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LAWN DISEASES

*How
to
control
them*



U.S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service



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For more information on lawn care and the control of lawn insects, see Home and Garden Bulletin No. 51, "Better Lawns," and Home and Garden Bulletin No. 53, "Lawn Insects, How to Control Them." Single copies of these publications—prepared by the Agricultural Research Service—can be obtained free from your County Extension Agent or by writing to the Office of Communication, U.S. Department of Agriculture, Washington, D.C. 20250. Send your request on a postcard. Be sure to include your ZIP Code.

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LAWN DISEASES

How to control them

By F. V. Juska¹ and J. J. Murray, ARS Research Agronomist²

Most of the grasses in lawns grow under artificial conditions and are more subject to attack by disease organisms than they would be in a natural environment. Healthy, vigorously growing, adapted lawn grasses that are properly managed can best survive disease attacks.

The homeowner's best defense against lawn diseases is to follow these basic principles of lawn establishment and maintenance:

- Select grasses adapted to the soil, climatic, and light conditions under which they will be grown.
- Spend the necessary time, effort, and money on caring for the lawn. In addition to disease control, lawn care includes proper

fertilizing, watering, mowing, and insect and weed control.

Proper care does not completely prevent or cure diseases, but it helps to curb them so that chemical controls can be more effective if they become necessary.

Knowing how to diagnose the most common causes of dead or injured grass and knowing the recommended treatments for various unhealthy conditions will help the homeowner to prevent serious lawn damage. Poor turf may be due to disease or to any one or a combination of other causes—undesirable or unadapted species, insect damage, fertilizer and chemical burning, dog urine, improper mowing, improper watering, localized dry spots, and compacted soil.

FUNGUS DISEASES

Fungi cause most of the serious and widespread diseases of lawn grasses. All the diseases discussed in this bulletin are fungus diseases. Most of the fungi that at-

tack lawn grasses occur in the form of microscopically small filaments, or threads. The mass of threads, which sometimes have a cobwebby appearance, are called mycelium. Many fungi reproduce

¹ Deceased

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by means of microscopic fruiting structures called spores.

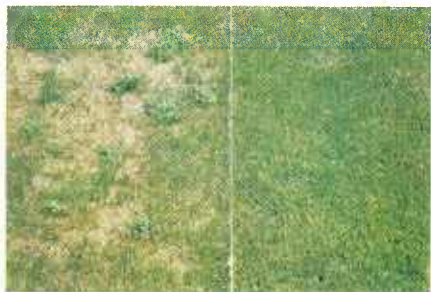
Only those fungi that get their nutrients from a living host are true disease organisms. Such organisms cause *Helminthosporium* leafspot, fading-out, brown patch, rust, grease spot, dollar spot, stripe smut, and snow mold.

Mushrooms and slime molds in lawns are examples of fungi that are not true disease organisms. They do not attack lawn grasses directly, but are discussed with disease organisms because they are a common lawn problem.

HELMINTHOSPORIUM LEAFSPOT AND FOOT ROT

This disease, which gets its name from the *Helminthosporium* fungi that cause it, is one of the most widely distributed and destructive grass diseases. Kentucky bluegrass is one of the species most severely damaged.

The principal fungus causing leafspot in Kentucky bluegrass also causes a foot rot condition known as going-out or melting-out. The disease occurs mainly during cool, moist weather of



Helminthosporium leafspot caused damage at left in this plot of common Kentucky bluegrass.



Lesions on the five leaves of Kentucky bluegrass at right were caused by a *Helminthosporium* leafspot fungus. Healthy leaf is at left.

spring and fall, but it may develop throughout the summer. Pure stands of Kentucky bluegrass favor development of the disease; mixtures of several recommended species usually retard development, because most mixtures contain naturally resistant species.

Symptoms

Damage is most conspicuous in the leaves. However, the fungus responsible for the disease also causes a sheath rot or foot rot. The fungus produces reddish-brown to purplish-black spots on leaves and stems of Kentucky bluegrass. Leaves shrivel and the stems, crowns, rhizomes, and roots discolor and rot. Leafspots and foot rots produced on other grasses by different species of *Helminthosporium* resemble those on Kentucky bluegrass. Dead

grass in attacked areas often is attributed to drought injury. Weeds and crabgrass usually invade these areas.

Control

In Kentucky bluegrass lawns, you can control the disease by growing less susceptible varieties such as Fylking, Merion, Pennstar, and Windsor. Some leafspotting may occur, but these varieties are more resistant than ordinary Kentucky bluegrass and are seldom killed during the destructive foot rot stage.

Follow these management practices to reduce damage: Mow upright-growing grasses to a height of $1\frac{3}{4}$ to 2 inches rather than $\frac{1}{2}$ to 1 inch. Apply enough fertilizer to keep grass healthy and thriving. Avoid overstimulation with nitrogen, particularly in the spring. Remove clippings, especially on lawns receiving heavy fertilization.

Fungicides that control *Helminthosporium* leafspot are listed on page 19.

