If the soil is moist during humid autumn weather, various fungi or toadstools may emerge from the soil. Some of these fungus diseases are parasitic on woody ornamentals, whose roots may be infected, and extend below lawn areas. Most fungal infections in turf have a circular pattern and a characteristic musty, mushroomy smell in the soil surrounding the roots. Few require routine preventative treatments, which may lead to other turf problems.

Factors favouring infection are excessive fertilising, very close mowing, lack of aeration, soil compaction and excessive thatch buildup. Certain weather conditions, such as hot and humid, or cool and moist, allow rapid development of the fungal spores. Some infections are caused by excessive use of nitrogenous fertilisers that create 'soft' turf and thatching.

Damage that may appear to be caused by a fungus disease is not uncommon. It is important to correctly diagnose the cause of injury to avoid mistreatment. Spilled petrol, urine, leaking gas pipes, dry conditions and misuse of fertiliser can produce disease-like symptoms.

**Anthracnose**

Anthracnose disease is favoured by waterlogged, compacted soil conditions and poor drainage that does not encourage turf vigour but weakens turfgrass. Anthracnose is a major disease problem with *Poa annua* but only a minor one with bentgrass. The strategy against anthracnose therefore is to:

- maintain good surface and sub-surface drainage;
- reduce/delete thatch/root mat;
- avoid excessive nitrogen; and
- control/eradicate *Poa annua*.

Where *Poa annua* is the main grass species in the greens, similar cultural practices should still be employed, and where possible changes to the grass species should be made. However, chemical control strategies will be needed.

DEK fungicide is registered for controlling anthracnose in turf. However, trials have shown that control in severe outbreaks is best achieved using a contact fungicide followed shortly by a systemic fungicide. This combination will control a greater number of stages in the life cycle of the anthracnose disease. Best results appear to be with a contact applied separately, which will control spores and setae respectively.

**Brown patch  *Rhizoctonia spp***

*Rhizoctonia solani* causes brown patch of creeping bentgrass and other turfgrass species.

*Rhizoctonia* species have characteristically right-angled branching of the mycelium. The hypha constricts slightly near the septum.

The mycelium of *Rhizoctonia* species varies but tends to be gray to brown in color. Many isolates produce dark, poppy-seedlike microsclerotia.

*Rhizoctonia solani* typically causes reddish stem lesions.

*Rhizoctonia solani* exists as genetically isolated strains that vary in their host range. Genetically related strains are identified by their ability to anastomose (fuse together)

*Rhizoctonia* species are important plant pathogens that cause a variety of diseases.

Rhizoctonia fruit rot develops where tomatoes are in contact with the soil.

Web blight lesions of bean are initiated when basidiospores of *Thanatephorus cucumeris*, the teleomorph of *Rhizoctonia solani*, are splashed up from the soil. A rice hull mulch helps prevent infection by creating a barrier between the soil surface and the bean plants.

Wirestem is a common root rot symptom caused by *Rhizoctonia solani*.

Rhizoctonia root and crown rot of sugar beet.

Rhizoctonia canker of potato.

These impatiens seedlings were destroyed by Rhizoctonia damping-off.

*Rhizoctonia solani* is probably second only to *Pythium* spp. as a cause of damping-off.

Normally associated with hot, humid autumn conditions, but may also occur during spring if temperatures are above 19°C. Cool-season grasses are more prone to infection, but warm season grasses are also affected. The most common symptom is a large, up to 1 metre, brownish, more or less circular patch. These patches may have a smoky black rim in the early stages of infection. The damage spreads rapidly and the turf thins out dramatically. The leaves may have grey, brown or tan irregular shaped lesions. Warm season grasses are attacked at the base of the
leaf sheath where the leaf attaches to the stolon. The result is a basal leaf rot where the affected leaves and shoots can easily be pulled from the stolon.

**CONTROL**  Reduce the application of nitrogenous fertilisers. Use chlorothalonil (125g in 5 litres water / 100 square metres) or triadimefon

Improve surface and subsurface drainage. Selectively prune surrounding trees and shrubs to increase light reaching the grass and improve air circulation.

