerations for selection

There are advantages to selecting good quality nursery trees. Good quality trees are more likely to survive post-planting, establish more quickly, and live longer in the landscape. Choosing a good quality tree also can reduce the likelihood of failure from structural defects during a hurricane. Defects in the trunk and branch structure are easier to correct than defects in the root system. This makes it very important to choose trees from a grower with a demonstrated capacity to produce good root systems. Smart buyers evaluate root systems thoroughly.

## Production method

To ensure greater transplant survival, choose trees grown in the nursery production system best suited for the characteristics of the planting site. Under ideal conditions, i.e. well-drained and irrigated soil, production methods perform about equally well. However, if irrigation capabilities will be limited, the production method best suited for the site is an important consideration.

There are three main types of production methods: container, field-grown (balled-in-burlap or B&B), and bare root (Figure 1). Container trees are grown above ground in plastic, metal, wood, or fabric; pot-in-pot in the ground; or in fabric containers in the ground. B&B trees are grown in field soil, then dug with a tree spade and secured in wire and burlap. Bare-root trees are rarely marketed in the southeastern U.S. including Florida. Bare-root deciduous trees are dug from field soil and receive no media covering on the roots; they are usually available only when dormant and in a limited size range.

Table 1 compares production methods with typical root ball weights and staking requirements. For example, trees produced in containers typically have a light root ball and frequently require staking, whereas B&B trees have heavy root balls, so they require staking less frequently.



Figure 1

Container-grown trees (top) and B&B trees (bottom) are the main types of nursery production methods in the southeastern U.S. Several different container types are shown; roots growing through burlap in the field-grown tree indicate a high-quality hardened-off tree.

Table 1. Choose among tree production methods based on weight and staking capabilities.

PRODUCTION METHOD	ROOT BALL WEIGHT	NEED FOR STAKING
Container above ground or pot-in-pot	light	frequently
Fabric containers in ground	light	usually
B&B* not root pruned	heavy	sometimes
B&B* root pruned	heavy	sometimes
Bare root	very light	usually

\*B&B = field grown

Trees perform best when irrigated frequently after planting. If irrigation can be applied to the root ball twice weekly or more often, the production method may have little impact on tree survival. For landscapes where irrigation is less frequent, much of the research shows that it is best to install B&B trees that were root pruned during field production and dug at least several weeks before planting to the landscape (Table 2). These trees are referred to as “hardened off” (Figure 1, bottom) and frequently have new roots growing through the burlap. Root pruning live oak and some other trees during production provides a product that is slightly smaller, has a denser, more fibrous root system, has a more uniform root system (Figure 2), and transplants more successfully. Oaks grown in certain soil types may need less frequent root pruning than in other soil types, although this has been not been thoroughly documented.

Certain trees that are dug from sandy, well-drained soil without prior root pruning suffer more shock in the landscape, especially when not sufficiently watered. Some trees such as crape myrtles, maples, birches, hollies, and others are not routinely root pruned like oaks. In many instances, these seem to perform fine without root pruning due to their naturally dense root system.

Table 2. Live oak<sup>1</sup> survival in the landscape can depend on the production method and irrigation practices after planting.

PRODUCTION METHOD	SURVIVAL WITH FREQUENT IRRIGATION AFTER PLANTING	SURVIVAL WITH INFREQUENT IRRIGATION AFTER PLANTING
Container above ground or pot-in-pot	very good to excellent	fair
Fabric containers in ground	very good to excellent	poor to fair
B&B not root pruned	fair to good	poor to fair
B&B root pruned	very good to excellent	good
Bare root	very good to excellent	good

<sup>1</sup> Research performed on live oak in sandy, well-drained soil. Other species and trees grown in different soil types may perform differently.

