A3187

Turf Diseases of the Great Lakes Region

Identification and control guide for golf courses, parks, and lawns

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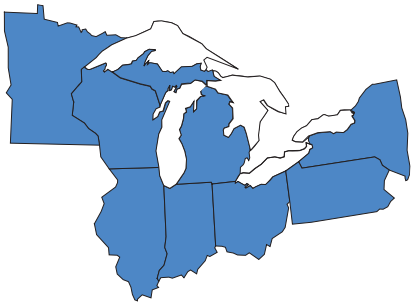


Using this publication

This book describes turf diseases common to the Great Lakes region plus cultural and chemical measures to control them. Some diseases are specific to landscape or golf course turfgrasses. Others affect both types of turf, but the symptoms and recommended control measures are often different. Hence, the separate keys for landscape turfgrasses and golf course turfgrasses.

Each disease entry includes one or two icons to indicate whether the disease affects landscape turfgrasses, golf course turfgrasses, or both.

To use the keys, start by referring to the correct key to help you identify your particular disease. Read the descriptions next to the first number and pick the entry that most closely describes your problem. Skip to the number listed after the description you have chosen and repeat this process until you come to the name of a disease. For a detailed disease description, photographs, and treatment recommendations, turn to the page number listed in parentheses after the disease name.

The keys account for more than 90% of the disease problems encountered by turfgrass growers in the Great Lakes region. They do not, however, address problems caused by insects or non-living **(abiotic)** factors such as physical, chemical, or environment stresses. If you're unable to diagnose the problem using this book, you may wish to send in a sample to your state's turf or plant disease diagnostic laboratory. Addresses and contact information are provided on the back cover.

For an in-depth discussion of the various factors that play a role in disease development, turn to "Controlling Turfgrass Diseases" on page 20. This section identifies which turfgrass species perform best in sunny versus shady conditions, and which are available for landscape situations versus golf courses. It also provides recommendations on managing thatch, watering, mowing, fertilizing, and chemical options available to prevent and control disease problems.

The glossary on page 23 defines any special terms used. These terms are boldfaced the first time they appear in the main text of the publication.

And finally, the color chart in the appendix is a handy reference to help you anticipate when diseases are most likely to occur.

For help identifying the turfgrass species present in your lawn, consult your county Extension agent or the University of Wisconsin-Extension publication *Identifying Grasses in Wisconsin Turf* (A1827).

landscape key

In the Great Lakes region, the grasses typically grown in home lawns, parks, athletic fields, and golf course roughs are **Kentucky bluegrass** (*Poa pratensis*), **fine-leaved fescues** (*Festuca rubra*, *Festuca rubra* var. *commutata*, *F. ovina*, and *F. longifera*), and **perennial ryegrass** (*Lolium perenne*).

1

- Overall symptoms of affected area appear as distinct patches or rings ➡**2**
- Overall symptoms affect individual blades without forming distinct patches ➡**10**

2

- Patches first noticed in early spring after the snow melts ➡**3**
- Patches first noticed between mid-spring and fall ➡**4**

3

- Bleached to pinkish patches are a few inches to a few feet in diameter ➡ **Microdochium patch (pink snow mold)** (page 12)
- Bleached to gray patches are a few inches to a few feet in diameter; small, round structures resembling poppy seeds may be found on diseased grass blades ➡ **Typhula blight** (page 18)

4

- Patches of bleached grass are mostly circular and have ragged edges ➡**5**
- Patches are circular or arc-shaped with distinct borders ➡**6**

5

- Individual grass blades have red, thread-like tendrils growing from the tips ➡ **Red thread** (page 14)
- Individual grass blades have pink tufts that resemble cotton candy growing on them, but do not have red, thread-like tendrils ➡ **Pink patch** (page 13)
- Individual leaf blades have bleached lesions with reddish brown borders; lesions are often hourglass-shaped when they girdle the leaves ➡ **Dollar spot** (page 8)

6

- Patches are straw-colored circles, rings, or arcs ➡**7**
- Patches are gray, brown, or dark green ➡**8**

7

- Patches first noticed in spring or early summer when weather turns hot or dry ➡ **Necrotic ring spot** (page 12)
- Patches appear during hot, wet weather ➡ **Summer patch** (page 17)

8

- Gray to dark brown patches appear during hot, humid weather; white to gray cottony growths are often present at the edge of the patches ➡**9**
- Patches are dark green rings of turfgrass ➡ **Fairy rings** (page 9)

9

- Grass blades in the patches are shriveled and may have straw-colored lesions with dark brown borders ➡ **Brown patch** (page 7)
- Grass blades mat together and are slimy to the touch ➡ **Pythium blight** (page 14)

10

- Leaves have lesions with dark borders ➡**11**
- Leaves do not have lesions with dark borders ➡**12**

11

- Leaves have distinct lesions with purple to black borders ➡ **Leaf spots and melting-out** (page 11)
- Affected area looks droughty; leaves are twisted and have olive- to brown-colored lesions with light gray centers ➡ **Gray leaf spot** (page 10)

12

- Leaves die back from the tips and are bleached to straw-colored; small black specks are visible on affected portion of the leaves ➡ **Ascochyta leaf blight/Septoria leaf spot** (page 6)
- Leaf blades are shredded and/or colorful growths are seen on leaf surface ➡**13**

13

- Leaves are covered with a powdery white growth ➡ **Powdery mildew** (page 13)
- Leaves are covered with yellow to dark red growths ➡ **Rust** (page 15)
- Leaves are covered with slimy white to purple growths ➡ **Slime mold** (page 16)
- Leaves have black stripes or are shredded like ribbons ➡ **Stripe smut** (page 16)

golf course key

Golf course putting greens, tees, and fairways consist primarily of **bentgrasses** (*Agrostis* spp.) and annual **bluegrass** (*Poa annua*), which can tolerate very close mowing. Creeping bentgrass (*A. stolonifera*) is the most widely used **species** of bentgrass, but colonial bentgrass (*A. tenuis*), and velvet bentgrass (*A. canina*) are occasionally used as well. Bentgrasses and annual bluegrass are generally regarded as weeds in most other turfgrass situations.

Note: Many golf courses maintain Kentucky bluegrass, perennial ryegrass, or fine-leaved fescues in roughs, fairways, and/or tees. To identify diseases of these landscape grasses, use the disease key on page 3.

1

- The affected area has distinct patches or rings ➡**2**
- The affected area is irregularly shaped; there are no distinct patches ➡**10**

2

- Initial patch color is white ➡**3**
- Initial patch color is bronze or brown ➡**5**
- Initial patch color is yellow ➡**8**
- Patches are dark green arc or rings ➡ **Fairy rings** (page 9)

10

- Turfgrass appears thin, and the soil surface is black and slimy to the touch ➡ **Algae** (page 5)
- The soil surface is not black and slimy ➡**11**

8

- Patches or rings are several inches to a few feet in diameter ➡**9**
- Patches are no larger than 1 inch in diameter; yellow tufts are easily pulled from the ground ➡ **Yellow tuft (downy mildew)** (page 19)

5

- Bronze-colored patches or rings are a few inches to a few feet in diameter ➡**6**
- Brown patches with purple borders (smoke rings) appear during hot, humid weather ➡ **Brown patch** (page 7)

3

- Patches first noticed after the snow melts or during cold, wet weather ➡**4**
- Patches are 1–2 inches across and occur anytime between mid-spring and fall; leaves have bleached lesions with reddish brown borders ➡ **Dollar spot** (page 8)

11

- The affected area is reddish, brownish, or purplish and has diffuse edges; leaves may have minute reddish, brownish, or purplish lesions ➡ **Leaf spots and melting-out** (page 11)
- Affected area looks droughty; leaves are twisted and have olive- to brown-colored lesions with light gray centers ➡ **Gray leaf spot** (page 10)
- The affected area is yellowish or orange and symptoms are most severe on annual bluegrass; small black spots with black hair-like structures are visible under a hand lens ➡ **Anthracnose** (page 5)
- Patches are brown to gray in color and occur during hot, humid weather; the border of active patches may be purple or may have white to gray cottony growths; the affected areas may be circular or irregular in shape, following drainage or mowing patterns ➡ **Pythium blight** (page 14)

