Different years result in different disease problems. 1996 was relatively cool and wet in most northern areas, and the diseases reflected that. The season began with a period of recovery from the severe snow mold in many areas. Deep, lasting snows

In the fall of 1995, long lasting snow fell on turfgrass that had not yet gone dormant in many sections of the Northeast. This created perfect conditions for snow mold fungi. These fungi prefer moist conditions and refrigerator temperatures. Two different diseases are commonly found: *Typhula* blight (also known as gray snow mold) and *Fusarium* patch (also known as pink snow mold), but both diseases are more severe when snow covers green grass in moist soil for many weeks, especially where late-season, excess nitrogen applications have prolonged the growth of the grass.

**Snow molds are different**
- *Fusarium* patch, in particular, is more severe at high soil pH. Fall lime applications can exacerbate this disease. *Fusarium* patch is also different from *Typhula* blight in that it is more likely to result in crown infection and the death of turfgrass plants. It can also become active with the first cool, wet weather of fall and last throughout cool, rainy springs even in the absence of snow. In the absence of snow, the primary symptom of *Fusarium* patch is small, greasy patches similar to those caused by *Pythium* blight in the heat of summer. The fungus can easily be streaked by mowers causing added injury and confusing symptoms.

**Tip blight not severe**

A stress disease most commonly observed in hot weather appeared in early summer at our research field plots in 1996. *Leptosphaerulina* blight is usually a minor tip blight which is mowed away once drier weather conditions prevail. The prolonged wet weather in early summer 1996 seemed to favor it, leaving some bentgrass areas with a reddish look similar to anthracnose.

**Anthracnose at low heights**

Anthracnose was by far the most common complaint in the Northeast in the summer of 1996. This stress disease is common when excessive moisture combines with factors which slow the growth of the turfgrass. Although it is more common on annual bluegrass, it can also be found on bentgrass especially at low mowing heights and in compacted, nutrient-deficient soils. Superintendents who skipped spring core aeration reported increased problems with the disease, so they should consider spring coring.

Anthracnose is probably one of the most misdiagnosed turfgrass diseases. A certain diagnosis requires observation of the tiny hair-like structures (setae) produced in the fruiting bodies of the causal fungus. In recent years, the crown rot form of anthracnose has become more common. This is probably related to the fact that stresses continue to increase in modern golf turf with longer playing seasons, greater number of rounds, lower mowing heights and increased compaction. Even when a fungicide stops the growth of the fungus, recovery will be slow, if it occurs at all.

**Red thread may persist**

The fungus that causes red thread prefers cool conditions, but can remain active throughout the year at moderate temperatures in prolonged wet weather. In past years, applications of nitrogen fertilizer seemed to reduce the disease
Gray leaf spot in warm temps

The hot, stressful weather in the summer of 1995 led to the destruction of perennial ryegrass fairways in the mid-Atlantic states. *Pyricularia grisea* causes gray leaf spot of both ryegrass and tall fescue in hot weather and appears to be a new threat to these turfgrasses.

Gray leaf spot was reported in Kentucky in late August of 1996, but the relatively cool season probably prevented major epidemics. Turfgrass managers should learn more about this potentially damaging disease if 1997 brings hotter weather.

Rust in high, moist turf

The last weeks of August in the Northeast brought a surprising dry spell of weather which slowed turf growth. Even though there was little rainfall, some days were foggy and moist for many hours. This resulted in severe rust outbreaks, especially in lawns and other turf areas that are not mowed frequently.

Rust is easily diagnosed by the presence of pustules of

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**FOLIAR DISEASES- CULTURAL AND CHEMICAL MANAGEMENT**

These diseases all begin with infection of the leaf blades. Minimize the time water remains on leaf blades through dew removal, proper irrigation timing, and pruning of landscape plants for air movement.

