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Turfgrass

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Chapter 13

Turfgrass

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Learning Objectives

At the end of this unit, you will be able to articulate and explain:

- Terms associated with turfgrass identification;
- Turf species grown in Maryland;
- Lawn establishment practices – seeding, sod, and site preparation;
- Cultural practices – fertilizing, mowing, watering, thatch control, aeration, and liming;
- Common lawn problems including, weeds, insect pests, diseases, and abiotic disorders.

Introduction

Lawns are an integral part of Maryland landscapes. In addition to enhancing the landscape, lawns provide practical benefits. A healthy lawn increases property values, controls soil erosion, filters pollution from runoff, moderates summer ground temperatures, and adds oxygen to the air. On the other hand, misapplication of pesticides and fertilizers greatly contributes to pollution of the Chesapeake Bay. Proper timing, selection, and correct application rates of these products can greatly reduce the negative impact the improper use of these products have on the health of the Bay. Proper cultural practices that encourage a healthy lawn are also essential.

Turfgrass Identification

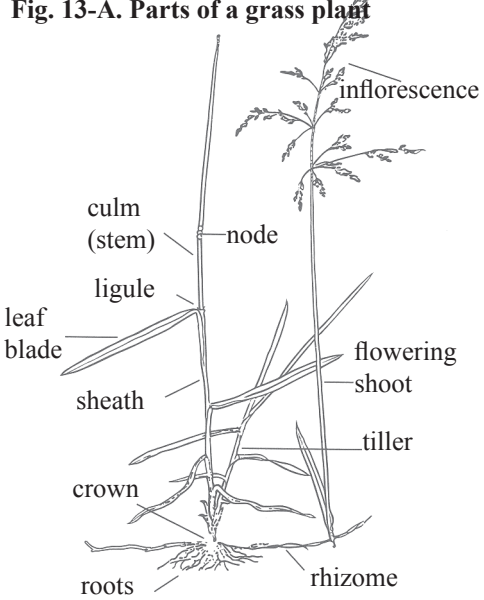
Turfgrass terminology
Vegetative parts of a grass plant (Fig. 13-A) are useful for identifying a grass. Also consider:

- Leaf blade;
- Leaf sheath;
- Vernation;
- Collar;
- Ligule;
- Auricles; and
- Growth habit.

Figures 13-B to 13-H illustrate each of these and give hints on what to look for when identifying a type of grass.

Always use more than one plant and identifying structure for identification, since vegetative characteristics can vary depending on environmental conditions or cultivar.

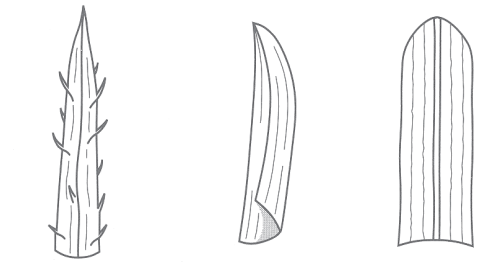
Fig. 13-A. Parts of a grass plant



Leaf blade
The blade is the upper flattened portion of a turfgrass leaf (Fig. 13-B).

- Is the leaf texture fine, medium, or coarse?
- Are veins prominent?
- What shade of green is the blade?
- Is the blade smooth (glabrous) or hairy (pubescent)?
- Is the tip of the blade sharply pointed, boat-shaped, or blunt and round?

Fig. 13-B. Leaf blade shapes and textures



Leaf sheath
The sheath is the lower portion of a leaf — the part that encircles the stem (Fig. 13-C).

- Is the sheath cylindrical or compressed?
- Is the sheath closed or open, or do the margins overlap?

Vernation
Vernation refers to the arrangement of new leaves within the older leaf sheath (Fig. 13-D).

- Is the leaf folded or rolled when it emerges?

Collar
The collar is a band at the junction of the blade and sheath (Fig. 13-E).

- Is the collar divided, broad, or narrow?

Ligule
The ligule is an appendage on the inner side of a grass leaf at the junction of the blade and the leaf sheath (Fig. 13-F).

- Is the ligule absent, membranous, or hairy?
- If present, what is the size and shape of the ligule?
- What does the upper edge of the ligule look like? Is it smooth, notched, or hairy (*ciliate*)?

Auricles
Auricles are appendages occurring in pairs at the base of the blade (Fig. 13-G).

- Are auricles present or absent?
- If present, are auricles small (rudimentary) or prominent (clawlike)?

Growth habit
Growth habit refers to the orientation of shoots (Fig. 13-H).

- Is the plant erect or lying down (*decumbent*)?
- Are there lateral shoots such as *rhizomes* (underground stems), *stolons* (above-ground stems), or *tillers?*

Fig. 13-C. Leaf sheath types

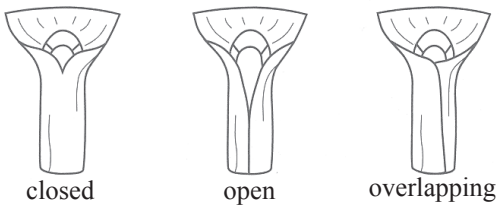


Fig. 13-D. Vernation types

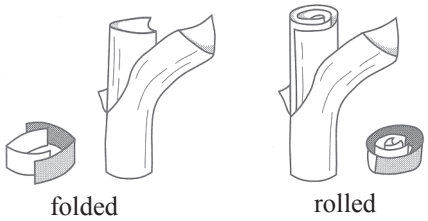


Fig. 13-E. Collar types

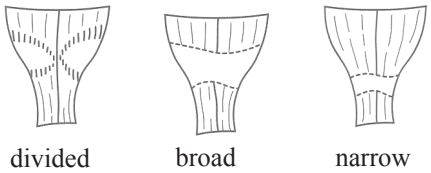


Fig. 13-F. Ligule types

Fig. 13-G. Auricle types

Fig. 13-H. Growth habits

Turfgrass Species

Maryland is located in an area referred to as the "transition zone." Within the transition zone, neither cool-season nor warm-season turfgrasses perform well during the entire year. Cool-season grasses will go dormant during a dry, hot summer and warm-season grasses go dormant after the first frost in the fall. In most situations cool-season turf is recommended.

Cool- vs. Warm-Season Grasses

Cool-season turfgrasses

Include species that are adapted to most areas of Maryland.

- Maximum growth during cool spring and fall weather.
- May become semi-dormant during hot and/or dry periods of summer.
- Include turf-type tall fescue, the fine fescues, and Kentucky bluegrass.

Warm-season turfgrasses

Include species that are best adapted to Southern Maryland and the Eastern Shore.

- Maximum growth during hot weather and dormant during the fall, winter, and early spring.
- Excellent heat and drought tolerance.
- Include zoysiagrass and bermudagrass.

List of Species

Tall fescue (*Festuca arundinacea* L.)

- Forms a persistent and durable turf for home lawns, parks, playgrounds, and athletic fields. It is commonly used in other low-maintenance situations such as utility areas, highway medians, airstrips, and fairgrounds. Recommended for most homeowner sites.
- Many new and improved varieties (called turf-type tall fescue) have a finer texture, high tiller densities, and a darker green color than the early-developed, coarse-textured, light green varieties such as "Kentucky 31" and "Alta." Dwarf-type varieties are currently in demand for their reduced height and increased tiller densities. Although some of these varieties are used successfully, the reduced rate of growth may slow recovery from disease, insects, and wear.
- Of the cool-season turfgrasses, tall fescue is the most tolerant of heat and drought, due to its ability to form a deep root system. It is also the most resistant to disease and insect damage, but only has a fair recovery potential from damage.
- It performs well in open, sunny areas and is moderately shade tolerant (needs about four hours of direct sunlight). It is more shade tolerant than Kentucky bluegrass and perennial ryegrass. It grows best in well-drained soil.
- It produces a minimal amount of thatch.
- Identification features:

  Leaf blade: K-31 is medium to coarse; turf-types are medium textured, dark green color, 5- to 10-mm wide; blades flat

  Vernation: rolled

  Collar: broad, divided

  Ligule: membranous

  Auricles: short, blunt

  Growth habit: bunch type, tillers

The fine fescues *(Festuca spp.)*

- Are utilized for low-maintenance areas such as slopes, rights of way, or vacation homes. Of the cool-season species, are the most tolerant of shady sites.
- Are composed of narrow-leaved species. The most common turf-type fine fescues include creeping red fescue (*Festuca rubra* L.), chewings fescue (*Festuca rubra* var. *commutata*), hard fescue (*Festuca longifolia* L.), and sheep fescue (*Festuca ovina* L.).

- Produce an attractive, uniform stand of turfgrass. Are compatible in mixtures with most cool-season turf. As a group, tolerate low fertility soils, low pH, droughty soils, and shaded conditions.
- Are not well adapted to high heat, humidity, poorly drained sites, or high-traffic areas such as athletic fields or playgrounds.
- Do not tolerate high rates of nitrogen fertilizer.
- Require periodic dethatching.
- Identification features:

  Creeping red fescue (*Festuca rubra* L.)

  - Leaf blade: fine texture, 1.5- to 3-mm wide, medium-dark green
  - Vernation: folded
  - Collar: narrow
  - Ligule: membranous 0.5-mm long, truncate
  - Auricles: absent
  - Growth habit: creeping

  Chewings fescue (*Festuca rubra* var. *commutata*). Similar to creeping red fescue

  - Growth habit: non-creeping

  Hard fescue (*Festuca longifolia* Thuill) and Sheep fescue (*Festuca ovina* L.)

