



Colorado MASTER GARDENER

Tree Selection: Right Plant, Right Place 7.832

by D. Whiting, J. Boussetot, R. Cox, and C. O'Meara'

Outline. . .

Species Selection, page 1

Mature Size, page 2

Growth Rates, page 2

Soil Considerations, page 2

Water Needs and Tolerances,
page 2

Management Concerns, page 2

Climatic Adaptation, page 3

Other Selection Criteria, page 4

Size Considerations, page 4

Types of Nursery Stock, page 5

Selecting Trees – Don't Buy
Problems, page 6

Shipment and Pre-plant
Handling, page 7

The average life of a tree in the landscape is only eight years due to poor design and planting techniques. This fact sheet outlines considerations in tree selection for the home landscape. Additional information on this subject is in fact sheets 7.831, *Tree Placement: Right Plant, Right Place* and 7.833, *The Science of Planting Trees*.

Species Selection

Many species of trees and shrubs are well suited to Colorado landscapes. Several Colorado State University publications list trees and shrubs for Colorado, including:

CSU Cooperative Extension fact sheets

- 7.415, *Deciduous Shrubs*
- 7.414, *Evergreen Shrubs*
- 7.403, *Evergreen Trees*
- 7.208, *Hedges*
- 7.419, *Large Deciduous Trees for Street and Shade*
- 7.422, *Native Shrubs for Colorado Landscapes*
- 7.421, *Native Trees for Colorado Landscapes*
- 7.423, *Trees and Shrubs for Mountain Areas*
- 7.418, *Small Deciduous Trees for Privacy and Color*
- 7.229, *Xeriscaping: Trees and Shrubs*

Other CSU Cooperative Extension Publications

- *Woody Landscape Plants for the High Plains*, LTB93-1, \$14.00

In addition, many communities and nurseries have tree lists for the local area. Many communities have small arboretums in local parks where a variety of trees can be viewed.

In selecting trees for a home landscape, remember that there is NO perfect tree. All trees have good and bad characteristics. Select trees based on site considerations as well as personal likes.

The best advice for selecting trees is to intentionally plant a diversity of species in the neighborhood and community. Avoid frequent use of only a few tree species as this increases the likelihood of insect and disease problems. Dutch elm disease spread through the United States due to the overplanting of elm trees. Ash trees became a common replacement for Elms. Now the lilac/ash borer is commonplace. Currently Honeylocust is very popular and pest problems on Honeylocust are becoming common. Aspen is popular along the Colorado Front Range. While native to our mountains, it is not native to the high plains and has many problems in irrigated yards along Front Range communities.



Putting Knowledge to Work

Mature Size

Size is a primary consideration in tree selection. Trees should fit in the available growing space without pruning. This is of primary concern under utility lines as the utility has the right-of-way.

Since large trees give a higher return in environmental benefits, plant large tree species whenever the space allows. Large trees can be structural strong if attention is given to structural training while young. For additional details on size selection and the environmental benefits of large trees, refer to fact sheet 7.831, *Tree Placement: Right Plant, Right Place*.

Growth Rates

Homeowners often desire fast-growing trees. However, fast-growing species are typically more prone to insects, diseases and internal decay. Fast-growing species typically have a shorter life span.

Soil Considerations

Suitable rooting space is the most limiting factor in tree growth. Poor soil conditions contribute to 80 percent of tree health issues. Unfortunately, many homeowners and landscape designers fail to consider soil limitations in tree selection and planting. Impacts of poor soil conditions include:

- Many trees fail to establish or are slow to establish.
- Growth rates will be reduced.
- Tree vigor will be low predisposing trees to insects, diseases and other stress factors.
- Mature size will be smaller.
- Longevity will be shorter.

Soil texture, structure and tilth are considerations in tree selection. Some trees perform poorly on compacted and clayey soils (due to low soil oxygen levels). On compacted clayey soils, drainage can be a limiting factor. Reference books often list trees that are “flooding or compaction tolerant” as an indication of trees more tolerant of low soil oxygen and more adaptable to compacted clayey soils. Other trees do poorly on dry sandy soils (due to drought).

