Volume 9, Number 4
July–August 2001

TURFAX™

of the International Sports Turf Institute, Inc.

The International Newsletter about Current Developments in Turfgrass

IN THIS ISSUE

Summer Stresses

James B Beard

Summer by definition extends from the June (~22) solstice through the September (~23) equinox in the northern hemisphere. The following discussion emphasizes primarily atmospheric or external stresses imposed directly on turfgrass plants. The major summer environmental stresses of concern on turfgrasses typically are associated with heat or water. Often they occur in combination and are difficult to distinguish. There also are a number of biotic stresses such as diseases, viruses, insects, mites, and nematodes, that occur during the summer period. These will not be addressed in this article.

The major types of summer stress injuries to turfgrasses and their symptoms, causes, and prevention are summarized in the following table. It should be noted that a turf may enter a brown dormancy phase if not irrigated during periods of extreme water stress. **It should be kept in mind that a dormant turf composed of creeping perennial turfgrasses is basically a healthy turf.** Development of a brown dormant turf is a normal occurrence under severe water stress. It enables the turf to survive, with the shoots regrowing from the meristematic nodes on basal crowns and lateral stems once moisture again becomes available, assuming the drought period has not been excessively long.

Many problems associated with summer atmospheric stresses can be minimized by turfgrass cultural practices that ensure maximum root development. This is particularly true of water stress and also of heat stress, since the ability of roots to absorb water from as great a portion of the soil profile as possible is essential in maintaining adequate transpirational cooling. Thus, a review of the cultural practices that are important in maximizing root growth is appropriate as follows:

1. Maintain the soil pH between 6.0 and 7.3.
2. Minimize soil compaction through turf cultivation, as by coring, or by root zone modification to a high-sand mix in the case of putting greens, tees, selected fairway areas, and sports fields.
3. Prevent waterlogged soil conditions that exclude oxygen by ensuring surface drainage through proper contouring and by internal drainage through use of drain lines, slit trenches, catch basins, and root zone modification to a high-sand mix in the case of putting greens, tees, selected fairway areas, and sports fields.
4. Minimize potential problems from pesticides toxic to the root system. Of particular concern are certain preemergence herbicides, which should be used only as needed to control a serious weed problem.
5. Control potentially serious insect, disease, and nematode pests that feed on the roots.
6. Maintain an adequate soil potassium (K) level.
7. Avoid excessive nitrogen (N) fertilization of cool-season turfgrasses that forces shoot growth at the expense of root development.
8. Employ soil and water management practices that minimize the development of saline or sodic soil problems.

Continued on page 7

Common Summer Stress Injuries to Turf and Their Symptoms, Causes, and Prevention

			Practices That Minimize Injury		
Injury	**Symptoms**	**Causes**	**Cultural**	**Soil**	**Specific Protectants**
Heat					
Indirect Chronic Stress	Decreased root growth followed by slowing of shoot growth; reduced shoot density; eventual cessation of growth along with a darker blue-green color	Soil temperatures (above 75 F [24 C] for cool-season species and above 100 F [38 C] for warm-season species), that exceed the optimum range for metabolic/ growth processes	Maintain transpirational cooling through irrigation and enhancement of root growth; raise cutting height and use a solid roller when mowing greens; maintain a moderately-low nitrogen level; control any thatch/mat problem prior to the stress period	Provide rapid surface drainage by proper contouring and drainage ways, and adequate subsurface drainage by drain lines, slit trenches, catch basins, and root zone modification to a high-sand root zone in the case of greens and tees	Use heat-tolerant species and cultivars; syringe 1 to 3 times a day during heat stress, especially on closely-mowed bentgrass greens and tees; ensure air movement across greens and tees
Direct Acute Kill	Shoots turn tan to white in large irregular patches; leaves tend to remain erect	Lethal heat levels cause precipitation of the protoplasm in cells	(Same as above)	(Same as above)	Use heat-tolerant species and cultivars; syringe 1 to 3 times a day during heat stress, especially on closely-mowed bentgrass greens and tees; ensure air movement across greens and tees
Scald	Shoots turn tan to brown with scorched appearance; usually occurs in depressional areas; leaves tend to lay prostrate to soil	Shallow pools of standing water in soil depressions plus high sunlight cause rapid rise in water temperature to lethal levels	Raise cutting height; maintain moderately-low nitrogen level; control any thatch or mat problems; spiking or shallow coring	(Same as above)	Remove shallow pools of standing water from greens immediately (a squeegee can be used) until soil drainage problem is corrected
Desiccation					
Atmospheric	Irregular patches of turf wilt and die within a short period at midday due to internal water stress; shoots erect with white to tan color	Shoots desiccate because rate of transpiration exceeds rate of water absorption by roots, even if soil moisture is adequate wet wilt	Enhance root growth; maintain moderately-low nitrogen level and high potassium and iron levels; irrigate lightly as needed to maintain adequate plant water level	Cultivate turf by coring or slicing to enhance water infiltration	Syringe 1 to 3 times a day as needed to prevent wilt, especially on closely-mowed greens
Soil Drought	Shoots erect with white to tan color over large areas that have not been irrigated; extensive cracks may form in clay soils	Lack of rainfall or irrigation over an extended period, along with high summer evapotranspiration rates, causes death of shoots by desiccation	Enhance root growth; maintain moderately-low nitrogen level, and high potassium level; limit use of herbicides, especially preemergence types	Cultivate turf by coring or slicing to enhance water penetration	Use drought-resistant species and cultivars