  - Leaf blade: fine texture, medium-dark green
  - Vernation: folded
  - Collar: broad, divided without hairs
  - Ligule: membranous 0.3-mm long, rounded
  - Auricles: rounded
  - Growth habit: non-creeping, bunch-type growth

Fine Fescue Tips

- Creeping red fescue produces rhizomes, allowing it to fill in thin areas of turf and to make a good recovery from injury. This species has good seedling vigor, as compared with hard and sheep fescues.
- Chewings fescue lacks strong rhizome development but has greater tolerance for low mowing.
- Hard fescue has received much attention in recent years for its tolerance of low-fertility soils and drought. Its major disadvantage is its relatively slow rate of germination and establishment.
- Sheep fescue is a bunch-type grass used primarily in low-maintenance situations. It is the least used of the turf-type fine fescues.

Kentucky bluegrass (*Poa pratensis* L.)

- Performs best in well-drained soils and open, sunny areas. Does not tolerate poorly drained soils or heavily shaded areas. Is cold tolerant, wear tolerant, and moderately heat and drought tolerant. Has superior recuperative potential compared to most other cool-season turfgrasses.
- Requires a higher amount of nitrogen (N) fertilizer than other cool-season turfgrasses. Is more susceptible to disease and insect infestations (white grubs). Is considered to be a high-maintenance turf in Maryland.
- Produces a significant amount of thatch. Periodic dethatching is necessary.
- Due to its production of underground stems, called rhizomes, is commonly used in sod production.
- Slower to become established and to germinate than most other turfgrasses (requiring up to three weeks for emergence).

- Identification features:

  Leaf blade: V-shaped or flat, boat-shaped tip, medium to fine texture, medium to dark green color

  Vernation: folded

  Collar: broad, divided

  Ligule: membranous

  Auricles: absent

  Growth habit: spreading-rhizomatous

Perennial ryegrass (*Lolium perenne* L.)

- Grows best in neutral to slightly acidic well-drained soils.
- Commonly used in grass-seed mixtures because of its quick germination rate.
- Very susceptible to turf diseases, such as gray leaf spot. Is not a recommended turfgrass species for Maryland.
- Identification features:

  Leaf blade: flat, 2- to 5-mm wide, medium texture, medium to dark green

  Vernation: folded

  Collar: broad, divided

  Ligule: membranous

  Auricles: small, clawlike

  Growth habit: bunch-type growth

Zoysiagrass (*Zoysia japonica* L.)

- Warm-season species makes optimum growth during periods of high temperatures. The recommended time to fertilize is in mid- to late spring and in mid-summer. Fertilizer should not be applied past mid-August.
- Forms an attractive turf in the southern portions of the state and the Eastern Shore.
- Produces extensive, thick stolens that spread rapidly giving it good recuperative potential. Can also spread into areas where it is not wanted (like neighbors' yards).
- Drought tolerant once established. It performs best under moderate moisture levels on fertile, well-limed soils. Will not tolerate poor drainage or shade.
- Goes dormant (turns a straw-brown color) after frost in the fall and does not green-up until late spring or early summer.
- Produces an abundant amount of thatch. Dethatching needs to be done in early summer, when thatch becomes thicker than one inch.
- Propagated vegetatively in late spring through July by planting sod plugs or sprigs. Cost of establishment is high.
- Can be slow to become established. The development rate depends on plug size, competition from other grasses, weeds and the growing environment. Quickest establishment is with four-inch-diameter plugs. Three to six years may be required to develop a solid stand of "Meyer" zoysiagrass.
- Identification features:

  Leaf blade: flat, stiff, 2- to 4-mm wide, medium-textured

  Vernation: rolled

  Collar: broad, continuous, with long hairs

  Ligule: a fringe of hairs

  Auricle: absent

  Growth habit: spreads by stolens and rhizomes

Table 13-A. Characteristics of turfgrass species						
Species	**Drought tolerance**	**Full sun**	**Shade**	**High traffic tolerance**	**Insect and disease resistance**	**Days to seed germ-ination**
Turf-type tall fescue	Excellent	Excellent	Fair	Good	Good	7-14
Kentucky bluegrass	Good	Excellent	Fair - poor	Excellent	Poor	14-21
Fine fes-cue	Good - fair	Good - fair	Excellent - good	Poor	Good	7-14
Perennial ryegrass	Poor	Excellent	Fair - poor	Good	Poor (fair if seeds contain endophytes*)	5-10
Zoysia-grass	Excellent	Excellent	Poor	Good	Good	N/A
Bermuda-grass	Excellent	Excellent	Poor	Excellent	Good	N/A

**Endophytes are beneficial fungi or bacteria that live within plant tissue. Perennial ryegrass and fescue turf with high endophyte levels are more drought resistant and less prone to damage from sod webworm and chinch bugs.*

Recommended Turgrass Cultivars

During the last decade, numerous new turfgrass cultivars have been developed and released by turfgrass seed breeders. However, although many of these cultivars are adapted to the environmental conditions that prevail in other regions of the country, many are not adapted to the difficult environmental conditions that occur in the transition zone, which includes Maryland and Virginia. Thus, to identify cultivars that will perform well in this region, extensive cultivar trials are conducted each year at the University of Maryland and Virginia Polytechnic Institute and State University.

The cultivar performance data obtained at various locations in Maryland and Virginia are reviewed annually in a joint meeting of university researchers and representatives of the Departments of Agriculture of both states. The use of recommended cultivars usually results in a turfgrass stand of higher quality and density, greater stress tolerance, lower nutrient requirements, less water usage, fewer pest problems, and thus reduced pesticide use.

Turfgrass species with reduced nutrient requirements, especially nitrogen, have attracted great interest in recent years. The two recommended turfgrasses with the lowest nitrogen requirements are the fine fescues and zoysiagrass; turf-type tall fescue has intermediate requirements. Kentucky bluegrass and bermudagrass generally have the highest nitrogen requirements. However, several Kentucky bluegrass cultivars provide fair quality under reduced nitrogen fertility and other maintenance inputs.

Publication TT 77, “Recommended Turfgrass Cultivars for Certified Sod and Professional Seed Mixtures” by Dr. Thomas Turner, Turfgrass Specialist, and David Funk, Research Assistant, University of Maryland Department of Natural Resource Sciences and Landscape Architecture, contains a comprehensive list of the tested turfgrass cultivars that have performed well in trials in both Maryland and Virginia over a period of at least 2-3 years. Although geared towards professional turf managers and sod producers, this publication is an excellent reference for homeowners who want the most current, proven cultivars of turfgrass available. Homeowners should be made aware that it is difficult to find many of these cultivars on the market. The best way to access this publication (as it is updated periodically) is online at the Maryland Turfgrass Council website (www.mdturfcouncil.org) or the Home and Garden Information Center website (hgic.umd.edu).

Key points about cultivars

- Recommended cultivars have been evaluated for performance in Maryland and Virginia.
- Maryland Certified Sod must contain only recommended cultivars.
- Recommended cultivars provide better quality turf and improve ground cover.
- The use of recommended cultivars reduces many pest and management problems.
- Recommended cultivars often have lower fertilizer, water, and pesticide needs.

Lawn Establishment

The quality of a new lawn depends on the time, effort, and expense homeowners are willing to devote to proper planning and site preparation. A number of basic steps should be taken to ensure successful establishment. If any of these steps are omitted or done improperly, the resulting stand may be thin and may deteriorate over time. Commonly, new lawns are started on soil that has been stripped of topsoil, is very rocky, and contains little or no organic matter. Greater success will be achieved if the effort is put into preparing the seed or sod bed.

Soil Testing

Soil testing is an important step to begin a turf establishment project, whether seeding or laying sod.

- The test results will indicate the soils pH and lime requirements, and the amounts of phosphorus, potassium, and organic matter present in the soil. Fertilizer and liming recommendation will be provided if necessary.
- Soil pH should be between 6.0 to 6.8 for optimal turf growth.
- Soil testing information is found in publication HG 110 "Selecting and Using a Soil Testing Laboratory" and HG 110a "Comparison Chart of Regional Soil Test Laboratories." The publications are available from your county extension office or the Home and Garden Information Center (800-342-2507 or hgic.umd.edu).

Seeding

Timing is crucial when sowing grass seed.

- Late summer to early fall (mid-August to mid-October) is the recommended time for seeding cool-season grasses. Warm soils and moderate air temperatures encourage seed germination and there is less competition from weeds.
- If autumn leaf drop is a concern, seeding should be done in August or early September.
- The second-best time for seeding is early March through early April. Seed planted at other times tends to fail, usually because of weed competition and weather.
- Divide the seed into two parts; apply one-half in one direction (north/south) and the remainder in the opposite direction (east/west).
- Seed-to-soil contact is essential. If overseeding, use a core aerator before sowing seed, or a slit seeder.

Selecting and Buying Seed

Seeding rates for various turf-grass varieties are shown in Table 13-B.

Table 13-B. Seeding rate for lawn establishment and overseeding (after using a core aerator)

Turfgrass species	Lawn establishment	Overseeding*
Turf-type tall fescue	6 - 8 lbs./1000 sq.ft.	3 - 4 lbs./1000 sq. ft.
Kentucky bluegrass	2 - 3 lbs./1000 sq.ft.	1 - 1.5 lbs./1000 sq.ft.
Fine fescue	4 - 5 lbs./1000 sq. ft.	2 - 2.5 lbs./1000 sq. ft.

**Seeding into an existing lawn, using a core aerator or slit seeder.*

Select high-quality seed, and a seed mixture that is adapted to the site conditions (e.g., select tall fescue for sunny areas and fine fescue for shade) and intended use of the turf. Poor quality seed may have a poor germination rate and contain weed seeds and undesirable grass species. If the species in the seed mixture are not adapted to your conditions, the resulting stand may become thin and subject to weed encroachment.

When purchasing turfgrass seed, read the label to determine the kind, amount, and quality of seed in the container. All seed sold is required by law to bear a tag or label indicating basic information about its quality. The Maryland Department of Agriculture is in charge of regulating turfgrass seed. The basic information that should appear on the label is as follows:

- Name and address of labeler (the party responsible for the container's contents);
- Lot number (allows the contents to be traced to the original source of production);
- Kind and variety of turfgrass seed listed in order of predominance;
- Percentage by weight of pure seed of each species and variety (percentage purity);
- Germination percentage (percentage of viable seed);
- Percentage by weight of other crop seed;
- Percentage by weight of weed seed (should be less that 0.5% by weight);
- Percentage of undesirable grass seed (should not contain any);
- Percentage by weight of inert matter (chaff mostly); and
- Date on which the germination test was conducted.

