Managing Trees and Shrubs in the Landscape

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All plants are not created equal. The specific type of plant material selected for the landscape has the ability to make or break a quality design. Consult several references and talk with local gardeners and/or plant professionals before making a final decision on plants to be purchased. Free plants are often the most expensive choice in the long run if they are undesirable for the location. Facts about plants that should be known before purchase are: longevity; susceptibility to diseases and insects; ultimate size; hardiness; and cultural problems, such as litter and storm damage.

It is also undesirable to plant too many of the same species in a region. If a disease or insect were to become a problem, it could result in the destruction of most, if not all, of that type of plant. A good example of this is the American elm. Many of these stately, old trees were killed by a disease called Dutch elm disease in the mid-1900s. In the early 1900s another disease called chestnut blight killed almost all of the American chestnuts in North America. In many parts of the Appalachian Mountains, the American chestnut made up 40 percent of the forest.

Woody ornamental trees and shrubs purchased for a landscape come in one of four forms. These are **balled and burlapped** (often referred to as B&B), **container grown**, **bare root** and **packaged**. Each of these methods has distinct advantages and disadvantages and no one method is best for all plants.

Balled and Burlapped (B&B)

Most trees and shrubs can be purchased B&B. Some plants, such as evergreens (rhododendron, azalea, conifers, etc.), do not survive well unless they are transplanted this way or as container grown material. B&B plants are grown in a field and dug with a ball of soil around the roots. This ball of soil is wrapped with burlap and held in place with twine, nails (called pinning nails) or wire baskets. Burlap has been traditionally made of jute though synthetic fibers are now sometimes used. When planting, it is not necessary to remove pinning nails and jute burlap. Materials made of plastic or treated burlap must be removed.

Treated burlap has been saturated with chemicals to prevent it from rotting in the retail nursery before it is sold. Treated burlap is usually a bright green, orange, or blue color instead of the dull tan of natural burlap. Plastic or synthetic burlap (as well as that which has been treated) keeps roots from growing out into the planting hole. Plastic twine will girdle the trunk and must also be removed. These materials do not break down when buried. Remove all synthetic materials before planting. If you are in doubt, touch a burning match to the material. Plastic melts and jute smolders. If you are still in doubt, remove it.

Wire baskets are also used to hold the burlap and soil ball together. Baskets smaller than 24 inches in diameter should be removed. Larger wire baskets should have as much of the wire near the surface removed as possible once the soil ball is in the planting hole. If wire baskets are left on the root ball, root damage can result as the roots will increase in diameter through the years and the wires will start to constrict root growth which in turn effects plant growth and health.

Plants moved B&B generally experience the least amount of transplant shock of any of the four methods. Soil balls are very heavy, bulky and expensive to ship long distances so are often locally grown. This means they are already acclimated to the climate. This turns into a disadvantage when large soil balls become a problem for homeowners who wish to install their own landscape.

B&B plants must be handled properly during planting. In some areas of the country, winter is an excellent time for planting most types of trees and shrubs. The root system of a plant is less hardy than the above ground system of stems and leaves. As a result, it is important that the soil ball be protected from freezing. It is possible for roots to be killed while the top remains undamaged. When spring growth begins, there is no way for the plant to take up water and nutrients necessary for the continuation of growth. As a result, the entire plant dies.

When planting B&B material, it is important to get the aid of another person if the soil ball is heavy. Never pick up any plant by its trunk. This can result in damage to the root system. The thin roots are not capable of supporting the great weight of the soil ball. Roots can also be damaged severely if the soil ball is dropped or cracks. Heavy soil balls should be placed on a sling of canvas or burlap and moved by two people. While it is not necessary for untreated burlap to be removed, it is a good idea to loosen it from the top of the soil ball and lay it back so that water will be able to penetrate into the soil ball. The remainder of the burlap decays rapidly in the moist soil.

Bare Root

Deciduous fruit and shade trees, flowering shrubs, roses, brambles, strawberries and some annuals are commonly sold bare root. They are generally field grown and gently lifted out of the soil in late fall or early winter. Since plants are shipped without soil, they are 40-70 percent cheaper than the same plant shipped with a soil ball. Setting plants out bare root in fall or winter gives time for roots to regenerate before spring growth begins. The disadvantage of this method of transplanting is that roots exposed to the air dry out very rapidly. Plants must be kept in a cool humid area until planted.