If the soil has *free lime*, iron chlorosis is a common problem for some species of trees in heavily irrigated lawns. Avoid planting species susceptible to iron chlorosis (like silver maple and aspen) in this situation. Refer to 7.728, *Iron Chlorosis*, for additional information.

Water Needs and Tolerances

Water needs and tolerances are primary considerations in light of Colorado’s drought cycle. Gardeners need to understand that the water needed to *maintain life* is unrelated to the water needed for tree *growth*. Drought tolerance for any tree changes with the life cycle of the tree. Trees listed as drought tolerant may not be suitable to extremely dry sites or prolonged water stress.

Scientists cannot yet answer the common question of “How many gallon of water does this tree need?” At best, listing of trees more tolerant of dryer sites is only observational based on routine dry spells, not extreme drought situations.

Another common issue about tree selection is tolerance to wet soils. Due to poor irrigation system design, maintenance and management, most home lawns are significantly over-watered. Some trees, such as crabapples and aspen, are rather intolerant of the excessive irrigation.

Management Concerns

Common management issues are a consideration in tree selection.

Trees with a decurrent growth habit are more prone to storm and wind damage. Damage potential can be minimized if the trees are structurally trained while young.

Common insect and disease problems should be a consideration. What are the common pests of the tree? Which are only cosmetic and which can impact

its health? How tolerant are you of cosmetic pests? Under what situations do management efforts become warranted? What is your interest and willingness to make pest management efforts?

For example, stressed Ash trees are highly susceptible to lilac/ash borer that may kill trees. If unwilling to routinely treat for borer, ash would be a poor choice, particularly on a site with limited rooting area. Aspen are highly susceptible to Poplar Twig Gall when planted in a heavily irrigated lawn. If you don't like this cosmetic damage, don't plant aspen in routinely irrigated sites. Honeylocust are highly susceptible to the Honeylocust spider mite (which can defoliate the tree mid summer) when planted on dry sites. If you are not willing to treat for spider mites, don't plant Honeylocust on dry sites or with restricted rooting areas.

Other maintenance factors include:

- Fruiting habit
- Leaf litter nuisance
- Seed germination
- Root and basal suckering

Climatic Adaptation

Exposure to sun, wind, heat and cold are considerations in tree selection. Issues around winter hardiness and winter burn can be reduced with winter watering on susceptible species.

Hardiness zones are an indication of the *expected minimum low winter temperature*. However, in Colorado, we occasionally have an extremely cold winter that challenges the hardiness zone data as we approach record lows.

Hardiness (ability of a plant to withstand cold) comes from many interrelated factors including:

Photoperiod and genetics – Length of night (photoperiod) is the first signal trees receive that winter is approaching. When parent materials are collected from the south and then moved north, they may not be adapted to the differences in photoperiod and winter damage may be more pronounced. Growers are becoming aware of this important issue in selection of nursery stock.

Minimum temperatures that trees tolerate is set by the plant's genetics and influenced by recent temperatures.

Recent temperatures – A tree's tolerance to cold is heavily influenced by the temperature patterns of the previous few days. When temperatures gradually drop over a period of weeks, trees are generally tolerant of extreme cold. However, trees are less tolerant of extreme cold when it appears suddenly following moderate temperatures.

Rapid temperature change is a primary factor limiting our plant selection. In Colorado it is common to have a spring thaw followed by an "Arctic Express" back to winter. Temperatures can drop more than 50 degrees in an hour.

Water – Woody plants going in to winter with dry soil conditions lose approximately 20 degrees in hardiness. Colorado's dry fall and winter weather reduces plant hardiness. Fall watering, after leaves drop but before soils freeze, helps minimize hardiness issues.

Wind exposure is another factor reducing hardiness in open areas of the high plains. Winter watering helps manage this issue.

Exposure to sun, including reflected sun from snow or structures, is an issue in winter bark injury and frost cracks.

Carbohydrate reserves – Plants under stress, with lower carbohydrate reserves, are more susceptible to winter damage. During the drought of 2002-4 Colorado trees experienced extensive winter injury related to stress, even without extreme cold.

Microclimates – The typical yard has dryer and wetter sites, windy and less windy areas, warm and cooler areas. These microclimates may create a site that is more or less suitable for some specific plants.

