

Disease Analysis

- How can it work for you?

Dr Kate Entwistle discusses the importance of accurate disease analysis.

There are three main reasons why turf disease analysis is important:

1. Accurate and effective management relies on knowing the cause of the problem.
2. Identification of the cause will enable appropriate fungicide selection (if it are needed)
3. The cause of the problem may not be related to pest or disease activity

Diagnosing the exact cause of damage to amenity grasses can be both challenging and rewarding. Your experience as a turf manager allows many pest and disease problems to be confidently and correctly identified on the course, but there are occasions when confirmation of a tentative identification is needed, or diagnosis is uncertain and a laboratory examination of the problem can be helpful.

INVERTEBRATE PEST, FUNGAL DISEASE OR DISORDER?

Turfgrasses can be damaged by invertebrate pests and by fungal disease but the symptoms that develop on the sward, especially during the early stages of infection, can sometimes be quite similar for both.

In addition, certain disorders (problems not caused by a living organism but by environmental conditions or maintenance problems, e.g. water repellent rootzones, nutrient imbalance, scorch) can also produce symptoms on the turf surface that can resemble both invertebrate pest damage and disease problems.

Some of the terms generally used to describe symptoms of unhealthy turf, are given in the left hand column of Table 1 with descriptions of these terms below. The table gives an indication of when these terms can be used to describe fungal disease problems, invertebrate pest damage and disorders as they develop on amenity turfgrasses.

The '?' symbol in the table means that, for example, certain invertebrate pests can cause spots to develop on some host plants but these symptoms are not common symptoms on amenity turf.



▲ Figure 1

Table 1

Terms used to describe the symptoms of disease, damage and disorder on turfgrasses.

	FUNGI	INVERTEBRATES	DISORDER
Chlorosis	yes	yes	yes
Reddening	yes	yes	yes
Etiolation	yes	?	yes
Necrosis	yes	yes	yes
Watersoaking	yes	no	?
Wilting	yes	yes	yes
Spots	yes	?	yes
Pustules	yes	no	no
Reduced vigour	yes	yes	yes
Dieback	yes	yes	yes

Chlorosis: Fading to pale green/yellow; **Reddening:** Of entire leaf or edge; **Etiolation:** Yellowing/whitening of leaf + lengthening of stem; **Necrosis:** Death, accompanied by darkening or discoloration; **Watersoaking:** Plant tissues that are wet or translucent; **Wilting:** Loss of turgidity; **Spots:** Limited chlorotic/necrotic circular-oval areas on leaf; **Pustules:** Blister-like, usually erumpent; **Reduced vigour:** Reduced healthy growth; **Dieback:** Progressive death of leaves/roots from tip backward

Invertebrate pest problems can, on the whole, be confidently identified on the course if you know where to look for the potential cause of the damage. Depending on the time of the year, the larvae of certain flies or beetles will be found at different depths in the rootzone and the larvae of the frit fly will only be present within the plant itself.

The latter can be quite difficult to see due to their pale colour and small size (approximately 2 mm long) but a x10 hand lens should enable you to see the larvae and also the brown pupae of these flies that also develop between the stem tissues.

In addition, moth caterpillars (cutworms) have been found on courses across the UK but, given the size of these larvae (35-50 mm long), they can be relatively quickly identified (at least to a basic level) using reference textbooks.

With potential disease problems, the process of identification is not as straightforward. Although the majority of diseases on cool-season turfgrasses are known to be caused by fungi, the fungi themselves are microscopic and therefore you are not able to see them in the field.

The exceptions to this are the fruiting bodies or mushrooms of certain basidiomycete fungi that can be seen at certain times of the year and the masses of aerial mycelium that may develop on the sward during conditions of ideal growth. Individual strands of this mycelium are microscopic.

What you will be able to observe on the damaged turf are the symptoms that develop following fungal infection. To complicate the diagnosis of disease problems, the expression of the symptoms will vary depending on the grass affected, the composition of the sward, the height of cut and local environmental conditions.



▲ Figure 2

Fungi produce several structures that can be clearly seen using a microscope, for example the mycelium (the 'body' of the fungus), spores (reproductive propagules), spore producing structures and resting structures.

The spores of the fungus can be regarded as their fingerprint since no two fungi produce exactly the same spore size, shape, colour or structure. Under high magnification (x400 or x1000), the spores of the fungi can be recognised and a name given to the fungus that is present.

Not all fungi produce spores and an example of those that do not are the *Rhizoctonia* species of fungi. Their identification is therefore based on other characteristics. It cannot be over emphasised that the presence of a fungus on an affected turf does not necessarily mean that it is causing the damage.

All swards will be covered by and all rootzones full of, a wide diversity of microorganisms (including fungi) which starts to build up from day one following the construction of any area. Fungal identification and disease identification are two separate things but experience allows any relationship between these two to be confirmed.

Disease identification is based partly on the ability to recognise the characteristics of the fungi that are present and partly on the ability and experience of the pathologist to interpret the findings in the context of



▲ Figure 3

what is happening on the sward. Therefore, what you get out of any turf analysis depends largely on what you, as the turf manager, put in.

SENDING THE RIGHT SAMPLE IS IMPORTANT

Diagnosis of the cause of any damage is essential if effective management is to be realised. In addition, if you want to use plant protection products as part of your integrated management approach, it is necessary that you identify the problem correctly.