9

- Yellow rings appear during cool, wet weather in spring or fall ➡ **Yellow patch** (page 19)
- Yellow or orange patches or rings appear during hot, wet weather; annual bluegrass is primarily affected ➡ **Summer patch** (page 17)

6

- Sunken patches where only bentgrasses are affected (annual bluegrass shows no symptoms) ➡**7**
- Bronze-to-orange colored rings that primarily affect *Poa annua* ➡ **Brown ring patch** (page 7)

7

- Patches are never larger than 12 inches in diameter and occur only on turf stands younger than 7 years old; small, flask-shaped structures may be visible on leaves of affected plants ➡ **Bentgrass dead spot** (page 6)
- Patches are several inches to a few feet in diameter; in poorly drained areas, patches may be irregular in shape ➡ **Take-all patch** (page 17)

4

- Patches are bleached to pinkish in color and may have a pinkish to reddish border; patches range in size from a few inches to a few feet in diameter ➡ **Microdochium patch (pink snow mold)** (page 12)
- Patches are bleached white to gray in color and range in size from a few inches to a few feet in diameter; small, round structures resembling poppy seeds may be present on diseased leaf blades ➡ **Typhula blight** (page 18)
- Patches are white and affected grass blades have red, thread-like tendrils growing from the tips ➡ **Red thread** (page 14)

Descriptions of turfgrass diseases

This section describes the most common diseases affecting turf in the Great Lakes region. Each description includes the name of the pathogen, susceptible turfgrass **species** (hosts), optimum conditions for disease outbreaks, symptoms, and cultural control practices to minimize future disease development and promote plant recovery. Specific cultural control methods are described in more detail in the control section on page 20. The susceptibility of the host plants is scored as high ($^{+++}$), moderate ($^{++}$), and slight ($^{+}$).

Algae (not a disease)

Pathogens: Several species of algae, mainly blue-green algae

Hosts: Bentgrasses^{+++}, annual bluegrass^{+++}

Optimum conditions: Wet weather, low nitrogen fertility, closely mown turf.

Symptoms: Algae grows particularly well in areas where the soil surface remains wet, is compacted, and is low in fertility. It produces a slippery black slime that forms a crust when dry. Turfgrass thinning occurs most commonly on bentgrass putting greens where close mowing exposes the photosynthetic algae to increased light.

Cultural control: Improve drainage and reduce compaction through aeration practices and regular topdressing. Increase the mowing height and maintain adequate nutrition if fertility is low.

Figure 1. Dark-colored algal slime among creeping bentgrass plants on a golf course tee.

Anthracnose

Pathogen: *Colletotrichum cereale*

Hosts: Annual bluegrass^{+++}, bentgrasses^{++}, perennial ryegrass^{+}, fine fescues^{+}, Kentucky bluegrass^{+}

Optimum conditions: Turfgrasses under physiological stress, caused by factors such as temperature stress, drought, low nitrogen fertilization, heavy **thatch**, compacted soil, low clipping height, heavy traffic, and **crown hydration** (damage caused during freezing and thawing).

Symptoms: Nondescript areas of blighted turfgrass that turn yellowish-orange to brown in color. Minute black spots can be seen on affected leaves. Close examination with a hand lens reveals conspicuous black setae (hairs) arising from the spots. These structures are often found on the leaves of closely mown or groomed grasses that are undergoing temperature, drought, or chemical stress. In contrast, the structures are often found on the leaf sheath and crowns of plants affected by crown hydration or on plants that have been mechanically damaged by excessive traffic or management practices.

Cultural control: Identify and minimize the stresses placed on the plants. Raise mowing height and increase frequency of nitrogen applications.

Figure 2a. Chlorotic annual bluegrass affected by anthracnose in an annual bluegrass/creeping bentgrass fairway.

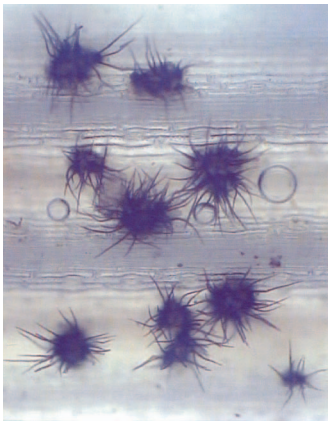


Figure 2b. Close-up of the reproductive structures of the anthracnose pathogen on a leaf showing the characteristic black setae (hair-like structures).

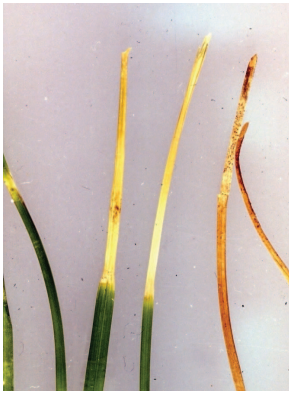


Figure 3. Tip dieback symptoms of Septoria leaf spot on Kentucky bluegrass leaves showing the minute black fruiting structures of the pathogen. *(Courtesy H.B. Couch)*

Ascochyta leaf blight and Septoria leaf spot

Pathogens: *Ascochyta* spp. and *Septoria* spp.

Hosts: Kentucky bluegrass^{+++}, annual bluegrass^{++}, perennial ryegrass^{+}, bentgrasses^{+}, fine fescues^{+}

Optimum conditions: Extended periods of leaf wetness, cool to moderate temperatures.

Symptoms: Chlorotic (pale yellow) lesions are often found on leaves in the early stages of infection and colonization. As the disease progresses, leaf blades die back from the tips and turn straw to white in color. Minute brown to black fruiting structures are often visible on colonized leaves. The overall appearance of the affected area resembles frost injury or drought stress. Septoria leaf spot and Ascochyta leaf blight are usually only problems on turfgrasses that are continuously wet. These diseases are prevalent on turfgrasses that have improper irrigation practices and are more common in shaded areas because of the increased time it takes for dew to dry.

Cultural control: Irrigate infrequently, deeply, and only during the morning hours.

Bentgrass dead spot

Pathogen: *Ophiosphaerella agrostis*

Hosts: Bentgrasses^{+++}

Optimum conditions: Warm temperatures (75°–85°F), dry weather.

Symptoms: Symptoms of bentgrass dead spot have only been reported from sand-based putting greens that are less than 7 years old. The pathogen produces sunken reddish-brown spots that are initially $^{1}/_{2}$–1 inch in diameter and resemble ball marks. Individual patches may expand up to 4 inches in diameter and rarely grow together. As patches enlarge, the centers turn tan in color, but the edges remain reddish-brown. Close examination of the tan leaves with a hand lens often reveals tiny black fruiting bodies of the pathogen.

Cultural control: Maintain adequate soil moisture, especially on exposed golf course putting greens. Since recovery from bentgrass dead spot is slow, frequent light applications of fertilizer will enhance regrowth.

Figure 4a. Bentgrass dead spot patches have tan centers with reddish-brown margins. *(Courtesy J. Kaminski)*

Figure 4b. Minute black fruiting structures of the bentgrass dead spot pathogen on necrotic bentgrass leaves. *(Courtesy J. Kaminski)*

Brown patch

Pathogen: *Rhizoctonia solani*

Hosts: Bentgrasses^{+++}, annual bluegrass^{+++}, perennial ryegrass^{+++}, Kentucky bluegrass^{++}, fine fescues^{++}

Optimum conditions: Hot (days: >80°F; nights: >68°F), wet weather, high nitrogen fertility.