Plant bare root plants within a day after they arrive. If this is not possible, protect roots with moist straw or paper towels and cover with plastic. Store plants in a cool area above 32°F. Roots must be fresh and plump, not dead, dry or withered. Soaking roots for an hour or two in water before planting will help roots that are alive (but dried down) absorb enough water to cause them to swell up again. A sharp pair of clippers should be used to remove damaged roots before planting. Some plants may also require corrective pruning of the top though it is unnecessary to ever “balance” the top with the roots.

The planting hole should be large enough so roots are not cramped or bent. Spread all roots out in the planting hole. There must be soil around each root just as there was before digging. It will be necessary to stake most bare root trees and large shrubs to prevent wind damage. Never plant a tree or shrub deep to help it stand up.

Dormant plants need less water than those in active growth. If the soil is kept too wet, new roots will fail to form and kill existing roots. Bare root plants are often slower to leaf out in the spring than plants moved with soil.

Packaged

Plants are sometimes dug as if they were going to be sold bare root. Roots are then put into a plastic bag and packed with rotted sawdust or other light weight material. Selling plants this way has the advantage over bare root material that roots are less likely to dry out. However, these plants still need to be watered occasionally and protected from heat and cold. Watering can be difficult since the plastic bags are generally tied tightly at the base of the trunk.

All plastic, packing material and ties must be removed at the time of planting to prevent future problems. This necessitates care at planting to prevent drying out of the roots. Roots must also be carefully spread out in the planting hole as if this was a bare root plant. Packaged plant materials are more common with mass marketing outlets than retail nurseries. Be wary of plants stored on asphalt parking lots. It does not take long for the heat to kill the roots.

Container Grown

Plants grown in containers are popular for many reasons. They are lighter in weight than B&B material and can be shipped for longer distances. They are also cheaper because there is no labor in digging plants from the field. Since the root system is not damaged by a digging operation, plant species that do not regenerate roots efficiently often reestablish better as a container grown specimen than plants moved B&B or dug bare root. This is especially true of plants with tap roots. Container grown plants are available in all seasons for planting whenever installation is desired.

It is important that the plant not be **pot bound**. Pot bound means that roots are circling the inside of the container. Although it may be impossible to look at the root system, you can still tell if a plant has been in the container too long because the top is unusually large for the size of the container, growth is stunted, or dead twigs are present. Roots curling around inside the container often continue to go around in a circle even after planting. This results in loss of vigor as roots run out of soil or begin girdling the trunk choking the flow of nutrients.

Soil used in containers must drain well and be more porous than soil found in the garden. This light, loose medium also favors quick, uniform root development. Roots grow through the path of least resistance. Roots in a light, loose medium are often slow to become reestablished in the new location because of heavier soil they are now in. It is beneficial to unwind long roots and lay them out in the fill soil. A sharp pointed stick can be used to loosen roots or they can be cut at three of four points with a sharp knife.

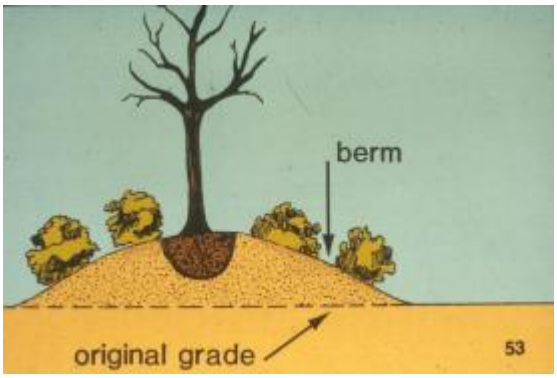
There are several types of containers that are used for the production of plants. Plastic is the most common and has fewer problems than other systems. Fiber pots are sometimes used. While they are sometimes advertised as being suitable for planting, it is best to remove them before planting. If the rim of the pot is left above the soil surface it wicks water out of the soil ball and prevents moisture from moving into the soil ball from the surrounding soil. Metal containers are cheap but rust, and they must be cut with a can cutter. This leaves sharp edges that can cut hands.

