

A Rolling Stone . . . and Healthy Turf

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WHAT DO ROCKS and putting greens have in common? Not much you might say, although we always have the local golf cynics who will claim that the greens are as hard as rocks at certain times of the year. More and more commonly, though, putting greens in northern climes experience vegetation growth of the kind normally associated with rock outcroppings, tree trunks and the spaces between patio blocks . . . that is, moss growth.

The number of golf course greens experiencing moss encroachment has risen dramatically in recent years, fed by the unquenchable thirst of some golfers for the golfers' ultimate grail, *fast greens*. In other words, in providing the turf conditions that inspire fast greens, golf course

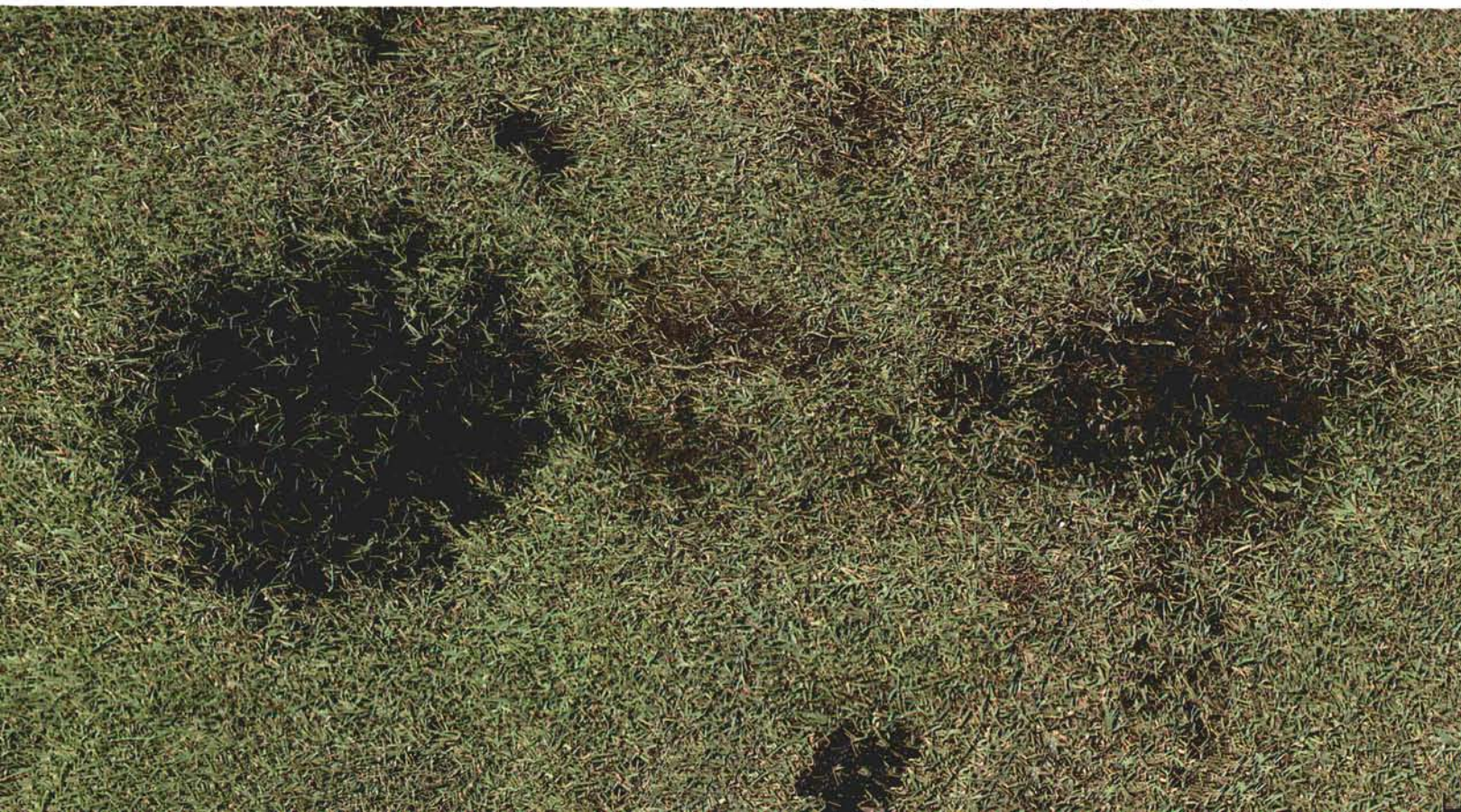
superintendents have unsuspectingly hit upon the formula for promoting moss growth. Perhaps a look at the environmental conditions that favor moss growth will shed more light on this subject.

