Some USGA Putting Green Management Issues

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Putting greens presumably constructed according to USGA recommendations do not always meet expectations. This has happened on even some of the most prestigious courses in the country. Traditionally the blame has been placed on faulty construction. This attitude is starting to change. The feeling is growing that management is a contributing factor, if not the primary reason for some "USGA" putting greens to perform unsatisfactorily.

At the risk of raising the ire of someone (something I seem to have become adept at doing), let me share with you what I see as some "USGA" putting green management issues and where research is urgently needed.

In my opinion, one of the premier issues grows out of how superintendents are responding to club pressures to bring new putting greens into play as quickly as possible. The long term consequences of applying 15 to 30 lb N/M during the grow-in season beg documentation, as do the reasons why superintendents apply this much N in the first place. Is this primarily a response to club pressures or are there actual signs such as turfgrass loss of color that are prompting excessive N rates during grow-in?

Assuming that N application on new putting greens is prompted mainly by poor turfgrass color, then the question arises as to why so much N is needed the first year, only to taper off in a year or two to more typical N rates of 3 to 5 lb/M/season. The most logical explanation one can come up with is that sand-based greens are initially rather sterile environments from the standpoint of microbiological activity. This being the case, there is virtually no biocycling of N. The 20, 30 or even 50 percent of the fertilizer N applied that, in mature greens may be consumed by soil microbes and subsequently slowly released over time, simply whizzes right by the immature turfgrass on new putting greens. This is a research subject that demands immediate attention, first to verify that high grow-in N rates are a consequence of low levels of microbial activity and, if found true, to seek out root zone additives that are effective in quickly building up microbe populations in putting greens.

It is entirely possible that pushing turfgrass growth too hard during grow-in and then immediately striving for speeds of 10 feet or more when the greens are brought into play is a combination of management objectives that leave us with turf intolerant of low levels of stress of any type. These actions may also negate one of the important features of USGA greens and, in so doing, thrust us into a vicious, downward spiral of declining turf quality.

A fundamental principal designed into USGA putting greens is that water will not move from a finer textured soil into a coarser textured soil until the water content in the finer textured soil approaches saturation at the interface with the coarser textured soil. This is why USGA greens consist of a relatively fine-textured root zone mix over a coarser textured sand layer that, in turn, overlies and even coarser-textured gravel. Through this combination of soil texture differences, the amount of water retained in the root zone mix increases with depth and, at least in theory, gives the turfgrass an adequate reserve of water so as to not to suffer moisture stress even on days of exceptionally high transpiration rates.

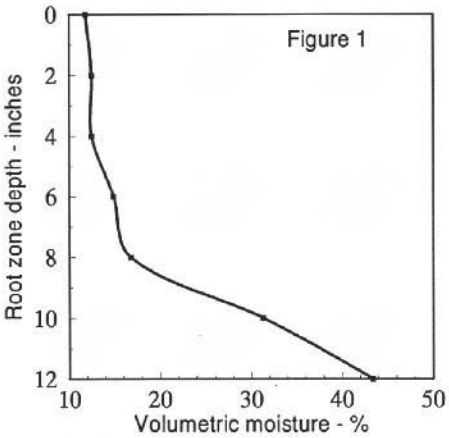
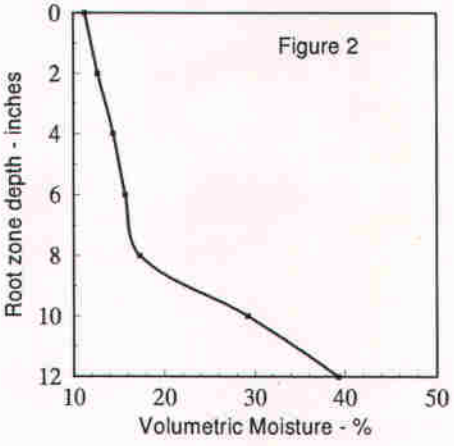


Figure 1 shows the effect of soil texture changes on the amount of water retained in one of our experimental putting greens whose root zone mix was blended from sand and peat that exceed USGA standards. Note carefully the depth at which you first see some increase in water retention (at about 6 inches) and where the effect of a textural change really impacts on the amount of water in the root zone mix (at about 8 inches).

