Planting and Transplanting Trees and Shrubs

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The Plant

Trees and Shrubs should be selected for a site based on the ability of the plant to tolerate the soil, light, climate, and residential conditions present at that location. Information on the ability of various shrubs to tolerate environmental conditions in Minnesota can be found in the following guides published by the University of Minnesota Extension Service:

Recommended Trees for Southeast Minnesota (FO-6574)

Recommended Trees for Southwest Minnesota (FO-6575)

Recommended Trees for Northern Tallgrass Prairie (FO-6989)

Recommended Trees for Northwest and Central Minnesota (FO-6945)

Recommended Trees for Northcentral Minnesota (In Press)

Recommended Trees for Northeast Minnesota (In Press)

Fitting Trees and Shrubs into the Landscape (FO-0604)

The Site

The conditions of the planting site are as important as the plant. Soil type and drainage, available water and sunlight, exposure to drying winds, and other factors must be considered. Attempting to match the requirements of the plant to the site increases the survivability, performance, and longevity of the plant selected.

Soil Texture and Drainage

The first step in assessing the condition of the planting site is to examine the soil. Is it sandy and well drained? Is it moist with some organic material? Is it heavy clay and, therefore, wet and perhaps compacted? Construction practices such as cutting and filling, installation of underground utilities, and backfilling against foundations can create great diversity in soil structure. This variability can change drastically with depth and between planting locations on the same property—investigate each planting site.

Soil texture and drainage are closely related. Sandy soils usually are very well drained, have large pore spaces, and poor water-holding capabilities. They are usually associated with dry conditions. Conversely, clayey soils have much smaller pore spaces, are poorly drained, and can suffocate plant roots. The pore spaces in soil are very important to plant growth because the oxygen that occupies them is essential to healthy roots. A tree planted in poorly drained soil will be slow to establish, lack vigor, and often will slowly die.

Because plant roots require both moisture and oxygen for growth, soil drainage should be checked before planting. A poorly drained soil, high in moisture but low in oxygen, prevents both proper root development and growth of beneficial soil micro-organisms that are responsible for decomposing organic matter and releasing plant nutrients.

To test for soil drainage, dig a hole 18 inches deep, fill it with water, and let it stand overnight. If the water has not drained by morning, there is a drainage problem. (Do not test the drainage in this manner after heavy rainfall or before the ground has thawed in the spring.)

If soil drainage is inadequate, species that are tolerant of poorly drained soils may be planted,

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or soil drainage may be improved. This can be done in two ways. If a hard pan is present (a compacted, impermeable layer of soil) with an underlying layer of well-drained soil, a hole can be dug down to the permeable layer to provide drainage for the planting hole **(Figure 1)**. If the soil is poorly drained and there is no well-drained layer below, a tile system can be laid **(Figure 2)**. This, however, is expensive and requires the assistance of a professional for proper design. Simply adding gravel to the bottom of the planting hole will further decrease oxygen availability to the root system.

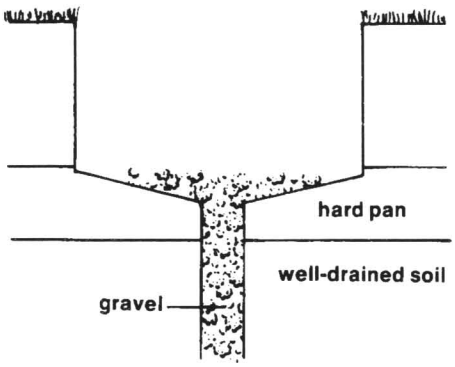

Figure 1. Development of drainage through hard pan layer.

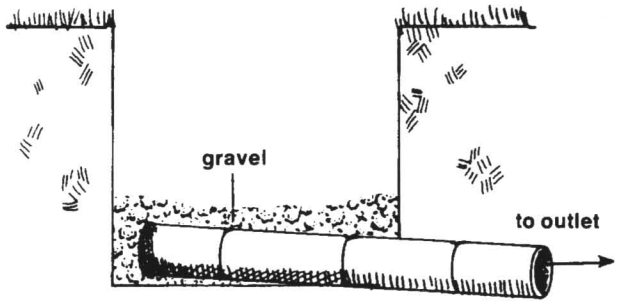

Figure 2. Installation of a drain tile system.

