

Lawn Management

Kentucky Master Gardener Manual Chapter 15

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Turf is the foundation of a quality landscape. It improves the beauty of other ornamentals and provides a safe recreational surface. Quality lawns greatly increase the economic and sociological value of urban homes. They beautify and reduce the often harsh urban environment by decreasing noise, glare, heat, dust, and mud. Lawns and other recreational turf areas are an integral part of our daily activities.

As trees and ornamentals within a landscape mature, turf becomes less obvious and somewhat less important. In immature landscapes, however, the importance of a uniform turf cannot be overstated. Millions of individual grass plants (Figure 1) form the turf, but collectively the grass plants become one landscape plant. Just as an individual tree or shrub should have uniform shape, the turf should be uniform in texture, color, height, and density. Whether the turf is cut high or low, has coarse or fine texture, is fast or slow growing, or is dark or light green is of little importance in landscaping for non-recreational turf. Uniformity is the key to quality. A list of common turf terms as well as sources for further information may be found at the end of this chapter.

Lawn Establishment

To establish turf with the greatest potential for uniformity, quality, and management ease, select the best grass for your needs and establish it properly. Use the right mowing practices, fertilization, irrigation, and pest controls to maintain that uniformity.

If your lawn isn't established properly, you may never achieve a quality lawn, and your maintenance costs may be prohibitive.

Choosing the Best Grass

The "right" grass for Kentucky lawns may not be the one you like best but rather the one that is best adapted and easiest to grow. Kentucky is in the transitional climate zone where we have hot summers and cool winters. Because of this, there is no single turfgrass that is perfectly adapted to our climate. Due to its name, many believe that Kentucky bluegrass is the best grass choice for Kentucky. However, because Kentucky bluegrass generally lacks heat tolerance, it can struggle and become diseased during warm summers. Depending on budget and level of maintenance desired, many grasses can be grown throughout Kentucky. However, to minimize the impact on the environment, a turfgrass should be selected that will not require frequent inputs to look good.

Table 1. Characteristics of some turfgrasses and perennial grass weeds.

Grass	Stolons (aboveground stems)	Rhizomes (belowground stems)	Texture ¹	Ligule ²	Bud Leaf ³	Other Characteristics
Red Fescue	No	Few	F	S	F	Blade narrow—needlelike and usually folded.
Creeping Bentgrass	Yes	No	F	L	R	Often grows in wet or shady areas; grows in patches; stolons usually white; veins prominent.
Rough Bluegrass	Few	No	F	L	F	Boat-shaped tip; dual veins in midrib; grows in patches.
Kentucky Bluegrass	No	Yes	M	S	F	Boat-shaped tip; dual veins in midrib; smooth leaf.
Perennial Ryegrass	No	No	M	S	F	Underleaf shiny; red stem base; veins prominent.
Nimblewill	Yes	No	M	SH	R	Aerial tillers; short leaves; compressed sheaths; grows in patches; stolons usually green; rooting at lower nodes.
Quackgrass	No	Yes	M	M	R	Claw-like clasping auricles; blue-green color.
Bermudagrass	Yes	Yes	C-F	MH	F	Upright tillers grow at 30°-60° angle from lateral stems; some hairs on leaf surface; sheaths round; long stolons.
Zoysiagrass	Yes	Yes	C-F	MH	R	Tillers grow at 90° angle; sheaths compressed; tuft of hairs at collar; hairy on leaf surface; very knotty nodes.
Tall Fescue	No	No	C	S	R	Leaf margin serrated; red stem base; veins prominent.
Timothy	No	No	C	L	R	Bulbous base.
Orchardgrass	No	No	C	L	F	Stem very flat; blue-green color.
Dallisgrass	No	No	C	L	R	Hairs grow on leaf margin.

¹ Texture: F = fine, M = medium, C = coarse

² Ligule: S = short, M = medium, L = long, H = hairy

³ Bud leaf: F = folded, R = rolled

Generally, Kentucky bluegrass is somewhat adapted to Central and Eastern Kentucky, bermudagrass and zoysiagrass to Western Kentucky, and tall fescue throughout the state. Also, red fescues or ryegrasses may be desirable in some situations. For most lawns throughout the state, tall fescue is the best choice due to heat and drought tolerance. All of the grasses, however, differ in their performance and qualities. Table 1 gives certain characteristics that will help identify many lawn and weed grasses.

Improved cultivars of all species grown in Kentucky are tested annually at the University of Kentucky. For the most recent list of improved cultivars go to www.uky.edu/ag/ukturf/varieties.html.

Sod is grown in Kentucky for all species except perennial ryegrass and fine fescue.

Kentucky Bluegrass (*Poa pratensis*)

Many cultivars of Kentucky bluegrass are sold in Kentucky. The common types, such as the cultivar Kenblue, are persistent when maintained at high mowing heights, at low nitrogen fertility, and with minimum traffic. Many improved cultivars have better summer quality and improved heat tolerance and disease resistance. The top performing cultivars in Kentucky are listed at www.uky.edu/ag/ukturf/kgb.html. However, to determine how a cultivar sold at your local store/sod farm will perform in Kentucky, visit www.ntep.org and visit current and previous data.

Adaptation—Grows best on well-drained soils in full sunlight; performance in western Kentucky is very poor.

Major qualities—Fine texture, good resiliency, good spreading habit, relatively slow growth.

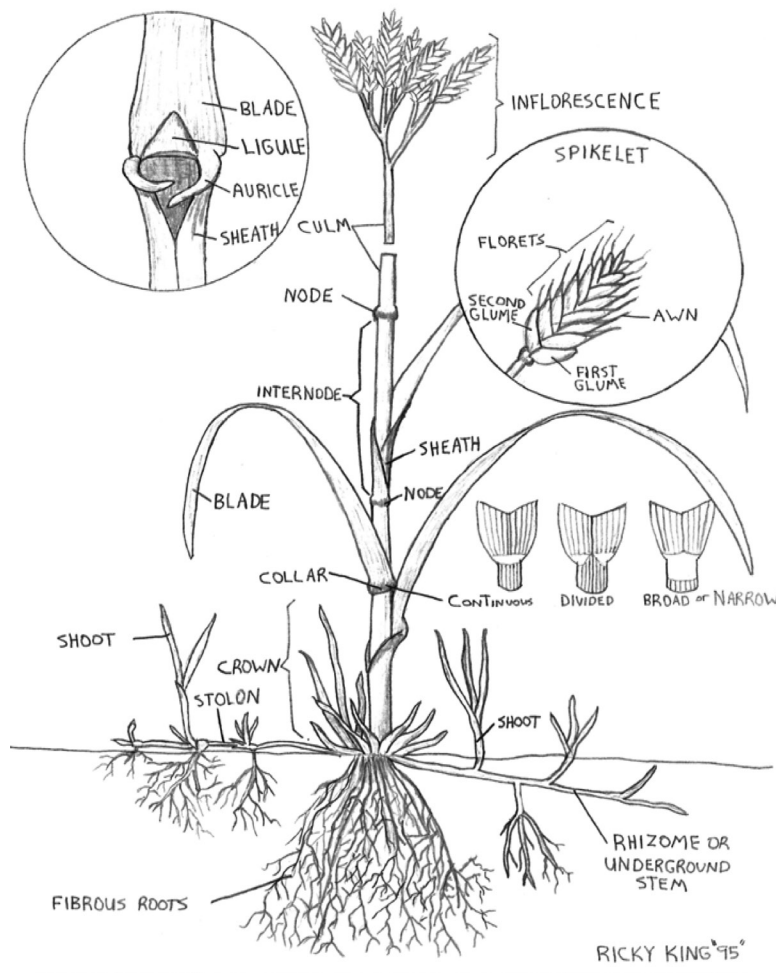


Figure 1. Physical structure of a grass.

Major problems—Very poor traffic tolerance; not adapted to shade; severe white grub susceptibility; diseases such as Leaf Spot and Melting Out often cause thinning in May and June; irrigation required when maintained with high nitrogen fertilization; becomes semidormant (brown) when not irrigated during the summer; slow seed germination (10-21 days); very poor seedling vigor, causing slow establishment; not adapted to clay soil; will creep into landscape beds.

Seeding rate—2 pounds per 1,000 sq ft.

Mixtures—Can be mixed with perennial ryegrass or fine fescue as indicated below.

Tall Fescue (*Festuca arundinacea*)

Tall fescue is used for lawns, hay, and pasture throughout Kentucky. When properly seeded and managed as a lawn, however, it has little resemblance to the tall fescue in pastures. Although it is normally a bunch-grass, when a dense cover of tall fescue is established in a lawn, leaf coarseness and clumping are not problems.

The top performing cultivars in Kentucky are listed at www.uky.edu/ag/ukturf/tf.html. However, to determine how a cultivar sold at your local store/sod farm will perform in Kentucky, visit www.ntep.org and visit current and previous data. New, turf type cultivars are more finely textured and denser cultivars than Kentucky 31 (KY 31), and they may have more brown patch disease problems. They are best for highly maintained, more formal lawns. KY 31 is best for large acreage, minimum-maintenance turf areas, and slopes that need to be stabilized. Turf type tall fescues more closely resemble a good Kentucky bluegrass lawn than pastures.

Adaptation—Most widely adapted turf-grass for use in Kentucky.

Major qualities—Adapted to full sun or medium shade; performs well on heavy clay to sandy soils; good traffic tolerance, no serious insect problems; very competitive with weeds; little if any irrigation required (except in severe drought); faster to establish than Kentucky bluegrass.

