

DISEASE CONTROL BY NUMBERS

By Dr Karl Danneberger



Dr Karl Danneberger, of Ohio State University, believes a better understanding of the dynamics of turf disease populations, and how they interact with environmental conditions, could enable greenkeepers to achieve better results with Integrated Turf Management programmes.

Turf managers need to get a handle on the complexities of population dynamics to better understand the risk of disease attack, and how they might reduce the regularity and the severity of future attacks.

The basis is that any population will grow faster when there is (a) a large number to start with and (b) conditions are more conducive to development. In the early 19th century, socio-economist, Thomas Malthus, put forward radical models of population growth, introducing the theory of exponential growth (see fig 1), and the catastrophic consequences that would occur when population numbers exceeded the carrying capacity of the natural resources.

While Malthusian theories primarily relate to human population growth, they are directly applicable to disease development in turf. The principle of exponential growth demonstrates that, from a very low population, disease only starts to increase slowly – 2; 4; 8; 16; 32...etc. Once you get to bigger numbers, however, exponential growth of the same sequence really starts to take off – 8192; 16,384; 32,768; 65,536...etc. This potential for growth can be magnified by a huge factor for turf diseases, with the presence

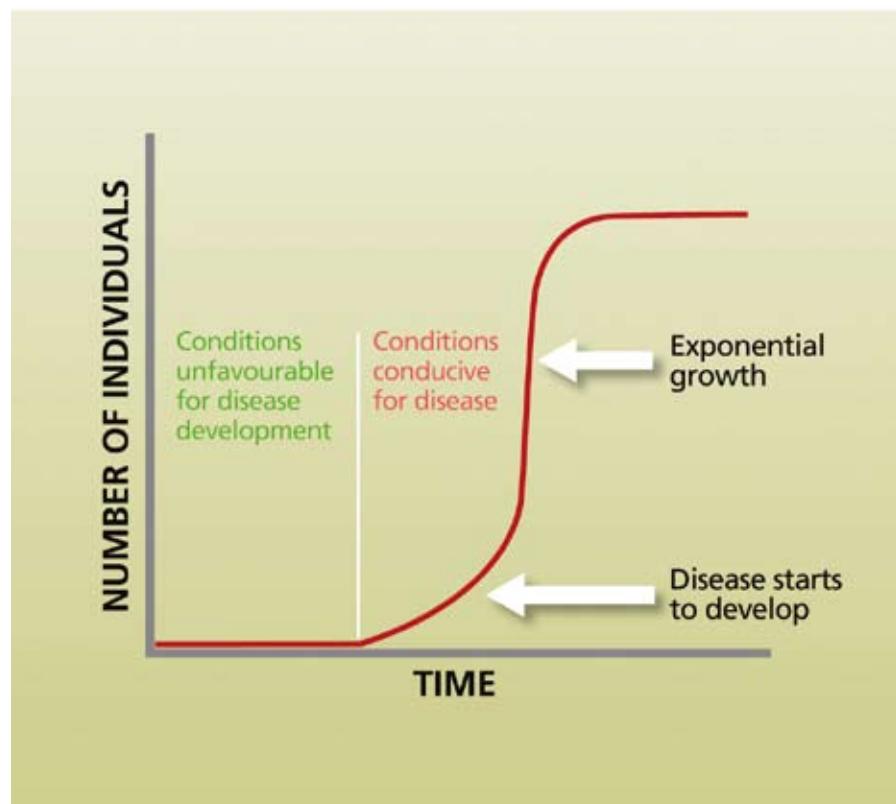


Fig 1. When turf disease populations build to a critical point, any conditions conducive to disease will see exponential growth with serious results.

of millions of spores within the turf just waiting for the right conditions to germinate.

ENVIRONMENTAL CONDITIONS

The speed at which disease goes through its development and multiplication is dictated by the prevailing environmental conditions, including temperature, humidity and the state of the turf as a host for infection. Periods of warm, moist conditions conducive to Fusarium, for example, will see disease move from the invisible latent phase, to the full blown infection much faster and develop quicker - especially on any lush, soft growth where the pathogen thrives.

The Malthusian theory prophesised that when population growth outstripped the natural resources numbers would reach a ceiling, which is just as true with turf disease – resulting in severe damage and turf die back. Investigations have shown turf can withstand a degree of disease presence, particularly when it is actively growing

and replacing any damaged leaf.

The risk is that if conditions turn especially favourable to disease, or the turf comes under any stress that weakens its resources, the potential for the disease to develop rapidly can cause severe damage to the playing surface.

INHOSPITABLE CONDITIONS

The answer is for turf managers to adopt a two-pronged approach. Firstly, to reduce the level of background disease inoculum within the turf sward and, secondly, for turf managers to make conditions as inhospitable to disease as possible, and hence slow down any development. If you can shift the disease growth curve to the right (see fig. 2) the appearance of visible symptoms may be delayed. In fact, if in that time conditions become less favourable for disease, a severe outbreak may be avoided. It also gives greater flexibility in timing to get a preventative fungicide applied to counter the risk.



Factors such as removing thatch, improving drainage and aeration, growing less susceptible cultivars and tailoring fertiliser inputs accurately are all elements of Integrated Turf Management (ITM) that will discourage disease from developing. Adjusting mowing height and using growth regulators to minimise effects of drought and heavy play also have a significant role in reducing stress on the plant its susceptibility to infection.

