



CMG GardenNotes #632

Tree Selection: Right Plant, Right Place

Outline:

- Species selection, page 1
 - Mature size, page 2
 - Growth rates, page 2
 - Soil considerations, page 2
 - Water needs and tolerances, page 3
 - Management concerns, page 4
 - Climatic adaptation, page 4
 - Other selection criteria, page 5
- Size considerations, page 6
 - Size and establishment, page 6
 - Moving trees – a weight issues, page 6
 - Minimum root ball size, page 6
- Types of nursery stock, page 7
 - Bare-root stock, page 7
 - Field-grown B&B, page 8
 - Container-grown, page 8
- Selecting trees – don't buy problems, page 9
- Shipment and pre-plant handling, page 10

The average life of a tree in the landscape is only eight years due to poor design and planting techniques. This publication outlines considerations in tree selection for the home landscape.

Species Selection

Many species of trees and shrubs are well suited to Colorado landscapes. Colorado State University Extension publications listing trees and shrubs for Colorado, including the following:

CSU Extension Fact Sheets available online at www.cmg.colostate.edu.

- Deciduous Shrubs, #7.415
- Evergreen Shrubs, #7.414
- Evergreen Trees, #7.403
- Hedges, #7.208
- Large Deciduous Trees for Street and Shade, #7.419
- Native Shrubs for Colorado Landscapes, #7.422
- Native Trees for Colorado Landscapes, #7.421
- Shrubs for Mountain Communities, #7.407
- Small Deciduous Trees, #7.418
- Trees and Shrubs for Mountain Areas, #7.423
- Xeriscaping: Trees and Shrubs, #7.229

Other Publications

- *Front Range Tree Recommendation List* available at

In addition, many communities and nurseries have tree lists for local areas. Some communities have small arboretums in local parks where a variety of trees may 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 over-planting 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.

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.

Because large trees give a higher return in environmental benefits, plant large tree species whenever the space allows. Large trees can be structurally strong if attention is given to structural training while young.

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 shorter life spans.

Soil Considerations

Suitable rooting space is a major limiting factor in tree growth. Poor soil conditions contribute to 80% 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 the following:

- 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 in compacted or clayey soils (due to low soil oxygen levels). On compacted or 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 or clayey soils. Other trees do poorly in 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. For additional information, refer to *CMG GardenNotes* #223, **Iron Chlorosis**. [Figure 1]

Figure 1. Iron chlorosis (yellowing of younger leaves with veins remaining green) on aspen.



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, “How many gallons 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.

Pruning – 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 affect tree health? How tolerant are you of cosmetic pests? Under what situations would 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. For gardeners unwilling to routinely treat for borers, 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 do not like this cosmetic damage, do not plant aspen in routinely irrigated sites. Honeylocust are highly susceptible to the honeylocust spider mite (which can defoliate the tree midsummer) when planted on dry sites or with restricted rooting areas. If you are not willing to treat for spider mites, do not plant honeylocust on dry sites or those 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 related to 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 (the ability of a plant to withstand cold) comes from many interrelated factors:

Photoperiod and genetics – The 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 are set by the plants' 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 readily drop more than 50°F in an hour.

Water – Woody plants going into winter with dry soil conditions lose approximately 20°F 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, contributes to 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 2002-2004, 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, and warmer and cooler areas. These microclimates may create a site that is more or less suitable for some specific plants.

Other Selection Criteria

- Potential damage to hardscapes (sidewalks, gutters, etc.) 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 flaws. 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 public-access sites. However, the root systems of larger trees also take longer to redevelop in the establishment phase of the life cycle before the trees shift 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.

In Hardiness Zones 4 and 5, with good planting techniques and good soil conditions, it typically takes one growing season per inch of trunk caliper (measured at six inches above soil line) for roots to establish following transplanting. That is, a one-inch caliper tree will take one season for the roots to establish, while a three-inch caliper tree will take three seasons. In cooler regions with shorter growing seasons, it will take longer. With longer growing seasons, like the southern United States, the establishment phase will be measured in months.