**Damping off  Pythium spp**
The turf will look pale and in the worst areas plants will collapse in circles about 100mm in diameter. In new plantings or with overseeding, individual plants will often appear wrinkled, twisted or distorted. Roots appear short and brown. In mature turf, prolonged hot, humid weather will cause thinning and a pale yellow appearance. Heavy use of nitrogenous fertilisers can create “soft” turf that is more susceptible to attack.

**CONTROL**  Keep the seed moist but do not over water. Do not use nitrogenous fertiliser at the time of seeding, but use a fertiliser with a high proportion of phosphorus. Drench the soil with furalaxyl (1g per litre water) over an area 70cm x 70cm. Use 200 litres (=200g furalaxyl) per 100 square metres. This is expensive!

**Dollar spot Sclerotinia homeocarpa, Lanzia sp. and Moellerodiscus sp.**
Dollar spot affects small, circular areas of turf, about 50mm on low-cut lawns, but may be larger on grass that is allowed to grow longer. The spots may merge to form large, irregular areas. The dying leaves appear water-soaked, become tan or straw-coloured with a distinct brown border surrounding the spots on the leaves. Cobweb-like threads and white fluffy fungal growths (hyphae or fungal threads) may be seen on affected spots in early morning dew.

Bentgrasses, couchgrasses, bluegrasses, fescues, ryegrasses, and annual bluegrasses are susceptible. The fungus survives in soil as sclerotia, which are tiny, hard, often dark, resting bodies. Occurs during periods of high humidity during cooler spring weather, summer and autumn. Moderate temperatures (15° to 25°C), excess moisture or water stress, and excessive thatch favour dollar spot. Turf deficient in nitrogen tends to develop more dollar spot than turf adequately fertilised.

**Cultural Control:**
Keep thatch to a minimum. Irrigate only when needed to a depth of 100 mm, but do not stress the plants between irrigations. Apply adequate nitrogen. Maintain good air circulation by keeping the turf mowed and pruning barrier trees and shrubs. Composted top dressings may suppress dollar spot.

**CONTROL**  Apply adequate but not excessive nitrogenous fertiliser. Because it most often affects drought-stressed lawns, maintain adequate moisture at the root system with infrequent but thorough irrigation. Reduce the time the foliage remains wet by watering in the early morning and never before midnight. Spray with bitertanol, carbendazim, chlorothalonil, fenarimol (Use with caution on bluegrass species), iprodione, mancozeb, myclobutanil, PCNB, thiophanate, thiram, triadimenol, triadimefon Bayleton, or vinclozolin.

**Dry patch**
A water-repellent condition, common in sandy soils, but also occurring in clay soils, more frequently in older turf.

The fungi involved do not attack living grass but break down the dead grass (thatch) as they obtain nourishment from it. The chemical products formed coat the individual soil particles rendering them hydrophobic (water repellent). Rain and irrigation water cannot penetrate this layer and do not reach the plant roots and the plants suffer from water stress.

**CONTROL**  Relief of symptoms can be obtained by aerating (coring) the area to allow better moisture penetration, and by drenching the turf with a detergent. Agricultural wetters are less likely to cause damage to plants than domestic detergents.

**Fairy rings**
Fairy rings are characterised by a ring of vigorous deep green grass, surrounded by an outer ring in which the grass is brown or almost dead. Mushroom-like growths are often found in the affected area. The fungi do not attack the grass but the fungal threads cement the soil together, preventing or repelling moisture entry. Plant death may result from a lack of water even though adequate moisture may be available for the remaining turf. Fairy ring development can often be traced to buried organic debris. Undecomposed tree roots, wood scraps from construction projects should be removed before establishing a new lawn. Proper watering and management practices that minimise thatch build up may prevent fairy ring development. All the references recommend: Good thatch control, Aerate regularly, Apply wetting agents to prevent hydrophobic conditions. If using fungicides they need to be well drenched into the soil.

**CONTROL**  Spike the area to a depth of 20cm. Use an agricultural wetting agent. Dust copper oxychloride over the affected area. Fungicides that have proven to provide some success in reducing the symptoms are flutolanil, Azoxystrobin, Bitertanol, Triadimenol, Triforine.
Fusarium patch  *Fusarium nivale*

Normally a winter disease, as the fungal spores have a cold requirement where night temperatures are low, between 0° and 16°C. All cool season grasses are affected, but *Poa annua* (wintergrass) is particularly susceptible. Fusarium patch rots the grass to ground level and leaves a slimy look to the yellowed grass. The cobweb-like fungal spores are light pink in colour. The patch is usually about saucer size, and is easily spread by mowing. Heavily fertilised grass is more susceptible than lightly fertilised grass.