Compaction of the soil by vehicles or people can reduce pore space and restrict water infiltration, as well as cause physical damage to roots of existing trees. In compacted soil, oxygen is depleted, carbon dioxide accumulates, and root penetration is reduced. This is detrimental to root growth. Aerating the soil will help correct the problem.

Soil pH is a measure of the acidity or alkalinity of a soil. A pH below 7 (7 is neutral) would indicate an acid soil, and a pH above 7 indicates an alkaline soil. Many plants have an optimal range of pH. Most trees thrive on a pH between 5.5 and 6.5. Soil pH is raised by calcium carbonate or lime. Plant species that will tolerate a high pH should be considered for areas with buried concrete, near foundations, or sidewalks, etc. Plant species considered tolerant of high pH (greater than 7.0, but less than 8.0) include: green ash, white ash, amur corktree, ginkgo, hackberry, honeylocust, and Russian olive. Evergreens perform best in slightly acidic conditions. There are some exceptions: arborvitae, ponderosa pine, and Colorado blue spruce can tolerate a wider pH range (6.5-7.3). Before a plant is planted on a particular site, a soil test of that site should be conducted to determine possible pH problems or nutrient deficiencies.

Water

The correct amount of water for plants is essential. Select plants that are tolerant of excess water for low areas where water may be standing or very close to the surface, or where a heavy clay soil exists. Standing water or a high water table means low oxygen content in the soil. Therefore, trees and shrubs that can tolerate excessive moisture are often better suited to these poor sites. Trees that are able to tolerate moisture are: green ash, river birch, hackberry, bicolor oak, red maple, and Russian olive. Drought tolerant trees can withstand extended periods with little water and are best suited for sandy soils. They include: green ash, amur corktree, ginkgo, hackberry, Kentucky coffeetree, and Russian olive. Drought tolerant shrubs include amur maple, barberry, caragana, honeysuckle, buckthorn, sumac, alpine currant, elderberry, buffaloberry, spirea, and lilac.

Sunlight

Although some plants can tolerate low light conditions, most require full sun to maintain their vigor and attain their full potential. Trees considered to be more shade tolerant include: green ash, white ash, river birch, ironwood, Kentucky coffeetree, American linden, Norway maple, hackberry, red maple, and sugar maple. Some plants may require some protective shade to prevent leaf scorch and desiccation.

Location

The location of the planting site in relation to other trees and objects such as buildings, fences, etc. will have a considerable influence on temperature and moisture conditions. Prevailing westerly winds will have a drying effect on non-protected sites. The south side of a building will be much warmer and drier than the north side. The warming effect of the sun on a cold winter day can cause injury to the bark and may cause the tree trunk to split. For evergreens, this warming can cause water loss and growth activity resulting in needle damage when the temperature is again lowered. Plant hardiness can be greatly affected by the amount of protection provided by individual microclimates.

Planting

Plants

Take special care when transporting plants from the nursery. The proper vehicle, a truck or trailer, can reduce the possibility of injury from loading and unloading. Often the cost of delivery is well worth the reduced damage to the tree. Protect leaves and needles from the sun and wind by wrapping or covering while in transit. Cushion stems and branches from injury. Always tie the plants down securely and avoid high speed travel.

Methods of Marketing Trees and Shrubs

1. Bare Root. Bare root plants are dug from nursery fields in the fall or spring. Soil is removed from the roots, and plants are held in humidity and temperature controlled storage over winter. They must be planted in early spring before growth begins. Because many roots are cut during field digging, bare root plants suffer severely from transplanting shock. Bare root stock is normally the least expensive, but if handled improperly, can have the highest mortality. When handling or transporting bare root stock, keep the roots moist and protected from sun and wind at all times.

2. Packaged. Packaged trees and shrubs are bare root plants with their roots packed in moist material such as peat moss or shingle tow. Plant them in early spring before growth starts. Keep packing materials moist, and the package cool and shaded until planted. These plants should be treated as bare root plants.

