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the irrigation system was fully operational, the turf on soil mixture No. 5 gradually recovered until there were no more differences observed between plots for the rest of the season.

In 1988, bentgrass throughout the green looked excellent during April and May. The weather in May was already hot and dry, but irrigation was keeping up with water demand. During the last week in May, one of the sprinkler heads was damaged during some very hot and windy weather. Within a 48-hour period, damage occurred to turf on soil mixture No. 5, again with distinct lines showing greater damage to turf on soil mixture No. 5 than to turf on the bordering plots.

Beginning about the first week in July, the irrigation pump at the golf course began to go bad. Pressure in the irrigation lines gradually decreased for the rest of July, making irrigation of the entire course a tremendous problem. On the experimental green, water distribution problems were evident as portions began getting inadequate amounts of water. Although significant damage occurred to bentgrass growing on soil mixture Nos. 3, 4 and 5, damage was most severe on No. 5, with the edges of that plot distinctly visible. The pump was replaced in early August, 1988, but damage to turf on the green was still evident at the end of the growing season. By mid-May, 1989, bentgrass damaged the previous summer was recovering, but damaged areas were still clearly visible.

Drawing conclusions

The results on this green over the past two summers have reinforced a caution when using high sand, particularly straight sand, for the rootzone of a golf green. Adequate irrigation is absolutely critical; even irrigation problems of short duration can cause significant damage to the green. In the case of this experimental green, when irrigation problems occurred in both 1987 and 1988, sand/soil/peat mixtures or sand/peat mixtures with peat mixed uniformly throughout the rootzone layer maintained bentgrass much better than straight sand with peat tilled into the surface four inches. **LM**

Don Taylor received his master's and Ph.D. degrees in soil science from the University of Minnesota. Now an associate professor at the University of Wisconsin, River Falls, he has also served as an extension specialist in turf science at the University of Minnesota. He is currently on a one-year sabbatical leave at the Department of Agronomy and Horticulture, Brigham Young University, Provo, Utah.

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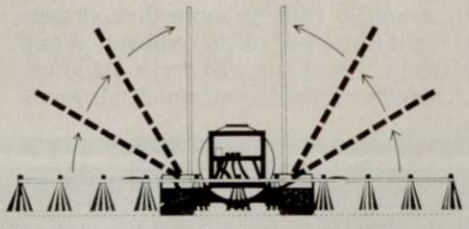

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PART II OF II

MANAGING TALL FESCUE IN URBAN LANDSCAPES

Cultural practices for this grass should be followed with an eye on its limitations and weaknesses.

by Bob Morris and John Van Dam

As turf-type varieties develop, tall fescue lawns are gaining in popularity throughout the United States. Compared to other cool-season turfgrass species, they are better suited for dry, urban climates where good quality irrigation water is available at reasonable prices.

In contrast to other cool-season grass, tall fescue can be maintained at lower fertilizer levels. It also experiences fewer insect and disease problems. However, maintenance practices for tall fescue lawns differ from those developed for bluegrass or ryegrass.

In colder climates, nitrogen applications just before the cold months extend turf color into the winter. Early spring fertilizer applications (late Jan. to Feb.) aids spring green up and turf recovery.

Tall fescue is realtively easy to maintain. However, it does have limitations and weaknesses. Typically these include:

- Poor competitiveness with more aggressive grasses;
- Disease problems;
- Lower tolerance to high temperatures than warm-season grasses such as bermudagrass and zoysiagrass;
- Poor recuperative potential and recovery following damage; and
- Moderate tolerance to compaction.

Tall fescue looks and performs best when mowed and edged between 1½ and 2½ inches. Mowing should occur regularly with no more than 40 percent of its leaf blade removed at one time or scalping will occur. At lower mowing heights, turf quality is sacrificed; weed and other grass establishment is encouraged. The heavier vascular tissue can dull mower blades.

Edging at heights lower than this encourages invasion by weeds such as crabgrass and spurge, reduces turf quality and slows recovery. If left unmowed or untrimmed, tall fescue can reach heights of 18 to 24 inches with seedheads attaining a height of four feet.

