



LIVABLE LAWNS

MANAGING A HEALTHY LAWN

The benefits of a healthy, attractive lawn are many and diverse. Lawns prevent erosion, provide cooling, reduce dust and mud, remove pollutants from the environment, absorb CO₂ and produce O₂. Lawns provide a safe, comfortable surface for many athletic and social activities. Areas of lawn, whether large or small, help bring green to the urban environment. Lawns provide the carpet upon which other plants are located and act as a unifying feature in the landscape.



Lawn provides a great pathway to promote circulation through your landscape.

A lawn is a comfortable surface for people to sit on . . . play on.



This small strip of lawn unifies a relatively complex landscape bed and makes the entire composition more attractive.

In fact, lawn is such an important component of most landscapes, its location should be planned when designing the landscape. But people in the United States have a love affair with the lawn and use it everywhere. Instead, incorporate lawn to serve as play areas, pathways and gathering spaces. Once you have allocated useful spaces for lawn, manage everything else in the landscape as an alternative to lawn such as, forest or tree grove, meadow, or landscape bed. See *Livable Ecosystems: A Model for Suburbia* for ideas about how to incorporate forest groves, meadows and landscape beds into the home landscape.



This lawn, surrounded by landscape beds, makes a pleasant gathering space.



This landscape bed at the corner of the property defines a usable lawn space inside.

Lawns, like any living plant provide a number of environmental benefits, but they aren't as effective at cleaning stormwater or supporting a diverse population of wildlife as other types of vegetation. So, it is important to limit their use to areas that require the functionality lawns provide.



A small lawn space for picnicking is surrounded by a meadow, which will slow and cleanse runoff water flowing down the slope.



The front lawn meadow looks well-kept because the edges along the drive are routinely mowed.

It is also important to manage the lawn properly. A “freedom lawn”, one with no maintenance other than mowing, is not environmentally sound. Research has shown that after a few years, lawns begin to thin, weeds take over, and erosion can more easily occur resulting in more phosphorus leaching into streams

and rivers. But, always having the brightest green lawn, especially in the middle of a drought, is not environmentally sound either. This brochure will present the proper way to manage your limited lawn area to have a healthy lawn you can use and enjoy!

With the selection of an appropriate grass for Delaware, fall fertilization, proper mowing and recycled clippings, this lawn is green and healthy.



Without regular fertilization, lawns begin to thin and this pond may receive soil containing unwanted phosphorus, due to erosion.



ESTABLISHING A LAWN

The easiest way to maintain an attractive lawn is to start with healthy turf. A thick, healthy stand of turf can resist many problems that plague lawn managers.

PREPARE THE SITE

Begin by clearing away all obstructions including rocks, debris, and existing plants. Kill existing plants by covering with black plastic to exclude light for several weeks or treating with an herbicide like glyphosate and cut back dead grass on the lowest lawn mower setting.

By adding 2 to 4 inches of organic matter (i.e. yard waste compost, mushroom soil, manure) you can greatly improve the soil structure and increase the chance for success. Till in organic matter and take a soil sample to determine the nutrients present in the lawn. Soil sample bags can be purchased from each county Cooperative Extension office in person or online. Soil sample results will



I'd dare a weed to make it through this dense, healthy lawn!

include recommendations on lime, phosphorus and potassium required for lawn establishment.

Establish a smooth final grade and rake in a starter fertilizer containing 1/2 pound of nitrogen (N) per 1000 square feet. The starter fertilizer is not necessary if the organic matter used contains readily available nitrogen.

- **Remove existing debris.**
- **Till in organic matter.**
- **Modify soil pH, phosphorus (P) and potassium (K) levels.**
- **Establish a smooth surface.**
- **Rake in starter fertilizer (if needed).**

SELECT THE PROPER TURF SPECIES

Turfgrasses are divided into two categories based on their climate adaptation. Cool-season grasses grow best in the spring and fall, with optimum growth when the temperature is between 60 and 75° F. Warm-season grasses grow best in the summer, with optimum growth at 80 to 90° F. Delaware is in the transition zone. Our winters are too cold for warm-season grasses and our summers are too hot for cool-season grasses. Since we are in the northern part of the transition zone, we grow primarily cool season grasses but they may go dormant in hot, dry summers.

Cool-Season Grasses:

Kentucky Bluegrass - This high-quality turf has a nice green color and recovers well from injury. But it damages easily, suffers from heat and drought, requires moderately high maintenance, has a tendency to thatch, is susceptible to many diseases, and is intolerant of shade or salt.

Perennial Ryegrass - This turfgrass establishes very rapidly and is often included in grass mixtures to provide a quick cover. It does not wear or recuperate well and is intolerant of heat, drought, shade, and salt. Perennial ryegrass is susceptible to a moderate number of fungal diseases.

Tall Fescue - The turf-type tall fescues are excellent for Delaware. While they take a little while to establish or recuperate, since they are a clump-type grass, they are extremely wear-resistant, drought-, heat- and salt-tolerant, and moderately shade-tolerant. Tall fescues have few disease problems and require less maintenance than other grasses. Kentucky bluegrass is the first grass to brown out in the summer and tall fescue is the last. Especially for a new lawn in Delaware, tall fescue is the best choice.



This lawn in Sussex County, Delaware is primarily turf-type tall fescue, which is the best cool season grass for our tough conditions.

Fine-leaf Fescues - Fine fescues have an extremely narrow, almost needle-like leaf blade. They are included in turfgrass mixtures for their excellent shade tolerance. Red fescue (one of the fine-leaf fescues) often appears in neglected lawns because it withstands a high pH. Due to its fine texture, red fescue is often difficult to mow.