Major problems—Requires more frequent mowing than Kentucky bluegrass; some brown patch disease problems during hot summers; turf has little resiliency; lateral spread is very slow.

Seeding rate—6 pounds per 1,000 square feet.

Mixtures—Mixtures with other species such as Kentucky bluegrass are not recommended except where sod is grown specifically for transplanting purposes.

Fine Fescues (*Festuca rubra*, *Festuca ovina*, *Festuca trachyphylla*, etc.)

These fine-leaf grasses are often designated as creeping red, chewings, hard, or sheep fescue. Fine fescue is a niche grass that will tolerate some shade, drought, and low fertility.

Very little fine fescue is grown in Kentucky, thus cultivar recommendations are not specifically available. See www.ntep.org for top performing cultivars from other states.

Adaptation—Poorly adapted except where some shade is present; not adapted to heavy shade or heavy traffic.

Major qualities—Tolerant to low fertility; droughty and acid soils; has fine texture.

Major problems—Poor traffic tolerance—often clumps when heavy traffic imposed; becomes semi-dormant (brown) in summer when located in full sun; susceptible to severe grub damage; lateral spread is very slow; will not survive continuous heavy nitrogen fertilization.

Seeding rate—2 pounds per 1,000 sq ft.

Mixtures—When a turf area includes both full sun and shade a mixture of approximately 50 to 80 percent Kentucky bluegrass and 20 percent to 30 percent (by weight) fine fescue may be seeded.

Perennial Ryegrass (*Lolium perenne*)

Most perennial ryegrass cultivars are not reliable and form a clumpy, open turf that has little appeal and poor persistence. Several new, improved, fine-leaf perennial ryegrasses are available. These blend well with Kentucky bluegrass when it is necessary to obtain quick cover, protect the soil from erosion, or seed out of season.

The top performing cultivars in Kentucky are listed at www.uky.edu/ag/ukturf/pr.html. However, to determine how a cultivar sold at your local store will perform in Kentucky, visit www.ntep.org and visit current and previous data.

Adaptation—When seeded alone, ryegrasses may not survive the summer unless irrigation and disease control are provided. Although not adapted to heavy shade, they can survive it some years and are easily established among the surface roots of trees.

Major qualities—Fine texture similar to Kentucky bluegrass; more tolerant than other grasses to heavy clay and compacted soils; germinates quickly (five to seven days); excellent seedling vigor; great traffic tolerance; can be mowed short (approximately 1 inch); will often dominate nimblewill and other weed species; can be seeded with minimum soil preparation.

Major problems—Somewhat difficult to mow (requires sharp mower); susceptible to summer brown patch disease; has little heat tolerance; needs summer irrigation if thick stand is established; sod has little resiliency.

Seeding rate—4 lb/1,000 sq ft when broadcast seeded.

Mixtures—For quick establishment and increased erosion control, seed no more than 10 percent to 15 percent by weight (approximately ¼ pound per 1,000 sq ft) with Kentucky bluegrass (1¾ pounds per 1,000 sq ft); do not seed with tall fescue or fine fescue.

Bermudagrass (*Cynodon dactylon*)

Bermudagrass occurs naturally in many Kentucky lawns and is most often considered a weed. Native bermudagrass, often called “wiregrass,” is usually found or planted in hot, dry locations where it is difficult to grow cool-season grasses.

Cultivars should be selected that are adapted to Kentucky winters. The top performing cultivars in Kentucky are listed at www.uky.edu/ag/ukturf/bg.html. However, to determine how a cultivar sold at your local store/sod farm will perform in Kentucky, visit www.ntep.org and visit current and previous data.

All bermudagrass cultivars must be planted in late May or early June.

Adaptation—Mainly adapted to full sun and well-drained soils.

Major qualities—After establishment, bermudagrass is tolerant to low fertility and drought and makes a resilient, traffic-tolerant turf.

Major problems—Difficult to mow (requires sharp mower); not shade tolerant; is dormant (brown) from late September to early May; winterkill can be a concern during especially cold winters; because of

its creeping habit of growth, bermudagrass often becomes a serious pest in gardens and flower beds and will rapidly creep into a neighbor's lawn.

Planting rate—Plug on 1-ft centers, sprig in 6-inch rows 1 ft apart, or (for large areas) broadcast 2-7 bushels of shredded sprigs over 1,000 sq ft and cover by light disking or soil topdressing.

Seeding rate—(Seeded varieties), 1 lb/1,000 sq ft for non-coated seed or 2 lb/1000 sq ft for coated seed.

Zoysiagrass (*Zoysia japonica*)

This is an excellent summer grass for areas with full sunshine or moderate shade and heavy summer traffic.

Zoysiagrasses in general are known for having better cold tolerance than bermudagrasses. Several cultivars are available that are adapted to the transition zone climate. Visit www.uky.edu/ag/ukturf/zg.html for the top performing cultivars for Kentucky.

Adaptation—Zoysiagrass has moderate shade tolerance so may be used in sun/shade situations. It has excellent winter hardiness and will grow throughout Kentucky.

Major qualities—After establishment, zoysiagrass is extremely tolerant to low fertility and drought and makes a very resilient, traffic-tolerant turf; it is very competitive against weeds and has few pest problems; will grow very slowly so will not require frequent mowing; spreads slowly so not as invasive as other creeping grasses.

Major problems—Dormant (brown) from October to early May; can become thatchy, especially if over fertilized.

Soil Preparation

Proper soil preparation is critical to the establishment and long-term quality of a lawn. Soil conditions are very poor on many lawn sites because the lawn was the last consideration instead of the first. The following factors should be strongly considered when starting a new lawn.

Grading

Ideally before a new lawn is established, the topsoil should be stockpiled to the corner of the lot prior to house construction. After the house is finished, all building debris should be removed from the lawn area. This is a step that most contractors skip and simply push the topsoil over the construction debris. If you are building a house, insist that the site is thoroughly cleaned prior to moving topsoil. The subgrade should be sloped away from the house in order to reduce the possibility of water entering the basement. After the subgrade has been completed, the stockpiled topsoil can be respread. With 4-6 inches of good topsoil, establishment and maintenance of your lawn can be a pleasure rather than a nightmare. Oftentimes contractors will remove some of the topsoil from the yard and leave you with 0.5-1 inch of topsoil, which results in many challenges in growing lawns and landscape plants.

Soil Amendments

It is hard to purchase good topsoil. Frequently, the homeowner ends up getting soil much poorer than what is already there, and often it is seriously infested with weed seed.

Adding large quantities of organic matter is the best way to improve a poor soil. Peat moss; well-decomposed sawdust; well-rotted, weed-free manure; sewage sludge; or compost will improve soil that is either too sandy or contains too much clay. Use 2-3 cubic yards of organic matter for each 1,000 sq ft of lawn area. The organic matter should be spread evenly over the surface and thoroughly mixed into the upper 4-6 inches of soil before seeding.

Lime and Fertilizer

The soil should be tested to determine exact lime and fertilizer needs. Your local office of the Cooperative Extension Service can provide soil cartons and the information you will need for performing soil tests. The soil should be taken from the completed grade, rather than the subgrade. Soil tests are very inexpensive and can be conducted at any time of the year. Many

Turfgrass Terminology

Annual, summer—Plant that completes its life cycle, from seed, in one growing season.

Annual, winter—Plant that initiates growth in the fall, lives over winter, and dies after producing seed the following spring or summer.

Blend—A combination of two or more cultivars of a single turfgrass species.

Bunch-type growth—Plant development by tillering at or near the soil surface; no lateral stems produced.

Clippings—Leaves cut off turfgrass by mowing.

Cool-season turfgrass—Turfgrass species best adapted for growth during cool portions (60°–75°F) of the growing season. Examples: Kentucky bluegrass, tall fescue, fine fescue, perennial ryegrass.

Coring—A method of turf cultivation by which soil cores are removed using hollow tines or spoons.

Cultivation—Disturbance of the soil without destruction of the turf. Examples: coring, spiking, aeration.

Cutting height—On a mower, the distance between the soil surface and the plane of cut.

Dethatch—To remove an excessive thatch accumulation, usually by a mechanical practice such as vertical mowing.

Foliar burn—Injury to leaf tissue caused by dehydration due to contact with high concentrations of certain fertilizer salts or chemicals.

Herbicide—A pesticide used for controlling weeds.

Irrigation—Application of water to turf by

either hand-set sprinklers or by automatic means using electronic controllers.

Localized dry spot—A dry spot of sod that resists rewetting by normal rainfall or irrigation. Usually associated with an accumulation of thatch, a high spot, shallow soil over buried debris or rock, or major fungal activity that renders the soil hydrophobic.

Mixture—A combination of two or more species.

Mowing frequency—The number of times the lawn is mowed per week or month.

Mowing height—The distance above the ground surface at which the turfgrass is cut during mowing.

pH (soil)—A numerical measure of the acidity of the soil. A pH of 7 is neutral, above 7 is alkaline (basic), and below 7 is acidic.

Reel mower—A mower that cuts turf by means of a rotating reel of blades that passes across a bed knife fixed to the mower frame, thus giving a shearing type of cut.

Renovation—Turf improvement involving replanting into existing live and/or dead vegetation.

Resiliency—The capacity of the turf to spring back when balls, shoes, or other objects strike the surface, thus providing a cushioning effect.

Rhizome—An underground elongated stem with new plants springing from nodes along the stem.

