TURFGRASS TRENDS

MANAGING BLUE-GREEN ALGAE

Cultural Practices as Important as Chemicals for Blue-Green Algae Control

By Steven M. Borst, J. Scott McElroy and Greg K. Breeden

With the ever-increasing demand for faster, more-competitive putting surfaces, superintendents are finding blue-green algae encroachment on bentgrass putting greens all too often. Excessive organic matter and moisture in the upper layers of the root zone accompanied with cultural and environmental stresses make golf greens an excellent growing medium for blue-green algae, various fungi and microflora.

Blue-green algae are prokaryotic organisms often referred to as cyanobacteria; but they differ from bacteria because they contain chlorophyll-a and release oxygen during photosynthesis (Bold and Wynne, 1985). Blue-green algae associated with turf decline have been identified as *Phormidium* and *Oscillatoria* species (Tredway et al., 2006). However, because of the diversity of soil bacteria, other species can be involved and can potentially be apart of the blue-green algae problem. Research is being conducted to identify all the agents that comprise the blue-green algae complex and determine exactly which organisms are the true pathogen/weed problems on bentgrass putting greens.

Blue-green algae cause two distinct problems on putting greens: surface slime

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PHOTO 1

Blue-green algae encroachment on bentgrass putting greens can manifest as a slime surface mat or a subsurface black layer.

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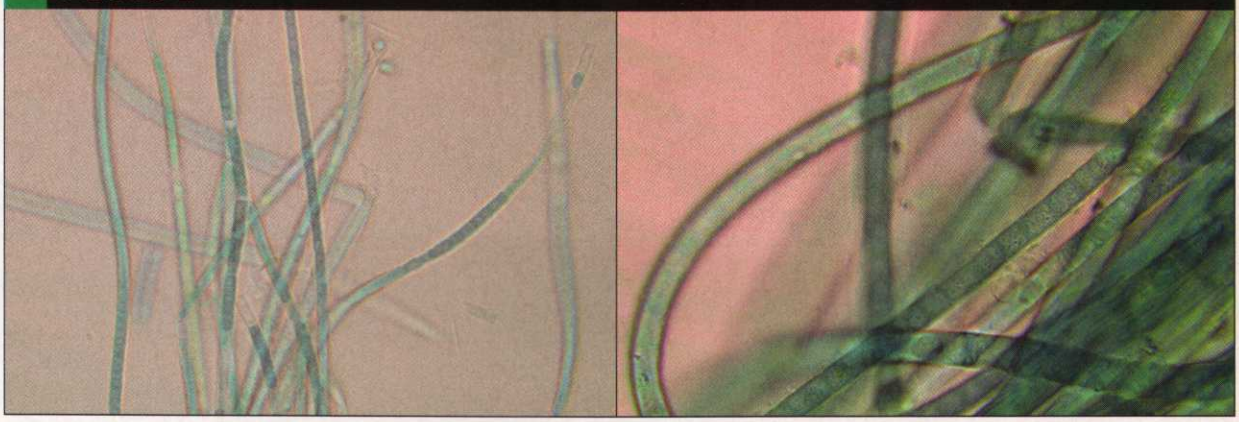
PHOTO 2



Blue-green algae isolates taken in Knoxville, Tenn. Crust layers can range in color from green to brown or black.

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mats and subsurface black layer. The slime mats are described generally as scum or crust layers and range in color from green to brown or black (Baldwin and Whitton, 1992). Surface slime mats are the most common problem occurring on bentgrass putting greens. These mats disrupt the playing surface and create a soil medium unsuitable for bentgrass growth. They are a result of a mucilage substance that the blue-green algae secrete, which the organism uses for protection and conservation of water. When this slime dries, it creates a crust that is impermeable to water, limiting bentgrass growth (Turgeon and Vargas, 2006).

Blue-green algae, through these mats and fibrous growth, can clog soil pores and cause anaerobic conditions making the sand medium susceptible to subsurface black layer. When a soil becomes anaerobic, it allows sulfur-reducing bacteria to thrive and cause turf decline (Tredway et al., 2006).

Recent research identifies a new possible blue-green algae associated problem found on golf course greens: yellow spot disease. Identified on golf greens as yellowing small blotches, yellow spot disease is becoming a problem in the southeastern and western United States (Tredway et al., 2006). Though the disease does not pose a serious killing threat to turf stands, it does pose a problem with aesthetics.

Blue-green algae complex

A major factor for blue-green algae encroachment is water status. (Baldwin and Whitton, 1992). Persistent wet conditions favor blue-green algae development on putting greens (Turgeon and Vargas 2006).

A poorly drained root zone can increase blue-green algae encroachment, as well as pose a problem for bentgrass establishment and growth. Blue-green algae problems tend to occur in these poorly drained areas along with areas that are bare in the turf or where the turf stand is weak (Baldwin and Whitton, 1992). These bare areas can be a result of mechanical stress, such as areas where mower overlap and mower turn stress occur, poor seedling establishment, or perhaps areas distressed by disease.

Without competition from the bentgrass stand, blue-green algae growth can expand over the entire golf green.

Without competition from the bentgrass stand, blue-green algae growth can increase and expand over the entire golf green. Along with water issues, poor air circulation, which delays proper drying of the turf canopy, can increase the chance of blue-green algae encroachment as well.

