Research You Can Use

Cultivating to Manage Organic Matter in Sand-Based Putting Greens

University of Arkansas researchers provide important insight for managing organic buildup on putting greens.

BY JOSH LANDRETH, DOUG KARCHER, AND MIKE RICHARDSON

It is not uncommon for newly constructed creeping bentgrass greens to perform very well during the first few years following establishment, but then decline in subsequent years. This is likely the result of the rootzone physical properties changing over time, especially near the surface where organic matter accumulates. It has been demonstrated that organic matter concentrations greater than 4 to 5% in a USGA rootzone will decrease water percolation through, and air movement into, the rootzone.[2,3]

Although verticutting treatments (left) removed more surface organic matter, plots that were core aerated (right) recovered significantly faster.

Recent cultivation techniques that are effective in reducing organic matter and maintaining desirable rootzone physical properties include aggressive verticutting and core aeration with closely spaced tines. Verticutting equipment such as the Graden GS04 has been demonstrated to aggressively cut channels through surface organic layers in putting greens, removing more organic matter than traditional core aeration treatments. Another recent trend in putting green core aeration is the use of more closely spaced tines, either by retrofitting older aeration units with adapters or through the introduction of new aeration units with closer tine spacing.

A moderately aged USGA putting green typically has desirable physical properties throughout the profile, except near the surface where organic matter has accumulated. Under such conditions, an aeration tine needs only to be long enough to completely penetrate and remove cores from the organic matter layer. Longer tines would only result in excess sand debris being pulled to the surface, increasing the labor required to remove the debris and the amount of sand needed to backfill aeration channels.

The objective of this research was to determine the effects of various aggressive verticutting and core aeration treatments on surface organic matter removal from a sand-based putting green.

CULTIVATION EXPERIMENTAL METHODS

A two-year experiment was initiated in the spring of 2003 at the University of Arkansas Research and Extension Center (Fayetteville, Ark.) on a one-year-old Penn G-2 creeping bentgrass putting green built according to the USGA method of putting green construction.[1,4]

Cultivation treatments were applied using either a Graden verticutter or a Toro greens aerator in the spring and fall of each study year. Verticutting treatments were made to a 1-inch depth to ensure complete penetration through the thatch/mat layers and included varying blade widths (1, 2, and 3 mm). Core aeration treatments included various combinations of tine spacing (1.25 × 1.50 or 2 × 2.5 inches), tine diameter (.25 or .50 inch), and tine penetration depth (1.5 or 2 inches). Cultivation treatments were made to individual plots measuring 5 × 20 feet, and each treatment was replicated four times.

ORGANIC MATTER REMOVAL

All of the verticutting treatments removed more surface organic matter than any of the core aeration treatments (Figure 1). The 3 mm verticutting treatment removed more than four times the amount of organic matter than each core aeration treatment. There was not much difference in

organic matter removal between the 1 and 2 mm verticutting treatments; however, they only removed about half the organic matter compared to the 3 mm treatment. Turf managers with sand-based rootzones very high in organic matter content should consider aggressive verticutting to remove excessive organic matter near the rootzone surface. Among the core aeration treatments, the larger-diameter, closely spaced, deeper-penetrating treatment removed the most organic matter.

Although core aeration was not as effective as verticutting in removing large amounts of organic matter from the rootzone, it was more efficient in completely penetrating through the organic matter layer without bringing excess sand to the surface, especially those treatments with shorter tines.

TURFGRASS RECOVERY AND QUALITY

Turfgrass recovery evaluations following cultivation are summarized in Figure 2. Cultivation channels healed over more quickly for core aeration treatments compared to the verticutting treatments. The time required for the verticutting treatments to heal following cultivation was nearly 60 days, approximately twice that necessary for turf that was core aerated. Many of the verticutting channels had partially closed, making it difficult to fill the channels with sand and smooth the surface.

Aeration holes created by coring treatments were less prone to collapsing and were more completely filled with topdressing sand, creating a smoother surface that hastened recovery. In all plots that were core aerated, the amount of topdressing sand that was incorporated back into the turf canopy was greater than 100% of the volume of the debris that was removed during cultivation. In contrast, only 70% of the volume of cultivation debris could be incorporated back into the canopy as topdressing sand for turf that was verticut.

