Managing Shaded Turf, Part I: Why Shaded Putting Greens Go Down in the Summer

By Dr. John Stier, *Professor and Chair, Department of Horticulture, University of Wisconsin-Madison*

It's been estimated that approximately 25% of our turf suffers from some sort of shade stress. Certainly, most golf courses have at least one putting green where shade causes the turf to thin and grow poorly. I've been on too many courses that otherwise looked impeccable, but where the superintendent was having difficulty keeping their position because of a problem shaded green, to think that shade doesn't cause job stress, too.

We often create our own hells. Many of us have visited courses during their construction, only to see putting greens purposely placed in a grove of trees, where lack of sunlight and air movement are sure to cause problems. On older courses, it's not uncommon to hear something like ""clearly the superintendent is at fault, we didn't have these problems 20 years ago when the course was built". My comment back is usually something to the effect of "What do you think the trees have done in 20 years?" These types of situations are what leads some people to the conclusion that a chainsaw is a superintendent's best friend!

Sometimes the turf survives adequately for several years, only to die in one particular summer or spring for no apparent reason. Again, the superintendent is not necessarily at fault because various stresses can accumulate over the course of a summer or winter that tax the grass beyond its limits. For example, my neighbor, who lives on a heavily wooded lot, reseeds his lawn nearly every spring. The lawn looks great for the first several weeks after germination. By late summer, the turf is noticeably thinner than it was in the spring. In the following spring, it is sometimes no better or worse, other years it's nearly completely dead. What's going on?

Turf dies in the shade for at least one of three reasons. Tree roots can outcompete turf for water, reducing the turf's ability to grow. Contrary to popular belief, the roots of many tree species grow quite close to the surface. I've seen semi-shaded putting greens where the turf died back in squiggly lines during summers; digging into the green, large tree roots were at fault.

The second, and more common reason, for turf death on shaded putting greens is disease. In shade, the lack of air movement and sun create high humidity and moderate the temperature fluctuations, which make for a microclimate more favorable for fungal pathogens. *Microdochium* patch (otherwise known as pink snow mold) is a common pathogen during the summer in shaded conditions (Fig. 1). We often don't see the typical snow mold patch on the surface, though, as the fungus usually grows just below the leaf surface, sapping the vitality of the living grass plants, causing leaves to discolor and turf to thin. Rarely does the fungus actually produce visible mycelium as shown in Fig. 1. However, I believe the Turf Diagnostic Lab at the O.J. Noer Facility has received samples containing *Microdochium* patch disease in every month of the year, with samples during the summer coming from shaded areas. Powdery mildew, leaf spot, brown patch, and rust are other diseases which are favored by shade. Dollar spot, incidentally, does not appear to be favored by shade, though it's possible the disease may cause different types of symptoms than we're used to seeing.

Fig. 1. *Microdochium* patch on Kentucky bluegrass at 10% sunlight. Note the yellowed leaves caused by the disease before the obvious patches of mycelium developed on the surface.

Lack of sufficient light is the main reason turf dies in shade. Light is necessary for photosynthesis, which produces carbohydrates (sugars) for the plant to use for growth and respiration 24 hours a day, seven days a week, 52 weeks of the year. Photosynthesis, of course, occurs only during the day when temperatures are above freezing, and is very limited until temperatures reach about 40° F. Respiration increases as temperatures rise, and if respiration rates surpass photosynthesis, the turf eventually runs out of carbohydrates and dies (Fig. 2). Consequently, if the summer temperatures are too high, my neighbor's turf is unable to store enough carbohydrates to supply the turf during the winter, and so in the spring the turf can be dead, assuming it can even survive the summer. I've offered him my chain saw, but he's refused it. The best thing my neighbor has going for him is his eternal optimism and an indulgent wife!

Quality of light is also important. Light comes in different wavelengths: picture light coming from a prism, where white light is split into the colors of a rainbow (think Pink Floyd's album cover "Dark Side of the Moon"). Tree shade reduces the amount of high energy blue light, transmitting instead mostly the lower-energy red light to the turf. The lack of blue light received by turf starts a chain reaction which ends up in the form of weak, spindly shoots with long, narrow leaves and an under-developed root system. This etiolated condition occurs because the turf produces excessive amounts of the hormone gibberellic acid, which causes excessive cell elongation. When photosynthesis rates are high, cell elongation is accompanied by production of more cell wall material, resulting in relatively thick cell walls and wider leaves that can resist traffic and disease-causing fungi. In the shade, the turf plants don't make enough sugars to continue building the cell walls as thick as they should be, making the plant less traffic tolerant and easier for fungi to enter. The lack of light also means each plant has fewer shoots, and those shoots have fewer leaves, than plants in full sun. In some cases, the vascular system disintegrates, reducing the plant's ability to transport water, nutrients, and sugars. In any case, the lack of strong, robust growth makes the turf less traffic tolerant which isn't a good thing for putting greens.

