A PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TURFGRASS TRENDS

Volume 9, Issue 12 • December 2000

BACK TO BASICS

Best Management Practices — Part 2

Reduce organic materials in landscape plantings

By Janet Hartin, Dennis Pittenger & J. Michael Henry
University of California Extension

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.

AN ADVANSTAR ★ PUBLICATION

IN THIS ISSUE

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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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Four More Unconventional Grasses to Know and Love

By Doug Brede, Ph.D.

The first installment of "Grasses to Know and Love" appeared in the August 2000 TurfGrass Trends. This second edition describes four more unconventional grasses, and how and where you can use them in your landscapes.

Sheep fescue, when combined with other fine fescues, provides a low maintenance, shade-hardy mixture for golf courses and other turf surfaces. In this photo, a Scottish Links brand mixture forms an attractive cascading appearance on a hill slope, requiring little upkeep.

There's an old African proverb that says, "When elephants fight, it's the grass that suffers." Now you might think I brought up that quote to talk about wear tolerance or something similar. I didn't. I brought it up to discuss the classification of grass species.

Right now there is a great deal of wrangling going on among botanists and taxonomists ("the elephants") about how grasses are grouped. Species lines that were once crystal clear, are becoming increasingly blurred. All this squabbling adds to the confusion among consumers.

In this installment of "Grasses to Know and Love," I'm going to show you how four (or possibly five or six, depending on which expert you talk to) unconventional grasses can be used in your landscape. And I'll help steer you through the current maze of species changes, without getting trampled.

Most sheep are no longer sheep

Sheep fescue is a vastly underappreciated grass, considering its potential. Sheep fescue

TABLE 1: CHARACTERISTICS OF SHEEP FESCUE

- Dusty blue (glaucous) appearance
- Fine leaf texture with stiff, curving blades
- Tufted growth habit (a bunch grass) with some minor creeping ability
- Very tolerant of low pH and drought
- Fairly rapid seed germination
- Slender seedheads form in June, turning red at maturity, and later tan
- When left unmowed, it will produce viable seeds that scatter and fill in bare spots
- More heat tolerant than other fine fescues (6)
- Most varieties do not contain an endophyte


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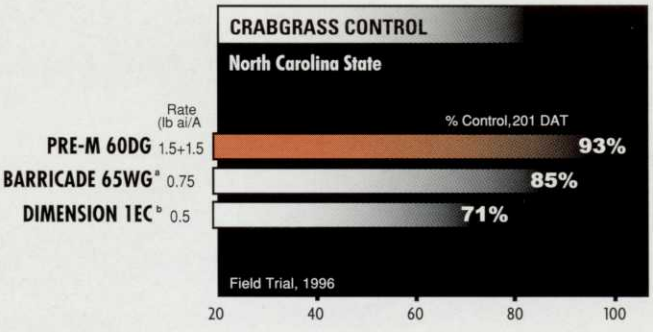

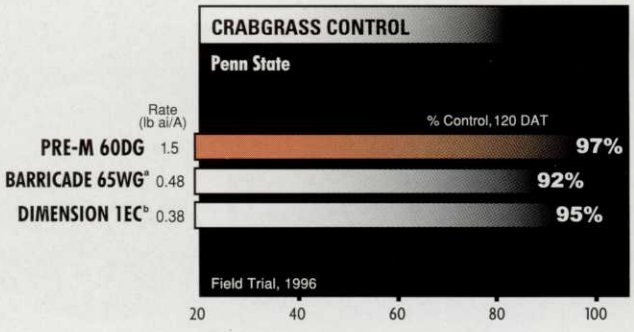

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TEAM[c]	H	M	M	M	M	M	NR	NR
RONSTAR[d]	M	H	NR	M	M	NR	NR	NR
SURFLAN[c]	H	H	H	M	MH	M	H	H
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*Source: Kline & Company Report, US Acre Treatments by Turf Management.

has the best drought tolerance and water-use rate of all the cool-season turfgrasses. Recent studies have grouped sheep fescue even among the best prairie and dryland grasses in terms of water consumption. It ranks neck-and-neck with the top warm-season species – long renown for their drought proclivities.

A drought study at Colorado State University (5) put sheep fescue in a class by itself among fine fescues (see page 8 table).