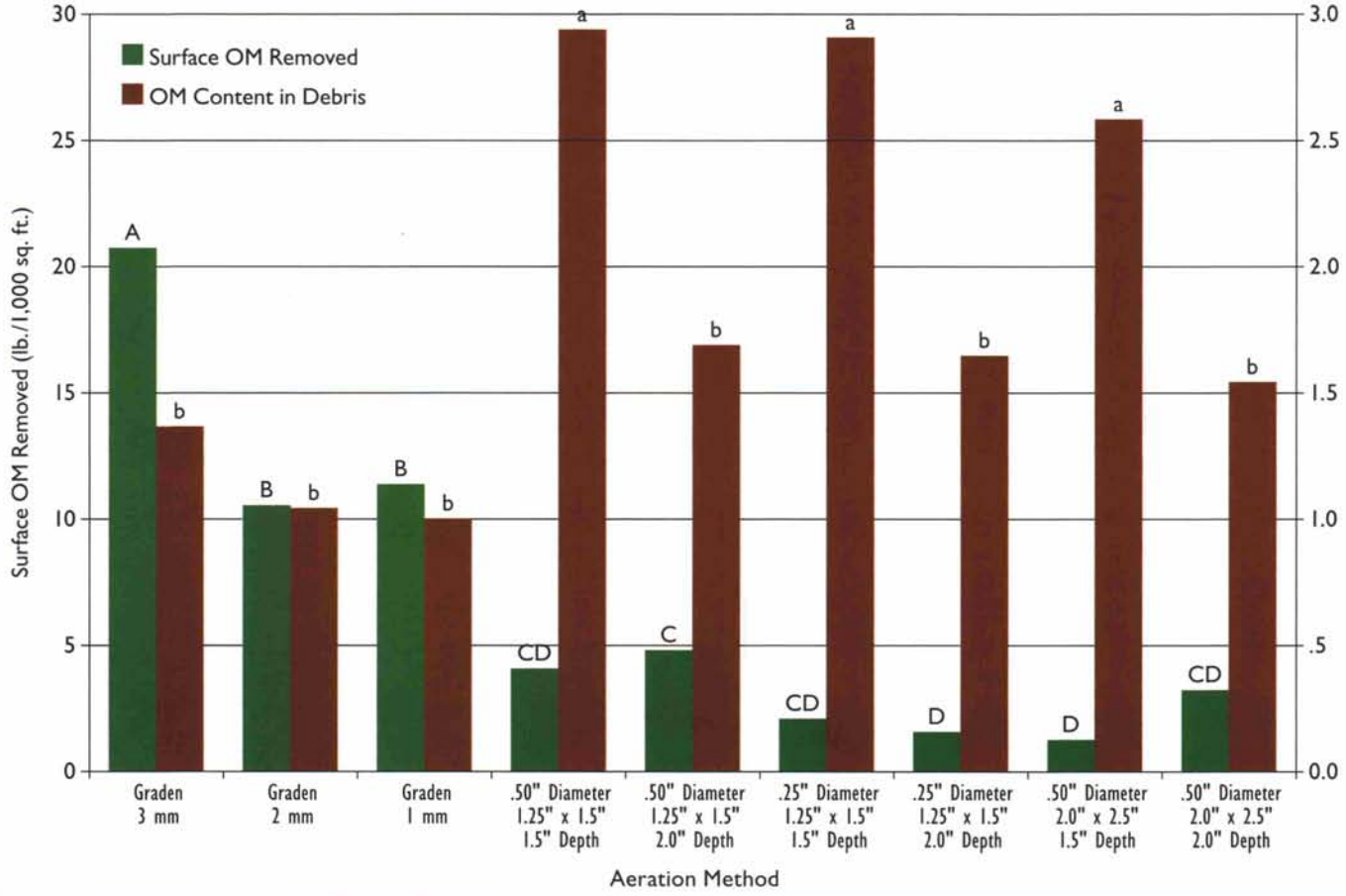
Once the cultivation treatment debris was collected, sand topdressing was applied and brushed into the turf until the cultivation channels were filled.