BROWN PATCH

The fungus responsible for brown patch attacks practically all species of grasses, but it is most serious on bentgrasses, fescues, Kentucky bluegrass, ryegrass, centipedegrass, and St. Augustinegrass. Brown patch is one of the most prevalent lawn grass diseases in the warm, humid regions of the United States. It occurs during warm, wet weather. Brown patch is most damaging following excessive applications of



Brown patch fungus caused this injury in Kentucky bluegrass.

nitrogen fertilizer. This promotes a lush growth of grass that is readily attacked. The disease spreads by fungus threads, or mycelium. New infections can start from mycelium carried on shoes, mowing equipment, or grass clippings.

Symptoms

Brown patch is characterized by development of irregular circular areas a few inches to several feet in diameter with a brownish discoloration. In bentgrasses a narrow, dark, smoke-colored ring borders the diseased area. This disappears when the weather becomes cool or dry. Sometimes only the leaves are affected and the turf recovers in 2 or 3 weeks. However, if the disease is severe and weather conditions remain favorable for its development, it attacks the crowns and kills the grass. The dead grass generally remains erect and does not lie flat like grass killed by grease spot, a *Pythium* disease. The fungus threads, or mycelium, are fre-



quently observed as filmy, white tufts early in the morning while the grass is still wet with dew. As the leaves dry, the fungus threads shrivel and disappear, and only dead and dying leaves are left. After several weeks, new grass grows back into the affected area.

Control

Management practices that help in control: Avoid excessive applications of nitrogen fertilizer. Water lawns early in the day to give grass leaves time to dry out before night. Remove clippings if excessive.

Brown patch can be controlled if the lawn is watered 48 hours before treating with fungicide and if this is repeated three times at weekly intervals.

RUST

Rust fungi attack many lawn grasses. Rust usually occurs in late summer and remains until frost. Heavy dew favors its development.

Rust damage is more severe on Merion Kentucky bluegrass and zoysia than on other grasses. Meyer and Emerald zoysias are susceptible to rust infection.

Rust has appeared on Merion Kentucky bluegrass from Rhode Island to California and from Canada to Oklahoma. The rust fungus seems to attack Merion wherever it is grown.

Some Kentucky bluegrass varieties resist rust infection entirely. Common Kentucky bluegrass is less susceptible to rust than Merion. However, it is vulnerable to the more destructive *Helminthosporium* leafspot.

Symptoms

Symptoms are yellow-orange or red-brown powdery pustules that develop on leaves and stems. If a cloth is rubbed across affected leaves, the rust-colored spores ad-



A rust fungus attacked the three Merion Kentucky bluegrass leaves at left. Healthy leaf is at right.

here to the cloth and produce a yellowish or orange stain.

Control

Lawns containing pure stands of Merion Kentucky bluegrass are especially susceptible to attack by rust fungi. Damage is less severe if Merion Kentucky bluegrass is mixed with common Kentucky bluegrass or with red fescue. Recommended mixtures are 50-percent Merion and 50-percent common Kentucky bluegrass; 50-percent Merion Kentucky bluegrass and 50-percent red fescue; or 50-percent Merion, 25-percent common Kentucky bluegrass, and 25-percent red fescue.

The Kentucky bluegrass varieties, Fylking, Pennstar, and Kenblue are more rust-resistant than Merion.

Mowing, fertilizing, and watering practices recommended in the summary of management practices (page 16) will help control rust.

Several chemicals (see p. 20) control rust on Merion Kentucky bluegrass and other grasses. Chemicals do not completely eradicate rust or prevent infection of growth that comes out after treatment. Repeated applications may be necessary to keep rust under control, especially on Merion Kentucky bluegrass.

PYTHIUM DISEASES

The two most destructive lawn diseases caused by *Pythium* fungi are grease spot and cottony blight. Grease spot occurs in many parts



Mycelium of the *Pythium* fungus that causes cottony blight. This is an early stage of an infection in ryegrass.

of the country on a wide range of grasses; cottony blight occurs mainly on ryegrass in the South.

Pythium diseases occur in humid areas and may be more widespread than is generally realized. The fungi are destructive at 70° F, and above, especially in poorly drained soils. These diseases are most common on newly established turf, but if conditions are favorable they occur on grass regardless of age.

Symptoms

Diseased areas vary from a few inches to several feet in diameter and they sometimes occur in streaks as though the fungus had spread from mowing or from water flow following heavy rains. In-

jury is most noticeable in early morning as a circular spot or group of spots about 2 inches in diameter surrounded by blackened grass blades that are intertwined with the fungus threads. Diseased leaves become water soaked, mat together, and appear slimy. The darkened grass blades soon wither and become reddish brown, particularly if the weather is sunny and windy. Grass is usually killed in 24 hours and it lies flat on the ground rather than remaining upright like grass affected by the brown patch disease. New grass does not grow back into the diseased area.

Control

The most important management recommendation is to avoid watering methods that keep foliage and ground wet for long periods. Other suggestions: Avoid excessive watering during warm weather. Delay seeding until fall because cool, dry weather generally checks the disease.

Chemicals give best results if used when the disease first appears (see p. 19).