Planting Trees and Shrubs in the Landscape

Planting holes should never be dug when the soil is saturated with water. Side walls of a hole dug in a clay soil become glazed just like a ceramic pot. This smooth side wall prevents roots from going out of the planting hole. Eventually the plant becomes pot bound and declines.

The planting hole should be two to three times the diameter of the soil ball or spread of the roots in the case of bare root plants. The poorer the soil and the more difficult it is to dig the hole, the wider the planting hole should be. **The depth of the planting hole should be equal to the height of the soil ball**. Measure the depth of the hole carefully against the height of the soil ball. It is easier to double check the measurement than to lift a heavy plant out of the hole so that it can be dug deeper or filled.

The most important rule is that the root system should be the same depth as it was previously growing in the nursery. If the newly transplanted tree or shrub is too deep, feeder roots die because of lack of oxygen and the trunk begins to decay. If it is planted too high, the upper part of the root system will dry out and roots die. Decay also occurs when graft unions are buried. Decay organisms that attack the graft union or trunk result in a plant that is stunted, begins to decline and eventually dies.



Some soils do not drain well. If you suspect that the soil you are hoping to use to plant into has this characteristic, you can test prior to planting by filling the hole with water. If it takes more than a day for the hole to drain you will need to select another location or drain the excess water from the bottom of the hole. This is more easily done on slopes than flat areas. In low areas, you will have to resort to using a raised mound called a **berm**.

Now that you have determined that the planting site will drain properly and the plant has been carefully placed into the hole, you are ready to fill the hole. This soil is called backfill. The only

thing that should go back into the planting hole is the soil that came out of it. Rock and other foreign material should be removed but you should not add peat moss, sand, bark, compost or other material to the soil. This is especially true for heavy clay soils. The only exception is when the entire area where the root system will ultimately grow can be modified. The best example is raised beds for rhododendrons and azaleas. Amended soil in the planting hole can hold water like a sponge in a bucket making it too wet for roots.

Roots grow through the path of least resistance. We dig a large planting hole, so that there will be lots of loose soil for new roots to grow in. Amending the backfill can lead to a situation that is like growing a plant in a large container. Eventually the plant becomes pot bound and runs out of water and nutrients.

As soil is put into the planting hole, it should be firmed but never compacted. Firming removes air pockets and prevents settling. Compaction makes the soil so hard that roots will have difficulty growing through the compacted layers. After the hole has been filled about half way, it should be filled with water. This is especially important for large planting holes. After the water has soaked in, fill the remainder of the hole taking care to not compact the wet soil and thoroughly water again. This is easier if a small dike of soil is built around the planting hole so water stands long enough to soak into the soil.

Ericaceous plants (rhododendron, azalea, blueberry, pieris) should be planted in a soil amended with 50 percent sphagnum peat moss. This soil should be mounded up at least 18-inches above the natural grade of the soil and should be wide enough to handle the root system for the life of the plant. Using berms prevent soil from becoming waterlogged and allows oxygen to penetrate these soils. Insufficient oxygen in the soil increases fungal diseases attack roots of plants, and is prevalent in compacted and/or high clay soils.

Mulch

Mulching plants in the landscape can be very advantageous for the plant. After all, most trees and shrubs evolved in woodland areas where a carpet of leaves and small branches provide a year round layer of organic matter on top of the soil. This layer of organic matter decays recycling nutrients for reuse by plants. Over time mulch, regardless of whether it is natural or added by gardeners, improves the quality of the soil. Mulch also conserves moisture and moderates temperature, keeping the soil cooler in the summer and warmer

in the winter. Mulching helps control weeds and protects trees from string trimmers and mowing equipment.

With all of these wonderful virtues, it seems that if some mulch is good, more would be even better. Unfortunately this practice is not only wasteful of time and materials but is very detrimental to plant health.