### Maximum size at planting

The maximum size nursery stock suited for a particular planting site should be determined by the irrigation capabilities after planting, as well as the climate and site drainage. Smaller nursery stock should be used where irrigation can not be provided for the recommended period of time. Nursery trees larger than 2 inch caliper can be poorly suited for wet sites because roots in the bottom of the root ball can become submerged in water. This may stress the trees by killing the deeper roots in the root ball, which can prevent the tree from growing for several years after planting. Smaller nursery stock is the better option for poorly drained sites because they have a shallow root ball. If large trees are necessary, then trees with shallow root balls (trees grown in low-profile containers, Figure 3) should be selected, or trees can be planted 10 to 30% above grade and soil gently mounded to cover sides of the root ball. Smaller trees can be better suited than larger trees to compete with weeds for limited water availability, especially when weeds are not controlled with mulch or chemical applications.



Figure 2

Root pruning can dramatically increase the amount of fine roots and reduce the size of the largest roots in live oak. This combination results in trees that are less stressed when they are planted into the landscape. More research is needed for other species.

Figure 3

These shallow and wide (low profile) root balls are well suited for planting in poorly drained and compacted soil because all roots are shallow and will be positioned mostly above standing water in the landscape. Trees grown in these containers should have fewer root defects than traditionally shaped root balls.



Smaller nursery stock (Figure 4, top) has a shorter establishment period because roots come into balance with the top in the first 6-12 months after planting. Large nursery stock such as the 6-inch-caliper tree pictured in Figure 4 (bottom) requires much more time to become established. This makes it susceptible to dying from drought for a longer period after planting. It can take up to three years for a 6-inch-caliper tree to become established. Unless plenty of water can be supplied, it may be best to plant smaller nursery stock.

### Root ball dimensions

The shape and depth of the root ball may be an important consideration for poorly drained soils. Root balls of any shape perform equally well in well-drained soil. Tall root balls help keep deeper roots moist. Wide and shallow root balls are better suited for planting in poorly-drained and compacted sites but dry more quickly on well-drained sites (Figure 3). Again, irrigation and site drainage are important considerations. A tall root ball may be more appropriate if irrigation will be infrequent or the site soil drains quickly because the deep roots stay moist longer.

### Root collar location

The area where the topmost roots meet the trunk is referred to as the root collar or root flare. If it is buried too deeply in the root ball, the tree could decline over time due to lack of oxygen for the root system. Trees can also decline from roots growing over the flare and forming stem-girdling roots. If the trunk emerges from the soil like a telephone pole, without any swelling or root flare, then soil should be excavated away from the trunk base to determine where the root flare is located (Figure 5). Remove soil or media around the base of the trunk until you locate the root flare or the area where the top most roots emerge from the trunk. The topmost major root should be no deeper than one inch from the surface of the root ball (Figure 5, bottom).

Do not purchase trees that were planted too deeply (Figure 6). If you have already purchased one, soil, media, and roots growing above the original topmost root should be mostly removed prior to planting.



Figure 4

Smaller nursery stock (top), have a shorter establishment period than larger nursery stock (bottom).



Figure 5

The point where the topmost root attaches to the trunk in the top photo is slightly above the soil surface. This is fine and indicates that the tree is not planted too deeply in the root ball. Root flare can be under the surface an inch or so; but problems can arise if it is much deeper (bottom). Root flare needs to be at or above landscape grade when planted.

## Root defects

Root ball defects can occur on any tree regardless of the production method. Once formed, these severe defects close to the trunk are time consuming or impossible to correct and can reduce the capacity of landscape plants to survive and grow. These problems are difficult to spot because they can be buried inside the root ball (Figure 7). Types of root defects include circling roots, kinked roots, stem girdling roots, and root-bound trees.

Trees with severe circling roots should not be planted (Figure 7). Roots circling close to the trunk can eventually slow growth and girdle the trunk. Circling roots at the top of the root ball are especially troublesome. Few roots grow from the outside edges of circling roots, making the tree unstable and more likely to blow down during hurricane-force or even lesser winds.