Mixtures and blends of grass seed

Seed is commonly sold in mixtures or blends. A mixture is a combination of two or more grass species, such as turf-type tall fescue and perennial ryegrass. A blend is three or more cultivars of the same species. Mixtures and blends are popular because they increase the genetic diversity of the lawn. Certain grass species and cultivars are more susceptible to disease and insect problems; using mixtures and blends increases the turf's ability to resist diseases and overcome insect infestations. Mixtures are also used if growing conditions vary within the yard. A single cultivar of turf-type tall fescue can also be planted.

Sod

Sod produces mature turf in days rather than the months required to establish turf from seed.

- Most of the sod produced consists of Kentucky bluegrass, although some growers do produce tall fescue, fine fescue, and zoysia sod.
- Certified sod is high quality and produced under the supervision of the Maryland Department of Agriculture. Production fields must be inspected before being seeded and at periodic intervals prior to sale of the sod. Certification gives assurance of the sod's genetic purity, and the inspection program demands that cultural practices be carried out to ensure that the sod is free of weeds, undesirable grasses, insects, and diseases.

Tips on Laying Sod

- Success depends on the quality of sod, the care used in preparing the sodbed, and laying the sod.
- Sod should be dense and well knit so it can be cut thinly into strips that can be handled easily. Thin-cut sod weighs less, lays better, and roots more quickly. High-quality sod should have a maximum root and soil thickness of 0.5 to 0.75 inch.
- Sod should be laid immediately after delivery. If it needs to be held for several days before installing, spread it out in a cool, shaded area, grass side up, and keep it moist. Never store it in the sun.
- Lay the first strip of sod parallel to the longitudinal axis of the area. Lay the next strip against the first so the joints between the pieces are staggered, similar to the laying of bricks.
- Edges should be tightly fitted against adjacent strips as each strip is laid and then lightly tamped to ensure good contact with the soil.
- Fill any openings that remain in the seams with soil to prevent drying and facilitate knitting of rhizomes.

- Use a knife or spade to trim off any excess sod or to straighten strips that may be uneven.
- Use kneeling boards (plywood or planks) to prevent excessive walking and tracking over the prepared sod.
- Do not use a seed roller on freshly laid sod.
- On a slope, keep strips perpendicular to the slope and secure each strip with stakes until root development is strong enough to hold the sod in place.
- Immediately after installing, water thoroughly to wet the soil to a four- to six-inch depth. During initial rooting period (usually two to three weeks) irrigate daily to maintain adequate soil moisture but do not water to the point where water is running off the site. Do not allow the sod to wilt or dry during this period.

Sod vs. Seeding

The advantages and disadvantages of sod and seeding are shown in Tables 13-C and 13-D.

Table 13-C. Sod: advantages and disadvantages

Advantages	Disadvantages
Can be installed any time of the year as long as the ground is not frozen and daytime temperatures are below 95 degrees.	Higher initial cost.
Immediate results are obtained and establishment is faster.	Limited choice of turf cultivars.
Quicker erosion control. Can be used successfully in areas prone to soil erosion such as steep banks or culverts.	More labor required for installation.
Fewer problems with weed encroachment.	Not always readily available.

Table 13-D. Seeding: advantages and disadvantages

Advantages	Disadvantages
Lower initial cost.	Limited time-period for establishment. Seed needs to be sown in late summer to early fall for greatest success rate.
Desired cultivars of turfgrass can be sown.	Daily watering is necessary, sometimes twice a day, depending on weather conditions during initial establishment period.
Less labor and time is required.	Takes a longer time for lawn to become established. Seeded areas need to be restricted from use for up to two months.
Greater flexibility in planting a mixture for specific site conditions (e.g., mixture that performs better in the shade or on high traffic areas can be sown).	Greater chance of weed encroachment during establishment.
	Heavy rain can wash seed away.

Site Preparation

Site preparation is the same for seeding and laying sod. The following steps are crucial for successful lawn establishment. After the lawn is established it is difficult and costly to try to improve the soil.

1. **Test soil**
2. **Rough grade**. Rough grading involves removing all debris, including large stones or wood left by construction work. Where topsoil is to be replaced or brought in, grade the area to the contour of the desired finished grade to facilitate uniform distribution of topsoil. Slope the soil away from buildings to prevent water problems. Steep slopes should be terraced, contained with a retaining wall, or planted with a low-maintenance ground cover.
3. **Lime according to soil test results**. Grass growth will be unsatisfactory if soil pH is not in the 6.0 to 6.8 range. If the soil is too acidic as indicated by a soil test, broadcast

and work into the top 4 to 6 inches of topsoil the recommended amount of ground or pelletized limestone. If soil test results are not available when you are ready to seed, postpone lime application until you find out the soil pH level.

4. **Apply basic fertilize**r. If a soil test has been taken the soil test report from the lab will indicate any nutrient deficiencies and provide recommendations. Follow the lab's fertilizer and lime recommendations for all nutrients except nitrogen. Follow the University of Maryland Extension recommendations for nitrogen found in Tables 13-F and 13-G. Failure to correct a soil phosphorus deficiency (phosphorus deficiencies are rare in Maryland soils) or low soil pH is a common reason for poor establishment. If a soil test cannot be done before seeding, apply a starter fertilizer on the seedbed. A starter fertilizer has a high level of phosphate relative to the nitrogen and potash. In accordance with the Fertilizer use Act of 2011 turf fertilizer containing phosphorous can only be used if the measured phosphorous level is low, a new lawn is being established, or the lawn is being repaired or reestablished.
5. **Incorporate organic matter, if necessary**. This step is more important on lawns that are being seeded on sites that have been stripped of topsoil, such as new construction. Work organic matter into your soil along with the lime (if required) and fertilizer. Avoid overtilling or tilling wet soil, which can damage soil structure. Apply the lime and fertilizer, in separate applications, with a lawn spreader to ensure they are incorporated evenly. Sources of organic matter include leaf compost, composted sewer sludge, well-rotted manure, and mushroom compost. Apply approximately two inches of organic matter evenly over the area. Till amendments into the top 4 to 6 inches of soil. After tilling, it is advisable to allow the soil to settle for several days before seeding or use a sprinkler to apply about an inch of water over the area.
6. **Finish-grade**. Rake area to finish-grade just before seeding. Make sure all low spots are filled in.
7. **Distribute seed**. Divide the total seed quantity into two equal lots, sowing one lot in one direction and the second lot at right angles to the first with a mechanical seeder or spreader.
8. **Rake lightly**. Rake lightly with a metal rake; use a seed roller or even footsteps to firm soil around the seed. Seed should not be covered with more than one-fourth of an inch of soil.
9. **Mulch**. Mulch the seeded area with weed-free straw. Light mulches (some soil showing through the mulch) may be left on the area to naturally decompose.
10. **Fertilize**. A light fertilizer application at a rate of 0.5 - 0.9 lbs. of a slow release source of nitrogen per 1,000 sq. ft. should be made after the new turf has been cut 2 to 3 times. Do not apply after June 1 for a spring seeding or later than six weeks after the first frost for a fall feeding. In the fall all fertilizer applications need to be made by November 15th.

Renovation and Overseeding

If there is severe weed encroachment, begin complete renovation in August to allow ample time for reseeding. Spray the existing lawn with a non-selective herbicide to kill the entire area. Two or three applications might be necessary if you are killing a perennial grass weed

Reasons for Renovation and Overseeding

- Large weed infestations (40 to 50 percent weeds) or an infestation of a perennial grass weed such as bermudagrass;
- Insect and disease damage;
- Drought damage;
- Shade;
- Heavy foot traffic;
- Poor cultural practices (e.g., improper fertilization or mowing too short); or
- To convert existing lawn to an improved cultivar or species.

such as bermudagrass or nimblewill. To prepare the site for planting, mow the dead plant material to between one-half and one inch, then follow the same steps for lawn establishment.

Overseeding is performed to repair minimal damage sustained in the summer, to improve the overall quality of lawn, and to thicken up lawns to minimize weeds. It is necessary to core aerate or to use either a vertical mower or a slit seeder when overseeding. Overseeding should be done in the late summer through early fall on cool season lawns.

Cultural Practices

Turf Fertilizers

Fertilizing is an essential element in maintaining a healthy lawn that is able to resist disease and to crowd out weeds.

- The purpose is to provide nutrients to encourage active turf growth.
- Fertilizer should be applied according to a fertilizer schedule during the time of active growth so that the grass plants will utilize the nutrients.
- Cool-season turf is largely fertilized in the fall. Warm-season turf is fertilized in the late spring through summer.
- Nitrogen is the nutrient required in the greatest amount and recommendations are based on the amount of nitrogen needed or pounds of nitrogen per 1,000 square feet. The recommendation is a maximum of 0.9 pounds of nitrogen per 1,000 square feet applied at each application (based on the Fertilizer Use Act of 2011.)
- Nitrogen helps maintain high turf density. During the fall the nutrient encourages the growth of a deep root system. This is key to a healthy lawn that can withstand drought and recover from stress.
- Fertilizer should be bought on the basis of its quality rather than on bag size and price. Value depends on the amount of plant nutrients contained in the bag and the source of the nitrogen-carrying portion of the fertilizer.
- The three prominent numbers found on every type of fertilizer is the guaranteed analysis. It is required that the total amount of nutrients be shown on the bag. The numbers represent the percentage of nutrients by weight contained in the bag. In order, the numbers represent the percentage of nitrogen, phosphorus, and potassium (N,P, K). For example, a 32-0-4 fertilizer contains 32% nitrogen, 0% phosphorus, and 4% potassium. If the phosphorous level in soil is high or excessive on established lawns (10 years or older), use zero-P fertilizer.