Generally, 2 to 3 lbs. of nitrogen per 1,000 sq. ft. annually is adequate under normal use. This amount of nitrogen should be split into a minimum of three applications per season and should not total more than ¾ to one pound of nitrogen per 1,000 sq. ft. per application. Higher levels of nitrogen and more frequent applications are needed with increased traffic and wear.

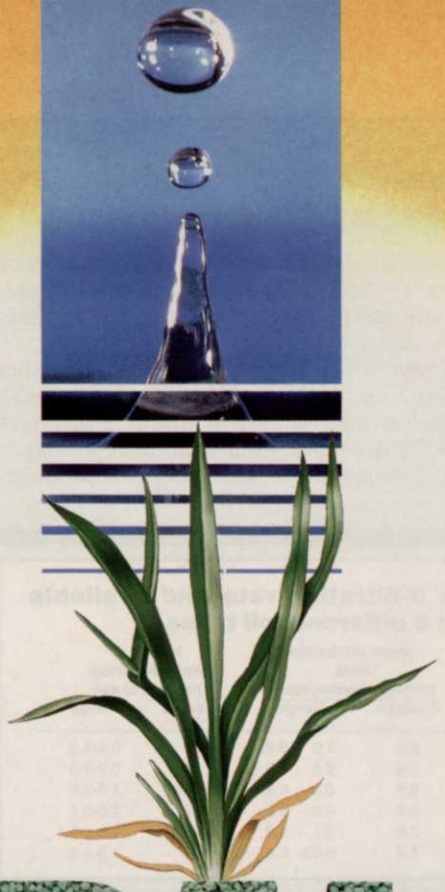
Other nutrients should be applied according to soil test reports or, when not available, use a 3-1-2 or 4-1-2 ratio fertilizer (such as 21-7-14 or 18-6-12).

TABLE 1

CALENDAR OF TALL FESCUE MAINTENANCE PRACTICES

Maintenance Practice	Spring	Summer	Fall
Mowing and Edging	———	———	
Fertilizing[1]			
Low Use	—	—	—
High Use[2]	—	— — —	—
Aerification[3]	—		—
Dethatching[3]			—
Overseeding[3]	—		—

[1] *Fertilizations during summer months should be applied using slow-release nitrogen fertilizers or low rates of quick-release fertilizers.*
[2] *Fertilizer application rate is determined by dividing the total amount of fertilizer applied during the year by the number of applications.*
[3] *Optimum time of year.*



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Familiarity with soil needed in order to irrigate properly

It's not possible to recommend a standard irrigation cycle suitable for everyone. It depends on many variables such as local climatic conditions, soil water holding capacity and its infiltration rate, soil preparation before planting, design of the irrigation system and other factors.

Changes in temperature, humidity, wind, and the intensity of sunlight interact to affect the demand for water by plants. During the summer, when temperatures are high, humidity is low and winds are strong, a turfgrass's potential for water use may exceed three- or four-10ths of an inch per day.

To reflect this change in water use, irrigation clocks should be reset several times during the year. This reduces water waste, saves money and improves general plant health.

TABLE 2

Water percolation depth infiltration rate and available water for turfgrowing and 6 different soil types

Soil Type	Percolation Depth of One Inch of Applied Water (Inches)	Water Infiltration Rate (Inches of water/hour)		Inches of Water Available per foot of soil	
		Average	Range	Average	Range
Sand	12-18	2.0	1.0 -10.0	0.8	0.4-1.0
Sandy Loam	8-15	1.0	0.5 - 3.0	1.1	0.9-1.3
Loam	6-10	0.5	0.3 - 0.8	1.5	1.3-2.0
Silt Loam	6- 8	0.4	0.2 - 0.9	2.0	2.0-2.1
Clay Loam	5- 6	0.3	0.1 - 1.0	1.9	1.8-2.1
Clay	3- 6	0.2	0.02- 0.4	1.9	1.8-1.9

Source: the authors

Irrigating with overhead sprinklers during windy weather is uneconomical and inefficient. Irrigations should be made when winds are light or not blowing. Early morning hours usually provide the best timing for overhead irrigations.