Kinked roots are roots that have been deflected and turned back on themselves almost 180 degrees. They occur mostly when roots are folded into a propagation tray or container at the liner stage. Water and sugars have a difficult time passing this severe turn in the root, and kinked roots do not provide the mechanical support straight roots do. Kinks in small roots are much less of a concern than kinks in a large root (Figure 8).

Stem-girdling roots are formed when new roots grow perpendicular to a cut root, or when the tree is growing in a container too long. As the trunk increases in diameter, these roots may meet the trunk and begin to strangle it, hence the term stem-girdling roots. The trunk may become severely indented where the root was girdling it; this can cause trunk and root decay, which reduces the tree's ability to stand up, especially in a hurricane (Figure 9).

Root-bound trees have many roots circling around the outside of the root ball (Figure 10), which causes a physical barrier, sometimes preventing the tree from spreading roots into the landscape soil after planting. All these roots should be cut when trees are potted to a larger container and when planting to the landscape.

## Examples of poor root systems



Figure 6

This tree is planted too deeply in the root ball. The root flare is 5 inches below the surface. The many roots growing over the root flare will cause problems later.



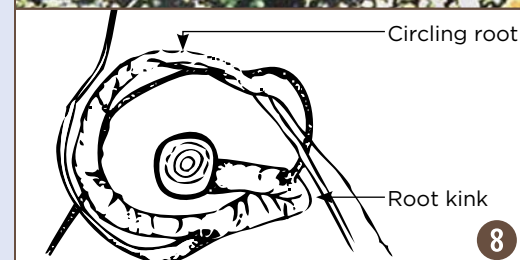
Figure 7

Circling roots develop when trees are grown in containers for too long, causing roots to be deflected by the container wall and to circle the outside of the root ball (top). Roots that circle when trees were in a smaller container are more difficult to detect because they are not on the edge of the current root ball (bottom).



Figure 8

Kinked roots can slow growth or even kill the tree as it grows.



8

A quick test can be performed to check root quality. When you push the trunk back and forth, the trunk on a good quality tree will bend along its length and will be firm in the soil or medium. The trunk on a tree with a defective root system will often pivot at its base and will lean over quite a way before it bends (often caused by circling roots when a tree was in a smaller container) (Figure 11). While passing this test does not eliminate trees with root defects, it is a good way to determine if there are severe defects close to the trunk.

Root ball caliper:  
height relationship

The American National Standards Institute and Florida Grades and Standards for Nursery Stock recommend minimum root ball sizes for nursery-grown trees based on trunk diameter or tree height, and the different kinds of containers they were grown in (Table 3). For instance, a field-grown tree with a trunk caliper of 3 inches should have a minimum 32-inch-diameter root ball and should be between 12 and 16 feet tall. Adhering to these standards helps trees to establish successfully in the landscape.

Table 3. Minimum root ball diameter and minimum/maximum tree height for trunk caliper.					
TRUNK CALIPER <sup>1</sup> (INCHES)	1	2	3	4	5
MIN. BALL DIAMETER ON FIELD-GROWN SHADE TREES	16	24	32	42	54
MIN. BALL DIAMETER ON FABRIC-CONTAINER-GROWN TREES	12	18	20	30	36
MIN. CONTAINER SIZE (GALLONS)	5	20	45	95	95
MIN. TREE HEIGHT ON STANDARD TREES	6	10	12	14	--
MAX. TREE HEIGHT	10	14	16	18	--

<sup>1</sup> Caliper is trunk diameter 6 inches from soil surface unless diameter is greater than 4 inches, in which case it is measured at 12 inches from soil surface.



Figure 9  
A stem-girdling root (bottom) caused this pine tree to blow down during a tropical storm. The root caused all roots on that side of the tree to die, resulting in trunk decay. There were few roots to hold this tree up in 60-mph winds.



Figure 10  
There are too many roots circling the root ball edge (left). Cut before planting by making 6 slices with a sharp blade from the top of the root ball to the bottom several inches deep inside the ball (right). This will slice through roots circling the outer edge of the root ball and will cut through larger roots circling from when the tree was in a smaller container. If defects are severe, it may be difficult to cut roots.