DOLLAR SPOT

Dollar spot, also known as small brown patch, occurs on many species of grasses. The disease is particularly destructive in bentgrasses. It is most prevalent in the humid northern areas of the United States but occurs also in States farther south.

The fungus is most destructive during cool, wet weather. It gen-

erally attacks in May and June, stops during July and August, and starts again in September and October. Dollar spot may occur in any turf regardless of management or soil fertility, but damage usually is greatest if there is a deficiency of nitrogen.

Symptoms

The disease is characterized by development of bleached spots the size of a silver dollar. Affected grass is killed, and the turf is left pitted. Sometimes the diseased areas merge and form large, irregular patches. At first, spots of diseased grass are dark and somewhat water soaked; then they turn brown and ultimately bleach nearly white. If the fungus is growing actively, a fine, white, cobwebby mycelium can be seen when dew is still on the grass. Sometimes only the uppermost grass blades are affected and light-colored blotches develop on them.

Turf recovers quickly if treated with fungicides in the early stages



Spots in bermudagrass caused by the dollar spot fungus.



Dollar spot fungus caused the lesions on the four Kentucky bluegrass leaves at right. Healthy leaf is at left.

of a disease attack; if left untreated it may take many weeks for new grass to fill in dead areas.

The best control is to use chemicals listed on page 18.

STRIPE SMUT

Stripe smut fungus attacks several lawn grasses but it is most prevalent and destructive on Merion Kentucky bluegrass, principally in the northern half of the United States.

Smut spores in contaminated soil germinate and produce infection threads that invade grass seedlings and young tillers. Since the fungus grows systematically, infected plants remain diseased until they die.

Symptoms

Narrow gray or black stripes that may be continuous or dis-

continuous develop lengthwise in leaf blades. The gray stripes are unruptured smut sites called sori. The black streaks result when smut sori rupture and liberate a mass of black, powdery spores. Following rupture of the sori, diseased leaves wither, curl, and shred from the tip downward, and die.

Diseased Kentucky bluegrass plants occur singly, or in spots from a few inches to a foot or more in diameter. Infected plants are often pale green to slightly yellowed. They also are shorter than neighboring healthy plants and may be obscured by them.

Stripe smut is most readily seen on leaves during cool weather in spring and fall. Diseased plants are difficult to find during hot, dry weather because many infected plants die. Smutted plants also are difficult to find shortly after mowing due to their slower growth.



Stripe smut fungus caused the linear dark streaks in the three Kentucky bluegrass leaves at left. Healthy leaf is at right.



Leaves of a Kentucky bluegrass plant curled and shredded by stripe smut infection.

Control

Fungicides are available for treating the disease. Smut damage is less severe if Merion Kentucky bluegrass is mixed with common Kentucky bluegrass, or if smut-tolerant varieties like Fylking, Kenblue, Park, or Pennstar are grown.

POWDERY MILDEW

In recent years, powdery mildew has become an increasingly important fungus disease of Merion Kentucky bluegrass and other Kentucky bluegrasses. Powdery mildew also infects red fescue, bermuda, and other grasses used for lawns. The use of high rates of nitrogen fertilizer produces an ideal environment for this mildew fungus.

The disease is generally more damaging to grasses in shaded and protected areas (on north and east sides of buildings), although it also occurs in severe form in fields of Merion during late fall and early spring. Because the fungus significantly reduces the growth of leaves, roots, and rhizomes, it is an important cause of turf deterioration of bluegrass lawns in shaded areas. Many plants may be weakened, die from drought, or be winter-killed because of this deterioration.

Symptoms

Powdery mildew appears first as small superficial patches of white to light-gray fungus growth on leaves and sheaths. These patches enlarge rapidly and become powdery as spores are produced. The older, lower leaves are often completely covered by mildew. The leaf tissue under the mildew becomes yellowed soon after infection and later turns tan or brown and is killed. Severely infected leaves gradually dry up and die.

The fungus survives the winter as a mass of thread-like filaments on the live leaves of Kentucky bluegrass. Numerous spores are produced on these filaments in the spring. Spores are carried by the wind and initiate new infections during cool (optimum 65° F.), humid weather. With favorable temperature and high atmospheric humidity, the host tissue dies and the spores are carried to other grasses in the same or neighboring turf areas to produce new in-

fections and start the cycle once again.

Control

Kentucky bluegrass varieties differ in their susceptibility to powdery mildew. Merion is very susceptible while other varieties exhibit varying degrees of resistance.

To reduce turf shading and improve air circulation be sure to prune or remove trees and shrubs that shade or border turf areas. Keep the lawn vigorous but avoid overstimulation with nitrogen fertilizer. Water during dry periods to maintain adequate moisture in the soil. Where possible, mow at the recommended height and—when the disease is present—collect all clippings.

In the spring or early fall, when powdery mildew becomes evident, one or more applications of a fungicide at 7 to 10 day intervals should control the disease. Suggested fungicides to obtain control are listed in the guide on page 19.

