Black Layer and Root Problems

by Randy Kane, PhD
Chicago District Golf Association

I have come across several cases of turf being damaged by apparent black layer problems on sand-based and sand topdressed greens. Needless to say, there have been significant problems this year concerning root loss, excess water, poor drainage, algae, and thinning of turf on greens. Black layer tends to occur in areas where water sits or drains slowly (low contours), in areas where traffic is high (walk-off, clean-up), and in shady areas. However, once drainage is stopped or the soil surface is sealed, black layer can develop anywhere on a green. It is definitely more of a problem in very wet years such as this one (remember when this all got started with heavy rains in Northern Michigan a few years ago ...?).

What is Black Layer?? Most simply put, black layer is a symptom of anaerobiosis, which is the (mostly) bacterial decomposition of organic matter in the absence of oxygen.

Black layer is a symptom of anaerobiosis, which is the (mostly) bacterial decompositon of organic matter in the absence of oxygen.

Anaerobes are very inefficient at breaking down complex organic molecules to carbon dioxide, so more complex organic acids, and other "sour" organic molecules accumulate. Most notable are organic sulfides, which give anaerobic soils that wonderful aroma, and reduced metals such as ferrous iron (which contributes to the dark color). Many of these compounds are toxic to roots. Also, the lack of adequate oxygen itself is also "toxic" to roots, since roots need adequate oxygen to function properly. Black layers form at an interface where drainage is impeded and oxygen becomes unavailable. In 1993, this occurred at or near the soil surface.

The Role of ALGAE. Algae are often sited as a cause of black layer. My feeling is that algae often contribute to the anaerobic condition that results in black layer and loss of turf. However, algae can be a significant problem in their own right, and can be very detrimental to turf without causing anaerobic conditions in the rootzone. Also, anaerobic conditions can arise on golf greens without the presence of algae, although algae may come in after the fact on injured greens.

Algae are always associated with thinned and weakened turf. Once the canopy thins, sunlight reaches the soil (sand) surface and stimulates algal growth (algae have chlorophyll and utilize sunlight for carbon assimilation, ie autotrophs). Our high pH, high carbonate sands seem to favor algae even more.

(continued on page 9)

BLACK LAYER (continued from page 6)

Algae are detrimental because:

(1) They secrete a gooey ooze or slim matrix that effectively seals up sand pores and limits oxygen movement into the rootzone. This also can stop water movement down through the profile much like putting your finger over the top end of a straw will keep liquid from falling out the bottom.

(2) Algae can grow over the surface of leaves and shade out the plant, and lead to further thinning of the canopy. This usually results in an expanding patch of algae. (3) There is some experimental evidence that algae may have some direct toxic effect on turfgrasses. They could therefore be considered as true plant pathogens if this pans out (cool!).

Relief from anaerobic/black layer situations. Since oxygen loss in the rootzone is probably the major problem you want to solve, it seems logical to me that aeration is the best answer to the problem. I recommend quadratine or some other small, closely-spaced core cultivation be done immediately when an anaerobic condition is recognized.

I recommend quadratine or some other small, closely spaced core cultivation be done immediately when an anaerobic condition is recognized.

Spiking can also be beneficial. Also, the aerification needs to be repeated as often as necessary to get plants through a stressful period. Here the small tines are helpful since they don't disrupt play too much. In badly thinned, algae infested areas, I also recommend topdressing and overseeding to shade out the algae and reestablish the turf cover. Also, you must remove the thinning stresses placed on the turf where possible: raise cutting heights, reduce traffic, improve drainage, etc, etc.

Role of irrigation water quality. I know nothing about water/soil chemistry, but it appears that long-term use of irrigation water with high lime, carbonates, sodium, high pH, or sediments may contribute to plugging of fine pores in sandy rootzone mixes. I am interested to see if the pHAIRWAY urea sulfamide treatments can have a significant effect on this problem, also other water treatment techniques that are on the market. I think it is too soon to tell at this point, especially with all the rain we got this year — not much irrigatin' goin' on . . .

I hope to hear some more information about these treatments at meetings this winter. See you there!!!

Please Support Our Advertisers