Granted, sheep fescue does not have the smooth texture and high density of some of the premium turfgrasses. In his classic textbook (3), Jim Beard states that sheep fescue, "forms a relatively low quality turf. It seldom forms a uniform shoot density and appearance." However, modern cultivars are making strides in appearance, while retaining sheep fescue's tenacious drought-defying rooting.

In the 1993 National Turfgrass Evaluation Program (NTEP) trial, two sheep fescues, 'MX-86' and 'Bighorn,' were among the top entries, trouncing many popular chewings and strong creeping red fescue varieties (www.ntep.org/comm/ff93_98-13.htm). Heat and drought tolerance enables sheep fescue to prosper under harsh summers.

However, if you put sheep fescue under a cool, drizzly, coastal climate, it will become noncompetitive and relatively unattractive. It looks far better in Wichita,

TABLE 2: GRASSES MENTIONED IN THIS ARTICLE

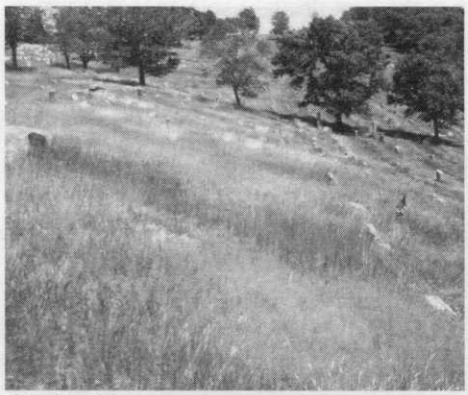
Common name	Latin name	US distribution	Worldwide distribution	Most resembles	Cultivars	Seeding rate lbs/1000 ft2
Highland bentgrass	Agrostis castellana Boiss. & Reut.	Naturalized throughout US and Australia, New Zealand, South America	Native to Africa, Portugal, Azores, Albania, Bulgaria, France, Greece, Italy, Portugal, Spain, Yugoslavia	Colonial bentgrass	Highland, BR 1518	1 to 3
Idaho bentgrass	Agrostis idahoensis Nash	Native to British Columbia, AK, AZ, CA, CO, ID, NM, MA, NV, OR, UT, WA, WY	Naturalized in South America	Colonial bentgrass	GolfStar	1 to 3
Sheep fescue	Festuca ovina L.	Naturalized throughout US and much of the temperate world	Native to Armenia, Azerbaijan, China, Georgia, Japan, Korea, Mongolia ,Russian Federation, Turkey, most of Europe, Sweden,Ukraine, United Kingdom	Hard fescue	Quatro is the only "true" sheep fescue; MX-86, Azay, Mecklenburger common, Bighorn, Azure, Norfarm 67135 are to be now considered bluish hard fescues	4 to 6
Blue fescue	Festuca glauca Vill.		France	Sheep fescue	SR 3200, PST-4MB (a blue x hard fescue hybrid)	4 to 6

KS, than where Beard observed it in Michigan.

One particular application of sheep fescue is for unmowed, vista turf. Sheep fescue has a striking blue color and short stature when unmowed. Its blades rarely exceed 10 inches with seedheads reaching 18 to 24 inches in June. A once-yearly trim mowing eliminates the seedheads and keeps sheep fescue looking tame. I have two acres of MX-86 sheep fescue in my back yard that provides an soft, meadow-like appearance with no mowing required. Golf courses have successfully used sheep fescue on unirrigated rough areas. On slopes, it forms a eye-catching waterfall appearance (see photo on page 8).

And now the controversy. For the last 100 years or so, sheep fescue was Festuca ovina and hard fescue as a botanical variety of it, F. ovina var. duriuscula. And all was well with the world.

Then in 1954 C.E. Hubbard (8) recast hard fescue as F. longifolia, only to have it renamed F. trachyphylla in 1980 by I. Markgraf-Dannenberg (10). More recently, F. trachyphylla was splintered into two separate species, F. brevipila and F. lenensis, and F. longifolia was subdivided into the normal F. longifolia and F. glauca, or blue fescue (9).



Dryland bentgrasses are more common than you might think. The swirling patches in this old cemetery near Pittsburgh, PA, are all dryland bents. Under unirrigated conditions like this, dryland bent can outcompete many other turfgrasses, including bluegrass and fescue.

You've no doubt seen plants of F. glauca. The vegetative variety 'Elija Blue' is used in all-too-many ornamental beds.