Wear					
Turf	Leaves and stems bruised, torn, and worn away in distinct patterns where intense traffic has occurred	Mechanical wearing away of turfgrass shoots from severe pressure and twisting action of foot and/or vehicular traffic	Raise cutting height; maintain moderately-low nitrogen level, and high potassium level; use moderate irrigation; provide moderate thatch/mat cushion; use solid rollers on mowers	Improve soil resiliency through turf cultivation, as by coring	Rotate traffic patterns by planned movements of holes and tee-markers; use design features that tend to distribute traffic over wide areas; switch to alternative spiked shoes; use cart paths where traffic is highly concentrated
Flooding					
Submergence	Leaves prostrate with tan to brown color and signs of rapid decomposition in large irregular areas that have been under water for an extended period	Death associated with complex set of conditions created by an anaerobic environment	Maintain moderate but adequate nutritional levels	Provide surface drainage via proper contouring	Construct perimeter dikes to prevent flooding; elevate greens and tees; keep water moving and cool; provide for rapid removal of surface water
Soil Deposition	Soil layer covering turf following flood. (Same effects result from high winds, especially in more arid climatic regions)	Flood waters carrying eroded soil slow to velocity where soil can settle out	Intense coring following soil deposition to open the soil layer	Mechanically remove deposited soil from greens and tees so that turf is exposed, then wash turf; on fairways remove deposits of more than 1 inch (25 mm)	

TURFAX™
© 2001 Ann Arbor Press
Introductory offer: $69.95 + shipping and handling
6 issues/year
Available by mail and/or fax

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

FEATURE ARTICLE

Bermudagrass Infestations in Cool-Season Turf

Fred Yelverton

Bermudagrass (*Cynodon* spp.) is an aggressive warm-season perennial that is a major turfgrass species in warm climates throughout the world. It spreads by rhizomes, stolons, and seed (except for improved hybrids) and its northern range as a turf species is the transition zone. Bermudagrass thrives in areas of moderate to high moisture, high sunlight, and daytime temperatures of greater than 95°F (35°C). Do these conditions sound familiar? For many turfgrass managers around the world, these conditions often exist in the middle of summer, including areas that grow cool-season turf year-round.

If you have these types of conditions, chances are bermudagrass is a weed of cool-season turf. Bermudagrass can be a major weed of bentgrasses, fescues, bluegrasses, and perennial ryegrass. In many areas of the world where bermudagrass is grown as a turfgrass species in fairways and roughs, and bentgrass is utilized on putting greens, bermudagrass encroachment into the bentgrass in summer seems like a runaway train.

Can Bermudagrass be Killed with Herbicides?

The answer to this question is yes, bermudagrass can be killed, but in practice it is seldom killed. Why? Because for complete bermudagrass kill, herbicides must be applied a minimum of twice, and usually three to four times. To put it another way, killing bermudagrass requires several herbicide applications and lots of patience. It is also easy to be tricked into believing bermudagrass is dead when in fact, it is still alive. For instance, **an application of glyphosate (Roundup Pro®, Touchdown Pro®, etc.) may cause the above-ground growth to brown out and totally disappear, but regrowth from rhizomes and stolons will occur months later or perhaps the following summer.** So how do you get rid of bermudagrass?

