Soil Profile Dictates Topdressing Programs

By Adam C. Moeller and Cale A. Bigelow

Topdressing, or the regular application of thin layers of sand to golf course putting greens, has been used as an important cultural practice since the early days of Old Tom Morris at St. Andrews Golf Links (Labbance and Witteveen, 2002). The benefits of sand topdressing for thatch management and surface firmness, smoothness and grain control are well recognized.

Insufficient sand topdressing may result in excessive organic matter accumulation in the upper-soil profile. Excessive organic matter, or thatch, results in greater pest damage, shallow rooting, poor soil air exchange and may cause the turf to be more prone to scalping.

The most-effective surface organic matter management programs for putting greens normally combine hollow tine aerification with regular sand topdressing. In addition to a seasonal heavy application to back-fill aerification holes, sand should be applied frequently enough to match seasonal shoot growth and to prevent an organic layer from forming.

In recent years, this has been conducted biweekly using light applications of sand during the growing season to dilute organic matter and smooth out wear areas. If applications are spaced too far apart using too much sand, then layering occurs and little thatch management actually takes place.

Topdressing application frequency

In the past three decades, the frequency of topdressing applications has changed significantly. The introduction of new application equipment turned a former time-consuming, labor-intensive process into a relatively quick and easy management practice. This has enabled golf course managers the ability to apply very small, precise amounts of sand more regularly.

Add to this the prevalence of improved high shoot density creeping bentgrass cultivars [*Agrostis stolonifera L.* var *palustris* (Huds.) Farw.] that produce higher amounts of organic matter and elevated golfer expectations for firm, smooth and fast-playing surfaces, and you have a recipe that demands more frequent topdressing.

Although topdressing application frequency has increased, the overall annual amount seems to be declining. Ultralight topdressing on a weekly basis is not always enough to keep up with organic matter accumulation.

It is important to remember that for effective thatch management, it is necessary to match the rate of organic matter production with appropriate amounts of topdressing material. Some greens may require more topdressing than others due to differences in growing environments, fertility programs, traffic and compaction. Cool-season turfgrass organic matter production is highest during periods of cool temperatures (32 to 55 degrees Fahrenheit) and in areas with poor air circulation and high moisture (Carrow, 2003).

The frequency of applications and topdressing rates may need to be increased for regions that experience any of these conditions for the majority of the year.

Sand particle sizes

A long-term successful topdressing program normally includes the use of a material with a particle-size distribution that matches the underlying rootzone. For properly constructed sand-based rootzones this is relatively easy since you simply purchase a sand that matches the construction sand. Native soil greens present a challenge. However, using a sand that meets USGA specifications (Figure 1) is advisable because these sands are developed to provide optimal soil physical properties; good water retention and drainage; and resistance to compaction (USGA Green Section Staff, 2004).

Sands meeting USGA specifications normally contain ≥ 60 percent in the medium-coarse size fraction. On many closely mowed newer putting greens, coarse topdressing sand particles may be easily picked up by greens mowers. Finer sand is easier to work into the turf canopy, especially at lower mowing heights, and with new high shoot density bentgrass cultivars, and a desire to have less impact on play, are all persuading turf managers to switch to finer sands. The long-term implications of this practice are not well understood.

Within reason, topdressing particles slightly coarser than an existing rootzone will not adversely affect long-term soil physical characteristics. Conversely, topdressing sand that is dramatically finer than an existing rootzone may have serious negative consequences on soil physical properties. As putting greens age, saturated hydraulic conductivity or percolation declines naturally due to the loss of macropore space from organic matter accumulation or sometimes silt and clay migration into the upper profile.

A similar loss of macropore space occurs when finer sand is used for topdressing. Additionally, a distinct layer forms at the surface resulting in a perched water table. This layer

restricts drainage and air movement, resulting in a softer, wetter surface more prone to scalping.

Improperly timed topdressing during summer stress periods can cause leaf abrasions, which may cause a loss of turf density and aesthetics (Dernoeden, 2002).

Mechanical injury can also occur when forcing sand particles into the turf canopy with brushes or other attachments. Stiff brushes and high temperatures can make plants more susceptible to stress-induced diseases and weed infestation. If a turf stand is stressed or weak, even light applications of topdressing should be delayed until plants are healthy and actively growing.

Sand selection

Selecting topdressing sand is a very important decision and should be made with a long-term performance characteristics and thatch management program in mind. Analysis of particle-size distribution should always be done before using any topdressing sand to ensure that it matches or is slightly coarser than an existing sand rootzone. This is best handled by an accredited soils testing laboratory. However, if you have a set of sieves this test can be done in matter of minutes. A minimum of six sieves plus the pan is required. The sieves sizes include: 2mm, 1mm, 0.5mm, 0.25mm, 0.15mm, 0.5mm.

A sample of at least 60 grams (about 1 tablespoon) is needed; shake for a minimum of five minutes to ensure adequate separation of finer particles and determine the weight of each size class. An appropriate sand will contain 60 percent medium-coarse particles and should not posses more than 20 percent fines.

