

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

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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.

Start Date: 1996

Project Duration: 5 years

Total Funding: \$100,000

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It is the hypothesis of the author that two turfgrass grower problems arise by accumulation of organic matter (O.M.) in the surface 0 to 1.25 inch zone of a USGA green from an initial level of 1.0 to 3.0% (by weight) at establishment to 5 to 12% or more after 2 years.

Organic matter accumulation often occurs even under excellent management and regardless of specification due to the abundance of roots produced by bentgrass within this surface zone along with any thatch/mat accumulation. A considerable portion of the O.M. in the surface zone is as root tissue that can contribute to soil macropore plugging or sealing. The two proposed problems arising from surface O.M. occur at different times of the year and were the basis of two projects in Phase 1 (1996 to 1998).

Results from the two projects of Phase 1 were used in Phase 2 (1999 to 2000) to formulate potential annual management programs (i.e., cultivation, topdressing)



The accumulation of organic matter can create layers that restrict water and air movement through the root-zone.

that, (a) would allow maximum root growth development in spring/fall without the decrease in rooting depth now observed on high-sand golf greens a couple years after grass establishment, and (b) would maintain root viability in the summertime and minimize summer bentgrass decline caused by low O_2 exchange.

The availability of a new type of verticutter (Graden) that can remove considerable O.M. 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 2 study was initiated in Spring, 1999 and the treatments allow for evaluation of whether the Graden can be used to replace all or part of core aeration operations.

Root and core samples (0 to 3 cm; 3 to 6 cm) for soil physical parameter analysis are currently being processed. The control plots which did not receive any cultivation operations and received approximately 50% of the total annual topdressing exhibited the highest frequency (91%) in the top statistical category for shoot performance.

Core Aeration (2x per year) plots also ranked in the top grouping (91%). Plots receiving more intensive cultivation operations demonstrated somewhat lower turf quality but the magnitude was not great. However, the highest SHC (saturated hydraulic conductivity) and soil O_2 content values were observed under the more intensive cultivation treatments.



Core cultivation is still a critical practice used to avoid the accumulation of organic matter.

Treatment differences were greater in 1999 (hot, humid) versus 2000 (hot, drier) where hot, humid conditions favor summer bentgrass decline.

Cultivation programs involving less intrusive cultivation practices (solid, quadrants; Hydro Ject in raised position) had averaged O_2 contents of 16.3% (1999) and 14.5% (2000), versus 12.0% (1999) and 14.1% (2000) compared to other treatments. The less intrusive cultivation had SHC values of 223 (1999) and 174 mm hr^{-1} (2000), versus 163 (1999) and 157 mm hr^{-1} (2000) for cultivation programs without those operations.

Summary Points

- Cultivation programs involving less intrusive cultivation practices (solid quadrants and HydroJect) averaged 16% oxygen content versus 12% for other treatments. (Oxygen contents near 10% are severe oxygen stress to the turf).
- The Graden verticutter is not a substitute for core aeration.
- The highest SHC and soil O_2 content values were observed under the more intensive cultivation treatments.