Nonselective Herbicide Programs to Kill Bermudagrass

If bermudagrass has infested cool-season turf, or if you are trying to kill bermudagrass where turf is not growing, one option is to use a nonselective herbicide. Among weed scientists, glyphosate (Roundup Pro®, Touchdown Pro®, etc.) formulations are generally considered to be the most effective. Of course, glyphosate will also kill cool-season turfs. Therefore, the use of glyphosate will involve reseeding or reestablishing the turf once the bermudagrass has been killed. **During periods of active growth in midsummer, bermudagrass should be sprayed with approximately 2 pounds of active ingredient/acre (2.2 kg ai/ha) or if spot-spraying, use a 2% to 3% solution of glyphosate. Wait for bermudagrass regrowth and reapply at the same rate. To ensure good kill, this should be repeated a third time.** Dr. John Boyd, weed scientist at the University of Arkansas, has found that tank-mixing glyphosate plus fluazifop (Fusilade®) is very effective for control of bermudagrass. Dr. Boyd found that two applications of glyphosate (2 lb ai/a or 2.2 kg ai/ha) plus fluazifop (0.38 lb ai/a or 0.42 kg ai/ha) was as good as three applications of glyphosate at 2 lb ai/a (2.2 kg ai/ha).

Selective Herbicide Programs to Kill Bermudagrass

Selective control of bermudagrass is even more difficult than nonselective control. **Best results in cool-season turf include repeated applications of fenoxaprop (Acclaim Extra®) at 0.09 lb ai/a (0.1 kg ai/ha) at four-week intervals throughout the summer. In most climates, three to four applications can be made in the summer. The area should be monitored the following summer.** If bermudagrass comes back (and there is a good chance this will occur), reapply fenoxaprop as in the previous summer.

Additional research has shown that tank-mixing triclopyr ester at 1 lb ai/a (1.1 kg ai/ha) with each fenoxaprop application will enhance the control of bermudagrass. This will also provide broadleaf weed control. However, care should be taken when using triclopyr ester in the summer. Ester formulations are volatile and surrounding plants can be injured. In addition, turf discoloration may be worse and, of course, this can only be done in turfgrass species that are tolerant to both fenoxaprop and triclopyr. One last word of caution, this program cannot be applied to bentgrass putting greens because neither fenoxaprop nor triclopyr are registered for this use.

FEATURE ARTICLE

Organic Fertilizers—A Risk Factor for Black Turfgrass Ataenius?

Daniel A. Potter

Black turfgrass ataenius (BTA), a small white grub, is a sporadic, severe pest of golf courses in regions where cool-season turfgrasses are grown. **Superintendents who normally don't expect to see grub injury until late summer may be surprised to find high densities of BTA grubs damaging fairways, tees, collars, and putting greens in June. My recent research suggests that use of certain organic fertilizers may be a risk factor for this pest.**

BTA differs from other turf-infesting grubs in having two generations per year through most of its range. At the latitude of southern Ohio, Kentucky, West Virginia, and Nebraska, damage typically appears about mid- to late June, and again in late summer, coinciding with the first and second broods of grubs. In such areas, the first brood of grubs tends to be more synchronized and destructive than the later generation. More northern regions (e.g., Minnesota, northern New England, southern Ontario) may have only one generation, with damage appearing in July and August.

BTA belongs to the subfamily Aphodiinae, a group of small scarab beetles, which in natural habitats feed mainly in animal dung or decomposing organic matter. **If the females are predisposed to deposit their eggs in manure or compost, then I suspected that they might also be attracted to odors emanating from organic fertilizers.**

My two-year study was conducted on a northern Kentucky golf course. Fairways and greens were perennial ryegrass and creeping bentgrass, respectively. Some putting greens that had been maintained with organic fertilizers had been damaged by BTA in the preceding year. The fairways had a background density of 50 to 100 BTA grubs per square foot, which for this small species is generally too low to produce noticeable damage. For practicality, my tests were done on the fairways.

I evaluated three types of slow-release, granulated organic fertilizers: Milorganite®, which contains organic solids from activated sewage sludge; Nature Safe®, which is made from feather, meat, bone, and blood meals; and Sustane®, made from aerobically composted turkey litter. Slow-release urea was included for a nitrogen comparison, along with untreated controls. Fertilizers were applied monthly from April to June at 1 lb N/1000 ft^2 (0.5 kg/100 m^{-2}) per application. Plot size was 3 × 3 m (about 100 ft^2). In the first year, there were 10 replicates per fertilizer across 2 fairways. In 2001, treatments were replicated 15 times across 3 fairways. Adult BTA were monitored with pitfall traps or soap drenches, and first-generation BTA grubs were assessed from soil samples taken in late June or early July.