Other things to consider are: sand shape and purity, calcareous vs. silica, source location, cost, and delivery options.

TABLE 1

Percent moss as affected by five thatch management programs, three creeping bentgrass cultivars and two annual nitrogen levels, 2005.

		Moss incidence
		2005
Management program†	Sand particle size	24 July
		--------- % moss cover ---------
HT + Seas. Top.	Medium-coarse	0.1 bc*
HT + Freq. Top.	Medium-coarse	0.4 bc
HT + Seas. Top.	Medium-fine	0.9b
HT + Freq. Top.	Medium-fine	1.9a
Freq. Top. Only	Medium-coarse	0.1c
Cultivar		
A-4		0.0b
L-93		0.2b
Penncross		1.7a
Annual N level‡		
2.3 lbs. N yr^{-1}		0.9a
4.0 lbs. N yr^{-1}		0.4b

† Hollow tine aerification occurred on 14 April and 14 September.

‡ Nitrogen was applied either as liquid or granular formulations depending on application rates and dates.

** Means in the same column followed by the same letter are not significantly different according to Fisher's protected LSD t-test (p=0.05)*

Sand shape is sometimes overlooked when considering topdressing material. Angular sand resists shifting better than rounded sand. Either sand shape will work for topdressing, but it is generally recommended that you attempt to match the existing rootzone because the new material will ultimately make up the upper profile.

Current research

Research is ongoing in the third year at Purdue University evaluating the effectiveness of various putting green sand topdressing programs.

Our research objectives are to develop specific topdressing requirements for low (Penncross), medium (L-93), and high (A-4) shoot density bentgrass cultivars maintained at two different nitrogen levels. Clearly there are large

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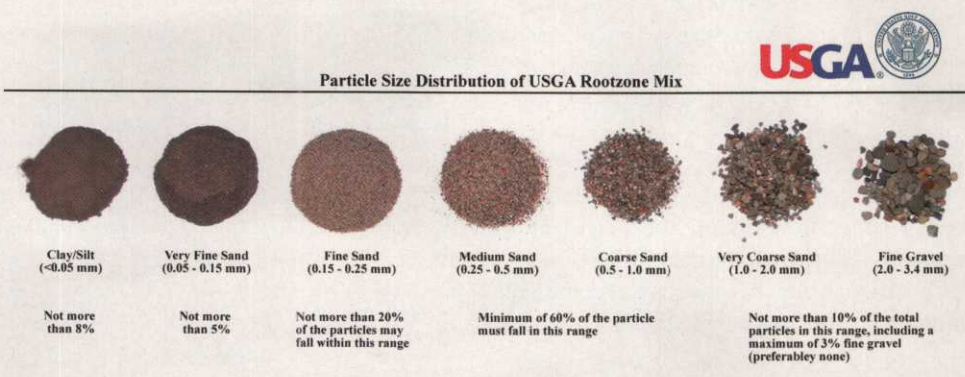

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differences between the shoot density of cultivars and their ability to maintain density during the summer months. This likely affects topdressing needs and strategies as well.

We are monitoring the long-term changes in rootzone physical properties of a sand-based putting green rootzone topdressed with two sand sizes. These programs also vary with sand application frequency with and without seasonal hollow tine cultivation. The sand (one cubic foot per week) is lightly brushed into the turf canopy. Additionally, performance characteristics such as appearance, volumetric soil water content, surface hardness, dollar spot incidence, and moss encroachment are being documented.

Moss (*Bryum agentium*) encroachment is more evident on our research plots that received frequent topdressing each week throughout the summer months. Moss incidence was highest in Penncross plots topdressed weekly with fine sand in 2005 (Table 1, p. 67).

It is important to note that this was a warmer than normal year and the turf was likely under some heat stress. Volumetric water content (0 to 5.7-centimeter depth) in plots receiving regular medium-fine sand is increasing probably due to the fine sand holding more water (data not shown). This may also be affecting the growing environment and favoring moss.

Conclusion

Sand topdressing is still an essential cultural practice to maintain the highest-quality putting green. Remember, one size does *not* fit all.

It is important to critically evaluate your topdressing program. If you are applying topdressing more frequently, ask yourself if you are actually meeting the critical annual amount necessary to minimize thatch and excessive organic matter and ensure firm, smooth surfaces.

Analysis of topdressing material prior to sand selection can prevent potential long-term layering issues and detrimental effects to soil physical characteristics caused when a sand finer than an existing rootzone is used for topdressing. Mechanical damage can easily occur if plants are stressed and topdressing should be delayed until the turf is actively growing and healthy.

Our research aims to answer many common topdressing questions to help present a better understanding of the topdressing requirements for high-quality putting greens.

Adam C. Moeller is a graduate research assistant in agronomy at Purdue University.

Cale A. Bigelow is an assistant professor in Agronomy at Purdue University.

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