If a problem develops on the turf and a sample of dead material is sent to a laboratory for analysis, all that is likely to be found are saprophytic secondary infections that are developing on the decaying plant material.

The best way to ensure that the pathologist has the material they need to identify the cause of the problem, is to send a sample of the turf to the laboratory that has been taken from the edge of the affected area, not the centre.

The reason for this is that most fungal disease problems will start from a central point and develop radially outwards. Since the centre of the affected area was the first part to be infected, it follows that this part of the sward will be the most heavily decayed by secondary, saprophytic infections.

As the disease progresses through the sward, it will pass in to unaffected plants around the edge of the affected area. It is these recently infected plants that are of most use in determining the cause of the damage. If you are in any doubt as to the best way of taking a turf sample for analysis of the problem, speak to the pathologist and they will be able to advise you.

DOES SIZE MATTER?

The size of the turf sample is important for several reasons. A large, hole cutter sized sample will show not only the sward composition but also the grasses in the sward that are affected and the symptoms of the infection on those plants (Figure 1).

Hollow tine cores and small pieces of turf pulled from the sward are not useful for disease identification (Figure 2). There will be very few intact plants and most plants will be separated from the roots when sampled in this way.

This means, for example, that it will not be possible to relate root infections to a specific grass type in a mixed sward and an accurate diagnosis of the turf symptoms cannot be made. In addition, large samples sent with a depth of rootzone will allow additional analysis of the rootzone quality and comments to be made on how this may relate to the symptoms on the sward (Figure 3). This is again not possible with hollow small core samples.

PACK THE SAMPLES CORRECTLY TO AVOID SPOILAGE

Samples should be wrapped tightly in newspaper or paper towel and packed into a padded bag or cardboard box for postage and not sent in plastic bags. It is important to try and keep the sward clean of rootzone and packing the sample tightly will prevent the sward from being contaminated during postage.

The rootzone contains many organisms that will 'spoil' the surface and potentially mask the symptoms of disease (Figure 4). Packing the samples in plastic bags will encourage them to sweat and to speed up saprophytic growth and plant decay (Figure 5).

Samples should then be sent by next day delivery to ensure minimal deterioration of the sward and rapid delivery of the result so that the problem can be dealt with quickly and effectively.

Remember to include your contact details with the turf samples – you would be surprised how many turf cores arrive in the laboratory with no indication of who sent them and from where.

WHAT HAPPENS TO YOUR TURF IN THE LAB

Initially, the intact turf sample is looked at under a dissecting microscope at a magnification of up to 50x. This allows the infected grasses to be identified, the symptoms on the affected plants to be recorded and problems with the roots to be observed.

Small pieces of the affected plant material are then placed on to glass slides and viewed under higher magnification using a compound microscope that can magnify the material up to 1000x. On occasion, the fungus can also be isolated from the disease plant tissues by encouraging it to grow on to artificial nutrient media.

This isolation of the pathogen can allow characteristics of its growth habit to be observed away from the plant material and it can also be encouraged to produce spores that will confirm its identity.

The results of the analysis are issued in a report that states what has been found on the sample. It is only when the findings of the analysis are used in conjunction with the detailed history of the problem that diagnosis of the disease can be confirmed.

FROM FUNGUS IDENTIFICATION TO DISEASE IDENTIFICATION

Some turf disease problems are relatively easy to identify, if you know what you are looking for, but for the majority, information on the history of the problem is essential for an accurate and complete diagnosis.

The important facts that need to be given are (i) when did the symptoms first appear, (ii) what did they look like and how have they developed from then until the present day, (iii) how old is the sward (is it seedling turf or established), (iv) what grasses are present and which are affected, (v) what products were applied during a 10-14 day period prior to the symptoms showing, (vi) what products have been applied to the turf since the problem developed.

ANALYSIS CAN TELL YOU MORE THAN WHAT DISEASE IS PRESENT

Quite often, analysis uncovers evidence of product applications that have not knowingly been made. Suspicions as to the cause of any damage can often be confirmed or discounted, but often the best evidence of problems being related to applications is the presence of 'lines' across the damaged area – invertebrates and fungi don't do lines!



◀ Figure 4



Figure 5 ▶

Certain products 'distort' the growth habit of the plants in the sward and this is clearly visible under the microscope. Granular products can be seen at the base of the sward and descriptions of these can help you to confirm what has and what should have been applied.

I have had cases where I have been told that nothing has been applied to the sward, but analysis shows definite residues on the leaf (possibly fungicide) and intact granular products on the surface.

Accurate identification of the problem does depend largely on receiving all the facts and a pathologist is interested only in being able to help you to identify the cause of any damage.

Analysis of the rootzone can also highlight developing problems of water repellence and reduced water movement through the profile. If these are picked up early, severe problems can be avoided in later months.

Sending turf samples for disease analysis can be seen as another tool available to you in managing a healthy sward. Analysis can confirm the nature of current the problem and allow you to choose the best management option for your course. It can prevent unnecessary product applications and ensure effective use of resources.

A complete analysis can also inform you of potential problems in the rootzone and, where certain diseases are developing as a result of them, allow you to consider alternative cultural approaches to reduce disease incidence or severity.

Turf problems can develop rapidly on any well-managed sward but knowledge, experience, communication and openness can work together to relieve at least some of the stresses inherent in our profession.

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