*Diseases generally worse under LOW nitrogen conditions*

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cultural control</th>
<th>Fungicidal control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracnose</td>
<td>Reduce compaction, raise mowing height.</td>
<td>aoxystrobin, chlorothalonil, cyproconazole, fenarimol, propiconazole, thiophanate-methyl, triadimefon</td>
</tr>
<tr>
<td>Dollar spot</td>
<td>Reduce compaction, raise mowing height.</td>
<td>mancozeb, mane, myclobutanil, PCNB, propiconazole, thiophanate-methyl, thiram, triadimefon, vinclozolin</td>
</tr>
<tr>
<td>Red thread</td>
<td>Reduce compaction, irrigate.</td>
<td>aoxystrobin, chlorothalonil, cyproconazole, fenarimol, flutolanil, iprodione, mancozeb, mane, propiconazole, thiophanate-methyl, triadimefon, vinclozolin</td>
</tr>
<tr>
<td>Rust</td>
<td>Reduce compaction, irrigate.</td>
<td>chlorothalonil, cyproconazole, mancozeb, mane, myclobutanil, propiconazole, triadimefon</td>
</tr>
</tbody>
</table>

*Diseases generally worse under HIGH nitrogen conditions*

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cultural control</th>
<th>Fungicidal control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown patch</td>
<td>Raise mowing height.</td>
<td>aoxystrobin, captan, chlorothalonil, cyproconazole, fenarimol, flutolanil, iprodione, mancozeb, mane, myclobutanil, PCNB, propiconazole, thiophanate-methyl, thiram, triadimefon, vinclozolin</td>
</tr>
<tr>
<td>Snow molds:</td>
<td>Allow turf to go dormant, remove snow where practical, avoid lime apps where fusarium is a problem.</td>
<td>for fusarium only: mancozeb, thiophanate-methyl typhula blight only: chloroneb; flutolanil; both snow molds: aoxystrobin, chlorothalonil, cyproconazole, fenarimol, iprodione, PCNB, propiconazole, thiophanate-methyl, thiram, triadimefon, vinclozolin</td>
</tr>
<tr>
<td>Fusarium patch (pink)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typhula blight (gray)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bipolaris and Drechslera</td>
<td>Mow at height recommended for turf species.</td>
<td>aoxystrobin, captan, chlorothalonil, iprodione, mancozeb, mane, myclobutanil, PCNB, propiconazole</td>
</tr>
<tr>
<td>Leaf spots</td>
<td>Avoid surface drainage; do not mow or irrigate when disease is active.</td>
<td>aoxystrobin, chlorone, etradiazole, fosetyl-AL, mefenoxam, metalaxyl, propamocarb</td>
</tr>
<tr>
<td>Yellow patch (cool-season brown patch)</td>
<td>Improve drainage.</td>
<td>aoxystrobin, flutolanil, propiconazole</td>
</tr>
</tbody>
</table>
powdery orange spores. These begin to show up 10 to 14 days after spores have infected the leaf blades. This explains why rust is uncommon on frequently mowed turf. The leaf blades are mowed away before the rust has a chance to develop. Rust may weaken plants, but rarely kills them. In northern areas, the spores will not survive winter, so the turf should begin spring with a fresh start.

**Fungicide news**

Some new fungicides and new formulations of fungicides are available for the coming season. When new formulations are produced, it is important to read the revised labels carefully for new application recommendations and new rates. For example, Daconil Weather Stik is formulated at a 6F rate, which has a higher concentration of the active ingredient, chlorothalonil, than Daconil 2787 which is a 4F.

There are now five DMI (sterol-inhibitor) fungicides available: cyproconazole (Sentinel), fenarimol (Rubigan), myclobutanil (Eagle), propiconazole (Banner), and triadimefon (Bayleton). It is important to know the chemical group or family of all fungicides you use. Repeated use of fungicides from the same chemical group can result in fungicide resistance. Banner Maxx and Subdue Maxx have been reformulated from emulsifiable concentrates, which are oil-based, to microemulsion concentrates. Banner Maxx has some new diseases added to its label including take-all patch. Subdue Maxx has a new active ingredient, mefenoxam, which is an isomer of the previous ingredient metalaxyl. Chipco Aliette Signature (fosetyl-Al) has also been reformulated to allow more compatible tank-mixing with other fungicides.

Azoxystrobin (Heritage) is a newly registered fungicide with a different chemistry from existing fungicides. University research reports have shown excellent control of many important turfgrass diseases including anthracnose, brown patch, red thread, snow molds, and summer patch. Heritage also has activity against Pythium blight which is unusual in a broad-spectrum fungicide. Turf managers should be aware that this fungicide, like many current products, has potential for resistance with repeated use and does not control dollar spot. At this time, it is registered only for golf courses, not lawn care.  

