Holes in the Ground

Ian McClements studies aeration and its role in cultural disease suppression, fusarium patch and anthracnose basal rot.

Turfgrass diseases are most common on highly maintained close mown turf, particularly golf greens. As maintenance intensity increases, so diseases become more common. Partly as a result of more intensive maintenance practices, we are now seeing disease pressures increasing on greens, tees and fairways that would have been uncommon five to ten years ago. Changes in climate are also having an impact, for example we have detected an increased incidence in fusarium activity over the past three autumns due to milder, wetter weather conditions.

Disease symptoms are the result of a causal agent (pathogen) attacking a susceptible host which, for the purposes of this discussion, is the turfgrass stand. Disease development thus depends upon three factors:

(a) **The availability of a virulent pathogen, such as a fungus or virus.**
(b) **A susceptible host possessing a growth rate that favours the parasitic activities of the pathogen.**
(c) **A favourable microenvironment, particularly regarding temperature and moisture.**

The most common turfgrass diseases in Ireland, fusarium patch disease and anthracnose, are as a consequence of fungal activity. These fungi are incapable of synthesizing their own food and thus live as saprophytes by feeding on dead plant material or as parasites by infecting and deriving nutrients from living plants. Most of the common fungal pathogens live as saprophytes on dead plant material in the turf profile but also have the ability to become parasites when conditions are favourable. This parasitic activity can only arise when the fungus enters the host plant, through wounds and stomata, and undergoes an incubation period, during which time the fungus colonises and disrupts the normal physiological processes within the host plant.

It is important not to underestimate the importance of environmental conditions and their role in disease development. Excessively wet conditions are particularly favourable for the development of most turfgrass diseases. Films of moisture allow spores to travel freely from infected to uninfected plants and, combined with humid conditions, tend to accelerate fungal growth rates. Fusarium patch disease is extremely prevalent under cool damp, humid conditions.

The maintenance of a healthy, actively growing turfgrass stand under dry conditions will make it much less prone to disease attack and therefore reduce the need to apply plant protection products, itself a costly exercise. There are many management factors that will determine the health and strength of the sward cover on putting greens but the two most important are water management and nutrition.

In my opinion, too much emphasis is placed on nutrition and not enough on water management, drainage and irrigation. Mechanical aeration helps improve the intrinsic drainage characteristics of the soil profiles but unfortunately aeration doesn't sound glamorous nor does it gain favour amongst golfers, who tend to despise holes in their greens, not to mention the superintendent who wants an easy life. Yet the foundations of a solid maintenance programme should be based around a year-round aeration programme that is suited to the nuances of the site, green profiles and levels of traffic on the course. There is no such thing as a "one size fits all" since all courses differ environmentally, architecturally and in terms of construction.

OPERATION

Producing firmer, drier surfaces will help promote a healthier turfgrass stand as well as reducing disease incidence. Water must penetrate the surface first before it can move through the profile to depth, highlighting the importance of surface aeration treatments such as solid or hollow tining. Hollow tining has the greatest influence on surface drainage, improving drainage rates for a five to eight week period with 1/2-5/8 inch (13-16 mm) tines on high sand content greens with the holes backfilled with sand (Carrow 2004).

Solid tining with a 1/4 inch (6 mm) tine will also improve surface drainage rates but its effectiveness is reduced within three to four weeks of the operation. The effectiveness of these aeration treatments declines due to hole closure at the surface as well as the plugging of the holes with new root mass.

Since fusarium patch disease tends to be most prevalent through the autumn period, it is crucial that any coring work completed at the end of the season is done so when weather conditions are suitable for sward recovery and, more importantly, to allow for the integration of top dressing. The application of heavy dressings to fill the tine holes is fraught with difficulties if the weather conditions are poor and the surfaces damp. The smearing of sand on a damp turf surface is a sure recipe for fusarium, more so in Ireland given the alkaline sands that are commonly used. Potentially disruptive hollow coring treatments associated with the subsequent risk of disease again suggest that this work is best completed as early as possible in the autumn period.

The predictions of milder wetter autumns due to climate change may extend the growing season but offer little comfort when contemplating the application of top dressings. A few forward-thinking clubs that complete the work in late August or early September enjoy better surfaces through the autumn as well as quicker recovery immediately following the operation. All in all, less disruption to play and better playing surfaces for longer.

Anthracnose basal rot infection occurs long before symptoms become apparent and control applications of fungicide made once the symptoms are apparent will only protect plants that have yet to be infected. Routine preventative fungicide applications are costly and increase the risk of inducing fungicide resistance. Cultural control strategies represent the first line of defence against this particular disease, a disease that may be increasing due to the greater levels of stress that putting surfaces are being subjected to.

ANTHRACNOSE BASAL

Anthracnose basal rot is a stress indicator; healthy turfgrasses just don't succumb to this particular disease. Aggressive brushing in of top dressing, aeration and other cultivation techniques create stress but also have the potential to create wounds that allow the fungus to enter the plant. Verticutting and close mowing have been shown to increase disease incidence even if the treatments are completed prior to infection (Uddin & Soika 2003). It also seems possible that hollow core aeration is likely to be more damaging to the turfgrass stand than less disruptive forms of aeration such as HydroJecting or solid tining, the latter clearly being preferred during periods of stress or if anthracnose basal rot is already prevalent.

Lack of sufficient summer aeration combined with routine close mowing will enhance the sward's susceptibility to anthracnose basal rot. Sealing off at the surface prevents gaseous exchange resulting in reduced root function and greater stress. This is particularly common during rapid fluctuations in weather conditions and can exacerbate sward recovery from drought stress or drying. It is not uncommon to see midsummer outbreaks of anthracnose misdiagnosed as a consequence of poor nutrition rather than a lack of summer aeration that maintains an open, receptive surface to both air and water.

SUMMARY

There are clearly a number of factors to consider when determining the most appropriate aeration programme to adopt to minimise disease activity but considering the plethora of modern aeration equipment, it should be possible to implement a year-round aeration programme with the minimum of disruption to play. The depth and intensity of aeration treatments should be varied to optimize gaseous exchange and drainage yet, on the basis of the standards demanded today, a monthly treatment through 12 months of the year would not be an unrealistic aeration policy to adopt.

Nonetheless, the nature and intensity of the aeration programme will have a bearing on the strength and health of the sward and should therefore be site specific.

Carrow, R.N. (2004). Surface organic matter in bentgrass greens. USGA Green Section Record 42 (1): 11-15.

Uddin, W. & Soika, M.D. (2003). Effects of turfgrass cultural management practices on severity of anthracnose basal rot in mixed-annual bluegrass and creeping bentgrass greens. American Phytopathological Society Annual Meeting, August 9-13, Charlotte, NC.

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