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, but rather 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 factor in tree selection. It takes two people to move a two inch caliper tree (measured six inches above the soil line). Larger trees require mechanical help. Trees up to four inch 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 the Colorado Department of Agriculture in the *Rules and Regulations of the Colorado Nursery Act*. [Tables 1 and 2]

Maximum tree size to move with a spade is given in Table 3. It is common mistake to expect tree to live when moved with an undersized tree spade! [Table 3]

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

<u>Tree Caliper*</u>	<u>Minimum Root Ball Diameter</u>
½ to ¾ inch	12 inches
¾ to 1 inch	14 inches
1 to 1 ¼ inches	16 inches
1 ¼ to 1 ½ inches	18 inches
1 ½ to 1 ¾ inches	20 inches
1 ¾ to 2 inches	24 inches
2 to 2 ½ inches	26 inches
2 ½ to 3 inches	28 inches
3 to 3 ½ inches	32 inches
3 ½ to 4 inches	36 inches

*Measured 6 inches above soil line.

Table 2.
Minimum Root Ball Size for Coniferous Evergreens

<u>Height</u>	<u>Caliper¹</u>	<u>Minimum Root Ball Diameter²</u>
1 to 2 feet	½ to ¾ inches	12 inches
2 to 3 feet	¾ to 1 inch	14 inches
3 to 4 feet	1 to 1¼ inches	16 inches
4 to 5 feet	1¼ to 1½ inches	18 inches
5 to 6 feet	1½ to 1¾ inches	20 inches
6 to 7 feet	1¾ to 2 inches	24 inches
7 to 8 feet	2 to 2½ inches	26 inches
8 to 9 feet	2½ to 3 inches	28 inches
9 to 10 feet	3 to 3½ inches	32 inches
10 to 12 feet	3½ to 4 inches	36 inches

¹ Measured at 6 inches above the ground

² Root ball size based on the larger of height or caliper.

Source, Colorado Department of Agriculture: Colorado Nursery Act

Table 3.
Maximum Size for Tree Spades

<u>Spade Size</u>	<u>Deciduous Trees Caliper</u>	<u>Evergreen Trees 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

Bare-Root Nursery Stock

Bare-root plants are sold without an established soil ball. Bare-root stock is generally limited to smaller-caliper materials. Some evergreen materials will not transplant well as bare-root stock.

The cost of 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 at sale, roots are 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, Balled and Burlapped Nursery Stock

Field-grown, Balled and burlapped (B&B) trees are dug from the growing field with the root ball and soil intact. In the harvest process, only 5-20% of the small roots are retained in the root ball, the other 80-95% is left behind in the field. This puts trees under water stress until roots can reestablish. [Figure 2]



Figure 2. Field-grown B&B nursery stock

To prevent the root ball from breaking, the roots are Balled and wrapped with Burlap and twine (known as 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.

The weight of the root ball readily becomes an issue with larger-caliper trees. A two 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

Container-grown nursery stock is grown in the container. Because the root system is not seriously disturbed, container-grown nursery stock can be readily transplanted throughout the growing season; spring, summer or fall.



Figure 3. Container-grown nursery stock.

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 cannot spread, the root system of container-grown stock will be only 5-20% 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 the following:

- Because **codominant trunks** (trunks of equal size) account for the majority of storm damage, avoid purchasing trees with codominant 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. (Refer to pruning fact sheets for details.) [Figure 4]



Figure 4. Codominant trunks account for the majority of storm damage. Avoid purchasing trees with codominant trunks or correct the situation with structural pruning.

- Consider what other **corrective pruning** will be needed to structurally train the tree. (Refer to pruning fact sheets for details.) Avoid trees with poor branching structure.
- Any **pruning wounds or bark injury** should be less than one inch or less than 25% of the trunk circumference.
- Trees should have good **growth** the past 2-4 years and good **leaf color**.
- Evaluate the potential long-term impacts of any **insect or disease problems**. While some insect and disease problems are not an issue, others could seriously affect 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 the tree in the root ball** – Generally, at least two structural roots should be within the top 1-3 inches of the soil surface, measured 3-4 inches out from the trunk. (Refer *CMG GardenNotes* #633, *The Science of Planting Trees*, for 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 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 the following:

- **Handle carefully.** The root ball is subject to cracking, killing the tree.
- **Lift by the root ball**, not the trunk. If lifted by the trunk, the roots may not be able to support the weight of the root ball soil, cracking the root ball.
- **Protect from mechanical injury** during shipment. The bark on young trees is tender and easily damaged by rubbing or bumping against the vehicle.
- **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.**
- When possible, **plant immediately.**
- **Exposed roots** are readily killed by desiccation and should be cut off in the planting process.

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