Symptoms: On landscape turfgrasses, the pathogen produces straw-colored lesions with dark brown borders on individual leaf blades. As the disease progresses, the lesions girdle the leaf and the entire blade turns straw to gray in color. This results in irregular-shaped, brown patches of turfgrasses one to several feet in diameter. Unlike plants affected by Pythium blight, the leaves of grasses colonized by *R. solani* become brittle and are usually not soft or slimy. On closely mown turf, the patches have a distinct margin that is purplish in color during favorable weather conditions. On longer turf, the margin of the patches is more diffuse and patches may take on a frog-eye appearance. During hot, humid periods, cottony mycelium may be visible at the borders of the patches. Brown patch is a common cause of **damping-off** of turfgrass seedlings that are planted in the warm summer months.

Cultural control: Avoid applications of fertilizers containing nitrogen during hot, humid weather. Plant turfgrass seed during the spring or fall, thus avoiding the hot summer months.

Brown ring patch

Pathogen: *Waitea circinata* var. *circinata*

Hosts: Annual bluegrass^{+++}, creeping bentgrass^{++}

Optimum conditions: Disease can occur between 50° and 90°F, but optimum appears to be between 70° and 85°F. Low nitrogen fertility and accumulation of thatch.

Symptoms: Initial symptoms on annual bluegrass putting greens begin as diffuse, thin yellow rings or crescents (a few inches to a foot in diameter) that can turn golden brown under hot or wet conditions. Often, the rings will be uneven and have a "scalloped" appearance. On low fertility greens, sometimes a green halo can be seen inside of or surrounding the yellow rings. Symptoms can be confused with those of yellow patch, fairy ring, or necrotic ring spot.

Cultural control: Fertilize with nitrogen and/or iron products to mask symptoms. Aerify and topdress to limit thatch production.

Figure 6a. Stand symptoms of brown ring patch on an annual bluegrass putting green and collar. *(Courtesy D. Settle)*

Figure 6b. Brown ring patch causes thatch degradation, a common diagnostic feature of this disease. This fungus lives primarily in the thatch and is similar to fairy ring fungus. *(Courtesy F. Wong)*

Figure 5a. Distinct patch of brown patch on a creeping bentgrass putting green. Note the purplish margin of the patch.

Figure 5b. Diffuse patch of brown patch on landscape turfgrasses.

Dollar spot

Pathogen: *Sclerotinia homoeocarpa*

Hosts: Annual bluegrass^{+++}, bentgrasses^{+++}, Kentucky bluegrass^{++}, perennial ryegrass^{++}, fine fescues^{+}

Optimum conditions: 65°–85°F, high humidity, low nitrogen fertility, low soil moisture.

Symptoms: On closely mown turfgrasses (shorter than 1 inch) circular, bleached patches are 1–2 inches in diameter (silver dollar sized) with well-defined edges. As the disease progresses, individual patches merge to form large blighted areas. On turf maintained at heights greater than 1 inch, bleached patches are several inches to one foot in diameter and have ragged edges. Individual leaves have white or light tan lesions with reddish brown borders that may expand to completely girdle the blade. These lesions often have an hourglass shape, which distinguishes them from brown patch lesions. During periods of high humidity such as early in the morning, cottony growths of mycelium may be seen on colonized leaves.

Cultural control: Fertilizing and properly irrigating turfgrasses that are growing slowly will help to hasten recovery. Speed leaf drying by dragging a hose across the turf to remove dew or by irrigating or mowing early in the morning.

Figure 7a. Dollar spot on Kentucky bluegrass maintained at landscape height. Note the diffuse patches on taller turf.

Figure 7b. Close-up of a dollar spot lesion on a Kentucky bluegrass leaf. The bleached white center and reddish-brown border of the lesion are characteristic of the disease.

Figure 7c. Distinct dollar spot patches on a closely mown creeping bentgrass putting green.

Fairy rings

Pathogens: Several species of basidiomycete fungi

Hosts: Kentucky bluegrass^{+++}, annual bluegrass^{+++}, bentgrasses^{+++}, perennial ryegrass^{+++}, fine fescues^{+++}

Optimum conditions: Anytime during the year, although symptoms are usually more evident during dry weather.

Symptoms: Fairy rings are most troublesome on landscape and golf course turf with heavy thatch layers. Symptoms can come and go without warning and include rings of dark green grass, one to several feet in diameter. The dark green rings appear as the fungi decompose thatch and other organic substrates, releasing nitrogen into the soil. Occasionally, a narrow band of dead grass may border the outer or inner edge of the ring. The dead bands of grass, especially on sand-based putting greens, are caused when the fungi make the soil hydrophobic (water repellent). These soils will not become wet even when watered heavily and may require a chemical surfactant in order to re-wet the soil. During certain times of the year, mushrooms of the fairy ring fungi may be present.

Cultural control: Applications of nitrogen or iron will temporarily mask the symptoms of fairy rings. Soils that have become hydrophobic should be aerated and watered to alleviate drought stress.

Figure 8a. Fairy ring on a home lawn with mushrooms of the causal fungus.

Figure 8b. Dark-green fairy rings on a creeping bentgrass green. The brown area where the rings converge is hydrophobic (repels water).

Figure 9a. **Drought-like symptoms of gray leaf spot on a perennial ryegrass golf course fairway.**

Figure 9b. **Characteristic twisted appearance of perennial ryegrass blades affected by gray leaf spot.**

Figure 9c. **Gray leaf spot lesions on a perennial ryegrass leaf blade. Note the greenish brown margins and light gray centers of the lesions.**

Gray leaf spot

Pathogen: *Pyricularia grisea*

Hosts: Perennial ryegrass^{+++}, annual bluegrass^{+}, Kentucky bluegrass^{+}, bentgrasses^{+}, fine fescues^{+}

Optimum conditions: Extended periods of leaf wetness, air temperature 70°–85°F.

Symptoms: Gray leaf spot is a major problem in areas where perennial ryegrass is used extensively. The disease is most common in the lower Midwestern states, from central and southern Illinois and below, and is **rarely found north of Interstate 80**. Gray leaf spot is common during extended periods of leaf wetness and is first noticed as dark green to brown leaf lesions. As the disease progresses, the lesions expand and the centers become gray in color. Affected leaves turn yellow, then wither and turn brown. A diagnostic characteristic of the disease is the fact that the withered leaves are often twisted. The overall symptoms of gray leaf spot make the turf appear as if it is undergoing drought stress, even when soil moisture is adequate. On golf courses, symptoms are often first noticed in stands of perennial ryegrasses that are maintained at higher mowing heights and where increased humidity is favorable for disease development.

Cultural control: Minimize the period of leaf wetness by irrigating in the morning and/or removing moisture from the leaves by dragging a hose or pole across the turf. Avoid applications of high rates of water-soluble nitrogen during weather conducive for disease.

Leaf spots and melting-out

Pathogens: Many species of *Drechslera* and *Bipolaris* (formerly classified as *Helminthosporium*)

Hosts: Kentucky bluegrass^{+++}, bentgrasses^{+++}, perennial ryegrass^{+++}, annual bluegrass^{++}, fine fescues^{++}

Optimum conditions: Wet weather, high nitrogen fertility, temperature range is dependent upon the species of the particular pathogen.

Symptoms: Leaf spots appear initially, with circular to elongate lesions that may be dark purple, black, red, or brown in color (depending on the species of pathogen). As the disease progresses, the crown and roots begin to rot. Overall, these diseases cause non-descript areas of blighted, thin turfgrasses. *D. poae* is unique because it causes leaf spotting that often girdles the **leaf sheaths** of Kentucky bluegrass during cool weather. These girdled leaves often wither and fall off. This leaf-dropping and subsequent root and crown rot is termed "melting-out" because of the bare appearance of the turf stand.

Cultural control: Avoid using high rates of water-soluble nitrogen (above 0.5 lb/1,000 sq ft) when conditions are favorable for disease development. Decrease the duration of leaf wetness by removing dew and monitoring irrigation practices. Overseed affected areas with partially resistant varieties.

Figure 10a. Leaf lesions of melting-out on Kentucky bluegrass maintained at landscape height.