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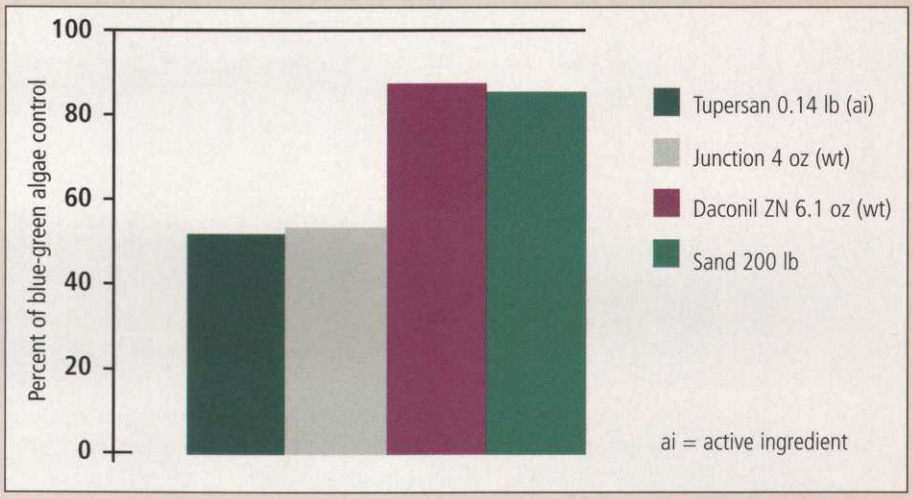
TABLE 1

Comparison of chemical and cultural methods of blue-green algae control. All rates are given per 1,000 square feet.



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In the turf market, there are numerous fungicide/algaecide control options that have been studied for control of blue-green algae on bentgrass putting greens. However, these control methods should be second to alleviating the conditions that are favoring blue-green algae growth.

Water management should be one of the first cultural practices considered when trying to remedy algae encroachment. Drainage and excessive subsurface water retention should be improved in order to decrease anaerobic conditions and improve turfgrass vigor. Air circulation should be enhanced around the surrounding area to increase water evaporation and maintain adequate subsurface water levels.

Cultivation methods such as aerification or spiking should be used to break up the blue-green algae crust and allow water and air circulation into the root zone (Turgeon & Vargas 2006). Topdressing also can be used to coat the algal mat to help break up the crust layer. Blue-green algae are photosynthesizing organisms, so a layer of sand above the photosynthetic tissue can create a stress on the organism allowing bentgrass to compete. Once conditions that favor blue-green algae growth have been corrected, overseeding and chemical control can be considered.

Current research

Research at the University of Tennessee has identified the same species of blue-green algae that have been identified by Tredway et al. In addition, other microflora have been isolated, further adding to the complexity of the blue-green algae complex.

The diversity and makeup of the blue-green algae complex could potentially be the reason for control variation that can be seen with control products. Each chemical could be toxic to one species of cyanobacteria but have no effect on another. Hypothetically this could be why timing of application and combinations of chemicals yield different control results.

The diversity and composition of blue-green algae complex might explain efficacy variation that can be seen with control products.

In Table 1, Daconil ZN, applied at 6.1 ounces/1,000 square feet controlled the algae population 87 percent when applied every two weeks. Sand topdressing controlled algae at 85 percent, which is comparable to the Daconil treatments and proves that cultural practices are just as important in control of algae as chemicals. Junction applied at 4 ounces/1,000 square feet controlled algae at 53 percent. Similar control with Tupersan (siduron), which is not labeled for algae control, was also observed. In our research it is becoming apparent that Junction is a potentially better algae preventive than it is an afterbloom control agent.

Further understanding the biology of blue-green algae can fuel efforts to achieve consistent cultural and chemical control.

Various fungicide/algaecides are available for blue-green algae control. Mancozeb (Junction, Fore), chlorothalonil (Daconil Ultrex, Daconil Zn), sodium carbonate peroxyhydrate (TerraCyte), hydrogen dioxide (ZeroTol) and copper hydroxide (Kocide 3000) are some examples of materials labeled for the control of blue-green algae in turf. According to Dernoeden and Shmitt, (1992), chlorothalonil is effective for blue-green algae control, and different formulations did not change effectiveness.

Elliot (1998) also noted this same result in a study with different formulations of chlorothalonil on bermudagrass putting greens. Mancozeb and chlorothalonil will effectively suppress development of blue-green algae on putting greens (Elliot, 1998). When these chemicals were tested as preventive instead of curative applications, better results were observed, and both chlorothalonil and mancozeb were able to restrain the encroachment of blue-green algae on bermudagrass putting greens (Elliot, 1998).

According to Elliot, mancozeb and chlorothalonil can be used as an effective preventive of blue-green algae encroachment. Chemical control always should be secondary to alleviating environmental and cultural factors contributing to blue-green algae encroachment. Monitoring weather patterns and applying these chemicals as labeled can help to prevent blue-green algae from encroaching onto golf course greens.

Both chemical and cultural-control options are available for control of blue-green algae control on bentgrass putting greens. But while some success has be achieved in the area of blue-green algae control, minimal information is available regarding the biology of the organism. Further understanding the biology of these organisms could aid in our continuous efforts to achieve consistent cultural and chemical control.

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