Volume 10, Number 1

TURFAX™

January–February 2002

of the International Sports Turf Institute, Inc.

The International Newsletter about Current Developments in Turfgrass

IN THIS ISSUE

Turfgrass Shade Adaptation

James B Beard

The sun is the energy source that supports life on earth, including turfgrasses. The radiant energy is converted to chemical energy in green plants by photosynthesis. In the case of mowed turfgrasses, they are capable of absorbing and converting to chemical energy only 1 to 2% of the total incident solar radiation. Thus, a major portion of the incident radiant energy is absorbed and reradiated at longer wavelengths with the release of heat.

Shade. Studies in a number of states reveal that home owners rank shade as the number one problem in growing turfgrasses. It is estimated that between 20 and 25% of the lawn turfs in the United States are grown under some degree of tree or structural shade stress. Obviously, the problem becomes more severe in older residential areas as the trees grow and mature. Another shade stress aspect is an increase in the construction of tall, erect stadia and partially-roofed, fully-roofed, or retractable-roofed stadia, where turfgrasses are to be propagated.

Radiation Assessment. In the past, light intensity has been used when referring to plant requirements. However, **the more appropriate terminology for the receipt of radiation on the surface of the turfgrass canopy is irradiance,** which is defined as the radiant flux density or energy received on a specified surface and expressed in energy units of watts per square meter (Wm^{-2}). **A preferred, more specific term is photosynthetically active radiation (PAR),** which is the radiation in the photosynthetically active portion of the spectrum, from 400 to 700 mm. A typical PAR under direct sunlight is 400 Wm^{-2}.

Unfortunately, many architects involved in the construction of stadia where shade is a concern in turfgrass propagation fail to use the proper energy terms and measurements. They tend to use **illuminance,** which is the luminance flux per unit area on an intercepting surface at a given point. It is typically used in relation to quantifying lighting requirements for human activities, such as for recreational and sporting facilities, and especially where the event is televised. The standard unit of illumination flux is the **lumen.** To reemphasize, **it is incorrect to use illuminance in assessing the radiation energy requirements of turfgrasses in shaded environments.**

SHADE MICROENVIRONMENT

Shade alters the microenvironment in which turfgrasses must grow. **The most obvious change is a reduction in irradiance. However, a number of other important microenvironmental factors must also be considered in turfgrass shade ecology.** One of the few published comparative quantitative characterizations of the altered turf-level microenvironment under a tree monostand is shown in Table 1.

In addition to the direct blockage of incident solar radiation by the above tree canopy, there is also the reduction in radiant energy caused by **an alteration in light quality.** In the case of tree shade, there is selective screening of the blue and red wavelengths, with a higher per-

Continued on page 2

Turfgrass Shade Adaptation

Continued from page 1

centage of green wavelengths being reflected resulting in the visual perception by the eye of a green color.

There is typically **a restriction in wind movement** under a canopy of trees, especially if surrounded by a barrier of shrubs or other low-growing woody vegetation. A lack of air movement results in a stratification of higher temperatures and humidities adjacent to the turf canopy, thereby resulting in a more favorable microenvironment for certain disease-causing fungal pathogens.

Typically, the microenvironment under tree shade is characterized as having an **increased relative humidity,** especially adjacent to the turfgrass canopy. This results in a much more favorable microenvironment for fungal pathogen activity that causes increased disease problems.

Two positive dimensions of microenvironment alteration under tree shade include a **moderation in extremes of both diurnal and seasonal temperatures.** In addition, there may be **an increased carbon dioxide level.**

Finally, trees have a significant **negative impact due to root competition for water and nutrients from the soil.**

TURFGRASS RESPONSES TO SHADE

A low irradiance weakens the turfgrass due to reduced photosynthesis and carbohydrate reserves, and causes a decrease in the shoot density. A complete loss of turf occurs if the reduction in radiant energy is severe enough. However, the irradiance is sufficiently above the compensation point in many shade situations to permit maintenance of an acceptable turf. Several hours of full sunlight plus the diffuse radiation from leaf reflection and transmission are usually adequate for turfgrass growth under properly maintained individual trees. When trees are grouped, the resulting dense canopy is more likely to limit turfgrass quality and to increase the problems of turfgrass culture.