3. Field-Potted. Field-potted nursery stock are field-grown plants dug with a ball of field soil intact which is then placed as is, in a container. These plants should be sold and planted during the spring, as field soil will not provide good plant growth in a container. It is important that the root ball be disturbed as little as possible during the digging and planting process.

4. Containerized. Containerized trees and shrubs are dug from the nursery in the spring or fall as bare root stock, placed in a container with a special growing medium, and sold in the container. If containerized in early spring, most plants will be sufficiently established in the container and can be transplanted in late spring, summer, or fall. Roots must be established in the container and hold the media together before transplanting. Do not completely break up the root ball at planting time, but do cut any circling roots prior to planting. The tighter the root ball, the more the root system should be disturbed.

5. Container Grown. Container grown stock has been growing in a container throughout most of its production. Because the roots of these plants are not disturbed at the time of planting, container grown plants suffer little transplant shock and may be planted at any time during the growing season. Plants that have outgrown their containers may have deformed root systems, which can result in girdling roots. Large plants may be root bound in the container. The root ball of these plants must be torn or cut open to eliminate subsequent circling or girdling roots **(Figure 3)**.

6. Balled and Burlapped (B & B). Balled and burlapped trees and shrubs are dug with a firm ball of soil around the roots, and held securely in place with burlap, twine, and sometimes a wire basket. A broken, damaged, or dry soil ball can result in serious damage to the roots. The stem should not wobble in the soil ball. Because

of the weight of the soil ball, B & B trees can be difficult to transport and plant without special equipment. B & B stock is often the most expensive, but if handled and planted properly, is as reliable as container grown stock. Always lift B & B plants from beneath the ball, never by the stem. B & B stock can be planted in spring, summer, and fall.

7. Tree Spade. Larger plants are often moved with a tree spade—a machine that digs a mass of soil including the plant and some of its roots. The plant and root ball may stay in the machine until it is planted into a pre-dug matching hole, or it may be placed in a wire basket lined with burlap. The size of the root ball is critical and species dependent. An experienced machine operator can make the difference between success and failure. Matching soils from the digging site to the planting site is also important, as is compaction within the planting hole. Roughing up the sides of the hole can offset some of this compaction. Plants can be moved in most seasons with a spade, although plants dug in summer and early fall should have an oversized ball and receive special attention relative to species, condition, handling, and irrigation. Prior to planting with a tree spade, locate all utilities to prevent cutting through wires, cables, etc. Call the Gopher State utility location numbers as follows:

SAINT PAUL:	651-454-0002
MINNEAPOLIS:	612-454-0002
GREATER MINNESOTA:	1-800-252-1166

Make the call at no charge. It's better to be safe than sorry.

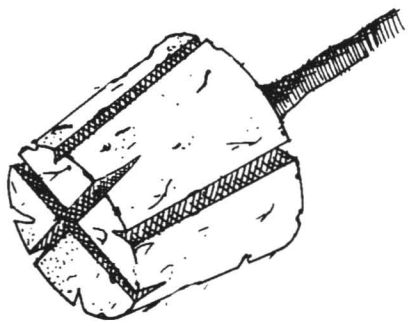

Figure 3. Cutting pattern for rootbound container stock.

Preparing the Planting Hole

Successful planting starts with proper site preparation. Digging the hole for a new plant is the first step. The hole should be at least 1-2 feet wider than the size of the root system (except for direct tree spade planted trees). A larger hole will allow better root growth, especially in poor soil. Roughen the sides of the hole with a shovel and make the hole as wide or wider at the bottom than at the top.