Less commonly used, low fescues (a type of fine-leaf fescue) can make an attractive lawn that is mowed less frequently.

Bentgrass - This fine-textured grass is unique among cool-season grasses in its ability to be cut at heights of 1/2 inch or less. It has a high disease potential, poor drought tolerance and requires extremely high levels of maintenance. Bentgrass is a weed in home lawns and should be left on the golf course where it belongs.

Warm-Season Grasses:

Zoysiagrass - This is the only warm-season grass grown as a lawn in Delaware. Zoysia is easy to identify because its leaves are covered with stiff hairs. It remains brown well into the spring and turns brown again with the first fall frost. Zoysia

is very aggressive and is often a bone of contention between neighbors. The best place for zoysiagrass is at a beach residence where it is viewed only during the summer. Zoysia does require less mowing and some people are happy with a lawn that is only green for 4-5 months out of the year.

Since no one grass has a full list of desirable characteristics, we use blends of cultivars and mixtures of species to achieve versatile lawns with fewer shortcomings. Tall fescue and zoysiagrass are usually not mixed with other grasses.

Recommended Turfgrass Mixtures

1. For a low to moderate maintenance lawn, use primarily turf-type tall fescue.
2. For a high maintenance lawn, use three varieties of Kentucky bluegrass with a little perennial ryegrass for quick germination.
3. For a shady lawn, use primarily fine-leaved fescue mixed with Kentucky bluegrass or perennial ryegrass.

New turfgrass varieties are being developed and released all the time. Varieties are tested by the National Turfgrass Evaluation Program. There is no testing site in Delaware, but based on Maryland and New Jersey sites, the following varieties performed the best. Seed mixes may contain several of these varieties. In some stores, that sell individual seed, you can make your own mix.

Kentucky Bluegrass:

Granite	Impact	4-Season	Everest	Hampton
Barrister	Shiraz	Alexa II	Rhythm	Award
Nuchicago	Zinfandel	Gladstone	Baron	Solar Eclipse
Nu Destiny	Ginney II	Bluestone	Blue Note	Diva
Shamrock	Bewitched	Sudden Impact	Midnight	Aura
Rhapsody	Glenmont	Futurity	Beyond	Excursion
Emblem Aires	Rugby II	Rubicon	Washington	

Perennial Ryegrass:

Octane	Palmer V	Rio Vista	Sox Fan	Uno
Mach I	Pizzazz 2 GLR	Sideways	Allante	Fiesta 4
Insight	Dominator	Pangea PLR	Rinovo	Haven
Sienna	Bonneville			

Tall Fescue *(recommended – 90-100% on a weight basis):*

Spyder	Catalyst	Toccoa	Finelawn Xpress	Falcon IV
Faith	Falcon V	Turbo	Falcon NG	Traverse SRP
Stetson II	Umbrella	Firecracker LS	Bullseye	Pedigree
Tulsa Time	Tahoe II	Cochise	Tanzania	Garrison
Gazelle II	Essential	Xtremegreen	Sidewinder	Raptor II
Jamboree	Talladega	Firenza	Corona	Cannavaro
Van Gogh	Mustang 4	Darlington	Braveheart	Speedway
Wolfpack II	Shenandoah Elite	Rhambler SRP	Shenandoah III	Escalade
Justice	3 rd Millenium SRP			

Fine-leaf Fescue:

Gotham	Beacon	Longfellow 3	Zodiac	Treasure II
Spartan II	Bighorn GT	Wrigley 2	Intrigue	Cascade
Sword	Radar	Navigator III	Lacrosee	Fairmont

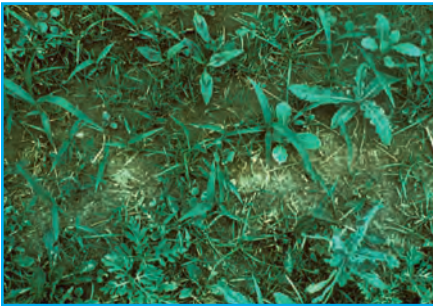
Zoysia *(Varietal differences in texture and winter hardiness are important considerations):*

Emerald Meyer	Zoro	Compadre	Himeno	Zenith
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PLANT THE LAWN

The best time to seed a lawn in Delaware is between August 15 and September 30. Grass seed germinates quickly with warm soil temperatures, and cool temperatures provide optimum growing conditions for newly-establishing seedlings. Additionally, frosts in the fall eliminate competition from summer annual weeds. Spring is a poor second choice for beginning or reseeding a lawn. Soil temperatures are cool, air temperatures are becoming warmer, and weed competition is fierce. If spring seeding is unavoidable, seed between March 1 and April 15.

Spread seed uniformly over the soil surface. Seed the lawn in at least two different directions to ensure full, uniform coverage. If you are



When lawns are seeded in spring, summer annual weeds can be extremely competitive and take over.

seeding into an existing lawn, remember that each seed must have contact with the soil to germinate. Slit seeders can be rented at local equipment companies. A slit seeder places the seed in a shallow hole ensuring good seed/soil contact. Cover seed by raking lightly or adding a thin layer of topsoil.

Apply a mulch of straw or salt hay to maintain moisture, control weeds, and reduce potential for erosion and seed loss. Use one to two bales of straw or salt hay per 1000 square feet.



Grass is starting to come up through the thin layer of straw mulch applied on this sloping lawn.

