



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 3
Climate Adaptation, page 3
Other Selection Criteria, page 4
Size Considerations, page 5
Types of Nursery Stock, page 6
Selecting Trees – Do Not Buy Problems, page 7
Shipment and Pre-Plant Handling, page 8

The average life of a tree in Colorado is greatly reduced often due to poor design and planting techniques. This publication outlines considerations that should be made during 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, include the following Fact Sheets, found online at <https://extension.colostate.edu/topic-areas/yard-%20%20garden/?target=publications>:

- #7.208, *Hedges*.
- #7.229, *Xeriscaping: Trees and Shrubs*.
- #7.403, *Evergreen Trees*.
- #7.414, *Evergreen Shrubs*.
- #7.415, *Deciduous Shrubs*.
- #7.418, *Small Deciduous Trees*.
- #7.419, *Large Deciduous Trees*.
- #7.421, *Native Trees for Colorado Landscapes*.
- #7.422, *Native Shrubs for Colorado Landscapes*.
- #7.423, *Trees and Shrubs for Mountain Areas*.
- #7.427, *Columnar and Fastigate Trees for Colorado Landscapes*.

Other Publication(s)

- Find the *Front Range Tree Recommendation List* here:
<https://extension.colostate.edu/docs/pubs/garden/treereclist.pdf>.

In addition, many communities and nurseries have tree lists for local areas. Contact your local municipality. Look for communities that have small arboretums in local parks where many types 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 preferences.

The best advice for selecting trees is to intentionally plant a diversity of species in the neighborhood and community, avoiding the frequent use of only a few tree species as this increases the likelihood of insect and disease problems. For example, Dutch elm disease spread throughout the United States due to the over-planting of elm trees. Ash trees became a common replacement for Elms and are now under threat by Emerald Ash Borer. Currently honeylocust is popular, and pest problems with honeylocust are becoming common. Aspen is also popular along the Colorado Front Range. While native to our mountains, it is not native to the high plains. Because of the differences in these two environments, aspen has many problems in irrigated yards along Front Range communities.

Mature Size

Size is a primary consideration in tree selection when selecting a tree. 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. Smaller or more narrow trees should be chosen for areas under power lines or with other space restrictions.

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 want 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 a high percentage of tree health issues. Unfortunately, most homeowners and landscape designers do not consider soil limitations in tree selection and planting.

Impacts of poor soil conditions include the following:

- Many trees are slow to establish or do not 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* typically due to alkaline soils, iron chlorosis is a common problem for some species of trees in heavily irrigated lawns. Avoid planting species susceptible to **iron chlorosis** (like

red and silver maple, and aspen) in this situation. For more information, refer to CMG GardenNotes #223, *Iron Chlorosis of Woody Plants*. [Figure 1]

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 support 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 for extremely dry sites or prolonged water stress.

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

Choosing a tree to match the water availability of the site and soil conditions is essential for long term tree health.

Management Concerns

Common management issues are a consideration in tree selection.

Pruning

Trees with a **decurrent** growth habit (trees with a more rounded form with multiple scaffold branches) are more prone to storm and wind damage. Damage potential can be minimized if the trees are structurally trained while young. Examples of decurrent trees include Maple, Ash, Elm and Honeylocust.

Common Insect and Disease Problems

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, aspen is 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 sites with restricted rooting areas.

Other maintenance factors include:

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

Climate 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.



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

Hardiness zones are a sign of the **average annual minimum winter temperature**. However, in Colorado we occasionally have an extremely frigid 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 the 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 periods of prolonged drought, Colorado trees experience extensive winter injury related to stress, even without extreme cold.
- **Microclimates.** The typical yard has drier 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, etcetera.) from root growth.
- Utility rights-of-way 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.

Most 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. 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 in 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 decline over a period of time.

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 inches in caliper can be moved with front-end loaders used in landscape installation. For larger-caliper trees, special tree-moving equipment is needed.

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]

Tree Caliper*	Minimum Root Ball Diameter
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

*Tree caliper measured 6 inches above soil line.

Table 2. Minimum Root Ball Size for Coniferous Evergreens		
Height	Caliper *	Minimum Root Ball Diameter **
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

* Measured at 6 inches above the ground.
** Root ball size based on the larger of height or caliper.
Source, Colorado Department of Agriculture: Colorado Nursery Act

Types of Nursery Stock

Bare-Root Nursery Stock

Bare-root plants are sold as dormant trees without an established soil ball. Bare-root stock is generally limited to smaller-caliper materials and shipped in bulk, making the cost of bare-root stock significantly lower than the same plant as a container-grown or B&B tree.

With bare root trees, roots dehydrate rapidly and must be protected. Bare-root stock is often marketed in individual units with roots bagged in moist media to prevent dehydration. Some nurseries maintain bare-root stock in moist sawdust and as plants are removed at sale, roots are packed in protective packaging for transport to the planting site. These need to be planted within twenty-four hours of purchase. Sometimes bare-root stock is temporarily potted to protect roots.

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 (known as 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 kept in the root ball, the other 80-95% is left behind in the field. This puts trees under water stress until roots can reestablish after planting. [Figure 2]

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.



Figure 2. Field-grown B&B nursery stock.

The weight of the root ball readily becomes an issue with larger-caliper trees. A two-inch caliper tree is the largest size recommended for two people 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 transplant-ability 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]

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.



Figure 3. Container-grown nursery stock.

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 containers used in container grown nursery stock. 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 Trees – Do Not Buy Problems

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

- Because **codominant trunks** (trunks of equal size) account for most of the storm damage, avoid buying trees with codominant trunks. A single-trunk tree should have one trunk to the top, and all branches should be less than half the diameter of the adjacent trunk. (Refer to pruning Fact Sheets for details.) [Figure 4]
- 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** for the past two to four 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



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

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 one to three inches of the soil surface, measured three to four inches out from the trunk. Refer to CMG GardenNotes #633, *The Science of Planting Trees*, for added details and exceptions.
- A **visible trunk flare** is another sign of proper planting depth in the root ball. However, on many small trees the trunk flare is hardly noticeable. A small gap between the trunk and soil shows that the tree is planted too deep.
- **Healthy roots** are whitish, while dead roots are dark. **Girdling roots** can become a severe 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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