Aerification directly reduces organic matter percentages.

THE RIGHT COMBO

Aerification and topdressing provide the best potential for managing organic matter in sand-based greens

ARTICLE AND PHOTOS BY KEVIN J. ROSS, CGCS

Recently, there's been a lot of discussion about organic matter management in sand-based greens, primarily the U.S. Golf Association-specified green. Research has shown controlling the levels of organic matter in greens will have the greatest effect on the quality, performance and longevity of sand-based greens. Therefore, it's understandable that managing organic matter has risen to the forefront of agronomic management programs for greens.

The first step to control organic matter accumulation is to have a basic understanding of its composition and production. It would be misleading to classify organic matter in greens as only thatch. The organic matter zone within a green can be separated into two distinctive groupings or stages.

First, stage one organic matter can be classified as true thatch, which is composed of the initial dead and dying plant tissue. Stage one organic matter is located just below the turfgrass surface. Generally, it makes up about half an organic matter zone.

The second group, or stage two, is a material that's humus in nature. This is material

Sampling all greens on a golf course can determine potential problems with indivdual greens.

that has undergone the entire degradation process. Stage two material is located in the bottom half of an organic matter zone and might be the most important area of this zone. It's composed of much finer textured material, which can cause extensive clogging of pore space within that area of the root zone. Presently, turfgrass researchers are investigating this stage-two layer and are only beginning to understand its dynamics in the performance of greens.

When it comes to organic matter accumulation in a sand-based growing environment, the odds are stacked against a turfgrass manager. When one combines an amazing ability to produce organic matter with a sterile growing medium (sand), accumulation can happen at a rapid rate. Dealing with this sterile, sand-based growing environment also limits the potential speed of organic matter degradation. The faster a plant grows, the quicker organic matter builds up. Therefore, each time turfgrass managers fertilize, it has a profound effect on the plant's growth rate and its organic matter accumulation potential.

As an example, when greens are constructed of an 80/20 root-zone mix, the organic matter content of that initial mix is about 0.7 percent by weight. Researchers have identified that within only a few short years the amount of organic matter skyrockets to a 3- to 4-percent range in the upper surface of a green.

CONTROL

Controlling organic matter accumulation in greens is achieved primarily through two methods: physical removal of the material and dilution of the material. Physical removal involves cultural practices, primarily core aerification and dethatching (liner aeration). Diluting the organic matter is achieved by adding sand via topdressing.

How much aerification is needed to control the buildup of organic matter is something most turf managers have guessed about for many years and really don't have any scientific basis to support their decision. The best information about the degree of aerification needed to control organic matter on sand-based greens comes from Robert Carrow, Ph.D., at the University of Georgia. His work was funded by a research grant from the USGA and is titled "Surface Organic Matter in Bentgrass Greens."

Carrow's research determined that a 4-percent level of organic matter by weight in the upper 2-inch zone is a breaking point for the performance of greens. He cites that a level greater than 4-percent organic matter should send a red flag to golf course superintendents, indicating potential problems could be on the horizon. His work points out, however, that the 4-percent guideline isn't a steadfast rule. Carrow indicates that in cooler climates greens might do fine above 4-percent organic matter. However, it can be especially critical in the southern-most zone where bentgrass can be grown.

This research is significant because it provides superintendents with a number to use

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when designing cultural practices. It can tell a superintendent directly if he needs to be aggressive with an aerification program.

Adopting the 4-percent rule to design aerification programs is simple. First, the percentage of organic matter in the upper 2-inch surface of each green needs to be identified. To accomplish this, samples must be tested by a qualified laboratory. This test is determined in the lab by ignition, and the result is organic matter percentage by weight. The results of this test can tell superintendents exactly how much material, if any, to remove through cultural practices to achieve their desired organic matter percentage level. These actual numbers are something superintendents never had in the past.

DESIRED LEVELS

After the organic matter levels have been identified, it's important for superintendents to set a desired level of organic matter they'd like to achieve. Although Carrow's work identified 4 percent as the possible break point, a desired level should be set lower.

For example, using a level of 3.5 percent as a targeted value is probably a good option. The organic matter reduction formula example (see figure 1) can be used to calculate the amount of surface area removal/impacted needed. In the example, a fictitious 4.49 percent organic matter tested result value is used. This tested result (4.49 percent) is subtracted from the desired value (3.5 percent) to calculate the percentage amount above the desired level (0.99 percent). Then, calculating the surface area removal/impacted needed is determined by setting up a fraction. The example shows that to achieve the desired level, 22 percent of the surface area needs to be removed.

