A PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TURFGRASS TRENDS

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BACK TO BASICS

Best Management Practices — Part 2

Reduce organic materials in landscape plantings

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Last month, Part 1 of this article discussed trends in turfgrass irrigation management. This section covers irrigation, tree care and fertilization topics.

Following proper management practices can significantly reduce the production of organic materials in landscape plantings. Implementing recommended irrigation, fertilization and other cultural practices can reduce the vegetative growth of turfgrass and woody plants without sacrificing aesthetic appeal or performance. You can achieve both of these goals by employing the techniques described in this article.

Studies indicate that maturing trees receiving 40 to 60 percent of reference evapotranspiration (ETo) often perform as well as trees receiving 80 to 100 percent ETo.

Landscape tree irrigation

Most landscape trees require at least some water throughout their establishment period. Properly scheduling irrigations based on reference evapotranspiration (ETo) and applying the water into the root zone play important roles in the structural integrity and health of the tree, water conservation, and limiting excess organic matter production.

Routinely check and correct sprinkler problems such as misdirected heads that apply large volumes of water to sidewalks and parking lots, and nozzles on drip irrigation systems that are clogged.

Because landscape trees are planted in varying densities and are often mixed with shrubs, groundcovers, and turfgrasses, the use of crop coefficients (Kc's) cannot be legitimately used to schedule irrigations. However, studies indicate that maturing trees receiving 40 to 60 percent of reference evapotranspiration (ETo) often perform as well as trees receiving 80 to 100 percent ETo, with the added benefit of reduced excessive foliar growth and organic matter production. Table 2 lists monthly historical ETo for locations throughout California.

Landscape trees prefer more infrequent, deep irrigations than do nonwoody plants such as turfgrass. Knowing when to irrigate is as important as knowing how much water to apply. Soil texture and species preference largely determine when to irrigate.

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Water budgeting

Using a water budget approach to schedule landscape irrigations is often useful. To develop a budget, determine the water-holding capacity of the soil, and the desired depth of each irrigation (in general, trees should be watered about two feet deep). Table 3 compares available water for four soil textures.

To determine the total water budget per tree, multiply the average water-holding capacity of the soil by two feet. For example, a sandy loam soil holding one inch of available water, multiplied by two feet equals two inches of water at field capacity.

Since in general, landscape trees should be irrigated at 50 percent soil-moisture depletion, the tree should be irrigated when one inch of water has been depleted and one inch should be added. Daily ETo measurements may be obtained through the CIMIS network, or historical averages may be used.

Fertilizing turfgrass

An understanding of nutrient needs of turfgrass is important for maintaining high quality plantings, and for making prudent, environmentally sound management decisions. Applying too much fertilizer can lead to undesirable rapid growth, resulting in large amounts of turfgrass clippings that are difficult to grasscycle.

There are 16 essential nutrients required by turfgrass, classified as either macro or micronutrients. While micronutrients are just as important for plant growth and development as macronutrients, they are required in lower concentrations. Essential macronutrients not supplied by air and water but required for plant growth and development and their corresponding chemical symbols are: Nitrogen (N); Phosphorus (P); Potassium (K); Calcium (Ca); Magnesium (Mg); and Sulfur (S).

Essential micronutrients and their corresponding chemical symbols are: Iron (Fe); Manganese (Mn); Zinc (Zn); Copper (Cu); Molybdenum (Mo); Boron (B); and Chlorine (Cl).

By far, nitrogen is the most limiting nutrient and is required in the greatest amount by turfgrass. Nitrogen-deficient turfgrasses will grow slowly, appear chlorot-

Additional methods of conserving water and reducing unnecessary organic matter production at landscape tree sites:

- Irrigate early in the morning to reduce soil evaporation.
- Irrigate trees separately from surrounding plants whenever possible.
- Avoid adding soil amendments to planting holes; they can lead to layered soil and prevent downward water movement resulting in shallow roots.
- Irrigate most frequently in spring and summer. When water is scarce, one or two thorough spring irrigations may supply enough water for the entire season.
- Keep turfgrass and other plants at least one foot from tree trunks.
- Apply mulch around trees, keeping it several inches from tree trunks. Mulch reduces water evaporation from the soil, buffers soil temperature, and reduces weeds. Irrigate thoroughly through mulch layer into soil.
- Control weeds around trees; they compete for water and nutrients and can harbor insects and diseases.
- Avoid soil compaction around trees. Compaction restricts water movement into soil and decreases oxygen. Keep construction activities several feet from tree trunks.
- Do not routinely fertilize maturing trees. Nitrogen causes new growth flushes, increasing organic matter production and water requirements.
- Prune trees according to professional guidelines. Excess pruning and/or improper pruning promotes shoot growth that increases water demand.

ic and thin and not withstand traffic well.