Rotary mower—A mower that cuts turf by high-speed impact of a sharp blade rotating in a cutting plane that is parallel to the turf surface.

Scalp—To remove an excessive quantity of functioning green leaves at any one

mowing, resulting in a brown appearance with exposed crowns, lateral stems, and dead leaves.

Scum—A layer of algae on the soil surface of thinned turf.

Slowly available fertilizer—Designates a rate of dissolution of nitrogen that is less than that obtained from completely water-soluble (readily available) fertilizers.

Sod—Plugs, squares, or strips of turfgrass with adhering soil; can be used in vegetative planting.

Sprig—A stolon, rhizome, or tiller used to establish new turf or plants in furrows or small holes.

Stolon—An elongated stem that grows along the surface of the ground and from which leaves and roots develop at the nodes.

Thatch—A layer of undecomposed or partially decomposed turfgrass roots and stems situated above the soil surface and constituting the upper stratum of the medium that supports turfgrass growth.

Tiller—A lateral shoot, usually erect, that develops intravaginally from axillary buds.

Turf—A covering of mowed vegetation, usually a turfgrass, growing intimately with an upper-soil stratum of intermingled roots and stems.

Turfgrass—A species or cultivar of grass that is maintained as a mowed turf.

Verdure—The layer of aboveground, green, living plant tissue remaining after mowing.

Warm-season turfgrass—Turfgrass species adapted to favorable growth during warm portions (80°–95°F) of the growing season. Examples: zoysiagrass, bermudagrass.

soils throughout Kentucky do not require additional phosphorus or potassium. Because applying fertilizers to soils that do not require them can be serious pollutants, no fertilizers or lime other than nitrogen should be applied without taking a soil test. Refrain from applying nitrogen until seeds have germinated and roots are able to remove nutrients from the soil. Nitrogen applied at seeding will have a higher

tendency to leach through the soil or runoff with rain with no plants to remove nutrients or slow water movement on the soil surface.

Planting

Before Planting

A newly graded lawn area should be allowed to settle before planting. Two or three good rains or irrigations will aid in the settling. Puddles

of water that form during a rain or irrigation indicate low spots that need to be leveled or have drainage installed. Excessive water on the lawn is as bad or worse as not enough water. Good surface drainage is a must!

The final seedbed should be firm and free of large clods, rocks, and discarded building materials.

When to Establish

There are only certain periods each year when temperature, moisture, and weed competition favor successful seeding of lawns.

The best time to seed cool-season grasses such as Kentucky bluegrass or tall fescue is from mid-August to mid-September and not later than the end of September. The second-best time is from mid-February to mid-March and not later than mid-April. Due to weed competition and moisture stress, late spring to midsummer seedings are seldom successful.

Sod of Kentucky bluegrass and tall fescue can be installed almost anytime except midwinter when soil is frozen. During extremely hot and dry summers, however, sodding should be delayed, or the soil should be watered to cool it just prior to installation.

Vegetative strains of bermudagrass and zoysiagrass are normally sprigged or plugged and should be established during May or June after the soil is warm. Seeded bermudagrass should be planted at the same time so the turf can be well established before a potentially bad winter.

Seed, Sod, or Vegetative Planting

Kentucky bluegrass and tall fescue lawns can be seeded or sodded, while improved strains of bermudagrass or zoysiagrass are most usually planted from existing vegetative material. Soil preparation is the same, regardless of the planting method used.

Seeding is usually accomplished with a rotary seeder or the commonly used seed and fertilizer spreader. For uniform distribution, the seed should be divided into two equal lots, which should be seeded

at right angles to each other. It is imperative that the seed is lightly covered by soil (referred to as seed-soil contact) for good germination. Cover the seed by raking lightly or rolling, and avoid a smooth surface. It is best to mulch the area with clean straw or other suitable material. Mulch will help keep moisture at the soil surface and minimize soil movement (erosion) before the grass can hold it in place. The mulch covering should be thin enough to expose approximately 50 percent of the soil surface, which usually requires approximately one bale of straw/1,000 sq ft of area. It is important to water frequently in order to keep the soil surface moist until seedlings become established, especially if a mulch is not used.

Before ordering or obtaining sod, be sure you are prepared for its installation. It is generally best to establish a straight line lengthwise through the lawn area. The sod can then be laid on either side of the line with the ends staggered, as when laying bricks.

The better the sod quality, the easier it is to transport and install it. Quality sod is light, does not easily tear apart, and generates a root system quickly. Sod is perishable and should not remain on the pallet or stack longer than 36 hours. The presence of mildew and distinct yellowing of the leaves is usually good evidence of reduced vigor.

Installing sod is an art. A sharpened concrete trowel is very handy for cutting pieces, forcing the sod pieces tightly together, and leveling small depressions. Just as seed-soil contact was important above, sod-soil contact is also important. Immediately after the sod is laid, it should be rolled and kept moist until the sod is well-rooted into the underlying soil. Any air spaces

between the sod and soil will cause those areas to dry out and rooting will be impaired.

Vegetative planting, using either sprigs or plugs, is the common method used in establishing high-quality bermudagrass and zoysiagrass. Once again, plant material-soil contact is critical for success. Sprigs can be either broadcast over an area and covered lightly with soil or can be individually planted on 6- to 12-inch centers. In either case, the individual sprig should have one end about 2 inches below the soil surface and the other end above the soil surface so that a node or joint with some leaves extends aboveground. Sprigs can be purchased by the bushel or can be purchased as sod and then shredded. One bushel of sprigs is approximately equivalent to 1 square yard of sod. Plugs of zoysiagrass are commonly available and are 1-2 inches in diameter and 1-2 inches deep. The plugs should be fit tightly into prepared holes and tamped firmly into place. Sprigs and plugs should be kept moist until they are well established. Vegetatively planted bermudagrass can be fully grown in within 1-2 months while zoysiagrass may take a year or longer depending on planting density, environmental conditions, and cultivar.

Caring for New Lawns

Moisture is probably the most important consideration immediately after planting. Regardless of the method used for planting, the soil must be kept moist for two to three weeks.

Mowing should not be delayed just because the lawn is new. After the turf begins to grow, mow to recommended heights.

Lawn Renovation

Preparing a Seedbed

Little success can be expected if you just broadcast seed on the soil surface. In order for seed to germinate and survive, it must have good soil contact. Sometimes a heavy raking will loosen the soil surface sufficiently, but most often the surface is hard, and weeds or dead grass make raking difficult.

A vertical mower or dethatching machine can often be rented from a local lawn supplier or equipment-rental agency. Not only will vertical mowing or dethatching loosen the dead grass and weeds, it will leave shallow grooves or slits in the soil surface. Seeds falling into these slits are much more likely to germinate and live. For best results, it may be necessary to traverse the area several times in different directions in order to disturb the soil sufficiently.

Most commercial lawn companies and some rental agencies have power seeders. These machines vertical mow/dethatch and distribute the seed in a single pass, however, it is still desirable to seed in multiple directions to avoid missing any areas.

Selecting the Right Grass

Assuming that the lawn is established on an adapted grass, it is usually more desirable to seed the same species as the existing grass in order to maintain uniform appearance. Do not seed coarsely textured grasses like KY 31 tall fescue into a Kentucky bluegrass lawn. Turf-type tall fescue is the preferred renovation grass as it has a similar texture to Kentucky bluegrass. Kentucky bluegrass is very difficult to establish within an existing lawn—the seed are very small and seedling vigor is low.

Success is best achieved when:

- Existing grass and/or weeds are almost entirely killed by insects, disease, drought, or non-selective herbicides.
- The majority of existing grass/weeds can be completely removed with a dethatching machine.
- Renovation can be accomplished in early fall or early spring.

- The surface can be kept moist for about two weeks with irrigation.

Sowing the Seed

The seed should be evenly spread over the area at the rate of 2 lb/1,000 sq ft for Kentucky bluegrass, 6 lb/1,000 sq ft for tall fescue, or 2-4 lb/1,000 sq ft for perennial ryegrass or red fescue. Rake the seed lightly into the seedbed or traverse the area again with the dethatching machine for good seed-soil contact.

If using a power seeder, seed only about 1 lb/1,000 sq ft per pass and make multiple passes if possible. If only making one or two passes, you can broadcast 3-4 lbs/1,000 sq ft before making the last pass.

Remember, chances of success are good if you seed during late August and September, fair during late February or early March, and very poor from mid-spring to August.

Proper Care

Newly-seeded areas should be watered immediately after seeding. Watering should continue as long as necessary to obtain satisfactory germination and growth. The surface should be kept consistently moist without forming puddles. Begin mowing as soon as some of the grass grows higher than the desired mowing height. Keep the mower blade sharp as a dull blade can rip young plants out of the soil.

If the area is seeded in spring and crabgrass is a potential problem, apply a pre-emergent crabgrass herbicide immediately after seeding. Siduron (Tupersan) or mesotrione (Tenacity) are the only pre-emergent herbicides that can be used. A second application should be applied in late spring or early summer. Follow the specific label directions.

Caution: Germination of desirable grasses may be decreased if broadleaf weed killers such as 2,4-D have been applied one to two weeks before seeding. These herbicides should not be applied to young seedlings. Before applying these herbicides, wait until the new grass has grown enough to be mowed at least twice.

Table 2. Optimum mowing height for some grass species.