Figure 10b. Leaf lesions of leaf spot on perennial ryegrass maintained at landscape height.

Figure 10c. Stand symptions of Bipolaris leaf spot on a creeping fairway.

Microdochium patch (pink snow mold)

Pathogen: *Microdochium nivale*

Hosts: Annual bluegrass^{+++}, bentgrasses^{+++}, perennial ryegrass^{++}, Kentucky bluegrass^{+}, fine fescues^{+}

Optimum conditions: Cool to cold (30°–65°F), wet weather; high nitrogen fertility; alkaline soils; snow cover (not necessary).

Figure 11a. Microdochium patch on an annual bluegrass/Kentucky bluegrass fairway following snow melt. No sclerotia are found on turfgrasses affected by this disease, unlike for other snow mold fungi.

Symptoms: Melting snow reveals circular patches of tan to white grass a few inches to a few feet in diameter. The leaves of affected turfgrasses often mat together and white or pink mycelium is commonly visible at the edge of the patches. The mycelium and spores of the fungus give the border of the patches a distinct pink to reddish brown color. In the absence of snow cover, during cool wet weather, water-soaked patches of grass that are 1 to a few inches across are common. These patches are grayish to white in the center with reddish-brown borders. At higher temperatures (50°–65°F), the fungus may cause yellow to red spots on taller-cut grasses during wet periods.

Cultural control: Plant less-susceptible turfgrass species such as Kentucky bluegrass or fine-leaved fescues. Avoid late-season applications of water-soluble nitrogen and mow the grass until dormancy in the fall. The disease is more severe under **alkaline** conditions, so maintaining a pH of 7.0 or less in the thatch and top portion of the soil profile will reduce disease damage. In the spring, rake and fertilize damaged areas to stimulate turfgrass regrowth. Severely damaged turf may require reseeding.

Figure 11b. Microdochium patch may appear with cottony mycelium (left) or as water-soaked patches (right) during cool, wet periods. Patches turn pink as they age.

Necrotic ring spot

Pathogen: *Ophiosphaerella korrae*

Hosts: Kentucky bluegrass^{+++}, fine fescues^{++}, annual bluegrass^{++}

Optimum conditions: Cool, wet weather and high nitrogen fertility.

Symptoms: Circular or arc-like patches of yellow or straw-colored grass that are a few inches to a few feet in diameter. Weeds and grasses often fill in the center of the patches giving them a **"frog eye"** appearance. Individual plants on the edge of patches may have a red or purple discoloration due to phosphorus deficiency caused by root loss. The **crowns** and roots of affected plants are often dark brown or black. Although the pathogen is active during cool, wet weather, symptoms usually do not appear until the warm, dry weather of late spring or summer causes the affected plants to undergo drought stress. This disease is most severe on sodded turf stands less than 5 years old where root growth has been limited due to compacted soil. Individual rings and arcs usually expand and **coalesce** over the next 5–10 years. Once necrotic ring spot has spread through a stand of turfgrasses, it is unlikely to cause damage in the future.

Cultural control: Avoid early spring applications (before mid-May) of nitrogen, which make plants more succulent and susceptible to fungal infection and colonization. Maintain adequate drainage and minimal thatch layer by aerifying at least once every other year.

Figure 12. Kentucky bluegrass landscape turf affected by necrotic ring spot illustrating characteristic frog-eye patches.

Pink patch

Pathogen: *Limonomyces roseipellis*

Hosts: Fine fescues^{+++}, perennial ryegrass^{+++}, bentgrasses^{+}, annual bluegrass^{+}, Kentucky bluegrass^{+}

Optimum conditions: 60°–75°F, wet weather.

Symptoms: Symptoms of Limonomyces pink patch are very similar to red thread and can be seen from early spring through late fall. Frequently red thread and pink patch occur at the same time. Pink patch is most common on turfgrasses that are experiencing low fertility. Symptoms of the disease are irregular whitish to light pink patches of turfgrass ranging from a few inches to a few feet in diameter. Individual patches may coalesce to form large areas of blighted turfgrass. Pink tufts of **mycelium** are often visible and are diagnostic of the disease. Pink patch is strictly a foliar disease, and affected plants will recover when environmental conditions become less conducive for disease.

Cultural control: Increase nitrogen fertility if it is low. Irrigate early in the day to minimize the length of time leaves remain wet.

Figure 13. Bleached area of perennial ryegrass affected by pink patch. Note the diffuse nature of the patch.

Powdery mildew

Pathogen: *Blumeria graminis*

Hosts: Kentucky bluegrass^{+++}, fine fescues^{+}

Optimum conditions: Moderate temperatures (55°–70°F), high humidity, shade, poor air circulation.

Symptoms: Powdery mildew is most common in the fall on Kentucky bluegrass growing in the shade. The stand will have a white cast to it and individual leaf blades will appear to be covered with a white powdery coating. Damage from powdery mildew is usually negligible, although in severely diseased areas the grass may appear yellow and thin.

Cultural control: Increasing light conditions and air circulation by pruning trees and shrubs will minimize the occurrence of powdery mildew. Plant resistant **cultivars** of Kentucky bluegrass or a more shade-tolerant species of turfgrass such as a fine-leaved fescue.

Figure 14a. Close-up of Kentucky bluegrass leaf blades covered with the white mycelium of the powdery mildew pathogen.

Figure 14b. Shaded Kentucky bluegrass landscape turf with a white cast caused by powdery mildew.

Figure 15a. **Cottony mycelium of active Pythium blight on perennial ryegrass.**

Figure 15b. **A Pythium blight patch that has begun to dry out in the afternoon sun.**

Pythium blight

Pathogen: *Pythium* spp.

Hosts: Perennial ryegrass^{+++}, annual bluegrass^{+++}, bentgrasses^{++}, fine fescues^{++}, Kentucky bluegrass^{+}

Optimum conditions: Hot (days: >80°F; nights: >68°F), high humidity, low soil moisture, high nitrogen fertility.

Symptoms: Symptoms are first noticed as irregular water-soaked patches of turfgrasses that turn dark gray, tan, or brown in color as the disease progresses. Individual leaves begin to decompose, mat together, and feel greasy to the touch. Under favorable conditions, cottony white to gray mycelium can be observed at the edge of the patches. Pythium **blight** is easily spread by the movement of water and mechanical means including mowers and foot traffic. Therefore, symptomatic areas often follow drainage or mowing patterns. *Pythium* ssp. are common pathogens of turfgrass seedlings when establishment is attempted during the summer months.

Cultural control: Avoid applications of fertilizers containing water-soluble nitrogen during hot, humid weather. Plant turfgrass seed during early spring or fall, avoiding the hot summer months.

Red thread

Pathogen: *Laetisaria fuciformis*

Hosts: Fine fescues^{+++}, perennial ryegrass^{+++}, bentgrasses^{++}, Kentucky bluegrass^{++}, annual bluegrass^{+}

Optimum conditions: 60°–75°F, wet weather.

Symptoms: Symptoms of red thread are very similar to pink patch and are often seen during wet periods from early spring through late fall. Red thread is most common on turfgrasses that are under drought stress or low fertility. Irregular white, pink, or red patches of turfgrass appear ranging in size from a few inches to a few feet in diameter. Individual patches may merge together to form large areas of blighted turfgrass. During mild, wet weather, pink to reddish tufts of mycelium may be seen on diseased leaves. A key diagnostic feature is that blades of affected grasses often have red, thread-like tendrils **(sclerotia)** emerging from the tip. Red thread is strictly a foliar disease, and affected plants will begin recovering when environmental conditions are less conducive for disease.

Cultural control: Try to limit the duration of leaf wetness. Increase nitrogen and potassium fertility to reduce disease damage and hasten plant recovery. During dry conditions, irrigate in the morning to encourage grass growth while allowing rapid drying.