Two years ago, Penn State's David Huff decided to make sense of all this splintering by surveying the chromosomes of fine fescue. His idea was to let the chromosomes guide him in grouping these grasses – especially considering that many of these fescues exhibit a nearly identical fine-bladed mor-

TABLE 3: FINE FESCUE CHROMOSOME COUNTS

56 chromosomes

- Strong creeping red fescue (F. rubra L. spp. rubra) {'Cindy,' 'Herald,' 'Flyer'}

42 chromosomes

- Hard fescue (F. brevipila Tracey) {'Biljart,' Scaldis, 'SR3100' – this category also includes the bluish hard fescues [formerly sheep fescues] of Bighorn, MX-86, Azure, 'Azay'}
- Chewings fescue (F. rubra spp. fallax [Thuill.] Nyman) {'Banner,' 'Brittany,' 'Jamestown II'}
- Slender creeping red fescue (F. rubra L. spp. litoralis Vasey) {'Dawson,' 'Marker,' 'Seabreeze'}

28 chromosomes

- Sheep fescue (F. ovina L.) {Quatro}

14 chromosomes

- Hair fescue (F. filiformis Pourret) {'Barok'}
- False sheep fescue (F. pseudovina Hackel ex Wiesb) {'Covar'}

phology. But as with any good research study, Huff's analysis raised as many questions as it answered.

Huff's paper (9) points to paradox in sheep and hard fescue: "In the USA, sheep fescue is described as having a bluish-gray leaf color whereas hard fescue leaf blades are considered to be green. In Europe, just the opposite is the case. Sheep fescue has a greenish leaf color whereas hard fescues often exhibits a bluish-gray color."

He turned to an elaborate laboratory device for answers. Laser flow cytometry is used normally to screen cells for cancer, by detecting minute weight differences in the cell's DNA. Cells with fractured chromosomes exhibit a varied DNA weight. Huff adapted this technique for turfgrasses and used it to group fine fescues.

From his analysis, Huff found only one variety in the USA that is a true sheep fescue: the variety 'Quatro.' Other sheep fescues (Bighorn, MX-86, 'Mecklenburger common,' and 'Azure') were reclassed as hard fescues. Huff did find a minor DNA difference between these bluish varieties and the traditional hard fescues, 'Spartan' and 'Scaldis' – but not enough of a difference to justify a new species.

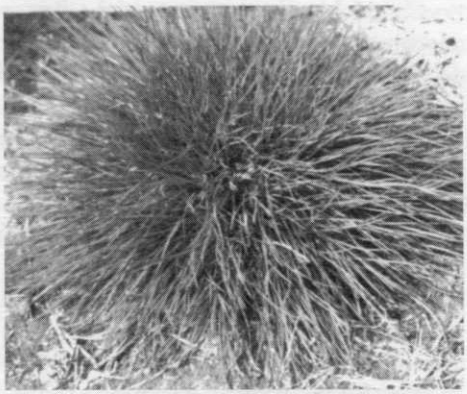
Huff grouped the fescues based on chromosome number (shown with typical cultivars in brackets) on page 10.

In spite of all these confusing reshuffles, sheep fescue and the newly recognized bluish hard fescues remain an excellent choice for the low maintenance landscape.

Dryland bentgrass – an oxymoron?

It seems inconceivable to most people who grow creeping bentgrass that a thing like "dryland bent" could actually exist. Creeping bentgrass, and its close relative colonial bent, are definitely moisture-loving grasses. One botanist even terms them marsh grasses. That explains why we have to pump so much water just to keep them alive.

The dryland bentgrasses evolved under droughty conditions. One of the best known members of the dryland bentgrasses is 'Highland' bent (Agrostis castellana). Highland bent evolved in the Southern Mediterranean, where warm, dry summers are the norm. Interesting enough, the name 'Highland' is the name for both the species and its most famous variety.



A 1-year-old spaced plant of Idaho bentgrass (A. idahoensis) (about 40 cm across) showing its bunch-type growth habit. In its second year of growth, lateral tillers can be observed pegging down at nodes, similar to perennial ryegrass. This photo was taken in mid June before flowering. Inflorescences begin appearing in mid July, and the species is in full color maturity around August 1st. Idaho bentgrass is one of several bentgrass species native to America. Most bentgrasses (creeping, velvet, colonial) originate from Europe. Some native American bents have stolons or rhizomes, but others like this one are true bunch grasses, showing little or no lateral creeping ability.