The more favorable microclimate for disease development and the lack of disease-resistant cultivars are key factors limiting the shade adaptation of certain cool-season turfgrass species. Pathogen activity in the shade is enhanced by longer dew persistence, higher atmospheric relative humidity, reduced wind movement, altered light quality, low evapotranspiration rate, and more succulent plant tissue. Adequate disease resistance is an important factor in the development of shade-adapted cool-season turfgrasses. Similar disease problems have also been observed with certain warm-season turfgrass species grown under shade. However, the disease problem is not nearly as critical as with the cool-season turfgrasses. **Adverse morphological responses under a shady environment are key factors in poor shade adaptation of certain warm-season turfgrasses.**

The ability to overcome disease problems contributes significantly to shade adaptation. Other factors that may contribute to shade adaptation of certain turfgrass species are: (a) a lower compensation point, respiration rate, and/or carbohydrate requirement, (b) lower nutrient and/or water requirements, (c) greater competitive ability for radiant energy and/or nutrients, and (d) a lower radiant energy requirement. The relative importance of these four dimensions has not been determined for most turfgrass species. **The survival of seedlings at low irradiance is greater in species, such as red fescue, that have an inherently slow rate of biomass accumulation. Also, the growth of red fescue is not influenced as much by reduced irradiance as for some other turfgrass species.** Plants grown at low irradiance have a lower compensation point and become light saturated at considerably lower irradiance than when grown in full sunlight. Evidently the photosynthetic apparatus of certain low-irradiance toler-

Continued on page 4

Table 1. Comparisons of the microenvironments of an unirrigated creeping red fescue turf in full sunlight and intense tree shade at East Lansing, Michigan, on a mid-August day.

Environmental Factor	Sunlight	Shade*
irradiance at 12 noon (Wm^{-2}/cal cm^{-2} min^{-1})	1,117/1.6	104/0.15
total daily incident radiation (Wm^{-2}/cal cm^{-2} min^{-1})	460,000/659	26,500/38
average air temperature at 1 inch/25 mm (°F/°C)	74/23	62/17
average soil temperature at 6 inch/150 mm (°F/°C)	72/22	60/16
maximum air temperature at 1 inch/25 mm (°F/°C)	96/36	73/23
minimum air temperature at 1 inch/25 mm (°F/°C)	52/11	53/12
wind velocity at 2 inches/50 mm (mph/kmph)	4.0/2.5	0.0/0.0
relative humidity at 2 inch/50 mm (%)	45	68
atmospheric carbon dioxide at 1 inch/25 mm, 12 noon (ppm)	276	305
duration of dew persistence (hrs.)	0	12.5

* A stand of mature sugar maple (*Acer saccharum*) trees surrounded by a dense shrub barrier.

FEATURE ARTICLE

Four New Herbicides Available for 2002

Fred Yelverton

For 2002, four new herbicides will be available for use on turfgrasses. This is great news for two reasons. The first is obvious—these four herbicides will be beneficial tools in the management of turfgrass weeds. The second is that because the various manufacturers are making significant financial investments into turfgrasses, they are optimistic about the future of the turfgrass business.

The trade names (common names) for the new herbicides are: (1) Tranxit GTA® 25 DF (rimsulfuron), (2) Speed Zone® (2,4-D + MCPP + dicamba + carfentrazone), (3) Speed Zone St Augustine Formula® (2,4-D + MCPP + dicamba + carfentrazone), and (4) Power Zone® (MCPA + MCPP + dicamba + carfentrazone). The following is a description of each.

Tranxit GTA® 24DF (rimsulfuron). Tranxit is marketed by Griffin LLC and is a sulfonylurea herbicide for postemergence control of weeds in bermudagrass (*Cynodon* spp.) turf only. It can be used on golf courses, sod farms, and professionally managed college and professional sports fields. Most warm-season turfgrass species have tolerance, but Tranxit is currently registered only on bermudagrass. All cool-season turfgrass species are injured to some degree. However, there are differences in tolerance among cool-season turfgrass species. Perennial ryegrass (*Lolium perenne*) appears to be the most sensitive to Tranxit. Tranxit will be used to control annual bluegrass (*Poa annua*) in bermudagrass and to remove perennial ryegrass from overseeded bermudagrass. Use rates will be 1 to 2 ounces/acre (12–24 mL ha^{-1}).