FUSARIUM BLIGHT

Fusarium blight affects Kentucky bluegrass, bentgrass, red fescue, and many other grasses. The fungi that cause Fusarium blight survive the winter months in infected grass roots, crowns, and in thatch covering the lower portion of grass plants. The pathogens are widespread; they occur on blighted turf wherever the above turf grasses are grown.

Bentgrasses are the most susceptible species, followed by Kentucky bluegrass and red fescue. The disease also occurs in Merion and Windsor Kentucky bluegrass, other varieties vary in susceptibility at different temperatures.

The severity of the disease varies directly with light intensity; areas that receive direct sunlight are the most severely infected. Infection of the leaves usually occurs when air temperatures are 70° F. to 90° F. and conditions of high humidity prevail. The disease ceases to be active when temperatures fall below 70° F. and there is an absence of rainfall or humidity.

Symptoms

At first, diseased areas are light green but within 36 to 48 hours the areas fade to tan and then to a light straw color. The diseased areas vary in size from a few inches to 2 or more feet in diameter. Dead areas may be circular, crescent shaped, streaked, or in circles with a patch of green grass in the central portion. The latter forms a distinctive “frog’s eye” symptom pattern. Extensive damage occurs when diseased areas are numerous and coalesce.

Individual plants are killed when the crown tissues are destroyed. On individual leaves, the disease is characterized by irregular-shaped, dark-green blotches. These blotches rapidly fade to a light green, then assume a reddish-brown hue, and finally become dull tan.

Control

The fungi that cause Fusarium blight grow in a layer of thatch on the soil surface. To control this disease, remove most of the thatch layer with a rake or lawnmower. A nitrogen imbalance in the soil causes the thatch on which the fungi feed to accumulate more rapidly.

To effectively control Fusarium blight the use of a preventive fungicide spray as well as thatch control is essential. Do not spray when night temperatures fall below 70° F. Spraying should be continued at 7-to-10 day intervals as long as daytime temperatures are 75° F. and above and conditions of high humidity prevail.

Fungicides that will help control Fusarium blight are listed on page 19.

RED THREAD

Red thread especially affects bentgrasses, red fescue, and Kentucky bluegrasses in the Northeastern States and in the Pacific Coast States of Washington and Oregon. In these regions, red thread occurs primarily in the early spring and fall during cool, wet weather. This fungus disease has also been reported on bermudagrass lawns in Mississippi during December.

When the grass is growing rapidly, nitrogen fertilization is a rapid and effective means of controlling the disease. However, the fungus again becomes destructive

when grass growth slows down. Therefore, fungicidal eradication is necessary for satisfactory disease control.

The pathogen survives unfavorable conditions as fragments of dried fungal tissues and as dormant mycelium in the residues of the diseased plants. These fragments may be carried by the wind or mechanically on mowers or similar machines.

Symptoms

The fungus attacks the leaves and leaf sheaths. These parts later become tan colored as the tissue dries out. The leaves may be completely covered by a pink, gelatinous growth of the fungus. As this growth spreads, it infects plant after plant.

In its final stages, the disease is characterized by reddish fungus threads at the leaf terminals. Diseased areas are usually 2 to 30 inches in diameter and irregular in shape.

Red thread is capable of growing over a wide range of temperatures; growth occurs from slightly above 32° F. to about 86° F. The most favorable temperature range for growth lies between 60° F. and 70° F.

Control

Red thread is serious only when cool temperatures slow grass growth or when the turf is underfertilized with nitrogen. Fungicides to control red thread are listed on page 19.

COPPER SPOT

Copper spot can cause a serious disease problem on bentgrasses. It is most damaging in the coastal states but is found throughout the United States.

The pathogen overwinters in the debris of the previous season's growth. The disease occurs in warm, wet weather; active growth of the organism begins when air temperatures range from 68° F. to 75° F. When the weather is warm and humid secondary spores are produced and new lesions are formed.

The spores, spread by means of splashing water, germinate rapidly and new leaf infections take place within 24 hours. Outbreaks of copper spot may occur in epidemic proportions within a few days.

Symptoms

From a distance, copper spot looks like salmon-pink or copper-colored turf; the spots range from 1 to 3 inches in diameter. Unlike areas infected by dollar spot, areas affected by copper spot are not definite in outline. Wet weather increases the intensity of coloration.

Control

Copper spot can be controlled by the use of fungicides. Apply preventive fungicidal applications at 10-day intervals when the daytime air temperatures stabilize at 70° F. to 75° F. Make curative

applications at 4 to 5-day intervals until recovery is effected.

Fungicides that will control copper spot are listed on page 18.

OPHIOBOLUS PATCH

Ophiobolus patch is the third most important fungus disease in the Pacific Northwest. It occurs west of the Cascades in Oregon, Washington, and British Columbia. The disease is especially common on bentgrass lawns.

The growth of the disease is stimulated by cool, wet weather. However, symptoms become most noticeable during midsummer under drier growing conditions. The disease usually appears as a thinning or drying of the grass in doughnut-shaped rings or larger areas. Both shoots and roots of the grass are severely attacked. Affected areas do not recover for several months.

Symptoms

The doughnut-shaped rings range from several inches to several feet in diameter. The injured areas are light brown in color becoming dull gray in winter. The centers of the rings are invaded by weeds and annual bluegrass.

