

from 7.5 to 6.5 requires approximately 500 lb/A or 12 lbs/M of sulfur. Contrast this with the fact that turfgrass injury is likely if more than 2 lbs/M of sulfur are applied at any one time and if more than four lbs. are applied in a single season. Clearly, soil pH control with sulfur has to be approached as an annual affair extending over several seasons.

Another problem with pH control through sulfur application is incomplete sulfur oxidation and, therefore, less than 100% effectiveness. How much sulfur will be oxidized varies greatly from one soil to another and is unpredictable. In the years to come we're going to hear a lot of heated discussion about the effectiveness of sulfur applications, simply because oxidation rates vary widely from one location to another.

Finally, in turf, sulfur must be surface applied. Soil pH at the surface will eventually drop very low, perhaps as low as 3.0. It is only over time that the acidifying action of the sulfur will work its way downward in soil. I am not aware of any studies that show how surface applications of sulfur affect soil pH in both the short and long run.

6. We're rebuilding some putting greens on our golf course next summer. The question I'm confronted with is one that has received a lot of discussion lately. Opinions seem to vary. Do you recommend the very coarse sand layer in the USGA specifications?

MANITOWOC COUNTY

ANSWER: The very coarse sand layer was originally incorporated into USGA greens solely to provide a barrier to prevent fine soil particles

from migrating into the pea gravel bed, clogging pores and impeding drainage. The idea that the very coarse sand layer may not be necessary arose from studies conducted by researchers at Texas A&M University and reported in the November/December 1980 issue of the USGA Green Section Record. They concluded from studies with eight-year-old greens and simulated greens subjected to prolonged saturated water flow in the laboratory that "no significant effect of the two-inch sand layer was evident when proper size gravel was used." In other words, they found no evidence for downward migration of fine soil particles into the pea gravel when the very coarse sand layer was left out.

The USGA Green Section does not refute this conclusion, but emphatically points out that the Texas A&M observations apply only when the 12-inch sand-peat mix adheres rigorously to USGA specifications and the pea gravel falls almost exclusively in the 1/4 to 3/8 inch size range. It is out of concern that these specifications are often not strictly adhered to that the Green Section staff continues to recommend installation of the 1 1/2 inch coarse sand layer over the pea gravel bed.

My recommendation is to continue to install the very coarse sand layer unless your construction materials have been subjected to rigorous laboratory testing, have been shown to meet USGA specs, and mixing of the sand and peat will be as prescribed by the USGA. Most people that I've talked to point out that the cost of installing the very coarse sand layer is not a major component of total green

construction cost and is worth the insurance it provides against drainage system failure.

7. We did some remodeling last year and built a new green. I was under a lot of pressure from the course architect to use straight sand in the rootzone mix. I resisted but still wonder if it would have been okay to use sand alone. He lobbied heavily with my committee and I would like some assurance it was worth the battle. What do you think?

PORTAGE COUNTY

ANSWER: Consider yourself lucky that you won the battle. Unfortunately, your club membership will probably never fully appreciate what you've done for them. Peat is mixed with sand to provide a lower soil bulk density that facilitates root penetration, to increase pore space by 30 to 40 percent so as to ensure adequate aeration and to increase water holding capacity by 60 percent or more. Without this added water holding capacity, it is very difficult to get completely through a single sunny, summer day without turfgrass wilting. Peat also contributes a substantial amount of cation exchange and pH buffering capacity. These mean better nutrient retention against leaching and a more stable soil pH. I know of a pure sand green in Wisconsin that requires 20 lbs N/M/season just to maintain satisfactory bentgrass color!

In summary, mixing peat with sand provides a more favorable physical environment for turfgrass and a chemical environment that makes soil fertility easier to control. The net results in the long run are

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8. I've religiously aerified my greens twice a year for the past 20 years. Each time I've removed the cores and backfilled the holes with my own rootzone mix. It's gotten to the point now where the cores are of the same texture as the topdressing I'm hauling back on. Can I stop aerifying now or is there still value to the procedure? Would one time a year be enough? (I'm under a lot of pressure from our members to give it up altogether.)

KENOSHA COUNTY

ANSWER: The answers to your questions lie in the reasons for core aerification and whether or not one or more of these reasons still applies to your greens. Core aerification alleviates soil compaction, minimizes soil layering, crusting and localized dry spots and retards thatch accumulation. You indicate that there is no longer any evidence of soil layering, so we can strike this from

the list. If you rely on wetting agents to handle localized dry spots, the list becomes even shorter. I'm of the opinion that core aerification can be replaced by slicing plus topdressing to control thatch. Assuming you're willing to go this less disruptive route for thatch control, then all that remains to worry about is soil compaction.

It would be foolhardy for me to sit here and decide whether or not compaction is or could become a problem for you should you cease core aerification. All I can do is try to provide information that will help you make this decision.

Research has shown that soil compactability is minimal and essentially constant once the sand content of soil exceeds 60%. Thus, with greens that contain more than 60 percent sand, traffic rather than soil composition controls how much compaction will occur. The minimum traffic is, of course, that arising from maintenance equipment. To this you have to add the number of rounds of golf being played each year. The

heavier the play, the greater the potential for compaction and its associated problems.

I find it difficult to believe that there are any golf greens whose bulk densities do not slowly increase over time due to compaction. The difficulty is deciding at what point compaction requires remedial action. What compaction does is collapse the larger pores in soil. The responses are reductions in water infiltration rates and increases in water holding capacity that eventually provide a nearly continuously moist soil surface on which algae and moss can become established. These, then, are the initial indicators of soil compaction and the need to begin or intensify a core aerification program.

Can one core aerification per year prevent compaction from becoming a problem? Very frankly, I don't have any basis on which to answer this question. Perhaps this is feasible on relatively lightly trafficked USGA type greens. I'd sure like to hear a panel of golf course superintendents discuss this issue sometime!

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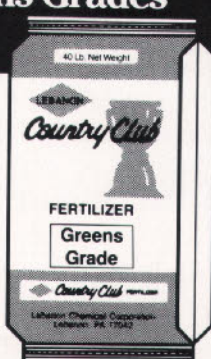
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