It's important to note all greens may or may not need this amount removed. On most golf courses, all greens don't have the same environmental growing conditions, and therefore, most likely have different percentages of organic matter. If a superintendent adopts the 4-percent guideline, it might be important to analyze each green individually. This can help identify individual green problems and might lead superintendents to consider the aerification needs of individual greens, instead of lumping them together as a whole.

AERIFICATION

Once the removal amount is known, it's possible to calculate how much aerification is needed. When the amount of removal is high, it might be desirable to achieve that level using multiple cultural practices. It's also important to take into consideration the health of the greens. Healthy greens can withstand much more impact than weaker greens during a single cultural practice. There's also a limit of maximum removal based on cultural practice equipment.

To calculate how much material should be removed by aerification, two factors are needed. First, to calculate the surface area removal/impacted, calculate the area of the tine-spacings used (see figure 2). For example, if the spacings on a machine are 2 inches by 2 inches, then 4 square inches would be impacted. Or, if 1-inch-by-1-inch spac-

Figure 1

Organic matter reduction formula

Organic matter tested result
- Desired organic matter level
= Amount above level

4.49% OM tested
- 3.5% OM desired
= 0.99% above level

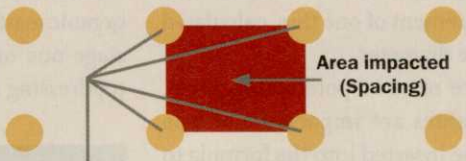
Amount above level ÷ OM tested result
= Amount of surface area removal/impacted (SARI) needed

0.99 ÷ 4.49 = 22% SARI Needed

Figure 2

Calculating surface area removal/impacted

Base the calculations on the area of one tine.



A total of four tines impact the area.
Each tine impacting with one-fourth of its size.

Figure 3

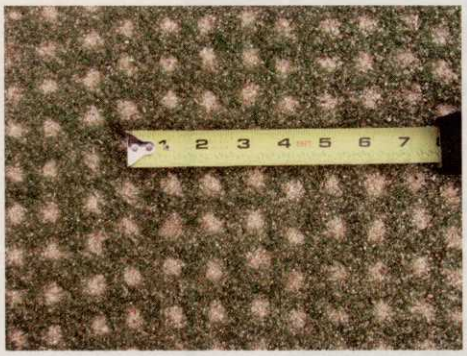
Surface area removal potential formula

ID area of one tine (area of a circle = (3.14) x (radius)^2 ÷ Square inches from spacing used.

Example below uses 1-inch x 1-inch spacings, with an inside diameter tine measuring 0.40 inch

(3.14) x (0.20)^2 = 0.125 square inch ÷ spacings 1 inch x 1 inch = 1 square inch

0.125 square inch ÷ 1 square inch = 12.5% SARP



Close spacings offer the greatest surface removal potential.

ings were used, then one square inch would be impacted.

The second factor is determining the inside diameter of the tine used, or needed to be used, to reach the correct removal potential. With square spacings, four tines impact the area with one-fourth of each tine hitting the area. Therefore, the total area impacted is the area measurement of one tine, calculated using the inside diameter.

In the surface removal potential formula, various area values are impacted and tine size areas can be inserted into the formula to determine surface area removal potential (see figure 3). In the example, a 1-inch spacing is used with a 0.40-inch inside diameter tine measurement. This equates to a 12.5-percent surface area impacted potential. Remembering the previous test example, it would take two aerification events using the example set-up to lower the organic matter 22 percent.

TOPDRESSING

Sand topdressing also is an important part of managing organic matter build-up. Topdressing sand filters into stage one organic matter, with the end result having a diluting effect on the material. The dilution of this organic matter helps keep porosity levels sufficient for proper greens performance.

How much topdressing is needed to help keep the organic matter content below the 4-percent threshold? Some have suggested applying sand at a rate of about 50 cubic feet per 1,000 square feet per year. This said, there are two important factors that should be thrown into the equation before considering 50 cubic feet of sand per thousand as the all-important amount.

First is the length of the growing season. Some parts of the country have a growing season as short as three to four months, and other parts have a 12-month growing season. Should both these areas of the country be on a 50-cubic-feet-per-1,000-square-foot rule?

Secondly, and maybe more importantly to a topdressing program, is the plant growth rate. Remembering the most important fundamental aspect about topdressing, applications should be directly proportional to the plant's growth. The plant's growth directly influences the amount of stage one organic matter produced. Therefore, to dilute stage one organic matter with best results, topdressing volumes and frequencies should be increased as the growth rate increases. The same applies to the plant when growth decreases – topdressing volumes and frequencies should be decreased.