The Highland variety is a collection of strains from the hills of Western Oregon. But it is not native to Oregon. Highland bentgrass was originally imported from Europe in the 1930's and was planted throughout the area west of the Cascades until the 1970's.

Species	Drought tolerance	Type of drought it can survive
Sheep fescue	Excellent	Frequent, severe
Hard fescue	Good	Occasional, long term
Chewings fescue	Medium	Frequent, moderate
Strong creeping red fescue	Medium	Frequent, moderate
Slender creeping fescue	Poor	Infrequent, short duration

SOURCE: COLORADO STATE UNIVERSITY STUDY

C.E. Hubbard (8) was one of the first to recognize Highland as a distinct species from colonial. Most scientists have since accepted this classification, including one writer from Oregon State University (www.orst.edu/Dept/hort/turf/common.htm): "I agree with [Hubbard] from a practical field standpoint because Highland bentgrass has distinct morphological and growth characteristics that set it apart from colonial bentgrasses. For example Highland is strongly rhizomatous and requires low mowing heights to avoid severe false crowning. Highland bentgrass forms a dense turf that looks best when mowed at 0.5 to 0.75 inch. Highland has a dark blue gray color and generally looks better in winter than other bentgrasses. It also looks good in early spring but loses color and becomes stemmy during May through mid-June."

Years ago, the production of Highland bentgrass was such as staple to the Oregon economy, that the Highland Bentgrass Commission was established in the late 1950's to promote seed in domestic and foreign markets (www.css.orst.edu/seed-ext/commissions/bentgrass.htm). Highland bentgrass was sold for golf course fairways and even putting greens. I personally spent two years of my life trying to manage 27 fairways of a Highland/'Astoria' blend in a Pennsylvania river valley. (We later gave up and converted to 'Penncross').

J.L. Eggens and his colleagues (7) at the

TABLE 4: CHARACTERISTICS OF IDAHO BENTGRASS

- Identifying features of the plant – A tufted, perennial bunch grass. Appearance in turf is most similar to colonial bent, although blades are somewhat broader and darker (see photo). Unmowed, the plants mature about knee high with a brilliant purple-red seedhead color at maturity.
- Identifying features of the seed – Seed characteristically lacks a palea, appearing to have a "naked belly." About 1/3 of the seed loses its lemma in threshing and appears as naked caryopses.
- Moisture requirements – In its native habitat, Idaho bentgrass survives on as little as 15 inches of annual precipitation. It is found most abundantly along streambanks, indicating that it favors moister conditions.
- Turf uses – Idaho bentgrass is ideally suited to lawns, where a softer, fine textured grass is desired. Also to: Low maintenance sites; alkaline, mildly saline, or heavy metal-impacted sites; golf fairways in blends with fine fescue; winter overseeding of greens as an alternative to Poa trivialis, where the superintendent desires the "look of bentgrass;" or as an ornamental grass when planted in mass and left unmowed.
- Mowing tolerance – Plants of Idaho bentgrass directly from the wilds become coarse and thinned when mowed below 3 inches. With breeding, however, Idaho bent has shown mowing tolerance to as close as _ inch. Its ideal performance is at traditional lawn heights of 1 to 2 inches. GolfStar has tolerated 5/32-inch (4 mm) cut when used for winter overseeding of dormant bermuda greens.
- Thatch – Low thatching; considerably less than velvet or creeping bentgrass but more than perennial ryegrass.
- Sod 'cutability' – Similar to Kentucky bluegrass, according to one Maryland turf farm. Nylon netting is not required for a sod crop.
- Disease reaction – Idaho bent is remarkably resistant to a number of North American turf diseases (see Fig. 2), particularly at mid-range cutting heights (1 to 2 inches). At closer cuts, it becomes increasingly susceptible.
- Seed establishment– Seeding rate is similar to other bentgrasses, in the range of 1 to 2 lbs. per 1000 ft2. For winter overseeding, rates up to 3 lbs. are desirable. Seedling vigor is better than most bentgrasses, and just shy of the rapid establishment rate of redtop.
- Major advantages – Because of its bunch growth habit, this species can be maintained as a lawn, without the problems of puffiness, scalping, false crowns, and excessive thatch associated with other bentgrasses. For the uninitiated viewer, a lawn of Idaho bentgrass looks like creeping bentgrass. Idaho bent can be mixed with perennial ryegrass or fine fescue.
- Shortcomings – Pale mid-winter color in the North (this mid-winter dormancy is probably a function of its cold hardiness). The current cultivar, Golfstar, becomes thinned if mowed below 5/8 inch.