One or two applications of a complete fertilizer that contains nitrogen, phosphoru, and potassium is recommended to fertilize most turfgrasses annually. A ratio of 3-1-2 or 4-1-2 of nitrogen, phosphorus and potassium, respectively (as found in formulations like 12-4-8 or 20-5-10), best matches the relative nutrient needs of this grass. Four to five additional pounds of actual nitrogen per 1,000 square feet are required throughout the growing season to maintain high quality playing fields and golf courses, but are not necessary for lawns and less-intensively used sites.

Slow & fast-release options

Nitrogen fertilizer sources generally are classified into two main categories: quickly available (fast release) and slowly available (slow release). This distinction refers to how fast the applied nutrients are available to the plant, and the length of time they remain active. Both quickly and slowly available sources of nitrogen fertilizer may be applied separately (although they are commonly blended) along with P and K fertilizer sources, in a pre-packaged combination. Because of this packaging, fertilizers vary in the amount of quickly available and slowly available N, P, K and other nutrients. You can find this information on the product label.

Sources of nitrogen that are quickly available include inorganic salts such as ammonium sulfate, ammonium nitrate and potassium nitrate, and organic forms such as urea and methylol urea. They are highly water-soluble. In California, ammonium sulfate is often the preferred quick-release fertilizer for general use turfgrass due to its acidifying effect on high pH soils.

Many sports field and parks maintenance managers in California routinely apply fast-release nitrogen products due to their low cost and convenience. It is important to remember that while fast-release fertilizers result in a more immediate turfgrass response than slow-release forms of nitrogen, greater skill is needed in their application to insure that the correct amount of nitrogen is applied and to avoid uneven spread. Apply no more than one pound of quickly available nitrogen or less per 1,000 square feet in a single application.

TABLE 3. WATER AVAILABILITY

Inches / gallons of available water in four soil textures

Soil Type	Inches per foot of depth	Gallons per cubic foot
Sand	0.5-1.0	0.33-0.67
Sandy loam	1.0-1.5	0.67-1.00
Clay loam	1.5-2.0	1.00-1.33
Clay	1.5-2.5	1.00-1.67

Slowly available nitrogen products are costlier than quickly available products, but do not require as frequent applications as quickly available N sources to provide an even supply of nitrogen. Longer-chained urea formaldehyde products such as Nitroform and Hydroform and natural organic products such as bone meal and activated sewage sludge are dependent on higher temperatures and bacterial activity for release, while polymer coated sulfur coated urea (SCU) and isobutylidene diurea (IBDU) are less temperature dependent.

Coated urea products slowly discharge urea through cracks in the coating. The urea enters the soil solution over a two- or three-month period. In many cases, slow-release nitrogen products result in less nitrogen loss due to leaching and volatilization than do quick-release fertilizers.

Although slow-release nitrogen products cost more than quick-release forms, they have a lower burn potential and are recommended for sandy soils and for use by entry-level employees who lack experience with fertilizer applications. They are also easier to use when grasscycling, since flushes of rapid growth are easier to avoid.

P & K basics

Besides nitrogen, phosphorus and potassium are nutrients that are also regularly applied to turfgrass. One or two annual applications of a complete fertilizer with a 3-1-2 or 4-1-2 ratio of N, P and K are usually adequate to supply the phosphorus and potassium requirement of most sports field plantings.

In California, ammonium sulfate is often the preferred quick-release fertilizer for general use turfgrass due to its acidifying effect on high pH soils.

The International Society of Arboriculture offers the following insights into properly pruning young, maturing trees:

- Each cut has the potential to change the growth of the tree.
- There should be a purpose for each cut.
- Proper technique is essential. Poor pruning can cause damage that extends over the life of the tree. It is important to know where and how to make cuts before beginning the project.
- Trees do not "heal" the way people do. When a tree is wounded, it must grow over and compartmentalize the wound. In effect, the wound is contained within the tree forever. Therefore, a small cut does less damage to the tree than a large cut. Waiting to prune a tree until it is mature can create the need for large cuts that cannot be easily compartmentalized.

How a pruning cut is made is critical to the growth response and wound closure of the tree. Pruning cuts should be made just outside the branch collar. The collar itself contains trunk or parent branch tissues leading to damage when cut. A permanent branch may be shortened by being pruned back to a lateral branch or bud. Internodal cuts, or cuts made between buds or branches, may lead to stem decay, sprout production and misdirected growth.

Phosphorus is necessary for nearly all metabolic processes involved in plant growth and development and it also regulates the formation and translocation of sugars and starches in the plant. Phosphorus deficiency symptoms include slow growth, stunting and occasionally, purplish leaves.