Sodding (transplanting large pieces of established turf) can be done any time of year as long as soil can be prepared and water is available. Note that soil preparation for laying sod must be as thorough as that for seeding. Soil should be

lightly moistened before sod is laid. Stagger the ends of each sod piece to minimize cracks and push pieces together for a firm fit. Lightly tamp the soil and sprinkle topsoil on the seams for rapid rooting.

Seeding Process

- Seed from Aug. 15-Sept. 30.
- Spread seed uniformly.
- Cover by raking lightly.
- Mulch with salt hay.

Sodding Process

- Sod anytime soil can be prepared.
- Moisten soil.
- Lay sod.
- Tamp.

CARE FOR THE LAWN AFTER PLANTING

Water either newly establishing seed or sod daily (or more frequently) to keep the soil evenly moist until seeded areas have reached 1½ inches in height (about three weeks after emergence) or sod is well rooted (when sod cannot be lifted easily). Mow newly seeded turf when leaves reach 2½ to 3 inches. Be sure to use a mower with a sharp blade.

Mow sod at the desired height, but avoid heavy mowing equipment for several weeks to prevent rutting. Three to four weeks after germination or sodding, apply 1 pound of nitrogen per 1000 square feet.

- Keep new seed or sod moist.
- Mow at 3 inches with a sharp mower.
- Fertilize with 1 pound N three to four weeks after planting.

MAINTAINING A HEALTHY LAWN —●

The key to successful lawn management is to focus on strategies for growing healthy grass. Weed, insect, or disease problems are often symptoms of an unhealthy lawn and soil system. For example, crabgrass seed needs light to germinate and will only invade sparse lawns or lawns that have been cut too short. Chinch bug is an insect that is most likely to

invade bluegrass planted on a southern slope that suffers from drought stress. Controlling the weed, insect, or disease will provide only a temporary solution. It is best to correct the cultural stress factors (such as scalped lawn, drought stress, etc.) that led to the opportunity for the problem to occur.

- **Correct stress factors to help the lawn defend against insects, diseases and weeds.**

MOWING

We mow lawns to keep them looking neat and allow light to reach the leaf blades. Plants make their own food through the process of photosynthesis, which occurs in the leaves. The longer the blade, the more leaf surface for photosynthesis, the more food made, the longer the root system, the greater the ability to reach water and nutrients, and the healthier the plant.

When grass is cut too low, photosynthesis is decreased and the crown (or growing point) may be injured. When grass is cut too high, long blades shade each other and reduce photosynthesis. Uncut grass has an unattractive shaggy, open, coarse texture. The following mowing heights are recommended:

	mowing height (inches)
Kentucky bluegrass	1 ½ - 2 ½
Perennial ryegrass	2 - 3
Tall fescue	2 ½ - 3 ½
Fine fescue	1 ½ - 2 ½

Recommended mowing height varies seasonally. In the spring and late fall, cut at the shortest recommended height. Cut higher in summer and if grass is grown in the shade.

To determine when to cut the lawn, follow the rule of one-third. Never remove more than one-third of the leaf area at any time. To maintain a lawn at 2 inches, you must remove 1 inch when the grass reaches 2 inches – cutting the lawn every time it grows an inch. To maintain a 3-inch lawn, remove 1 ½ inches when the grass reaches 4 ½ inches. So, the taller the height of the grass being maintained, the less frequently it must be cut.



This lawn is managed at a taller height because it is in a lot of shade.

Cut the grass only when it is dry. Keep the mower blade sharp. Keep the discharge chute clear and mow in alternate patterns. Clippings contain 30 percent of the nitrogen needed for a well-managed lawn. By cutting the

lawn frequently enough, clippings can be left on the lawn to provide organic matter and recycled nitrogen.



Sharp mower blades result in an evenly mowed lawn that is most attractive.

Clippings decompose quickly and do not contribute to thatch. If the lawn is mowed infrequently, clippings are too long, become matted on the lawn, exclude light and can damage patches of turf. In that case, they should be raked up or caught in a lawn mower bag and recycled in a compost pile. Mulching mowers are designed to cut turf blades repeatedly, so blades are in small pieces when they fall back on the lawn and easily filter to the soil surface. Mulching mowers don't work well if the grass is too wet or if the clippings are too long.

- **Mow removing only one-third of the leaf blade with each cut.**
- **Mow when the grass is dry.**
- **Keep the mower blade sharp.**
- **Use alternate mowing patterns.**
- **Recycle clippings to the lawn or a compost pile.**

MANAGING THE LAWN SUPPORT SYSTEM

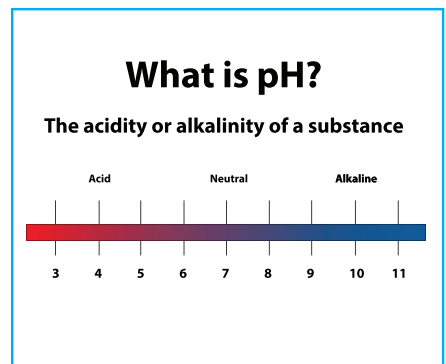
THE SOIL

The soil system includes water, air, organic materials and minerals. When we think of soil, we usually think of the mineral component and classify soils based on their texture or individual particle size. The smallest mineral particles in soil are clay, the largest are sand, and silt particles fall in between. A sandy soil is comprised of mostly sand particles; a loam has a combination of sand, silt, and clay particles; and a clayey soil has mostly clay particles. Clay soils tend to hold water and nutrients well but often drain poorly. Sandy soils are usually well drained but do not hold moisture or nutrients. Sandy soils require higher rates of fertilization and irrigation. There is little we can do to change the texture of a soil. Adding sand, for example, will not improve the drainage of a clayey soil unless you add massive quantities of sand (i.e. as in a constructed golf green).