**Aeration, drainage a good defense**

It is always difficult to predict potential disease problems for the coming season. Many midwestern states have had record snowfall, while the Northwest has received record-breaking storms of rain and snow. In many parts of the
Northeast, it has been a mild, almost non-existent winter. The groundhogs in those areas seem to be right in their predictions for an early spring. If the weather warms up quickly, we may see early problems with summer diseases and more time for potential heat stress. Some of our most difficult diseases to control are stress-related. Concentrate on spring aeration programs and improving drainage where it is needed. Try to give the turf optimal growing conditions to help it withstand any potential weather-related stresses that may come later on. **LM**

**FUNGICIDE ACTIVE INGREDIENTS AND EXAMPLE TRADE**

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Trade names</th>
</tr>
</thead>
<tbody>
<tr>
<td>azoxystrobin</td>
<td>Heritage (50WG)</td>
</tr>
<tr>
<td>captain</td>
<td>Captan WP, Captec</td>
</tr>
<tr>
<td>chloroneb</td>
<td>Proturf Fungicide V (6.25 G), Teremec SP (65WP), Terraneb SP</td>
</tr>
<tr>
<td>chlorothalonil</td>
<td>Chlorothalonil, Daconil 2787 (4F), Daconil Ultrex (82.5WDG), Daconil Weather Stik (6F), Echo (500F, 75WDG), Manicure (4F, DG), Thalonil (90DG)</td>
</tr>
<tr>
<td>cyproconazole</td>
<td>Sentinel (40WG)</td>
</tr>
<tr>
<td>etradiazole</td>
<td>Koban (30WP, 1.3G), Terrazole (35WP)</td>
</tr>
<tr>
<td>fenarimol</td>
<td>Rubigan (1A5)</td>
</tr>
<tr>
<td>fenarimol + chlorothalonil</td>
<td>Twosome (4F)</td>
</tr>
<tr>
<td>flutolanil</td>
<td>ProStar (50WP)</td>
</tr>
<tr>
<td>flutolanil + triadimefon</td>
<td>ProStar Plus (50WP)</td>
</tr>
<tr>
<td>fosetyl-al</td>
<td>Chipco Aliette Signature (80WDG), Prodigy (80WDG)</td>
</tr>
<tr>
<td>iprodione</td>
<td>Chipco 26019 (50WG, 2F), Proturf Fungicide X (1.3G)</td>
</tr>
<tr>
<td>mancozeb</td>
<td>Dithane T/O (75WP), Dithane (WF, 4F), Fore T/O (80WP, 4F), Protect T/O (80WP, WSB)</td>
</tr>
<tr>
<td>maneb</td>
<td>Maneb Plus Zinc (4F), Maneb (75DF)</td>
</tr>
<tr>
<td>mefenoxam</td>
<td>Subdue Maxx (2MEC)</td>
</tr>
<tr>
<td>metalaxyl</td>
<td>Proturf Pythium Control (1.2G)</td>
</tr>
<tr>
<td>metalaxyl + mancozeb</td>
<td>Pace</td>
</tr>
<tr>
<td>myclobutanil</td>
<td>Eagle (40WSP)</td>
</tr>
<tr>
<td>PCNB</td>
<td>Defend (4F, 10G, 75WP), Engage, Lesco PCNB (10G), Penstar (75WP, 10G), Penstar FLO, Revere (75DG), Terraclor (75WP), Turfcide (400F, 10G)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Trade names</th>
</tr>
</thead>
<tbody>
<tr>
<td>propamocarb</td>
<td>Banol (6L)</td>
</tr>
<tr>
<td>propiconazole</td>
<td>Banner Maxx (1.24MEC), Banner (41.8GL)</td>
</tr>
<tr>
<td>thiophanate-methyl</td>
<td>Cleary's 3336 (50W, WSP, 4.5F), Fungo Flo, Fungo (50WSB), Proturf Systemic Fungicide (2.3G), Systec 1998 (4.5F)</td>
</tr>
<tr>
<td>thiophanate-methyl + chlorothalonil</td>
<td>Consyst (66WDG)</td>
</tr>
<tr>
<td>thiophanate-methyl + chloroneb</td>
<td>Proturf Fungicide IX</td>
</tr>
<tr>
<td>thiophanate-methyl + iprodione</td>
<td>Proturf Fluid Fungicide</td>
</tr>
<tr>
<td>thiophanate-methyl + mancozeb</td>
<td>Duosan (80WP, 80WSP)</td>
</tr>
<tr>
<td>thiram</td>
<td>Lesco Thiram (75WDG), Spotrete (75WDG, 4F)</td>
</tr>
<tr>
<td>thiram + triadimefon</td>
<td>Proturf Fluid Fungicide III</td>
</tr>
<tr>
<td>triadimefon</td>
<td>Bayleton (25DF, 1G), Accost (1G)</td>
</tr>
<tr>
<td>triadimefon + metalaxyl</td>
<td>Proturf Fluid Fungicide II</td>
</tr>
<tr>
<td>vinclozolin</td>
<td>Curalan (50DF, 4F), Touche (4F), Vorlan (50DF, 4F)</td>
</tr>
</tbody>
</table>