The Graden GS04 verticutter is capable of cutting channels through the surface organic layer of putting green rootzones.

This greens aerator has been retrofitted with tine adapters allowing for a tine spacing of 1.25 × 1.5 inches.

Figure 1

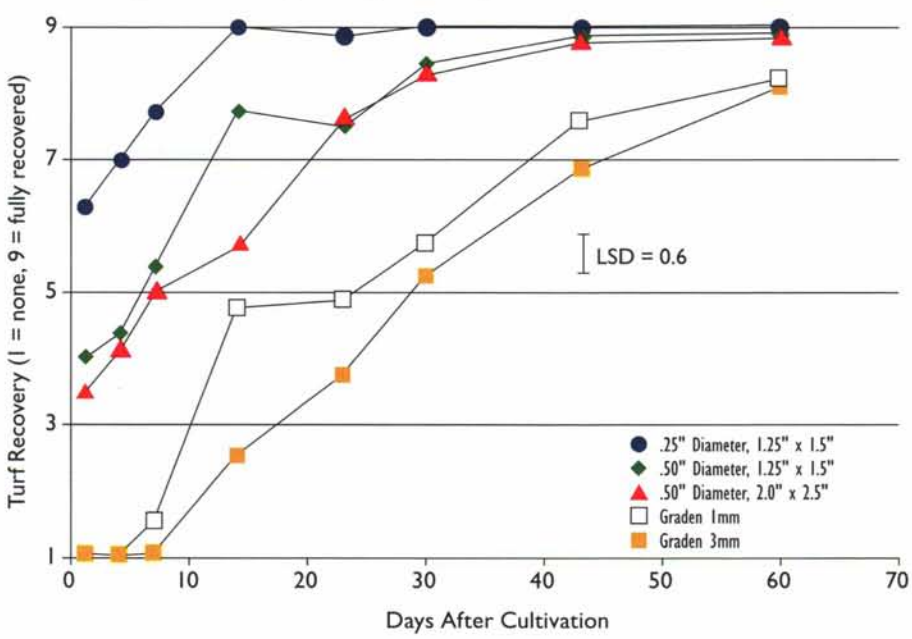
Comparisons of the amount of organic matter removed by various aeration methods



Surface organic matter removed and percent organic matter in the cultivation debris as affected by cultivation treatment. Data collected May 21, 2003, in Fayetteville, Ark. Within evaluations, treatments with bars sharing a letter are not significantly different.

Figure 2

Turfgrass recovery ratings following various aeration treatments



Turfgrass recovery from cultivation as affected by cultivation treatment. Data collected September through November 2003 in Fayetteville, Ark. Error bar represents least significant difference value between treatments within a single evaluation date.

Among core aeration treatments, recovery time was affected predominantly by tine diameter. Turf cored with .25-inch-diameter tines recovered in 14 days, about half the time of turf treated with .50-inch tines. Neither tine depth nor tine spacing affected turf recovery in this study. Consequently, a turf manager can use a closer tine spacing to affect a larger percentage of the putting surface without affecting recovery time. A shallow tine is preferable to a deeper tine, since less debris is brought to the surface, and the amount of organic matter removed and recovery time are equivalent.

After three sets of cultivation treatments and 14 months after the study was initiated, aggressive verticutting was most effective at minimizing organic matter content in the surface inch of the rootzone (Figure 3). Although all of the closely spaced core aeration treatments resulted in lower surface organic matter content than the control, differences were slight and not statistically different after three sets of treatments.

Verticutting treatments were more aggressive and effective at removing organic matter from the surface inch of the putting green rootzone than core aeration treatments. However, the verticutting treatments removed a disproportionately large amount of debris and recovered more slowly. Therefore, aggressive verticutting may be most useful when a large amount of organic matter must be removed at once and recovery time is not a primary consideration. Core aeration with closely spaced tines may provide more general surface organic matter maintenance for putting greens that must return to a high level of quality shortly following cultivation.

LITERATURE CITED

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EDITOR'S NOTE: An expanded version of this paper can be found at *USGA Turfgrass and Environmental Research Online* (http://usgatero.msu.edu/v06/n19.pdf).

