



Mulching trees properly regulates soil moisture and soil temperature fluctuations and provides a pleasing appearance.

Modern Tree Management Techniques For Today's Turf Manager

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EARLY Scottish golfers didn't have to worry about trees affecting their golf score. The Linksland of Scotland had no trees. To many golfers in the United States, though, these Scottish courses look oddly barren. In the U.S., we enjoy the aesthetics and golfing challenge that trees contribute.

A good example of a challenging tree is the loblolly pine in the middle of the 17th fairway at Augusta National. This individual pine was a source of frustration to President Dwight Eisenhower. The Chairman of Augusta National at that time, Clifford Roberts, would not permit the removal of this tree, even at the request of our nation's President!

Today this pine is respectfully named the "Eisenhower" tree.

Even though we enjoy the beauty and challenge of trees on our courses, tree management has not been emphasized in turf management training. The attitude that trees will live forever without any help from man has prevailed. Today, however, many trees are in a

declining or dying condition on golf courses due to a decade-long drought, increased air pollution, higher soil temperatures, severe winter freezes, and other factors. The golf course superintendent now faces the choice of cutting down trees as they die or obtaining more information on tree care.

As it turns out, neglect and abuse, rather than disease, are responsible for most golf course tree fatalities. It can be difficult or expensive to control diseases, but it is usually possible to control abuse and neglect and thus prolong the life of valuable trees. It is often easier and more economical to provide a sound tree management program than it is to continuously clean up storm damage, remove dead branches or trees, and then plant new trees.

To initiate a tree management program, the golf course superintendent needs an appreciation of the conditions under which trees grow best. In nature, a seed falls to the ground, germinates, and takes root. An average of five to seven primary roots are produced and grow outward from the trunk like spokes radiating from the hub of a wheel. The distance they grow varies with the soil and terrain, but is generally considered to be equal to one to two times the height of the tree. The depth to which roots grow varies with the depth, texture, and drainage of the soil. The feeder roots (those that absorb nutrients, water, and oxygen necessary for survival) are generally located in the top four to 12 inches of the soil, and most are in the top six inches. Because of their close proximity to the soil surface, these roots are very sensitive to such factors as heat, drought, flooding, herbicides, compaction, scraping, trenching, grass competition, and grass cultivation.

In a natural setting, feeder roots benefit from the thick, rich layer of organic litter (leaves, twigs, etc.) that usually develops. As leaves and twigs fall to the ground and decompose, they recycle nutrients, absorb and retain moisture, insulate the soil from environmental extremes, and protect delicate roots from the effects of compaction.

Man has altered this environment on most golf courses. During construction, bulldozers, backhoes, and other heavy machines are used to clean out underbrush and stumps, and to scrape away "undesirable" organic material.

Grading, adding soil, root raking, discing, and other mechanical activities commonly follow as man prepares the soil for turf establishment. Lime is generally applied to raise the soil pH, and fertilizers high in nitrogen are added so that the grass will grow. Later, irrigation, high-nitrogen fertilizers, and certain herbicides stimulate vegetative growth, causing trees to develop thin cell walls. Such trees are often weak, and during drought, freeze, and ice conditions, these thin cell walls can crack or collapse. In addition, such trees frequently develop weeping limbs and branch breakage. It is a wonder that any trees at all survive the initial destruction of their roots as a result of construction and follow-up activities.

THE OTHER activity of man that can pave the way for the eventual demise of a tree is to create a wound in its protective bark layer. Spores of decay-causing fungi, which are always present in the air and in the soil but generally of little harm to a tree that is protected by its layer of bark, can then readily enter the tree and begin the decay process. Decay can compromise the ability of a tree to nourish itself, to survive environmental stresses, and to support itself or its wounded limbs. It can be said, in fact, that a wound is the beginning of the end of many trees.

On golf courses, it is not uncommon to see that two, three, or more of the five to seven major roots of an average tree have been severed, shattered, or wounded to the point that they have been destroyed or their functional ability has been greatly reduced. In many instances, this damage need not have occurred. Golf course superintendents can easily take precautions to protect the root systems of trees.

Following are six management practices for healthier golf course trees:

Mulching — The use of mulch conflicts with the current standards for playability on many areas of a golf course, but there are portions of many courses that could probably be mulched. Where this is possible, the ideal situation is to create a forest-like environment for tree roots. This involves replacing the turf with mulch, which research has shown will produce more feeder roots and healthier trees. In addition to the benefits of an organic mulch mentioned previously, mulches tend to reduce tree injuries from

mowers, weed-eaters, and herbicides, and in some instances maintenance costs can be reduced.

