Pythium problems

With summer fast approaching, Ben Evans looks at the causes of *Pythium* root dysfunction which left unchecked can quickly decimate turf.

Running water transports the mycelium, sporangia, zoospores and oospores over considerable distances. Note how the spread of the disease on this green follows the surface drainage pattern

Diseases of turf caused by *Pythium* species include damping off, foliar blight, grease spot and crown and root rot with each name referring to only one aspect of the wide spectrum and symptoms caused by *Pythium* spp. To date, there are some 45 species of *Pythium* recorded which parasitise turf (Abad et al. 1994).

Pythium root dysfunction is one particular form that is a major problem to golf green managers during the summer and, if left untreated or ignored, can quickly damage large areas of turf. It occurs as small patches of blighted turf that are pale green at first and later turn yellow. They can be 2.5cm to 10cm in size and frequently coalesce to produce large patches. Under warm conditions, with extremely wet soils, the turf appears reddish-brown.

Turf affected by *Pythium* root dysfunction displays a general decline in health and symptoms are often non-specific. Blighted areas are thin, off-colour and grow slowly and the turf does not respond to applications of nitrogen. Infected plants are stunted, with leaves that are narrower than healthy plants.

As air temperatures rise, these plants readily wilt, despite the presence of abundant moisture in the rootzone. Unlike foliar affecting *Pythium* spp., no mycelium is present on the foliage. These symptoms are similar of those experienced with basal rot of anthracnose, however, no acervuli are present.

Upon inspection with a high powered hand lens (18x), the crowns and roots appear severely discoloured, with a reduction in length and number. Infected roots may have lesions or generalised, light-tan to brown discoloration and very few root hairs are seen under a microscope. When samples

Pythium root dysfunction is a debilitating disease which affects a wide range of turf species. The disease can occur at any time of the year, however, it is most commonly associated with wet, warm conditions in summer

are examined in a laboratory, confirmation can be made with the presence and size of oospores on roots - (see photo opposite page).

Pythium spp. is a water mould fungus, which means it can survive under water-logged conditions. The fungus is a facultative parasite where it is a saprophyte in the thatch layer living off the organic matter, however, it quickly becomes pathogenic to plants when favourable conditions occur.

This is ecologically and pathologically advantageous, as the fungus can rapidly infect plant structures which have short periods of high susceptibility. The oospores have thick cell walls and may survive for long periods in the thatch layer.

There are many species of *Pythium* which infect turfgrass. The most common species associated with root dysfunction include P. *aristosporum, P. catenulatum, P. irregulare, P. gramicola, P. dissotocum, P. rostratum, P. vexans* and *P. vanterpooli*. Different species of *Pythium* will be more dominant in some locations compared to others.

CAUSES

Pythium root dysfunction affects a wide range of hosts with all bentgrasses (*Agrostis* spp.) being susceptible. Couch (*Cynodon* spp.), zoysia (*Zoysia* spp.), perennial ryegrass (*Lolium* spp.) and wintergrass (*Poa annua*) are particularly susceptible to *Pythium* root dysfunction while the fine-leaf fescues (*Festuca* spp.) and Kentucky bluegrass (*Poa pratensis*) are least susceptible to infection.

The disease occurs at any time of the year, however, it is typically associated with wet, warm conditions in summer. Occurrence of *Pythium* root dysfunction depends on the environmental conditions, the type of *Pythium* and the host.

Vargas (2005) reports on a predictive model for root dysfunction with maximum air temperatures of 30°C, minimum air temperatures of 20°C and a relative humidity of 90 per cent providing the best conditions for the disease to be most active. Close attention to such an environmental model is economically and environmentally viable, as fungicides can be strategically applied when environmental conditions for the disease are present.

With the advent of hot weather the foliage dies rapidly even though it is not under any high temperature stress. The death of the foliage is due to the infected roots which are dysfunctional and impede the uptake and translocation of water.

Root dysfunction is the inability of what otherwise would appear to be a healthy root system to adequately absorb water and mineral nutrients. Under microscopic examination colonies of *Pythium* are evident in the vascular cylinder and root tip.

The fungi directly penetrate the root hairs, roots and crowns through invading hyphae from zoospores and sporangia. Running water transports the mycelium, sporangia, zoospores and oospores over considerable distances and the infection can occur a long way from where the spores originated.

A common accelerant of *Pythium* root dysfunction is low cutting heights and low soil oxygen levels. Low oxygen levels affect a reduction in host vigour causing premature root death via asphyxiation. Since roots are vital in supplying water in periods of drought, the turf becomes more susceptible to wilting under these conditions.