Remember that plants use water, soils don't. Turgrass growing on sandy soils and clay soils use the same amount of water. However, turfgrass growing on sandy and clay soils requires irrigations more frequently because the soil reservoir of water held by these soils is small compared to the amount of water held by clay soils.

The duration of irrigation should depend on the type of soil or soil texture (percentage of sand, silt or clay) and how the soil was prepared prior to planting. Ideally the duration of irrigation should be long enough for the water to percolate into the grass's rootzone (12 to 24 inches and deeper for sandy soils). On sandy soils this would require about 1 inch of water to reach 15 inches. On the heavier clay soils, 1 inch of water may reach only 3 to 5 inches in depth.

All of this water could be applied in one irrigation provided the soil infiltration rate is high enough. If the soil's infiltration rate is low and the irrigation water applied is too fast, water begins to run off to low areas instead of reaching the plant's roots.

Two solutions are available: Several companies now make low precipitation sprinkler heads that deliver water at lower rates than traditional sprinkler heads. Irrigation systems designed with low precipitation heads must have longer running times to compensate for their lower rates of precipitation.

The other solution is to split irrigation applications into several smaller cycles over a period of several hours. This gives a smaller amount of applied water a longer time to infiltrate the soil surface before running off.

Designing an irrigation system according to a manufacturer's specifications gives the highest uniformity of application. Deviating from these specifications by "stretching" the heads or spacing them further apart than recommended, leads to waste since some areas will be overwatered and others are underwatered.

Grass like tall fescue, which must be mowed at or above ½ inch for good appearance, needs to be irrigated with heads that extend three or more inches above the soil surface. Sprinkler heads must distribute the irrigation water above the top of the grass as the grass blades will block the sprinkler's spray pattern. This kind of interference causes uneven coverage and, like poor design, leads to water waste. □

Fertilizers containing slow-release nitrogen will be more expensive but may be applied less frequently at higher rates. Such application will help avoid summer applications of nitrogen.

In colder climates, nitrogen fertilizers applied just before the cold winter months (early November) extends turf color into winter. Early spring fertilizer applications (late January to February) aids spring green-up and turf recovery from winter loss of color.

If fertilizer is completely withheld or is inadequate, turf density will decrease. Its ability to recover from wear also diminishes. And its texture and appearance becomes more coarse.

With regular fertilization, the grass will maintain a deep green color and good density. Excessive fertilization should be avoided. It is wasteful and may contribute to groundwater pollution.

Because desert soils are generally alkaline (high pH), fertilizers supplemented with iron fertilizers need to be applied to correct turfgrass yellowing caused by iron chlorosis. Iron-containing fertilizers will prevent the problem if applied once or twice each season at ½ to ¾ lb. of iron per 1,000 sq. ft. or when chlorosis is evident.

Aerification needed

Tall fescue does not tolerate compacted soils as well as some other grasses. All soils growing grass, whether sandy or clay-like, need to be opened or perforated periodically. Aeration by core removal is recommended.

Coring to depths of 3 to 4 inches will allow irrigation water and air to penetrate the soil more easily. This will help avoid run-off and other waste. Slopes and areas of heavy traffic or play should be aerated frequently since water applied to these compacted areas runs off readily.

Remember that tall fescue, if watered properly and grown in light soils, can easily attain rooting depths of 3 to 4 feet. Aerifying also helps reduce thatch. Aerifying should be practiced during the fall months prior to overseeding.

When to dethatch

Power raking or dethatching is the physical removal of dead and accumulated fibrous, grassy material from the soil surface. Previously, thatch was not considered a problem on tall fescue turf.

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MANHATTAN	5.5
PENNFINE	5.5

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CITATION II	6.7
DIPLOMAT	6.5
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tions have shown that significant amounts of thatch accumulate in tall fescue, so its periodic removal may become necessary.

