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New tools and research have many superintendents rethinking their conventional aeration practices.

NEW TRENDS IN AERATION AND ORGANIC MATTER

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Managing organic matter content is critical to providing desirable playing conditions and healthy turf. With too much organic matter, putting greens become soft and are at greater risk for disease and other forms of decline such as mechanical damage, especially during periods of unfavorable weather. Conversely, not enough organic matter can be problematic as well. Without enough organic matter, the putting surface loses stability and becomes "shifty" underfoot – typically resulting in deceased traffic tolerance. This problem is less common because it typically results from performing aggressive cultural practices at a high frequency – something most facilities try to avoid.

While most of the golf community, including golfers and superintendents alike, would agree that healthy greens and firm playing conditions are preferred, there is often a great deal of contention when disruptive practices are implemented to provide these conditions. The good news is that new equipment, tools and techniques have superintendents better equipped to properly manage organic matter with less impact on playability.

There is no one-size-fits-all program for organic matter management. It is critical to evaluate the profile of your putting greens to identify potential issues, and then determine what practives would best address those needs. Organic matter management is a balancing act between the rate of accumulation and the rate of removal and dilution. Factors such as fertility, growth regulation, growing environment and turf species will influence the rate of accumulation. For this reason, it is also important to review your entire putting green management program when developing plans for organic matter management.

When organic matter becomes excessive, playing surfaces become soft and spongy.

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Regardless of current organic matter content or putting green management programs, some type of cultural practices will be necessary to manage organic matter. Traditionally, most courses have relied on hollow-tine aeration twice annually with larger-diameter tines to address their aeration needs. However, there are several new methods gaining popularity that tend to have less impact on playability.

Sand Injection

Sand injection is relatively nondisruptive compared to traditional core aeration, but it does not remove any organic matter like core aeration does. That said, facilities with excessive organic matter content would see the greatest benefit by supplementing core aeration with sand injection, not replacing it. However, if organic matter content is already being managed within an ideal range, shallow sand injection has the potential to replace other forms of cultivation.

Another use for shallow sand injection is helping to alleviate the negative effects of a sod layer. Oftentimes when sod is used to establish putting greens, an organic layer comes with the sod that will inhibit downward water movement and root development, but the greens can be too delicate after sodding to perform traditional core aeration. Shallow sand injection is beneficial in this situation because it creates sand channels through the sod layer without the aggressive pulling action associated with core aeration.

Traditional sand injection leaves very little sand in the upper portion of the profile, doing little to dilute organic matter. Shallow sand injection keeps most sand in the upper 2 inches, having a more significant impact on organic matter dilution.

Sand Topdressing

Sand topdressing is one of the most beneficial practices that can be performed on putting greens. The primary benefits of sand topdressing include:

- Organic matter dilution
- Surface smoothing
- Crown protection, resulting in decreased susceptibility to anthracnose disease on Poa annua putting greens

Despite the numerous benefits of sand topdressing, some golfers find it objectionable when sand particles remain on the surface because they impact ball roll. From a maintenance perspective, superintendents may elect not to topdress as often as they would like for fear of damaging mowing equipment. To overcome both issues, facilities are adopting a two-sand system, where a less-coarse sand is used for regular topdressing applications and a more well-graded sand is used for aeration.

Using a less-coarse sand for topdressing may sound like it would result in textural layering issues, but recent research from Rutgers University has shown that's not necessarily the case (Murphy et al., 2019). In this ongoing research, preliminary results have shown that topdressing with a less-coarse sand that contains 23% fine particles and 77% medium particles did not significantly increase soil moisture compared to plots topdressed with coarser material. Using a fine-medium sand, which contained 69% fine particles, did increase soil moisture compared to plots topdressed with coarser materials, but these plots had lower soil moisture than plots that were never topdressed. However, when the plots topdressed with the fine-medium sand were aerated and backfilled with

the medium-coarse sand, they performed more similar to plots that were topdressed with coarser materials and not aerated (Whitlark and Thompson, 2019).

Reducing the amount of coarse and very coarse sand particles in a topdressing sand can reduce mower damage and playability impacts.

That said, using a topdressing sand with predominantly fine sand particles is not ideal, but it is better than not topdressing at all. However, reducing the amount of very coarse and coarse particles in a topdressing sand allows the sand to be incorporated into the dense canopy much easier, thus reducing the impact on playability and wear on mowing equipment.

Facilities adopting the two-sand system should use a more well-graded sand during aeration or aggressive verticutting to incorporate larger particles into the profile. The physical properties of this sand should closely match the sand used for construction if the putting greens are sand based. Ensuring that larger particles are being incorporated into the profile will help improve infiltration and surface firmness by maintaining a well-graded sand composition in the topdressing layer.

"Micro" Hollow-tine Aeration

Aerating with small-diameter hollow tines is not a new idea but, until recently, an inside diameter (ID) of 0.20 inches was the smallest option. The outside diameter (OD) of this tine would typically be 0.33 inches. Manufacturers have now started producing even smaller hollow tines with an ID of 0.157 inches and an OD of approximately 0.275 inches or less. The smaller diameter means less disruption to the playing surface and superintendents are finding that they can aerate with these smaller tines more frequently throughout the season without any major impact on playability. There are numerous benefits that come with using these smaller tines for aeration.