Ophiobolus patch is first seen as depressed circular patches of blighted turfgrass, a few inches in diameter. The affected areas may increase to several feet in diameter and coalesce so that they become large, irregular-shaped patches. The colors range from

light straw to bronze. The centers of the patches often fill in with resistant species creating a "frog eye" symptom pattern.

Control

Ophiobolus patch is difficult to control with fungicides. The use of ammonium sulfate fertilizer as a source of nitrogen has been effective.

Apply ammonium sulfate four times a year in March, May, June, and early September. Apply 7½ pounds of the product as it comes from the bag per 1,000 square feet for each application. Turf must be thoroughly watered after each application of fertilizer.

To balance applications of ammonium sulfate apply 0-20-20 (O-P-K) fertilizer twice a year in early spring and early fall. Use 7 pounds of fertilizer per 1,000 square feet for each application. After the disease has disappeared use a 12-4-8 fertilizer for normal lawn fertilization.

SNOW MOLDS: FUSARIUM PATCH AND TYPHULA BLIGHT

These diseases are especially severe on bentgrasses, but they also occur on other lawn grasses. Snow mold, or winter scald, is caused by several different fungi. It is most severe when snow covers grass for long periods. It is particularly difficult to control if the grass is green and growing actively when covered by lasting snow. Fusarium patch, also known as pink snow mold, can occur during the growing season

when humidity is high and daily temperatures fall below 65° F. Any condition that keeps the turf excessively wet, such as poor surface drainage, favors these diseases.

Symptoms

Snow mold symptoms appear first as a white cottony growth on the leaves. As the leaves die they turn light brown and cling together. Diseased areas are usually 1 to 12 inches or more in diameter and discolored dirty white, gray, or slightly pink. Fusarium patch is characterized by development of irregular pale yellow areas from several inches to several feet in diameter. Later, affected areas become whitish gray. Sometimes the edge of an affected area has a faint pinkish color.

Typhula blight is particularly active under snow cover and is usually conspicuous at the first spring thaw. At first, the disease appears as light-yellow discolored grass areas 1 or 2 inches in diameter. Leaves of the infected plants change their discolored appearance to a grayish white. As the areas enlarge, a halo of grayish-white mycelial growth up to 1 inch in diameter develops. Affected areas may measure up to 1 or 2 feet, but under optimum conditions the diseased grass may coalesce into larger areas.

Initial disease development does not occur unless there is snow cover on unfrozen ground. When the ground is frozen, parasitic activity of the fungus essen-

tially ceases. The disease is most active with the advent of cool air temperatures and humid conditions in the spring.

Control

Proper management in the fall is especially important because the condition of the turf as it goes into the winter determines whether the snow mold fungus can easily get established. Do not apply high nitrogen fertilizers late in the fall because that might stimulate growth and result in an actively growing turf when snow covers the ground. Keep the lawn cut in the fall to prevent a mat of grass from developing. Apply lime if soil tests indicate a need for it.

For control of snow molds with fungicides, see table on page 20.

MUSHROOMS AND FAIRY RINGS

Many kinds of mushrooms grow in lawns and turf areas. They vary in size, shape, and habit of growth, and in the way they affect the turf. They may grow individually or in clumps. Some grow in a circle and cause a condition known as fairy rings.

Mushrooms

Mushrooms that grow individually or in clumps usually develop from buried organic matter such as pieces of construction lumber, logs, or tree stumps. Mushrooms with this growth habit are usually harmless to grasses but are objectionable because they are un-



Mushroom fruiting bodies emerging in lawn grass.

sightly and the fruiting bodies occur repeatedly. They develop following prolonged wet weather, and often disappear as soon as the soil begins to dry or when the grass is mowed.

Eliminate mushrooms that grow from buried lumber, logs, or stumps by digging up the pieces of buried wood. If this is impractical, drench the soil with captan. The simplest way to drench is to punch holes 6 to 8 inches apart and 6 to 8 inches deep in the ground within and surrounding the infected area. Use an iron rod or pipe for punching the holes, then pour a solution of captan down the holes.

Fairy Rings

Fairy rings are circles, or arcs, of dark-green grass surrounding areas of light-colored or dead grass. During spring and fall the fruiting bodies (mushrooms) develop in a circle outlining the



A large fairy ring with stimulated grass and fruiting bodies (mushrooms) of the fungus growing at the outer edge.

fairy ring. Unless the fungus is controlled the ring enlarges each year and leaves alternate bands of green and discolored grass.

The fungus that causes fairy rings begins growth at a particular point and continues to grow outward. It may spread from 5 to 24 inches annually; the rate of spread depends on soil conditions, temperature, moisture, and fertility. The fungus is usually several inches below the ground and it forms a dense layer of mycelial threads that break down organic matter at the outer edge of the ring. Grass at the outer edge grows faster than grass outside the ring, and is darker green. Dying or dead grass is inside the zone of stimulated growth. Fairy rings seldom occur in lawns that are adequately fertilized and treated with fungicides for control of other diseases.