Two of the three organic fertilizers were associated with statistically higher densities of BTA. In the first year, grubs averaged 98 per square foot in untreated plots, as compared to 140 and 148 with Milorganite® and Nature Safe®, respectively. In 2001, densities for those treatments averaged 64, 117, and 107 per square foot, respectively. That represents a nearly 1.5-fold and 2-fold increase in 2000 and 2001, respectively. **Adult densities, too, were consistently higher in the Milorganite®- or Nature Safe®-treated plots. In contrast, I saw no increase in BTA densities with Sustane® or slow-release urea.**

The significant benefits provided by organic fertilizers likely outweigh the drawback that certain ones may increase risk from BTA. Organics are non-burning, have a moderately-slow release rate, and resist leaching. They contain sulfur, iron, and trace elements that may enhance plant metabolism and disease resistance. BTA is a sporadic pest, and many golf courses never see damaging infestations. **Still, superintendents who use organic fertilizers should be especially alert for small black BTA adults crawling on fairways or putting greens, or picked up in mowing baskets, and consider preventive management if the pest is abundant.**

Polyoxin D (Endorse®)—A New Fungicide for Brown Patch and Large Patch Control

Peter H. Dernoeden

Brown patch (*Rhizoctonia solani*) is among the most common summer diseases of cool-season grasses. Large patch is a spring and autumn disease of zoysiagrass (*Zoysia* spp.), which also is caused by *R. solani*. Fungicides are routinely used to control both diseases. **Recently, a new fungicide, polyoxin D was labelled for use on turf for the control of brown patch and large patch.** It is sold under the trade name of Endorse® and is marketed by the Cleary Chemical Corp.

Polyoxin D has a unique mode of action and is of microbial origin. Polyoxin is an antibiotic produced by the bacterium *Streptomyces cacaoi* var. *asoensis*. The antibiotic was discovered by Japanese scientists around 1965. Polyoxin D was evaluated in turf for brown patch control in the mid-1990s and was referred to as polyoxorim. **There are no other turf diseases known to be controlled by polyoxin D.** Basically, polyoxin prevents normal cell wall synthesis in sensitive fungi by blocking chitin production. It has no known adverse effects on other microorganisms that do not have chitin in their cell walls, such as bacteria and yeasts. Hence, although it is an antibiotic it is not likely to control bacterial wilt (*Xanthomonas campestris*). There is no toxicity to livestock or plants, but it is considered moderately toxic to aquatic invertebrates and fish.

Cell walls of fungi primarily are composed of either chitin or cellulose. Most fungi, including *Rhizoctonia solani,* have chitin in their cell walls; whereas, some fungi such as *Pythium* spp. have cell walls containing cellulose. Chitin is composed of chains of sugar molecules (i.e., amino polysaccharides) called N-acetyl glucosamine. When polyoxin D is absorbed by the mycelium of *R. solani,* it inhibits the incorporation of glucosamine into cell wall chitin. Hence, polyoxin D inhibits the synthesis of chitin. **The result is that cell walls are not produced or they are abnormal, thus rendering *R. solani* noninfectious.** Because polyoxin D is single site specific (i.e., a chitin synthase inhibitor), *R. solani* resistant biotypes could develop. It should be noted, however, that *R. solani* strains resistant to other single site specific fungicides used on turf have not been reported.

Polyoxin D is absorbed by leaves and molecules can move across the leaf (i.e., translaminar movement). It is unknown if molecules move upward or downward in plants and therefore polyoxin D probably is a localized penetrant. Endorse® is formulated as a wettable powder and contains 2.2% polyoxin D and 0.3% zinc. It is labelled for use on golf courses, home lawns, parks and commercial and institutional grounds. **The use rate is 4.0 ounces of product per 1000 ft^2 (118 grams/93 m^2) and provides 7 to 14 days of brown patch control**. Endorse® has both preventive and curative activity, but like most fungicides it probably performs better when applied preventively.

Preventive applications of azoxystrobin (Heritage®), chlorothalonil (Daconil Ultrex®, Concorde®, Echo®, others), iprodione (Chipco 26 GT®), flutolanil (ProStar®), fludioxonil (Medallion®), mancozeb (Dithane®, Fore®), myclobutanil (Eagle), thiophanates (CL 3336®, Fungo 50®), trifloxystrobin (Compass®), and vinclozolin (Curalin®, Touche®, Vorlan®) also effectively control brown patch. For curative control, it is best to tank-mix a contact fungicide (e.g., chlorothalonil, fludioxonil, or mancozeb) with one of the aforementioned penetrants.