Figure 16a. **Symptoms of red thread on fine fescue maintained at fairway height. Note the similarity of these symptoms with dollar spot on closely mown grasses.**

Figure 16b. **Diffuse patch of red thread on perennial ryegrass maintained at golf course fairway height.**

Rust

Pathogens: *Puccinia* spp. and *Uromyces* spp.

Hosts: Perennial ryegrass^{+++}, Kentucky bluegrass^{++}, annual bluegrass^{+}, fine fescues^{+}, bentgrasses^{+}

Optimum conditions: Cool to warm weather, high humidity, low soil moisture, low nitrogen fertility, shade.

Symptoms: The stand of turfgrass has a diffuse yellow, orange, or reddish-brown cast to it. Individual leaf blades have rust-colored pustules (masses of spores) on the leaves. This disease usually appears in the late summer and fall when the grass is growing slowly. The rust fungi are strictly foliar pathogens that do not kill the turfgrass plants. During outbreaks of this disease, the abundant spores discolor equipment and shoes of people trafficking the area. The disease is very common on newly seeded areas with high populations of ryegrasses.

Cultural control: Fertilize and water slow-growing turfgrasses to alleviate symptoms. In shady areas, pruning to increase light penetration will help decrease the severity of rust on grasses. If the problem persists for several years, plant resistant varieties (for a current list, visit **www.ntep.org** and search for "rust").

Figure 17a. Rust pustules on Kentucky bluegrass leaves.

Figure 17b. Rust pustules on perennial ryegrass leaves.

Figure 16c. Close-up of perennial ryegrass blades with tendrils of the red thread pathogen emerging from colonized leaves.

Slime mold

Pathogens: *Mucilago spongiosa* and *Physarum cinereum*

Hosts: Kentucky bluegrass^{+++}, annual bluegrass^{+++}, perennial ryegrass^{+++}, fine fescues^{+++}, bentgrasses^{++}

Optimum conditions: High humidity.

Symptoms: Slime molds are most common on longer cut landscape turf during wet weather. Symptoms include slimy growths on the surface of the grass blades that are usually white or purple, but may sometimes be cream, yellow, or gray. The short-lived growths turn black and become brittle within a few days of their formation. Slime molds feed on bacteria on the leaf surfaces of turfgrasses and organic matter in the soil and thatch. While slime molds do not directly harm plants, they may cause minor damage by blocking light needed for photosynthesis.

Cultural control: Slime mold can be removed from leaves by dragging a pole, hose, rope, or chain across the affected area. If dry weather is expected, slime mold can be washed off leaves using a garden hose.

Figure 18. Close-up of Kentucky bluegrass leaf blades with purplish slime mold structures.

Stripe smut

Pathogen: *Ustilago striiformis*

Hosts: Kentucky bluegrass^{+++}, bentgrasses^{++}, annual bluegrass^{+}, perennial ryegrass^{+}, fine fescues^{+}

Optimum conditions: Wet weather; 60°–75°F (leaf shredding), >75°F (stunting).

Symptoms: During cool weather in the spring and fall, the stand appears thin and ragged and may have uneven growth. Leaf symptoms first appear as pale green (chlorotic) streaks between the leaf veins. The streaks turn black as the spores of the pathogen multiply. The masses of spores eventually rupture the surface of the leaf, leaving a shredded and shriveled blade. The symptoms often resemble dull mower injury or drought stress even though there is adequate moisture. During warmer weather, there is less striping and shredding of leaves; however, colonized plants are often stunted. Diseased plants are more susceptible to heat and drought stress than are healthy plants.

Cultural control: Maintain balanced fertility and adequate moisture during warm, dry periods. Once a plant is colonized by the pathogen, it will be colonized for the remainder of the plant's life. Therefore, overseeding the affected area with resistant cultivars is recommended (see **www.ntep.org** for a current list).

Figure 19a. Kentucky bluegrass lawn with ragged symptoms of stripe smut. *(Courtesy R.W. Smiley)*

Figure 19b. Close-up of Kentucky bluegrass leaf blades showing the black pustules and leaf shredding caused by the stripe smut pathogen. *(Courtesy R.W. Smiley)*

Summer patch

Pathogen: *Magnaporthe poae*

Hosts: Kentucky bluegrass^{+++}, annual bluegrass^{+++}, fine fescues^{++}, bentgrasses^{+}

Optimum conditions: Sustained hot, wet weather; soil temperature above 65°F; high pH.

Symptoms: Circular or arc-like patches of yellow or straw-colored grass that are a few inches to a few feet in diameter. The patches are usually first noticed during hot, wet weather in the summer. Weeds and resistant grasses often fill in the center of the patches giving them a frog-eye appearance. Tan to bleached tip dieback is sometimes found on leaves of plants affected by this pathogen. The vascular tissue of the crown and roots of affected plants are blackened and often rotted.

Cultural control: Monitor irrigation practices to ensure the turf is not overwatered during hot weather. Core cultivation in the spring or fall reduce summer patch severity by promoting good root growth, reducing thatch, and reducing soil compaction. Maintaining the pH of the thatch and **mat** below 6.5 also helps to decrease disease severity. (Soil pH test results can be used as a guideline for determining the pH of the thatch.) The pH level can be reduced using amendments such as sulfur or acidifying fertilizers such as ammonium sulfate, ammonium chloride, and ammonium nitrate.

Figure 20. Kentucky bluegrass landscape turf affected by summer patch illustrating characteristic frog-eye patches.

Take-all patch

Pathogen: *Gaeumannomyces graminis* var. *avenae*

Hosts: Bentgrasses^{+++}, perennial ryegrass^{+}, fine fescues^{+}, annual bluegrass^{+}

Optimum conditions: Cool, wet weather; soil temperature 50°–65°F; high pH.

Symptoms: Take-all patch is widespread on bentgrass putting greens, tees, and fairways that are less than 10 years old. This disease is also common on older golf courses in areas of poor drainage, heavy thatch, high pH, or frequently topdressed areas. Symptoms of take-all patch are sunken, bronze to white patches a few inches to a few feet in diameter. The patches tend to be circular but are often irregular in shape in areas of poor rooting and drainage. Patches enlarge every year and usually occur in the same spots year after year. Because of this, weeds and other turfgrasses that are resistant to the **fungus** often populate the center of the patches giving them a frog-eye appearance. On mixed stands of bentgrass and annual bluegrass, healthy-looking annual bluegrass plants amongst patches of declining bentgrasses is a key diagnostic feature. The pathogen is most active in the spring and fall when soils are moist and cool (50°–65°F). During these periods, disease symptoms are not very noticeable due to the adequate moisture available to colonized plants. However, as the weather turns warmer and drier, symptoms develop rapidly because the rotted roots of diseased plants are unable to supply enough water to the leaves. Commonly, by the time symptoms are noticed, the fungus is no longer active and fungicide applications are not effective.

(Continued on p. 18)

Figure 21a. Early symptoms of take-all patch on a creeping bentgrass putting green 1 year after establishment.

Figure 21b. Take-all patch on a creeping bentgrass fairway 3 years after establishment. Note the weeds growing in affected areas.

Cultural control: Plant recovery is slow, but can be accelerated with frequent irrigation to minimize drought stress and with well-balanced fertilization to encourage new root growth. Plants with healthy root systems are more tolerant to colonization by the pathogen, so techniques such as core aeration and regular topdressing can reduce or eliminate disease symptoms. Applications of complete fertilizers containing phosphorus and potassium (as well as nitrogen) will help to limit disease development. Maintaining the thatch and mat pH below 6.5 increases the availability of manganese, an important element for boosting plant defenses to pathogens. The pH level can be reduced using amendments such as sulfur or acidifying fertilizers such as ammonium sulfate, ammonium chloride, or ammonium nitrate. The severity of take-all patch can also be reduced by the direct addition of products containing manganese, such as manganese sulfate. Follow label instructions for rate and timing before applying amendments and fertilizers to minimize burn potential.