One benefit is that cleaning debris following aeration is much less labor intensive than cleaning larger cores. Cores from the newer tines with an ID of 0.157 inches are easily cleaned with a couple of backpack blowers, whereas cleanup following aeration with large-diameter hollow tines requires shovels and numerous staff members. Smaller tines are ideal for superintendents struggling with labor issues, especially if they are shorthanded in spring and fall when conventional aeration is typically performed on cool-season grasses.

Aeration with small-diameter hollow tines is a much faster process than conventional hollow-tine aeration. However, multiple aeration events must be performed to have a similar effect.

Some superintendents are replacing one of their conventional hollow-tine aeration treatments with multiple aeration events using small-diameter hollow tines. The total surface area that needs to be disrupted annually depends on preexisting conditions, but the following points illustrate how multiple aeration events with small-diameter tines can replace one larger hollow-tine aeration event:

- Many traditional aeration programs consist of spring and fall aeration with 0.50-inch ID (0.65-inch OD) hollow tines used on 2 inch by 2 inch spacing. Each treatment affects about 5% of the putting surface.

- Some of the smaller tines that are now available, which have a 0.157-inch ID and 0.275-inch OD, impact about 1% of the surface area with each treatment, assuming 1 inch by 2 inch spacing. If these small-diameter tines are used five or six times per season, the total area impacted is similar to that of the conventional aeration event described above.

- Be aware that when small-diameter hollow tines are used, the holes are practically impossible to fill with sand. This will reduce the rate that organic matter is diluted in the upper portion of the profile.

- Replacing conventional aeration events with small-diameter tines would be better suited for facilities trying to maintain current organic matter levels. If organic matter is excessive, these treatments should be used as a supplement to conventional aeration programs with large-diameter tines.

- Another limiting factor with small-diameter hollow tines is depth and durability. Many of the

new “micro” tines are not as durable as larger tines, so cost becomes a factor. To prolong the life of these tines, adjust the aeration depth to the depth of the organic layer.

Venting aeration is common, especially during periods of wet weather. Small-diameter solid tines are often used for this application due to their minimal disruption of the putting surface. However, facilities have started replacing solid tines with “micro” hollow tines for venting because the disruption to the surface is about the same, but the hollow tines seem to provide longer-lasting venting effects and remove a small amount of organic matter in the process.

Small-diameter hollow tines also offer another way to mitigate the impact of sod layers in recently established putting greens. These tines are a great option in this situation because they remove small amounts of the sod layer and provide venting effects simultaneously. Since small-diameter tines are less invasive than larger tines, sod heaving should not be an issue provided rooting is adequate.

Solid-tine-only Aeration

USGA agronomists are frequently asked whether solid-tine-only aeration is a viable option and the answer isn’t always a simple yes or no. The bottom line is that dilution is the solution for managing organic matter content. If enough sand can be added through topdressing and filling solid-tine aeration holes, solid-tine-only programs may be a viable option (Gross, 2019). However, there are several factors to consider, including soil conditions and how rapidly improvements are expected if there is a preexisting issue.

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Eliminating hollow-tine aeration entirely is not ideal for most facilities, but it can be effective in the right scenario with the right set of preexisting conditions. This type of program is desired by many because solid-tine aeration is less disruptive and requires less labor than hollow-tine aeration. However, because solid-tine aeration does not remove any material from the profile, it will not produce desirable results for facilities that do not topdress regularly or that are dealing with some type of soil issue, such as elevated organic matter content or soil layerin

Solid-tine-only aeration programs are better suited for putting green profiles that are well modified with sand and have no textural layering issues. Additionally, with this type of program it is critical that sand topdressing applications are made frequently to dilute new organic matter as it accumulates near the surface. Facilities that have adopted this type of program typically topdress every week during the growing season and implement a minimalistic nitrogen fertility program to eliminate luxuriant growth and reduce the rate of organic matter production.

It is also important to weigh the political implications when considering a move to this type of program. If hollow-tine aeration becomes necessary in the future after adopting this type of program, it will likely be a difficult sell to the golfers after they have become accustomed to less-disruptive practices. It would be a wise decision to establish a protocol for testing organic matter every year to confirm levels

are being maintained within an ideal range. Additionally, before a firm decision is made to switch to a solid-tine-only aeration program, it should be documented that if yearly testing shows organic matter levels are moving outside the ideal range, it will be necessary to implement core aeration.

Summary

Organic matter management is one of the key components to providing healthy, resilient and firm putting greens. While there is no one-size-fits-all program, there are plenty of options to help superintendents accomplish what is necessary from an agronomic perspective while also trying to minimize the level of disruption to the playing surface. That said, the growing popularity of the methods discussed in this article does not mean that more traditional methods are not effective. Every course has its own site-specific circumstances and the superintendent should work with other managers at the facility to determine what program is best for the golf course and golfers. A USGA agronomist can also help evaluate the putting greens and develop a customized plan for the course. Regardless of what methods are chosen, it is important to remember that the long-term benefits far outweigh the short-term disruption associated with any form of putting green cultivation.

References

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