Combination fertilizers
Weed-and-feed products or fertilizers combined with an herbicide are commonly available to homeowners. Although convenient, they often lead to over-fertilization and fertilizer applied at the wrong time of year. It is best to fertilize and treat weeds or insects, such as white grubs, separately using products labeled specifically for the problem.

Starter fertilizer
Starter fertilizers are formulated for use when starting or renovating a lawn. They are higher in phosphorus. The nitrogen applied should be included in the total amount of nitrogen that is being applied for the year. After two to three cuttings, additional fertilizer can be applied to the new turf according to the fertilizer schedule. (See Tables 13-F and 13-G.)

Nitrogen Sources

The ideal fertilizer program provides for uniform turfgrass growth over the entire growing season. Although this ideal is never fully reached because of temperature and moisture fluctuations, the types of nitrogen-carrying materials in a fertilizer are important in achieving steady, season-long growth. Nitrogen sources are divided into two broad groups – quick-release and slow-release. Slow-release sources include both inorganic and organic sources of nitrogen. The Fertilizer Use Act of 2011 requires that at least 20% of the total nitrogen in lawn fertilizers be slow release.

Quick-release nitrogen. Quick-release, or water-soluble, nitrogen sources include ammonium nitrate, ammonium sulfate, ammonium phosphate, and urea. Their major characteristics are:

- Rapid release of nitrogen, providing immediate green-up.
- Less expensive.
- Water soluble.
- Greater tendency to burn (dehydrate) the turf.
- Short-term sudden flush of growth and rapid depletion (three to six weeks) of the available nitrogen.
- Frequent light applications are necessary to obtain uniform growth.
- Higher potential to leach, causing nutrient pollution, if overapplied.

Slow-release nitrogen. Slow-release, or water-insoluble nitrogen (WIN) sources include ureaformaldehyde (urea compounds), IBDU, and sulfur-coated urea. To calculate the percentage of WIN divide the percentage of water-insoluble nitrogen by the total percentage of nitrogen in the bag and multiply by 100.

The major characteristics of slow-release nitrogen sources are:

- Slow release of a major portion of nitrogen over an extended period.
- Depend on microbial decomposition, physical processes, and/or chemical reactions to provide nitrogen in a form available to the plant. The activity of soil microorganisms is highly dependent on soil moisture, pH, and temperature.
- Under high temperatures and adequate moisture, microbial breakdown is accelerated. Under high temperatures and low moisture or low temperatures, the breakdown is much slower.
- More expensive per pound of nutrient.
- Less likely to damage lawn.
- Effects last over a longer period of time.
- Less likely to leach and cause nutrient pollution.
- Help to improve soil structure.
- Help to reduce thatch build-up.

Slow-release Inorganic Fertilizers

Urea compounds are synthetic nitrogen sources made by the chemical union of urea and formaldehyde. Within a given ureaform product there is a series of chemical compounds with varying degrees of solubility and/or resistance to decomposition. As the ratio of urea to formaldehyde increases, the length of the methylene urea chains, or polymers, decreases. As soil microorganisms decompose these materials, the short-chained compounds break down first, followed in succession by each longer-chained compound. Thus, the nitrogen is released over a relatively long period.

- "Standard" ureaform has a urea:formaldehyde ratio of approximately 1.3:1.0. It contains about 25% water-soluble nitrogen and 75% water-insoluble nitrogen. These materials may be applied at higher rates at relatively infrequent intervals. Currently, compounds called methylene ureas are available commercially. These nitrogen sources have higher urea:formaldehyde ratios (shorter-chained compounds). They contain approximately 75% water-soluble nitrogen and 25% water-insoluble nitrogen. As the amount of water-insoluble nitrogen decreases, the application rate should be decreased and the frequency of application increased.
- Fluid ureaformaldehydes containing short-chain methylene ureas are commonly used by the lawn-service industry. These materials generally contain quick-release nitrogen but are less likely to burn plant roots than other fluid or liquid nitrogen carriers. Care must be taken not to confuse urea (quickly available nitrogen) with ureaform products (slowly available nitrogen).

IBDU (isobutylidene diurea) is an example of a synthetic nitrogen source that depends on moisture for the nitrogen to be released. IBDU has extremely low solubility in water; thus,

nitrogen is released slowly. Because it is relatively unaffected by temperature, it has the advantage of releasing nitrogen during cold weather provided adequate moisture is available. IBDU also has been shown to be more efficient (more of the applied nitrogen is recovered by the plant during the year of application) than natural organics or ureaform nitrogen.

Sulfur-coated urea (SCU) is a slow-release nitrogen source made by coating urea prills, i.e., small granules, with molten sulfur. Most SCU products also are coated with a sealant, such as wax, to seal cracks or other imperfections in the sulfur coating. The release of nitrogen is determined by the thickness of the coating. Urea particles with varying thicknesses of sulfur coatings release nitrogen over a relatively long period (six to eight weeks).

SCU does not qualify as water-insoluble nitrogen under accepted definitions and is, therefore, often labeled with a controlled-release nitrogen (CRN) statement or with a rate of dissolution statement. The dissolution rate refers to the amount of sulfur-coated urea that will dissolve in water in seven days under a set of standard laboratory conditions. If an SCU product has a 30% dissolution rate, then 30% of the nitrogen acts as a quickly available source and 70% as a slow-release source.

Slow-release organic fertilizers
These include activated or processed sewage sludge, animal and/or vegetable tankage, manures, various composted products, poultry meal, and cottonseed meal. Natural organic sources vary greatly in their chemical composition. There is a wide variation in the rate of breakdown, although all of them release their nitrogen at a slower rate than the quickly available nitrogen sources.

Table 13-E. Examples of starter fertilizer and slow release fertilizer labels.

Starter Fertilizer 12-24-6		Slow Release Fertilizer 18-0-3	
Total nitrogen (N)*	**12%**	**Total nitrogen (N)***	**18%**
Ammoniacal nitrogen	10%	Ammoniacal nitrogen	4.7%
Urea	2%	Other water-soluble nitrogen	5.3%
Available phosphate	**24%**	Water-insoluble nitrogen*	8.0%
Soluble potash	**6%**	**Soluble potash**	**3%**
Fertilizer ingredients: sulfur coated urea, urea, monoammonium phosphate, muriate of potash.		Fertilizer ingredients: dehydrated manure, feather meal, kelp meal, ureaform, ammonium sulfate, and sulfate of potash.	

*It is common for manufacturers to blend a number of nitrogen sources, which can include quick release and slow release sources. The Fertilizer Use Act of 2011 requires that at least 20% of the nitrogen in lawn fertilizers be slow release.

Fertilizer Schedule

Tables 13-F. and 13-G. contain the official University of Maryland Extension recommendations for home lawns.

Table 13-F. Low Input Turf Fertilizer Recommendation

Grass Type	Date of Application	Pounds of nitrogen per 1000 sq. ft.
Tall fescue	September/October	0.9 - 1.8 lbs a year- 0.9 lb. in September and 0.9 lb. in October
Kentucky bluegrass	September/October	0.9 - 1.8 lbs a year- 0.9 lb. in September and 0.9 lbs. in October
Fine fescue	October	0.9 lb.
Zoysiagrass	June	0.9 lb.
Bermudagrass	June/July	0.9 lb. in June and 0.9 in July

- If clippings are left on the lawn you may only need one application per year regardless of your lawn's age.
- Healthy lawns established longer than twelve years may only need one application per year.
- No fertilizer can be applied between November 15 and March 1.

Table 13-G. Optional Turf Applications

Grass Type	Date of Application	Pounds of nitrogen per 1000 sq. ft.
Tall fescue	Late May or early June	0.5 to 0.9 lb.
Fine fescue	Late May or early June	0.5 lb.
Kentucky bluegrass	Late May or early June	0.5 to 0.9 lb.
Zoysiagrass Bermudagrass	July or August	0.5 to 0.9 lb.

Tall fescue and particularly Kentucky bluegrass may need moderate additional applications of fertilizer to maintain density and reduce pest and weed problems. The optional applications may help your lawn if:

- clippings are removed
- there is a severe crabgrass problem
- the lawn is heavily used
- there has been pest or other damage
- lawn was seeded the previous fall
- the previous fall fertilization was missed

Table 13-H. Calculating the correct amount of fertilizer to apply

Three numbers are important: 1) pounds of nitrogen per 1,000 sq. ft. (check fertilizer schedule Tables 13-F and 13-G), 2) percentage of nitrogen in guaranteed analysis, and 3) square footage of lawn. Use the following formula:

$$\frac{\text{Pounds of nitrogen desired to apply per 1,000 sq. ft.}}{\text{Percent of nitrogen in fertilizer in guaranteed analysis}} \times \frac{\text{sq. footage of lawn}}{1{,}000} = \text{amount of fertilizer needed to apply}$$

Example: A lawn measures 8,000 sq. ft and 0.9 lb. of nitrogen is needed per 1,000 sq. ft. The guaranteed analysis is 26-0-3.

$0.9 \div 0.26 \quad \times \quad 8000 \div 1000 \quad = \quad 27.7$ lbs. of fertilizer needed

If the lawn area is more than an acre, convert the area to square feet. There are 43,560 square feet in one acre.

Always use the calculated amount of fertilizer and follow label instructions. Excess fertilizer should be kept in a tightly closed container, stored in a dry environment, and used as soon as possible. Long-term storage is not advisable. Calculate how much fertilizer will be needed before purchasing.

Fertilizer, when applied to a healthy lawn at recommended rates, normally won't threaten groundwater or surface water. If your soil is sandy or if you live in an area with a high water table, try to use a fertilizer with a high percentage of water-insoluble nitrogen.