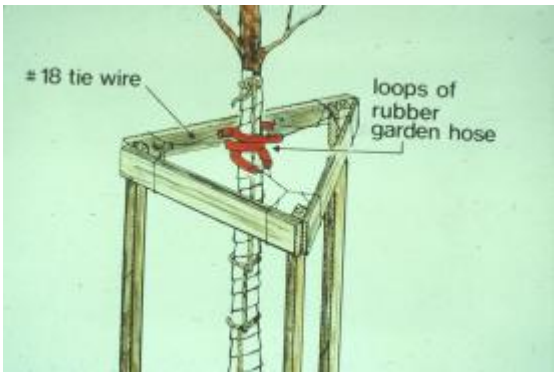
While mulch helps conserve soil moisture, too much mulch can prevent carbon dioxide from escaping from the soil and oxygen from moving into the soil. High levels of carbon dioxide is toxic to roots and oxygen in the soil is essential for roots to take up water and nutrients. When mulch excludes oxygen from the soil, roots die and the plant begins to die. It doesn't take too much excess mulch to damage roots. Generally anything over four inches will have detrimental effects.

When mulch is too deep, the roots grow up into it. Removal of excess mulch then results in removal of feeder roots. Mulch layers also dry out in summer resulting in roots that are growing in an area that is too dry. Once dry, mulch becomes hydrophobic meaning that it sheds water making it very difficult to rewet. Like planting something too deep, mulch piled up on the trunk also causes decay. Mulch against the trunk is also a great shelter for insects, mice and other small mammals that will feed on the trunk.

Staking

Trees should be staked only when there is a real danger that they will blow over. If the plant was dug with a soil ball sized according to the *American Standard for Nursery Stock*, there should be little danger that it will blow over except in very windy sites. Very large plant material is often staked to keep it straight as it settles. Staking has also been shown to reduce vandalism.

The reasons not to stake trees are stronger than the reasons for staking. Trunk diameter of unstaked plants increases faster than tightly staked trees. Staked trees also grow taller more quickly than unstaked trees. This means that a tree that has been tightly staked may be more likely to blow over a year later than one allowed to sway in the wind.



If staking is deemed necessary, it is best to use three stakes rather than one (crossing the trunk) or two vertical stakes. Stakes must be driven far enough into the ground to prevent them from being pulled out. They should also be outside the planting hole where the soil is firm. Stakes may be short or long but in either case the securing lines should be attached approximately 1/2 of the way up the trunk. **Metal wires are sometimes used to guy the tree but must never go around the trunk**. A piece of rubber hose is sometimes used around the wire with the thought that it protects trees from being girdled. Unfortunately the rubber hose does almost as much damage as a piece of wire. Using a piece of cloth or broad nylon strap around the trunk is much better protection for the trunk.

Leave enough slack for the tree to sway gently in the wind. The purpose of staking is to protect the tree from blowing over in high winds. Never leave staking on trees for more than one year. Check the supporting straps frequently, especially in early spring. Excessively tight ties can girdle the trunk as it increases in diameter.

Pruning

Most plants show increased vigor and benefit aesthetically from pruning at some point in their life. Pruning is done to **improve the form of the plant**. Examples of this include removal of lower limbs so that attractive bark can be admired or to create a tree form from a large multistemmed shrub. Pruning is also necessary to **improve the health of the tree and improve safety to people and property**. This includes removal of diseased, dead and dying branches. The third major reason is for **correction of problems**. This includes shaping of hedges, removal of crossing branches, branches with narrow crotches, those that grow toward the center of the tree, multiple leaders and suckers, or those growing towards water sprouts.

Pruning is a method of rejuvenating plants. Removal of old wood in flowering shrubs will cause the plant to produce young, vigorous shoots with an abundance of flowers.

On small stems, pruning cuts should be made back to a live bud when shearing and shaping shrubs (i.e. boxwood, juniper, holly and yew). Other plants like privet have the ability to produce an abundance of adventitious buds on older branches. Privets can be pruned as far back as is necessary to control their height. Doing this to a juniper will result in a dead plant.

Sometimes large branches must be removed. Removing the offending branch as soon as possible results in a smaller wound than if it is done later and it will seal over more quickly. Plants do not heal when they are injured. Healing is the repairing and replacing of damaged tissues, something only animals can do. Plants seal or close over wounds and develop chemical and/or physical barriers to wood rotting organisms (bacteria, fungi, etc.).

