CHALKBOARD

TIPS FROM THE PROS

EXPLORING CAUSES AND CURES FOR BLACK LAYER IN SANDY SOILS

When golf course superintendents first noticed yellowing and dying turf on greens and tees topdressed with sand, they suspected the culprit was some type of disease. After all, it was their concern over turf diseases that caused many of them to topdress with sand in the first place.

Recently turf specialists at universities have determined the problem is not a disease, but a foul-smelling layer of black material near or below the surface. This "black layer" apparently gives off toxic gases, ties up important nutrients and prevents water from draining through the soil as it should. What they have not yet determined fully is what causes this layer to form and how it can be prevented. They do know it can be corrected rather quickly once discovered.

The popularity of sand topdressing has grown greatly in the past ten years. The idea is to apply thin layers of sand over the turf to slowly raise the plant above the damp soil and into well-drained, oxygen-rich sand. Better drainage means less chance for an outbreak of disease. It also protects the turf from compaction and provides an exceptionally fast surface. The concept originated and has worked very well in portions of the country with high seasonal rainfall.

Superintendents know there are tradeoffs. Buying and applying the sand are just two. Sand is available in an infinite range of sizes and shapes. It is very important to obtain the right sand initially and to match it each time the course is topdressed. Improperly matched sands will create layers which actually trap water instead of draining it away. Large rotary spreaders or PTO-powered topdressers are needed to apply uniform layers of sand over large areas.

Sand does not retain the same amount of nutrients or water as clay and loam soils do under well-drained conditions. Once repeated topdressings create a layer of sand thick enough for turfgrass roots to grow in, extra applications of fertilizer and irrigation become necessary. Shorter cutting heights for greens have also caused superintendents to irrigate more frequently.

Determining how much extra water is needed is often a guessing game. As a result, superintendents tend to keep topdressed greens and tees on the wet side rather than the dry side, even during unusually wet weather. This is one major part of the problem says Lee Berndt, a graduate student at Michigan State University conducting research on the black layer. "The layer gets established because excess water in the soil blocks out oxygen," states Berndt. Without oxygen, organic material in the soil is broken down abnormally to form toxic gases and black "precipitates." In Berndt's opinion, these black deposits make up the black layer.

Berndt has created a black layer in a tube of sand in the MSU greenhouse. "Certain bacteria in the soil can break down organic material without oxygen," he explains. "My work indicates that elemental sulfur from some turf fertilizers and micronutrient products contributes to the formation of the black layer. The sand tube in the greenhouse that did not have elemental sulfur did not produce a black layer. Of course, sulfur only becomes a problem under anaerobic (oxygen deprived) conditions caused by poor drainage and compaction."

By correcting drainage and irrigation, necessary oxygen will enter the soil and break down the black layer. As a result, black layer symptoms can be reduced in as quickly as a day. However, if heavy and regular rainfall causes sand greens to remain damp for long periods, Berndt suggests withholding applications of elemental sulfur until the greens can drain properly.

Dr. Roy Goss, turf specialist for Washington State University, defends sulfur fertilizers by saying, "most of the soil's sulfur is held in reserve in organic matter. Whether we apply elemental sulfur (in fertilizers) or the plant gets it from breakdown of organic matter is irrelevant." In waterlogged soils, sulfur will combine with a number of heavy metals (including iron) to form black substances. "There isn't much question," says Goss, "that under total neglect of soil drainage and aeration that additional sulfur will cause problems."

A second theory or type of black layer has been advanced by Dr. Clinton Hodges at Iowa State University. Hodges points out that the "artificial conditions" of sand greens are ideal for the growth of algae. Irrigation water from algae-infested lakes can contaminate overirrigated sand greens. Algae prospers in sandy soil lacking oxygen and produces a gelatin-like mucous that plugs up the pore spaces between the sand particles. A black layer forms near the surface disrupting drainage, blocking out oxygen and releasing methane and other gases that may be toxic to turf.

Hodges has created a black layer in laboratory tests with tubes of wet sand containing algae. He is now using these laboratory-produced layers to study the influence of various fertilizers and maintenance practices on them. "Black layers do not necessarily result in the death of turfgrass," he state. "Sometimes, the only visible impact on a green is poor drainage. Early detection of poor drainage quickly followed with aeration can prevent damage to the turf."

"I think the black layer is more than just a series of chemical reactions taking place in the soil," claims Hodges. "The sand rootzone for turf is a whole new system. We have not been able to anticipate all the special challenges it presents for turf managers. We're running into extremes that we've never seen before. At the same time, our chemicals have changed. Today's pesticides are biodegradable. That means there are organisms out there that can break them down. We're using wetting agents, new fertilizers and micronutrients for the first time. A great amount of time and money is needed to explore the impact of these changes on turfgrass management."

Jonathon Scott, superintendent of Grand Traverse Resort Golf Course in Traverse City, MI, has been working with a number of methods to prevent formation of a black layer on his topdressed greens and tees. "This has been an unusually dry spring for us," says Scott, "without any evidence of black layer. We have also eliminated applications of fertilizers containing sulfur which may have helped. Still, I think there's much more we need to find out."

The black layer isn't totally limited to the wet, humid regions of the nation. Tom Lubin, professor of chemistry at Cypress College in Cypress, CA, has been studying the black layer in sand greens and on football fields. "I've found a layer of heavy metals two or three inches below the surface," said Lubin. "Turfgrass roots were unable to penetrate this layer. On a hunch, I did both soil and tissue analysis and discovered the turf lacked phosphorus."

By applying soluble phosphorus to the area, the diameter of the roots quadrupled and they proceeded to penetrate the layer of heavy metals. The phosphorus also flushed some of the metals out of the layer. Within two weeks, the turf recovered completely. Lubin recommends a monthly application of 1/4 pound per 1,000 square feet of soluble phosphorus for sand fields or greens known to have high concentrations of metals.