Topdressing has become more of a calendar cultural practice recently, instead of a true agronomic cultural practice.

BOTH ARE KEY

Even though sand-based greens have been around for many years, it seems we're still trying to understand the complexities of managing them, especially regarding organic matter. When it comes to core aerification and topdressing, neither is more important than the other. However, one thing is certain: The net effect of both practices combined will give superintendents the best potential for managing organic matter build-up and maintaining successful greens performance. **GCI**

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Diluting organic matter through sand topdressing is just as important as aerification or dethatching.

MAKING IT FAST AND F

Ron Bivens, golf course superintendent at the private Country Club of Salisbury in North Carolina, often gets pulled aside by members telling him they were hitting a 150-yard shot on a green during the spring and they're hitting a 170-yard shot after the same drive during the summer and wonder why.

"They don't understand the firmness they had on the fairways changes with the season and grass conditions," Bivens says. "I'm always educating members about what we do with greens and fairways."

Such is part of the life of a golf course superintendent. In short, members want and expect only the best course conditions any time of year. It might be a generalization, but it's safe to say private club members want the conditions of their courses fast and firm, while those at daily-fee facilities prefer less-severe playing conditions. Where greens at a private club might be rolling 11 and above on average, the normal Stimpmeter reading for a daily-fee facility is around nine.

"I don't think there's any question that members at private clubs want their greens firm and fast," Bivens says. "We can get them running 12 and even 13 if we want."

Jeff Shafer, golf course manager at the municipally-owned Las Positas Golf Course in Livermore, Calif., says greens there generally are 9.5, and are 10.5 at various times of the year.

"We think that's a good speed for a municipal course," Shafer says.

At Aberdeen Country Club, a resort course in North Myrtle Beach, S.C., golf course superintendent Dan Connolly tries to keep green speed at 9.5, and everyone seems pleased with that.

"Why would I want to keep them faster for first timers?" he asks. "With the undulation we have on our greens, I would have people four- and five-putting. They would never come back."

USGA INPUT

The U.S. Golf Association issues no guidelines for green speeds but discourages superintendents from going to extremes to make their putting surfaces as fast as marble countertops, says James Snow, national director of the USGA Green Section.

"If you make your greens too fast, you'll discourage mid- and high-handicappers from playing your golf course," he says. "And while the better player likes a tight lie in the fairway and firm ground for more roll on drives, older players, especially ladies, want a little more of a fluffy lie.

BY JOHN TORSIELLO

RM

Superintendents strive to strike a balance between golfers' preferences and healthy turf conditions that are best for the bottom line

At the OGA Golf Course in Woodburn, Ore., golf course superintendent Ryan Wyckoff communicates with golfers to find out how the course is playing. Photo: OGA Golf Course

At Aberdeen Country Club, golf course superintendent Dan Connolly maintains green speed at 9.5, and he says most golfers seem to be happy with that. Photo: Aberdeen Country Club

"And there's always a worry that by keeping the grass too tight you'll stress out the turf and wind up losing parts of the course," Snow adds.

The U.S. Open, which the USGA operates, is notorious for fast and firm playing conditions. But Snow says even a course set up for an Open must have its conditions carefully analyzed and then managed properly to avoid presenting unfair playing conditions.

"I wasn't there, but I believe the greens at Winged Foot (site of the 2006 U.S. Open in Mamaroneck, N.Y.) were no more than 10.5 on the Stimpmeter," he says. "If you went beyond that, some of those greens would be impossible to putt on because of their slope and undulation. Again, I wasn't there, but I have heard greens running a 14. But that was on relatively flat surfaces with little undulation."

GOLFERS' IMPACT

With green speeds, there's always a trade-off, even at private clubs. Skilled players love being tested by firm and fast putting surfaces, while less accomplished players want slower greens that allow them to be more aggressive on putts.

"There's a lot of difference between a two handicap and a 22," Connolly says. "A scratch player wants the greens 11 or higher, and a 77-year-old lady who's barely getting around wants them at 7.5."

Green speed and firmness is always course specific, says Ryan Wyckoff, golf course superintendent at the OGA Golf Course in Woodburn, Ore.

"A superintendent has to take into consideration the caliber of golfer playing his or her course," he says. "Usually, private clubs have very strong players, and their expectations are firmer and faster conditions through the green. Public courses have lesser caliber golfers who would be better served with slower greens and a little higher-cut fairway grass."

Wyckoff, who has worked on grounds crews at several U.S. Opens, believes superintendents need to be proactive and seek input from the customer.