We can modify the structure of soil by adding organic matter. Organic matter will fill in the large pores between sand particles and increase water and nutrient retention in sandy soils. Organic matter holds clay particles together into clumps so large pores are formed and drainage is improved. So the addition of organic matter solves the problems associated with both sandy and clayey soils!

The organic component of the soil includes not only decaying material, but very small living organisms (microorganisms) in the soil such as good bacteria and fungi. This living component is important to the establishment and maintenance of a healthy lawn. Microorganisms break down organic materials into nutrients required for proper turf growth and development. A healthy population of microorganisms will help keep thatch under control.

For a healthy lawn, maintain soil pH between 6.0 and 7.0. In this range, nutrients are available to the turfgrass plants, but not available in toxic quantities, so microorganisms thrive. Most soils in the Northeast tend to become acidic with time so we must apply lime periodically to raise the pH.



To determine the amount of lime required, have the soil tested. Soil test bags can be purchased from your county Cooperative Extension office in person or online. The soil test results will include a lime recommendation. Do not apply more than 50 pounds per 1000 square feet at any one time. If more is needed, use split applications. Since lime moves very slowly in the soil, it should be incorporated, if possible. Of the limestone products available, ground limestone has the highest surface area and is the best product to raise soil pH. Pelletized lime is ground limestone that has

been manufactured to hold together as pellets and is easier to work with than the powdery ground limestone. Granular lime has large chunks and does not have enough surface area to substantially change pH. Due to their ability to tie up nutrients, clay soils require twice as much lime as sandy soils. Dolomitic lime contains both calcium and magnesium and is useful for a soil low in magnesium.

Take a soil sample by collecting soil from 10 different locations in the lawn and mixing them in a bucket. Then fill a soil test bag and send it to the soils lab.



- Add organic matter to improve soil structure.
- Maintain a pH of 6.0 - 7.0.

FERTILIZE RESPONSIBLY

Many people think about fertilizer as plant food. But, we've already established that plants make their own food through photosynthesis. Fertilizer provides the nutrients that combine with sugars and carbohydrates produced by the plant to make complex proteins and other chemicals used throughout the plant. Of

the 13 essential mineral elements necessary for growth, nitrogen (N), phosphorus (P), and potassium (K) are the principal nutrients applied to turf. Fertilizer recommendations are usually given in terms of nitrogen requirements. Nitrogen is available as either water soluble nitrogen (WSN) or water insoluble nitrogen (WIN).

WSN Fertilizers

- Rapid response
- Release independent of temperature
- Usually less expensive
- Possibility of burn
- Short residual response
- Greater chance of loss due to leaching

Examples:

ammonium nitrate
ammonium sulfate
potassium nitrate
urea

WIN Fertilizers

- N released slowly
- Low potential for foliar burn
- Longer residual response
- Less leaching potential
- Slower response
- Higher cost

Examples:

ureaformaldehyde products (UF)
isobutylidene diurea (IBDU)
sulfur-coated urea (SCU)
natural organic materials

Most mixed fertilizers contain more than one source of nitrogen. The following is one example of a mixed fertilizer containing several different sources of nitrogen. This lawn fertilizer contains 30% of its nitrogen as WIN nitrogen.

**Lawn Fertilizer
12-4-8
Guaranteed Analysis**

Total Nitrogen	12%
6.50% Ammoniacal Nitrogen	
1.00% Nitrate Nitrogen	
0.90% Other Water Soluble Nitrogen	
3.60% Water Insoluble Nitrogen	
Available Phosphate Acid (P ₂ O ₅)	4%
Soluble Potash (K ₂ O)	8%
Total Available Plant Food, Not Less Than	24%

Fertilization rate depends upon many factors such as N source, time of year, fertilizer requirement of species, and quality of turf desired. When using solely WSN, don't apply more than 1 pound actual nitrogen per 1000 square feet per application to avoid too much topgrowth, potential leaf burn and runoff or leaching of excess

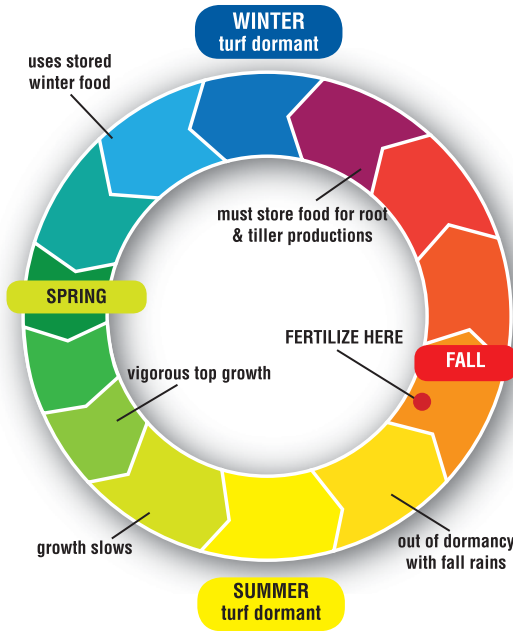
nitrogen. Apply fertilizers containing at least 30 percent WIN at rates of 1½ pounds per 1000 square feet per application and fertilizers containing over 50 percent WIN can be applied at 2 pounds per 1000 square feet per application.

Most lawns thrive on a total of 2-3 pounds of total nitrogen per 1000 square feet per year. Kentucky bluegrass lawns are heavy feeders and thrive with the upper limit, while tall fescue lawns do well with the lower suggested rate.