Planting depth is critical. For compacted clay soils or poorly drained soils, plants should be planted at, or slightly higher than, the depth that they drew in the nursery. A good rule of thumb for B & B plants is to plant the tree or shrub so that almost 1/3 or the height of the soil ball is above ground level after planting. This will improve oxygen availability to the roots. Allow for settling, especially if the hole has been dug deep and backfilled. Air pockets should be eliminated by watering during and after backfilling. Poor soils can be amended with organic material or loamy top soil depending on the improvement needed. Peat is not recommended for poorly drained, clayey soils, as it can act as a sump and draw too much water into the planting hole. Never completely backfill with a soil amendment; only create a transition zone to the existing soil where the roots must eventually grow. Too much soil amendment can create moisture gradients and cause roots to be confined to the planting hole. Remove rocks and debris from the hole and never put rocks or gravel in the bottom of the hole to improve drainage unless it is connected to a drain tile.

Planting the Plant

Bare Root and Packaged Stock

Examine the stock and prune away any diseased or damaged roots or branches. Dig the planting hole and backfill with enough soil to hold the plant slightly higher than the depth it was growing in the nursery. Tamp the soil and center trees with the largest branches facing southwest. Straighten the roots and spread them evenly. Cover the roots with soil, avoiding any clods, rock, etc. Gently raise and lower the plant while adding soil to eliminate air pockets. When the hole is three-quarters full, tamp the soil and fill the hole with water. This should take care of

any remaining air pockets. Finish filling the hole with soil, and then water thoroughly.

Balled and Burlapped (B & B)

Carefully set the plant in the hole at or slightly higher than it was at the nursery. The root flare and the top of the ball will indicate original planting depth. Take extra care not to loosen or break the soil ball. Fill the hole one-third full, tamping to remove air pockets. Cut and remove the twine from around the trunk. Next, with wire cutters and scissors, remove as much of the wire basket and burlap containing the soil ball as possible *without allowing the soil ball to fall apart*. Water slowly to saturate the soil ball and to remove air pockets in the backfill. Finish filling the hole with soil. No burlap should remain above the soil surface as it may act as a wick and dry the root ball. Evergreens should not be planted later than October so the roots will have a chance to become established.

Container Grown and Containerized Stock

Carefully remove the container at the planting site. Cutting the container may be necessary. Remove all containers, including biodegradable papier-mache pots. Newly containerized stock may be only slightly rooted; the container must be removed with great care so as not to disturb the root ball. In contrast, container grown stock may be rootbound. If roots are growing in a spiral around the soil ball, the plant is rootbound. These roots need to be separated or they will eventually girdle the plant. Make vertical cuts on the sides of the ball just deep enough to cut the net of roots **(Figure 3)**. Also, make a criss-cross cut across the bottom of the ball. Plant the plant the same as a B & B plant. Don't plant evergreens later than October so the roots will have a chance to become established.

Tree Spade

The use of mechanical tree spades has become a common method of tree planting. Trees should be watered thoroughly before moving to hydrate the plant and to avoid soil sifting out during transport. The sides of the planting holes should be roughed up with a shovel, rake, etc., to break up compaction caused by the spade. Trees should be placed at or slightly higher than the original grade to allow for settling. After planting, work loose soil into the area between the hole and the tree plug, and water thoroughly.

After-Planting Care

Watering

Newly planted plants require routine watering. Typically, 5-7 gallons, applied to the root ball once a week, is an appropriate quantity of water to add to a newly planted tree or shrub; however, differing soil and weather conditions will affect the frequency with which water must be added. Examine the soil moisture 4-8 inches deep to determine the need for water. If the soil feels dry or just slightly damp, watering is needed. Soil type and drainage must also be considered. Well-drained, sandy soil will need more water, and more often than a clay soil that may hold too much water. A slow trickle of the garden hose at the base of the plant for several hours or until the soil is thoroughly soaked is the best method. Short, frequent watering should be avoided as this does not promote deep root growth but rather, the development of a shallow root system that is vulnerable to several environmental stresses.

Mulching

Adding a mulch around the base of the plant is a very important part of plant care that is often overlooked. By mulching plants, a more favorable environment is provided for the tree roots. A mulch allows better infiltration of water, holds soil moisture, limits weed growth, and discourages injury from lawnmowers and weed whips.