Speed Zone® (28.6% 2,4-D + 5.9% MCPP + 1.7% dicamba + 0.6% carfentrazone). Speed Zone will be used for broadleaf weed control and is manufactured and sold by PBI Gordon Corporation. This new herbicide mixture is similar to the older Trimec Classic herbicide, but has the addition of carfentrazone, which is a new herbicide. Trimec Classic often was referred to as a 3-way mix. Speed Zone may be referred to as a 4-way mix. The addition of carfentrazone results in faster activity on various broadleaf weeds compared to Trimec Classic and other 3-way mixtures. Speed Zone can be used on dactylon and hybrid bermudagrasses; zoysiagrasses; Kentucky bluegrass (*Poa pratensis*); annual bluegrass; annual and perennial ryegrasses; tall, red and fine-leaf fescues; and creeping and colonial bentgrasses (not putting greens). It can be used on golf courses, sod farms, commercial and residential turf, and various other institutional and non-cropland sites. Use rates range from 2 to 5 pints/acre (0.38–0.96 L ha^{-1}).

Speed Zone St Augustine Formula® (10.5% 2,4-D + 2.7% MCPP + 0.7% dicamba + 0.5 carfentrazone). Speed Zone St Augustine Formula will be used for broadleaf weed control and is manufactured and sold by PBI Gordon. It has the same 4 herbicides as the above-mentioned Speed Zone, however, the concentrations are lower. Use rates range from 2 to 6 pints/acre (0.38–1.15 L ha^{-1}). Speed Zone St Augustine can be used in dactylon and hybrid bermudagrasses; bahiagrass; zoysiagrasses; buffalograss; St. Augustinegrass; centipedegrass; seashore paspalum; kikuyugrass; Kentucky bluegrass; annual bluegrass; annual and perennial ryegrasses; tall, red and fine-leaf fescues; and creeping and colonial bentgrasses (not putting greens). It can be used on golf courses, sod farms, commercial and residential turf, and various other institutional and non-cropland sites.

Power Zone® (42% MCPA + 5.4% MCPP + 2.7% dicamba + 0.5% carfentrazone). Power Zone will be used for broadleaf weed control and is also manufactured and sold by PBI Gordon. It is a 4-way herbicide mixture, but contains MCPA instead of 2,4-D. Use rates range from 2 to 6 pints/acre (0.38–1.15 L ha^{-1}). In areas where 2,4-D use is a concern, Power Zone may be a viable alternative. Power Zone can be used on dactylon and hybrid bermudagrasses; zoysiagrasses; Kentucky bluegrass; annual bluegrass; annual and perennial ryegrasses; and tall, red and fine-leaf fescues. It can be used on golf courses, commercial and residential turf, sod farms, and various other institutional and non-cropland sites.

All four of these new herbicides are viable options for control of various weeds in turf. Turfgrass managers will see these products advertised in various trade journals. More information on each of these products will occur in subsequent issues of TurFax.

Turfgrass Shade Adaptation

Continued from page 2

ant turfgrasses can adjust more readily to a low irradiance so the available radiant energy is utilized more efficiently.

In certain climates, shading affords a more favorable microenvironment in which turfgrass species may persist. For example, Kentucky bluegrass grows and may persist under the shade in the cooler portions of warm-semiarid climates, but not in full sunlight. This is contrasted to the cooler climates where zoysiagrass grows in full sunlight, but not in shaded sites. The lower temperatures of shaded sites can favor or impair the adaptation of turfgrass species, depending on the temperature optimum of the species and the dominant climate of a region. A delay in low-temperature discoloration of warm-season turfgrasses typically occurs under a tree canopy due to the moderation of low temperatures and reduced irradiance that lowers the photo degradation of chlorophyll.

