Black Layer Formation in Turf

Characteristics, Causes and Cures

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The occurrence of black layer in turf for sports facilities has been a continuing problem over the past two decades. Generally the condition has been associated with construction of the fields using U.S.G.A. Green Section specifications or variations thereof. The condition is recognized by chlorosis and die back of the turf which can not be identified as a nutritional or pathogenic problem but which appears associated with it certain characteristics of the root zone.

What are these characteristics?

As the name suggests the condition is black discolorations on the soil particles and slime materials in the root zone which occur as continuous horizontal plates of varying thickness or vertical columns of black, often slimy, root zone material. Associated with the black layer are unpleasant swampy or sewer like odours; even that of rotten eggs which is the aroma of hydrogen sulphide.

The black layers may be from 0 - 10 cm below the surface. The layers may range from 2 to 7.5 cm thick where they occur at or near the surface to 1 to 3 cm thick where they are deeper in the profile. The affected areas may be associated, but not necessarily, with minor depression in the playing surface. The affected areas have a reduced infiltration rate, combined with a reduced hydraulic conductivity. Due to the black slime of bacteria - metal complexes the condition is often referred to as a "black plug layer".

While generally a condition that occurs on sand based root zones, it is also found in natural soils where a program of sand topdressing has been employed to control thatch or modify poor physical conditions. In the latter case the black layer generally occurs at or near the surface.

The turf growing on the affected areas dies in a relatively nondescript pattern. The grass may die rapidly by turning a straw to reddish-straw or bronze colour; or occasionally, the affected turf may become chlorotic before dying.

A parallel phenomenon is know to occur in water wells and in drain lines. In water wells slime producing microorganisms proliferate on the screens of sand points and out into the surrounding aquifer. This brown to black slimy growth gradually becomes sufficiently dense enough to plug the screen and reduce the water flow. When tile lines are placed in high iron content soils and backfilled with high organic content top soils a reddish brown slime deposit occurs within the tile which eventually plugs the tiles. In the first case the colour is associated with reduced manganese whereas with the tile lines the material is precipitates of reduced iron compounds.

What are the causes?

Many theories have been promoted for the formation of the black layer but they all accept the basic cause is an anaerobic condition; that is, a lack of oxygen in the soil atmosphere. Work at Michigan State has provided rather definitive data that the anaerobic condition results in the reduction of sulphate sulphur by sulphur reducing bacteria to sulphides. The reducing conditions...