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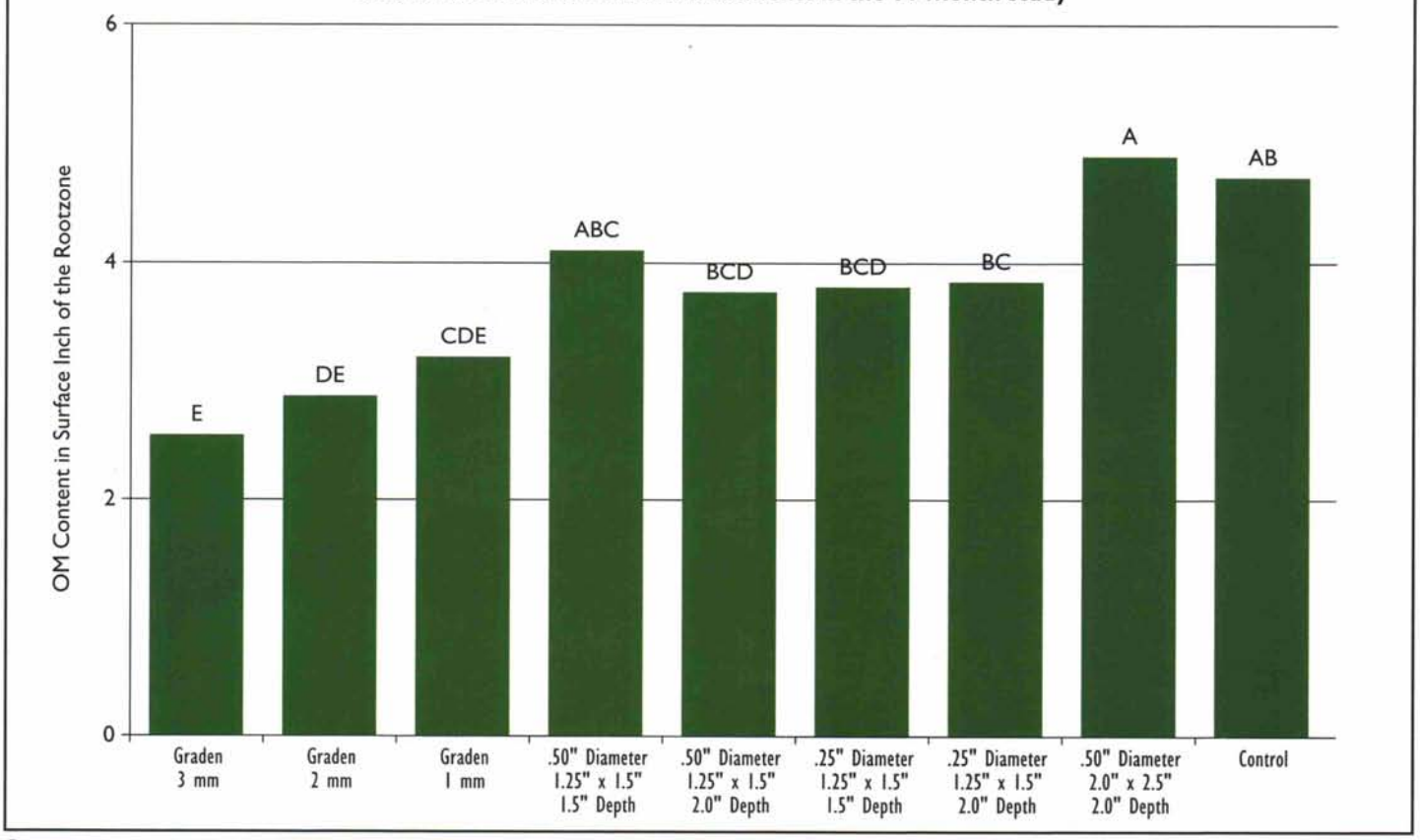
Figure 3
Comparisons of organic matter in the upper one inch of rootzone after three sets of cultivation treatments in the 14-month study



Organic matter content in the surface one inch of the rootzone as affected by cultivation treatment. Data collected June 21, 2004, two months after the third set of treatments was applied. Treatments with bars sharing a letter are not significantly different.