Spread fertilizer over the lawn with a drop spreader, splitting the application and applying half in one direction and apply the other half perpendicular to the first application.

Fertilize lawns in the fall. Cool season grasses are actively growing, natural rainfall is usually present and weed pressure is less than in the spring and summer. One application of 1-2 pounds total N (depending on percent WIN) in late summer (August 15-September 15) and one application of 1-2 pounds total N in the fall (October 1-November 1) is recommended. A light fertilization in early spring can be used to provide early lawn green-up, but when you fertilize the lawn, you are also fertilizing spring and summer weeds. Do not fertilize in late spring or early summer, when most cool season grasses are stressed and susceptible to diseases, insects, and weeds.



Another factor to consider when determining fertilizer rates is whether or not clippings are returned to the lawn. Clippings represent about 1/3 of the N requirement and all the P and K requirements over the course of a year. If you return clippings, you can reduce the fertilizer added by those amounts.

In this publication, N fertilizer recommendations have been given in terms of actual N. Fertilizers contain varying percentages of N. For example, a 12-4-8 fertilizer contains 12 percent N, so a 50 pound bag would contain 6 pounds N. At a rate of 1 pound N per 1000 square feet, the bag would treat a 6000-square foot area.

- Apply 2-3 pounds of total N per year.
- Fertilize in the fall.

MANAGING THATCH

Thatch is a layer of partially decomposed tissue found at the soil surface. An accumulation of excessive thatch is caused by an imbalance between turf growth and decomposition rates. A thin layer of thatch (less than ½ inch) is beneficial. It creates a cushiony feel to the turf, acts as an insulator, and decreases weed seed germination. Once thatch accumulates in layers greater than ½ inch, it becomes a problem. Thatch can absorb water, fertilizer, and pesticides before they reach the soil. It provides a breeding ground for insects and diseases. Turf roots and tillers (young grass plants that grow next to an existing plant) that grow in thatch are more susceptible to dehydration, frost, traffic and insect damage. The sponginess of heavily thatched lawns makes mowing difficult and can result in cutting your lawn too close or unevenly.

Contrary to popular opinion, thatch is not caused by grass clippings. The tough tissues of dead grass, such as rhizomes and stems, cause thatch.

To prevent thatch buildup, keep turf growth and decomposition in balance. To control growth, avoid overfertilization and select slower-growing species. To enhance decomposition, encourage microbes by maintaining a pH between 6.0 and 7.0 and use a minimum of pesticides. Core aeration (removal of plugs of soil with hollow tines) will also enhance decomposition by increasing infiltration and aeration.

A dethatcher is a poorly named piece of equipment. It is designed to remove a very thin layer of thatch. In fact, it can only remove thatch before it becomes a problem. This is very useful for site preparation during overseeding but of little value when a thatch problem already exists. Core aeration, adding soil or organic matter to the surface and possibly removal of the lawn with a sod cutter (in extreme cases) are the only solutions for an existing thatch problem.

- **Prevent thatch with regular liming, limited use of pesticides, limited fertilization, and core aeration.**
- **Correct a thatch problem with core aeration, topdressing, and ultimately a sodcutter.**

WATER ONLY WHEN NECESSARY

Is a green lawn really necessary all summer long? Most lawns in Delaware go dormant during the summer in response to drought stress. These lawns are not dead and will green up and continue to grow vigorously as soon as fall rains arrive. In a few cases, turf that is already stressed may die. This should serve as an opportunity to correct the problem and reseed those areas in the fall. Newly seeded or sodded lawns need water until the new turf is well established.

If a green summer lawn is important, follow these recommendations for proper watering.

1. Wait until the soil dries out to water.
2. Water approximately every 7-10 days.
3. Water deeply and slowly to avoid runoff (2-4 hours).
4. Wet the soil to a depth of 4-6 inches.
5. Set sprinklers to avoid water waste.

- **Allow lawns to go dormant rather than watering all summer.**
- **Water newly establishing lawns.**

COPING WITH SHADE

Turfgrass needs a minimum of four hours of light per day. Insufficient light for photosynthesis, root competition, poor circulation and leaf accumulation are problems found when trying to grow turf under trees. To solve this problem, choose trees with light shade, plant shade-tolerant grasses, reduce all other stresses on the turf, and finally, substitute a different shade-tolerant ground cover for the unacceptable turf.



Increasing the mowing height has allowed this patch of lawn to thrive even though it is in some shade.

- **Plant trees with light shade.**
- **Plant shade tolerant grasses.**
- **Reduce all other turf stresses.**
- **Replace turf with ground covers when shade is too dense.**

CONTROLLING WEEDS

A weed is undesirable because it disrupts the aesthetic appearance, stabilizing capacity or overall utility of the turf. The best method of weed control is to prevent weeds from becoming established by following proper turfgrass establishment and maintenance practices. A dense turf has few weeds.

Turfgrass weeds can be divided into three categories based on the strategy for successful control.

Annual Grass Weeds

Summer annuals include grasses such as crabgrass and goosegrass. Annual bluegrass is an example of a winter annual. Most grass weed seeds require light for germination, thus a dense stand of turf, maintained at 2½ to 3 inches, will reduce annual grass weeds dramatically.

A preemergent herbicide will also control annual grass weeds. With a preemergent, timing is critical. The herbicide must be applied before weed seeds germinate but very early application allows the herbicide barrier to degrade and lose its effectiveness. For summer annuals, apply a preemergent herbicide when the soil temperature at 2 inches is 55 degrees for three or four consecutive days (about when the forsythia bloom). Control winter annuals with a late summer to fall preemergent appli-

cation, but this timing is trickier because winter annuals germinate over a long period each fall.