The large amount of paved areas in cities and suburbs provides a direct route for nutrients and other pollutants to enter streams, rivers, and the Chesapeake Bay. Careful application of fertilizer is one way you can prevent pollution.

Follow these tips to make sure the fertilizer you use stays on the lawn and out of the water:

- Don't apply fertilizer within 15 ft. of a body of water (10 ft. if you use a drop spreader or rotary spreader with a deflector.)
- Do not apply fertililizer near storm drains or drainage ditches.
- Do not apply fertilizer if heavy rain is expected.
- Sweep any fertilizer that lands on the driveway, sidewalk, or street back onto your lawn.

- Use a drop spreader instead of a rotary spreader in restricted spaces, especially when near water, driveways, or sidewalks. Look for lawn spreaders with an edge guard.
- Fill and wash spreaders over grassy areas, not on hard surfaces.
- Avoid getting fertilizer into natural drainage areas on your property.
- Never apply to frozen ground or dormant lawns. The Fertilizer Use Act of 2011 prohibits fertilizing lawns between November 15 and March 1.
- Do not use fertilizer to melt ice and avoid melting products that contain nitrogen. Refer to University of Maryland Extension publication FS 707, "Melting Ice Safely."

Mowing

Proper mowing technique is perhaps the most important factor in the appearance and longevity of any turf area. Often it is the most overlooked and mismanaged cultural practice.

The following are the important factors to consider when evaluating a mowing program:

Height of cut

- Low mowing is a major cause of lawn deterioration. Remove no more than one-third of the grass blade each time you mow. For example, to maintain a two-and-a-half-inch height, mow before the grass reaches a height of three-and-a-half inches. Mowing to the proper height can reduce weeds by 50% to 80% in tall fescue and help reduce disease problems. (See Table 13-I.) Scalping the lawn may encourage a crabgrass infestation.
- Removing larger amounts of leaf surface may result in physiological shock to the plant, cause excessive graying or browning of leaf tips and greatly curtail photosynthesis.
- Low mowing also stresses the root system, causing the turf to become weaker and less drought tolerant.
- Raise the mower height one-half to one inch during hot, dry periods in the summer.

Table 13-I. Mowing guide

	Spring and summer (inches)	Fall and winter (inches)
Tall fescue	2 ½ - 3 ½	2 ½
Kentucky bluegrass	2 ½ - 3 ½	2 - 2 ½
Fine fescue	2 ½ - 3 ½	2 ½
Perennial ryegrass	2 ½ - 3	2 - 2 ½
Bermudagrass	½ - 1	½ - 1 ½
Zoysiagrass	½" - 1	½ - 1 ½

Frequency of cut

- Infrequent mowing allows the turf to grow too tall. Subsequent mowing removes too much leaf surface and may shock the plants.
- Mow your lawn frequently so that clippings break down rapidly. The accumulation of clippings, from grass that has grown too long between cuttings, may smother the grass and provide an environment conducive to disease and insect damage.
- Weekly mowing may not be enough, especially during the peak period of leaf growth in the spring.
- The rate of growth depends on weather, season, soil fertility, moisture conditions, and species.
- Grasscycling (see below) can be practiced on lawns cut at proper intervals.

Maintenance of mowing equipment

- Sharpen mower blades annually.
- When servicing the mower, move it onto a non-turf surface such as a driveway.

Grasscycling

Grasscycling is the simple practice of letting grass clippings decompose on the lawn after mowing.

- Helps protect the environment by reducing the amount of grass clippings in the landfill.
- Encourages a healthier lawn by returning both macronutrients and micronutrients to the soil in a slow-release form. Can reduce fertilizer use (see Table 13-F) saving time and money and decreasing the amount of runoff into the Chesapeake Bay and its tributaries.
- Eliminates the need to bag or rake grass clippings.
- Does not contribute to thatch buildup or increase turf diseases. Grass clippings are largely composed of water and decompose rapidly. Microbial decomposition of clippings occurs on soils that are maintained at a pH of 6.0 to 6.8.

Tips on Grasscycling

- Mow with sharp blades.
- Mow lawn when dry. After a rainy period, large clumps of grass can be remowed or raked up and removed.
- Mow on a regular basis. Remove no more than one-third of the leaf blade. During the spring it may be necessary to mow twice a week.
- Mulching mowers hasten the decomposition process but are not necessary. Check availability of mulching "kits" which can be purchased for some models of lawn mowers. Kits include a plate that blocks discharged shoots, forcing clippings back through the blades. Check your lawn mower manual for information.
- Avoid the overuse of fertilizer.

Watering

Lawn irrigation is not encouraged, but there are certain times when it is necessary.

- Newly seeded lawns, or lawns less than two years old, should be irrigated. Water if the grass blades begin to wilt, develop a blue-gray color, or show footprints after being walked upon.
- Established tall-fescue lawns can go dormant during the summer. Dormancy is an important survival mechanism and lawns will recover quickly when rainfall returns. Dormant lawns continue to protect water quality by holding soil and potential pollutants. Do not fertilize dormant or drought stressed lawns and adjust mowing height accordingly.
- Water in the early morning, before noon.
- Water slowly to prevent runoff. Use a sprinkler to apply 1 inch of water to the lawn. Place a shallow can in the area being watered to monitor the amount being applied. After an inch of water collects in the can, check the soil moisture. Insert a screwdriver or other type of probe in the area. The soil should be moist 4 to 6 inches down.
- Frequent, shallow watering, as sometimes applied with a sprinkler system, tends to keep the upper layers of soil near a point of saturation most of the time. This encourages shallow rooting and disease and insect problems, as well as damage from foot traffic.

Thatch Management

Thatch problems

- Thatch is defined as a tightly intermingled layer of partly decomposed stems and roots of grasses that develops between the actively growing green vegetation and the soil surface.
- It is undesirable because accumulations decrease the vigor of turfgrasses by restricting movement of water, air, plant nutrients, and pesticides to the soil. During wet periods, it may act as a sponge and hold excessive amounts of water, reducing the oxygen supply to the roots. On the other hand, if thatch becomes dry, it is extremely difficult to rewet.
- Many turfgrass disease organisms and insects (billbugs, chinch bugs, and sod

webworm larvae) may be harbored in thatch. Fungicide and insecticide effectiveness is reduced because these materials cannot infiltrate the thatch layer.

- It interferes with maintaining the proper mowing height of turf. As the thatch layer builds up, mowers tend to ride on the thatch and do not cut at the desired height.
- Thatch build-up is dependent on several factors. Certain grasses such as Kentucky bluegrass and zoysia tend to thatch much faster than others, some because of their vigorous growth, and others because of the resistance of their tissues to decomposition.
- Lawns should be dethatched when the thatch layer is 1/2- to 1-inch thick.

Thatch control should be considered from two perspectives: Prevention and Removal.

Preventing thatch

- Soil pH should be kept in the 6.5 to 6.8 range, which is most favorable for the microorganisms that decompose thatch. Applications of ground limestone are required when pH levels drop below this range.
- Avoid over-fertilizing turf.
- Dethatching a lawn every two years as part of a prevention program results in much less debris and damage to established turf than having to thatch in a curative program.

Removing thatch

- Dethatch cool-season turf in the fall and warm-season turf in the summer.
- The health and general vigor of the plant and root system, climatic conditions, and the amount of thatch present determines how much thatch can be removed in one treatment. Healthier turf can tolerate more abuse during thatch removal than unhealthy turf.
- Mechanically removing thatch should be attempted only when growth conditions are adequate for rapid recovery of the grass.
- Raking and removal of the dislodged thatch is necessary after using a dethatching machine. This material can be composted.
- When a large amount of thatch is present, it is unwise to attempt to remove all in one treatment. If temperatures are ideal for growth, and adequate moisture is available, the treatment can be much more drastic than under high temperatures and/or low moisture conditions.
- Preferred dethatching machines have blades or knives that cut through the thatch into the underlying soil. These machines are called vertical mowers. Avoid spring tine machines or tines added to a rotary mower blade. They are ineffective. Machines can be rented from hardware stores or equipment-rental companies.

Aeration

Mechanical aeration alleviates soil compaction in established turf, encourages root growth, and allows lime and fertilizer to enter the soil.

- Compaction occurs primarily in the soil surface. A compacted layer as thin as one-fourth to one-half an inch can greatly impede water infiltration and gas exchange between soil and atmosphere.
- Aerating machines should remove plugs of soil from the turf, creating a system of large pores by which moisture and plant nutrients can be taken into the soil. They are referred to as core aerators. Core aerators pull plugs about ½- to ¾-inch in diameter, 2 to 4 inches deep, and about 2 to 6 inches apart. Equipment having solid tines or spikes should not be mistaken for aerating equipment. These types of machines actually increase soil compaction by compressing the soil into a denser mass.
- Fall is the best time to aerate cool-season lawns, and June through July is the recommended time to aerate warm-season lawns. Never aerate when a lawn is dormant. A general rule is to aerate only when desirable grasses are growing vigorously.
- Soil should be moist, but not wet, before aerating. Irrigate the lawn prior to aerating if the soil is dry.

- Aeration can be done before overseeding. This procedure makes holes for the seed to fall into, therefore increasing seed-to-soil contact. To increase the organic matter of soils, finely decomposed organic matter (compost) can be spread over the area after aeration has been performed. No more than a one-fourth to one-half inch layer of organic matter should be applied to avoid damaging the existing turf.
- Core aeration should be performed every one to two years on lawns that receive heavy foot traffic. Otherwise, aerating every two to four years on home lawns is sufficient.
- Soil plugs can be left on the surface of the lawn. They will decompose in a couple of weeks.

Liming

Liming is an important step in maintaining a healthy lawn.