If you think about where you've seen moss growth occurring, at least one feature is almost always true. That is, such growth usually occurs where nothing else grows well, where there is no competition, and in what most people would probably consider a hostile growing environment. It seems to be able to become established on rocks, tree trunks and other inhospitable locations during cool, damp periods, surviving hot, dry spells by becoming semi-dormant, and resuming growth when weather conditions are again favorable. Moss repro-

duces by emitting spores into the air, which can be carried long distances by the wind. The spores that land on moist or damp substrates can develop into new plants, especially where there is little other competition for space from other plants.

Though there are hundreds of species of moss in nature, only a few are common in turfgrass stands. The most important, particularly where putting greens are concerned, is the group of upright types which commonly occur under dry, infertile conditions. Formerly found primarily on bunker banks and on thin, unirrigated rough mounds, these types of mosses are apparently finding growing conditions on putting greens in some areas.

Moss beginning to die, 12 days after application of iron sulfate.



SINCE MOSS initially establishes itself on substrates with adequate moisture and light, and in the presence of little other competition, it follows that moss encroachment on greens occurs first in the persistently thin, weak areas during the spring and fall, when growing conditions are favorable. Moss is often first seen on high mounds that suffer from repeated scalping and thin areas resulting from triplex ring. As long as other turf areas on the green remain vigorous and reasonably dense, moss will generally remain confined to the persistently weak locations. If turf growth can be improved in the thin areas, the moss will often disappear altogether.

So what does the quest for fast greens have to do with the sudden, increased incidence of moss on greens? To digress for a moment, for many years greens were cut at a height of 3/16 to 1/4 inches, fertilized somewhat heavily at rates of six to ten lbs. N/1,000 square feet per year, and mowed three or four times per week whether they needed it or not. Under these conditions, turf growth was dense and vigorous, affording too much competition for moss to become established. As technology became more sophisticated, as demands for improved playing conditions increased, and as our understanding of turfgrass science improved, cutting heights and fertilization levels were reduced and mowing frequency was increased, but not to the point where moss could become competitive with the turf. Wide use of the Stimpmeter in the mid-1970s, however, and the subsequent over-emphasis on green speeds by some golfers have placed heavy demands on golf course superintendents to produce consistently fast greens, regardless of the consequences.

To satisfy golfer demands for greater and greater green speeds, superintendents have pushed turfgrass science, and the turfgrass plant itself, to the limit. Cutting heights and fertility levels have been reduced, irrigation schedules have been cut back, mowing frequencies have been increased, and the turf is routinely thinned by means of verticutting, brushing, combing, etc. It is not uncommon to find greens today that are cut seven or more times per week at 1/8 inch or less, fertilized at less than one pound N/1,000 square feet per year, double verticut once per week or more, and receiving irrigation schedules designed only to keep the soil firm and the grass alive.

Credit must certainly go to the superintendent who has the skills to keep the turf alive under these conditions, but in

the process of keeping the grass thinned and subdued to such an extent, moss is able to become established and thrive on putting greens. Ultimately, the turf is so lacking in vigor that it can't compete successfully with the moss!

HAVE WE REACHED the limit? Most would agree by these descriptions that we have, and that the pendulum must now begin to swing the other way. The quest for faster greens must now be tempered by the need to maintain adequately vigorous turf to ward off moss invasion and other problems.

Finding the proper balance between cutting heights and fertility levels seems to be the key to solving the moss problem. On experimental plots at Penn State University, moss encroachment was one of the first observations made on plots cut at 1/8 inch or less. Thus, if close cutting heights are desired, then greater amounts of nitrogen fertilizer should be used to maintain a reasonably dense, vigorous stand of turf. Where higher heights are utilized (approaching 3/16 inch), the use of lighter rates of nitrogen fertilizer should be inconsequential as far as moss encroachment is concerned.

On putting greens where moss is already well established, a change in the maintenance program is certainly indicated. If possible, the cutting height should be raised to 3/16 inch and the nitrogen fertilization schedule should be increased to 1/2 to 3/4 pound N/1,000 square feet/growing month, or three to five pounds N/1,000 square feet for the season in northern areas. During this time, regular verticutting, brushing, etc., can be utilized to help keep the greens smooth, true and reasonably fast. Once the moss has been eliminated, the ultimate balance between cutting heights, fertility levels and green speeds will have to be determined.