Now let's go back to application of 15 to 30 lb N/M during grow-in and, after grow-in, mowing at something in the range of 0.12 inches to get the desired speed on the green. Under these conditions, is it possible to maintain, let alone ever achieve a turfgrass rooting depth of 6 to 8 inches? I strongly suspect not, and by failing to do so, we lose one of the advantages of USGA greens.

A possible consequence of not getting the depth of rooting required to tap into the moisture reserve of USGA-design greens is compensatory excessive irrigation. This sets up the green for surface algae growth accompanied by an active cyanobacteria (N-fixing) population, a crowding out of the turfgrass, and blacklayer formation.

We badly need research that shows whether or not the picture painted above is correct and what can be done to avoid these sequential events from occurring. Is it primarily a matter of educating people on what is agronomically feasible or, failing this, redesigning our putting greens to close the gap between whatever depth of rooting can be maintained while meeting golfer demands and the depth in the root zone where the amount of water retained increases significantly?



Instead of modifying the depth of the root zone mix, what if we used an organic amendment that does not meet USGA recommendations? In other words, what if we used a peat that had more than 15% ash content? We've done this in our research. The moisture profile of the green is as shown in figure 2. From all appearances, turfgrass rooting down to as little as 4 inches is all that is needed to tap into the increase in moisture retention that is a consequence of the way USGA greens are constructed.

Is it possible that a change in USGA recommendations for the amendment used in putting green construction can result in greens whose moisture retention profiles are more in line with the types of cultural practices superintendents are being pressured into using?

Some detailed nutrient management studies may also generate information that can help superintendents achieve what everyone expects from USGA putting greens. The practice of blending into the root zone mix or surface applying a micronutrient package needs inquiry. We've obtained some evidence that, depending on the amendment employed, phytotoxicites of certain nutrients can at least slow grow-in and turfgrass response to the micronutrients is either nihl or limited to sulfur. Tissue analyses continue to raise questions about the need to periodically apply boron to sand putting greens, particularly those with high pH.

Use of calcareous sand creates two problems. One is difficulty in maintaining adequate levels of available phosphorus early in the life of the greens. Carbonates are capable of adsorbing and rendering unavailable large quantities of phosphate. The other problem arising with use of calcareous sand is a soil test method issue. Except in regions of the U.S. where soils are typically calcareous, the soil test methods employed are designed for use on acid soils. They do not work well with calcareous soils. The general tendency is for these methods to seriously underestimate plant available supplies of phosphorus in the root zone. Management based on such test results could be creating some of the problems we're seeing with USGA greens.

Finally, we have the issue of potassium management in sand putting greens. There is a theoretical basis for the common recommendation that N and K be applied at a 1:1 ratio. Our field and laboratory observations say that this ratio is considerably above where it need be for adequate potassium nutrition. A N:K ratio of 3:2 appears to be more than adequate and even at this ratio soil solution levels of potassium remain extremely high, the result being excessive potassium leaching losses. While this may not seem to be of any great consequence, we always have to remember that when cations such as potassium ions leach, they're accompanied by equivalent amounts of anions. Among these in calcareous soils is the borate ion, which may be why we're seeing declining levels of boron in bentgrass clippings as the season progresses.

Most of the ideas I've presented here are of a speculative nature with very little hard evidence to back them up. Thanks to the financial support of the O.J. Noer Turfgrass Research Foundation, during the forthcoming season we'll be examining in greater depth the influences of root zone amendents on the nutrient dynamics of putting greens. This is but a small part of what I envision as the total need for studies on the effective management of USGA putting greens and possible modification of construction methods, perhaps to the point of regionalizing the recommendations.