University of Guelph (Ontario, Canada) surveyed the performance of four bentgrass species for fairways and greens. They found (as expected) that creeping bent was the most suitable in terms of quality, color, and resistance to Poa annua. Dryland bent performed a lot like colonial bent, except with a darker color and lesser resistance to Poa. Browntop bentgrass (A. capillaris) showed characteristics intermediate between the two. 'Egmont' is a browntop bent.

Dryland bent has two unique services on a golf course:

1. In the froghair area or intermediate rough, where mowing heights are below one inch – generally that's too tall for creeping bent to prosper.

2. On dry mounds and rough areas receiving little or no irrigation or mowing.

Look at Idaho bentgrass

This is a native American bent. Idaho bentgrass is a novel species of bent, released only recently onto the seed market. It is similar in many of its characteristics to the dryland bentgrasses, but has several unique characters and adaptations.

I wish I could say the discovery of the turf potential of Idaho bentgrass was the result of the exhaustive study of hundreds of potential native grasses. It wasn't. Oftentimes in research, serendipity is one of our finest tools.

I first discovered the potential of Idaho bent in 1987 when one of our fieldmen brought in a sample of what he thought was dwarf redtop (A. gigantea). The plant was growing in a field of 'Streaker' redtop, along a river drainage so polluted with heavy metals, that it's within one of EPA's Superfund sites. Upon examination of the field, I found a number of these dwarf plants, which later keyed out to A. idahoensis. Subsequent collection trips to that river basin (by fishing boat) netted several hundred promising specimens.

The initial turf quality of these introductions was poor, averaging 2 to 3 on a 1 to 9 quality scale, with 9 equal to ideal turf – similar to redtop. However, the species responded favorably to breeding, increasing in quality with each generation. In 1999, we produced our first crop of 'Golfstar' Idaho bentgrass (4). You can see several characteristics of this turfgrass on the previous page.

— Doug Brede is a scientist, plant breeder, and writer based in Post Falls, Idaho. His breeding efforts have led to the identification of a new species with turf potential – Idaho bentgrass – for which he holds the US patent (5,981,853). His breeding staff is responsible for developing over 50 of today's most popular turf cultivars. Brede earned a Ph.D. degree at Penn State University and worked as Associate Professor at Oklahoma State University before taking the research director's job at Jacklin Seed/Simplot Turf & Horticulture, where he works today.

Brede describes Idaho bentgrass and 400 additional unconventional grasses in a new book dealing with useful ways for lowering your turf maintenance – making turf care easier rather than more complicated. The book, entitled "Turfgrass Maintenance Reduction Handbook – Sports, Lawns and Golf," can be found at the publisher's web site (http://www.sleepingbearpress.com/catalog.asp?category=turf or phone 734 475-8787) or at many turf trade shows.

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Hollow-tine vs. deep-tine aeration

Editor's note: Please send your turfgrass questions to our Management Forum panel for a quick response. Call Curt Harler at 440/238-4556; fax him at 440/238-4116 or email him: curt@curtharler.com

Q *I'm a superintendent in Illinois. For years we've been told the only way to aerate in Spring and Fall was using hollow-tines (and that it isn't effective unless you remove the plugs). But in the last few years, we've seen a push to use solid, deep-tine aerators. Since all the buzz about this goes against everything we've been taught for years, I'm wondering if this push to deep-tine aeration is driven by research or marketing?*

Can you tell me what research there is to support this concept. I don't want to start using this discover five years from now that I've made a mistake. What are the effects on the soil? — Illinois

Dave Kopec, turf specialist at the University of Arizona replies:

Deep-tine aeration was not designed as a replacement for standard core aerification. It simply is used for other soil/turf purposes. The standard core aerification process we all use is well suited for:

1. relieving shallow or surface compaction (less than 3 inches, or at the surface).
2. mixing soil with thatch, for helping the breakdown of thatch when the soil cores are returned to the turf as a mulch.
3. Breaking through a interface layer (two or more soil texture types) that are close to the surface (3.5 inches or less). This can occur if sod is installed.