Typhula blight

Pathogens: *Typhula incarnata* and *Typhula ishikariensis*

Hosts: Bentgrasses^{+++}, annual bluegrass^{+++}, perennial ryegrass^{++}, fine fescues^{++}, Kentucky bluegrass^{+}

Optimum conditions: Cold (30°–40°F), wet weather; more than 60 days of snow cover; high nitrogen fertility.

Symptoms: Melting snow reveals circular gray or straw colored patches. The grass in these areas is usually matted down and a grayish-white cottony growth (mycelium) is often visible at the edge of the patches. Sclerotia of the fungi can often be found in and among the diseased grass blades. Susceptible turfgrasses are usually severely thinned or may even be killed. *T. incarnata* has large, rust-colored sclerotia, while the sclerotia of *T. ishikariensis* are smaller (about the size of a pinhead) and black.

Cultural control: Plant less-susceptible turfgrass species. Avoid heavy (more than 0.5 lb/1,000 sq ft), late-season applications of water-soluble nitrogen and mow the grass until dormancy in the fall. In the spring, rake and fertilize damaged areas to stimulate turfgrass regrowth. Severely damaged turf may require reseeding.

Figure 22a. Distinct, round patches of Typhula blight on a creeping bentgrass fairway 1 week after snow melt.

Figure 22b. Patches of Typhula blight revealed at snow melt.

Figure 22c. Small, black sclerotia of one of the Typhula blight fungi *(Typhula ishikariensis)* on the surface of colonized creeping bentgrass leaves.

Figure 22d. Reddish brown sclerotia of one of the Typhula blight fungi *(Typhula incarnata)* on the surface of colonized creeping bentgrass leaves.

Yellow patch

Pathogen: *Rhizoctonia cerealis*

Hosts: Bentgrasses^{+++}, annual bluegrass^{+++}, Kentucky bluegrass^{+}, perennial ryegrass^{+}

Optimum conditions: 50°–65°F, wet weather.

Symptoms: Yellow rings or arcs of turfgrasses that are a few inches to a few feet across. The yellow band itself is only 1–2 inches in thickness and the healthy grass apparent in the center of the patches gives the affected area a frog-eye pattern. The yellowing of the turf is only a cosmetic problem, as the pathogen rarely kills the plants. Symptoms of yellow patch are transitory and disappear when daytime temperatures drop below 45°F or rise above 75°F.

Cultural control: Where yellow patch is a recurring problem, avoid heavy applications of water-soluble nitrogen (above 0.5 lb/1,000 sq ft) late in the fall or early in the spring. Mow until dormancy in the fall. Irrigate turf early in the morning. Hasten leaf drying by dragging a hose or pole across the turf to remove dew.

Figure 23. Symptoms of yellow patch on bentgrasses maintained at fairway height.

Yellow tuft (downy mildew)

Pathogen: *Sclerophthora macrospora*

Hosts: Bentgrasses^{+++}, annual bluegrass^{++}, perennial ryegrass^{+}, Kentucky bluegrass^{+}, fine fescues^{+}

Optimum conditions: 50°–70°F, high humidity, saturated soil.

Symptoms: Downy mildew is most commonly found in low areas and areas with poor drainage. Symptoms of yellow tuft are most noticeable on golf course putting greens and fairways as dense, yellow clusters of turf up to 1 inch in diameter. These "tufts" are multiple shoots of grass emanating from a single crown and can easily be pulled from the soil. During hot, dry conditions, the tufts often wither and turn brown. Symptoms of downy mildew fade as temperatures remain at or above 70°F.

Cultural control: Improve drainage through core aerification. Symptoms can be masked by applications of iron or a nitrogen-containing fertilizer.

Figure 24. Yellow tufts that have been easily pulled from the soil, showing the multiple chlorotic shoots/tillers emanating from a single crown.

Controlling turfgrass diseases

The severity of disease development is dictated by the interaction of three important factors: the host plant, the pathogen, and the environment. A shift in any of these three factors can lead to a severe outbreak of disease or the complete disappearance of disease symptoms. Integrated pest management (IPM) is a holistic approach to disease control that is based on an understanding of how factors such as the biology of the pathogen, turfgrass species and variety, fertility management, irrigation practices, environmental conditions, cultural practices, and pesticides influence disease development. Since individual diseases have their own specific set of contributing characteristics, the first step in any IPM program is the accurate diagnosis of the pest that is causing a problem. This publication is designed to aid in the diagnosis of the most common turfgrass diseases in the Great Lakes region using plant symptoms, signs of the pathogen, and environmental conditions. This publication does not include diseases that are uncommon in the region. Nor does it cover problems caused by insects or non-living (abiotic) factors such as nutrient deficiency, compaction, and chemical damage. If you're still uncertain about the cause of your problem after reading through the keys and disease descriptions, contact your local county Extension agent (see **Resources**) or send a sample to a turfgrass or plant disease diagnostic laboratory (see list at end for address). These labs are staffed by experts who can identify disease, insect, weed, and management problems and can make control/prevention recommendations.

Turfgrass species

Selection of turfgrass species when establishing landscape turf or renovating an existing turfed area plays a key role in which diseases and the severity of the diseases you may encounter in the future. Grasses grown in suitable environmental conditions and under management appropriate for the particular species are healthier and less prone to disease problems. Areas that regularly sustain considerable damage from a particular disease can be overseeded or renovated using less-susceptible or non-host turf species to minimize the possibility of severe damage in the future. Several species of grasses are well suited for sunny landscape situations—Kentucky bluegrass, perennial ryegrass, and fine-leaved fescues. For shaded areas, the choices are limited to fine-leaved fescues for dry soils, and supina bluegrass and rough bluegrass for moist soils.

The characteristics of each grass species vary greatly. Factors to consider when choosing the proper turfgrass species or mixture of species for a specific site include shade tolerance, growth habit, drought tolerance, maintenance requirements, disease susceptibility, color, and texture. For more information on choosing the proper turfgrass species for your situation, refer to UW-Extension publication *Lawn Establishment and Renovation* (A3434).

Golf course managers have fewer species to choose from. Grasses suited for putting greens, tees, and fairways must be able to tolerate very close mowing and high traffic. In addition, turfgrass density and uniformity are extremely important. Because of this, golf course managers are restricted to the use of bentgrasses and annual bluegrass on areas maintained below ½ inch in height. In fairways and roughs, which are maintained at heights above ½ inch, Kentucky bluegrass, perennial ryegrass, and fine-leaved fescues may be used. However, when these grasses are maintained below 2½ inches, they are more susceptible to diseases, insects, and abiotic stresses and require more intensive management.

Turfgrass cultivars

Within each species of turfgrass there are dozens, and in some cases hundreds, of commercially available cultivars. These cultivars are selected and bred for aesthetic characteristics such as color, texture, density, uniformity, and upright growth habit as well as diseases resistance and tolerance to abiotic stresses such as drought, low temperature, shade, traffic, and salt. Cultivars that are resistant to the most common turfgrass diseases in the region should be chosen for establishing new stands of turfgrasses. For example, there are multiple creeping bentgrass cultivars on the market with improved dollar spot resistance. Areas that are regularly damaged by a particular disease can be overseeded or renovated using resistant cultivars. The most reliable information regarding disease resistance comes from local sources such as university turfgrass experts, county Extension agents, and the National Turfgrass Evaluation Program, which posts cultivar evaluation results from throughout the country at **www.ntep.org**.

Thatch management

Thatch is the layer of organic matter above the soil and below the green parts of the plants. Thatch is composed of dead organic matter such as dead leaves and stems as well as living roots, stems, and crowns. A thin layer of thatch provides a beneficial cushion for the crowns of the plants. The recommended thickness for thatch in landscape turf is between 1/4 and 1 inch. Plants growing in areas with excess thatch have less contact with the soil and are more susceptible to fluctuations in temperature, moisture stress, heat stress, and winter kill. Additionally, several pathogenic fungi and insects live in and feed on thatch, increasing the incidence of pest problems such as necrotic ring spot of Kentucky bluegrass.