For best control, fumigate the affected area with methyl bromide. As an alternate method, punch holes around the outside of

the ring and throughout the affected area, then pour a solution of captan into the holes.

SLIME MOLDS

A group of fungi known as slime molds often covers grass with a dusty, bluish-gray, black, or yellow mass. Slime molds are not parasitic on grass, but they are unsightly. They feed on dead organic matter. The most damage they do to grass plants is to shade and discolor the blades. Slime molds occur during wet weather; they disappear rapidly as soon as it becomes dry. The large masses can be readily broken up by sweeping with a broom or by spraying with a strong stream of water. During prolonged damp weather slime molds can be especially annoying and it may be desirable to apply a turf fungicide listed on page 20 to affected areas.



Slime mold fungus clings to the three Kentucky bluegrass leaves at left. Clean leaf is at right.

OTHER CAUSES OF POOR TURF

UNDESIRABLE SPECIES

Short-lived perennials like red-top and ryegrass or weedy annuals such as annual bluegrass and crabgrass do not make a desirable lawn. Annual species usually die at the end of the growing season, and leave brown or bare areas that may be mistaken for disease injury.

UNDESIRABLE MIXTURES

Bermudagrasses and zoysiagrasses turn straw colored or brown following a killing frost. When these species are grown in a sod composed mainly of cool-season grasses, a mottled brown and green lawn often results because of the differences in sensitivity to cold. This effect may resemble disease injury.

INSECT INJURY

Lawn grasses are often damaged by insect pests. For information concerning lawn insects and their control, see your county agent or write to the U.S. Department of Agriculture, Washington, D.C. 20250.

FERTILIZER BURN

Concentrated inorganic fertilizers, if applied too heavily, burn grass in 2 or 3 days. Burned areas may occur in spots or streaks or the entire lawn may be damaged. To prevent injury, apply the fertilizer evenly in recommended amounts when the grass is dry,

then water immediately. If burning occurs, water generously to wash off excess fertilizer and reduce injury.

HYDRATED LIME BURN

Hydrated lime burns grass if it is applied unevenly and in large amounts. Ground agricultural limestone is safer and is usually recommended for lawns.

PESTICIDE INJURY

Some of the chemicals used for disease, insect, and weed control are potent and may injure grass if improperly applied. Chemical formulations vary with manufacturers. Follow directions and observe all precautions on the label.

DOG URINE INJURY

This kind of injury is frequently mistaken for disease damage. Affected spots are usually round or slightly irregular and variable in size. The grass within the spot turns brown or straw colored and usually dies.



Fertilizer burn caused yellowing in grass at right.

IMPROPER MOWING

Cutting grass too closely or too frequently may result in a condition that looks like disease. Cut Kentucky bluegrass, red fescue, and other grasses with upright growth habit to a height of $1\frac{3}{4}$ to 2 inches. Do not lower the height of cutting in midseason; it may result in serious injury. Mow the grass before it gets too tall; not more than one-half of the leaf surface should be removed at one time. The frequency of mowing will depend on quantity of fertilizer and water applied, weather conditions, and other factors that influence plant growth. Clippings need not be removed unless growth is excessive.

IMPROPER WATERING

Frequent light watering induces shallow rooting in grasses. Shallowrooted grasses are readily injured during periods of severe drought. Frequent evening watering favors disease development because it keeps grass leaves moist for long periods.



Do not water grass until it begins to wilt, then apply enough water to soak the soil to a depth of 6 inches or more. It is more economical to water the lawn only when water is needed and it is better for the grass.

BURIED DEBRIS

A thin layer of soil over rocks or debris such as lumber, stumps, plaster, and cement dries rapidly and may not retain enough moisture to keep grass green. Correct this condition by removing the cause.

ACCUMULATION OF RUNNERS

Another type of dry spot results when an accumulation of runners (thatch) in bermudagrass, bentgrass, and zoysiagrass becomes impervious and does not let water into the soil. Mowing following vigorous hand raking corrects this condition.

COMPACTED SOILS

Saturated soils pack easily and bake hard when dry, especially where traffic is heavy. The soil may become packed so hard that water will not penetrate the surface. Grass then thins out and bare spots result. To correct this condition, loosen or perforate the soil with a tined fork or aerifying implement and, if necessary, fertilize and reseed the lawn.