Research has shown that brown patch in cool-season grasses is more effectively controlled when fungicides are applied prior to the onset of blighting (i.e., applied preventively). Proper cultural management strategies help to minimize disease severity. Imposing sound cultural practices would therefore be expected to ease the need for frequent applications of high rates of fungicides. Fertility and timing of fertilizer applications affects brown patch significantly. In particular, **autumn applications of a slow-release nitrogen (N) source to cool-season grasses results in less brown patch the following summer than spring applications of water soluble N.** Furthermore, autumn applied slow-release N plus phosphorus (P) and potassium (K) lowers brown patch severity the following summer when compared to autumn applied water soluble N plus P and K. Applications of high rates of N in the spring or summer can intensify brown patch. However, foliar feeding with low N rates (0.1 to 0.125 lb N/1000 ft^2; 5–6 kg N/ha) intermittently throughout the summer does not appear to enhance brown patch. Indeed, some studies suggest that foliar feeding on some occasions may reduce brown patch severity.

Irrigation timing also impacts brown patch severity. **A study conducted in fairway height perennial ryegrass (*Lolium perenne*) showed that irrigating at dusk intensified brown patch, whereas, irrigation during early morning hours reduced brown patch.** Evening irrigation intensifies brown patch by providing for a longer leaf wetness duration. Conversely, early morning irrigation does not extend the leaf wetness period and knocks *R. solani* foliar mycelium off leaves. Use of wetting agents as well as dragging or poling speeds leaf drying and may help to reduce disease activity. **Frequent irrigation that results in saturated soil conditions favors brown patch, particularly in shaded sites with poor air circulation.**

Continued on page 7

JB Comments

Thatch Versus Stem Biomass

Thatch is defined as an intermingled organic layer of dead and living shoots, stems, and roots that have developed between the zone of green vegetation and soil surface. Inherent in this definition is an assumption that this intermediate zone is dominated by dead organic material. This terminology has been satisfactory for many decades. However, the introduction of newer high-density turfgrass cultivars having vigorous lateral stem development dictates the need for additional refinement in the definition. **In the latter case this intermediate zone is dominated by living stoloniferous lateral stems rather than dead organic material. Accordingly, an additional term is proposed to describe this situation, which is stem biomass.**

It is important to have two differentiated terms because the cultural practices utilized in managing these two types of intermediate zones are distinctly different. In the case of thatch, an accumulated layer can be removed on a corrective basis by vertical cutting into the actual thatch layer dominated by dead organic material. In contrast, such an approach within a stem biomass dominated intermediate layer results in excessive damage to the turf which is quite slow to recover. In the case of stem biomass, the preferred cultural approach is a preventive basis involving a low nitrogen nutritional level, assuming the cultivar tolerates the lower level, combined with a close cutting height, with 1/8 to 1/10 inch (3.2–2.5 mm) being particularly effective for greens situations. An additional preventive approach that may be used when needed is grooming and/or relatively frequent, light vertical cutting. In other words, **stem biomass micro-correction is a surface-oriented approach in which preventive measures are essential.** In contrast, **management of a thatch preferably involves preventive approaches, but in addition, corrective approaches involving interior mechanical operations also are an option if needed.**

Polyoxin D (Endorse®) . . .

Continued from page 6

Brown patch is more intense in dense, high cut turfs when compared to lower mowing in more open stands. However, under high disease pressure conditions, mowing height appears to have little affect on brown patch severity. Generally, mowing high within the recommended range helps turf to better tolerate summer stresses, diseases, insect pests, and helps to reduce weed colonization. Hence, for numerous agronomic reasons, it is generally best to maintain the highest possible mowing height in the summer.

In summary, the best cultural practices for managing brown patch in cool-season grasses include the following: apply balanced N + P + K fertilizers in the autumn using as much slow-release N as possible; irrigate early in the morning; avoid excessive and/or nighttime irrigation; and maintain the mowing height high within the recommended range for the species grown. If possible, improve drainage and air circulation, reduce thatch, and alleviate soil compaction.

References

Fidanza, M.A. and P.H. Dernoeden. 1997. A review of brown patch forecasting, pathogen detection, and management strategies for turfgrasses. *International Turfgrass Society Res. J.* 8:863–874.

Lyr, H. 1995. *Modern Selective Fungicides—Properties, Applications, Mechanisms of Action.* Gustav Fischer Verlag, New York.