**CONTROL**  Application of a potash fertiliser in autumn will help minimise the disease. Don’t over fertilise. Bitertanol, triadimenol, triadimefon or benomyl are appropriate fungicides.

Kikuyu yellows

Caused by wet soil conditions in hot weather. Water movement aids the spread of the fungus over the surface of the soil, causing extensive root rot and a general thinning and yellowing of the kikuyu turf. The affected areas die out, leaving bare patches that are quickly colonised by both broad-leaved and grass weeds.

**CONTROL**  There is no specific treatment, although Benlate provides some control. Improvement in drainage may help.

Helminthosporium type Leaf spot  *Drechslera* spp.

Characterised by saucer sized patches that occur during periods of high summer humidity. Purplish spots with ash coloured centres that develop on leaves and stems are symptoms of leaf spot infections. The turf turns from black to brown to grey, persisting for a long time.

**CONTROL**  Spray with *zineb* or *mancozeb* (120g in 5 litres water) over 100 square metres. Apply nitrogenous fertiliser. If it is necessary to irrigate, do so in the early morning hours to minimise leaf wetness. Make sure the amount of water is adequate to reach the root system. It also helps to raise the mowing height, whether on a putting green or a domestic lawn.

Take-all (Ophiobolus patch)  *Gaeumannomyces graminis* var. *avenae*

This disease of bent grass and cool-season grasses growing in hot areas is caused by the same pathogen that causes ‘take-all’ in wheat. It severely stunts and rots the roots of the plants, which may not be noticed in the cool weather when the damage is occurring, but may become obvious with the onset of hot weather. The grass will suddenly show symptoms of browning and yellowing similar to water stress, but in definite circular rings. The grass on the edges is often a fiery orange colour, while the grass in the centre recovers poorly and is often invaded by weeds.

**CONTROL**  Spray with triadimenol. Use acidifying fertilisers such as sulfate of ammonia. Ensure that drainage is good and that proper watering practices are followed.

Take-all root rot  *Gaeumannomyces graminis* var. *graminis*

A serious disease of Kikuyu and couch grass during warmer sub-tropical periods of high humidity and overcast days. The disease can destroy large areas of turf if left uncontrolled, and has proven to be a difficult disease to control. Management practices, not chemicals, offer the best hope for controlling take-all root rot disease.

Ammonium containing fertilisers (such as ammonium sulphate and urea) are the preferred nitrogen sources. Light monthly applications to maintain moderate growth through the growing season is recommended. Heavy nitrogen application in excess of 5 g/m² may contribute to disease development. Take-all disease in wheat has been linked to a manganese deficiency. Lowering soil pH to 5.5 to 6 will release any manganese present in the soil to the plants. Foliar application of 2.3 g/L (4 teaspoons in a 10 litre bucket of water over 10m²) will correct any deficiency

Red thread  *Laetisaria fuciformis*

Characterised by mottled patches of grass in cool season species, fine fescues, ryegrass, bent and Kentucky bluegrass. Some leaves in the affected area are tan coloured and dead, while others remain uninfected. The fungus is visible as broad pink or pale red threads that have a gelatinous appearance. The colour is similar to that of some match heads. Problems usually occur when fertility levels are low.

**CONTROL**  Best treated by keeping the turf growing vigorously with a good fertiliser program. Treat also with iprodione (60g in 5 litres water) over 100 square metres.

Rust  *Puccinia* spp. and *Uromyces* spp.

Rusts will occur on many grass species and can be very destructive. If the attack is severe the whole sward will take on an orange-red colour. Individual leaves will be covered in pustules of orange coloured spores that darken as they mature. Most common when the weather is hot and humid.

**CONTROL**  Best treated by keeping the turf growing vigorously with a good fertiliser program.
Slime moulds
These fungi are generally in damp shaded places on the surface of decaying organic matter such as dead leaves or rotting logs. For most of their life they exist as jelly-like blobs that may grow to several centimetres across and move very slowly as they feed on spores, microscopic organisms and small pieces of plant material. They are noticed only when they move up on to leaves of grass to produce spores in late spring or autumn after prolonged wet weather. The fungal mass develops into black spore containers on white stalks 1-2mm long. Occur during, warm, humid conditions. May kill the grass by blocking out light.