Tree shade creates a stressful environment for most turfgrasses in terms of growth, morphological, and anatomical responses. One of the more obvious effects results from the reduced irradiance levels in the shade. However, this component is not necessarily the primary limiting factor in shade adaptation of turfgrasses. Most likely, those turfgrass genotypes with the best shade adaptation will possess a combination of favorable physiological, morphological, and pathological resistance characteristics.

Cool-Season Turfgrasses. In terms of interspecies comparisons of shade adaptation of four major C_3, cool-season, perennial turfgrasses, it was found that disease was the principal limiting factor rather than a lack of irradiance. Kentucky bluegrass (*Poa pratensis*) is severely thinned by bipolaris leaf spot (*Bipolaris sorokiniana*), perennial ryegrass (*Lolium perenne*) is severely thinned by Helminthosporium diseases and snow molds, tall fescue (*Festuca arundinacea*) is severely thinned by typhula blights (*Typhula* species), and rough bluegrass (*Poa trivialis*) is severely thinned by take-all patch (*Gaeumannomyces* spp.) and bipolaris leaf spot. The only turfgrass species that sustained a reasonable turf cover in the shade environment was red fescue (*Festuca rubra*). Also, **a polystand of one or two turfgrass species with red fescue reduces the severity of disease on any one species in the polystand.** Subsequent research revealed that 18 Kentucky bluegrass cultivars, which exhibited no symptoms of bipolaris leaf spot (*Bipolaris sorokiniana*) and powdery mildew (*Erysiphe graminis*) injury in nearby full sunlight plots, were severely injured by these pathogens when grown under a tree shade environment. Similar responses to brown patch (*Rhizoctonia solani*) were found on 10 tall fescue cultivars.

Warm-Season Turfgrasses. A key limiting factor in sustaining adequate turf vegetation in the shade for a number of C_4, warm-season, perennial turfgrass species with an indeterminate growth characteristic is a morphological limitation. **Specifically, the initiation and/or growth of lateral stems is greatly restricted by the low irradiance.** In the case of the St. Augustinegrass (*Stenotaphrum secundatum*) cultivar Floratam, all lateral stem initiation ceases when placed in a shaded environment. Investigations with four bermudagrass (*Cynodon* spp.) genotypes revealed a drastic reduction in shoot density and restrictions in lateral stem development, but increased internode length. **The elongated lateral stems tended to grow more upright, and consequently were removed during the mowing process.** The

Continued on page 6

Table 2. Comparative shade adaptation of 30* turfgrasses in their respective regions of adaptation.

Relative Comparison	Turfgrass	Relative Comparison	Turfgrass
excellent	fine-leaf fescues	medium	redtop
	wood bluegrass		meadow fescue
	St. Augustinegrass*		Canada bluegrass
	rough bluegrass		centipedegrass
	kikuyugrass		tropical carpetgrass
	creeping bluegrass		crested dog's-tailgrass*
	supina bluegrass	poor	common carpetgrass
good	tufted hairgrass		perennial ryegrass*
	annual bluegrass		seashore paspalum*
	creeping bentgrass		bahiagrass
	tall fescue	very-poor	annual ryegrass
	crested hairgrass		Kentucky bluegrass*
	colonial bentgrass		bermudagrasses*
	manila zoysiagrass		American buffalograss
	Japanese zoysiagrass		
	mascarene zoysiagrass		

* Varies among certain cultivars.

FEATURE ARTICLE

Late Autumn Weather Brings on Yellow Patch and Red Thread: Diseases that are Likely to Recur in the Spring

Peter H. Dernoeden

Cool-humid climatic regions of the United States experienced a mild and dry autumn in 2001. **In late November and December, more seasonal temperatures and rainfall returned. These cool and moist conditions resulted in unusually high levels of red thread (*Laetisaria fuciformis*)** in fine-leaf fescues (*Festuca rubra* and other *Festuca* spp.) and perennial ryegrass (*Lolium perenne*). **Similarly, yellow patch (*Rhizoctonia cerealis*) was commonplace** in annual bluegrass (*Poa annua*) and creeping bentgrass (*Agrostis stolonifera*), particularly on greens. Both diseases are favored by cool, wet weather, and generally are more common in the spring than autumn. These diseases cease to be active after the advent of cold weather and the freezing of the soil surface. **The build-up of inoculum** (i.e., plant infecting propagules like sclerotia, dormant mycelium in dead tissue, and spores) **in late autumn will likely contribute to a more severe recurrence of these diseases in the spring.**