COMPONENTS OF RECOMMENDED FUNGICIDES

- Acti-dione TGF: ® 3-[2-(3,5-dimethyl-2-oxocyclohexyl) - 2 - hydroxyethyl]glutarimide (cycloheximide)
- Acti-dione-thiram: ® cycloheximide plus bis(dimethylthiocarbamoyl) disulfide
- Captan: *N*-[(trichloromethyl thio)-4-cyclohexene-1,2-dicarboximide
- Cleary 3336: ® diethyl [(1,2-phenylene) bis (iminocarbonothioyl)]bis [carbamate] (thiophanate)
- Daconil 2787: ® tetrachloroisophthalonitrile (chlorothalonil)
- Dexon: ® sodium *p*-(dimethylamino)benzenediazosulfonate
- Dowfume MC-2: ® methyl bromide with 2% chloropicrin
- Dyrene: ® 2,4-dichloro-6-(*o*-chloroanilino)-*s*-triazine
- Fore ® coordination product of zinc ion and manganous ethylenebis[dithiocarbamate]
- Fungo 50: ® dimethyl [(1,2-phenylene) bis (iminocarbonothioyl)]bis [carbamate] (thiophanate-methyl)
- Koban: ® 5-ethoxy-3-(trichloromethyl)-1,2,4-thiadiazole
- Mertect 140-F: ® 2-(4-thiazolyl) benzimidazole (thiabendazole)
- Tersan 1991: ® methyl 1-(butylcarbamoyl) - 2 - benzimidazole-carbamate (benomyl)
- Tersan LSR: ® manganous ethylenebis[dithiocarbamate] (maneb)
- Tersan SP: ® 1,4-dichloro-2,5-dimethoxybenzene (chloroneb)
- Zineb: zinc ethylenebis[dithiocarbamate]

® denotes a trademark or proprietary product

Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

GUIDE FOR SELECTING FUNGICIDES

Disease and Causal Organism	Fungicides ¹	Application Per 1,000 sq ft		Directions ²
		Ounces of Formulation	Tablespoons	
Brown Patch <i>Rhizoctonia solani</i>	Cleary's 3336® WP 50%	2	11	Disease can appear from June to August. Treat your lawn every 5-10 days until the disease has been controlled.
	Daconil 2787® WP 75%	4	22	
	Dyrene® WP 50%	4-6	19-28	
	Fore® WP 80%	4	14	
	Fungo 50® WP 50%	2	11	
	Mertect 140-F® liquid	2	4	
	Tersan 1991® WP 50%	2	11	
	Tersan LSR® WP 80%	6	4-5	
Copper Spot <i>Gloeocercospora sorghi</i>	See Dollar Spot (Sclerotinia)			
Dollar Spot <i>Sclerotinia homeocarpa</i>	Acti-dione-Thiram® WP	2-4	11-22	Disease can appear from June to October. Treat your lawn at 7-14 day intervals until the disease has been controlled.
	Cleary's 3336® WP 50%	2	11	
	Daconil 2787® WP 75%	2-4	11-22	
	Dyrene® WP 50%	4-6	19-28	
	Tersan 1991® WP 50%	2	11	
	Fore® WP 80%	6-8	14-21	
	Fungo 50® WP 50%	1	6	
	Mertect 140-F® liquid	2	4	
Fairy Rings Mushrooms <i>Psalliota campestris</i> <i>Marasmius</i> <i>Lepiota</i>	Captan WP 50% Dowfume MC-2	4-5	15-20	Disease can appear throughout the growing season. Pour double or triple strength concentrate of captan into 1-inch holes punched 4-6 inches deep and 6-8 inches apart both inside and outside the affected area. Alternative method: Fumigate infected area with Dowfume MC-2® (1 lb/

				100 sq ft) and reseed or resod. Recommended largely for golf courses, parks, and other large turf areas.
Fusarium Blight <i>Fusarium roseum</i>	Cleary's 3336® WP 50% Fungo 50® WP 50% Tersan 1991® WP 50%	2-4 4-8 2	11-22 19-38 33	Treat at first appearance of disease and repeat 10-14 days later. Water thoroughly to wet into soil.
Grease Spot and Cottony Blight <i>Pythium</i>	Tersan SP® WP 65% Dexon® WP 70% Fore® WP 80% Koban® WP 65% Zineb WP 75%	4 2 8 4 2	5-6 14 28 17 13-27	Disease can appear from July to September and in fall and winter during warm, humid periods in the South. Treat your lawn every 5-14 days until the disease has been controlled.
Helminthosporium diseases	Acti-dione-Thiram® WP Captan WP 50%	4 4-6	22 15-23	Disease can appear from April to August, depending on kind of grass and species of fungus. Treat your lawn every 7-14 days three times consecutively or until the disease has been controlled.
Leafspot (Blight, Going-out, Melting-out)	Cleary's 3336® WP 50% Daconil 2787 ® WP 75% Dyrene® WP 50%	2 4 4-6	11 22 19-28	
<i>Helminthosporium</i> spp.	Fore® WP 80% Tersan LSR® WP 80% Zineb WP 75%	4 3-4 2	14 4-5 13-27	
Ophiobolus Patch <i>Ophiobolus graminis</i>	See page — for control.			
Powdery Mildew <i>Erysiphe graminis</i>	Acti-dione Thiram® Acti-dione TGF® WP Tersan 1991® WP 50%	4 1-2 2	22 6 11	
Red Thread <i>Corticium fuciforme</i>	Acti-dione-Thiram® WP Cleary's 3336® WP 50% Fore® WP 80% Fungo 50® WP 50% Tersan LSR® WP 80%	4 2 4-6 2 6	22 11 14-21 11 4-5	May, June, and August, every 10-14 days.