Figure 11  
This quick test checks for root quality defects close to the trunk.

## Trunk form and branch structure

Choosing a nursery tree with good structure can postpone future pruning and maintenance. Trees with poor structure could require more pruning cuts, and a greater portion of the canopy will have to be removed to correct defects.

Shade trees of lesser quality have two or more trunks. Best quality shade trees have one dominant trunk (Figure 12). Multiple leaders represent weakness and can cause the tree to split apart as it grows. Some smaller ornamental trees such as crapemyrtle, ligustrum, wax myrtle, and others naturally have multiple trunks and this does not have to be corrected. Major branches and trunks should not touch, and branches should be less than  $\frac{2}{3}$  trunk diameter (Figure 13).

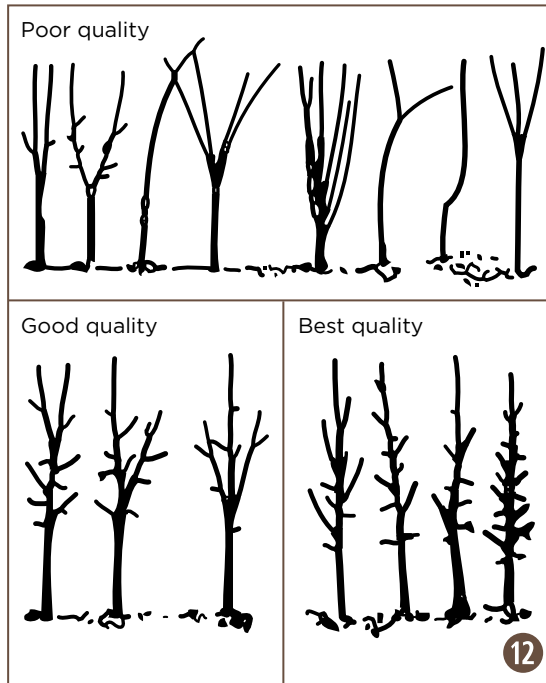


Figure 12

Poor quality shade trees have multiple leaders that weaken the strength of the tree. This makes the tree susceptible to hurricane-force winds (only trunk and main branches are shown).

## Other factors influencing tree quality

Though the qualities of the root ball and tree structure are the main considerations, there are some other important factors. Tree wrap should be removed so that the trunk can be inspected for hidden wounds. The trunk can be rewrapped after inspection to prevent wounding during shipping. Trees with large trunk injuries should be avoided.

Canopy uniformity is less important than trunk form and branch arrangement. However, a uniform canopy represents a detail accomplished by attentive growers. Trees with an irregular canopy, one dominant trunk, and good branch arrangement are far better than trees with a uniform canopy and a double trunk with included bark (Figure 14). The canopy on well-structured trees will fill in as the tree grows. Canopy fullness depends on the tree species or cultivar in question. Thin canopies do not necessarily mean that the trees are poor quality, diseased, or infested with insects, since species and cultivars vary greatly in this characteristic. Some trees, such as trumpet tree, Shumard oak and gumbo limbo, are naturally thin when they are young.

Evaluate pruning cuts to determine the quality of the nursery stock. Properly made pruning

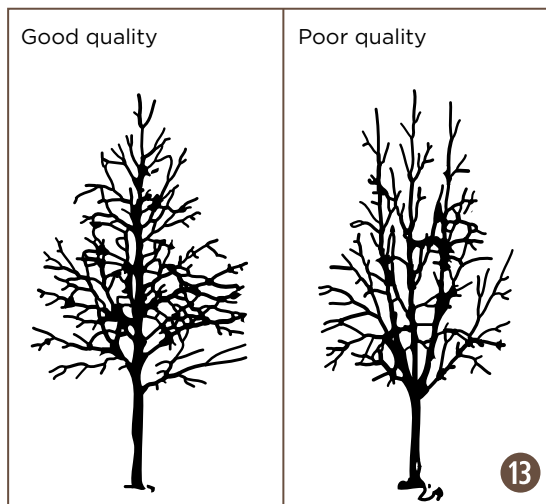


Figure 13

Trees with one dominant trunk (left) are better quality than trees with multiple upright trunks (right).