Species	Height (in)
Kentucky Bluegrass	2 - 3
Tall Fescue	2.5 - 4
Creeping Red Fescue	2 - 3
Perennial Ryegrass	1 - 2
Bermudagrass	1 - 1.5
Zoysiagrass	.75 - 1

Lawn Maintenance

The intensity of turf maintenance varies with the homeowner's inclination, expertise, available working hours, and budget. It also varies greatly depending upon your soil and the grass species in place. There are certain maintenance practices, however, which are necessary for quality turf.

Mowing

Some of the most serious mistakes are mowing lawns too closely, too infrequently, or using a dull mower blade.

Below-optimum mowing heights restrict root development, and the grasses become susceptible to disease, heat and drought damage, traffic injury, and weed infestation. Check the blade height and follow the guide in Table 2.

Mowing is somewhat injurious to grass because it removes a portion of the youngest, most active leaves. Unless the tiller is beginning to flower, which usually occurs

in late spring, the growing point of each stem is located near the soil surface and protected from the mower blade. Therefore the grass plant is just a series of leaves that we often call a *pseudostem*. The true upright growing stem does not develop until the flowering process begins (Figure 2).

The general rule is to mow often enough so that no more than one-third to one-half of the leaf is removed at any one mowing. If the grass grows too tall between mowings, increase the mowing height—do not cut it all off at one time. Removing half or more of the leaf blade in any one mowing results in a negative impact on the root system. Remember, the lower you mow, the more frequently you *need* to mow.

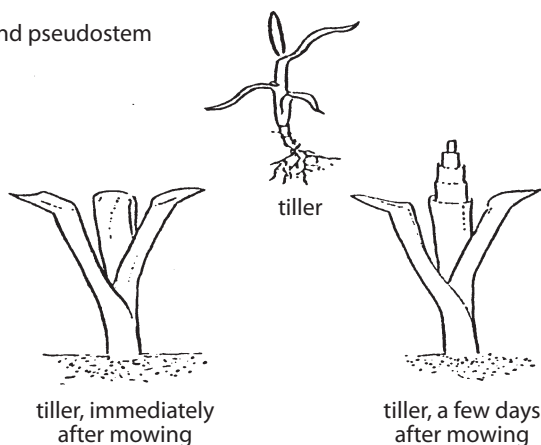
A sharp mower blade makes mowing easier and results in a better looking and healthier turf. Dull blades result in a longer healing time for the leaf which can result in increased disease pressure. Further, dull blades require more power to cut through the leaf resulting in increased fuel usage. Reel-type mowers are preferable, but a sharp rotary mower also gives a clean cut and is easier to maintain. You may need to sharpen the mower two to three times a year.

Removal of Clippings and Thatch

Unfortunately, most people still believe clippings increase thatch, which is the tightly intermingled layer of organic matter that sometimes accumulates between the soil surface and the green leaves. Research has shown, however, that thatch is caused by species (grasses that produce rhizomes and stolons have greater thatch), too much nitrogen fertilization, acidic surface soil, frequent irrigation, and a low population of earthworms.

Clippings have no effect upon thatch accumulation. They contain 75 percent to 85 percent water and are easily decomposed into humus. Research has shown that thatch is made up of about 60 percent dead and living roots and rhizomes, with the remaining 40 percent composed of dead stems, leaf sheaths, and crown tissue—all highly ligneous (woody) and slow to decompose.

Figure 2. Grass tiller and pseudostem after mowing.



When clippings are not removed, they occur only in the upper surface layers as “pseudo” thatch. This pseudo thatch can be raked out of the turf, but raking it out won’t reduce a problem with real thatch, which cannot be removed with a rake because it is tightly interwoven by a mass of roots. Real thatch can be removed only partially with mechanical dethatchers.

Thatch is currently not a problem in most cool-season grass lawns. It never accumulates in tall fescue, moderately fertilized lawns, or in lawns with a healthy earthworm population.

Many people also remove clippings to reduce disease problems. Removing any biomass does help slow down a fungus, but Kentucky lawns seldom have a serious disease problem. When they do, the disease almost always occurs during the hot summer when the turf is growing slowly and producing few clippings.

Some people remove clippings to prevent windrowing or globs of wet clippings left on the lawn’s surface. Mow more frequently to avert this problem. As mentioned previously, mowing should be repeated when the leaves have grown about 30 percent to 50 percent above the previous mowing height. If you are mowing at a 2-inch height, mow again when the turf reaches a height of about 3 inches. If it rains for a week and the height reaches 5 inches, raise the mower to 3 inches for the next mowing. After a couple days, lower the height back to the original 2 inches and mow again. Don’t take off all the leaves at once because it increases the amount of clippings that shade the remaining grass, often causes the mower to pile up or windrow the clippings, weakens the grass by removing its photosynthetically active leaves, and looks unsightly.

You need to mow frequently during April and May, when almost 50 percent of the total annual growth occurs.

Some cheaper mowers do a poor job of distributing clippings even when conditions are great. However, all mowers work best when the grass leaves are dry, the grass has grown no more than 50 percent higher than the previous mowing height, and mower blades are sharp. A common complaint against returning clippings is that the homeowner does not like the look of the clippings on the lawn. However, if the lawn is mowed properly and leaf clippings are short, they don’t look unsightly because they filter down between the remaining grass leaves and quickly decompose.

Some mowers are advertised as mulching mowers that cut or shred the leaves into smaller fragments. These mowers work as advertised, however, to prevent clogging of the mower, the turf must be dry and mowed often.

Another reason for removing clippings is to remove the mess—clippings being tracked into the home and scattered onto the sidewalk or driveway and creating a slightly neater appearance on the surface of dense turf. But is removing clippings worth the problems it creates? No!

Finally, not removing clippings helps the environment. It’s not necessary to use landfills to dispose of vegetative material that will decompose into something as useful and safe as humus.

So what can we do with grass clippings? That’s easy! Don’t collect them in the first place. Clippings add fertilizer back to the lawn, maybe as much as 25 percent of the lawn’s annual needs. One thousand square feet of a well-fertilized lawn can produce as much as 400 lb (dry weight) of clippings per year. These clippings average about 4.8 percent

N, 0.7 percent phosphorous, 2.6 percent potassium and also have minute quantities of many minor nutrients—good stuff.

If you must collect clippings, use them yourself. First, consider spreading them lightly over a low-maintenance turf area, vacant lot, etc. Scatter them; don’t dump them into a pile.

Second, consider using them as a mulch around ornamentals or between rows in the garden to reduce weed competition, conserve soil moisture, and supply nutrients as the clippings break down. Apply them at least an inch thick and turn them under in the fall to improve soil tilth and supply additional nutrients.

Third, consider composting the clippings and using the compost to modify soil in the garden or in plant pots. Grass clippings alone are sometimes difficult to compost since they become very dense and anaerobic, often causing an odor problem. It is best to compost a mixture of clippings, tree leaves, wood chips, garden weeds, etc. You can often hasten composting by keeping the pile moist and by occasionally adding some soil, nitrogen fertilizer, and lime.

When using clippings as a mulch or compost, be aware that such compost may contain weed seed such as crabgrass. Also, make sure that the lawn has not been sprayed with a herbicide within a few days of mowing, because residues from certain broadleaf weed herbicides may cause damage to the mulched plants.

Finally, because clippings are full of nutrients, it is important to sweep or blow them off sidewalks and back onto the lawn. Clippings that are washed into the storm system act just like fertilizer and can cause algal blooms in ponds and lakes.

Table 3. Schedule for nitrogen application to lawns.

Maintenance Level	Applications per Year	Cool-Season Grasses ¹ (Kentucky Bluegrass and Fescue)	Warm-Season Grasses (Bermudagrass Zoysiagrass ²)
Low	1	Oct-Nov	Jun
Medium	2	Sept-Oct, Nov-Dec	May, Jul
High	3	Sept-Oct, Oct-Nov, Nov-Dec	Apr, Jun, Aug
Very High	4	Sept-Oct, Oct-Nov, Nov-Dec, late May-early June (1/2 rate)	Apr, May, Jun, Aug

¹ Red fescue and all cool-season grasses grown in shady lawns should be fertilized only once per year.

² Zoysiagrass needs only minimal nitrogen after lawn is fully established.

Fertilization

In order to maintain a quality lawn, nitrogen fertilizer must be applied annually to help maintain turf uniformity, a good green color, and reduce weed problems. However, if fertilizer is applied improperly or at the wrong times, you can lose these benefits.

Soil Test

Randomly collect one to two pints of soil from the top few inches of the lawn and take it to the local extension office. The University of Kentucky Soils Testing Lab can determine if phosphorus (P), potassium (K), or lime are needed. The recommended rates of nutrients can be applied by a fertilizer containing only P (for example, triple superphosphate 0-46-0 or K (for example, muriate of potash 0-0-60) or by using a complete fertilizer such as 10-10-10, 17-17-17, 10-20-10, etc. Once you get a high level of P and K in the soil, little additional P or K may be needed for several years. As was mentioned above, many soils throughout KY do not require P or K due to parent material or many years of fertilizing with these products. Additional applications of these nutrients to soils with adequate levels is a waste of your money and can have a negative impact on the environment.

Timing

Fall is the best time of year to apply nitrogen to cool-season grasses such as Kentucky bluegrass and tall fescue (Table 3). In response to fall nitrogen, the turf develops a better root system, becomes very dense, and has much better color in late fall and early spring. By eliminating or minimizing spring fertilization, you prevent the heavy flush of growth that occurs with it, develop a better root system, and develop a more heat-tolerant, weed-free turf.