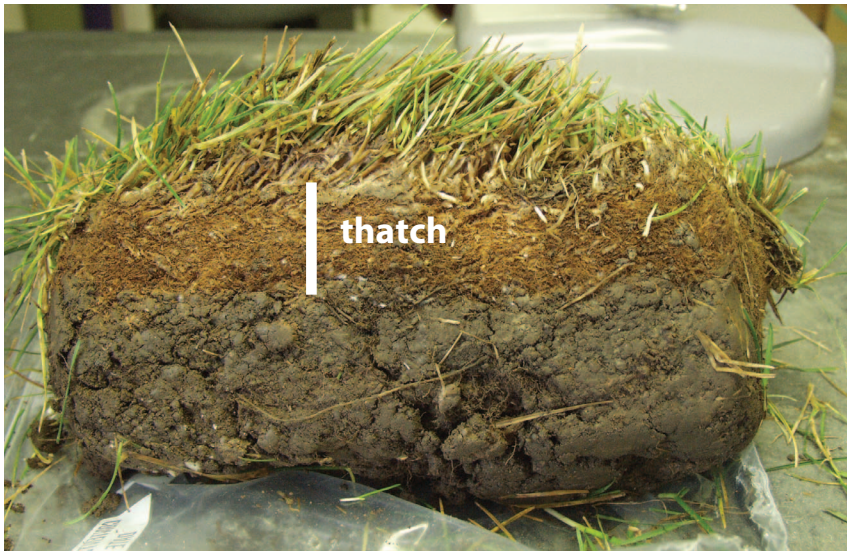
Ordinarily, naturally occurring microorganisms present in the soil decompose thatch, keeping it at optimum levels. Certain factors can cause thatch to build up. For example, turfgrasses that receive excess fertilization often grow faster and accumulate thatch faster than the microorganisms can break it down. Similarly, wet soils in overwatered turf hold less oxygen that thatch-reducing organisms need to thrive. Also, soils with low pH are less hospitable to thatch-decomposing microorganisms.

Several cultivation techniques can be used to thin thatch. These include hollow-tine core aeration, solid-tine aeration, spiking, and slicing. Cultivation techniques should be performed in the spring or fall when the plants are actively growing and are more tolerant to injury. For lawns with thatch less than 1-inch thick, cultivation every 1–3 years is usually adequate. Lawns with thicker thatch should be cultivated twice a year until the thatch layer is reduced to the proper depth and then once every 1–3 years to maintain the recommended level.

The root depth of turfgrasses growing on golf course putting greens, tees, and fairways is much shallower because of reduced mowing height. Because of this, turfgrasses grown under these management conditions are particularly susceptible to problems associated with thatch accumulation. Excess thatch on sand-based putting greens and other golf course turf can lead to scalping from mowers, reduced water infiltration, localized dry spot, and insufficient oxygen in the root zone. To reduce and dilute thatch on golf course turf, hollow-tine core aeration, vertical mowing, solid-tine aeration, spiking, and slicing in conjunction with regular sand topdressing are often performed. For more information about thatch management, please refer to UW-Extension publication *Lawn Aeration and Topdressing* (A3710).

Irrigation practices and duration of leaf wetness

A good rule of thumb for the water requirement of landscape turf is approximately 1 inch per week. This requirement may need to be increased during hot, dry periods, and decreased when it is very cool and when there is frequent precipitation. High-maintenance landscape turfgrasses that are watered during dry periods should be done so infrequently and deeply (3–4 inches in depth, 1 to 2 times per week) to promote deep rooting and reduce the duration of leaf wetness. The longer a particular turfgrass leaf remains wet, the more susceptible it is to attack by foliar pathogens.



Thatch provides a beneficial cushion for turf plants and should be maintained at 1/4–1 inch thick.

Leaves become wet from any of four sources of water: precipitation, condensation (dew), irrigation, and guttation (nutrient-containing water exuded from leaf tips). While you have little control over three of these sources of moisture, there are several techniques to limit the length of time water is present on the leaves. Most importantly, irrigate turf in the morning when plants are already wet from dew. If necessary, you can remove moisture from leaves by dragging a hose or pole across the turf. An alternative to irrigation is allowing lawns to go dormant during dry periods. In the absence of water, grass plants will turn brown and go dormant. Typically, turfgrasses can remain dormant for several months and will regrow from the crown when moisture returns.

Mowing practices

Landscape turfgrasses should be maintained between 2½ and 3½ inches in height depending on the desired level of maintenance. The following mowing recommendations will help reduce plant stress and the likelihood of disease development:

- Maintain sharp mower blades to ensure a clean cut. Dull mower blades fray the tips of the grass blades, which gives the turf a white or tan cast and makes the grass more susceptible to diseases and abiotic stresses.
- Remove no more than ⅓ of the grass blade in a single mowing. Removing more of the leaf blade is stressful to the plant and slows regrowth.
- Mow the turf when dry to avoid clumping of the clippings.
- Leave clippings on the lawn to return nutrients to the soil, thereby decreasing fertilizer requirements.

Fertilization and pH

Turfgrass diseases are influenced by fertilization practices in different ways. Some diseases, such as necrotic ring spot, Pythium blight, brown patch, and Microdochium patch are more severe when turfgrass plants are succulent because of excessive nitrogen fertilization. On the other hand, diseases such as red thread, pink patch, rust, and stripe smut are more severe on slow-growing turf with low fertility. When you have a particular disease problem that is influenced by fertilization, modify your fertility program when the disease is active to reduce disease severity. Similarly, **acidic** or alkaline soil and thatch pH plays a pivotal role in the severity of some diseases. Application of lime will raise the pH, while applications of sulfur or acidifying fertilizers will lower the pH and reduce disease severity. For more information on fertilizer application and timing refer to UW-Extension publication *Calibrating and Using Lawn Fertilizer and Lime Spreaders* (A2306) or *Lawn Maintenance* (A3435).

Chemical control

Fungicides are generally not recommended for homeowners because landscape turf diseases are rarely lethal to grass. They should only be considered when all other cultural control options have been exhausted. Cultural control methods are usually very effective at managing disease outbreaks in home lawns without the use of chemicals. When chemical treatment is warranted, the label of the selected product should be read thoroughly and strictly followed. The properties of fungicides labeled for use on turfgrasses and the diseases they control are listed in *Fungicides for Turfgrass Diseases* (A3952). On areas that are regularly treated with fungicide, additional care should be taken to minimize the potential of fungicide resistance in the pathogen. Steps that can be taken to reduce the hazard of fungicide resistance include rotating and/or tank-mixing fungicides in different chemical families, calibrating spray equipment often, spraying preventatively when possible, and following label rates and instructions.

glossary

Abiotic — Non-living.

Acidic — Refers to a substance that has a pH lower than seven. Compare to **alkaline**.

Alkaline — Refers to a substance that has a pH greater than seven. Compare to **acidic**.

Annual bluegrass (*Poa annua*) — A common weed of landscape and golf turf that can withstand extremely low mowing heights. This grass is more susceptible to diseases and abiotic stresses than other turfgrasses. Annual bluegrass has light green, folded leaves with blunt, boat-shaped tips. Annual bluegrass can produce seed at mowing heights lower than 1/4 inch.

Bentgrasses — Members of the grass genus *Agrostis* that are often used on golf course putting greens, tees, and fairways because of their ability to tolerate low mowing height. The most common bentgrasses used on golf courses include creeping bentgrass (*A. stolonifera*), velvet bentgrass (*A. canina*), and colonial bentgrass (*A. tenuis*). Bentgrasses are weeds in landscape settings because their color differences give lawns a mottled look and some types aggressively spread by stolons (lateral stems). Bentgrass leaves are rolled with ridges on the upper surfaces and have a tip that tapers to a point.

Blight — A name used for plant diseases and the symptom of plant diseases where there is sudden and serious turf damage characterized by withering of the leaves without rotting.