"I always try and communicate with golfers to find out how the course is playing and get their feedback," he says. "And you need to communicate with the guys in the pro shop. A lot of times they'll get more feedback directly from golfers when they check in or pass through on their way out the door."

Bivens says there should always be an education process going on between the superintendent, his staff and the members about the whys of playing conditions.

"We try to educate our members through our newsletter and various committees, telling them why course conditions change from season to season," he says.

THE AGRONOMIC ASPECT

Mother Nature plays a role in course setup and conditions, too. For example, Bermudagrass fairways on courses in the South will roll faster in spring because a thatch layer has yet to build up. During summer, even though the grass might be being cut the same height as in the spring, the fairways will build up thatch, become thicker and offer less bounce and roll. Thus, the reason for a 150-yard shot in April becoming a 170-yard shot in July.

Fast and firm at Berry Hill Country Club in Charleston, W.Va., means golf course superintendent John Cummings and his staff do what they can to maintain conditions so at no time the ball plugs through the greens, Cummings says.

"This is, of course, assuming Mother Nature cooperates," he says.

Cummings says fast and firm conditions can best be achieved through the amount of water the turf receives.

"We don't overwater and irrigate only enough to keep the turf from stressing out to

At Huntingdon Valley Country Club, playing conditions are more important than turfgrass color. Photo: Huntingdon Valley Country Club

Dan Connolly says there are concerns about keeping grass low and dry because it opens the door for pathogenic attacks. Photo: Aberdeen Country Club

the point of death or nonrecovery from the heat and wear and tear of the day's play," he says. "As for greens, it means to mow, roll and topdress depending on the growth rate of the turf to keep the greens smooth, consistent, quick but healthy, with good dense canopies. A properly hit shot should allow the ball to release and advance toward the hole."

Green speed also can be controlled by spot watering, rolling and double cutting, says P.J. Ringenberger, golf course superintendent at Green Valley Ranch Golf Club in Denver.

"You can even use a vibratory roller and spot roll right around a hole placement for additional speed," he says.

To create firm fairways, more superintendents are topdressing with sand, which helps break down organic matter and allows greater air and water circulation to keep the turf firmer, Connolly says.

"A good golfer will always like firmer fairway conditions, so the ball doesn't plug and sits up nicely," Shafer says. "You create that by not watering as much and having fairways with proper drainage so water isn't sitting and softening the turf.

"We have found with our comment cards that golfers enjoy firm, dry and fast conditions, and their scores have reflected that," he adds.

BE CAREFUL

But maintaining fast and firm playing conditions can place a strain on a superintendent's budget and manpower.

"Any superintendent with basic skills can do anything he wants with the firmness and speed of fairways and greens," Connolly says. "We can double and triple cut, roll, topdress, treat the greens with growth retardants and groom every day. Private clubs that have big budgets can do this. Usually municipal and privately owned public courses don't have the type of budgets that allow for such maintenance."

But Connolly says there are concerns about stressing the turf by keeping the grass low and dry. It opens the door for pathogenic attack and can weaken the plant in which it becomes less resistant to stress.

If one wants firm and fast conditions, that person will have to stay on top of things, Ringenberger says. If a course is set up for a tournament and the greens are dry and fast, the turf can take a hit if the weather is really hot. If that's the case, spot watering is needed so the turf doesn't stress out.

Maintaining fast and firm greens also can limit the number of pin placements a green can have.

"If we have the greens rolling 11 or 12 most times of the year, that means we lose in placements, especially on the edges of greens," Bivens says. "But when we drop down to a nine during July and August – when the weather is too hot to keep them running faster – it opens up all sorts of new pin placements on higher levels of the greens and around the edges. This way the members still can have greens that appear to be faster than they really are."

CONDITIONS OVER COLOR

Scott Anderson, superintendent at Huntingdon Valley (Pa.) Country Club, has taken a unique approach to course maintenance. He considers himself a playing conditions manager more than a turf manager.

"We have placed playing conditions above color," he says. "The soil-based greens seem to allow for a lot of resiliency in achieving firm and fast playing conditions, even on extremely hot days. The turf will turn brown at certain times of the year but the playing conditions are always the focus. The grass has been conditioned over time with a survival of the fittest approach. Our organic and minimalist base program keeps costs down."

The reaction from members has been positive, Anderson says.

Knowing a course inside and out is crucial to maintaining consistent playing conditions, Bivens says.

"You have to know each individual green and understand the little things, like how much sunlight it gets, when the sun hits it and its undulation, and treat it accordingly if you want to be consistent," he says. "It's all about having a balance in playing conditions from hole to hole. That's what members want no matter what the speed is." **GCI**

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