If for some reason nitrogen was not applied the previous fall, an application during early spring will improve green-up. Even if fall nitrogen was applied, it is helpful in some years with heavy spring rainfall to apply a half-rate of nitrogen in late May or early June, but only if necessary to improve color. Crabgrass and other summer annual weeds respond to the nitrogen much more than bluegrass or fescue. The more you fertilize cool-season grasses with nitrogen in spring and summer, the more you need to irrigate, control thatch, and use chemicals to control weeds, insects, and diseases. A lush, green lawn may not be worth these problems.

Late spring to early summer is the best time to fertilize bermudagrass and zoysiagrass, since they are warm-season grasses and perform best during hot summer months.

Table 4. Examples of fertilizers and rates needed for 1 lb of actual nitrogen per 1,000 sq ft.

Fertilizers	Rate (lb)
Farm	
Ammonium Nitrate (34-0-0)	3
Urea (46-0-0)	2.2
10-10-10	10
5-10-10	20
Specialty	
24-4-4	4.5
16-6-8	6
27-4-9	3.5
20-5-10	5
32-4-8	3

Note: Rates apply 1 lb N per 1,000 sq ft of lawn.

How Much Nitrogen to Apply

A good rule is to apply about 1 pound of actual nitrogen per per 1,000 sq ft per application. Most home lawns will perform well with only 2 lbs of actual nitrogen per year. Additional nitrogen may be warranted for lawns that have a lot of traffic from kids or pets or are heavily irrigated. Lawns receiving more than 2 lbs of actual nitrogen per year will often require additional mowing and pest control. The fertilizer analysis tag indicates actual nutrients and the first number (as in 10-6-4) indicates the percent N, so you can easily calculate the pounds of actual nutrient in a bag. For example, a 50-lb bag of 10-6-4 contains 5 pounds ($50 \times 0.10 = 5$) of actual nitrogen. It also contains 3 lb ($50 \times 0.06 = 3$) of P₂O₅ and 2 lb ($50 \times 0.05 = 2$) of K₂O. The remainder of material in the bag ($50 - (5 + 3 + 2) = 40$), i.e., 40 pounds, is called the filler or carrier. To apply 1 lb N/1,000 sq ft you would need to apply 10 pounds ($10 \times 0.10 = 1$) of the 10-6-4 fertilizer.

Table 4 shows both farm fertilizers and hypothetical fertilizers representative of many specialty

fertilizers with high nitrogen and low phosphate levels.

Farm Versus Specialty Fertilizers

Lawns can be fertilized either with the specialty fertilizers, which are often sold in garden centers, or with farm fertilizers. The main advantages to the specialty fertilizers are their normally good nutrient ratios, uniformity in particle size, low burn potential, and the printing of calibration and application rate information on the bag.

Farm fertilizers are usually three to five times less expensive, but they have some disadvantages. Farm fertilizers such as ammonium nitrate and 10-10-10 must be used with caution because of their burn potential. You should not apply them during extremely hot weather or when moisture is on the grass leaves. However, if they are applied in the fall and early winter as suggested and at the proper rate, they will seldom, if ever, burn a turf. The biggest problem with these fertilizers is the lack of calibration and application information on the bag. You have to calculate the correct amount to apply and calibrate the spreader to get the appropriate coverage.

Depending on the type of spreader used, it is sometimes difficult to get only 2.2 or 3 pounds of fertilizer evenly spread in a 1,000 sq-ft area. Without experience it often appears that too little fertilizer is being applied, and the temptation is to apply more. *Be Careful!* Applying more than 1½ to two times the recommended rates will greatly increase the burn potential and cause an excessive flush of growth. Applying 10 lb/1,000 sq ft, such as with 10-10-10, is easier to detect in the grass. However, the burn that results when applying more than 15 lb/1,000 sq ft is even more serious with these mixed fertilizers because of the potassium salts that are included.

Most of the specialty fertilizers also contain a certain amount of slow-release nitrogen, which is indicated on the bag under the heading “water-insoluble nitrogen” or “coated nitrogen.” Usually the amount of this slow-release nitrogen is less than one-third of the total amount of nitrogen in the bag. Slow-release nitrogen adds safety in

application, but the small amount of it that’s included doesn’t really provide good long-term nitrogen availability.

Most of the specialty fertilizers can be programmed exactly the same as you would program a farm fertilizer.

If you do not remove clippings, most specialty fertilizers contain sufficient P and K to maintain the soil level. Therefore, once you correct any soil deficiency, continual use of specialty fertilizers will be sufficient for P and K for many years.

Spreader Calibration

Spreader calibration becomes necessary if you use a fertilizer brand that does not have calibration information or if the bag information does not include your spreader model. Since the density and granule size of fertilizers are quite variable, it sometimes becomes necessary to recalibrate the spreader for almost every application.

When using a drop-type push spreader, begin by guessing at a spreader setting, then apply a known amount (such as 5 lb) to a test area and determine the square footage covered (length x width)

or

apply the fertilizer over a plastic sheet or sidewalk area of known square footage and collect and weigh the fertilizer deposited.

After calculating the rate applied per 1,000 sq ft, if the first guess was right, treat the lawn at that setting. If not, readjust the spreader and follow the same procedure until the correct calibration is achieved.

Calibrating to a half-rate setting and going over the yard twice will ensure a more uniform coverage and color.

It is somewhat easier to calibrate a rotary-type push spreader or a hand-crank (shoulder strap) rotary spreader than a drop-type spreader, since the width of coverage with those spreaders is much greater (10-25 ft). Measure a test area of lawn (for example, a side yard that equals 2,000 sq ft). Put the correct amount of fertilizer (for the 2,000 sq ft) into the spreader with the opening adjusted to be just slightly larger than the size of the individual granule. If more than two or three passes are required to dispense the fertilizer, then select another

known area (for example, the backyard). Increase the size of the opening and continue to refine the calibration until the total amount needed is spread in a couple of passes through the yard.

Calibration is not easy and usually requires more time than the application itself. Because of wear and rust, spreader openings often change in relative size. Whether the calibration information from the bag or your actual calibration is used, always recheck to see if the approximate amount of fertilizer is actually used.

After completing the fertilizer application, immediately clean the spreader. Because of its high salt content and ability to absorb moisture, fertilizer left in a spreader will cause immediate rusting. Also, do not let the wash water from the spreader run onto the lawn. It may cause uneven growth or excessive burning.

Liming

A soil pH test is required to determine the extent of soil acidity. The pH test should be run every two or three years, especially if the lawn is under high maintenance. Natural weathering of soils and the addition of acid-forming fertilizer can lower the pH sufficiently to reduce the growth and quality of most grasses, especially Kentucky bluegrass. However, due to limestone parent material in many KY soils, our soils are naturally high in pH and may improve with some acidification. Liming without the need to lime can tie up nutrients in the soil and weaken the overall health of the lawn.

The limestone normally purchased at rock quarries is cheap but very coarse and is difficult to apply in lawn spreaders. It is probably most easily applied by shovel from the back of a pickup truck. Often as much as 100-300 lb. will be required per 1,000 sq. ft.

Agricultural limestone is recommended if the soil is acid. Finely ground agricultural limestone is often sold through garden centers in 50-lb. bags as agricultural lime or dolomitic limestone. Like rock quarry limestone, it is also difficult to get through lawn spreaders in sufficient quantities and

is very dusty. The dolomitic limestone is also usually slightly more expensive because it contains some magnesium carbonate as well as calcium carbonate (ag lime). Since our Kentucky soils contain sufficient quantities of magnesium, the dolomitic limestone is not needed.

A bagged, pelleted-lime product is available in many lawn and garden stores. This product flows freely through lawn spreaders and is not extremely dusty. It is, however, more expensive than agricultural lime and must be used at equivalent rates.

Hydrated and burned lime can often be purchased. Although somewhat lesser quantities than other limestone types are needed to reduce the acidity, some burn problems may occur. Gypsum (calcium sulfate) is often sold as a substitute for lime or as a soil conditioner to loosen a heavy clay soil. It is not effective in changing pH or improving the structure of Kentucky soils.

Core Aerification

Core aerification is a mechanical cultivation process in which cores of soil, about $\frac{3}{4}$ inch by 3 inches, are removed from the soil surface with an aerifier and then scattered back on the soil surface. On heavily trafficked golf greens and athletic fields, core aerification is extremely beneficial in reducing compaction and organic accumulation on the surface as well as smoothing the surface. Core aerification may be somewhat beneficial for home lawns to penetrate surface organic matter that sometimes becomes hydrophobic and to provide some leveling as the soil cores are distributed back into surface depressions. On the other hand, core aerification is not as beneficial for lawns as it is for sport turf surfaces because of the following:

- Surface compaction, which is caused by heavy traffic, is not usually a problem on lawns.
- Clay, the dominant soil texture on most urban lawns, is difficult to penetrate with the aerifier, and clay soil cores are hard to extract from the coring tines.
- It is difficult to influence the surface significantly. To achieve best results,

cores need to be made on 2 x 2-inch or 3 x 3-inch centers, which is hard to achieve with aerifiers available on the consumer market.

- Coring just before broadcasting seed is often suggested as a method for renovating lawns. This is not effective, however, unless the grass/weed cover is very thin and the extracted soil can be considered as topdressing for the seed. If the aerifier only extracts cores on 6 x 6- or 8 x 8-inch centers, then effectiveness will be nil.

Watering

Water a lawn only during excessively dry periods once it is established. *Frequent, shallow watering should always be avoided.* It causes shallow rooting and encourages crabgrass invasion and diseases.