Summer Stresses

Continued from page 1

9. Maintain as high a cutting height as possible within the confines of the particular use on putting greens, tees, fairways, and sports fields.
10. Avoid an excessive thatch accumulation that encourages root development in the thatch/mat layer only.
11. Minimize intense mechanical maintenance practices, such as topdressing, vertical cutting, and turf cultivation, during critical summer stress periods.

Adjustment of cultural practices to maximize root growth and development results in a turf with much better potential to survive summer stresses. The importance of roots in relation to turfgrass culture must not be overlooked by turf managers. Warm-season grasses generally possess more extensive root systems than do cool-season turfgrasses. Because of the very close mowing height, turfgrasses growing on putting greens possess a much shorter root system.

Research Summary

Fungicide Management Strategies for Dollar Spot and Brown Patch

There has been a lack of investigations concerning the performance of creeping bentgrass (*Agrostis stolonifera*) cultivars of differing disease susceptibility under varying fungicide application regimes. Thus, the objective of this study was to evaluate dollar spot (*Sclerotinia homoeocarpa*) and brown patch (*Rhizoctonia solani*) severity and resultant turfgrass quality of four creeping bentgrass cultivars managed under curative and preventive fungicide application strategies. The study was conducted over a three-year period from 1997 to 1999 on a putting green constructed to USGA specifications and located in Manhattan, Kansas. The preventive fungicide treatments included flutolanil plus tridimefon at monthly intervals, and iprodione plus a pigment formulation of fosetyl-aluminum at 14-day intervals. Iprodione was applied as a curative treatment when dollar spot or brown patch infection centers were visible and thereafter at two-week intervals only if the disease was active. In 1998 a combination treatment of azoxystrobin and tridimefon at 14-day intervals was added, and in 1999 chlorothalonil was used instead of iprodione as a curative treatment.

The results revealed that greater flexibility was available in the disease control strategy when a more disease-resistant turfgrass cultivar was used rather than a disease-susceptible cultivar. For example, dollar spot was controlled using preventive fungicide applications of 14 or 28 days, preventive low-rate applications of chlorothalonil every 7 days, or a curative fungicide application when disease was observed. In contrast, only a 14-day preventive fungicide regime effectively controlled dollar spot on a highly susceptible cultivar. **Over the three-year period of the study where a composite of all cultivar data was evaluated, there were substantially fewer fungicide applications using a curative treatment program than a preventive strategy.** The curative strategy was effective on dollar spot, but not on Rhizoctonia brown patch. A number of the cultivars in this study exhibited season-long unacceptable turf quality when receiving no fungicide treatment. The disease attacks were most severe after July 1, and was expressed as a decline in turf quality.

Comments. The intense dollar spot pressure observed on the most susceptible cultivar in this study coupled with the continuous use of fungicides, especially the demethylation inhibiting (DMI) fungicides, could result in rapid selection for resistant strains of *Sclerotinia homoeocarpa.* This potential problem plus essentially a doubling of the amount of fungicide required certainly are serious concerns when considering the use of cultivars with a high susceptibility to dollar spot. This research also emphasizes that **the application rate of a fungicide, particularly in terms of a preventive program, can and should be adjusted in relation to the relative susceptibility of the cultivar to a particular disease of concern, in order to achieve minimal fungicide usage.**

Source: Dollar Spot and Brown Patch Fungicide Management Strategies in Four Creeping Bentgrass Cultivars by Derek Settle, Jack Fry, and Ned Tisserat. *Crop Science,* 41:1190–1197, 2001.

Ask Dr. Beard

Q *I have scattered patches of rough bluegrass in the fairways of the golf course planted two years ago. What can be done?*

A The rough bluegrass (*Poa trivialis*) present in the fairways probably was a contaminate in the seed originally planted. The yellow-green color and stoloniferous patchy growth cause it to be visually objectionable in fairways. One obvious approach is to specify *Poa trivialis*-free seed at the time of purchase.

It has been my experience that the ***Poa trivialis* tends to persist in annual bluegrass (*Poa annua*) fairways under that cultural regime. However, a switch in the cultural program combined with interseeding of creeping bentgrass (*Agrostis stolonifera*) has resulted in a dissipation and eventual disappearance of *Poa trivialis*.** This cultural program includes a lower mowing height typically with a light-weight mower combined with a lower nitrogen nutritional level, more modest irrigation program, and periodic coring for turf cultivation. In addition, the *Poa trivialis* tends to be prone to a number of diseases. Thus, a preventive fungicide program tends to sustain its presence, while minimal use of fungicides accelerates the rate of decline in *Poa trivialis.*

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