Thatch is not considered a problem unless it accumulates to a depth of ½ inch or more. Up to this point thatch may benefit the soil environment through a mulching or cooling effect on the soil surface during the hot summer months. It also provides some cushioning from traffic.

When thatch accumulates too deeply however, it prevents water and air from reaching the root zone and provides an environment for insects and diseases. Grass roots begin to grow in thick thatch, increasing the turf's water needs during the summer.

When thatch becomes too thick, gradual removal over several seasons is necessary, accompanied by aeration to encourage deeper rooting. Dethatching is best when done in late summer or fall before overseeding. Do not dethatch in late spring or summer when the grass may be too slow to grow back.

Overseed in fall

Tall fescue lawns should be overseeded with 1 or 2 lbs. of tall fescue seed per 1,000 sq. ft. each fall. This practice will help to maintain a dense and thick lawn.

Fescues are bunch grasses that do not have the ability to fill in bare areas. Tall fescue turf that has been damaged by dog urine, chemical spills, wear or mechanical damage must either be reseeded or mended with sod. Overseeding in the fall helps to replace grass plants that have died from disease or insects, and keeps a lawn dense, healthy and vigorous.

Tall fescue does not tolerate compacted soils as well as some other grasses.

Pasture-type tall fescues, bluegrasses and ryes are not compatible as an overseeding into a turf-type tall fescue lawn and should not be used.

Pest problems

Tall fescue is relatively insect free. White grubs are the most difficult insect to control, though cutworms and sod webworms may also pose significant problems to tall fescue turf. Consult your local extension office or farm advisor for control recommendations.

The most serious tall fescue disease problems are brown patch, fusarium blight and pythium.

Brown patch usually occurs during the cooler spring and fall months on neglected, under-fertilized turf growing on wet or over-irrigated soils. Fusarium blight usually occurs during hot, dry, summer months under high fertility and in underwatered situations. Both diseases appear as a patchwork of brown spots in the lawn that may coalesce into larger, dead areas. The "frog-eye" spots usually attributed to fusarium may not appear on tall fescue turf.

Damage from fusarium appears as depressed or sunken patches in the lawn. Pythium usually occurs on newly established lawns from seed. This disease also appears as patches of dying grass but results from over irrigation. It can usually be controlled simply by reducing the frequency of irrigation.

New fungicides for disease control are becoming available each year. But keep in mind that all turfgrass dis-