Yellow Patch

Yellow patch, sometimes called cool-temperature brown patch, **develops during prolonged cool (50–65°F; 10–18°C), overcast, and moist periods from late autumn to early spring**. Yellow patch is a disease of bentgrass and annual bluegrass, and sometimes perennial ryegrass and Kentucky bluegrass (*Poa pratensis*) turf. **The disease may develop in late autumn or winter, but in many regions it is most prevalent in early spring**. This disease has received very little study and not much is known about the nature of *R. cerealis* in turf or the management of yellow patch.

Symptoms. Yellow patch is most frequently observed on bentgrass or annual bluegrass putting greens, tees, and fairways where **it produces yellow or reddish-brown rings, or circular yellow patches a few inches (8 cm) to one or more feet (>30 cm) in diameter**. A grayish smoke ring may appear at the periphery of yellow patches. Smoke rings, however, are uncommon and generally only develop during extended rainy periods when putting greens have not been mown for two or three days. **The yellow or reddish-brown rings can interloop** like rings on the Olympic flag, and over 100 rings or yellow patches can develop on a single green. When weather conditions shift to sunny and dry periods, blighted turf at the edge of patches or rings may develop a brown or tan color. These brown rings or arcs are disfiguring and can remain evident for many weeks. Oftentimes, however, the rings and patches fade during sunny and dry periods causing little apparent damage if temperatures are warm enough to promote foliar growth. This disease can be confused with Microdochium patch (*Microdochium nivale*), take-all patch (*Gaeumannomyces graminis* var. *avenae*), or fairy ring, and diagnosis should be confirmed if in doubt. Damage is generally superficial, but significant thinning of turf may occur during prolonged wet and overcast weather between late autumn and early spring. **Yellow patch tends to be most severe in wet, poorly drained or shaded sites.**

Management. Yellow patch severity is reduced by improving surface drainage and by squeegeeing-off standing water on greens during rainy weather. Fungicides appear to perform better preventively in an October or November timing rather than curatively in a spring timing. Flutalonil (ProStar®), myclobutanil (Eagle®), and triadimefon (Bayleton®) were reported to provide good preventive yellow patch control in a Kansas study. Once the disease appears, fungicides such as chlorothalonil (Daconil Ultrex®, Echo®, Concorde®, Manicure®, others), iprodione (Chipco 26 GT®), and flutalonil will prevent severe thinning. Even following multiple curative applications of different fungicides the rings and patches may remain evident for long periods. In general, fungicide-treated turf will heal more rapidly than untreated turf with the advent of warmer temperatures in the spring. An application of some nitrogen fertilizer will help speed recovery once winter dormancy has broken and the turf has resumed active growth.

Red Thread

Red thread development is also favored by extended periods of wet and overcast weather in the spring and autumn. Unlike yellow patch, however, red thread can occur at almost any time of year. Red thread may occur during warm and drizzling weather in summer, during cool weather in the presence of abundant surface moisture, or at snow melt in winter. Red thread may become widespread among turfgrass species during mild winters.

Red thread is most damaging to perennial ryegrass, common-type Kentucky bluegrasses, and the fine-leaf fescues grown under low fertility. Improved cultivars of Kentucky bluegrass as well as tall fescue, bentgrass, and bermudagrass (*Cynodon* spp.) may also be affected, but these grasses do not usually sustain a significant level of injury if sufficiently fertilized with nitrogen. Red thread, however, is becoming more commonplace on lawns serviced by lawn care companies and even on golf course fairways. **Red thread therefore should not always be thought of as a disease of poorly nourished turf.**

Symptoms. Symptoms of red thread are concentrated in pink to red colored circular patches of two inches (5