Water thoroughly when you do water. The soil should be wet to about 4 inches deep, which usually requires ½ to 1 inch of rainfall or irrigation. You can check with a probe or knife to see the depth of moisture.

Early morning is the best time of the day to water, but unless a serious disease problem exists, evening watering causes few, if any, problems. Lawns can also be watered at midday, but you can expect increased evaporation loss.

Remember that localized dry spots, which frequently appear during the summer months, are often misdiagnosed as insect or disease problems.

To differentiate localized dry spots from disease or insect patches of dying grass, always probe the soil first, using a screwdriver, soil probe, shovel, etc. If the top 1 to 2 inches is bone dry—powder dry—the problem is likely localized dry spot. Correcting it with a pesticide is impossible.

Pest Control

Pests can include weeds, insects, disease, and animals such as moles.

We misdiagnose disease and insect problems all too frequently. When you see dying patches of grass during the summer, always check the soil before treating with a pesticide.

Weeds

An adapted turf species that is properly established, mowed, and fertilized will have few weed problems, but all weeds won't be eliminated.

Keep in mind that a plant becomes a weed when it grows where it is not wanted. That means plants that are considered desirable in some crops or waste areas can become serious lawn weeds. For example, many people believe that clover is desirable in turf because it fixes nitrogen so that the turf seldom needs fertilization. Others strongly object to its white flowers because they disrupt a lawn's uniformity and attract bees that may sting bare feet. Also clover often leaves a stain on clothing that is difficult to remove. Another example of this paradox is tall fescue. Although tall fescue is the best adapted lawn grass in Kentucky, many consider it objectionable in Kentucky bluegrass lawns because of its coarseness and clumping growth habit. Kentucky bluegrass can also creep into landscape beds and become a weed.

Broadleaf weeds—Chemical herbicides are used to control weeds. Some can be applied to control a specific weed but not damage the desirable grass. With other herbicides, all green vegetation to which the herbicide is applied will die. Sometimes these herbicides are persistent in the soil and further reseeding of desirable grasses cannot be accomplished for months or even years after the herbicide application. Some herbicides must be applied before weeds germinate (pre-emergence), and others must be applied after weed emergence (post-emergence). Knowing the nature of the herbicide is a must. The herbicide label describes the weeds controlled, the desirable grasses on which it is safe to apply it, and certain safety precautions. *Always read the label.*

Broadleaf weeds are generally characterized by netted veins in their leaves. Examples are dandelion, plantain, chickweed, ground ivy, henbit, white clover, spurge, and knotweed. Such weeds are most often controlled selectively after they germinate. These postemergence herbicides are absorbed into the leaf. They then move

through the plant and kill the roots, underground stems, and the aboveground plant. Such systemic herbicides are 2,4-D, MCPP, and dicamba. Many products contain a mixture of two or three of these chemicals in order to get a broad range of control. For example, 2,4-D is an excellent dandelion killer, and dicamba is best for white clover. A mixture of the two will give maximum control of both species and many others.

Combination products containing 2,4-D, MCPP, and dicamba will kill almost all broadleaf weeds that grow in lawns. An exception is wild violet, which must be sprayed at least two times with triclopyr, a common brush killer, or mesotrione.

These chemicals are most safely applied in spring or fall, when the weeds are actively growing. Hot summer applications may injure desirable grasses, and if the soil is dry, the weeds probably won't be controlled. These products can be purchased as a spray or granular material. Generally products applied as a liquid are most effective. If a granular chemical is used, the foliage should be moist with dew before application to ensure that the granules stick to the leaf.

If these materials contact the leaf or are applied above the root zone, they may injure ornamentals. *Read all cautions on the label.*

Grassy weeds—Grassy weeds are characterized by parallel leaf veins. They are not often affected by the broadleaf herbicides described above.

Annual grassy weeds, such as crabgrass and foxtail, are best controlled with pre-emergence herbicides that are applied before the weeds germinate. These herbicides should be applied before April 1 in western Kentucky and before mid-April in central and eastern Kentucky. Examples are Pendimethalin (Pre-M), benefin + trifluralin (Team), prodiamine (Barricade), and dithiopyr (Dimension). Mesotrione (Tenacity) and siduron (Tupersan) are the only commercially available preemergence crabgrass herbicides that can be applied in the spring at the same time that desirable grasses are seeded. Other preemergent herbicides, if used, would prevent germination of the desirable grasses as well.

Post-emergence crabgrass herbicides include fenoxaprop (Acclaim Extra), quinclorac (Drive XLR8), mesotrione (Tenacity), and topramezone (Pylex). These products should be applied while crabgrass is small and easier to control. Mature weeds typically require several applications to control.

Perennial grassy weeds such as tall fescue clumps, nimblewill, and bermudagrass are more difficult to control without also killing desirable turf. A herbicide such as glyphosate (Roundup) will kill almost all grasses and weeds that are green when sprayed. Treated areas must be reseeded or sodded with desirable grasses. Nimblewill is best controlled with mesotrione (Tenacity), and bermudagrass with topramezone (Pylex). *Always read the label* for proper herbicide selection and use. Almost all grassy weeds require multiple applications for complete control.

Insects

Only a few of the insects that are present in a lawn actually cause damage. By far the most common damaging insect in Kentucky lawns is the white grub. Other insects such as the sod webworm, bluegrass billbug, and chinchbug are potentially damaging to Kentucky lawns, but their population is seldom sufficient to cause serious problems.

Successful control of turf insects depends upon detecting their presence before they cause serious damage. This requires frequent inspections, looking for signs such as blades chewed off at ground surface; roots chewed off and sod easily dislodged; old insect casings or shells on the lawn surface; birds feeding heavily in the lawn; presence of moles or skunks causing damage; and moths or beetles flying over the surface in the late evening or early night.

Injury from heat and drought are often mistaken for insect injury. Applying insecticides will certainly not control damage caused by the localized dry spots that frequently appear in late spring or summer. Before assuming insect damage, always check to see if the underlying surface inch of soil is dry. Even though potentially damaging insects may be present, they may

not cause turf damage if the turf is properly watered.

Insecticides can kill desirable as well as undesirable insects, and if they are used improperly or overused, additional serious insect problems or thatch buildup can occur.

White grubs—White grubs are the most serious pest problem in Kentucky bluegrass lawns but seldom cause problems in tall fescue lawns. They devastate Kentucky bluegrass by feeding on the root system, which deprives the individual plants of moisture. In addition, moles, skunks, and even birds may further damage the lawn while feeding on white grubs.

Grubs are the larvae of any hard-shelled beetles. The most common of these beetles in Kentucky is the masked chafer, which is light tan and about ½-inch long. The Japanese beetle, which is increasing in Kentucky, is about ½-inch long, metallic green, and has coppery-brown wing covers. White grubs (larvae of the masked chafer and Japanese beetles) have stout, white bodies and brown heads, are ½ to ¾-inch long, and are curled into a C-shape. The beetles lay eggs a few inches below soil level, mainly in June and July. The grubs hatch in three to four weeks and begin feeding on grass roots, so almost all turf damage is done from late August through early November. When the soil temperature drops, the grubs quit feeding and move deeply into the soil for the winter. They resurface during spring and begin feeding again. Almost no turf damage occurs in spring because the turf has an extensive root system that is easily regenerated during the good spring weather. In May and June, white grubs pupate (resting stage) and emerge as adults after one year's development.

Large dead patches on your lawn, up to 20 feet in diameter, may develop in grub-infested areas. During late August through early November, homeowners should carefully look for any discolored grass. The drying sod can be rolled back like a carpet to expose the grubs. If the sod can be easily pulled back and numerous grubs are found, an insecticide such as trichlorfon can be applied immediately and watered into the

turf (enough water to wet the soil to ½ inch depth) to prevent further damage.

For lawns with a history of white grub problems, insecticides containing chlorantraniliprole, imidacloprid, clothianidin, or thiamethoxam are available for preventive applications. Those products should be applied before egg hatch, ideally between late May and mid-July, and watered into the turf.

Although moles may feed on grubs, an insecticide application won't starve or kill them, because they feed mainly on soil-inhabiting insects, mainly earthworms. Insecticides used to kill grubs should not kill earthworms, either.

Milky disease or milky spore disease, often sold to biologically control grubs, has not proven effective in Kentucky. It targets only Japanese beetle grubs and may not be effective on the targeted species.

Sod webworms—Although sod webworms are present in almost all turf, they seldom cause damage to lawns. Sod webworm adults are beige to grayish-white in color with a wingspread of about ¾ inch. These moths are frequently seen during the growing season flying over lawns at dusk. The eggs laid by the female moths hatch in about two weeks. The caterpillars are grayish to beige in color, have small dark spots on their bodies, and may reach a size of ¾-inch long. As they mature, they build silk-lined, grass-covered tubes near the soil surface. These larvae feed by chewing off grass blades near the plant crown.

Turf damaged by sod webworms will show isolated yellow-to-brown patches of grass a few inches in diameter. The infected areas will appear to be closely grazed, and small green- to-tan pellets of excrement may be located within the damaged areas. Birds feeding on these caterpillars will often leave obvious probe holes in the turf thatch.

Chinch bugs—Chinch bugs will occasionally infest a Kentucky bluegrass lawn, especially if the lawn is heavily contaminated with creeping bentgrass. Scattered patches of grass will turn yellow or brown due to the sucking of plant fluids by the young nymphs. Even when full grown, the black and white chinch bugs are only about

¼-inch long and are difficult to find. The immature nymphs are only about 1/20-inch long and may be reddish in color.