Potassium is important in water uptake and transport throughout the plant and for increased drought resistance. It also encourages root growth and is essential for cell growth and photosynthesis. Ammonia contained in some nitrogen fertilizers may reduce the amount of available potassium in the soil. Potassium sulfate provides sulfur in addition to potassium, and is often recommended in high pH soils to reduce alkalinity. Potassium deficiency symptoms include tip and margin-burn on older leaves and slow growth.

Pruning trees reduces materials

Training and pruning immature trees is essential for insuring the development of mature trees with strong structures and desirable forms. Improperly pruned young, developing trees often require extensive corrective pruning in the future that could have been avoided.

The International Society of Arboriculture and other tree care organizations endorse the use of professional pruning standards that will help insure the development of healthy, safe trees that provide maximum environmental benefit. Use of these standards are also an important factor in reducing unneccessary greenwaste production.

Pruning tools

Proper tree pruning requires using the correct tool for required procedures. Selected tools should be routinely cleaned and sharpened for optimum performance, as well. For small trees, most of the cuts can be made with hand pruning shears (secateurs).

The scissor type or by-pass blade hand pruners are preferred over the anvil shears because they make cleaner, more targeted cuts. However, pruning cuts larger than 1/2-in. in diameter should be made with lopping shears or a pruning saw. Never use hedge shears to prune a tree.

Establishing a strong scaffold structure is necessary while the tree is young because scaffold branches provide the framework for the mature tree. Properly trained young trees will develop a strong structure that will require less corrective pruning during maturation.

Good pruning techniques remove structurally weak branches while maintaining the natural form of the tree. In fact, it is often difficult to visually determine whether a landscape tree has been pruned following a high quality pruning. A major goal when training young trees is to establish a strong trunk with sturdy, properly spaced branches.

The strength of the branch structure depends on the relative sizes of the branches, the branch angles and the spacing of the limbs. These factors vary among species, due to individual growth patterns. Some trees, such as pin oaks, have conical, upright shapes with a strong central leader. Con-

versely, elms and live oaks are usually wide spreading without a dominant central leader. Some trees, like Ficus nitida and Bradford pears, are densely branched.

Leader development

In most cases, a single, dominant leader should be allowed to develop in a young tree. The tip should not be pruned back and competing branches should not be allowed to outgrow the leader. A tree with a double leader is prone to structural weaknesses; the strongest, most upright leader should be selected and the second one remove while the tree is young.

Lateral branches (known as temporary branches) often contribute to the development of a sturdy, well-tapered trunk. It is important to leave some in place, although they may need to be removed later. Temporary branches may also help protect the trunk from sun and mechanical injury. They should be kept short enough to avoid creating obstructions or competition with permanent branches.

Selecting permanent branches

Nursery trees often have low branches that appear well placed on a young tree, but are inappropriate for large growing trees in an urban environment. The primary function the tree will serve at maturity should determine how a young tree is trained. For example, street trees should be pruned to allow at least 16 feet of clearance for traffic, while many landscape trees require only about eight feet of clearance.

The height of the lowest permanent branch is also determined by the intended function of the tree in the landscape. Trees that are used to screen an unsightly view or provide a windbreak may be allowed to branch low to the ground. Most large growing trees in the landscape should eventually be pruned to allow head clearance.

Vertical and radial branch spacing is critical to future development and structural strength of the tree. Branches selected as permanent, scaffold branches need to be properly spaced along the trunk. In general, permanent branches that are vertically spaced at distances equal to about three percent of the ultimate height of the tree are preferred. Therefore, a tree expected to grow 50 feet tall should have permanent scaffold branches spaced about 18 inches apart along the trunk, while scaffold branches should be spaced approximately seven inches apart for species growing an average of 20 feet tall.

Scaffold branches should be spaced radially to avoid two growing next to each other on the same side of the tree. Some trees have a tendency to develop branches with narrow angles of attachment and tight crotches. As these trees develop, bark may become enclosed deep within the crotch between the branch and the trunk, which weakens the attachment of the branch to the trunk and can lead to branch failure when the tree matures. Branches with these types of weak attachments should be pruned while they are young.

Research indicates that the structural integrity of a tree can best be maintained by promoting the development of half of the branches in the lower 2/3 of the tree. Also, avoid overthinning the tree's interior. Removing too many leaves can reduce the photosynthetic production of the tree, leading to poor growth and stress.

Recently planted trees

Recently planted trees should not be heavily pruned, but may require minor corrective pruning. Broken and damaged branches should be removed, but more comprehensive pruning and training should occur over the next few years.

The belief that trees should be pruned when planted to compensate for root loss is misguided. Instead, trees should be allowed to retain as much foliage as possible to provide necessary photosynthetic material for optimum shoot and root growth. Unpruned trees establish faster, and develop a stronger root system than trees pruned at the time of planting.