GUIDE FOR SELECTING FUNGICIDES—continued

		Application Per 1,000 sq ft		
Disease and Causal Organism	Fungicides ¹	Ounces of Formulation	Tablespoons	Directions ²
Rust <i>Puccinia</i>	Acti-dione-Thiram® WP	4	22	Disease can appear from June to September. Treat your lawn every 7–14 days until rust disappears.
	Daconil 2787® WP 75%	4	22	
	Dyrene® WP 50%	4–6	19–28	
	Fore® WP 80%	4	14	
	Tersan LSR® WP 80%	3–4	4–5	
	Zineb WP 75%	2	13–27	
Slime Molds <i>Physarum cinereum</i>	Fore® WP 80%	6–8	21–28	Disease can appear throughout the growing season and can be controlled without fungicides. See page —.
	Zineb WP 75%	2	13–27	
Snow Molds Fusarium Patch <i>Fusarium nivale</i>	Tersan 1991® WP 50%	2	11	Disease can appear from fall to spring. Treat your law at intervals of 2–6 weeks as needed.
	Mertect 140-F® liquid	2	2	
	Fore® WP 80%	6–8	21–28	
	Fungo 50® WP 50%	2	11	
Typhula Blight <i>Typhula itoana</i>	Tersan SP® WP 65%	6–8	5–6	Disease can appear from fall to spring. Tret your lawn at intervals of 2–6 weeks as needed.
	Dyrene WP 50%	2–3	19–28	
Stripe Smut <i>Ustilago striiformis</i>	Fungo 50® WP 50%	4–8	19–38	One application in October or early spring before grass growth begins. Water thoroughly to wet into soil.
	Tersan 1991® WP 50%	6	33	

CAUTION: Do not graze treated areas or feed clippings to livestock.

¹ See page 17 for components of registered fungicides.

² The directions given in the above table may not be complete enough. Be sure to read and follow the manufacturer's directions on the label for all fungicide applications.

MANAGEMENT PRACTICES THAT HELP PREVENT LAWN DISEASES

These practices are general guides to be used according to one's judgment. Their importance depends on the kind and seriousness of the disease threat. Not all of them are practicable under all conditions.

- Select grass species best adapted to the soil, climatic, and light conditions under which they will be grown.

- Plant mixtures of recommended grasses. Species vary in their susceptibility to different disease organisms, and in a mixture one or more of the grasses usually will survive a severe disease attack.

- Do not clip upright-growing grasses such as Kentucky bluegrass and red fescue too closely—1¾ to 2 inches is the best height. Creeping grasses such as bentgrass and zoysia may be clipped at ½ inch or less.

- Mow the grass before it gets too tall; not more than one-half of

the leaf surface should be removed at one time.

- Mow the lawn frequently enough in the fall to prevent the accumulation of a thick mat of grass before snow comes.

- Apply enough fertilizer to keep grass vigorously growing, but avoid overstimulating the grass with nitrogen. Apply lime if soil tests indicate a need for it.

- Clippings need not be removed except on heavily fertilized lawns or during periods when the grass is growing rapidly. Clippings provide nutrients for fungi and help to maintain humidity long after the sun has dried off surrounding uncovered areas.

- Water early enough in the day to allow grass leaves time to dry out before night. Avoid frequent, light waterings, especially during warm weather.

- Do not water grass until it begins to wilt, then soak the soil to a depth of 6 inches or more. Provide good surface drainage.

USE OF PESTICIDES

This publication is intended for nationwide distribution. Pesticides are registered by the Environmental Protection Agency (EPA) for countrywide use unless otherwise indicated on the label.

The use of pesticides is governed by the provisions of the

Federal Insecticide, Fungicide, and Rodenticide Act, as amended. This Act is administered by EPA. According to the provisions of the Act, "It shall be unlawful for any person to use any registered pesticide in a manner inconsistent with its labeling." (Section 12(a)(2)(G))

EPA has interpreted this Section of the Act to require that the intended use of the pesticide must be on the label of the pesticide being used or covered by a Pesticide Enforcement Policy Statement (PEPS) issued by EPA.

The optimum use of pesticides, both as to rate and frequency, may vary in different sections of the country. Users of this publication may also wish to consult their Cooperative Extension Service, State Agricultural Experiment Stations, or County Extension Agents for information applicable to their localities.

The pesticides mentioned in this publication are available in several different formulations that contain varying amounts of active ingredient. Because of this difference, the rates given in this publication refer to the amount of active ingredient, unless otherwise indicated. Users are reminded to convert the rate in the publication to the strength of the pesticide ac-

tually being used. For example, 1 pound of active ingredient equals 2 pounds of a 50 percent formulation.

The user is cautioned to read and follow all directions and precautions given on the label of the pesticide formulation being used.

Federal and State regulations require registration numbers on all pesticide containers. Use only pesticides that carry one of these registration numbers.

USDA publications that contain suggestions for the use of pesticides are normally revised at 2-year intervals. If your copy is more than 2 years old, contact your Cooperative Extension Service to determine the latest pesticide recommendations.

The pesticides mentioned in this publication were federally registered for the use indicated as of this publication. The user is cautioned to determine the directions on the label or labeling prior to use of the pesticide.