Bluegrass billbugs—In May or June, Kentucky bluegrass lawns are sometimes infested with bluegrass billbugs, a dark gray-to-black insect. Damage will occur as spotty patches of yellowing grass. The ½-inch long adult lays eggs within the stems of grass plants, and the hatched larvae feed in the stems. As they develop, the white, legless grubs leave the stems to feed externally on the plant crown, near which masses of fine, sawdust-like frass can be found.

Turf Disease

Numerous diseases occur in Kentucky lawns, but the use of fungicides to control these diseases is generally not recommended. Diseases often require multiple fungicide applications, which not only are expensive but difficult for the homeowner to apply evenly. Most diseases do not completely kill the turf, and considerable recovery can be expected during the following cool season of spring or fall. Also, the extent of these unsightly diseases can generally be minimized by proper mowing, moderate nitrogen fertilization, and infrequent irrigation. The most common disease problems are described below.

Leaf spot and melting out—Leaf spot and melting out (*helminthosporium*) is a very common disease on Kentucky bluegrass. When infected, the lawn will appear chlorotic; areas the size of a golf ball or coffee cup may be very brown in color. Upon close inspection, individual leaves will be shown to have tan spots with dark margins. Most damage occurs in spring and early summer, and complete turf recovery is usually evident by late fall.

Dollar spot—Dollar spot mainly affects Kentucky bluegrass lawns. It can be active throughout the growing season but causes most damage when soil moisture is low and dew or fog is excessive. The disease appears as small, tan spots that are from the size of a silver dollar to a coffee cup. Light brown or reddish margins on the spots will be obvious if the individual leaves are inspected closely. If disease pressure

becomes extreme, the spots can coalesce to form large brown areas. The damage is not often serious, but it can be very unsightly until the turf's growing conditions improve. A light fertilization with nitrogen and deep, *infrequent* irrigation is often needed to improve growing conditions enough to mask the damage.

Brown patch—Brown patch is most prevalent on perennial ryegrass and tall fescue lawns. It is mainly a hot weather disease (85°-95°F) but sometimes can occur in late winter to early spring when grass top growth has been allowed to accumulate and lodge. This disease is characterized by circular dead or brown turf areas that may be a few inches to several feet in diameter. The outer edges of the infected area may have a gray, smoky color, particularly in early morning. While dew or surface moisture is present, you can often detect a mass of cobwebby-looking mycelium that tends to make the leaves slimy. This disease can cause unsightliness and can thin tall fescue turf enough to increase its coarseness. Brown patch is difficult to control with fungicides, since damage can occur almost overnight. Heavy nitrogen fertilization, especially when applied in spring or early summer, encourages brown patch. Development of this pathogen can be discouraged by proper mowing (not allowing the grass to get more than one-third taller than normal mowing height before it is removed) and heavy but infrequent summer irrigation. Extremely tall mowing heights may also promote brown patch.

Summer patch—Summer patch mainly occurs on heavily fertilized, dense Kentucky bluegrass lawns. During the hot (85°-95°F) summer, scattered light green patches varying in size from 2 to 6 inches in diameter develop first along sidewalks, driveways, and especially on south-facing (hot) slopes. With continued hot weather, these patches fade to a dull tan and then to a light straw color. Some apparently healthy plants may be surrounded by the discolored turf, giving a frog-eye effect. This disease can be controlled by timely fungicide applications, which is extremely expensive. The best control is obtained by following a fall nitrogen

fertilization program and proper summer irrigation.

Red thread—Red thread (pink patch) is very common on Kentucky bluegrass and perennial ryegrass lawns, mostly in May and June. The symptoms are similar to that described for dollar spot, but red thread disease also causes small pink-to-reddish threadlike growths to emerge from tip ends of blighted leaves. During moist periods, a pink slime may cover the leaves and mat many leaves together. The damage is not extremely destructive, and the turf will completely recover by late fall. A light application of nitrogen and heavy, infrequent irrigation is usually as effective in masking the disease as a fungicide treatment.

Localized dry spot—Localized dry spot is the most serious summer problem encountered on Kentucky bluegrass lawns. It first appears as patches of brown or dying grass, 2 to 4 inches in diameter. Localized dry spot continues to grow in a circular pattern, and it mimics any number of diseases and insect problems such as grubs, sod webworms, dollar spot, red thread, and summer patch.

As is the case with most serious lawn pest problems, dry spot most often occurs on lawns with south-southwest facing slopes, a severe thatch problem, heavy traffic, open sun areas, and heavy clay with shallow soil. These traits most often describe “front” lawns. After a good summer rain, a turf with localized dry spot will usually improve for only two to three days. The improvement doesn’t last long, because little moisture penetrates the soil. If the soil will only take $\frac{1}{10}$ inch of water per hour, then a rain falling at 1 inch per hour is of little value. In addition, when a thatchy lawn becomes dry, the thatch becomes water repellent. Hours of light rainfall would be needed to penetrate the thatch.

You have to irrigate to correct dry spot. Most sprinklers apply water very slowly, at rates of $\frac{1}{4}$ to $\frac{1}{2}$ inch of water per hour. If the water begins to run off before you have thoroughly wet 2 to 3 inches of surface soil, wait an hour or so before continuing irrigation. The only way to know how deeply you have wet the soil is to probe the soil with a knife, screwdriver, soil probe,

bulb planter, etc. After you’ve thoroughly irrigated 2 to 3 inches of surface soil, do not repeat irrigation until the surface begins to dry again. If the weather is extremely hot and dry and the soil is very bad, it may only be four to five days before the surface dries. If the weather is fairly cool at night, repeat irrigation is usually not needed for one to two weeks. With luck, you will also get some helpful rainfall during that period. Remember, when diagnosing lawn problems, always check the soil first.

Moles

Moles are typically a serious problem in lawns with good soil that are located near woody areas or pastures. The only serious specie we have in Kentucky is the eastern mole. This mole dislodges/uproots the grass as it makes runs, and it smothers the grass in circles as it extracts soil into surface mounds. Moles are insectivores. They mainly eat earthworms, but they will also eat grubs, spiders, etc. They are active every month of the year and have to eat every day. They spend most of their time disrupting areas where insects and earthworms are most abundant.

If mounds appear in lawns, it is imperative that the fresh surface mound be spread out immediately by foot or rake, preferably before it rains and settles down. If you spread the soil out, the remaining hole will not be more than an inch in diameter. Never run over the mound with the wheel of a riding lawn mower. You will kill/smother out an area of grass bigger than a basketball.

Mole control is work, and no easy solutions exist. Consider the following:

- Cats will stalk moles and remove them gently from lawns; however, training of cats to stalk moles has not been productive.
- Dogs will actively remove moles, but they often tear up more lawn than the mole.
- The harpoon trap has historically proven the best method for mole control. If you have a lot of mole problems, it is best to purchase several traps, set them over active runs, and move the traps every

day or two to make sure you are engaging those runs. If you do not see new runs, the mole has likely left the lawn and may not be back for several weeks or months.

- A pitch fork is a very effective method of mole control. Tamp down an active run and observe it often for soil movement. Quietly approach the run and forcefully insert the fork into the soil when the soil moves. Although this method sounds somewhat gruesome, it is likely one of the most humane methods of mole control as there is no suffering for the animal.
- Molexit is a castor oil-based product that can cause moles to leave a lawn area for a few weeks, but the mole often returns with a vengeance.
- Talpirid or Tomcat Mole Killer are new products that use fake worms with an injected rodenticide called bromethalin. These gummy-type worms can be placed into active runs or mounds and appears to be the best solution for ridding lawns of moles. These can be placed into active runs or mounds to give immediate mole kill.

Here's the best method when using these fake worms:

- When you see an active run or mound that is a day or two old, place a fake worm within the run's empty space or within the empty space below the mound. The run (void) is only an inch or two below the grass and is easy to locate. The mounds are usually 6 to 18 inches above the underground run, and you'll need to use a dowel or stick to push the fake worm through the 1-inch-diameter hole that the mole has made in order to connect to the belowground run.
- When you see a network of runs or see runs that could be several days or weeks old, it is best to walk the runs down and then check the area daily. If any portion of the run is again raised by the mole, place a worm in it. Moles have a habit of working an area and then leaving that area for better hunting ground. It is not practical to place these fake worms in older runs because the organic worms may decay before the mole returns.

These fake worms look similar to earthworms or rubber fishing worms and will cost \$2 to \$4 each. Because you are placing them underground and because each worm has only sufficient bromethalin to kill a single mole, it is unlikely that you would poison a pet with this product. But as always, follow the safety precautions carefully.

Regardless of which method is used and how many you have killed, moles will often return within several weeks or months. The surface runs that are so obvious and annoying to the homeowner are not nearly as extensive as the underground runs that occur from 6 to 18 inches underground. It is easy for moles to reinfest a lawn via these deeper runs and likewise easy for the mole to escape your vengeance.

Shady Lawns

A comment often heard from people living in homes with older landscapes is "This lawn used to have good grass under the trees, but now it has almost nothing." It is a legitimate complaint. This situation occurs for at least two reasons:

- The shade becomes more intense as the trees grow older.
- As the turf thins, the homeowner initiates a salvage program of reseeding, fertilizing, and killing weeds.

The problems with this approach are competition and disease.

Competition

Trees do get bigger and more competitive each year. The most serious competition is for sunlight. A group of large shade trees may reduce the incident sunlight to 5 percent to 10 percent of normal. If the trees are tall, it is sometimes possible to remove lower branches and reduce the competition for light.