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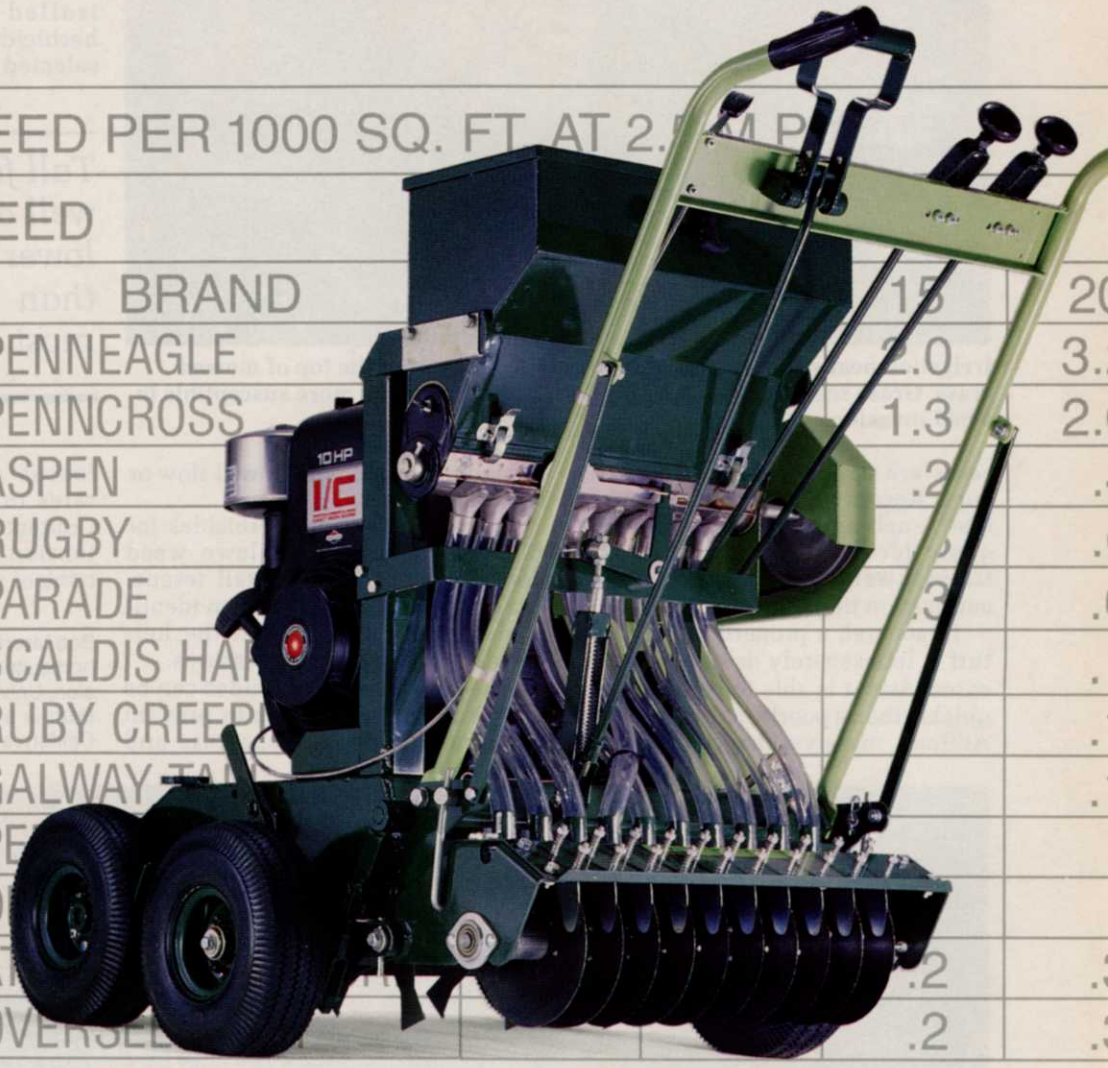

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Irrigation heads should rise high enough to spray over the top of mowed grass. Grass scalped around heads with line trimmers is more susceptible to weed invasion.

eases are easier to prevent than to cure. Recommended cultural practices, such as proper mowing, adequate fertilization, judicious and timely irrigations and frequent aerification help prevent diseases.

In general, a properly maintained turf is less severely damaged by diseases. And it is able to recover more quickly than a poorly maintained one. At times, merely a change in cultural or maintenance practices will slow or stop the disease.

Many of the same herbicides for bluegrass and ryegrass lawn weed control can be used on tall fescue. Make sure the weed has been identified correctly and consult the herbicide label for control measures.

Pre-emergence herbicides can be used in the early spring to prevent crabgrass, spurge, goosegrass and other summer annual weed species. If control has been poor, post-emergence crabgrass control chemicals can be applied to tall fescue during the early stages of the weed's growth.

Broadleaf weeds such as dandelions or mustards can be controlled with several available herbicides. Make sure the herbicide selected is approved for use on tall fescue and follow recommended rates to prevent herbicide injury. Contact your local cooperative extension office or farm advisor for control recommendations. **LM**

Tall fescue is well adapted to lower nutrient levels than required by most other turfgrass.

Bob Morris is an area extension specialist in horticulture at Nevada Cooperative Extension, University of Nevada, Reno. John Van Dam is a turf advisor at the University of California Cooperative Extension.

Tall fescue's bunch growing habit gives it a lower recuperative potential after damage to large areas. Overseed with 1 to 2 lbs. of seed per 1,000 sq. ft. each fall.