- The optimum pH for turf growth is 6.0 to 6.8. If the pH level falls below 5.5, turf growth will be compromised.
- Soils in Maryland have a tendency to become acidic over time and a soil test should be performed every three to four years to check the pH. Soil test results will provide a liming recommendation. If more than 50 lbs. of limestone per 1,000 sq. ft. is recommended, the amount should be split into two applications. For example, if 85 lbs. is needed, apply 50 lbs. immediately then wait six months to apply the remaining 35 lbs.
- Limestone should be applied with a lawn spreader. To attain uniform coverage, apply half of the lime in an east-west direction and the remainder in a north-south direction.
- Lime can be applied anytime, but the ideal time is in the fall. The freezing and thawing of the soil over the winter will help to incorporate the lime into the ground. It is not recommended to apply lime on snow or frost-covered turf.
- Agricultural lime or calcitic lime is the recommended form of limestone for homeowner use. Pelletized lime is very similar and is easier to spread because it limits the amount of “dust” created when spreading Ag lime. Dolomitic lime is recommended for soils that are also low in magnesium. Burnt or hydrated limestone is caustic and not recommended for homeowner use.

Turfgrass Problems

Weeds

Weed management

Any management practice that increases the density and vigor of desirable turfgrasses tends to discourage competition from weeds. Studies show that weeds are not prevalent in a dense, healthy, vigorously growing lawn. Weeds are opportunistic; they will germinate in thin, weak stands of grass. Cultural practices for controlling summer annual grasses, such as crabgrass and broad-leaved weeds, are aimed at shading and crowding the young weed seedlings by producing a dense sod. Effective cultural control measures include the proper selection and establishment of turfgrasses, adequate liming and fertilization, proper mowing and watering practices, and insect and disease control.

Herbicides are an important tool for weed control but should not be relied upon solely for weed elimination. Before selecting an herbicide the following issues should be addressed:

- Assess the amount of weeds in the lawn. A low infestation of certain broadleaf weeds, such as dandelions, can be hand pulled. Also be realistic. Most home lawns will include a low population of weeds and still be healthy and attractive.
- Identification of the weed is necessary to determine the most effective herbicide and timing of application.
- Review cultural practices, along with growing conditions, as the possible reason for weed encroachment.
- Try to determine how the weed was introduced into the yard and the conditions that favor it. For example, ground ivy is often found in shady areas where shade-intolerant turfgrasses have begun to thin out and decline. Nutsedge prefers wet, poorly drained areas.

Crabgrass

Crabgrass is one of the most common turf weeds. Two species, hairy or large (*Digitaria sanguinalis* L.) and smooth or small (*D. ischaemum* L.), are found in Maryland. Both are summer annuals. Seed germination period ranges from mid-spring to mid-summer; all plants are killed by the first frost. Abundant quantities of seeds are produced, ready to germinate the following season.

To control, mow turf to the proper height in the growing season and follow proper lawn-care practices to encourage a thick, healthy stand of turfgrass. Crabgrass germinates in thin areas of lawns and in compacted, dry, infertile soil. Do not aerate a lawn or overseed during the seed germination period of summer annual weeds. Germination begins when soil temperatures reach 55ºF to 60ºF for seven to ten consecutive days. This is usually early March to early April on the Eastern Shore, mid-March to mid-April in Central Maryland, and mid-April to mid-May in Western Maryland. Applying a preemergent before germination is recommended. Indicators such as forsythia bloom are not consistently reliable for determining the timing of application but can be a convenient reminder for homeowners. For season-long crabgrass control, check the product label to determine if two applications, about 6 weeks apart, is recommended. Also refer to TT-43, "Herbicides for Crabgrass and Goosegrass Control in Turf" for information on herbicides and application. (See References and Resources.) Postemergent herbicides can be used to control young crabgrass (in the 1- to 3-leaf stage).

Table 13-J is a list of other common lawn weeds.

Table 13-J. Common lawn weeds and control

Name of weed	Life cycle	Type	Cultural control	Chemical control
Japanese stilt grass (*Microstegium viminuem* L.)	Summer annual.	Grassy	1) Mow or hand pull before seed set. 2) Mow turf to proper height.	1) Use preemergent crabgrass control herbicides applied approximately two weeks earlier than the recommended time for crabgrass control. 2) Spray infested area with a nonselective herbicide in August and reseed.
Annual bluegrass (*Poa annua* L.)	Winter annual, noticeable in early spring, usually a light green color. In hot weather it dies out.	Grassy	1) Aerate and improve drainage. *Poa annua* thrives in compacted and poorly drained soils. 2) Mow turf to proper height.	Apply a preemergent herbicide labeled for *Poa annua* in mid-September (if not planning on overseeding).
Bermudagrass (*Cynodon dactylon* L.)	Perennial. Goes dormant and turns brown after the first frost.	Grassy	Control should begin when the infestation is first detected. Complete eradication of perennial grass weeds is difficult.	Use a nonselective herbicide to either spot treat the problem area or, if necessary, undertake complete lawn renovation. Start the process in early August to allow time to retreat the area if regrowth occurs. Seed after the areas have completely died.
Nimblewill (*Muhlenbergia schreberi* L.)	Perennial. Goes dormant and turns brown after the first frost.	Grassy	Hand dig small patches.	Control same as for bermudagrass.
Yellow nutsedge (*Cyperus esculentus* L.)	Perennial	Sedge	1) Improve soil drainage. 2) Hand pulling is difficult because nutlets left in the ground will form new plants.	Treat with a postemergent herbicide labeled for nutsedge.
White clover (*Trifolium repens* L.)	Perennial	Broadleaf	More prevalent in low-fertility soils. Follow nitrogen schedule.	Spot treat with a liquid broadleaf selective postemergent herbicide when actively growing, in fall or spring, or use a granular herbicide.

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Table 13-J. Common lawn weeds and control

Name of weed	Life cycle	Type	Cultural control	Chemical control
Ground ivy or Creeping Charlie (*Glechoma hederacea* L.)	Perennial	Broadleaf	1) Hand pull small infestations. Usually creeps along the edges of lawns and near trees and shrubs. 2) Follow nitrogen schedule.	Spot treat with a liquid broadleaf-selective postemergent herbicide or a granular herbicide in the spring and again in the fall.
Wild violet (*Viola spp.*)	Perennial	Broadleaf	1) Hoe or hand pull. 2) Seed with shade-tolerant grasses, such as fine fescue. 3) Follow nitrogen schedule and mow to proper height.	Spot treat with a liquid broadleaf-selective postemergent herbicide labeled for wild violets or spot treat area with a nonselective herbicide and reseed.
Wild garlic (*Allium voneale* L.)	Perennial	Broadleaf	Hand pull when soil is moist; need to remove bulb.	Treat with a broadleaf-selective postemergent herbicide. Crushing the foliage before applying herbicide provides better control.
Common chickweed (*Stellaria media* L.)	Winter annual	Broadleaf	Maintain a thick stand of turfgrass by following recommended cultural practices.	1) Apply a preemergent herbicide in mid-September before germination. 2) Treat with a selective postemergent broadleaf herbicide when actively growing.
Mouseear chickweed (*Cerastium vulgatum* L.)	Perennial	Broadleaf	Same as for common chickweed.	Treat with a selective broadleaf postemergent herbicide when actively growing.

Types of Herbicides

Selective herbicides

Many preemergent and postemergent herbicides are selective herbicides. This means when used according to label directions, they target specific weeds only, with little or no damage to turf.

Preemergent herbicides are applied prior to the germination of weeds. They are commonly used to control annual grass weeds, such as crabgrass. Preemergent herbicides should be directed towards the soil. The chemical forms a barrier in the soil, which kills weeds as they germinate. Preemergent herbicides need to be watered in soon after they are applied. Caution must be used if you intend to overseed that season. In most cases you cannot overseed and apply a preemergent herbicide at the same time. The only exception is the herbicide Siduron (Tupersan®). Always read and follow the product label.

Postemergent herbicides are used to control actively growing grass and broadleaf weeds. The foliage of the weed is targeted. To be effective, the chemical needs to be absorbed into the plant itself and moved down to the root system. Mowing the grass should be avoided a few days before and after the application of the herbicide. Postemergent herbicides should not be applied if rain is in the immediate forecast. They are not watered in, because this will wash the product off the leaves. Some granular products will recommend the turf be wet before application to help the granules adhere to the weeds. Liquid herbicides can be used effectively to spot-treat weeds, eliminating the need to treat the entire lawn. Fall or spring is the best time to target perennial broadleaf weeds such as ground ivy, white clover, wild violets, and wild garlic.

Non-selective herbicides

Non-selective herbicides kill all vegetation they come in contact with and must be applied to vegetation that is actively growing. Most often they are used for complete lawn renovation. Renovation should be considered when a lawn contains 50% weeds or to control an invasion of a perennial grass weed such as bermudagrass (wire grass) and nimblewill. The recommended time to begin lawn renovation is late summer (mid-August). This will allow ample time to kill the weeds and have time to reseed.

Moss

Moss commonly occurs in home lawns. It appears when growing conditions are not optimum for turf growth. Moss does not kill the grass but rather moves into areas of weak, thin turf. The key to controlling moss is to improve growing conditions to encourage a thick stand of healthy grass.

Conditions that favor the growth of moss and need to be addressed for moss control

- Low soil fertility. Fertilize according to fertilizer schedule.
- Acidic soil. Perform a soil test and lime according to results.
- Dense shade from trees and shrubs. Prune surrounding plant material to increase sunlight.
- Areas of poor drainage. Improve drainage by adding organic matter to soil or regrading.
- Soil compaction. Core aerate at the appropriate time.
- Excessive irrigation. Do not irrigate the lawn.
- Poor air circulation. Prune surrounding plant material to increase air movement.
- General poor lawn care. Follow recommended cultural practices.
- Inappropriate choice of turf species for site conditions. Plant shade-tolerant turf where appropriate.

Several of these conditions may need to be improved before the moss can be eliminated. If growing conditions cannot be altered, consider converting the area to ornamental beds or plant a groundcover. Once established, groundcovers may require less maintenance than grass. Moss itself is considered a low-maintenance groundcover.