Trees can also compete for nutrients and water, but this does not seem to be very important when trees are large. Small trees might show moisture stress during a summer drought, but that does not usually thin the turf. Light is the limiting factor.

Algae and moss problems under shade trees are always a big concern. Since moss and algae become noticeable as the grass population decreases, it usually looks as if these lower forms of plant life are crowding out the turf. Not so! They are just the first forms of plant life that occur in shady-wet areas in which the grass population is declining or nonexistent.

Chemicals such as copper sulfate (2 oz./1,000 sq. ft.) have been used to kill moss and algae. However, unless the shade or other problems are corrected, the moss will return. Along with shade, poor soil or surface drainage, acid soil, soil compaction, and a close mowing height encourage moss and algae.

Diseases such as powdery mildew are encouraged by the environment of wet and “still” air usually found under shade. Fungicides can be used for control, but the organisms will continue to reappear as long as the favorable environment exists.

To correct problems caused by shade, it is necessary to reduce the shade and increase the air movement under the trees. Removing lower branches and thinning of border plantings can be of some benefit.

The relative shade tolerance of perennial grasses that can be used in Kentucky lawns are listed below from the most shade tolerant to least shade tolerant:

- Fine Fescue
- Tall Fescue
- Zoysiagrass
- Perennial Ryegrass
- Kentucky Bluegrass
- Bermudagrass

Choosing the Right Grass

It is not uncommon to see seed mixtures sold as “shade-loving” that contain a high proportion of annual ryegrass and very little fescue. The ryegrass comes up quickly but dies out the first year. Because of the initial competitive advantage of the ryegrass, the fescue never has a chance, and the hard-working homeowner concludes that grasses cannot be grown in that location. He or she may be right, but for the wrong reason. If shade is very dense, such as under large maple and oak trees, no grasses will persist.

Sun and shade mixes are popular choices for partially shaded lawns. These mixes usually contain Kentucky bluegrass, fine fescue, and sometimes perennial ryegrass. The Kentucky bluegrass persists and dominates in the full sun areas and the perennial ryegrass and fine fescue will grow in shaded areas. Perennial ryegrass will tolerate a little shade while fine fescue tolerates much more. Kentucky bluegrass and perennial ryegrass look similar, however, fine fescue is much more fine-bladed than either of the other grasses so uniformity in the lawn may not be ideal.

Recently, because of the frustrations of getting perennial grasses established under shade, many homeowners have chosen to seed one of the turf-type perennial ryegrasses. These grasses may not persist more than one to three years, but they are relatively easy and quick to get established. If used under shade, they should be seeded during late August or September at 2 to 5 lb./1,000 sq. ft. Seeding of such cool-season grasses is best accomplished during the fall since the leaves from deciduous trees will be falling and thereby allowing more light to penetrate. Obviously, fallen leaves should be removed.

Soil Preparation

The soil surface can be scarified with a dethatching machine or rototiller or by briskly raking the soil surface. The seed should come in contact with some loose soil for best germination. Since ryegrasses are not well adapted to shade, they will lose their dark green color the following summer and often thin out considerably. Reseeding the following fall may be necessary. Broadcasting a few pounds of perennial ryegrass over the shaded surface every fall and spring may be the best solution.

Fertilization

Since the understory grasses are competing with the trees for nutrients, should the grass be fertilized more often? No! A turf that is “just existing” under subdued light does not need the same amount of nutrients that it would need if growing in full sun. For maximum survival, it is best

to fertilize shaded turf with nitrogen no more than once a year and perhaps not at all. The more nitrogen you apply, the more you force the turf to grow, and the more you force the turf to grow, the more light it needs. In reality, the turf is getting less light because the trees are continuing to grow, and the more dense grass canopy tends to shade itself. The grass is actually growing itself to death because its only source of energy (sunlight) is insufficient.

With shaded grass, it is always appropriate to get a soil test to determine the needs for lime, phosphate, and potash. A deficiency of any of these will weaken a turf, whether it's in the shade or sun. Lime, phosphate, and potash can be applied anytime during the year, but nitrogen is best applied in the fall when the grasses are best able to initiate and develop tillers and when deciduous trees are losing leaves, thus reducing shading. To allow the grasses to develop, be sure to keep the leaves raked—do not let them shade the grass.

Mowing

Always consider mowing shaded grass higher than non-shaded grass, never closer than about 3 inches. The taller height may allow the leaf blade to capture additional light.

Weeds

Many homeowners are concerned about a predominance of weeds growing under heavy shade. Often the weeds, such as ground ivy, wild violets, creeping charlie, wild strawberry, nimblewill, etc., are more competitive under shade than the grasses are. So let them be! Why kill the weeds when it is virtually impossible to get desirable grasses to grow? In most cases the green weeds look a lot better than bare ground. Most of these weeds will give good cover from April to October.

Ground Covers

Even the most avid “grass person” recognizes that the presence of trees is more important than grass and that a cultivated ground cover is more aesthetic than a patch of weeds intermingled over bare ground and surface tree roots. When this is the case, ground covers such as periwinkle, English ivy, Pachysandra, and sweet woodruff can be planted. They thrive in heavy shade and give wonderful relief from the monotony of all turf.

For More Information

University of Kentucky Cooperative Extension Service publications

- Low-Maintenance Lawn Care, Stressing Pest Avoidance and Organic Inputs (ID-154), <http://www.ca.uky.edu/agc/pubs/id/id154/id154.pdf>
- Considering the Environment in the Maintenance of Your Kentucky Lawn: A Season by Season Approach (ID-222), <http://www2.ca.uky.edu/agcomm/pubs/ID/ID222/ID222.pdf>
- Lime and Fertilizer Recommendations/Soil Test Recommendations (Excerpt from AGR-1) <http://www2.ca.uky.edu/agcomm/pubs/agr/agr1/agr1.pdf> (page 20)
- Liming Kentucky Lawns (AGR-214), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR214/AGR214.pdf>
- Lawn Establishment in Kentucky (AGR-50), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR50/AGR50.pdf>
- Renovating Your Lawn (AGR-51), <http://www2.ca.uky.edu/agcomm/pubs/agr/agr51/agr51.pdf>
- Selecting the Right Grass for your Kentucky Lawn (AGR-52), <http://www.ca.uky.edu/agc/pubs/agr/agr52/agr52.htm>
- Turfgrasses of Kentucky (AGR-216), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR216/AGR216.pdf>
- Fertilizing Your Lawn (AGR-212), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR212/AGR212.pdf>

- Mowing Your Kentucky Lawn (AGR-209), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR209/AGR209.pdf>
- Aerifying and Dethatching Lawns (AGR-54), <http://www2.ca.uky.edu/agcomm/pubs/agr/agr54/agr54.pdf>
- Turf Care Calendar (AGR-55), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR55/AGR55.pdf>
- Weed Control for Kentucky Home Lawns (AGR-208), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR208/AGR208.pdf>
- Principles of Home Landscape Fertilizing (ID-72), <http://www.ca.uky.edu/agc/pubs/id/id72/id72.htm>
- Irrigation Tips to Conserve Water and Grow a Healthy Lawn (AGR-115), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR115/AGR115.pdf>
- Managing Mole Problems in Kentucky (FOR-42), <http://www.ca.uky.edu/agc/pubs/for/for42/for42.pdf>
- A No-math Method of Calibrating Backpack Sprayers and Lawn Care Spray Guns (AGR-220), <http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR220/AGR220.pdf>
- Disease Management in the Home Lawn (PPFS-OR-T-11), <http://plantpathology.ca.uky.edu/files/ppfs-or-t-11.pdf>
- Trees, Turf, and People (ID-203), <http://www2.ca.uky.edu/agcomm/pubs/id/id203/id203.pdf>
- Controlling White Grubs in Turfgrass (ENT-10), <http://entomology.ca.uky.edu/ent10>
- Velvet Ants (ENT0-442), <http://entomology.ca.uky.edu/ef442>
- Insecticides for Control of White Grubs in Kentucky Turfgrass (ENT-441), <http://entomology.ca.uky.edu/ef441>
- Yard Wasps (ENT-411), <http://entomology.ca.uky.edu/ef411>
- Earthworms: Thatch Busters (ENT-402), <http://entomology.ca.uky.edu/ef402>
- Japanese Beetles in the Urban Landscape (ENT-451), <http://entomology.ca.uky.edu/ef451>

Videos

- Backpack Sprayer Calibration: <https://www.youtube.com/watch?v=m2f1Ye1d1sA>
- Lawn Renovation: <https://www.youtube.com/watch?v=nDuciEPWVvU&t=67s>
- Mole Control in Lawn: <https://www.youtube.com/watch?v=XKs-fWZhZ-8&t=4s>
- Daily Mower Maintenance and Cutting Heights: https://www.youtube.com/watch?v=5_nhpchMyfs&t=27s
- Turf Master Gardener Training: <https://www.youtube.com/watch?v=UC1P47oEtvq>
- Soil Testing and Fertilizers for Home Lawns: https://www.youtube.com/watch?v=eTIVnAyR_rw&t=10s
- Seasonal Lawn Mower Maintenance: <https://www.youtube.com/watch?v=oxgbMDdT6bQ&t=35s>
- Lawn Mower Blade Sharpening: <https://www.youtube.com/watch?v=JMy1j9NR89o&t=15s>
- Organic Lawn Fertilizers: https://www.youtube.com/watch?v=qLg12Chm_Ao&t=6s