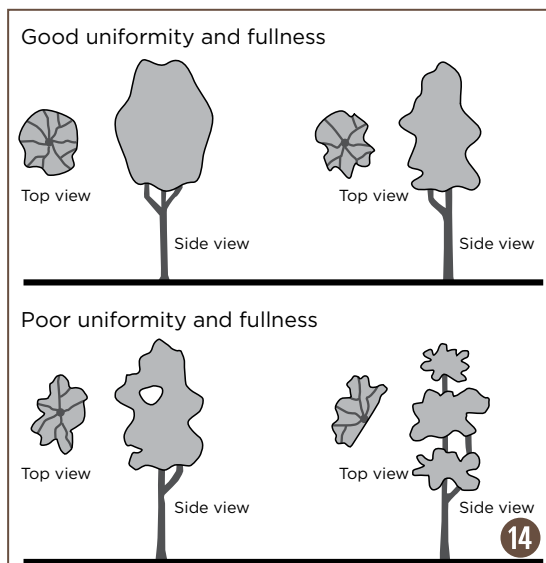


Figure 14

Trees with inferior canopy uniformity may have poor branch structure and may grow poorly in the landscape. However, some trees such as mahogany and trumpet tree are naturally more open and thin.

cuts indicate that the nursery has high pruning standards and is capable of growing high-quality trees (Figure 15). Improper cuts indicate a poor understanding of tree care and biology.

FOR MORE INFORMATION »	
ON PROPER PRUNING CUTS	CH 12 Developing a Preventive Pruning Program in Your Community: Young Trees

Trees propagated from plants in the same area as the planting site are likely to be perfectly adapted to the climactic conditions of the site; such trees are rarely available. Tree cultivars have been developed and varieties have been selected for tolerance of cold temperatures, high soil pH, drought, pests and diseases, etc. that are well suited to a wide range of planting sites.

Other concerns are foliage color and staking. Foliage can be discolored for a number of reasons. Discoloration can be a result of nutrient deficiencies. Stakes should be removed from trees before purchasing to assure that the trees can stand unassisted if caliper is more than 1.5 inches.

Figure 16 shows good quality field and container trees. Trees have one dominant trunk, the branches are not crossing, and the canopies are full and uniform. Trees of good quality are more likely to withstand strong winds in the event of a hurricane or tropical storm.

**For more information, visit:**

American National Standards Institute (ANSI)

<http://www.ansi.org/>

Florida Grades and Standards

<http://www.doacs.state.fl.us/pi/pubs.html>



Figure 15

A proper pruning cut is made along the line drawn next to the word “yes” just outside the branch collar (top). An improper cut made through the collar (next to word “no”) results in a flush cut and an elongated wound (bottom) that begins to callus from the sides only. Flush cuts cause decay.



Figure 16

These are examples of quality nursery trees well worth their price.

This document is ENH 1060, one of the Urban Forest Hurricane Recovery series of the School of Forest Resources and Conservation and the Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date January 2007. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu> and <http://treesandhurricanes.ifas.ufl.edu/>.

Edward F. Gilman, Professor and Laura Sadowski, Horticultural Information Specialist, Department of Environmental Horticulture; University of Florida, Institute of Food and Agricultural Sciences, Gainesville, FL 32611

Design and layout: Mariana Wallig & Julie Walters.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Employment Opportunity-Affirmative Action Employer authorized to provide research, educational information and other services only to individuals and institutions that function without regard to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For information on obtaining other extension publications, contact your county Cooperative Extension Service office. Florida Cooperative Extension Service / Institute of Food and Agricultural Sciences / University of Florida / Larry R. Arrington, Dean.