In some cases, turf is only shaded from one or two sides, and may receive full sunlight for several hours a day. The rule of thumb is that six hours of sunlight a day will allow turf to grow about as well as turf that doesn't receive any shading has actually been based on research (Bell and Danneberger, 1999). A probable misperception is that morning sun is better than afternoon sun. A look at the actual amount of light that occurs on a given day, however, reveals no differences in the amount of light energy between morning and noon, unless cloud cover occurs for part of the day (Fig. 3). Figure 3 also shows that six hours of sunlight between 6 am and 12 pm still doesn't provide as much energy as six hours of sunlight from 9 am to 3 pm. Furthermore, Bell and Danneberger (1999) actually tested morning versus afternoon sunlight on creeping bentgrass and found no difference in growth, which is pretty good news considering most of us don't have much say in whether shading of a putting green will occur in the morning or the afternoon.

In the next issue of *The Grass Roots* I'll cover strategies for successfully managing shaded turf.

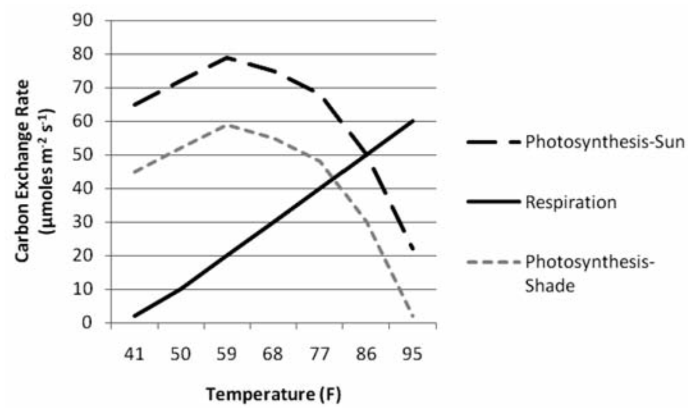

Fig. 2. Representation of temperature and shade effects on photosynthesis and respiration of creeping bentgrass, modeled partly after Gaussoin et al., 2005.

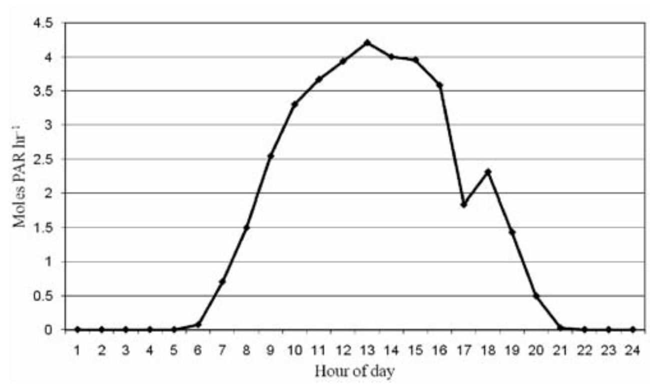

Fig. 3. Hourly variation in sunlight (= PAR) at the O.J. Noer Turfgrass Research and Educational Facility in Madison, WI, on 28 May 2006. Sunlight used in photosynthesis is termed photosynthetically active radiation (PAR) and is measured in mols. The dip between 5 and 6 pm was due to cloud cover.

Conventional strategies such as pruning, changing the height of cut, and others will be discussed. I'll also cover some new strategies that have been developed in the past 10 years from university research, including some funded by the Wisconsin Golf Course Superintendents Association!

References

Bell, G.E., and T.K. Danneberger. 1999. Temporal shade on creeping bentgrass turf. Crop Sci. 39:1142-1146.

Gaussoin, R.E., B.E. Branham, and J.A. Flore. 2005. The influence of environmental variables on CO2 exchange rates of three cool-season turfgrasses. Int. Turfgrass Soc. Res. J. 10:850-856.