Bentgrass putting greens are often under stress in summer, which predisposes the turf to pathogen attack. Bentgrass roots shorten naturally as soil temperatures rise in summer and this decline occurs throughout summer until new growth resumes with a drop in temperature in autumn.

Regular irrigation through the summer months provides *Pythium* with sufficient moisture to germinate and move about the soil. At high temperatures, root loss may actually begin close to the crown, as roots emanating from the crown are subject to slightly higher temperature stress than roots growing deeper in the soil. Root loss occurs more in over-watered, undrained soils and this is due to displacement of oxygen by water and a build-up of carbon dioxide in the rootzone.

The effect of constant, low mowing heights predisposes the turf to considerable stress. Putting greens demand low mowing heights to allow for sufficient ball roll and speed which can result in a restriction in root development. The dual accelerants of wet soils and low, aggressive mowing heights predispose putting greens to attack by *Pythium*, which is further compounded by summer stresses.

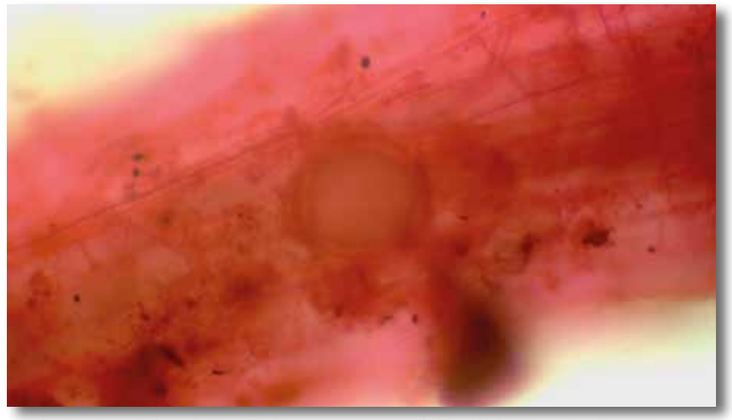
MANAGEMENT

There is no substitute for good soil drainage when controlling *Pythium* root dysfunction, while the management of irrigation is also regarded as key to keeping the disease in check. Any practice that encourages greater root growth is also needed during times when infection can occur.

Because wet soils allow the movement of spores throughout the infected area, adequate surface and subsurface drainage is essential to reduce the opportunity for infection to occur. Any low-lying areas on greens must be identified and re-levelled to allow excess water to drain away.

Compacted soils restrict root growth and limit infiltration and percolation and regular aerification practices are required on greens affected by *Pythium* diseases. Deep coring in spring is vital to encourage new root growth before the onset of summer stress.

Irrigation should be on an as needed basis and irrigating late in the day should be avoided. Watering should be infrequent, wetting the entire rootzone and allowing the soil to dry between watering to encourage greater carbon dioxide displacement.



The distinctive circular pattern of the *Pythium* oospore. When samples are examined in a laboratory, confirmation of *Pythium* can be made with the presence and size of oospores

Settle (2001) found that *Pythium* occurrence in plots irrigated daily was higher than for plots irrigated infrequently. In another experiment, he reported that by reducing irrigation frequency it moderated *Pythium* development in tall fescue (*Festuca arundinacea*).

A slight rise in mowing height and a reduction in mowing frequency is usually beneficial as this allows greater carbohydrate production which will promote greater root growth. Light, walk-behind mowers should be used, as heavier triplex mowers may twist and bruise leaves on the periphery as they turn. All mechanical stresses upon the turf should be delayed until cooler, favourable conditions set in. Topdressing, vertical mowing, double-cutting and rolling should be delayed to reduce stress on an already stressed plant.

Nitrogen fertility should be reduced, as *Pythium* is favoured by lush, dense growth. In an experiment by Gaussoin (1999), newly constructed bentgrass greens were fertilised with an accelerated fertiliser programme (total 6.1 per cent N) compared to a controlled fertiliser programme (total 3.04 per cent N) with severe *Pythium* outbreak occurring in the plots with high nitrogen fertility.

There are several fungicides registered for the control of *Pythium* root dysfunction. Because there are numerous species involved in root dysfunction, different fungicides with different modes of action may be required in an effort to control the disease.

Although the narrow spectrum acylalanines control diseases of *Pythium*, failures do occur with the use of these fungicides. Systemic fungicides such as propamocarb and azoxystrobin are recommended for curative control, but should be watered in to deliver the fungicide to the root system. Sanders (1985) reported excellent control with half-rates of metalaxyl with propamocarb or mancozeb. Fosetyl aluminium is also an excellent fungicide for preventative control.

REFERENCES

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