Superintendents' Korner

Core Cultivation: Dr Karl Danneberger

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Of all the turf management practices, core cultivation (aerification) is probably the most noticeable, and the least appreciated. The disruption to play is quite obvious but the benefits, although not as visual are just as important. Aggressive coring practices are normally done during periods of active turfgrass growth in the spring and fall. Factors involved in the type of coring to be done (hollow versus solid, tine diameter and depth, degree of disruption to the turf) are dependent on the desired long-term outcomes. Listed below are some of the outcomes from coring (and various types of cultivation practices). I have updated this information from previous postings.

Timing

Scheduling autumn coring into the golf course & sports turf calendar is often times the most challenging part of the process. From an agronomic perspective coring should be done when the turf is actively growing and the likelihood for environmental stress is low. If I had to quantify the "ideal" period, it would be when the average soil temperature is in the mid 60's F (16 C). If coring is done when soil temperatures are high you run the risk of injury to the plant. If you wait late into to the autumn temperatures are cool and turf recovery (ex. filling in the holes) is slow.

Soil Physical Properties

On compacted soils, research on loamy sand has shown that hollow tine coring (HTC) decreases the soil bulk density, increases air porosity and hydraulic conductivity (Murphy et al. 1993). The soil strength is decreased with HTC, which may or may not be a desired characteristic.

Solid tine coring (STC) is often a desired practice because it causes less disruption to the turf surface. However, STC is not as effective as HTC with regard to the previously mentioned soil physical properties. HTC decreases the soil bulk density to a greater extent than STC while air porosity is 19 to 21% greater with HTC than STC. Regarding soil macropores, HTC produces a greater percentage of these pores than STC. Hydraulic conductivity is also lower with STC when compared to HTC, while soil strength is greater with STC.

Note: It is a mute point but if the soil is not compacted, coring will actually negatively impact (in the short term) the before mentioned physical properties (Murphy, 1993)

Impact on Root Growth

Root length and mass is probably enhanced over time by coring. In the short-term however, root and shoot growth is injured with coring. The drier the soil conditions at time of coring, the greater the likelihood root and damage will occur. Increased root growth from coring in the autumn will not be observed until late fall or more likely the following spring. When coring, especially if the turfgrass plants are still suffering from residual summer stress, make sure soil moisture levels are adequate (close to field capacity) and soil temperatures are not high.

Cultivation Pan Layer

A potential problem with continual coring is the development of a cultivation pan layer. This layer is a thin zone of soil compaction that occurs immediately below the coring depth. Petrovic (1979) demonstrated that compaction occurs around a hollow tine core hole. Compaction along the edges of the coring hole is transient but at the bottom of the core a pan layer can develop. This layer is less likely to occur when coring under dry soil conditions, but the disadvantage as mentioned previously it the potential for increased root injury. I think it is important to stagger the depth of coring to break or reduce the potential for the development of this layer.

Thatch

Coring and removing the core results in no permanent reduction in thatch (the organic fraction). The re-incorporation of the cores can reduce through dilution the thatch layer. In general, coring in combination with other management practices like topdressing, and aggressive vertical cutting will help in thatch management.

Poa annua

Coring during the autumn potentially increases the opportunity for annual bluegrass invasion. Recently reported findings out of Penn State University has found that the potential for *Poa annua* invasion is less when solid tines are used versus hollow tines. A possible reason for this is that with hollow tines the soil brought to the surface also brings *Poa annua* seeds. This is the only advantage I see for using solid tines over hollow tines this time of the year. Also, be sure to core cultivate when the turf is actively growing. Quick recovery of the core holes will reduce the potential for weed invasion, and also provide a better putting surface.

High Pressure Water Injection

During the 1990's high-pressure water injection devices like the Toro Hydroject® were developed to help alleviate soil compaction on turfgrass greens. The advantage to this procedure is the variable depth in penetration that could be achieved with little surface disruption. Research at Michigan State University (Murphy and Rieke, 1994) showed that high-pressure injection was much more effective in relieving compaction as measured by soil physical properties than hollow tine coring.

The last few years DryJect® has become popular where sand is ejected into the green or turf through high pressure and water. In both these processes, root injury can occur from the water pressure and sand injection. I would recommend that these practices be done when root and

shoot growth are active. If root damage is to occur, it is important to do these practices at the time when root growth would recover.

Conclusion

Coring is an important management practice. The effectiveness of this practice is dependent on a clear focus of what the desired end result is.

Literature Cited

Murphy, J.A., A.E. Erickson, and P.E. Rieke. 1993. Core cultivation of a putting green with hollow and solid tines. *Agronomy Journal* 85:1-9.

Murphy, J.A. and P.E. Rieke. 1994. High pressure water injection and core cultivation of a compacted putting green. *Agronomy Journal* 86:719-724.

Petrovic, A.M. 1979. The effects of vertical operating hollow tine cultivation on turfgrass soil structure. *Ph.D. dissertation*. Michigan State University.

Author: Dr. Karl Danneberger