Note: trade names of products commonly available in the Northeast are included for convenience. No endorsement is implied, nor is discrimination intended against similar materials. Use of certain fungicides is restricted in certain states or areas. Each product has specific use rates and intervals. Read and follow label specifications.

**SOURCE: DR. SCHUMANN**
Fungal diseases in turf pose significant problems and have economic importance. Before beginning your warm-season disease control program, review the following list of the various symptoms.

By JANELL STEVENS JOHNK, PH.D.

Diseases play a major role in determining the success or failure of turfgrass. Early recognition and proper identification are essential for successful disease management.

Proper variety selection, fertilization, site maintenance, and cultural practices reduce disease pressure and increase the effectiveness of pesticide applications. Pesticides alone cannot control most diseases. No amount of pesticide controls plant disease if good cultural practices aren’t in place.

Too often, a single disease is dealt with, while a single plant species or cultivar may be attacked by many diseases throughout its growing season. Before accepting recommendations of cultivars, cultural practices, and pesticides, consider the impact these recommendations could have on other diseases occurring throughout the season.

Symptoms, factors, strategies

Fungal diseases are the most significant turfgrass diseases and have economic importance due to the threat they pose to large areas of turfgrass.

The following list of turfgrass diseases outlines symptoms, environmental factors favoring disease and management strategies for the most common southern turfgrass diseases.
Augustinegrass as tiny brown spots with purplish margins. As spots enlarge, they become diamond shaped. Lesions may completely consume leaves and girdle stolons resulting in a scorched appearance. Gray leaf spot occurs during hot humid weather. It is more severe in newly-established turf and in shady locations with poor air circulation.

**Management strategies:**
1) Irrigate early in the morning to allow foliage to dry quickly.
2) Avoid excessive nitrogen applications during hot, humid weather.

**Rust (Puccinia spp.)**
Rust infects zoysiagrass and overseeded ryegrass. From a distance, affected turf has a yellowish to reddish-brown appearance. Red, black, orange, or yellow pustules are found on diseased leaves. Rust damages poorly-nourished turf or turf grown under low mowing heights. Prolonged periods of overcast weather or shaded environments favor disease. Generally, rust-affected turf needs no treatment and can be effectively maintained with good cultural practices.

**Management strategies**
1) Maintain balanced fertility.
2) Deep, infrequent irrigation.
3) Increase mowing height and frequency.

**Helminthosporium complex; Leaf spot / melting out (Bipolaris sorokiniana, Exereohilum rostrata)**
*Bipolaris sorokiniana* causes leaf spots and crown and root rots of bermudagrass and zoysiagrass. In spring and fall, distinctive purplish-brown spots with tan centers appear on older leaves. During warm, wet weather the spots increase in size to encompass the entire width of the blade, causing a dieback from the tip. Disease progresses to crown and root rots during the summer. "Melting out," spots with purplish margins can be seen on the stolons.

*Exereohilum rostrata* causes a leaf spot on St. Augustinegrass and bermudagrass. However, these diseases are rarely severe and can be managed culturally.

**Management strategies**
1) Use resistant varieties.
2) Mow frequently at proper heights to reduce leaf spot phase.
3) Avoid high nitrogen fertilization.
4) These fungi produce many spores when thatch is frequently wet; irrigate deeply, infrequently.