A 3-6 inch layer of mulch, spread to form a 3-6 foot diameter circle around the plant, should be applied. Keep the mulch material from direct contact with the tree trunk. Wood and bark chips are good mulching materials. A porous landscape fabric that allows gas and water exchange can be used as a broadleaved weed barrier underneath the chips. Plastic under mulch can cause roots to suffocate and is not recommended. Soil tests should be conducted before planting to determine possible nutrient deficiencies that the plant may face.

Fertilization

Fertilization of newly planted plants may be done every 2-3 years in the fall after leaves have fallen or in early spring before growth begins. It can be applied to the surface or placed in holes around the plants. Beware of burning turf if surface-applied. Surface applications should be watered in. Do not apply nitrogen in late summer unless the plant is nutrient deficient, as this can promote new growth that may not harden off properly and can be damaged by winter weather. Phosphorous and potassium can be applied in the fall as they will enhance winter acclimation.

Pruning

Trees and shrubs generally do not need to be pruned immediately before or after planting as most nurseries prune out co-dominant leaders, limbs that rub against each other, and poorly angled branches, prior to sale. If these problems haven't been pruned in the nursery, remove them after planting. Some limbs may be damaged in transit from the nursery to the planting site. Plants should be inspected and these limbs removed immediately after planting.

Staking

Most newly planted trees will do better without staking. Young trees standing alone with their tops free to move will develop stronger, more resilient trunks than those staked for several years. Trunk movement is required to develop strong, tapered trunks.

If however, a tree is unstable in a strong wind or is pushed over, then staking is required. A common problem with staking trees is the girdling effect that the ties can have on the tree. Soft nylon webbing or carpet strips attached by grommets to a stake can reduce this damage. Often, wire is too tight around the trunk and will effectively girdle and kill the tree. Whatever material is used, be sure to allow for some movement, and remove the stakes and ties once the tree is established—usually after one year.

Winter Care

Proper winter care begins in the summer. Proper watering and fertilization in spring and summer is required. Watering can be decreased in early fall and increased in late fall to provide water needed to withstand the drying winds of winter. Plants need to go dormant; don't encourage late growth by heavy watering and nitrogen fertilization in early fall. Plants should be thoroughly watered in late fall just prior to the soil freezing.

Sunscald, characterized by sunken, dried, or cracked bark, is caused by the heating effect of the winter sun in cold weather. It usually occurs on the south or southwest side of the tree. In the fall, wrap young and thin-barked trees with commercial tree wrap from the bottom up to the first major branch. Remove the wrap in spring. Thin-barked species such as maples and honeylocusts may require protection for several years.

Winter browning of evergreens is normally caused by the combined effects of wind and sun. Trees lose water from the leaves (needles) while roots are in frozen soil. To protect evergreens, place a screen of burlap or similar material on the south, west, and windward side of the tree to block wind and sun. Antidesiccant sprays are not very effective in offsetting the drying effects. Water evergreens well throughout the growing season, lightly in September, and then thoroughly again before the soil freezes. Select species and cultivars that tolerate winter conditions. Plant species susceptible to winter injury in areas of minimal exposure to winter wind and sun.

Animal damage can be severe during the winter. To protect individual trees from mice, place a cylinder of 1/4-inch mesh hardware cloth or plastic drain pipe (it should not be black in color) around the trunk. The cylinder should extend high enough to prevent animals from feeding at snow level, and should be firmly anchored in the soil without disturbing the tree roots. Protection from rabbits requires coverage of up to 1 to 2 feet above snow level. Other means of fencing or animal control may be needed. If many trees and shrubs are to be protected, application of a commercial repellent may be more practical. The repellent can be sprayed or painted on the trunks and branches. The effectiveness and duration of the repellent will depend on the severity of the winter and the availability of other food.

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Summary

This publication provides information on planting trees and shrubs for the professional and amateur.

Proper planting involves proper site and plant selection. The plant and planting site must be properly prepared depending on the type of stock purchased.

Care of newly planted stock includes watering, mulching, pruning, and winter protection.

This publication is based on an earlier version by the same title. The original authors were: Bert T. Swanson, James B. Calkins, Peter-Jon Rudquist, and Steven Shimek.

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