Continued on page 7

JB Comments

All-Encompassing "Ultradwarf" Terminology Confusing

There are a number of turfgrass specialists grouping the newer high-density hybrid bermudagrass (*Cynodon dactylon* x *C. transvaalensis*) cultivars that are tolerant of very-close mowing heights on putting greens as "ultradwarfs." Included in this grouping are Champion, FloraDwarf, MiniVerde, MS Supreme, and TifEagle. **In utilizing the "ultradwarf" terminology they also assume the five cultivars have similar growth habits and cultural requirements. Unfortunately, this is not the case and is leading to problems.** A more correct terminology would be **ultradense.**

In terms of growth habit, certain of these ultradense cultivars are full dwarfs, while others are vertical-dwarfs with normal to accelerated lateral stem development. An example of the former is FloraDwarf, while Champion and MS Supreme are examples of the latter vertical-dwarf characteristics. The reason that the type of growth habit needs to be described and understood is that it can strongly affect the cultural practices to be used.

In terms of specific cultural requirements the research information is limited at this point in time. **There is evidence that among these five ultradense cultivars the nitrogen requirement can range between 0.3 to 0.5 lb N/1,000 ft^2 (0.15–0.25 kg N/100 m^{-2}) per growing month, to as high as 2 lb N/1,000 ft^2 (1 kg N/100 m^{-2}) per growth month.** Obviously, a cultivar having a nitrogen requirement in the lower range will tend to develop a serious biomass/thatch problem if fertilized in the higher nitrogen range, whereas a cultivar requiring the high nitrogen level will perform unacceptably if fertilized in the lower nitrogen range.

There also is research indicating that certain of these five ultradense cultivars vary in their response to lowering of the cutting height from 0.2 to 0.1 or 3/16 to 1/10 inch (4.8 to 2.5 mm). There is an increased density for certain of these cultivars, while certain others will start to thin at cutting heights of 1/8 inch (3.2 mm) and below.

The same principles apply to the newer high-density creeping bentgrass (*Agrostis stolonifera*) cultivars that tolerate very-close mowing.

In summary, it is important to recognize that each of the ultradense cultivars has specific cultural requirements to maximize their performance. Thus, it is important to obtain clear information in writing from the developer/marketer of each individual cultivar as to the cultural requirements they recommend.

Turfgrass Shade Adaptation

Continued from page 4

better shade adaptation of FB 137 bermudagrass was associated with a very short internode length, which facilitated a better sustainable shoot density under shade stress.

TURFGRASS SPECIES SHADE ADAPTATION

Turfgrass shade adaptation is the relative ability of a turfgrass to persist and grow under a multiplicity of shade-related stresses. It does not involve a single factor, but a rather complex microenvironmental regime. The comparative shade adaptation of turfgrasses in their respective climatic adaptation regimes and optimum cultural practices are summarized in Table 2. There may also be variations in shade adaptation among cultivars within certain species.

Cool-Season Turfgrasses. The **fine-leaf fescues** (*Festuca* spp.) continue to be the preferred species for shaded environments in cool climates. **Rough bluegrass** is adapted to cool, wet shaded environments. The **bentgrasses** (*Agrostis* spp.) are satisfactory, especially if a preventive fungicide program is followed and the soil is moist. **Tall fescue** is adapted to shade in the warmer portions of cool-humid climates where freeze stress kill is not a problem.

Warm-Season Turfgrasses. The shade adaptation of **St. Augustinegrass** is excellent in warm climates, except for the Floratam cultivar, as is kikuyugrass (*Pennisetum clandestinum*). The zoysiagrasses (*Zoysia* spp.) have good shade adaptation, while the bermudagrasses have very-poor shade adaptation. Only a few bermudagrass cultivars, such as MS-Choice, show promise for use in shaded environments.