When a branch is removed, it should be cut at the point where it comes out of a larger branch or a smaller branch comes out of it. The smaller branch should be at least a third the diameter of the one being removed.

At the base of every branch is a **collar** (Fig.13) that has the ability to develop a chemical zone to inhibit the spread of decay in the trunk. If a long stub is left, this chemical barrier will not develop. If the pruning cut is made flush with the trunk this special layer of cells is removed. In either case, wood rotting organisms will be able to progress into the trunk causing heart rot. **Sapwood** (outer few annual rings) and **heartwood** (inner part of an older tree) are not dead, useless tissue. It is very important for structural support, conducting water and nutrients from roots and storage of **carbohydrates** (sugars and starches). Stored carbohydrates are the energy source for buds in early spring until young leaves develop enough to begin making sugars (also a carbohydrate) for continuation of growth.

Occasionally large branches need to be removed. If the branch is out of reach or near utility lines, its removal is a job for a professional arborist. If the branch is over 3-inches in diameter it can be safely removed using the **three cut method** (Fig. 13). The first cut is made from the lower side of the branch, 6 to 8-inches away from the collar. This cut is made only a third of the way through the branch. The second cut is made from the upper surface of the branch all the way through the branch several inches further out from the first cut. As the branch falls, bark peels back only to the first cut. Now that the weight of the branch has been removed, the third cut can be made without danger of damaging the trunk. The type of pruning equipment used is important.

Clippers come in two types, scissors and anvil. The scissors type has two blades that pass to make the cut. The anvil type has a single blade coming down onto a flat surface to make the cut. The latter type tends to crush stems on the bottom as the cut is made. Damaged tissues are a prime site for entry of disease organisms. The scissors type of pruner is generally preferred on woody plants. The anvil type is satisfactory in floral work where crushing the stem aids the uptake of water. Using clippers that are too small for the job can also result in damage to the branch. Pruning saws do a better job on large branches. A pruning saw differs from a carpenter's saw. While the teeth of a pruning saw cuts as it is pulled, a carpenter's saw cuts as it is pushed. This makes it easier to make cuts at or above shoulder level.

Pruning paints should never be used. We paint our houses to keep the wood from rotting. Common sense tells us that paint will also help prevent decay in trees. Pruning paints (also called wound dressing) not only does not prevent decay, they actually increase the rate of decay in living trees. A heavy asphalt wound dressing is even worse because it inhibits formation of wound wood (callus roll) that seals over the wound. A light coating of shellac may be used for cosmetic purposes but does nothing for the tree.

Protecting the Plant

Lawn Equipment - The **greatest single cause of damage to young trees** in the landscape comes from lawn equipment. Mowers and string trimmers damage bark on trunks they contact. Sometimes the only evidence of damage is lack of vigor. Wounding reduces the flow of sugars from leaves to roots and is an excellent site for entry of insects and microorganisms. The best way to protect the plant from lawn equipment is to control weeds at the base with herbicides (being careful not to get them on any part of the tree) or a layer of mulch. Herbicides that contact tree trunks can also cause serious damage. Some herbicides are absorbed by tree roots and translocated to the remainder of the plant. Use caution when using any herbicide near trees and shrubs.

Sun Scald - Sun scald is a physiological disorder generally found on young, recently transplanted, thin barked trees in the landscape growing in colder regions of the country. It is closely associated with water deficiencies in the trunk. On cold, sunny days the sun warms the trunk well above freezing. Cell dormancy is broken. When the sun goes behind a cloud or below the horizon the trunk temperature drops rapidly resulting in freezing and death of cells just below the bark. Damage does not show up until late spring or early summer when the bark begins cracking and peeling off. As time passes, the wood begins to decay where bark is missing.

Sunscald occurs most often on the southwest side of the tree. Reflected light or heat can result in damage to other parts of the trunk. Sun scald does not occur on mature trees because their thicker bark protects them against sudden changes in temperature. It is not found on young trees in a forest because of shading provided by the larger trees.