In an ideal world, this approach could keep disease down to levels where it causes no visible problems. In the reality of modern turf management, the changing climate and the demands of players, however, there are times when conditions will enable infection to break out.

RISK CALCULATION

The challenge for turf managers is knowing when the risk is high and what measures they can take to alleviate the disease pressure. Weather is a key factor in the risk calculation. But turf managers also need to be aware of the specific conditions and stress points that will make their own turf more susceptible to disease.

If you know when disease is likely to attack, then a well timed preventative fungicide will both reduce any existing pathogen in the sward – which is the first major step in knocking back development of the disease – and physically prevent spores germinating.

If you can get the turf through the high risk period until conditions conducive to disease subside, then turf can remain healthy and maintain quality far more effectively.

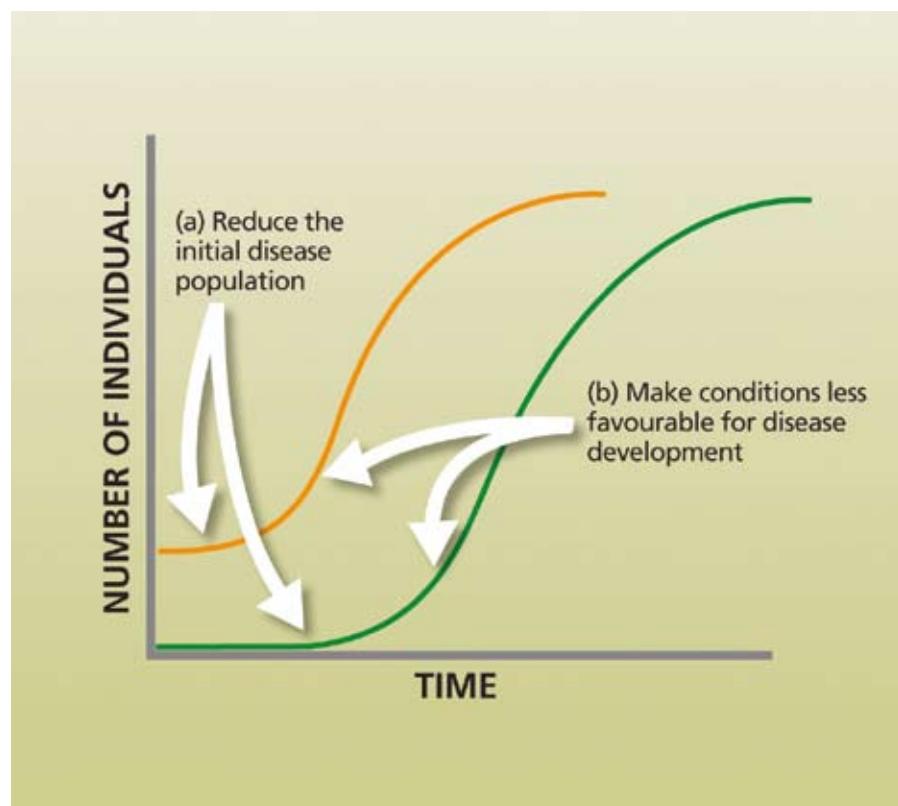
But, if the visible signs of disease have broken out during an attack, it will leave a huge legacy of spores and latent infection in plants, which will be poised to flare up again if conditions allow. Turf managers cannot afford to sit back and relax when risk periods have passed; a curative fungicide may prove invaluable in reducing the level of inoculum within the turf to limit further attacks. And it's the time when all action concentrates on the ITM measures that could reduce the risk of infection breaking out again.

GREENCAST AID IN PREDICTING RISK

"Being able to spot periods of high disease risk in time to take action is key to maintaining the highest turf quality," said Simon Elsworth, of Syngenta.

STRI trials have consistently shown the best results in turf quality are achieved from fungicide application when disease spores have landed on the leaf, but before any symptoms are visible. Well timed curative fungicides at the end of a protracted period of disease risk can also successfully reduce the level of inoculum remaining in the turf and minimise the risk of outbreaks flaring up again so quickly (see fig 3).

The web based turf disease forecasting service, www.greencast.co.uk provides five day advance warning of local disease risks, based on UK disease models and impending weather conditions. Armed with this information, combined



with their own knowledge and experience, turf managers can assess the local risk and time their fungicide applications accordingly.

The STRI trials have shown that using an ITM programme, along with Heritage fungicide applications timed solely according to GreenCast forecast of infection risk, can maintain better turf quality from a reduced number of fungicide applications over the course of the season, compared to routine or curative applications when disease damage has already occurred.

Fig 2 (above)

Reducing initial levels of disease present in the turf and changing environmental conditions to be less favourable for disease can delay the outbreak of any infection.

Fig 3 (below)

Turf managers can use GreenCast disease risk forecasts and information on previous disease attacks to formulate the best fungicide programme to protect turf quality.

1. Apply curative fungicide here to clear up disease and reduce inoculum e.g. DAICONIL WEATHER STIK
4. Short-term medium to low risk poses limited threat – watch out for extended periods of risk
6. Apply preventative fungicide here to protect through late summer risk. Use BANNER MAXX to alternate options

Disease risk for North Berwick, Borders, Scotland