Broadleaf Weeds

Due to their physiological differences from grasses, broadleaf weeds such as chickweed, henbit, dandelion, plantain, etc. can be controlled with selective herbicides. The common turfgrass herbicides include 2,4-D, MCPP and dicamba or a mixture of these three. Dicamba can injure surrounding trees and shrubs so avoid use near desirable landscape plants.

Perennial grass weeds - These weeds are no different from their desirable counterparts. Therefore, the only method of control is to hand-pull (removing the entire root system) or spot-treat with a non-selective herbicide such as glyphosate and reseed the affected area.

- **Control annual grass weeds by preventing germination.**
- **Control broadleaf weeds with selective herbicides.**
- **Control perennial grass weeds with spot treatments and reseeding.**

CONTROLLING INSECTS

White Grub

The larvae of several species of beetles feed on grass roots and can cause extensive damage on turf. The damage initially resembles drought stress, with general thinning and yellowing of turf. Eventually, brown areas appear and the turf will roll up like a carpet. Excessive mole or bird activity in a lawn is another sign of grub infestation. If more than 3 grubs in a 6" x 6" area are found in the lawn, treatment is warranted. The best time to control grubs is when they are actively feeding close to the surface in the late summer and early fall. For the best control, wet soil first, apply a labeled insecticide, and water again following treatment.

Japanese beetles are susceptible to a biological control called milky spore disease (*Bacillus popilliae*). It affects the digestive system of Japanese beetle grubs but is not effective against other species of grubs or non-target organisms. Milky spore takes several months to become effective but in some cases will remain effective for three to five years.

- Control the thinning and yellowing of grub damage with an insecticide in late summer or early fall.
- Check for chinch bugs with a can of water and control with a labeled insecticide.
- Use a can of soapy water to spot sod webworm larvae and control in June.

Chinch Bug

Chinch bug damage is most severe on droughty lawns. Small dead patches eventually coalesce into large areas of wilted or dead turf. To detect chinch bugs, insert an open cylinder into the turf to a depth of 4 inches. Gently fill the can with water and wait five minutes. Chinch bugs will float to the surface. Control with a labeled insecticide.

Sod Webworms

Adult sod webworms are small buff-colored moths that fly in a zig-zag pattern above the turf. It is the larvae that cause damage by cropping turf plants back to the crown. Unevenly cropped areas of grass are a sign of sod webworm damage. A can inserted into the ground will float up sod webworms if the can has been filled with soapy water. Control in June with a labeled insecticide.



These researchers and students couldn't find many insects in this large lawn!

MANAGING DISEASES OF TURF

Turfgrass diseases are frustrating for the home lawn manager. By the time symptoms of most diseases are noticed, it is too late for treatment. The best control strategy is to prevent disease by following cultural recommendations.

Factors that give disease organisms an advantage include:

1. Water on grass blades
2. Excess nitrogen
3. Periods of warm, humid weather
4. All one variety of turf

Stress factors that increase disease susceptibility include:

1. Compaction
2. Low or unbalanced fertility
3. “Scalping” caused by dull mower blades
4. Poor drainage
5. A low pH

The following is a key first printed in Professional Turfgrass Management Guide for Massachusetts 1992. It was prepared by the University of Massachusetts Cooperative Extension System Turfgrass Staff.

HOW TO USE THIS KEY

Decide first the temperature when symptoms first appeared. Then read the sub-sections to decide which best describes the problem. Symptoms of diseases are often quite different on lawns than on highly maintained turf such as golf putting greens. The diagnosis of turfgrass diseases can be difficult even in the laboratory. Use this key only as a general guide. Further information on each disease is available through Cooperative Extension. (Note: A common name of the disease is listed first. The name in parentheses which follows refers

to the same disease; it is another common name). The most common diseases are indicated by *.

Technical terminology has been minimized. The word “mold” refers to the mycelium (hyphae) of the fungus causing the disease. “Black specks” are the spore containers produced by a few of the disease-causing fungi. “Sclerotia” are dark, pin-head sized or slightly larger masses of mycelium that some fungi produce as survival structures.

SECTION I. Cold Weather (32-45°F) Diseases

A. Irregular pattern or streaks in turf

1. Bleached or dead grass, especially in wind-swept areas free of snow with deeply frozen soil. WINTER DESICCATION
2. New leaves killed back, often in yellow to white patches following freezing temperatures. SPRING FROST

B. Turf killed (rotted or straw-colored) in wettest areas.

1. May follow drainage patterns. WATER AND ICE DAMAGE
2. Circular patches of dead grass from 1" to 3' across.
 - a. Wet grass is often covered with white to bright pink mold; NO sclerotia present. *PINK SNOW MOLD (FUSARIUM PATCH)
 - b. Wet grass covered with white to gray or bluish-gray lint-like mold; small yellow to dark brown or reddish sclerotia often present in or on grass leaves. *GRAY SNOW MOLD (TYPHULA BLIGHT)

Section II. Cool-to-Warm Weather (45-75oF) Diseases

A. Circular patches or rings in turf after grass greens up in spring.

1. Sunken, straw-colored patches, 1-6" across. May be covered with dense white mold in moist weather.
 - a. Whitish tan leaf spots with brown, reddish brown or purplish borders. *DOLLAR SPOT
 - b. Turf wilted, killed, rotted or straw-colored. Often in poorly drained areas. PYTHIUM ROOT ROT

