

# Fighting fungi

**It is that time of year for fungal disease attack – but what do greenkeepers reach for? Clive Pearson details why the attacks occur, and what can be done to prevent and stop them**

**F**ungi are found wherever there is hard, carbon-rich woody organic matter. This could be dead rotting trees in a forest, leaf litter, or plant roots. Mycorrhizal fungi are found naturally in all soils. Techniques to determine their presence usually focus on indirect methods or look at the colonisation of plant roots and are therefore not that reliable. It is difficult to get mycorrhizal fungi to grow outside their natural state, but staining techniques and microscopy have been useful in identifying mycorrhiza from soil and plant samples. Fungi tend to dominate over bacteria and actinomycetes in acid soils as they can tolerate a wide pH range. Fungi can survive in the soil for long periods even through periods of water deficit by living in dead plant roots and/or as spores or fragments of hyphae.

## What do fungi do?

Fungi perform important functions within the soil in relation to nutrient cycling, disease suppression, soil structure and water dynamics, all of which help plants become healthier and more vigorous. They help decompose woody organic matter.

## Management of soil fungi

There are several things you can do to encourage fungi in your soil. To ensure fungi remain in the earth the soil environment must be kept as hospitable as possible. This means there must be enough food (organic matter), suitable host plants (if necessary), water and minimal disturbance of the soil, however, due to the nature of our industry, our good cultural methods we apply totally goes against this.

Soil fungi are microscopic plant-like cells that grow in long threadlike structures or hyphae that make a mass called mycelium. The mycelium absorbs nutrients from the roots it has colonised, surface organic matter or the soil. It produces special hyphae that create the reproductive spores. Some fungi are single celled. Fungi have many different structures but they can act in sim-



ilar ways and thus are not as plant specific in their needs as some soil bacteria such as rhizobia.

## Fungi groups

There are three functional groups of fungi. Decomposers or saprophytic fungi convert dead organic matter into fungal biomass (ie their own bodies), carbon dioxide and organic acids. By consuming the nutrients in the organic matter they play an important role in immobilising and retaining nutrients in the soil. The organic acids they produce as by products help create organic matter that is resistant to degradation.

Mutualists. These fungi develop mutually beneficial relationships with plants. They colonise plant roots where they help the plant to obtain nutrients such as phosphorus from the soil. Their mass hides roots from pests and pathogens, and provides a greater root area through which the plant can obtain nutrients.

Mycorrhizal fungi are perhaps the best known of the mutualists. Mycorrhiza means fungus root, and mycorrhizal fungi grow inside plant roots. Up to 5m of living hyphae of mycorrhizal fungi can be extracted from 1grm of soil.

Pathogens. This group includes the well known fungi such as verticillium, phytophthora, rhizoctonia and pythium. These organisms penetrate the plant and decompose the living tissue, creating a weakened, nutrient deficient plant or

death. The pathogenic fungi is usually the dominant organism in the soil.

Soils with high biodiversity have been shown to suppress soil-borne fungal diseases. Suppression mechanisms include the suite of native organisms out-competing the pathogenic organisms, for food and space, thus physically protecting the roots and providing better nutrition to the plant.

## Increase nutrient uptake

Mycorrhizal fungi are well known for their role in assisting plants in the uptake of phosphorus.

Ectomycorrhizal fungi can benefit plants by promoting root branching and increasing nitrogen, phosphorus and water uptake due to their large surface area and internal cellular mechanisms.

## Improve plant resilience

The sheer size and mass of fungal hyphae helps to decrease plant susceptibility to pests, diseases and drought.

## Improve soil structure

Fungal hyphae bind the soil particles together to create water-stable aggregates which in turn create the pore spaces in the soil that enhance water retention and drainage.

## Reduce fungicide use

Broad-spectrum fungicides are toxic to a range of fungi. Their use will result in a decline in the numbers of beneficial types of fungi. Herbicides are not generally thought to affect fungi, though the removal of some plant types may affect the distribution of different fungi types. Mycorrhizal fungi increase under sports turf because grass includes highly mycorrhizal plants such as grasses and legumes. A low level of mycorrhizal colonisation in plants is also associated with high available phosphorus levels in the soil.

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