**CONTROL** Poor soil drainage can contribute to the problem, so aerating can help. Not usually necessary as the fungi do not feed on living material. Dusting with copper oxychloride or Lawn B (Cloverkill) is sometimes effective. Mancozeb or zineb give some control

Spring dead spot  *Leptospharia spp*
A root rot disease specific to couch and especially severe in South African couch (*Cynodon transvaalensis*) and its cultivars, such as Santa Ana, Tifdwarf. The symptoms of this disease show up in winter as large dead patches shaped a bit like a doughnut, about 30-50cm in diameter. They look bleached and white, compared to the straw colour of the dormant couch. The fungus responsible is a soil inhabitant that damages the roots in late summer and autumn, although the symptoms are not visible until spring, when the grass fails to start growing after winter dormancy. Close inspection reveals that the roots, stolons and rhizomes in the infected patches exhibit a brown to black rot.

**CONTROL** is effected by drenching the areas with bitertanol on a regular monthly basis from late summer until the following spring. or thiram at double the label rate (ineffective at the recommended label rate). Improved cultural practices minimise the effect of Spring Dead Spot. Raise the mowing height before April. Higher mowing result in higher levels of carbohydrate reserves in roots and crowns and provide thermal insulation from winter cold. One or two aggressive corings during the summer will increase juvenile growth and tiller production. Minimise thatch. Avoid late-season nitrogen applications. Make the last nitrogen application in February so the turf runs out of available nitrogen around April or May. Maintain adequate potassium fertility. Even a slight deficiency can contribute to more severe SDS, an application of 3-4 g/m² in late autumn is good practice

Turf nematodes
Nematodes cause stunting of grass roots and produce a distinct digitate pattern of branching in the roots. Damaged roots often become heavily affected by fungi and are subject to water stress. Not normally a problem in Adelaide, but they affect warm season grasses, especially couch grasses.

**CONTROL** Apply fenamiphos as evenly as possible

Moss
Algae and moss appear as a black or green slime on the soil, developing in situations where there is little or no grass cover. Treatment should be aimed at encouraging the grass to cover the area, rather than rely on chemical control. Moss killers, many of which are based on iron sulfate, will work, but moss is a symptom of a neglected or badly constructed lawn. Common causes for moss infestations are an accumulation of thatch, underfeeding, pH too high, shade and soil compaction.

**CONTROL** Core the lawn and apply Top Lawn Mixture B. Selectively prune surrounding trees and shrubs to increase light reaching the grass and improve air circulation. Less frequent, deeper watering allows surface of the soil to dry

**FUNGICIDES**

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Product name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>benomyl</td>
<td>Benlate, Tersan</td>
<td>broad spectrum</td>
</tr>
<tr>
<td>bitertanol</td>
<td>Baycor Turf</td>
<td>broad spectrum, contact, curative and preventative action</td>
</tr>
<tr>
<td>chlorothalonil</td>
<td>Bravo, Daconil</td>
<td></td>
</tr>
<tr>
<td>copper oxychloride</td>
<td>Coppertox, Cop-ox</td>
<td>useful for a number of fungal diseases</td>
</tr>
<tr>
<td>furalaxyl</td>
<td>Fongard</td>
<td>control of <em>Phytophthora</em> and <em>Pythium</em></td>
</tr>
<tr>
<td>iprodione</td>
<td>Rovral</td>
<td></td>
</tr>
<tr>
<td>mancozeb</td>
<td>Dithane, Manzate</td>
<td></td>
</tr>
<tr>
<td>thiram</td>
<td>Thirospray</td>
<td></td>
</tr>
<tr>
<td>triadimefon</td>
<td>Bayleton</td>
<td></td>
</tr>
<tr>
<td>triadimenol</td>
<td>Bayfidan Turf</td>
<td>broad spectrum, systemic</td>
</tr>
<tr>
<td>zineb</td>
<td>Zineb, Curit</td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES:
Adelaide & Wallaroo Fertilisers Ltd (now Pivot Australia) *Sowing and growing lawns*
Bayer Turf care product guide MSD7223/690
McMAUGH J, 1985. *What garden pest or disease is that.* Lansdowne Press