Interestingly, despite what you often read, pH seems to have little to do with moss establishment. Throughout the northern range of states, moss has been as great a concern on greens measuring seven or eight on the pH scale as it has on greens with a pH of six or below.

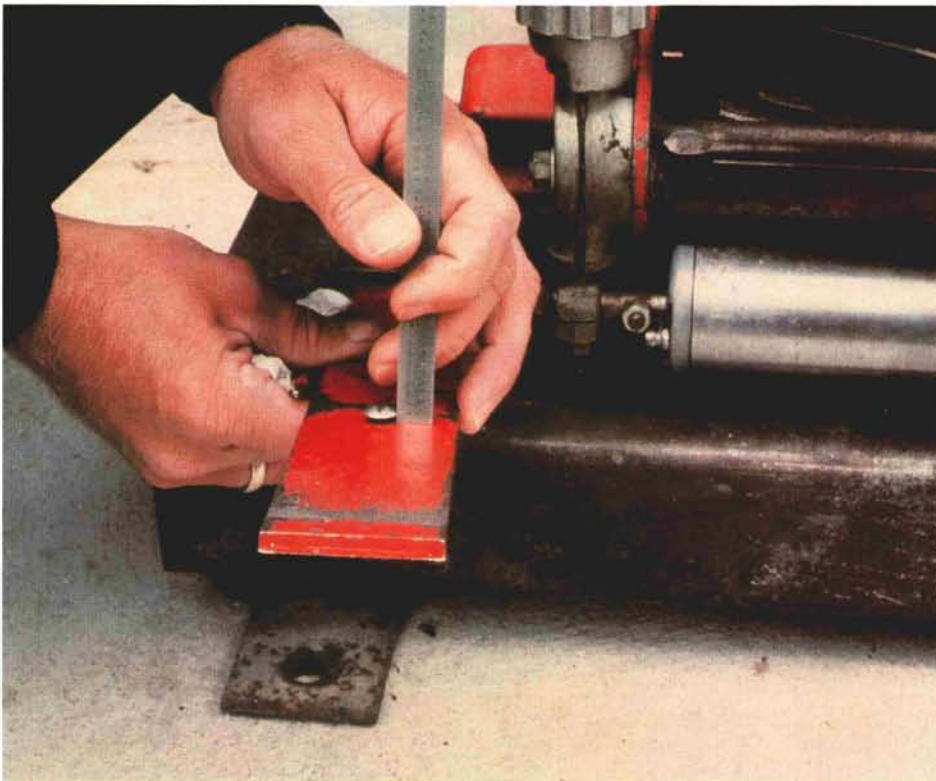
ON GREENS where moss has gained a substantial foothold, chemical treatment may be desirable to suppress the moss while the turf becomes reestablished. Hydrated lime and several commercial moss-killers have been used, but the most consistent results have been obtained with an old standby, iron sulfate. Iron sulfate crystals can be mixed with



sand, for ease of application, and put down at a rate of four pounds iron sulfate/1,000 square feet. Ammonium sulfate is sometimes mixed with the iron sulfate and sand at a rate equivalent to one pound N/1,000 square feet. The mixture should be watered in soon after application. These materials have a scorching effect on the moss, and the ammonium sulfate also provides nitrogen, which encourages the turf to grow and fill in the voids left by the dying moss. A single application of this witches' brew will probably not produce a complete kill of the moss, so several applications may be required over a period of several years. Verticutting the green prior to the application sometimes improves the effectiveness of the treatment. When applied



(Above) Persistent weak areas, such as those resulting from triplex ring, are often the first places where moss makes its stand.



(Left) Consistently close mowing can encourage the establishment of moss.

during the cool fall or early spring weather, the iron sulfate turns the grass a very dark color, but does not actually harm the turf. It would be wise to try this treatment on a small area first, before treating large portions of the greens.

Though iron sulfate treatments for moss control have been successful on many golf courses, moss will almost inevitably return to the greens unless a change is made in the cultural management program. Thus, chemical control is only a short-term solution, with best long-term results occurring only after the proper balance of cutting height, fertilization rates and irrigation is reached. A wise turf manager once said, "a rolling stone, and healthy turf, gather no moss." Amen!