- c. Leaves yellowing and wilting; black spiny hairs in tufts may be evident with a hand lens. ANTHRACNOSE (CROWN ROT)
2. Patches from 1" to 3' across.
 - a. A prolonged cool rain commonly following melting snow. Wet grass is often covered with white to bright pink mold. *PINK SNOW MOLD (FUSARIUM PATCH)
 - b. White patches or rings. Leaf blades often covered with whitish mold. Dense white mycelium in thatch. Tiny mushroom-like structures may be present on grassblades. WHITE PATCH
 - c. Patches usually with green centers.
 - i. Yellow to straw colored, sunken in high cut turf. Wet grass not covered with mold. *YELLOW PATCH (COOL WEATHER BROWN PATCH)
 - ii. Initially yellow, then reddish brown or bronzed, and finally sunken, tan rings. Centers often invaded by weeds. Most commonly found in cool, moist, coastal areas; most common in bentgrass. TAKE-ALL
 - iii. Lemon to bright yellow rings; dense white mold in thatch beneath affected area. YELLOW RING
 - iv. Patches, rings, arcs, "frog-eyes" about 6-8" across, enlarging later. Most common in Kentucky blue-grass sod 2-4 years old and annual bluegrass. *NECROTIC RING SPOT

3. Rings or arcs up to 15' or more across; often with outer right of dark green grass; may be mushrooms in rings. *FAIRY RINGS

B. Irregular patterns (usually) in turf.

1. Colored fungus or spores on leaf surfaces; leaf spots not usually evident
 - a. White to gray powdery mold; found mostly in shade and easily wiped off. *POWDERY MILDEW
 - b. Gray to black streaks of black powdery spores in leaves; leaves shred into ribbons and curl. Grass may later die in irregular patches or a general thinning; usually in turf three or more years old. *LEAF SMUTS
 - c. Pink to reddish often gelatinous mycelium on leaves; red thread-like growths beyond leaf tips; pink "puffs" under moist conditions; appears tan in patches; most common in low nitrogen turf. *RED THREAD/PINK PATCH
 - d. Bright yellow, orange, or reddish-brown pustules on leaf blades; mostly late summer; usually on slow growing turf. *RUST
 - e. Slimy, superficial whitish gray to yellow fungus-like material in the early stages; turns powdery later *SLIME MOLD
2. Leaves distinctly spotted or with tip blight.
 - a. Oval to eye-shaped, dark-bordered spots. In warm weather, turf may look thin and weak (melting out). *LEAF SPOT DISEASES

- b. Leaf spots that may enlarge to irregular blotches. Most common as tip blights; dark specks often present in older diseased tissue. ASCOCHYTA OR SEPTORIA LEAF BLIGHT
- c. Irregular tan spots with brown border. Pink fungus masses on stem bases when wet. FUSARIUM

Section III. Hot Weather (over 75°F) Diseases

Occur from late spring to late summer

Possibilities from previous sections

Circular patterns in turf

*Dollar Spot

White Patch

Yellow Ring

*Necrotic Ring Spot

Irregular areas

*Rusts

*Slime Molds

A. Circular patterns in turf.

1. Straw colored patches often 6-8" across, but can be larger; centers often remain green. Most common on Kentucky bluegrass sod 2-4 years old and in annual bluegrass. Symptoms often appear in hot weather after heavy rains. Symptoms identical to necrotic ring spot. *SUMMER PATCH
2. Patches up to 2-3' across; light brown; grass blades usually not matted. Patches appear during wet periods. Gray mycelium may be visible in moist conditions; most common on bentgrass greens (look for "smoke ring") and tall fescue lawns. *BROWN PATCH
3. Tan leaf spots without darker borders. Grass leaves matted and slimy. Dense white mold in moist weather *PYTHIUM BLIGHT

B. Irregular patterns of weak, thin, dormant or dead grass. Large areas appear dry, then wilt, and turn brown.

1. Turf is yellowish, then reddish brown. Leaves spotted to blighted. Black spiny hairs in tufts on blades evident with hand lens. Most common in compacted, stressed turf. Most common on annual bluegrass. ANTHRACNOSE
2. Some oval or eye-shaped spots with dark margins. *LEAFSPOTS/ CROWN AND ROOT ROT
3. Irregular, dull tan leaf spots; pink fungal masses on crowns when wet. FUSARIUM CROWN AND ROOT ROT
4. Mostly tip blight but perhaps more extensive damage. Black specks in older dead tissue. LEPTOSPHAERULINA LEAF BLIGHT

Section IV. Other Causes of Poor Turf

Usually independent of temperature

A. Turf gradually becomes pale green to golden yellow and grows slowly; often becomes thinned.

1. Definite leaf lesions or mottlings present. AIR OR SOIL POLLUTION
2. Yellow streaks may form parallel to the leaf veins. IRON OR NITROGEN DEFICIENCY

B. Turf suddenly appears scorched.

1. Usually in patches, bands or streaks. CHEMICAL BURN OR MOWER BURN
2. Bands, streaks, or irregular patterns; grass is stimulated at margins. FERTILIZER BURN
3. Ring of dark green grass at margins; patches up to about 1' across. DOG INJURY

4. Entire turf area or patches over slight elevations or mowing corners are yellow to brown. SCALPING INJURY

5. Leaf tips are shredded; appear gray, then tan. DULL MOWER INJURY

C. Round to irregular patches of dead or dormant grass; often follows dry periods. BURIED DEBRIS, INSECT INJURY OR THICK THATCH