One of the easiest and least expensive ways for most golf courses to initiate a mulching program is to collect and distribute shredded fallen leaves over out-of-play areas where turf is not doing well or where a natural setting is more appropriate. This type of mulch should be layered to a depth of three to four inches over the soil surface, and extend from the trunk outward as far as possible. In areas where pines are the predominant trees, pine needles should not be removed from the forest floor, but allowed to accumulate.

Because of its availability, pine straw is the most widely selected mulch in the Southeast. Unfortunately, pine straw has very limited ability to reduce evaporation from the soil or to protect the soil from the heating and drying effects of the sun unless it is applied to a thickness of 10 to 12 inches. Such a thickness of pine straw, however, can be a haven for mice and snakes. Also, pine straw decomposes quickly and washes or blows away quite readily. It is attractive, though, and makes a nice playing surface for the golfer.

Cypress bark mulch is popular in Florida, where few hardwood mills exist. The mulch chunks are actually comprised mostly of wood rather than bark. The entire tree is ground up and the product called mulch is produced. This type of mulch has significantly less insulating quality than other mulches.

The best mulch material is aged, shredded hardwood bark. Oak is the best species from which to obtain this mulch. Hardwood bark mulch has additional advantages if the initial application is comprised of materials that have been aged six months or more. Aged mulch will have already begun to decompose and will not rob soil of nitrogen needed for the decomposition process. If freshly shredded hardwood bark is used, the addition of 10 pounds of ammonium nitrate per thousand square feet assists the decomposition process without draining nitrogen from the soil. For the most pleasing aesthetic appearance, hardwood bark mulch should be double shredded. The highest quality shredded bark contains 2% wood or less and passes through a #2 mesh screen.

Shredded hardwood bark absorbs moisture, protects the soil from heating



(Left) Burlap around the base of a tree acts as a wick that can draw moisture out of the root ball and shorten the life of the tree.

(Below) Shredded hardwood bark mulch helps define areas of the golf course and encourage healthy trees.





Injection of systemic nutrients provides a "shot in the arm" for a sick tree.

and drying, and provides very good erosion control. It does not readily wash or blow away. A three- to four-inch layer is considered ideal for these benefits.

Another advantage of shredded hardwood bark is the fine surface it provides for the golfer compared to thin turf, exposed tree roots, or rocks. A good layer of mulch covers these blemishes and helps prevent wrist injuries and club damage. Golf balls lie on top of the mulch and, contrasted with the dark brown color of the mulch, are highly visible.

Shredded hardwood bark is available from most hardwood sawmills that routinely debark logs. Sawmills that produce bark residues are often listed with the state forester's office/wood utilization branch. Also, the local, state, or regional forest ranger, or a consulting forester, generally knows the sawmills in the area that produce bark residues. The

best way to purchase shredded bark is by truckload, which usually costs about \$8 to \$12 per cubic yard, delivered.

In turf areas where large amounts of mulch is used for definition, a "naked" appearance may be created. In such cases, the establishment of non-competing plants (such as azaleas, rhododendrons, mountain laurel, or flowering trees) is aesthetically helpful in the mulched area.

Dogwoods, serviceberry, redbuds, and others help keep the forest floor cool and moist, and supply leaves that decompose rapidly and provide nutrients.

Fertilization — There is no question that tree fertilization helps improve the health of the trees. The first step is to have a soil test of the area. When the existing soil chemistry is known, fertilizer is applied by broadcasting the proper blends to achieve and maintain an approximate ratio of 1:2:3 between

available nitrogen, phosphorus, and potassium in the soil. Fast-release materials are usually selected, since trees prefer a heavy charge of nutrients in the spring and fall to carry them through these growing seasons. Depending on the soil test results, materials such as a 33-0-0, 18-46-0, 13-0-44, or 0-0-60 may be used alone or in combination to achieve the desired levels of nitrogen, phosphorus, and potassium in the soil.

Stressed trees generally respond better to a fertilization technique known as deep-root fertilization and vertical mulching. This process consists of drilling two-inch diameter vertical holes approximately 18 inches deep and two to three feet apart throughout the root feeding area, and filling each hole with a 1:1 mixture of fertilizer and organic matter to produce a higher concentration of nutrients in close proximity to the tree roots. This process benefits

the tree by extracting plugs of soil and creating holes to allow oxygen and moisture to penetrate deep into the root zone, and provides far-reaching benefits for the improvement of "sick" trees or the preservation of specimen trees.

Another technique that is often used to stimulate stressed trees is known as tree injection. This process consists of drilling very small diameter ($1/64$ -inch) holes into the trunk of the tree near groundline, and inserting into each hole a tube to which a capsule containing nutrients is attached. This practice provides a relief to stressed trees and, in fact, can be compared to intravenous feeding for a hospitalized patient.