Other Selection Criteria

Other selection criteria include:

- Potential damage to hardscapes (sidewalks, gutters) from root growth
- Utility right-of-ways for above-ground and below-ground utilities
- Vandalism in public access sites
- Car damage along streets
- Turf competition and herbicide use
- Pesticide drift from adjacent properties
- De-icing salts

The majority of landscape management problems are traceable back to the design issues. Care in tree selection and placement will help minimize management problems.

Size Considerations

Size and Establishment

To give the “instant tree” appearance, larger caliper trees are often the choice for homeowners and in public access sites. However, larger trees also take longer for the root system to redevelop in the establishment phase of the life cycle before the tree shifts into the growth phase. During the establishment phase, canopy growth will be minimal. For this reason, smaller trees are recommended on sites where less than ideal growing conditions exist.

On sites with poor soils and poor planting techniques, the establishment phase may be longer and trees must live off carbohydrate reserves until roots become established. It is common to see trees planted with poor planting techniques and/or poor soil conditions that never establish; rather they decline over a period of time. In recent years, poor planting techniques have killed more trees than any insect or disease outbreak!

Moving Trees – A Weight Issue

Size (weight) is another issue in tree selection. It takes two people to move a 2-inch caliper tree (measured 6 inches above the soil line). Larger trees require mechanical help. Trees up to 4" caliper can be moved with front end loaders used in landscape installation. For larger caliper trees, special tree moving equipment is required.

Minimum Root Ball Size

The minimum size of the root ball for trees and shrubs is set by Colorado Department of Agriculture in the **Rules and Regulations of the Colorado Nursery Act**, as illustrated in Table 1.

Table 1. Minimum Root Ball Diameter for Nursery Grown, B&B Shade Trees

<u>Tree Caliper*</u>	<u>Minimum Root Ball Diameter</u>
1/2 to 3/4 inch	12 inches
3/4 to 1 inch	14 inches
1 to 1 1/4 inches	16 inches
1 1/4 to 1 1/2 inches	18 inches
1 1/2 to 1 3/4 inches	20 inches
1 3/4 to 2 inches	24 inches
2 to 2 1/2 inches	26 inches
2 1/2 to 3 inches	28 inches
3 to 3 1/2 inches	32 inches
3 1/2 to 4 inches	36 inches

*Measured 6 inches above soil line.

In hardiness zone 5 with good planting techniques and good soil conditions, it typically takes one growing season per inch of trunk caliper (measured at 6 inches above soil line) for roots to establish following transplanting. That is, a 1-inch caliper tree would take 1 season for the roots to establish while a 3-inch caliper tree will take 3 seasons. In cooler regions with shorter growing seasons it will take longer. With longer growing seasons, like the southern U.S., the establishment phase will be measured in months.

Table 2. Maximum Size for Tree Spades

<u>Spade Size</u>	<u>Deciduous Trees</u> <u>Caliper</u>	<u>Evergreen Trees</u> <u>Height</u>
44 inch	2-3 inches	5-7 feet
60 inch	3-4 inches	7-9 feet
78 inch	4-6 inches	9-14 feet
85 inch	6-8 inches	14-18 feet

Types of Nursery Stock

Plants may be produced under three different production systems:

Nursery grown – field grown in a managed nursery

Plantation grown – field grown with limited inputs

Collected – Dug from natural growing sites without inputs; require 33 percent larger root ball

Nursery stock is generally divided into three types. Many variations exist within each type.

Bare-Root Stock – Plant is sold without an established soil ball.

- Bare-root stock is generally limited to smaller caliper materials. Some evergreen materials won't transplant well as bare rootstock.
- Cost for bare-root stock is significantly lower than the same plant as a container grown or B&B stock.
- Roots dehydrate rapidly and must be protected.
 - Bare-root stock is often marketed in individual units with roots bagged in moist sawdust or peat moss to prevent dehydration. Sometimes, bare-root stock is temporarily potted to protect roots.
 - Some nurseries maintain bare-root stock in moist sawdust. As plants are removed after sale with roots packed in moist sawdust for transport to the planting site. These need to be planted within 24 hours of purchase.
- Survivability drops rapidly once the plant leafs out. Some nurseries keep bare-root stock in cold storage to delay leafing.