D. Turf bare or thinned; often in traffic areas, dense shade, waterlogged soil, etc.

1. Greenish to brown scum that later forms a black crust. ALGAE

2. Small green plants that grow on soil in slight mounds. MOSS

3. Soil hard in heavily tracked paths, under swings, etc COMPACTION

E. Turf dry, bluish green (easily tracked), wilts may later turn brown. DROUGHT, WILT OR IMPROPER WATERING

TURFGRASS DISEASE MANAGEMENT RECOMMENDATIONS

Disease (pathogens)	Turfgrass Hosts	Season	Cultural Management
Algae, Mosses	all turfgrasses		Improve fertility and drainage. Alleviate compaction
Anthracnose <i>Colletotrichum graminicola</i>	bentgrasses, fescues, bluegrass	July-Sept., cool season strains also	Provide adequate fertility. Avoid stress from too little or too much water and compaction.
Brown Patch <i>Rhizoctonia solani</i>	all turfgrasses, Tall Fescue*, Bentgrasses, Perennial Ryegrasses	July-Sept.	In hot weather, avoid excess N and excess water. Also, no night watering. Remove dew from putting greens.
Yellow Patch (Cool Season Brown Patch) <i>Rhizoctonia cerealis</i>	bentgrasses, Kentucky bluegrasses	Nov.-April	Avoid excess N.
Damping Off, Seed Rot several fungi including <i>Pythium</i> spp., <i>Fusarium</i> and <i>Rhizoctonia solani</i>	all turfgrasses		Careful seedbed preparation. Use good quality seed. Maintain soil moisture but avoid overwatering.
Dollar Spot <i>Sclerotinia homeocarpa</i>	all turfgrasses, Bentgrasses	June-Sept.	Avoid N deficiency. Remove dew from putting greens.
Fairy Ring (various fungi)	all turfgrasses	April-Oct.	Mask symptoms with N or iron. Core and water. Fumigate or remove soil in severe cases. For information on fumigation, contact a turfgrass pathologist.
Fusarium Leafblight, Crown and Root Rot <i>Fusarium culmorum</i> , <i>F. poae</i> and other <i>Fusarium</i> spp.	all turfgrasses	July-Sept.	Avoid drought.
Leafspots and Blights Melting Out “Helminthosporium” spp. <i>Ascochyta</i> , <i>Bipolaris</i> , <i>Curvularia</i> , <i>Drehslera</i> , <i>Nigrospora</i> , <i>Septoria</i> , <i>Leptosphaerulina</i>	all turfgrasses, Kentucky Bluegrasses, Bentgrasses, Fine Fescues	April-Oct.	Avoid excess N especially in spring. Keep blades dry as much as possible. Raise mowing height.

Necrotic Ring Spot <i>Leptosphaeria korrae</i>	Kentucky Bluegrasses, esp. sod (3-4 yrs old), fine fescues	June-Sept.	Avoid water and fertility stress. Avoid compaction and excess thatch.
Powdery Mildew <i>Erysiphe graminis</i>	Kentucky Bluegrasses, fine fescues	July-Sept.	Reduce shade to increase air circulation. Avoid excess N.
Pythium Blight (Grease Spot) (Cottonyblight) <i>Pythium</i> spp.	all turfgrasses, Perennial Ryegrasses, Bentgrasses	June-Aug.	Avoid excess N and night watering in hot weather. Do not mow when wet.
Pythium Root Rot <i>Pythium</i> spp.	all turfgrasses, Bentgrasses	Mar.-Nov.	Improve drainage. Increase organic matter.
Red Thread <i>Laetisaria fuciformis</i> and Pink Patch <i>Limonomyces roseipellis</i>	all turfgrasses, Perennial Ryegrasses, Fine Fescues	April-Oct. in cool-warm wet weather	Avoid N deficiency and low pH.
Rust <i>Puccinia</i> spp.	all turfgrasses, Kentucky Bluegrasses	July-Oct.	Avoid N deficiency and water stress.
Slime Molds various organisms	all turfgrasses	June-Sept.	Mow or hose away. No fungicide necessary.
Stripe Smut <i>Ustilago striiformis</i>	bentgrasses, Kentucky Bluegrasses	April-Nov.	Avoid excess N in spring. Avoid water stress.
Snow Molds Pink Snow Mold (Fusarium Patch) <i>Microdochium nivale</i> Gray Snow Mold (Typhula Blight) <i>Typhula</i> spp.	all turfgrasses, Bentgrasses	Nov.-April	Avoid lush growth in fall. Continue mowing until autumn growth ceases. Avoid prolonged snow cover: do not allow excessive piling of snow on turf and reduce drifting with placement of snow fence.
Summer Patch <i>Magnaporthe poae</i>	fine fescues, Kentucky Bluegrass	July-Sept.	Avoid water stress and overwatering. Avoid compaction. Maintain adequate fertility.
Take All Patch <i>Gaeumannomyces graminis</i> var. <i>avenae</i>	Bentgrasses	Mar.-June Sept.-Nov.	Avoid heavy lime applications. Lower pH in top inch of soil. Improve drainage.

* Most susceptible species of turfgrasses are in bold.

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AUTHOR:

Susan Barton, *Delaware Cooperative Extension, University of Delaware*

REVIEWERS:

Valann Budischak, *Delaware Cooperative Extension, University of Delaware*

Sara Wozniak, *Delaware Department of Natural Resources and Environmental Control*

PHOTOGRAPHS PROVIDED BY:

Susan Barton, *Delaware Cooperative Extension, University of Delaware*

Sara Wozniak, *Delaware Department of Natural Resources and Environmental Control*

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