Cultivation Techniques to Maximize the Efficiency of Organic Matter Removal from Sand-based Greens

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Objectives:

1. To determine the effectiveness of several cultivation methods on: the removal of organic matter near the surface of a sand-based putting green; limiting organic matter accumulation following cultivation through sand incorporation into the putting green surface; minimizing recovery time; and minimizing negative impacts on ball roll distance and trueness.

Start Date: 2004
Project Duration: two years
Total Funding: $17,250

High concentrations of organic matter (OM) near the surface of sand-based putting greens are likely to contribute to summer stress decline when creeping bentgrass is managed during hot, humid conditions. Cultivation techniques effective in reducing OM include hollow tine cultivation (HTC) and aggressive verticutting. Although aggressive verticutting equipment (i.e. Graden) typically affects a greater percentage of the putting green surface than HTC, its usefulness may be limited by the difficulty with which sand is back-filled into cultivation channels.

More shallow hollow tines may be ideal for OM control since it is normally only the surface inch of the putting green that needs cultivated. This is where OM is concentrated. Shallow hollow tine cultivation may result in economical savings (less labor for core removal and less sand needed to fill holes) without compromising the effectiveness in terms of OM removal.

An experimental area was established to compare several cultivation treatments for their effects on OM removal and turf recovery and overall quality. The area consisted of a one-year-old 'Penn G2' creeping bentgrass putting green built according to USGA recommendations. The green accumulated a grow-in OM layer of approximately 0.5 inch. Forty plots, each measuring 5 by 20 ft. were established so that ten cultivation treatments (Table 1) could be applied in four replicate plots. Plots were evaluated for OM removal on the day of cultivation, OM re-accumulation over the next few months following cultivation, recovery time, ball roll distance and uniformity, and overall turf quality. Evaluation data were statistically analyzed to determine if the effect of cultivation treatment was significant and to separate treatment means.

On average, the aggressive verticutting treatments removed more OM than HTC treatments, but they also removed a disproportionate larger amount of sand compared to HTC. It was more difficult to fill cultivation voids left by aggressive verticutting which reduced turf quality and lengthened the recovery time of plots receiving verticutting treatment.

During the first year of the study OM re-accumulation was not affected by cultivation treatment. However, the control treatment had nearly double the OM than plots receiving a cultivation treatment 60 days following the first treatment date.

Treatment	Cultivation Unit	Spacing (inches)	Tine Diameter (inches)	Depth (inches)
1	Control			
2	Toro greens aerator	2.25 X 2.5	0.5	2
3	Toro greens aerator	2.25 X 2.5	0.5	1.5
4	Toro greens aerator	1.0 X 1.5	0.25	2
5	Toro greens aerator	1.0 X 1.5	0.25	1.5
6	Toro greens aerator	1.0 X 1.5	0.5	2
7	Toro greens aerator	1.0 X 1.5	0.5	1.5
8	Graden verticutter	---	0.04	1
9	Graden verticutter	---	0.08	1
10	Graden verticutter	---	0.12	1

Table 1. *Cultivation treatments used in the OM removal study*

Aggressive verticutting treatments removed more organic matter than hollow-tine cultivation treatments, but they also removed a disproportionate larger amount of sand.

Treatments with shallow hollow tines performed relatively poorly in the first year of this study as they did not effectively extract a high percentage of cores from the rootzone. They may have been more useful in situations with a weaker rootzones.

Summary Points

- Aggressive verticutting removed a large amount of rootzone material, but much of this debris was not OM. Core cultivation treatments averaged 1.95% OM in the debris removed compared to 1.15% OM in the debris removed from aggressive verticutting treatments.
- Recovery from cultivation was significantly slower on plots cultivated with aggressive verticutting, and overall turf quality was shown to be very low over an extended period of time. Among core cultivation treatments, decreasing tine spacing did not affect recovery time.
- The 1-mm aggressive verticutting blades removed nearly as much OM as the 2-mm blades while bringing significantly less debris to the turf surface.
- Control plots showed a relatively high OM accumulation rate, possibly the result of less favorable conditions for OM decomposition compared to cultivation treatments.