Field Grown, B&B – Trees are dug from the growing field with the root ball and soil intact. In the harvest process, only 5 to 20 percent of the small roots are retained in the root ball, the other 80 to 95 percent is left behind in the field. This puts trees under water stress until the roots can reestablish.

- To prevent the root ball from breaking, the roots are Balled and wrapped with Burlap and twine (B&B). In nurseries today, there are many variations to B&B techniques. Some are also wrapped in plastic shrink-wrap, placed in a wire basket, or placed in a pot.
- B&B stock is best transplanted in the spring or fall season.
- The weight of the root ball readily becomes an issue with larger caliper trees. A 2-inch caliper tree is the largest size two people can expect to move. Equipment will be needed for larger trees.
- In field production, the roots may be routinely cut to encourage a more compact root ball. While this process improves the transplantability of the tree, it slows growth adding to production costs.

Container Grown nursery stock was grown in the container.

- Since the root system is not seriously disturbed, container grown nursery stock can be readily transplanted throughout the growing season; spring, summer or fall.
- Light textured potting mixes are generally used in container production to reduce weight and waterlogging potential in the pot. However, this can make the newly planted tree more prone to drought during the first two years.



- Since the roots can't spread, the root system of container grown stock will be only 5 to 20 percent of that found in field grown plants. Thus growth rates in the nursery may be slower.
- There are many variations of container production. In many systems, like "pot-in-pot" and "grow-bags", the container is in the ground. This protects roots from extreme heat and cold and prevents trees from blowing over.

Selecting Plants – Don't Buy Problems

There are several considerations in plant selection at the nursery, including:

- Since **co-dominant trunks** account for the majority of storm damage, NEVER purchase trees with co-dominant trunks. A single trunk tree should have one trunk to the top and all branches should be less than 1/2 the diameter of the adjacent trunk.
- Consider what other **corrective pruning** will be needed to structurally train the tree. Avoid trees with poor branching structure.
- Any **pruning wounds or bark injury** should be less than 1 inch or less than 25 percent of the trunk circumference.
- Trees should have good **growth** the past 2 to 4 years and good **leaf color**.
- Evaluate any **insect or disease problems** as to potential long term impacts. While some insect and disease problems are not an issue, others could seriously impact the tree's health. Due to the water stress imposed by the harvest and planting process, young trees are less tolerant of most pests.
- **Planting depth of tree in root ball** – Generally, at least two structural roots should be within the top 1 to 3 inches of the soil surface, measured 3 to 4 inches out from the trunk. (Fact Sheet 7.833, *The Science of Planting Trees* lists additional details and exceptions.) A visible trunk flare is another indication of proper planting depth in the root ball. However, on many small trees, the trunk flair is hardly noticeable. A small air gap between the trunk and soil indicates that the tree is planted too deep.
- **Healthy roots** are whitish, while dead roots are dark. **Girdling roots** can become a serious problem and will need to be cut in the planting process.

Shipment and Pre-Plant Handling

Pre-plant handling often predisposes new plantings to decline and death.

Factors to pay attention to include:

- **Handle carefully**; the root ball is subject to cracking, killing the tree.
- **Lift by the soil ball**, not the trunk.
- **Protect from mechanical injury** during shipment. The bark on young trees is tender and easily damage by rubbing or bumping.
- **Protect from dehydration** during shipment. A shade cloth gives good wind protection. Many nurseries routinely wrap trees for shipment. Water upon delivery.
- **Protect from wind and heat** until planted.
- **Check water needs daily**.
- **Plant immediately**, when possible.
- **Exposed roots** are readily killed by desiccation and should be cut off in the planting process.

Colorado Master Gardener training is made possible, in part, by a grant from the Colorado Garden Show, Inc.

¹D. Whiting, Colorado State University, Cooperative Extension consumer horticulture specialist and Colorado Master Gardener coordinator; J. Bousselot, Extension horticulture agent, Douglas County; R. Cox, Extension horticulture agent, Jefferson County; and C. O'Meara, Extension horticulture assistant, Boulder County.

Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating. Cooperative Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.