Sun scald is thought to result from crushing and severing of roots which prevents the uptake of water. This is especially serious when plants are dug with small soil balls. It can also occur when heavy items (foot traffic, equipment, building materials, etc.) crush the young feeder roots. The solution is to protect roots from damage. Wrapping the trunk with plastic screen or commercially available wrapping materials may help by shading the trunk. Paper type wraps should be put on from the bottom up to the first branches. Overlap each previous layer so that water is shed. Tree wraps should be put on in late fall and removed in early spring. Failure to remove tree wraps before summer can result in damage from girdling, boring insects and wood rotting organisms.

Frost Crack - Frost crack is another problem associated with winter though it can occur in areas that never freeze. Because of this, radial shake is a better term for this disorder. Radial shakes result from water stress within the trunk. Cracks begin at the point of a wound and become large, deep cracks. These cracks move mainly in an upward manner. They may be inactive for several years only to open up as a result of temperature differences or drought. The only solution is to prevent wounding.

Animals - Rabbits, mice and deer can be a problem in winter months when other food sources are limited. Hardware cloth around the trunk helps protect it. It must be at least 18-inches above the snow level to provide protection from rabbits. Scraping mulch back for 6 to 8-inches from trunks makes the site less favorable for mice. Moderate to good control of mice can be obtained by poison baits if they are kept dry. Hot pepper sprays to the plant and small bars of perfumed soaps have had limited success as repellants. Deer fencing (at least eight feet tall) and reducing the deer population have been the only really effective measure when this animal becomes a pest.

Fertilization

Woody ornamentals growing in fertile soils show little response to applications of phosphorus and potassium. Only a soil test will indicate if a soil is deficient in one of these elements. Most woody plants in the landscape respond only to nitrogen.

Fertilizer should be applied to woody landscape plants in fall after leaf drop. Roots grow any time the soil is at or above freezing. This continues until the soil warms up to about 55°F in the spring. At that point, growth begins on the shoots. As warming continues shoots grow more rapidly than roots. Fall fertilization with nitrogen encourages development of a good root system followed by good shoot growth the following spring. Fertilization in spring promotes growth of shoots without root growth. If there is more shoot growth than roots are able to support, leaf desiccation will occur during dry periods. Late summer applications of nitrogen delay hardening of the plant for winter, resulting in injury or death.

Mycorrhizae

Most woody plants have a **symbiotic relationship** with certain fungi called mycorrhizae. Symbiosis is when two different organisms live together better than either could separately. We normally think of fungi as causing plants to become sick or decay. In this case certain types of fungi are actually beneficial to plants. They are found everywhere that plants are and some plants can't live at all without them. These fungi and plants have had this mutually beneficial relationship for many millions of years.

Mycorrhizae live on or in root tips and grow out into the soil. They are much more efficient than plant roots at exploring soil and absorbing water and nutrients that are then passed along to the plant. In return, they get carbohydrates (sugars) from the plant that they would not otherwise be able to make for themselves.

Since mycorrhizae are beneficial to plants, we want to do everything possible to encourage them in landscapes. Excessive amounts of nitrogen fertilizer will kill them as will de-icing salt, fungicides and many other chemicals. They will not grow in alkaline soils or soils low in oxygen, especially those that are compacted. Moisture is important but saturated soils kills them. These unique fungi like soils with organic matter.

Over time organic mulches decay and enter the soil making an area more favorable for the growth of these essential fungi. In brief, all of the soil conditions that we have recognized that promote good plant growth are also good for the growth of mycorrhizae. Loose, moist, friable soils that are slightly acid, have some organic matter and are well drained produce the healthiest plants and mycorrhizae. Landscape plants could use a helping hand on poorer sites like disturbed soils found in new subdivisions. Unfortunately assistance is not going to come from mycorrhizae because they are not going to be able to live under these conditions either.

The growth and development of plants is not clear cut and straight forward. One action often effects several other things that are going on in the environment. As we are all on the planet earth as guests of the plant kingdom, it is important that we learn as much as we can about how everything works together as a unit. The more we understand, the fewer mistakes we are likely to make.