Mushrooms

During periods of wet weather various species of mushrooms can appear in lawns. Mushrooms are the fruiting bodies of a fungus and commonly appear in turf areas where trees were removed. Fungi feed on decaying roots, stumps, and buried logs and can be present many years after the tree is removed. Mushrooms can be unsightly, but they do not harm the turf. There are no products labeled to control them. Some species can be poisonous. If necessary, they can be raked up and appropriately disposed of.

Insects

The most damaging turf insect in Maryland is the white grub. Table 13-K identifies and describes the management practices for the most common lawn insects. Table 13-L provides a key to insect damage by symptom.

Table 13-K. Insect management

Insect	Damage	Monitoring method	Cultural prevention	Control
White Grub. Several species of grubs damage turf, including the larvae of the Japanese beetle, Oriental beetle, and Asiatic garden beetle. White grubs are identified by their raster pattern, located on the underside of the abdomen.	1) Root feeder. Damage is most evident in August through early October and is worse in droughty summers. Symptoms include gradual thinning, wilting, and browning of turf, and scattered, irregular dead patches. 2) Birds, skunks, and raccoons often dig up grub-infested areas, causing further damage.	1) Dead patches will roll back easily, like lifting a carpet. 2) Cut out a square- foot section of sod and examine the soil for c-shaped grubs. Inspect the top one to two inches of soil. Replace the sod and water. If an average of 6 to 8 grubs is found per sampled area, chemical control may be necessary. It is common to find some grubs; complete eradication is not necessary or practical.	1) Plant tall fescue, which generally has fewer grub problems. 2) Do not irrigate the lawn during the adult egg-laying period (June/July); beetles tend to lay eggs in moist soil. 3) Fertilize in fall to encourage a deep root system.	1) Apply an insecticide labeled for season-long grub control in June - July. These products are applied to prevent a grub infestation later in the summer. Areas with a history of grub problems need to be treated preventatively. 2) *Bacillus popilliae* (milky spore) treats Japanese beetle grubs only. For maximum effectiveness, neighboring lots need to be treated. Current research is inconclusive about using milky spore for control. 3) Entomopathogenic nematodes can be difficult for homeowners to apply properly. 4) Reseed areas with grub damage in the fall. Treat with recommended insecticide in June-July.

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Table 13-K. Insect management

Insect	Damage	Monitoring method	Cultural prevention	Control
Green June beetle. Larvae can grow to two inches.	Tunnel/push up small piles of soil.	Tunnels resemble the holes made by earthworms. Exit holes are about as wide as a pencil.	Tamp down the tunnels and reseed if necessary. Fertilize, mow, and lime according to recommendations.	Usually not necessary on home lawns.
Billbug. The adult is a dark brown to black weevil. Adults emerge in the spring after overwintering in thatch and leaf litter. After mating, they lay eggs in the stems of various grasses during June and July.	Root feeder. After the eggs hatch, larvae feed on the inside of the stem and eventually the crown and roots of turf. Larvae are small, white, and legless. Only the larvae cause significant damage. Larvae usually pupate in August and emerge as adults soon after. Sometimes, adults are observed on paved surfaces during September and October.	1) Heat- and drought-stressed turf is the first to show damage. 2) Small brown or tan patches (two to six inches in diameter) begin to appear in mid-summer. 3) Upon close observation, hollow stems and sawdust-like material is present at the base of the plants. Larvae are difficult to detect.	1) Control thatch. 2) Plant resistant varieties of turf, in particular, grasses containing endophytic fungi, such as tall fescue. 3) Maintain a healthy stand of grass to ensure adequate recovery from billbug damage.	Insecticide application is not recommended because it is too late to apply when damage is noticed. This pest is not significant enough to warrant preventative applications of insecticides.
Chinch bug. No larval or pupal stage. Hatch directly into minute nymphs. Adults have black bodies with white folded wings. Usually two generations per year, overwinter in leaf litter or thatch.	Leaf feeder. Feed by inserting their mouthparts into blades and sucking out fluids causing localized yellow or brown patches.	1) Heat- and drought-stressed turf is the first to show damage. 2) Adults can be seen in thatch layer. Carefully inspect turf bordering dead areas or place a large can, with both ends removed, a few inches into the soil and fill with water. If chinch bugs are present, they will float to the surface in 10 - 15 minutes.	1) Control thatch. 2) Plant resistant varieties of turf, in particular, grasses containing endophytic fungi, such as tall fescue. 3) Healthy turf can tolerate a low population of these insects without a negative impact on turf.	Populations are kept in check by natural predators such as big-eyed bug. Chemical control not recommended.

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Table 13-K. Insect management

Insect	Damage	Monitoring method	Cultural prevention	Control
Sod webworm. Larvae grow to about 3/4 in. and have rows of spots on their bodies. Moths are about 1/2 in. and they appear to have a long snout.	Leaf feeder. Larvae chew blades at the base. Female moths drop eggs randomly over turf as they fly.	1) Off-white moths flying over turf are noticeable. 2) Irregular patches of yellow-brown grass. Upon closer examination, areas appear scalped. Damage occurs in midsummer through early fall.	Plant resistant varieties of turf, in particular, grasses containing endophytic fungi, such as tall fescue.	B.t. (*Bacillus thuringiensis*), a biological insecticide, can be used to control young larvae. Natural enemies include big-eyed bugs and ground beetles.
Mining bee/ cicada killer wasp.	Burrowing/mounds of soil. Both of these insects are considered to be beneficial.	Mining bees, or cicada killer wasps, flying over lawn surface.	1) Irrigation during flying activity may reduce bee nesting. 2) Thicken up turf to discourage nesting.	1) Tolerate activity if possible. These are pollinating insects. Control is not necessary for mining bees. 2) If cicada killer activity produces numerous mounds, control with a labeled lawn insecticide.

Table 13-L. Key for diagnosing insect damage by symptom

Symptoms	Possible causes	Control/comments
Turf comes up easily, obvious lack of roots.	White grubs: turf can sometimes be rolled up like a carpet. C-shaped grubs found in soil from June through September. Can be severe on bluegrass, ryegrass, and fine fescue.	Reseed the lawn in the fall with a tolerant turf species such as tall fescue or zoysia.
Turf blades can be pulled easily from sod.	Billbugs: light tan, sawdust-like frass in areas of heavy feeding. Small legless grubs found near crowns and roots from June through August.	Water and fertilize grass to stimulate regrowth. Reseed with endophyte-containing tall fescues.
Irregular brown patches with white moths flying over the turf.	Sod webworm: brown caterpillars may be found at the base of the blades and in the thatch.	Reseed with grasses having high levels of endophyte, such as tall fescue, or spray with B.t. insecticide.
Localized yellow or brown areas.	Chinch bugs: tiny black insects with shiny white wings found on crowns and stems. Damage usually occurs in sunny, well-drained locations.	Reseed with grasses having high levels of endophyte, such as tall fescue. Often controlled by natural predators such as big-eyed bugs.

Diseases

Disease pathogens are present in most turfgrass stands. Usually, these organisms exist in a dormant or saprophytic state. (An organism that obtains nutrients from dead organic matter is termed a saprophyte.) Diseases become a problem when environmental conditions become favorable for the buildup of pathogen populations or cause an increase in the susceptibility of the host plant.

Any weather condition can initiate a turf disease problem. Turfgrass diseases can occur under a blanket of snow in the winter, as well as only during the hottest and most humid conditions of midsummer. Too much or too little nitrogen fertilizer can also contribute to a disease problem. Some diseases occur when soils are saturated with water; others occur under periods of drought stress.

Disease Management Strategies

Get an accurate diagnosis. Diagnosis can be difficult because pathogens that cause turf diseases are usually only visible under a microscope. However, pathogens occasionally will produce large fruiting bodies, such as mushrooms, spores, or threadlike filaments called mycelium, that can be seen without a microscope. (See Table 13-M.) Plant pathologists refer to these structures as signs of the pathogens. More commonly, symptoms (the characteristics of the plant indicating that it is diseased) are used for diagnosis. Symptoms can take on a variety of sizes, shapes, and colors and be present on leaf blades or on the crowns and roots. (See Table 13-N.) Symptoms also appear on populations of plants and may take the form of circular patches, rings, or irregular areas of blighted turf.

Table 13-M. Common turf diseases

Disease	Symptoms	Conditions favoring disease	Control
Brown patch. Affects all turfgrass, especially tall fescue and perennial rye.	Circular yellow-brown patches of thinned turf. On individual blades, elongated lesions bordered above and below by tan or chocolate-brown bands.	1) Prevalent June-September, when daytime temperatures are 85º or above, nighttime temperatures are above 68º, and relative humidity is high. 2) Applications of water-soluble fertilizer, especially urea, nitrate, or ammonium, in late spring-summer increases the possibility of the disease.	1) Pathogen does not kill the crown of the turf. Most tall fescues lawns will recover with proper fall fertilization and the return of rainfall. 2) Do not plant perennial rye. 3) Avoid spring applications of fertilizer.
Red thread. Affects mostly fine fescues and perennial rye, but can also be seen on tall fescue.	Foliar disease that causes circular or irregular patches. Produces a reddish, gelatinous, fungal growth that can be seen on leaf blades and sheaths. When blades dry, red, brittle strands extend from tips of infected blades. Patches have a pink/reddish color.	1) Cool, wet weather in early spring. Associated with periods of overcast, drizzly weather. 2) Usually more prevalent on under-fertilized turf.	Follow recommended fertilizer schedule.
Dollar spot. Affects all species of turfgrass grown in Maryland, including zoysia. Tall fescue appears to be resistant.	Hourglass-shaped lesions, extending across the blade with whitened centers and dark borders. Produces numerous two- to six-inch spots.	1) Occurs late spring through fall. Causes most damage in June-July. 2) Usually more prevalent on under-fertilized turf. 3) Drought, thatch, and compacted soil increase disease susceptibility.	1) Follow recommended fertilizer schedule. 2) Aerate and eliminate thatch.