Root Zone Aspects. The comparative role of the root system in the competitive adaptation of various turfgrass species to tree roots has received little attention. One *in vitro* study has been published in which **tree roots significantly reduced the shoot growth of four cool-season turfgrass species even when water and nutrients were maintained at optimum levels.** It also was found that **Kentucky bluegrass was more severely affected by competition from tree roots than red fescue, rough bluegrass, and perennial ryegrass.**

Research Summary

Wear Tolerance of Cool-Season Turfgrass Cultivars

A new method to simulate wear stress on large-scale turfgrass cultivar characterization studies was utilized to assess the comparative cultivar wear tolerance within nine cool-season turfgrasses. The wear assessments were conducted in two different years for the Kentucky bluegrasses (*Poa pratensis*) and perennial ryegrass (*Lolium perenne*) cultivars. Wear frequencies ranged from every two days in June and July to every four days in August. The resultant wear stress tolerance assessments were based on visual estimates.

Kentucky bluegrass cultivars, having good to excellent wear tolerance in both studies included, Princeton 103, Princeton P-105, Unique, and Eclipse. There was great variability in comparative wear tolerance among the 43 cultivars assessed in one study and also among the 54 cultivars in the second study.

Comparisons among the perennial ryegrass cultivars revealed that the most recently developed cultivars had better wear tolerance. Palmer III, Catalina, and Prizm had relatively high wear tolerance ratings in both years. The newer cultivars, such as Churchill, Exacta, Paragon, and Gator II, had excellent wear tolerance. There were 96 cultivars in one study and 32 cultivars in the new cultivar study.

Among the five fine-leaf fescues (*Festuca* spp.), Chewing's and hard fescues, as a group, had better wear tolerance than the strong-creeping red, sheep, and slender-creeping red fescues. However, Pathfinder strong-creeping red fescue had significantly better wear tolerance than the other 31 fine-leaf fescue cultivars assessed. Also, Reliant II hard fescue had excellent wear tolerance, while Southport and Brittany Chewing's fescues had good wear tolerance ratings.

Among the bentgrass (*Agrostis* spp.) cultivar assessments, the colonial bentgrass cultivars typically had better wear tolerance than the creeping bentgrass cultivars under a fairway cutting height of 0.4 inch (1.03 cm). Penn G-2 creeping bentgrass had the best wear among 32 bentgrass cultivars in the putting green assessment study and 26 cultivars in the fairway assessment study. Recently developed colonial bentgrasses, SR 7100 and Pebble, had better wear tolerance than most creeping bentgrass cultivars in the fairway assessment study.

Comments. Research by Anda and Beard has shown that the relative wear stress tolerance among Kentucky bluegrass cultivars is highly correlated with the canopy biomass, as reflected in a high shoot density.

Source: *Breeding cool-season turfgrasses for wear tolerance using a wear simulator* by S.A. Bonos, E. Watkins, J.A. Honig, M. Sosa, T. Molnar, J.A. Murphy, and W.A. Meyer. International Turfgrass Society Research Journal, 9:127–149, 2001.

...Yellow Patch and Red Thread...

Continued from page 5

cm) to three feet (90 cm) in diameter. Patches frequently coalesce to involve large, irregular shaped areas. From a distance, affected turf has a straw-brown, tan, or pinkish color. The signs of red thread are distinctive and unmistakable. In the presence of morning dew or rain, a coral-pink or reddish layer of gelatinous fungal growth can easily be seen on leaf blades and sheaths. The infected green leaves soon become water-soaked in appearance. When leaves dry, the fungal mycelium becomes pale pink in color and on close inspection it is easily seen on the straw-brown or tan tissues of dead leaf blades and sheaths. Bright red, hard, and brittle strands of fungal mycelium called "red threads" or sclerotia can invariably be observed extending from leaf surfaces, particularly cut leaf tips. These red threads fall into the thatch and serve as resting structures for the fungus by surviving long periods that are unfavorable for growth of the pathogen. Pink patch (*Limonomyces roseipellis*) produces similar signs and symptoms, however, the pink patch fungus does not produce sclerotia. Pink patch is usually found in association with red thread, and its pathological properties and management are the same as for red thread.