Wound dressings were once thought to accelerate wound closure, protect against insects and diseases, and reduce decay. However, research disputes these benefits and experts recommend that wound dressing not be used.

In fact, it is often difficult to visually determine whether a landscape tree has been pruned following a high quality pruning.

In most cases, routine pruning to remove weak, diseased or dead limbs can be performed at any time of year with little effect on the tree.

Mature trees

Pruning mature trees is important for functional and aesthetic reasons. Proper pruning, based on principles of tree biology, can maintain good tree health and structure while enhancing the aesthetic and economic values of urban landscapes.

In most cases, mature trees are pruned for corrective or preventative measures. Common reasons for pruning are to remove dead, crowded or poorly angled limbs, reduce potential hazards, and to increase light and air penetration.

Routine thinning does not always improve the health of a tree. Trees produce a dense crown of leaves to produce compounds necessary for growth and development. Removing large amounts of foliage can reduce growth and stored energy reserves, resulting in stressed trees.

In most cases, routine pruning to remove weak, diseased or dead limbs can be accomplished at any time of year with little effect on the tree. In general, tree growth is maximized and wound closure occurs most readily if pruning takes place before the growth flush.

Heavy pruning just after this spring growth flush should be avoided, to conserve energy and reduce stress. In some cases, opportunities for disease spread occur in some species during certain times of the year, which obviously need to be avoided.

Make proper cuts

Pruning cuts for mature trees should be made just outside the branch collar, as is the case with immature trees. The branch collar contains trunk tissue that needs to be preserved.

The weight of large limbs that require removal should be reduced before they are removed to minimize the risk of tear and damage. An undercut 12-18 inches from the point of attachment should be made, followed by a second cut from the top directly above or a few inches further out on the limb. The remaining stub should be removed by cutting back to the branch collar.

Specific types of pruning may be necessary to maintain a mature tree in a healthy, safe and attractive condition. Trees should not be topped!

Instead, use the following techniques to insure safety and preserve the structural integrity of the tree:

- *Crown cleaning* is the removal of dead, dying, diseased, crowded, weakly attached and low-vigor branches from the crown.
- *Crown thinning* is the selective removal of branches to increase light penetration and air movement through the crown. Thinning opens the foliage of a tree, reduces weight on heavy limbs, and helps retain the natural shape of a tree.
- *Crown raising* removes the lower branches to provide clearance for buildings, vehicles, pedestrians and vistas.
- *Crown reduction* reduces the overall tree size, often for clearance for utility lines. Reducing the height or spread of a tree is best accomplished by pruning back the leaders and branch terminals to lateral branches that are large enough to assume the terminal roles (at least one-third the diameter of the cut branch).

The amount of live tissue that should be removed depends on the tree size, species, age, and pruning objectives. An important principle is that a tree can recover from several small pruning wounds faster than from one large wound.

Avoid removing too much inner foliage and small branches. An even distribution of foliage should be maintained along large limbs and in the lower portion of the crown. Over-thinning reduces photosynthate production and can lead to limb failure.

Mature trees do not ordinarily require major routine pruning. In general, less than one fourth of the leaf-bearing crown should be removed during any given pruning. In older, mature trees, removing a single, large-diameter limb can result in a wound that is difficult to close. As a tree ages, it has a reduced ability to close wounds and defend against decay and insect attack.

Therefore, pruning large, mature trees is usually limited to the removal of dead or potentially hazardous limbs. Wound dressings do not accelerate wound closure, protect against insects and diseases or reduce decay, and therefore, should not be used.

Fertilizing landscape trees

Controversy has always surrounded the issue regarding routine fertilization of landscape trees. Some studies indicate no or only a slight increase in growth when fertilizers are added, while many professionals recommend fertilizing landscape trees as soon as they are planted.

Remember that landscape trees are not a crop plant that require certain nutrients at various developmental cycles for optimum production. In general, most healthy, well-established trees require little fertilizer. However, fertilizer is often beneficial to promote more rapid growth and faster establishment in newly planted trees or in older trees exhibiting symptoms of a nutrient deficiency, such as nitrogen. It may be useful to evenly broadcast a complete fertilizer (e.g.: 15-15-15, 11-4-8) at the recommended label rate (usually 1/3 to 1/2 pound of actual nitrogen per inch trunk diameter) over the soil surface extending several inches outward from the trunk to the drip line of the tree or slightly beyond to optimize growth of young, maturing trees. Older trees may benefit from applications at half of these rates applied in spring prior to rapid growth and again in mid-summer. Fertilizers should be irrigated in thoroughly to move nutrients vertically into the root zone.

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