Natural Phenomenon Precautions — Tree damage from hurricanes, tornadoes, and other natural disasters can be significant and is virtually uncontrollable. However, a superintendent can control the amount of damage caused by normal wind, snow, ice, and lightning through preventative maintenance.

Lightning protection is a key preventative measure for important trees near greens, tees, shelters, and other strategic areas. Lightning protection systems have had a bad image in many parts of the country, unfortunately, because many so-called experts did not know the correct materials to use or the correct methods for installing them. However, a documented failure of a properly installed lightning protection system that complied with the code of the National Arborist Association (NAA) or Underwriters Laboratories (UL) has never been recorded. Golfers are killed each year by lightning, and many of these lives could be saved by installing lightning protection equipment at shelters or trees adjacent to greens and tees or other locations of high golfer concentration.

Proper cabling and bracing prevents tree damage from wind, ice, rain, and snow. Cabling according to NAA specifications involves installing lag hooks or threaded eye-bolts in weak-crotched branches and connecting these with a seven-strand galvanized steel cable of the proper thickness. Such cables are generally installed at a height of two-thirds the distance between the crotch and the top of the tree. They should never be wrapped around a limb or tree trunk.

Regular pruning helps solve many potential problems for trees, turf, and golfers. Pruning may be done to manage tree growth, to lighten the weight of overloaded branches, or to remove hazardous, dead, or dying branches. Pruning may also be helpful, or indeed necessary, to provide sunlight and air circulation for stressed turfgrass or for removing overhanging branches affecting the golfer, especially at greens and tees. Do not remove more than one-third of the green foliage at one session. Also, make sure climbers don't use tree spikes or hooks on their boots, as these wounds attract insects and allow entry points for decay or disease organisms.

Vine and Spanish Moss Management — Spanish moss is very attractive on live oaks in the South. Large populations, however, can disguise hazardous dead limbs or add extra weight to branches. Also, prolific growth of moss within the foliage of a tree can shield the foliage from needed sunlight and cause entire branches to die. To minimize this threat, periodically pull the moss off the foliage at the ends of branches.

Bittersweet, wisteria, kudzu, honeysuckle, grape, and poison ivy are just a few of the vines that grow on trees. As with Spanish moss, a primary concern is to prevent their vigorous vegetative growth from shading the host tree's foliage, or causing breakage of limbs due to excessive vine growth or accumulation of ice and snow. Bittersweet and wisteria are also stranglers, and may twist around stems so tightly that they strangle and kill entire trees. Wisteria can be managed by periodic pruning, but the other species should be killed by severing the vine near the ground and spraying the freshly cut surface with 2,4-D, or by spraying the low-growing vine foliage with Roundup. Herbicide applications should be performed only by licensed applicators, and extreme care should be taken to avoid damage to the tree.

Tree Removal — Many golf courses remove trees only when they are dead, a policy that conflicts with sound tree management and turf management programs. A given area of land can support only a limited amount of vegetative growth. If overcrowded, trees must struggle in competition with others to obtain nourishment, moisture, and

sunlight. The weak become weaker (or more deformed), but even the strongest are adversely affected. Selective thinning, as directed by a consulting arborist or forester, removes the less desirable trees and enhances the beauty, visibility, and longevity of the more desirable specimens.

New Tree Plantings — When young trees are planted, it is critical to handle them with care and to reestablish their roots at the same depth they grew in the nursery or in the wild. Planting a new tree six inches deeper, for example, results in the suffocation of a high percentage of its roots. Deep planting also may cause the rotting of the trunk that was previously growing above the ground and exposed to air. Correct placement is very important because only a very small portion of a tree's roots (perhaps only one to three percent) are included in the root/soil ball during digging and transplanting.

It is important to cut and remove the wire or rope that is holding the burlap around the root ball and to lay the burlap in the bottom of the hole. The planting hole should be approximately twice the diameter of the root ball to provide a transition zone into which the roots can more readily develop. During this process the root ball should not be allowed to fall apart. The root ball should also be sliced and major roots directed outward to encourage radial growth. Backfill only with the soil that was excavated from the hole, and be sure there are no air pockets in the planting hole.

Cover the planting area with a three-inch layer of shredded bark mulch, fertilize lightly by broadcasting over the mulch area, and irrigate periodically during the first growing season to keep the roots moist. Most importantly, select only good quality nursery stock, and reject plants with cankered branches, weak crotches, poor form, poor root systems, and other problems.

This information provides a start for a golf course tree management program. Consulting arborists, extension personnel, and others are available to assist the superintendent on specific problems at his course, and should be included in any good tree management program.