Chlorosis (adj. chlorotic) — Yellowing of plant leaves that are deficient in chlorophyll. Chlorosis can be the result of nutrient deficiency, colonization by a pathogen, air pollution, or poor root growth.

Coalesce — The joining together of two or more disease patches to form one larger patch.

Crown — The base of the turfgrass plant from which the shoots and roots develop.

Crown hydration — The process by which excess water between the cells in the crown of the plant freeze. Sharp ice crystals puncture cell membranes and cause desiccation by pulling water from within the cell. Crown hydration is more severe when there are multiple freeze/thaw cycles in a season.

Cultivar — A variety of plant selected or developed for desirable traits and maintained under cultivation.

Damping-off — The failure of a seed to germinate or the rotting of a newly emerged seedling caused by a pathogen.

Fine-leaved fescues — A group of grasses belonging to the genus *Festuca* that is characterized by having extremely narrow, needle-like leaves. Species used for turf include creeping red fescue (*F. rubra*), chewings fescue (*F. rubra commutata*), hard fescue (*F. longifolia*), and sheep fescue (*F. ovina*). Fine-leaved fescues require less fertilizer, water, and sunlight than most other turfgrass species, but are less tolerant to wear.

Frog eye — A circular patch caused by several turfgrass pathogens in which there is a narrow ring of dead or off-colored grass with healthy looking grass or weeds in the center.

Fungus (pl. fungi) — An organism that lives by decomposing and absorbing the material it grows in. It usually produces a filamentous, thread-like body and reproduces by means of spores.

Kentucky bluegrass (*Poa pratensis*) — The most widely used grass species for home lawns, athletic fields, and golf course fairways and roughs. Kentucky bluegrass spreads by rhizomes (underground stems), is drought tolerant, and is well adapted to most locations in Great Lakes region except shady areas. Leaves are dark green and folded, and have a blunt, boat-shaped tip. There are hundreds of cultivars available with varying characteristics such as leaf texture, color, disease resistance, and shade tolerance.

Leaf sheath — Lowest portion of the turfgrass leaf that surrounds the stem.

Mat — A layer between the soil and thatch that is made up of a mixture of both components.

Mycelium — A mass of multiple thread-like vegetative filaments of a fungus.

Perennial ryegrass (*Lolium perenne*) — A bunch-type grass that is used in many seed mixes because it establishes quickly and is wear tolerant. Perennial ryegrass has folded, dark green leaves that are shiny on their underside. The upper leaf surface has ridges and the tip of the blade tapers to a point. This grass does well in open, sunny areas, but is not as cold tolerant as other turfgrasses.

Sclerotium (pl. sclerotia) — A hard, usually rounded mass of mycelium that is able to withstand difficult environmental conditions. Sclerotia serve as resting structures for many fungi and may remain dormant for many years.

Species — A group of organisms that have a unique set of characteristics that distinguishes them from other organisms. If they reproduce, individuals within the same species can produce fertile offspring. Within each turfgrass species (e.g., Kentucky bluegrass), there are often several commercial cultivars that have been selected and bred for their beneficial qualities (e.g., Midnight, Merion, Kenblue, Brilliant).

Thatch — A layer of organic matter above the soil and below the green parts of the plants. Thatch is composed of dead organic matter such as dead leaves and stems as well as living roots, stems, and crowns.

appendix

Likelihood of turfgrass diseases occurring throughout the year

Disease	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Algae				+	+	++	+++	+++	+++	++	+	
Anthracnose				++	++	++	+++	+++	+++	++	++	
Ascochyta leaf blight/ Septoria leaf spot					+++	+++	++	++	+++	+++	+	
Bentgrass dead spot						++	+++	+++	+++	+		
Brown patch						++	+++	+++	++			
Brown ring patch					+++	+++	+	+	+++	++		
Dollar spot					+++	+++	++	++	+++	+++	+	
Fairy rings	+	+	+	+++	+++	+++	+++	+++	+++	+++	+++	+
Gray leaf spot						++	+++	+++	++			
Leaf spots and melting-out				+	+++	+++	+++	+++	+++	+++	+	
Microdochium patch (pink snow mold)	+	+	+++	+++	+++	++	+	+	+	+++	+++	++
Necrotic ring spot				+	+++	+++	S	S	+++	+++	+	
Pink patch				+	+++	+++	+	+	++	+++	+++	+
Powdery mildew							+	++	+++	+++	++	+
Pythium blight						++	+++	+++	++			
Red thread				+	+++	+++	+	+	++	+++	+++	+
Rust							++	+++	+++	+++	++	
Slime mold					+	++	++	+++	+++	++	+	
Stripe smut				+	++	+++	++	++	+++	+		
Summer patch						++	+++	+++	++			
Take-all patch				+	+++	+++	S	S	+++	+++	+++	+
Typhula blight	+++	+++	+++	+++	+						+	++
Yellow patch				+	+++	+++	+	+	+	+++	+++	+
Yellow tuft (downy mildew)				++	+++	+++	++	++	+++	+++	+++	

+ = possible ++ = common +++ = likely S = symptoms only

Resources

Plant disease clinics in the Great Lakes region

For help diagnosing or confirming a turf disease problem, contact the turf disease lab in your state.

Illinois

University of Illinois Plant Clinic
1401 W. St. Mary's Road
Urbana, IL 61082
217-333-0519
plantclinic.cropsci.illinois.edu
Lab is open May 1–September 15 only

Indiana

Purdue Plant & Pest Diagnostic Laboratory
Purdue University
915 W. State Street
West Lafayette, IN 47907
765-494-7071
www.ppdl.purdue.edu/PPDL

Michigan

Diagnostic Services at Michigan State University
101 Center for Integrated Pest Systems
East Lansing, MI 48824-1311
517-355-4536
www.pestid.msu.edu

Minnesota

Plant Disease Clinic
Department of Plant Pathology
University of Minnesota
495 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
612-625-1275
pdc.umn.edu
Serving commercial growers

New York

Plant Disease Diagnostic Clinic
Cornell University
329 Plant Science Bldg.
Ithaca, NY 14853
607-255-7850
plantclinic.cornell.edu

Ohio

The C. Wayne Ellett Plant and Pest Diagnostic Clinic
The Ohio State University
8995 E. Main Street, Bldg. 23
Reynoldsburg, OH 43068-3399
614-292-5006
ppdc.osu.edu

Pennsylvania

Plant Disease Clinic
Department of Plant Pathology
The Pennsylvania State University
220 Buckhout Laboratory
University Park, PA 16802
814-865-2204
www.ppath.cas.psu.edu/Plant_Disease_Clinic.htm

Wisconsin

Wisconsin Turfgrass Diagnostic Lab
O.J. Noer Turfgrass Research and Education Facility
University of Wisconsin–Madison
2502 County Highway M
Verona, WI 53593
608-845-2535
www.tdl.wisc.edu

State resources

State Extension offices provide a wealth of information on caring for turfgrasses. For more details, contact your local office or visit these websites.

Illinois

Extension: web.extension.illinois.edu
Publications: pubsplus.illinois.edu

Indiana

Extension: www.ag.purdue.edu/extension
Publications: mdc.itap.purdue.edu

Michigan

Extension: www.msue.msu.edu
Publications: www.emdc.msue.msu.edu

Minnesota

Extension: www.extension.umn.edu
Publications: shop-secure.extension.umn.edu

New York

Extension: www.cce.cornell.edu

Ohio

Extension: extension.osu.edu

Pennsylvania

Extension: extension.psu.edu
Publications: pubs.cas.psu.edu

Wisconsin

Extension: www.uwex.edu
County Extension offices: www.uwex.edu/ces/cty
Publications: Learningstore.uwex.edu
877-WIS-PUBS (877-947-7827)

Other resources

National Turfgrass Evaluation Program
www.ntep.org

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Turf Diseases of the Great Lakes Region (A3187) R-05-2011