Table 13-N. Key for diagnosing lawn diseases by symptom

Symptoms	Possible causes	Controls/comments
Leaf spots	Most common fungi are:	
	Helminthosporium leaf spot: leaf spots with tan centers. Lesions are round or elongated. Turf thins out. Common in wet spring weather. Primarily affects bluegrass and ryegrass.	Avoid drought stress and light or frequent watering. Reduce thatch build-up and avoid spring fertilization with soluble nitrogen sources. Reseed with improved turf cultivars.
	Dollar spot: leaf lesions with a dark border and hourglass-shaped spots. Affects all turfgrass species, including zoysia. Tall fescue appears to be resistant.	Avoid drought stress. Prevent thatch buildup and soil compaction. Maintain adequate nitrogen fertility and reseed with improved turf cultivars. Tall fescue turf maintained at proper mowing height and fertility rate will recover in the fall.
	Brown patch: elongated lesions with chocolate brown margins. Entire leaves may turn brown and thinning may occur. Occurs in midsummer.	

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Table 13-N. Key for diagnosing lawn diseases by symptom

Symptoms	Possible causes	Controls/comments
Pink/reddish color on leaf blades	Red thread: red, thread-like growths extending beyond leaf blades. Appears in patches and occurs in spring and fall on fine fescue and perennial ryegrass species. Also can affect tall fescue.	Maintain adequate nitrogen fertility levels.
Gray to black streaks in leaf blades	Striped smut: leaves split into ribbons and curl. Appears in irregular patches and infects primarily bluegrass in spring and fall.	Avoid drought stress and excessive thatch. Reseed with improved turf cultivars.
Blades covered with red, orange or yellow powdery material	Rust diseases: turf may appear yellow or reddish from a distance. Occurs primarily on bluegrass, ryegrass, and zoysia.	Maintain adequate nitrogen fertility levels and reseed with improved turf cultivars.
Blades covered with a white coat-ing	Powdery mildew: white coating, typically occurs in shady areas in the fall on bluegrass.	Reduce shade and improve air movement. Avoid excessive nitrogen and drought stress. Increase mowing height and reseed with improved disease-resistant cultivars.
Blades covered with black sooty-like material	Sooty mold: not harmful. It is easily wiped off or removed. Blades remain green underneath. Occurs primarily in spring or fall after rain.	Wash off sooty material with a hose or remove ma-terial by mowing.
Rings or arcs of dead or green grass, mushrooms may be present	Fairy rings: rings or arcs of dead or green grass bordered by zones of darker green grass. More common on droughty sites and poorly nourished turf. Occurs on all turf cultivars year-round.	Aerate turf frequently. Maintain adequate nitrogen fertility and adequate water during dry spells.
Circular straw-col-ored patches	Summer patch: circular patches that range from 3- to 12-inches in diameter. Occurs in bluegrass and fine fescue lawns 2 years or older, July to September.	Avoid excessive nitrogen especially in spring. Use slow-release nitrogen sources. Increase mowing height, avoid light, frequent waterings, and reduce thatch build-up.

Cultural control. Cultural control always is the first line of defense against turfgrass diseases. Part of the diagnosis should include addressing the mismanagement of turf, which can contribute to a disease problem. Cultural practices that need to be addressed include:

- **Mowing**. Mowing below the recommended height can place stress on the grass making it more susceptible to some diseases (especially in the summer months). Every time a mower removes leaf tissue a wound is created though which a pathogen may enter the plant. Sometimes mowing may actually spread the pathogen from one location to another. Mow when turf is dry.
- **Fertilization**. Over-fertilization is a common reason for residential lawn diseases. Avoid heavy applications of nitrogen during spring and summer. Lush spring or summer growth can be more prone to certain diseases. Diseases favored by large applications of nitrogen fertilizer include leaf spot, brown patch, pythium blight, striped smut, and the snow-mold diseases. On the other hand, certain diseases such as dollar spot, red thread, pink patch, and rust diseases are more prevalent in low-fertility soils.
- **Irrigation**. Irrigation contributes to disease problems because most fungal pathogens require free water to infect plant tissue. Night watering should be avoided if possible since it leaves a film of water on plants for an extended period of time. Watering should be performed in early morning.
- **Thatch**. Thatch accumulation results in weakened plants that become more susceptible to diseases and can provide a habitat for disease organisms. An excessive amount of thatch can prevent wetting of the soil and restrict fertilizer from reaching the root system, further weakening the turf.
- **Compaction**. Compaction leads to poor infiltration and reduced oxygen diffusion to the root zone. Some root and crown diseases, such as summer patch and anthracnose, are frequently associated with compacted soils on putting greens.

- **Air circulation**. Areas with poor airflow are prone to diseases such as powdery mildew. Prune trees and shrubs to increase air movement.

Planting disease-resistant species and varieties. Turf-type tall fescue has the least amount of disease problems, although no turfgrass is resistant to all diseases. To increase a turf stand's overall resistance, plant mixtures of different grass species and/or blends of cultivars of an individual species. If a disease damages one cultivar or species, the others will fill the void. Plant shade-tolerant species in areas with low sunlight.

Chemical control. Homeowner use of fungicides should be discouraged. Fungicides need to be sprayed preventatively and by the time the homeowner notices symptoms, it is too late to spray. Multiple applications are necessary and usually homeowners do not own the proper equipment for an effective application. Fungicides are expensive and most of the effective products are available to licensed applicators only. Fungicides should be recommended only for diseases that kill the crown, such as summer patch. Homeowners can consult with a lawn-care professional for treatment. Contact fungicides are usually used to control foliar diseases, are only effective for short durations (7 to 14 days), and do not protect new foliage. As a group, they have a broad spectrum of control. Systemic fungicides are absorbed and translocated within the plant. They control both foliar, root, and crown pathogens, protect plants for a period of two to four weeks, and protect new growth. Systemic fungicides tend to have a rather narrow mode of action, encouraging pathogen resistance.

Abiotic Disorders

The vast majority of turf problems are abiotic, i.e., unrelated to disease or insect organisms. Symptoms can look very similar to those created by disease or insects, but treatment is very different. Abiotic problems can be tricky to diagnose and require the examination of site conditions, cultural practices, and use of the lawn area. In many cases, by the time the damage is noticed, it is too late for treatment and the only solution is to renovate the area. To avoid further damage, it is necessary to remedy the cause of the damage. For example, if patches of dead grass appear that are not caused by disease or insects, it is possible that construction debris or rocks are buried underneath the dead areas. The solution is to dig up the area to search for and remove the debris and then reseed.

Table 13-O. Key for diagnosing abiotic problems by symptom

Symptoms	Possible causes	Controls/comments
Straw-colored patches surrounded by a ring of dark-green turf	Dog urine: may resemble some diseases. May kill the crown tissue.	Heavy irrigation will promote recovery of spots.
Banded streaks or irregular patterns	Fertilizer or chemical injury: grass may be stimulated at the margins. May kill the crown tissue.	Calibrate spreaders and sprayers for uniform and accurate application of materials. Reseed areas.
Black or dark spots or patches on lawn	Oil or gasoline damage: from leaking lawnmower.	Severe oil leak or spill requires removal of affected soil. Small gasoline leaks or spills volatilize quickly. Soil should be replaced if saturated.
Large, yellow area near pool	Chlorine damage: from pool water.	Leach chlorine through soil using water. Replant.
Grass over high spots looks scalped	Mower injury: crowns of plants exposed.	Adjust terrain, raise mower blade, or change mowing direction.
Shredded blade tips	Dull mower injury: tips appear gray and then turn tan.	Sharpen mower blades.
Patches of dead or dormant grass	Buried debris, insect injury, or thick thatch: often follows a dry period.	Check for causes.
Pale green to golden-yellow turf	Chlorosis: iron or nitrogen deficiency. Yellow streaks may form parallel to leaf veins.	Maintain adequate fertilizer levels.
Black or greenish crust on soil	Algae growth: on bare soil or in thin turf. Occurs in poorly drained or compacted areas, usually more severe in shade.	Increase drainage and establish a thicker stand of turf. Aerate compacted areas and increase sunlight in shaded areas.

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Table 13-O. Key for diagnosing abiotic problems by symptom		
Symptoms	**Possible causes**	**Controls/comments**
Small green plants growing with turf	Moss: on bare soil or in thin turf. Occurs in poorly drained or compacted areas, usually more severe in shade.	Increase drainage and establish a thicker stand of turf. Aerate compacted areas and increase sunlight in shaded areas.
Turf appears dry and bluish green in color	Drought: foot prints remain after walking on turf. Grass wilts.	Irrigate turf.
Turf dies out every year over the summer	Site conditions: slope, or full-sun location with poor soil.	Plant site-appropriate groundcover. Aerate and topdress with organic matter to improve soil.
Areas of thinning turf	High-traffic/compacted soil: weeds, most often crabgrass, move into these areas.	Aerate turf at appropriate time and reseed.

Tips on Organic Lawn Care

A working definition of "organic" used by most organic gardeners is "without chemical fertilizers or pesticides."

Here are tips on organic lawn care:

- Maintain proper soil pH. Perform a soil test every three to five years and apply lime according to results.
- Fertilize at the proper time. Fall fertilization encourages root growth. Use slow-release fertilizers.
- Irrigate only if necessary. Tall-fescue lawns can go dormant in the summer and will recover when rainfall returns and temperatures fall. Only newly seeded lawns and those less than two years old need irrigation.
- Mow at proper height.
- Amend poor soil conditions: Aerate compacted soil, add compost to poor soil, and correct drainage problems.
- Use proper seed for site conditions and buy high-quality seed.
- Core-aerate and overseed in the fall.
- Remove thatch.
- Grasscycle.
- Hand-pull weeds, or use corn gluten products to control annual weeds before they germinate.

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