**Pythium-cottony blight, grease spot, crown and root rot (Pythium spp.)**
While more of a problem on cool-season grasses, *Pythium* spp. also may cause root rots in warm season grasses. Root-infecting *Pythium* spp. generally are more severe in shaded areas, low spots or near surface water where air circulation is poor. Root rots occur during or following long cool periods when soils are excessively wet.

**Management strategies**
1) Maintain balanced fertility.
2) Prevent thatch build-up.
3) Avoid overwatering.
4) Maintain balanced fertility.
5) Preventive fungicide applications may slow disease development.

**Take-all Root Rot (Patch) (Gaeumannomyces spp.)**
Most warm-season grasses are susceptible to take-all root rot, sometimes called bermudagrass decline which is generally active during the rainy season. However, symptoms often don't appear until the affected turf experiences stress, high temperatures, dry weather. Patches are irregularly shaped and plants in affected areas have short, rotted root systems. Plants are easily pulled or lifted from the ground. Nodes and stolons become infected and show a brownish discoloration and rotting.

**Management strategies**
1) Improve drainage.
2) Prevent thatch build-up.
3) Avoid overwatering.
4) Maintain balanced fertility.
5) Preventive fungicide applications may slow disease development.

**Spring dead spot**
(Spring dead spot (Leptosphaeria spp., Gaeumannomyces graminis var. graminis, Ophiophaerella herpotricha)
Spring dead spot occurs on bermudagrass grown in transition zones. Hybrid bermudas are more susceptible than other types. The longer the period of winter dormancy and the colder the temperature, the more damage spring dead spot can cause. Circular patches of bleached, dead grass appear as the turf breaks dormancy in the spring. Patches may range from a few inches to several feet in diameter. Turf is sunken in affected areas. Patches may reappear and expand over the years.

**Management strategies**
1) Avoid excess nitrogen applications, especially in the fall just prior to dormancy.
2) Manage thatch and promote vigorous root growth.
3) Few fungicides are labeled for this disease and may be of limited use in certain states.

**Fairy rings**
 caused by various soil-inhabiting fungi)
Fairy rings are caused by many fungi that grow in thatch and soil. They may appear as circles or arcs of dark green, fast-growing grass. Nutrients are released as fungi consume dead organic matter. Fairy rings also may appear as circles or arcs of dead grass. The massive build-up of fungal mycelium forms a hydrophobic barrier preventing water infiltration. This causes the turf to suffer from drought stress. Fairy rings may persist and increase in size over many years.

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**Management strategies**
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2) Prevent thatch build-up.
3) Avoid overwatering.
4) Maintain balanced fertility.
5) Preventive fungicide applications may slow disease development.
Rust in a zoysiagrass lawn. The disease thrives in under-nourished turf.

**Disease Control Guide**

Pression is the most practical management approach.

**Management strategies**

1. Core aeration, deep watering, and proper fertilization make symptoms less obvious.
2. Use wetting agents to improve water infiltration.
3. Remove soil to a depth of 18 inches and replace with fresh soil or use a soil fumigant to sterilize the soil.

**Nematodes**

Nematodes are microscopic unsegmented roundworms. A small group of nematodes can damage turfgrasses. They feed on turfgrasses by puncturing plant cells with a hollow, tube-like structure, and then injecting enzymes into the cells. Nematodes can damage turfgrasses by themselves, or in conjunction with an infectious fungus.

Above-ground symptoms of nematode damage include:

- wilting under moderate moisture stress;
- slow recovery of wilted turf after rain or irrigation;
- thinning or gradual decline of turf.

Because nematodes are not distributed evenly in soils, damage rarely appears in uniform areas. Roots damaged by nematodes are usually short and dark colored, with few lateral or ‘feeder’ roots. They may be rotted because of secondary fungal activity. Sometimes the root tip is swollen. The damaged root system will not hold soil together when a core or plug is lifted.

**Management strategies**

1. Use clean seed or sod and topdressing soil.
2. Clean equipment of all dirt, especially when moving from an area infested with nematodes.
3. Irrigate more frequently to compensate for reduced root systems.
4. Nematicides reduce nematode numbers but don’t completely eradicate them from the soil. 

The author is extension plant pathologist, Texas A&M University at Dallas. Watch for her article on disease control in warm-season ornamentals in the June 1997 issue.

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Barry Carter
Golf Course Superintendent
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San Antonio, TX

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