Management. Red thread is generally, but not always, most injurious to poorly nourished turfs. The pathogen is a foliar blighter and does not infect crowns or kill plants. Frequently, red thread is best managed by an application of 1.0 to 2.0 lb nitrogen/1,000 ft^2 (50–100 kg N/ha). **Quick-release, water-soluble nitrogen (e.g., urea) is more effective in reducing red thread injury than slow-release nitrogen. The most effective suppression accorded by nitrogen occurs when fertilizer is applied as soon as the disease develops** and may be less effective after significant blighting has occurred. The level of suppression provided by nitrogen does not always reduce blighting to commercially acceptable levels. **Application of nitrogen during periods too**

Continued on page 8

TURFAX™
© 2002 Ann Arbor Press
Introductory offer: $69.95 + shipping and handling
6 issues/year
Available by mail

Ann Arbor Press
P.O. Box 20
Chelsea, MI 48118
Telephone: 800-487-2323; 734-475-4411
Fax: 734-475-0787
www.sleepingbearpress.com

...Yellow Patch and Red Thread...

Continued from page 7

cool for turfgrass growth will not aid in reducing disease severity. This is because nitrogen alleviates red thread injury by stimulating the production of new leaves and tillers to replace blighted tissue. Phosphorus (P) and potassium (K) applied alone have little or no effect on red thread, especially in soils with moderate to high P and K levels. **Nitrogen plus potassium, however, has been shown to alleviate red thread more effectively than nitrogen alone.**

Red thread may develop in well-fertilized turf and additional nitrogen may not be warranted for general agronomic reasons. Furthermore, loss of turfgrass density due to foliar blighting often favors weed encroachment. Spring blighting in particular favors crabgrass (*Digitaria* spp.) and broadleaf weed invasion. **The use of fungicides to control red thread in the spring has been shown to reduce crabgrass levels significantly by preventing deterioration of stand density.** Hence, fungicide use may be necessary in some situations. Fungicides that control red thread include azoxystrobin (Heritage®), chlorothalonil (Daconil Ultrex®, others), iprodione (Chipco 26 GT®), flutolanil (ProStar®), propiconazole (Banner MAXX®), triadimefon (Bayleton®), trifloxystrobin (Compass®), and vinclozolin (Curalan®, Touche®, Vorlan®).

Reference. Tredway, L.P., M.D. Soika, and B.B. Clarke. 2001. Red thread development in perennial ryegrass in response to nitrogen, phosphorus, and potassium fertilizer applications. *International Turfgrass Soc. Res. J.* 9:715–722.

Ask Dr. Beard

Q. *I have seen a condition where an ice layer forms over the turfgrass leaves, yet the leaves are not killed even with species that are relatively susceptible to low-temperature kill. Why is this?*

A. There are two situations when this condition typically occurs.

One is during clear nights with nocturnal long-wave reradiation. As a result the temperatures in and above the turfgrass canopy fall rapidly. If the air temperature falls below the dew point then the moisture in the air condenses on the cold leaf surface. If dew forms on the grass leaves and if the temperatures are below 32°F (0°C) then ice formation occurs on the leaves. **During the freezing process a certain amount of the energy is released from the water, some of which is conducted to the leaf tissue causing a warming effect. This process may avoid lethal subfreezing temperatures during that particular night.** Subsequently, potential injury is minimized if the air temperatures rise above freezing the next day and the ice layer thaws.

There also is the situation when the temperature of the upper atmosphere results in **super-cooled rain that freezes on contact with the turfgrass leaf surfaces, thus forming a coating of ice known as *glazed frost*.**

With either of these situations, it should be noted that if temporary ice formation does occur within the leaf, then **either foot or vehicular traffic on the frozen leaves usually causes death. Death is attributed to the ice causing a mechanical fracturing of the brittle protoplasmic membrane within individual cells, which results in death of those leaves within the footprint or wheel track.** The obvious preventive approach under these conditions is to prohibit foot or vehicular traffic on the frozen turf leaves until thawing has occurred. This can occur either naturally as daytime temperatures rise with the irradiance level or by the application of a light water syringing during the morning period.

Ask Dr. Beard: TURFAX, c/o Ann Arbor Press, P.O. Box 20, Chelsea, MI 48118, E-mail: skip@sleepingbearpress.com