Organic Matter Dynamics in the Surface Zone of a USGA Green: Practices to Alleviate Problems

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Number of Years: 5
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Objectives:

1. *Determine the effectiveness of selected fall/spring-applied cultivation on enhancement of bentgrass root development, water infiltration, and soil oxygen status during spring and fall root development periods.*
2. *Determine the effectiveness of selected summer-applied cultivation, topdressing and wetting agent practices on bentgrass root maintenance and viability, water infiltration, and soil oxygen status during the summer months when root decline occurs.*
3. *The best treatments from the above objectives will be combined to develop an integrated year-round program for maximum root development and maintenance during stress periods.*

It is the hypothesis of the author that two turf grass grower problems arise by accumulation of organic matter (OM) in the surface 0 to 1.25 inch zone of a USGA green. Increase from an initial level of 1.0 to 3.0% (by weight) at establishment to 5 to 12% or more after tow years have been observed. Organic matter accumulation occurs even under excellent management and regardless of specification (i.e., it is not dependent on specifications) due to the abundance of roots produced by bentgrass within this surface zone along with any thatch/mat accumulation.

Phase I (1996 – 1998). A considerable portion of the OM in the surface zone is root tissue that can contribute to soil macropore plugging or sealing. This can occur under the following two conditions. First, OM content from decomposing plant material and microflora accumulates within this zone to an excessive level. Second, the nature or characteristics of the OM is dramatically altered by rapid death of roots in this zone This situation results in a gel-like condition that greatly limits soil 0_2 diffusion. The two proposed problems arising from surface OM occur at different times of the year and are the basis of two projects in Phase I:

1. Summer Bentgrass Decline in Response to Root Deterioration and Plugging of the Macropores that are Essential for Soil 0_2 Exhange and Maintenance of Water Infiltration.
2. Inhibition of Root Development, Soil 0_2 Diffusion, and Infiltration (in SPRING/FALL) from the Zone of High Organic Matter Content.

The results for Phase I were summarized in the 1998 report.

Phase II (1999-2000). Results from the two projects of Phase I were used in Phase II to formulate potential annual management programs (cultivation, topdressing). These programs were designed to:

1. Allow maximum root growth in spring/fall without the decrease in rooting depth now observed on high sand golf greens a couple years after grass establishment.
2. Maintain root viability in the summertime and minimize summer bentgrass decline caused by low soil O_2 exchange.

The availability of a new type of verticutter (Graden) that can remove considerable OM without severe surface injury is being incorporated into the second phase. Some golf course superintendents have used this device on bentgrass greens in place of spring core aeration because healing seems to occur more rapidly and this may allow earlier treatment and/or multiple spring treatment. The Phase II study has been initiated in Spring 1999 and the treatments will allow for evaluation of whether the Graden can be used to replace all or part of core aeration operations.

Results. Less intrusive cultivation practices (QT = solid, quad tines, 1/4 inch diameter; HJR = Hydro Ject in raised position, 1/4" diameter holes) in the summer substantially increased saturated hydraulic conductivity, and soil 0_2 level at 3.5 inches depth (Tables 1,2). All treatments not receiving summer cultivation by QT and HJR exhibited soil 0_2 less than 12 percent. Soil O_2 were greater than 15 percent for QT and HJR treatments. A soil 0_2 level of less than 10 percent is considered a severe 0_2 stress for most plants. Saturated hydraulic conductivity (water infiltration rate) averaged 85 to 159 mm $hr.^{-1}$ for QT or HJR treatments versus 48 to 72 mm, $hr.^{-1}$ without these treatments.