Deep-tine aerification is used for the following conditions:

1. When you need to break through soil layers or hard pan layers that a hollow-tine or side-discharge core tine cannot penetrate. Solid tines are often used here because of the rigidity required to perform the operation (since they are longer they can penetrate to greater depth). While deep tines do come in side-discharge options, you have to have a relatively uniform and friable soil for the tool to work best.

2. When you want to provide deep drainage where it is otherwise slow, limited or nonexistent. This is critical if the water quality of the irrigation source is salty, which may eventually cause high salt levels around the turfgrass roots. Deep tines can be used here quite well. Some units will "poke a hole" down 10 inches or more in soil. Over 95% of the working root zone of turfgrasses is going to be at 10 inches or less. So I don't think that compaction at the bottom of a 10-in. deep tine is really an issue. Besides, many machines twist and kick at the bottom of the penetration stroke, which really opens up things way down!

3. Narrow solid tines (shallow 1/4-in.) are okay to use on greens to promote surface drainage and alleviate localized dry spot type symptoms. They usually heal (cover) quickly, and the process can be performed when regular hollow tining is too disruptive, or the recuperative time from hollow tining would be unacceptable. The same tines can be used on highly trafficked collar and exit points from greens and tee boxes.

4. Both cases 1 and 2 above can use solid tines. You can use hollow or side-discharge tines when you want to bring cores to the surface (for the same reasons mentioned above that you would use standard aerification). The advantage now, is that you can take a "deeper" core.

Other words of advice:

Always look at the several soil samples to see why you are aerifying. Use a 3.0 soil core with a sharp edge, and sample in several places. If it is not satisfactory, sample with a sharp spade. The picture you find will be worth a thousand words. Then you can decide on what exactly the problem is, and if you should go with a solid or core removal type tine.

Warning label overkill

Curt Harler
Managing Editor

By Curt Harler/Managing Editor

Are the safety warning decals on motorized equipment really necessary any longer? Do they actually serve a purpose?

The corporate lawyers at any company that makes mowers and related equipment will argue an emphatic, "yes." But who actually reads them? Honestly, now, have you read the text of the warnings on the equipment you used yesterday? How many of our workers actually can read those warnings? How many take the time to do so?

Face it: Nobody reads warning statements on mowers any more than they read the warnings on cigarette packs (although everyone has a general idea of what their message is). Perhaps there is value in a warning label, not for the text it contains, but simply for the message it delivers that a dangerous situation exists nearby.

There is something wrong, however, when a simple $1.69 child's beach ball contains warning messages — in 16 languages ranging from English to Portuguese, Russian, Italian and Chinese — about the dangers of using a beach ball as a life preserver. At least, I presume the warnings in Rumanian and Greek were similar to the ones in German and Spanish, which I could translate easily.

And, yes, my daughter is proud possessor of that beach ball.

This is meaningless overkill. However important the message, it gets lost amid the din of other warning labels. Eventually, the typical label gets worn off or chipped off the equipment and becomes useless anyway. If those warnings did serve a purpose they would have to be replaced. . . just like spark plugs or wheel bearings. After all, it is not only the original user who needs to read and heed the warning. A person using six-year old equipment for the first time is in the same situation as a user taking delivery on a shiny, new mower.

There is something wrong when a simple $1.69 child's beach ball contains warning messages in 16 languages.

How many messages do we, as managers, deliver each day that are lost in the background din? How do we get our message to stand out — whether it involves agronomy, overtime policy or equipment safety? Or, is it time that we embrace a simple symbol, like an exclamation mark or the graphic severed foot warning, to indicate danger and forget the verbiage that so many people are unable to read anyway?

TURFGRASS TRENDS

TurfGrass Trends is published monthly. ISSN 1076-7207.

Subscription rates: One year, $180 (US); $210 (all other countries.)

ADVANSTAR COMMUNICATIONS

Postmaster: Send address changes to TurfGrass TRENDS, 131 West First St., Duluth, MN 55802-2065.

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QUICK REFERENCE NUMBERS

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Subscription: *888-527-7008*

Permission: *440-891-2740*

Reprints: *440-891-2744*

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